PROGRAMME CURRICULUM

AND

SYLLABI OF

DIPLOMA PROGRAMME IN

FOOD TECHNOLOGY

UNDER RATIONALISED SEMESTER SYSTEM

(IMPLEMENTED FROM ACADEMIC YEAR 2020-2021)

BOARD OF TECHNICAL EDUCATION, GOA STATE

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March 2020

SYLLABUS STRUCTURE FOR FOOD TECHNOLOGY

DIPLOMA IN FOOD TECHNOLOGY

(GC101) Communication Skills

1. COURSE OBJECTIVE :

The course aims to develop Communication skills in English by improving students' ability to write ,speak, listen and read effectively. Emphasis is also laid on students' personality development, helping them to build their confidence in interpersonal / group communication.

2. TEACHING AND EXAMINATION SCHEME

Semester	**I**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(GC101) Communication Skills		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		-	**-**	**02**	**32**	**-**	**-**	**25**	**25**	**50**

3 . COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

GC101.CO1 Understand the essentials of effective Communication.

GC101CO2 Develop reading. writing, speaking , listening and effective presentation skills.

GC101.CO3 Select the appropriate mode of Communication .

GC101.CO4 Demonstrate reading. writing, speaking , listening and effective presentation skills.

4.Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	0	0	0	0	3	3	3
CO2	1	0	1	0	3	3	3
CO3	1	0	1	0	3	3	3
CO4	1	0	0	0	3	3	3

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Phr = Practical hours**	**CO = Course Outcomes**		

Unit	**M**	**Phr**	**CO**
1 UNIT NAME: FUNDAMENTALS OF COMMUNICATION SKILLS	**-**		
1.1 **Communication Skills fundamentals** Definition, communication process, importance of Communication Skills, essentials of effective communication		01	
1.2 **Types of communication**: verbal Communication and Nonverbal communication (Body language, facial expressions, gestures, eye contact, posture, dress and grooming/personal appearance, deportment, personal hygiene) Paralinguistic (Volume, pace, pitch, pauses)		02	**CO1** **CO2** **CO3** **CO4**
1.3 **Barriers to communication:** physical barriers, psychological barriers and cultural barriers		01	
2. Unit: PRESENTATION SKILLS			
2.1 Presentations: Methods and style of presentation, Importance, planning a presentation, venue selection, audience awareness (age, gender, profession background, educational and social background) time and duration, audio visual aids (OHP, LCD projector, flip charts, white/black/green board, computer, microphone)		**02**	**CO2** **CO3** **CO4**
2.2 Public speaking: preparatory steps, tips for good beginning and end, delivery style, techniques for a good speech (repetition, signs, pictures, humor), body language		**02**	
3 UNIT: TECHNICAL Writing			
3.1 Report **writing** Functions and parts of a report, Qualities of a good report, and types: Report on any institute function, Accident report, Industrial visit Report		04	
3.**2 Business letters** Principles of effective letter writing, parts of a business letter, formats (Full block style, Semi block style, modified block style) Routine/ Generic letters (letter to the heads of the institute, letter to the heads of various departments/sections of the institute) Types of letters: Enquiry Letter, Quotation, Purchase Order, Letter of Complaint		06	**CO1** **CO2** **CO4**

3.3 **Job application** Tips for a good C.V and a Resume		02	
4 UNIT GRAMMAR	-		**CO1 CO2 CO4**
4.1 Fundamentals of English writing Subject verb agreement, homonyms, homophones, homographs, articles, Punctuation, synonyms, fundamentals of sentence construction		**02**	
4.2 Paragraph Writing: Developing Topics (the main idea), body (supporting sentences), conclusion, proof reading		**02**	
UNIT V: LANGUAGE WORKSHOP **5.1 Reading Skills** strategies to use for building vocabulary and reading fluencies (read extensively, identify new words, use of dictionary, online dictionary apps), reading comprehension, pronunciation, debate, role play,	-	08	**CO1 CO2 CO4**
5.2 Listening Skills How to listen effectively, listening comprehension			
5.3 Speaking skills speech, group discussion			
5.4 Writing skills précis writing, comprehension			
Total		**32**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, videos, exercises

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**NO of lectures**	**Marks**
1	Fundamental of Communications skills	04	-
2	Presentation Skills	04	-
3	Technical Writing	12	-
4	Grammar	04	-
5	Language workshop	08	-
	Total	32	25

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	**Practical**
1.	**Practical Title: Fundamental of Communications skills**
i.	Comprehension
ii.	Précis writing
iii.	Self-Introduction
2	**Practical Title: Presentation Skills**
iv.	Extempore speech
v.	Presentation on any given Topic
3	**Practical Title: Technical Writing**
vi.	Accident Report
vii.	Report on Institute function
viii.	Industrial visit report
ix.	Generic letters to the heads of various department/ Sections of the institute
x.	Inquiry letter

xi.	Quotation
xii.	Purchase or supply order
xiii.	Complaint letter
xiv.	Job application
4	**Grammar**
xv.	Exercises in subject – verb agreement
xvi.	Exercises in use of preposition
xvii.	Exercises in use of Homophones, homonyms, homographs
xviii.	Exercises in use of punctuation
xix.	Exercises relating to correcting the sentences
xx.	Paragraph writing
5	**Language workshop**
xxi.	Exercises to improve Reading skills
xxii.	Exercises to improve Writing skills
xxiii.	Group discussion
xxiv.	Listening comprehension

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R. C. Sharma & Krishna Mohan	Business Correspondence and Technical Writing	Tata McGraw Hill
2	P. Prasad, Sharma, K. Rajendra	The Functional aspects of communication skills	S.k. Kataria& sons
3	SanjayKumar,Pushpa Lata	Communication Skills	Oxford University Press
4	A.K.Jain,A.M.Shaikh&Pravin S R Bhatia	Professional communication Skills	S.Chand
5	Wren & Martin	High School English Grammar & Composition	S. Chand, N. Delhi

10.Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Raul R. Timm	How to make winning presentations	Sneha Printers
2	Dale Carnegie, Training CPI	Stand and Deliver, How to become a masterful communicator and public speaker	Cox & Wyman, UK
3	John Seely	The Oxford Guide to Effective Writing and speaking	Oxford University Press

Autobiographies, self-help books, Audio speeches given by famous personalities

Internet and Web Resources

https://www.grammarly.com/
https://www.bbc.co.uk/programmes/articles/5QFnVy3xzT5htTh13cmP2P8/teacher-resources
https://Ted.com

Videos and Multimedia Tutorials

https://you.tu.be/AykYRO5d_II

(GC102) Engineering Mathematics I

1. COURSE OBJECTIVE:

1. The course is aimed at providing mathematical knowledge, developing computational skills and reasoning. It also helps students to think logically and in systematic manner so as to grasp mathematical concepts easily. It helps to build analytical thinking which play an important role in solving real world problems in all scientific discipline.

2.TEACHING AND EXAMINATION SCHEME

Semester	**I**								
Course code & course title		**Periods/Week (in hours)**			**Total hours**	**Examination Scheme**			
						Theory Marks		**Term Work**	**Total Marks**
(GC102) Engg.Maths I		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	
		4	**2**	**-**	**96**	**75**	**25**	**25**	**125**

3.COURSE OUTCOMES:

GC102.CO1. Understand the basic mathematical concepts for Engineering applications.

GC102.CO2. Identify and use appropriate formulae for solving practical engineering problems

GC102.CO3. Apply formulae of algebra, geometry, trigonometry and calculus for solving problems.

GC102.CO4 . Co-relate mathematical formulae to practical problems.

4.Mapping Course Outcomes with Program Outcomes:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**
CO1	**3**	**2**	**1**	**0**	**0**	**0**	**2**
CO2	**3**	**3**	**1**	**0**	**1**	**0**	**1**
CO3	**2**	**2**	**3**	**3**	**2**	**0**	**1**
CO4	**2**	**3**	**3**	**2**	**1**	**1**	**1**

Relationship :Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**	

Unit	**Marks**	**Thr**	**CO**
1 MATHEMATICS FUNDAMENTAL	**8**	**6**	**CO1**
1.1 **Polynomials: Types** of polynomials, addition subtraction, (no question to be asked), Multiplication and division of polynomials	3	2	
1.2 **: Algebraic equations:**Different types of equations and their geometric meaning(line,circle parabola only) ,equations with one, two and three variables and solving equations with two and three variables Quadratic equations and nature of their solutions	3	2	
1.3: Logarithm: Definition of log, log with base 'e' and base'10' Properties of log, log and antilog , problems using definition and properties of log.	2	2	
2.STRAIGHT LINES AND CIRCLES	15	14	**CO1, CO4**
2.1: Straight line: Intercept, slope, intersection of lines Equations of line: 1. Slope intercept form, slope point form, two points form, parallel and perpendicular lines, angle between lines Perpendicular distance of a point from line	8	7	
2.2: Circle: circle as a locus, Centre, diameter, chord of a circle Equations of circle: Centre radius form, diameter form, general form and sums	7	7	
3. TRIGONOMETRY			**CO1, CO3**
3.1: Angle and measurement, degree and radians and conversion and related sums, arc length and area of sector and sums **3.2:** Trigonometric ratios and identities 3.3: Trigonometric ratios of compound and allied angles 3.4: Product formulae sinA±sinB, cosA±cosB **3.5:** Sum and difference formulae **3.6:** Multiple angle 2A, and their trigonometric ratios, **3.7**: Sine rule, Cosine rule in triangle, solution of triangle	12	15	
4 : MENSURATION	10	6	**CO1, CO4**
4.1: Areas of 2D figures like quadrilaterals, circle triangle etc (no questions to be asked)			

4.2: Surface area and volumes of cube, sphere, cylinder, cone, (no question to be asked) Surface areas and volumes of prism, pyramid, **4.3**: Frustum of cone, pyramid and their surface areas and volumes. **4.4:** Simpson's 1/3 rd rule for area and volume			
5 :CALCULUS	30	23	**CO1, CO2, CO3, CO4**
5.1:Limits 5.1.1 : Pre requisite : Sets , intervals, relation and function (no questions to be asked) 5.1.2 : Limit of a function , algebraic properties of limits 5.1.3: Limits of algebraic, trigonometric, exponential, logarithmic functions	7	6	
5.2 : Derivatives 5.2 .1: Derivative definition by first principle (no question to be asked) 5.2.2: Standard formulae, Algebraic properties of derivative (u±v) etc. 5.2.3: Derivatives of algebraic, trigonometric, exponential, logarithmic functions 5.2.4: Derivative of product of functions (uv rule). 5.2.6: Derivative of quotient of functions (u/v rule) 5.2.7: Derivative of composite functions 5.2.8: Derivative of parametric functions 5.2.9: Derivative of implicit functions 5.2.10 : Logarithmic differentiations 5.2.11: Second order derivatives (no question to be asked)	15	12	
5.3 : Applications of derivatives 5.3.1: Application to the geometry: i) derivative as a slope of a tangent ii) to find equations of tangent and normal at given point on the curve 5.3.2: Application to the Linear motion:i) displacement, velocity,acceleration 5.3.3: Application to the rate measure i) to find rate change in area and volume etc 5.3.4 : Maxima and minima	8	5	
Total	**75**	**64**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises

7. SPECIFICATION TABLE FOR THEORY

Unit No	Unit	Number of lectures	Marks
1	**Mathematics Fundamental**	06	8
2	**Straight line and circle**	14	15
3	**Trigonometry**	15	12
4	**Mensuration**	06	10
5	**Calculus**	23	30
	Total	**64**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

- Tutorial books should be maintained by students (5 marks)
- Two home assignments per semester (5 marks)

  The Two assignments each comprises of thirty questions which includes 15 short questions and fifteen long questions. First assignment will cover fifty percent of syllabus

  and second assignment will cover remaining portion of syllabus
- Topic-wise class assignment (15 marks)

  Class assignment comprises of ten short and ten long questions.

9. LEARNING RESOURCES

Text Books

S. No.	Title of Books	Author	Publishers
1	Mathematics for Polytechnic Students(Basic Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
2	Mathematics for Polytechnic Students(Engineering Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
3	S.B. Gore, M.B.Patil, S.P. Pawar	Applied Mathematics	Vrinda Publications

Reference Books for further study

S. No.	Title of Books	Author	Publishers
1	Applied Mathematics I	Dr. U.B.Jangam, K.P. Patil, Nalini Kumthekar	Nandu Printers& Publishers pvt. Ltd. Mumbai
2	Applied Mathematics for Polytechnics	H.K. Dass	CBS Publishers and distributers Pvt.Ltd. ,Pune
3	Set Theory and related topics	Seymour Lipschutz	McGraw-Hill

(GC103) APPLIED PHYSICS-I

1.COURSE OBJECTIVE :

On successful completion of the course, Students completing the Applied Physics I course will be able to demonstrate competency and understanding of the basic concepts found in, Units and Dimensions, Kinematics of motion in one dimension Force Work Power and Energy, Circular Motion and Gravitation, Properties of Matter and Heat and will be able to utilize the knowledge to demonstrate competency with experimental methods that are used to discover and verify the concepts related to content knowledge

2.TEACHING AND EXAMINATION SCHEME

Semester	I								
Course code & course title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(GC103) Applied Physics I		L	T	P	H	TH	TM	TW	PR/OR	
		03	0	02	80	75	25	25	-	125

3.COURSE OUTCOMES:

GC103.CO1: Understand the Fundamental concepts of physical quantities, Force, Power, Energy, Motion, Matter and heat transfer used in Engineering applications.

GC103.CO2: Explain the concepts of Dimensions, Work, Power , Energy ,Motion, properties of matter and heat transfer

GC103.CO3: Apply the Knowledge of Physical quantities, Types of motions, Force, work ,Power, properties of matter and heat transfer in Engineering applications

GC103. CO4: Analyze different types of Physical quantities, motions, properties of matter, and modes of heat transfer

4. Mapping Course Outcomes with Program Outcomes

Relationship: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	**Problem Analysis**	**Design and Devlopment of Solutions**	**Engg. Tools, Experimentatn& Testing**	**Engg. Practices for Society,Sustainability& Environment**	**Project Management**	**Life -long Learning**
CO 1	3	1	1	3	2	0	3
CO 2	3	1	2	3	0	0	3
CO 3	3	1	2	2	0	1	1
CO 4	1	1	2	2	0	1	1

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Outcomes**			
Unit	**Thr**	**M**	**CO**
1 UNIT NAME: UNITS AND DIMENSIONS	**08**	**12**	**CO1, CO2, CO3, CO4**
1.1 Fundamental and Derived units ,			
1.2 Different system of units, SI unit conversion from one system to other,			
1.3 Principle of Homogeneity,			
1.4 Dimensions, dimensional formula,			
1.5 dimensonal correctness of given equation using dimensions			
1.6 least count of vernier calliper and screw gauge			
1.7 zero errors-- in case of vernier calliper and screw gauge			
1.8 Types of error.			
2. UNIT NAME: MOTION IN ONE DIMENSION, FORCE, WORK,POWER AND ENERGY	**10**	**16**	**CO1, CO2, CO3, CO4**
2.1 Distance and displacement,			
2.2 Scalar and Vectors			
2.3**,** Speed and Velocity, Uniform Velocity, ,			
2.4 Uniform acceleration,acceleration due to gravity			
2.5 Equation of motion ($v=u+at$, $v^2=u^2+2as$, $s=ut+1/2at^2$)(no derivation)			
2.6 Motion under gravity. Force and its unit.			
2.7 Work and its unit. Energy, law of conservation of energy,			
2.8. Kinetic and Potential energy equation and examples.			
3. UNIT NAME: Uniform Circular Motion and Gravitation	**10**	**16**	**CO1, CO2, CO3, CO4**
3.1 Unifrom circular motion,			
3.2 Definition angular displacement,angular velocity, ,			
3.3 Conversion from rpm to rad/sec,$v=r\omega$, tangential velocity, radial acceleration			
3.4 Centripetal force and centrifugal force, examples,			
3.5 Banking of roads,superelevation, expression for angle of banking			
3.6 Newtons law of gravitation, acceleration due to gravity ,			
3.7 Expression for acceleration due to gravity. Escape velocity, Critical velocity, and periodic time definition and expression (no derivation)			
3.8. Sattellite, types(Geosationary,communication remote sensing)			
4. UNIT NAME: PROPERTIES OF MATTER	**10**	**16**	**CO1, CO2, CO3, CO4**
4.1 Elasticity ,			
4.2 Stress, Strain,Hooke's law,			
4.3 Youngs Modulus,			
4.4 Bulk Modulus, Rigidity Modulus,			
4.5 Stress v/s Strain graph			
4.6 Yield point, breaking stress,factor of safety, ,			
4.7 Surface tension definition and example			
4.8. Adhesive and cohesive force, application,			
4.9 liquid miniscus and angle of contact, capillarity,			
4.10 Expression for surface tension (no derivation), applications. viscocity,			
4.11 Definition velocity gradient, newtons law of viscocity, terminal velocity,stokes law,			
4.12 Streamline flow and turbulent flow,critical velocity, application of viscocity.			
5. UNIT NAME: HEAT	**10**	**15**	**CO1,**

5.1 Statements of boyles law,charles law,gay lussacs law			**CO2, CO3, CO4**
5.2 General gas equation,specific heat definition and unit, Latent heat definition and unit			
5.3 Modes of transfer of heat, conduction, convection and radiation,			
5.4 Conduction of heat through a metall rod,			
5.5 Variable and Steady state			
5.6 law of thermal conductivity (With Derivation)			
5.7 Applications of thermal conductivity, ,			
5.8. Thermal expansion of solids			
5.9 linear expansion,superficial expansion,			
5.10 Cubical Expansion			
5.11 Realtion betwenn α,β,γ (no derivation)			
5.12 Engineering applications of expansion of solids.			

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	UNITS AND DIMENSIONS	8	12
2	MOTION IN ONE DIMENSION, FORCE, WORK AND ENERGY	10	16
3	UNIFORM CIRCULAR MOTION AND GRAVITATION	10	16
4	PROPERTIES OF MATTER	10	16
5	HEAT	10	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS

No	Practicals	Marks
1.	Basic Conversion Techniques from one system of units to the other	25
2.	Use of Vernier callipers to find the Volume of Hollow cylinder, Block	25
3.	Use of Screw gauge to find the cross-sectional area of a wire and thickness of a clip	25
4.	To find the Coefficient of Viscosity of a given liquid by stokes method	25
5.	To Find the coefficient of Thermal Conductivity by Searle's Method	25
6	To Find the Surface Tension of a given liquid by capillary rise method	25
7	To Find Young's Modulus by Searles Method	25
8	To Find acceleration due to gravity by simple pendulum method.	25
	Total (Average)	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	B G Dhande	Applied Physics of Polytechnics	Pune Vidyarthi Griha Prakashan

2	Bhandarkar	Applied Physics of Polytechnics	Vrinda publication
3	R K Gaur and S L Gupta	Engineering Physics	Dhanpat Rai & Sons Delhi
4	Dr. Vasudev R Bhagwat	A Text Book of Applied Physics for Polytechnics	Broadway Publishing House
5	B L Thereja	Engineering Technology	S. Chand

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Halliday D and Resnick	Physics Part I-II	Wiley Eastern Ltd.
2	Satish k. Gupta	ABC of Physics I&II	Modern Publisher
3	Saxena HC and Singh Prabhakar	Applied Physics Vol I & II	S. Chand Publisher

(GC104) Applied Chemistry

1. COURSE OBJECTIVE:

Chemistry is the branch of Science which deals with the study of composition, properties and changes in matter. An understanding of the basic concepts of Applied Chemistry, chemical principles and chemical properties of materials is essential to all the engineers. The emphasis is on applying the knowledge of principles of chemistry in all the fields of engineering wherein students appreciate the significance of chemistry in day to day life. The subject develops in students the habit of scientific enquiry, the ability to investigate cause and effect relationship & the ability to interpret & analyze the results.

2. TEACHING AND EXAMINATION SCHEME

Semester	**I**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits (Hours)**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(GN104) Applied Chemistry		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**
		3	**-**	**2**	**80**	**75**	**25**	**25**	**-**	**125**

3. COURSE OUTCOMES:

GC 104.CO1: Understand the fundamental concepts of Atomic Structure, electrochemistry, water quality, corrosion and polymers.

GC 104.CO2: Explain the process of Chemical bonding, water softening, electroplating, corrosion control and polymerization

GC 104.CO3: Relate the principles of Chemical Bonding, Electrolysis, water hardness for domestic and Industrial applications and properties of polymers.

GC 104.CO4: Distinguish between types of Chemical bonding, Water softening methods, corrosion control methods, different processes of metal coating and different polymers.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimenting& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	2	1	1	2	1	1
CO2	2	3	2	1	3	1	2
CO3	3	2	2	2	3	1	2
CO4	3	2	2	2	2	1	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**Mks**	**Thr**	**CO**
UNIT 1.0 : ATOMIC STRUCTURE AND CHEMICAL BONDING	**15**	**10**	CO1 CO2 CO3 CO4
1.1 Atomic Structure 1.1.1 Fundamental particles and their characteristics. 1.1.2 Energy levels - Definition & designation 1.1.3 Sub Energy levels- Definition & designation 1.1.4 Orbital – Concept & shape (s and p only) **1.2** Quantum numbers 1.2.1 Designation, definition, values.			
1.3 Electronic distribution (Elements from atomic Number 1-20) 1.3.1 Bohr – Bury's laws for distribution of electrons in shells (1st three laws only) 1.3.2 Aufbau Principle. for distribution of electrons in sub-shells 1.3.3 Pauli's Exclusion Principle. 1.3.4 Hund's Rule of maximum multiplicity 1.3.5 Orbital Electronic Configuration of elements (from atomic numbers 1 to 20 only).			
1.4 Chemical Bonding 1.4.1 Lewis and Longmuir concept of stable configuration. 1.4.2 Electrovalent - Bond - Concept Formation of Electrovalent Compound (NaCL & MgO) 1.4.3 Covalent Bond – Concept Formation of Colvalent Compounds (Cl_2, O_2, N_2) 1.4.4 Co-ordinate Bond - Concept Formation of Co-ordinate Compounds (O_3) 1.4.5 Properties of Electrovalent, Colvalent & Co-Ordinate compounds.			
UNIT 2.0 : WATER	**15**	**10**	CO1 CO2 CO3 CO4
2.1 Hardness of Water 2.1.1 Soft and Hard Water - Concept Soap Test (Chemical Equation not expected) 2.1.2 Causes of Hardness 2.1.3 Types of Hardness 2.1.4 Degree of Hardness & Units of Hardness (mg/L & ppm)			
2.2 Disadvantages of Hard Water 2.2.1 Domestic Purpose Drinking, cooking, Washing & Bathing. 2.2.2 Industrial Purpose (Paper Industry, Textile & Dyeing Industry, Sugar Industry, Bakery & Concrete Making) 2.2.3 Boilers- Steam Generation Purpose. Sludge formation – causes & Disadvantages (No chemical equation expected)			

2.3 Water Softening 2.3.1 Zeolite and Ion Exchange process of water softening			
2.4 Desalination of water 2.4.1 Electrodialysis & Reverse Osmosis process. 2.4.2 pH- Concept, pH scale & Importance of pH			
UNIT 3.0 : <u>ELECTROCHEMISTRY</u>	**12**	**08**	CO1 CO2 CO3 CO4
3.1 Electrolytic dissociation 3.1.1 Arrhenius theory of Electrolytic dissociation 3.1.2 Factors affecting degree of Ionization- nature of solute, nature of solvent, concentration of solution and temperature.			
3.2 Electrolysis 3.2.1 Mechanism of Electrolysis. Ionization Reactions Reactions at cathode, Activity series of Cations. Reactions at Anode, Activity series of Anions. 3.2.2 Electrolysis of Molten NaCl using Carbon Electrodes. Aqueous NaCl using Platinum Electrodes. Aqueous $CuSO_4$ using Platinum Electrodes. Aqueous CuSO4 using copper Electrodes.			
3.3 Electrochemical series – Definition and Significance			
UNIT 4.0 : CORROSION AND ITS CONTROL	**25**	**14**	CO1 CO2 CO3 CO4
4.1 Dry /Direct Chemical corrosion 4.1.1 Definition 4.1.2 Oxidation corrosion 4.1.3 Corrosion due to other gases.			
4.3 Types of Electrochemical corrosion. 4.3.1 Galvanic Cell corrosion 4.3.2 Concentration cell corrosion(Metal ion concentration & differential Aeration)			
4.4 Corrosion Control Protection of metals by: 4.4.1. Using Pure Metals & Metal alloys 4.4.2 Proper designing 4.4.3 Modifying the environment (De- aeration, Deactivation, Dehumidification, Alkaline neutralization) 4.4.4 Cathodic protection (Sacrificial anode and Impressed current cathodic protection) 4.4.5 Metal Coating (Galvanizing, Tinning, Metal-Spraying, Electroplating & powder coating)			

UNIT 5: POLYMERS	**08**	**06**	CO1 CO2 CO3 CO4
5.1 Concept of Monomers & Polymers **5.2**Polymerization- Definition. 5. 2.1 Addition polymerization-Definition. 5.2.2 General equation of polymerization of :- Ethylene to Polyethylene. Vinyl chloride to Polyvinylchloride Tetra fluoro ethylene to Poly tetra fluoroethylene(PTFE) 5.2.3 Condensation Polymerization-Definition 5.2.4 General Equation for formation of Phenol formaldehyde Resin. **5.3** Plastics. 5.3.1 Types of plastic (Thermosetting and Thermo softening), Examples 5.3.2 Properties and applications of Poly-ethylene, PVC, polystyrene, Nylons, Bakelite & silicones.			
5.4 Rubber 5.4.1 Natural Rubber 5.4.2 Drawbacks of Crude rubber. 5.4.3 Vulcanization of Rubber (General Equation) 5.4.4 Rubber examples. 5.4.5 Properties of Synthetic Rubber & related applications.			

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**ATOMIC STRUCTURE AND CHEMICAL BONDING**	10	15
2	**WATER**	10	15
3	**ELECTROCHEMISTRY**	08	12
4	**CORROSION & IT'S CONTROL**	14	25
5	**POLYMERS**	06	08
	Total	**48**	**75**

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical
	Practical Title
1.	Double Acid-Base Titration using Phenolphthalein.
2.	Acid- Base titration using Methyl orange.
3.	Redox Titration of $KMnO_4$ soln., $FeSO_4$ soln. and Oxalic acid
4.	Determination of degree of Hardness by E.D.T.A method.
5.	Determination of Total Alkalinity of water sample.
6.	Determination of Chloride content of water sample by Mohr's method.
7.	pH- Metric titration.
8.	Conduct metric Titration.
9.	Determination of Conductivity of water samples from different water body sources.
10.	Corrosion Susceptibility of Aluminum to Acid or Base.
11.	Determination of pH of different food items.
	Total Marks: 25
	No Class room Assignments

*** Any TEN of the above.**

****Term Work Assessment Scheme**:1. Performance:15 marks (Carrying out experiment, Readings, Calculations and Results)
2.Knowledge :05 Marks(Theory of the experiment)
3. Journal : 05 Marks

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	M.M. Uppal	Text book of Engg. Chemistry	Khanna Publisher
2	V.P.Mehta	Text book of Engg. Chemistry	Jain Bros. Delhi
3	S.N Narkhede	Textbook of Engg. Chemistry	Niraj Prakashan
5	S S Dara	A Textbook of Engg. Chemistry	S Chand & Co
4	P.C. Jain and M.Jain	Engg. Chemistry.	Dhanpat Rai Publishing Co.

(GC105) Basic Engineering Practice (Electronics& Comp.)

1. COURSE OBJECTIVE:

The students will be able to acquire knowledge about safety aspects, firefighting, first-aid and carpentry, fitting, plumbing skills. The students will learn proper ways of using various hand tools, measuring devices in acquiring these skills and will also interpret simple electrical drawings/circuit diagrams.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(GC 106)	L	T	P	H	TH	TM	PR/OR	TW	
Basic Engineering Practice	0	0	5	80	-	-	50	100	150

3. COURSE OUTCOMES:

PART A

On successful completion of the course, the student will be able to:
GC106.CO1. Understand safety procedures to be followed in carpentry, fitting, and plumbing.
GC106.CO2. Identify various tools used for carpentry, fitting, and plumbing.
GC106.CO3: Demonstrate basic working skills in carpentry, fitting and plumbing.

GC106.CO4: Plan & execute a job/activity using job drawing.

PART B

On successful completion of the course, the student will be able to:
GC106.CO1. List the safety measures.to be observed in electrical workshop.
GC106.CO2. Identify various electrical tools, fittings used for electrical measurements & troubleshooting.
GC106.CO3: Distinguish between single phase and three phase supply.

GC106.CO4: Plan & execute a job/activity from electrical circuit drawing.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

PART A

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	3	2	2	3
CO2	2	1	2	3	2	2	2
CO3	2	1	1	3	2	2	2
CO4	2	1	3	3	2	3	2

Relationship: Low-1 Medium-2 High-3

PART B

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	3	2	2	3
CO2	2	1	2	3	2	2	2
CO3	3	1	1	2	2	1	2
CO4	2	1	3	3	2	3	2

Relationship: Low-1 Medium-2 High-

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Hr = Practical Hours**	**CO = Course Outcomes**			
Unit			**M**	**Hr**	**CO**
1 General Safety, Housekeeping, Fire Fighting & First Aid			10	06	
1.1Introduction to General Safety aspects of engineering workshop 1.2 Meaning and importance of housekeeping. 1.3 Fire hazards, fire triangle, types of fire extinguishers – selection and use. 1.4Basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.					CO1
2 Fitting Workshop Practice			30	18	
2.1 Introduction to the trade. 2.2 Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools 2.3 Types of files and filing methods. 2.4 Drill bits and drilling Processes, using portable and pillar drilling machine. 2.5 Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling 2.6 Threading using taps and dies.					CO1 CO2 CO3
3 Carpentry Workshop Practice			20	18	
3.1 Introduction to carpentry 3.2 Types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools 3.3 Wood working processes. 3.4 Different types of joints and their usage. 3.5 Introduction to wood working machines: 3.6 Lathe 3.7 Circular saw 3.8 Band saw 3.9 Wood planner 3.10 Universal wood working machine					CO1 CO2 CO3
4 Electrical Workshop Practice			30	32	
4.1 Brief introduction to power distribution and Electrical Safety. 4.2 Use of different hand tools used in electrical trade 4.3 Collection of details of motors and transformers. 4.4Introduction to Control Panel and its various sections/components. 4.5 Making of wire joints. 4.6Measurement of current, voltage, frequency and Power Consumption. 4.7 Connecting and starting of Induction Motor & Measurement of its speed. Changing of Direction of rotation of induction motor. 4.8 Introduction to commonly used electrical Fittings (Domestic & Industrial). 4.9Wiring of Simple Electric Circuit (Bulb & plug point and switches) on wooden board 4.10 Study, connection & use of Energy Meter 4.11Testing of components using Series test lamp & Multimeter 4.12Study of Fuses & practice replacement of Fuse 4.13 Study & Troubleshooting of Tube Light					CO1 CO2 CO3 CO4
5 Plumbing			10	06	

5.1Plumbing tools, pipe fittings and method of joining pvc pipes. 5.2 Use of spirit level and plumb bob. 5.3 Minor repairs and replacement of fittings. 5.4 Reading of plumbing drawings. *[Note: Plumbing restricted to domestic plumbing and pvc piping.]*			CO1 CO2 CO3
Total	**100**	**80**	

6. COURSE DELIVERY:

The Course will be delivered through workshop practical sessions in mechanical and electrical workshops.

7. SPECIFICATION TABLE FOR PRACTICALS/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of hrs.**	**Marks**
1	General Safety, Housekeeping, Fire Fighting & First Aid	06	10
2	Fitting Workshop Practice	18	30
3	Carpentry Workshop Practice	18	20
4	Electrical Workshop Practice	32	30
5	Plumbing	06	10
	Total	80	100

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	**Practical**	**Hrs.**
1	**General Safety, Housekeeping, Fire Fighting & First Aid**	**06**
a	Demonstration on use of Safety Measures while working in Workshop and use of safety signs.	03
b	Demonstration on use of First Aid and Artificial Respiration procedure ,Training on fire and emergency services (using video presentation /fire and safety expert talk)	03
2	**Fitting Workshop Practice**	**18**
a	Identification of various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools	03
b	Identification of various types of files and demonstration on filing methods.	03
c	Identification of various types of Drill bits, taps, dies and Drilling machines such as portable and Pillar Drilling machine.	03
d	Job involving filing, marking, cutting operation on MS Flat.	06
e	Job involving Drilling and Tapping operation on MS flat.	03
3	**Carpentry Workshop Practice**	**18**
a	Identification of various types of woods and wood working hand tools	03
b	Identification of various types of Carpentry joints and their usage.	03
c	Introduction to wood working machines such as wood working Lathe, Circular saw ,Band saw, Wood planner, Universal wood working machine	03
d	Job involving marking, measuring, planning, sawing, chiseling, joint preparation and assembly of wooden blocks.	06
e	Preparation of job on wood working lathe.	03
4	**Electrical Workshop Practice**	**32**
a	Measurement of Single Phase and Three Phase supply Voltage using multimeter.	02
b	Identification of various hand tools used in electrical trade.	02
c	Measurement of electric circuit parameters using Ammeter, Voltmeter, Frequency meter, Wattmeter.	04

d	Making of Straight and T wire joints.	02
e	Testing of electrical components such as Choke, starter, Fuse, Switch using Series Test lamp and Multimeter	02
f	Starting of induction motor using DOL Starter	02
g	Reversal of direction of rotation of Three phase induction motor	02
h	Identification of commonly used electrical fittings.	02
i	Wiring of simple electrical circuit using bulb and socket.	04
j	Measurement of Energy using Energy Meter.	02
k	Identification of Different types of Fuses and their replacement in circuit.	02
l	Testing of various components and connection of Tube light circuit.	02
m	Collecting Name plate Details of Motors and Transformers and operating and controlling speed of motor from Control panel.	04
5	**Plumbing**	**06**
a	Identification of Plumbing tools and pipe fittings , Reading of plumbing drawings, methods of joining PVC pipes, use of spirit level and plumb bob in piping.	03
b	To carry out minor repairs and replacement of fittings.	03

9. LEARNING RESOURCES

TEXT BOOKS

S. No.	Author	Title of Books	Publishers
1	N. Sesha Prakash	Manual of Fire Safety	CBS Publishers and Distributers
2	S.K. Hajara-Chaudhary	Workshop Technology	Media Promoters
3	B.S. Raghuwanshi	Workshop Technology-	Dhanpat Rai and sons, New Delhi
4	R K Jain-	Production Technology	Khanna Publishers, New Delhi
5	H. S .Bawa	Workshop Technology	Tata McGraw Hill Publishers, New Delhi
6	Kent	Mechanical Engineering Hand book	John Wiley and Sons, New York
7	B.L. Theraja	Fundamentals of Electrical Engineering and Electronics	S. Chand – New Delhi

REFERENCE BOOKS FOR FURTHER STUDY

S. No.	Author	Title of Books	Publishers
1	CIMI- Central Instructional Media Institute Madras	Turner – Trade Theory – Ist and IInd Year	Wiley Eastern Ltd. New Delhi

(GC106) Basic Engineering Practice (Mech & Elect.)

1. COURSE OBJECTIVE:

The students will be able to acquire knowledge about safety aspects, firefighting, first-aid and carpentry, fitting, plumbing skills. The students will learn proper ways of using various hand tools, measuring devices in acquiring these skills and will also interpret simple electrical drawings/circuit diagrams.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(GC 106)	L	T	P	H	TH	TM	PR/OR	TW	
Basic Engineering Practice	0	0	5	80	-	-	50	75	125

3. COURSE OUTCOMES:

PART A

On successful completion of the course, the student will be able to:
GC106.CO1. Understand safety procedures to be followed in carpentry, fitting, and plumbing.
GC106.CO2. Identify various tools used for carpentry, fitting, and plumbing.
GC106.CO3: Demonstrate basic working skills in carpentry, fitting and plumbing.

GC106.CO4: Plan & execute a job/activity using job drawing.

PART B

On successful completion of the course, the student will be able to:
GC106.CO1. List the safety measures.to be observed in electrical workshop.
GC106.CO2. Identify various electrical tools, fittings used for electrical measurements & troubleshooting.
GC106.CO3: Distinguish between single phase and three phase supply.

GC106.CO4: Plan & execute a job/activity from electrical circuit drawing.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

PART A

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	3	2	2	3
CO2	2	1	2	3	2	2	2
CO3	2	1	1	3	2	2	2
CO4	2	1	3	3	2	3	2

Relationship: Low-1 Medium-2 High-3

PART B

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	3	2	2	3
CO2	2	1	2	3	2	2	2
CO3	3	1	1	2	2	1	2
CO4	2	1	3	3	2	3	2

Relationship: Low-1 Medium-2 High-

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Hr = Practical Hours**	**CO = Course Outcomes**			
Unit			**M**	**Hr**	**CO**
1 General Safety, Housekeeping, Fire Fighting & First Aid				06	
1.1Introduction to General Safety aspects of engineering workshop 1.2 Meaning and importance of housekeeping. 1.3 Fire hazards, fire triangle, types of fire extinguishers – selection and use. 1.4Basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.					CO1
2 Fitting Workshop Practice				18	
2.7 Introduction to the trade. 2.8 Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools 2.9 Types of files and filing methods. 2.10 Drill bits and drilling Processes, using portable and pillar drilling machine. 2.11 Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling 2.12 Threading using taps and dies.					CO1 CO2 CO3
3 Carpentry Workshop Practice			20	18	
3.10 Introduction to carpentry 3.11Types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools 3.12 Wood working processes. 3.13 Different types of joints and their usage. 3.14 Introduction to wood working machines: a. Lathe b. Circular saw c. Band saw d. Wood planner e. Universal wood working machine					CO1 CO2 CO3
4 Electrical Workshop Practice			30	32	
4.1 Brief introduction to power distribution and Electrical Safety. 4.2 Use of different hand tools used in electrical trade 4.3 Collection of details of motors and transformers. 4.4 Introduction to Control Panel and its various sections/components. 4.5 Making of wire joints. 4.6Measurement of current, voltage, frequency and Power Consumption. 4.7 Connecting and starting of Induction Motor & Measurement of its speed. Changing of Direction of rotation of induction motor. 4.8 Introduction to commonly used electrical Fittings (Domestic & Industrial). 4.9Wiring of Simple Electric Circuit (Bulb & plug point and switches) on wooden board 4.10 Study, connection & use of Energy Meter 4.11Testing of components using Series test lamp & Multimeter 4.12Study of Fuses & practice replacement of Fuse 4.13 Study & Troubleshooting of Tube Light					CO1 CO2 CO3 CO4

5 Plumbing		06	
5.1 Plumbing tools, pipe fittings and method of joining pvc pipes. 5.2 Use of spirit level and plumb bob. 5.3 Minor repairs and replacement of fittings. 5.4 Reading of plumbing drawings. *[Note: Plumbing restricted to domestic plumbing and pvc piping.]*			CO1 CO2 CO3
Total		**80**	

6. COURSE DELIVERY:

The Course will be delivered through workshop practical sessions in mechanical and electrical workshops.

7. SPECIFICATION TABLE FOR PRACTICALS/ MACRO-LESSON PLAN

Unit No	Unit	Number of hrs.	Marks
1	General Safety, Housekeeping, Fire Fighting & First Aid		10
2	Fitting Workshop Practice		30
3	Carpentry Workshop Practice		20
4	Electrical Workshop Practice		30
5	Plumbing		10
	Total		100

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Hrs.
1	**General Safety, Housekeeping, Fire Fighting & First Aid**	**06**
a	Demonstration on use of Safety Measures while working in Workshop and use of safety signs.	03
b	Demonstration on use of First Aid and Artificial Respiration procedure ,Training on fire and emergency services (using video presentation /fire and safety expert talk)	03
2	**Fitting Workshop Practice**	**18**
a	Identification of various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools	03
b	Identification of various types of files and demonstration on filing methods.	03
c	Identification of various types of Drill bits, taps, dies and Drilling machines such as portable and Pillar Drilling machine.	03
d	Job involving filing, marking, cutting operation on MS Flat.	06
e	Job involving Drilling and Tapping operation on MS flat.	03
3	**Carpentry Workshop Practice**	**18**
a	Identification of various types of woods and wood working hand tools	03
b	Identification of various types of Carpentry joints and their usage.	03
c	Introduction to wood working machines such as wood working Lathe, Circular saw ,Band saw, Wood planner, Universal wood working machine	03
d	Job involving marking, measuring, planning, sawing, chiseling, joint preparation and assembly of wooden blocks.	06
e	Preparation of job on wood working lathe.	03
4	**Electrical Workshop Practice**	**32**
a	Measurement of Single Phase and Three Phase supply Voltage using multimeter.	02

b	Identification of various hand tools used in electrical trade.	02
c	Measurement of electric circuit parameters using Ammeter, Voltmeter, Frequency meter, Wattmeter.	04
d	Making of Straight and T wire joints.	02
e	Testing of electrical components such as Choke, starter, Fuse, Switch using Series Test lamp and Multimeter	02
f	Starting of induction motor using DOL Starter	02
g	Reversal of direction of rotation of Three phase induction motor	02
h	Identification of commonly used electrical fittings.	02
i	Wiring of simple electrical circuit using bulb and socket.	04
j	Measurement of Energy using Energy Meter.	02
k	Identification of Different types of Fuses and their replacement in circuit.	02
l	Testing of various components and connection of Tube light circuit.	02
m	Collecting Name plate Details of Motors and Transformers and operating and controlling speed of motor from Control panel.	04
5	**Plumbing**	**06**
a	Identification of Plumbing tools and pipe fittings , Reading of plumbing drawings, methods of joining PVC pipes, use of spirit level and plumb bob in piping.	03
b	To carry out minor repairs and replacement of fittings.	03

9. LEARNING RESOURCES

TEXT BOOKS

S. No.	Author	Title of Books	Publishers
1	N. Sesha Prakash	Manual of Fire Safety	CBS Publishers and Distributers
2	S.K. Hajara-Chaudhary	Workshop Technology	Media Promoters
3	B.S. Raghuwanshi	Workshop Technology-	Dhanpat Rai and sons, New Delhi
4	R K Jain-	Production Technology	Khanna Publishers, New Delhi
5	H. S .Bawa	Workshop Technology	Tata McGraw Hill Publishers, New Delhi
6	Kent	Mechanical Engineering Hand book	John Wiley and Sons, New York
7	B.L. Theraja	Fundamentals of Electrical Engineering and Electronics	S. Chand – New Delhi

REFERENCE BOOKS FOR FURTHER STUDY

S. No.	Author	Title of Books	Publishers
1	CIMI- Central Instructional Media Institute Madras	Turner – Trade Theory – Ist and IInd Year	Wiley Eastern Ltd. New Delhi

(GC201) ENGINEERING MATHEMATICS II

1. COURSE OBJECTIVE:

The course is aimed at providing mathematical knowledge, developing computational skills and reasoning. It also helps students to think logically and in systematic manner so as to grasp mathematical concepts easily. It helps to build analytical thinking which play an important role in solving real world problems in all scientific discipline.

2. TEACHING AND EXAMINATION SCHEME

Semester	**II**								
Course code & course title		**Periods/Week (in hours)**			**Total hours**	**Examination Scheme**			
						Theory Marks		**TERM WORK**	**Total Marks**
(GC201) Engineering Mathematics II		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**
		4	**2**	**-**	**96**	**75**	**25**	**25**	**-**

3.COURSE OUTCOMES:

GC201.CO1: Understand the basic principles of Matrices ,Integration, Determinants and Vectors in engineering problems.
GC201.CO2: Interpret the formulae to solve problems of Matrices ,Integration, Determinants and Vectors.
GC201.CO3: Apply appropriate mathematical methods for solving engineering problems.
GC201.CO4: Analyse the knowledge of Matrices ,Integration, Determinants and Vectors for various Engineering applications.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	3	1	1	2	0	2	2
CO2	3	1	1	2	0	2	2
CO3	2	2	2	3	1	2	2
CO4	1	3	2	3	1	2	2

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**Marks**	**Thr**	**CO**
1 .DETERMINANTS AND MATRICES			**15**	**12**	**CO1, CO2, CO4**
1.1 **Determinants**: Definition & order of determinant, value of determinant, properties of determinants(no question), Cramer's rule for solving equations with two & three variables			7	4	
1.2 **Matrices**: - Definition & order of matrix, types of matrices, Equality of matrices, addition & subtraction, multiplication of matrices, adjoint & inverse of a matrix , solution of linear equations with two & three variables using matrices			8	8	
2 .INTEGRATION			20	22	**CO1, CO2, CO4**
Definition, Standard Formulae, properties of Integration for sum, difference and scalar multiplication, integration of algebraic, trigonometric, inverse trigonometric, exponential, logarithmic, composite function, Integration by substitution, integration by partial fraction, integration by parts					
3 .DEFINITE INTEGRALS			10	08	**CO3**
Definition of definite integral and Properties of definite integral ,integration by parts Applications:Area under the curves & lines and area between the curves and Volumes (simple problems)					
4 .VECTORS			15	12	**CO1, CO2, CO4**
Definition of scalars & vectors, equality of vectors, Addition & subtraction of vectors, triangle, parallelogram laws for addition, position vector, dot product & cross product and their properties and applications, relation between dot and cross product and scalar triple product and applications					
5 .STATISTICS / COMPLEX NUMBERS			15	10	**CO3**
Statistics : **(ME and Allied courses only)** 5.1:Measures of central Tendency -mean, median, mode for ungrouped & grouped data 5.2:Measures of dispersion –Range, mean deviation, standard deviation, variance, coefficient of variation 5.3: Corrected mean and relation between standard deviation and mean.					**CO3**
5.Complex Numbers (electronics and Allied courses only) 5.1:Definition of complex number and Argand diagram, equality of complex numbers,					

5.2:powers of 'i' ,complex conjugates, 5.3:Addition& subtraction of complex nos. Multiplication& division of complex nos. 5.4: Modulus and argument of a complex number 5.5:Polar form & exponential form of complex no. 5.6: De Moivre's theorem., nth root of complex nos. 5.7:Hyperbolic, exponential, circular functions			
Total	**75**	**64**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY (GC201)

Unit No	**Unit**	**Number of lectures**	**Marks**
1	**Determinants & Matrices**	12	15
2	**Integration**	22	20
3	**Definite Integrals**	08	10
4	**Vectors**	12	15
5	**Statistics /Complex Number**	10	15
	Total	**64**	**75**

- Tutorial books should be maintained by students (5 marks)
- Two home assignments per semester (5 marks)

  The Two assignments each comprises of thirty questions which includes 15 short questions and fifteen long questions. First assignment will cover fifty percent of syllabus

  and second assignment will cover remaining portion of syllabus
- Topic-wise class assignment (15 marks)

  Class assignment comprises of ten short and ten long questions.

9. LEARNING RESOURCES

Text Books /reference books

S. No.	Title of Books	Author	Publishers
1	Mathematics for Polytechnic Students(Basic Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
2	Mathematics for Polytechnic Students(Engineering Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
3	Applied Mathematics	S.B. Gore, M.B.Patil, S.P. Pawar	Vrinda Publications

Reference Books for further study

S. No.	Title of Books	Author	Publishers
1	Applied Mathematics I	Dr. U.B.Jangam, K.P. Patil, Nalini Kumthekar	Nandu Printers& Publishers Pvt. Ltd. Mumbai
2	Applied Mathematics for Polytechnics	H.K. Dass	CBS Publishers & Distributers Pvt. Ltd. Pune
3	Advanced Engineering mathematics	H.K. Dass	S. Chand

(GC 202) APPLIED PHYSICS- II

1. COURSE OBJECTIVE:

On successful completion of the course, Students completing the Applied Physics II course will be able to demonstrate competency and understanding of the basic concepts found in, Electrostatics, Current Electricity, Electromagnetism and Electromagnetic Induction, Light and Optics and Sound, and will be able to utilize the knowledge to demonstrate competency with experimental methods that are used to discover and verify the concepts related to content knowledge.

2.TEACHING AND EXAMINATION SCHEME

Semester	**II**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(GC202) Applied Physics- II		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		03	**0**	**02**	**80**	**75**	**25**	**25**	**-**	**125**

3. COURSE OUTCOMES:

GC202.CO1: Understand the Fundamental Concepts of Electrostatics, Current Electricity, Electromagnetism and Electromagnetic Induction, Light, Optics and Sound.
GC202.CO2: Explain the basic principles of Electrostatics, Current Electricity, Electromagnetism and Electro Magnetic Induction, Light , Optics and sound.
GC202.CO3: Apply the knowledge of Electrostatics, Current Electricity, Electromagnetism and Electromagnetic Induction, Light, Optics and Sound to specific applications.
GC202.CO4: Compute various parameters in the field of Electrostatics, Current Electricity, Electromagnetism and Electromagnetic Induction, Light, Optics and Sound.

4. Mapping Course Outcomes with Program Outcomes

Relationship : 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	**Problem Analysis**	**Design and Devlopment of Solutions**	**Engg. Tools, Experimentatn & Testing**	**Engg. Practices for Society,Sustain ability& Environment**	**Project Management**	**Life -long Learning**
CO 1	3	3	1	1	2	0	3
CO 2	3	3	1	1	2	0	2
CO 3	3	2	3	3	3	1	1
CO 4	2	2	2	3	1	1	1

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**

Unit	**M**	**Thr**	**CO**
1 UNIT NAME: ELECTROSTATICS	**12**	**8**	**CO1, CO2, CO3, CO4**
1.1 Coulomb's law, Electric field,			
1.2 Electric field Intensity, Electric lines of force and properties			
1.3 Electric potential, Definition of Absolute potential			
1.4, Potential difference, Potential of sphere,			
1.5 Potential of earth.			
1.6 Capacitance,			
1.7 Capacitors in Parallel Derivation of Expression			
1.8. Capacitor in series Derivation Of Expression			
2. UNIT NAME: CURRENT ELECTRICITY	**20**	**12**	**CO1, CO2, CO3, CO4**
2.1 Definition of Electric Current and its Unit, Ohm's Law, Resistance,			
2.2 Factors on which resistance depends, Specific resistance. Effect of temperature on resistance Temperature coefficient of resistance,			
2.3 Resistances in Series and parallel			
2.4 EMF and Internal resistance of cell			
2.5 General Equation of ohm's law.			
2.6. Wheatstone's Network and Principle of Meter Bridge			
2.7 Principle of Potentiometer (Vα L) and Applications to compare EMF of given cells by single cell method and sum difference method			
2.8 Determination of Internal resistance of a cell using potentiometer.			
2.9 Electric Power and Electric Energy, KWh			
2.10 Calculation of Energy bills			
2.11 Heating Effect of Electric current. Joule's law.			
2.12 Applications in house hold appliances			
3. **UNIT NAME: ELECTROMAGNETISM AND EM INDUCTION**	**16**	**10**	**CO1, CO2, CO3, CO4**
3.1 Magnet, Magnetic field, Magnetic flux, and magnetic flux density and its unit			
3.2 Magnetic effect of Current, Oersted's Experiment, Right hand Thumb Rule, Biot Savart law			
3.3 Magnetic field at the center of the coil (no derivation), Magnetic field due to coil (Qualitative discussion only			
3.4 Electromagnet. Force acting on a current carrying conductor placed in magnetic field and expression (no derivation)			
3.5 Fleming's left-hand rule. Electromagnetic Induction. Faraday's Experiment			
3.6. Faraday's laws Lenz's law. Self-Induction and Mutual Induction.			
3.7 Transformer Principle.			
3.8 Step up and Step-down transformer.			
3.9 Induction Heating			
3.10 Induction heater and uses			
4. **UNIT NAME: LIGHT AND OPTICS**	**16**	**10**	**CO1, CO2, CO3, CO4**
4.1 Frequency Range of Infrared, ultraviolet and visible light and their uses			
4.2 Reflection, Refraction, Snell's law, refractive index.			
4.3 Refraction through glass slab and prism.			

4.4 Total Internal reflection applications in optical fibers.			
4.5 Advantages of optical fibers. LASER, sources and applications.			
4.6. Luminous Intensity, Intensity of Illumination			
4.7 Inverse square law of Illumination (No derivation)			
4.8 Principle of Photometry, X rays,			
4.9 Production of X Rays by Coolidge tube			
4.10 Properties and applications			
5. **UNIT NAME: SOUND**	**11**	**08**	**CO1, CO2, CO3, CO4**
5.1 Sound as longitudinal wave,wavelength,frequency,time period, amplitude,			
5.2 Free vibration force vibration,resonance, examples,			
5.3 Echo reverberation ,pitch loudeness,intensity of sound,			
5.4 Ultrasonic waves, Piezo electric effect, Principle of Production of ultra-sonics waves			
5.5 Application of Ultra sonics in finding depth of sea,			
5.6. Detection of flaws in metal, soldering, Drilling,			
5.7 Ultrasonic Cleaning			
5.8Ultrasound for medical purposes.(Just Uses)			

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	ELECTROSTATICS	8	12
2	CURRENT ELECTRICITY	12	20
3	ELECTROMAGNETISM AND EM INDUCTION	10	16
4	LIGHT AND OPTICS	10	16
5	SOUND	8	11
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS

No	Practicals	Marks
1.	Specific Resistance by Ammeter Voltmeter Method	25
2	Specific Resistance by Meter Bridge Method	25
3	To Verify the Series Law of Resistance by Meter Bridge Method	25
4	To Verify the Parallel Law of Resistance by Meter Bridge Method	25
5	To Compare the emf of two cells by single cell method	25
6	To find the internal resistance of a cell by Potentiometer Method	25
7	To find the velocity of sound by Resonance Tube method	25
8	To find the Refractive index	25
	Total (Average)	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	B G Dhande	Applied Physics of Polytechnics	Pune Vidyarthi Griha Prakashan
2	Bhandarkar	Applied Physics of Polytechnics	Vrinda publication
3	R K Gaur and S L Gupta	Engineering Physics	Dhanpat Rai & Sons Delhi

4	Dr. Vasudev R Bhagwat	A Text Book of Applied Physics for Polytechnics	Broadway Publishing House
5	B L Thereja	Engineering Technology	S. Chand

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Halliday D and Resnick	Physics Part I-II	Wiley Eastern Ltd.
2	Satish k. Gupta	ABC of Physics I&II	Modern Publisher
3	Saxena HC and Singh Prabhakar	Applied Physics Vol I & II	S. Chand Publisher

(GC203) ENVIRONMENTAL STUDIES

1. COURSE OBJECTIVE:

Environment is the nurturing force upon which we depend. It decides our well being, our health & quality of our life. The environment is deteriorating at an alarming rate due to increasing human activity and can be saved only by timely human action. The aim of Environmental studies is to sensitize the students towards the need to conserve & protect natural resources & biological support systems. With the aim to develop an attitude of concern for the environment the students will learn to choose environmentally friendly options for sustainable development and live in harmony with nature.

2. TEACHING AND EXAMINATION SCHEME :

Semester	**I**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(GC203) Environmental Studies		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		04	**-**	**-**	**64**	**75**	**25**	**-**	**-**	**100**

3. COURSE OUTCOMES:

GC203.CO1: Understand the role and importance of various elements of Environment.
GC203.CO2: Identify the concerns related to the natural resources, ecosystems, biodiversity, pollution and social issues of environment.
GC203.CO3: Develop sensitivity towards Environmental issues.
GC203.CO4: Co-relate causes affecting the environment & biodiversity.

4. Mapping Course Outcomes with Program Outcomes :

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experiments	Engg. Practices for Society,Sustainability	Project Management	Life -long Learning
CO1	2	1	1	0	3	2	2
CO2	2	1	1	0	3	2	2
CO3	1	1	1	0	3	2	2
CO4	1	1	2	0	3	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**Mks**	**Thr**	**CO1, CO3, CO4**
UNIT 1.0 : Multidisciplinary Nature of Environmental Studies	**09**	**08**	
1.1 Environmental studies : Definition , Scope and Importance			
1.2 Need for Public Awareness			
1.3 Environment & Human Health			
1.4 Environmental Ethics			
1.5 Value Education			
1.6 From Unsustainable to Sustainable Development : Concept and Guidelines			
1.7 Concept of Environmental Audit (EA) Environment Impact Assessment (EIA)			
1.8 Ecological Foot Prints			
UNIT 2.0 : ECOSYSTEM AND BIODIVERSITY	**15**	**13**	**CO1, CO2, CO3, CO4**
2.1 Ecosystem 2.1.1Concept, Structure & functions of ecosystem (Function of producer, consumer and decomposer) 2.1.2 Food chain & Food web- Concept & Examples 2.1.3 Energy flow in Ecosystem 2.1.4 Ecological Pyramids (Inverted & Upright) Pyramid of Number, Biomass & Energy. 2.1.5 Ecological Succession (Primary & Secondary Succession) 2.1.6 Study of Ecosystem: characteristic features structure and functions) Terrestrial(Forest, Grassland, Desert) Aquatic(Pond, River & Ocean)			
2.2 Biodiversity 2.2.1 Definition of Biodiversity 2.2.2. Types of Diversity (Genetic, Species & Ecosystem) 2.2.3. Value of Biodiversity (Consumptive , Productive, Social ,Aesthetic Moral & Optional value) 2.2.4 India as a Mega- diversity Nation 2.2.5 Biogeographical classification of India 2.2.6 Extinct, Endangered, Threatened & Endemic Species -Examples (of India) 2.2.7 Threats to Biodiversity (Habitat loss, Poaching of Wild life & Man Wildlife Conflict) 2.2.8 Reasons for loss of Biodiversity 2.2.9 Conservation of Biodiversity (Insitu & Exsitu conservation)			
UNIT 3.0 : NATURAL RESOURCES	**18**	**15**	**CO1, CO2, CO3, CO4**
3.1 Forest Resource 3.1.1 Direct & Indirect value of Forest 3.1.2 Deforestation-causes & effects 3.1.3 Forest Management **3.2** Water Resource 3.2.1 Water as a scarce Resourc 3.2.2Use and over exploitation of surface and ground water			

3.2.3 Need for Water Conservation 3.2.4 Construction of dams- Benefits and draw backs (Rehabilitation & Resettlement of people) 3.2.5 Rain water Harvesting. 3.2.6 Watershed Management 3.2.7 Conflicts over water in India **3.3** Energy Resource 3.3.1 Renewable & Non-Renewable sources of Energy 3.3.2 Growing Energy Needs. 3.3.3 Alternate Source of Energy (Solar ,Wind, Bio, Geothermal, Hydro & Nuclear Energy)			
3.4 Food Resource 3.4.1 Sources of Food 3.4.2 World Food Problems (Undernourishment & Malnourishment) 3.4.3 Changes caused by agriculture & overgrazing 3.4.5 Effects of modern agriculture on environment (use of synthetic fertilizers & synthetic pesticides in agriculture) **3.5** Mineral Resource 3.5.1 Types of Minerals 3.5.2 Use & Overexploitation of Minerals 3.5.3 Environmental Impact of Mining. **3.6** Land Resource 3.6.1 Pattern of Land Utilization (In India and World) 3.6.2 Land Degradation – Causes & Control Measures			
UNIT 4.0 : ENVIRONMENTAL POLLUTION- Sources , Effects & Control Measures	**24**	**20**	
4.1 Air Pollution 4.1.1 Definition, sources of air pollution(Primary and Secondary air pollutants with examples) 4.1.2 Effects on human health, animals, plants & Materials 4.1.3 Control of Air Pollution. 4.1.4 Removal of Particulate matter 4.1.5 Principles & Application of Control Equipments (Gravity and Inertial Separators, Cyclones, Filters, Electrostatic precipitators, Wet scrubbers) 4.1.6 Removal of Gaseous Pollutants (Combustion, Adsorption, Absorption) 4.1.7 Global Issues Definition, Cause & effects of Green House effect & Global Warming. Ozone layer Depletion, Acid Rain.			**CO1, CO2, CO3, CO4**
4.6 Noise Pollution :- 4.6.1 Definition. 4.6.2 Sources of Noise Pollution 4.6.3 Effects of Noise Pollution on Human health (Noise Induced hearing loss, Physiological & Psychological Effects)			

4.6.4 Control of Noise Pollution.			
4.7. Nuclear Pollution / Radioactive Pollution:- 4.7.1 Definition 4.7.2. Sources of nuclear Pollution (Natural & Man made) 4.7.3. Effects of Nuclear Pollution 4.7.4. Control of Nuclear Pollution 4.7.5.Disposal of Nuclear waste (Low, Medium & High activity waste) 4.7.6 Nuclear Accidents & Holocaust – case study			
4.8 Solid Waste Pollution. Definition: Refuse, Garbage Sources of Solid waste Types of solid waste (MSW, HW, BMW & EW) Effects of Consumerism Segregation of Solid waste at source Treatment of MSW (Open dumping, Land filling, incineration & composting) Waste Utilization (Reuse, Reclaim & Recycle) Solid waste Management System – Flow sheet diagram **4.9** Role of an Individual in Prevention of Pollution.			
UNIT 5.0 : **SOCIAL ISSUES & ENVIRONMENT**	**09**	**08**	**CO2, CO3, CO4**
5.1 Environmental Legislation Article 47 & Article 51-A(g)of the constitution on Environment. 5.1.1 Protection Functions of Ministry of Environment and Forest Govt. of India Objectives & Functions of Central & state pollution Control Boards Environmental Protection Act. Air (Prevention & Control of Pollution) Act. Water (Preventation & Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Motor vehicle Act.			
5.2 Social Issues 5.2.1Women & Child Welfare 5.2.2 Role of IT in Environment & Human Health 5.2.3 AIDS 5.2.4 Population Growth & Variation among Nations 5.2.5 Human Rights			

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**MULTI-DISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES**	08	09
2	**ECOSYSTEM AND BIODIVERSITY**	13	15
3	**NATURAL RESOURCES**	15	18
4	**ENVIRONMENTAL POLLUTION**	20	24
5	**SOCIAL ISSUES & ENVIRONMENT**	08	09
	Total	64	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Erach Bharucha	Textbook of Environmental Studies	Universities Press (India) Private Ltd.
2	Dr. Suresh K. Dhameja	Environmental studies	S.K. Kataria & Sons
3	Y. Anjaneyulu	Introduction to Environmental Science	B.S Publications
4	S. Deswal & A. Deswal	A Basic Cource in Environmental Studies	Dhanpat Rai & Co.
5	P. Meenakshi	Elements of Environmental Science and Engineering	Prentice Hall of India (PHI)

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Pandya and Camy	Environmental Engineering	Tata McGraw Hill
2	Asthana D.K. and Asthana Meera	Environmental Problems and Solutions	S. Chand & Co.
3	Gilbert M. Masters	Introduction to Environmental Engineering and Science.	Prentice Hall of India (PHI)
4.	M N Rao & HVN Rao	Air Pollution	Tata McGraw Hill

FIELD ACTIVITIES (OPTIONAL)

1. Visit to Selaulim/ Anjunem Dam.
2. Visit to show Hill cuttings, mining areas.
3. Visit to show Rain water harvesting project / Vermicomposting plant / watershed management project. (Krishi Vigyan Kendra – Old Goa)
4. Visit to Garbage treatment plant.

***On Completion of visit Report to be submitted.**

(GC204) ENGINEERING DRAWING

1. Course Objective: Drawing is a graphical language of engineering field. Engineering technician irrespective of his/her field of operation in an industry is expected to possess a thorough understanding of drawing, which includes visualization of objects and the proficiency in reading and interpreting a wide variety of engineering drawings. It is the skill, which translates an engineering idea into lines and dimensions. Besides this he/she is also expected to possess a certain degree of drafting skills- depending upon his/her job.

2. **TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	**Periods/ Week (In Hours)**			**Total Hours**	**Examination Scheme**				
					Theory Marks		**Practical Marks**		**Total Marks**
(GC204)	**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	**100**
Engineering Drawing	-	-	5	80	-	-	50	50	

3. Course Outcomes:

On successful completion of the course the student will be able to:
GC204.CO1: Understand different methods of projection, sectioning of solids and development of surfaces.
GC204.CO2: Select the relevant procedural methods for preparing Engineering Drawing.
GC204.CO3: Draw Isometric views and orthographic projection of full and sectioned objects and development of surfaces
GC204.CO4: Examine and Interpret Engineering Drawings

4. Mapping Course Outcomes with Program Outcomes

Relationship- 1:Slight (low) 2:Moderate(Medium) 3: Substantial(High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
	Basic and discipline specific knowledge	Problem analysis	Design & development of solution	Engg tools exptn and & testing	Engg Practice for society,sustainability and environment	Project management	Lifelong learning
CO1	3	2	1	3	1	1	1
CO2	3	1	2	3	1	2	2
CO3	2	2	2	3	1	2	2
CO4	2	2	2	2	1	2	3

5. Detailed course Contents/ Micro lesson plan

M=Marks Prhr= Teaching Hrs CO=Course Outcomes

Unit	Mark	Prhr	CO
1. Introduction 1.1 Importance of engineering drawing as a means of communication. 1.2 Planning of drawing sheet as per SP 46(latest revision) 1.3 Indian standard practices of laying out and folding of drawing 1.4 Different types of lines used in engineering drawing. 1.5 Importance of scale in Engineering Drawings. 1.6 Lettering 1.7 Methods of dimensioning, Dimensioning terms and notation -use of SP 46(latest revision), General rules for dimensioning, Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, countersunk hole, taper.	05	05	CO2
2. Geometrical construction & Engineering Curves 2.1Construction of an Equilateral and Isosceles triangle, Square, Regular pentagon & Regular hexagon given length of a side using general method of construction 2.2Construction of Engineering curves like: Ellipse- by focus & directrix method and arcs of circles method Parabola- by focus & directrix method and rectangle method Hyperbola- Focus and directrix method 2.3 Cycloid- by generating circle rolling on a straight line 2.4 Involutes of a circle. 2.5 Draw normal & tangents to the above curves from given point on the curve Curves to be explained with the help of applications.	05	15	CO2
3. Orthographic projection 3.1 Definitions of various terms associated with orthographic projections. Planes of projections. Concept of Quadrants. 3.2 First and third angle method of projection. 3.3 Projection of points 3.4Projection of lines Parallel to both Principal planes	18	30	CO1, CO2, CO3, CO4

Parallel to one and Perpendicular to other Principal plane. Inclined to one plane and parallel to other plane. 3.5 Projection of planes:Triangle, Square, circle when inclined to one principal plane & perpendicular to other plane. 3.6 Projection of solids: Cylinder, cone. Right regular solids such as (i) Prism: Square& Pentagonal (ii) Pyramid: Triangular & Square. Projections of above mentioned solids when axis is inclined to one principal plane & Parallel to other principal plane. 3.7 Conversion of simple pictorial views into orthographic views. *Problems where one end of the line is in one quadrant & other end in other quadrant and traces are to be excluded.* *Problems where apparent shape of plane are given, true shape & slope angle are to be drawn are excluded.*			
4. Section of solids Development of lateral surfaces **4.1** Concept of sectioning planes, Auxiliary planes and true shape of section. 4.2 Drawing section of solids like square prism, square pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other) 4.3Concept and importance of surface development in the engineering field. Methods of development of surfaces-Radial & Parallel line method. Development of surfaces for solids like square prism, square pyramid, cylinder and cone. *Development of solids standing on its base & cut by a plane inclined to HP and perpendicular to VP is also included.*	10	15	CO1, CO3
5. Isometric Views 5.1Difference between Isometric projection & Isometric view. 5.2Isometric view of geometrical planes and solids. 5.3Conversion of orthographic views into isometric views. 5.4Construction of Isometric view for any real object.	12	15	CO3, CO4

Total	50	80	

6. Course Delivery:

The course will be delivered through Practicals, class room interaction and exercises.

7. Specification table for Practical/Macro Lesson Plan

Unit No.	Unit	No. Of Practical Hrs.	Marks
1	Introduction	05	05
2	Geometrical construction & Engineering Curves	15	05
3	Orthographic projection	30	18
4	Section of solids Development of lateral surfaces	15	10
5	Isometric Views	15	12
	Total	**80**	**50**

8. Specification table for Practical/ Termwork:

No.	Practical
1	TYPES OF LINES, LETTERING, DIMENSIONING.
2	GEOMETRICAL CONSTRUCTIONS
3	ENGINEERING CURVES
4	PROJECTION OF POINTS & LINES
5	PROJECTION OF PLANES
6	PROJECTIONS OF SOLIDS
7	ORTHOGRAPHIC PROJECTIONS (First angle)
8	ORTHOGRAPHIC PROJECTIONS(Third angle)
9	SECTIONS AND DEVELOPMENT OF SOLIDS
10	ISOMETRIC VIEWS

9. Learning Resources:

Text Books

S.No.	Author	Title	Publisher
1	N.D. Bhatt	Engineering Drawing	Charoter Publisher,Anand

2.	R. K. Dhawan	Engineering Drawing	S. Chand Publishing
3.	K.R. Gopalakrishna	Engineering Drawing	Subhas Publications.

Reference Books only for further study

S.No.	Author	Title	Publisher
1	P.S. Gill	Geometrical Drawing	Kataria & Sons
2	P.S. Gill	Machine Drawing	Kataria & Sons
3	N.D. Bhatt	Machine Drawing	Charoter Publisher,Anand

Indian and International codes needed

S.No.	Author	Title	Publisher
1.	BIS, India	SP 46. (Latest revision).	BIS, India

(GC205) ENGINEERING MATERIALS

1. COURSE OBJECTIVE:

This course is introduced with an objective of providing knowledge to students regarding properties and composition of materials for engineering applications and enabling them to make comparative study of materials while selecting the appropriate material for various engineering applications.

2. TEACHING AND EXAMINATION SCHEME

Semester	**II**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(GC205) ENGINEERING MATERIALS		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**--**	**--**	**48**	**75**	**25**	**--**	**--**	**100**

3.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

GC205.CO1: List out the properties of materials used in engineering applications.

GC205.CO2: Explain the composition and properties of various engineering materials.

GC205.CO3: Classify materials based on composition and properties.

GC205.CO4: Select the appropriate material/s for the given engineering application/s.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society,Sustain ability & Environment	Project Management	Life -long Learning
CO1	3	2	0	0	0	0	1
CO2	3	2	1	0	0	0	1
CO3	2	2	2	1	1	0	1
CO4	2	3	3	2	1	0	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
1 INTRODUCTION TO ENGINEERING MATERIALS			**08**	**04**	
1.1 Classification of Materials: Metal and Non-metal, Ferrous Metal & Non-ferrous Metals, Differences between Metals & Non-metals					**CO1, CO2, CO3, CO4**
1.2 Properties of Materials:(Note: Properties to be explained with relevant examples.) 1.2.1 Physical properties – Melting point, Freezing point, Boiling point, Density, Linear co-efficient of expansion, Thermal conductivity, Electrical resistivity					
1.2.2 Mechanical properties – Strength, Elasticity, Plasticity, Ductility, Malleability, Toughness, Brittleness, Hardness, Fatigue, Creep.					
1.2.3 Electrical properties – Resistivity, Conductivity, Temperature coefficient of resistance, Dielectric strength, Thermo-electricity, Super conductivity					
1.2.4 Magnetic properties – Permeability and Coercive force					
1.2.5 Chemical properties - Corrosion resistance and Chemical composition					
2 FERROUS & NON-FERROUS METALS & ITS ALLOYS			**18**	**12**	
2.1 FERROUS ALLOYS: 1.1.1 Low carbon steel, Medium carbon steel, High carbon steel, their carbon percentage, properties & uses. 1.1.2 Cast iron: grey cast iron, white cast iron, their properties & uses 1.1.3 Alloy steels: Constituents of alloy steels such as Phosphorous, Sulphur, Silicon, Manganese and their effect on properties of materials. 1.1.4 Stainless steel, Nickel-chromium-molybdenum steel, its properties & uses. 1.1.5 Tool steel – composition, HSS, properties & uses					**CO1, CO2, CO3, CO4**
2.2 NON-FERROUS METALS & ALLOYS: 2.2.1 Aluminium – Properties & uses 2.2.2 Aluminium alloys – constituents of alloy & their effect on properties of metal 2.2.3 Properties & uses of Duralumin, Y-alloy and Al-Si alloy 2.2.4 Copper – Properties & uses. 2.2.5 Copper alloys – Constituents of alloy & their effect on properties of metal 2.2.6 Properties & uses of Copper – Zinc alloys such as Muntz metal, manganese, bronze, Copper-Tin alloys such as Bronze, Copper-Aluminium alloys such as Aluminium bronzes. 2.2.7 Lead and its hazard to the environment					**CO1, CO2, CO3, CO4**
3 NON-METALLIC MATERIALS			**18**	**10**	
3.1 CONSTRUCTION MATERIALS 3.1.1 Classification of rocks, common building stones and their applications. 3.1.2 Cement: Types of cement, composition and applications 3.1.3 Bricks: Composition, properties, Classification, Special bricks- Refractory and fly-ash bricks and uses 3.1.4 Clay: Types, products of clay- tiles and pipes 3.1.5 Sand- sources – river, crushed aggregates, applications					**CO1, CO2, CO3, CO4**
3.2 ENGINEERING CERAMICS 3.2.1 Refractories: Desirable properties, Properties and Applications of Fire clay and Silica Refractory, Difference between acid, basic & neutral					**CO1, CO2,**

refractories 3.2.2 Glass: Properties & uses of soda glass, borosilicate glass and fibre glass 3.2.3 Glass wool: Composition, properties & uses 3.2.4 Timber: Common varieties of timber, uses of wood products, veneer and plywood 3.2.5 Natural & Synthetic abrasive materials: Introduction, Properties & uses			**CO3, CO4**
4 CONDUCTOR, SEMI -CONDUCTOR, AND INSULATING MATERIALS	**16**	**12**	**CO1, CO2, CO3, CO4**
4.1 Classification of Materials as Conductor, Semiconductor and Insulating materials			
4.2 Conductor Material: 4.2.1 High conductivity materials: Copper, Aluminium, Carbon, Silver, Lead & Tungsten, their properties as conducting materials and applications. 4.2.2 High resistivity materials: nichrome, constantan, manganin and their applications			
4.3 Insulating Materials: Introduction and Characteristics of Good Insulating materials 4.3.1 Solid Insulating materials- wood, paper, rubber, mica, glass fibre, porcelain, PVC, resins, their characteristics as insulating materials and applications			
4.4 Semiconductor Materials: Silicon & Germanium, their specifications as semiconductor material and uses.			
Unit 5 MAGNETIC & COMPOSITE MATERIALS	**15**	**10**	
5.1 Magnetic Materials: Classification as Diamagnetic, Paramagnetic, Ferromagnetic, List of these materials and their applications			**CO1, CO2, CO3, CO4**
5.2 Composite Materials**:** metal matrix, ceramic matrix and polymer matrix composites, types of reinforcement materials and their applications			
5.3 Paints & Lubricants: 5.3.1 Classification: oil based and polymer based paints 5.3.2 Constituents of Paints – resin, binder, pigment, additives, solvents 5.3.3 Lubricants – Functions of lubricants, Types of Lubricants**,** Composition and Applications			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures and class room interactions

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit Name**	**Number of lectures (hrs)**	**Marks**
1	Introduction to Engineering Materials	04	08
2	Ferrous & Non-Ferrous Metals & its alloys	12	18
3	Non-Metallic Materials	10	18
4	Conductor, Semi-Conductor, & Insulating Materials	12	16
5	Magnetic & Composite Materials	10	15
		48	**75**

8. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.S. Khurmi	Material Science	S. Chand
2	R. Srinivasan	Engineering Materials & Metallurgy	Tata McGraw Hill
3	TTTI Madras	Electrical Engineering Materials	McGraw Hill Education, 2004
4	S. K. Hajra Choudhury	Material Science and Processes	Indian book distribution
5	P. C. Varghese	Building Materials	PHI
6	J. B. Gupta	Electrical and Electronic Engineering Materials	Katson

(FD301) GENERAL MICROBIOLOGY

1. COURSE OBJECTIVES:

The students will able to study the microorganisms, their classification, distribution in nature and their growth characteristics using microscopy and cultural techniques. They will also be able to understand the beneficial and harmful microorganisms, their growth patterns, physiology and effects in foods, sterilization methods for creating aseptic conditions for increasing the shelf life of foods. They will develop skills to isolate, identify and study the morphology and colony characteristics of microorganisms.

2. TEACHING AND EXAMINATION SCHEME

Semester	III								
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(FD301) GENERAL MICROBIOLOGY		L	T	P	Hrs	TH	TM	TW	PR/OR	
		2	-	3	5	75	25	25	25	150

3. COURSE OUTCOMES:

FD301. CO1: Understand the different microorganisms based on their growth requirements and their importance to the food industry.

FD301. CO2: Understand and select suitable microscopic techniques used to identify microorganisms.

FD301. CO3: Select sterilization and disinfection methods to create a conducive environment for food processing.

FD301. CO4: Select suitable laboratory techniques to culture microorganisms and study their colony characteristics.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	1	1	3	1	1	3
CO2	2	1	1	3	1	1	2
CO3	3	2	1	2	1	1	3
CO4	3	2	2	3	1	2	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	3	3
CO2	2	2
CO3	3	1
CO4	1	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			**M**	**Thr**	**CO**
UNIT 1.0 HISTORY AND CLASSIFICATION OF MICROORGANISMS			**22**	**9**	**CO1 CO2 CO3 CO4**
1.1 Place of microorganisms: 1.1.1 Protists, Monera, Prokaryotes, Eukaryotes. 1.1.2 Whittaker's 5 kingdom Theory. 1.1.3 Discoveries of Scientists: Anthony Van Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Joseph Lister and Edward Jenner. 1.1.4 Microorganisms as Allies and Foes. 1.1.5 Distribution of microorganisms in nature: Medical, Aquatic, Domestic water and Sewage, Air, Milk, Food soil, Industrial. 1.1.6 Classification of microorganisms: Differentiating characteristics of Eukaryotes and prokaryotes with examples.					
1.2 Yeasts and Molds: 1.2.1 Importance, distinguishing characteristics, morphology and cultural characteristics 1.2.2 Physiology and nutrition, cultivation. 1.2.3 Important Molds: Mucor, Rhizopus, Aspergillus, Penecillium, Trichoderma , Fusarium					
1.3 Algae 1.3.1 Economic Importance, soil fertility, vitamin synthesis, algal diseases. 1.3.2 Morphology and cultural characteristics. 1.3.3 Algal pigments, photosynthesis, motility. 1.3.4 Important Algae.					
1.4 Protozoa 1.4.1 Morphology, structure, locomotary organelles. 1.4.2 Important Protozoa: Amoeba, Paramecium, Euglena, Plasmodium					
1.5 Viruses 1.5.1 Characteristics, animal viruses. 1.2 Plant viruses, bacteria viruses.					
UNIT 2.0 ISOLATION AND CULTURING TECHNIQUES, MAINTENENACE AND COLONY CHARACTERISTICS OF MICROORGANISMS			14	6	**CO1 CO2 CO3 CO4**
2.1 Isolation and culturing techniques: 2.1.1 Streak plate method: Perpendicular method, parallel method. 2.1.2 pour plate ,surface plate, single cell isolation, 2.1.3.serial dilution method, enrichment media, selective media , differential media					
2.2 Maintenance of culture 2.2.1 Periodic transfer, over layering with mineral oil, lyophilization, Storage at low temperature. 2.2.2 Maintenance of media: Bacteria – Nutrient agar, Yeast – Wickerham's media, Fungi – Sabouraud's media.					
2.3 Colony characteristics: 2.3.1 Colonies on agar plate: size, shape, margin, edge, surface, consistency, elevation, opacity, whole colony, gram characteristics and motility. 2.3.2 Growth in broth : Amount of growth, Distribution of growth, Odour.					
UNIT 3.0 MICROSCOPY ,STAINING METHODS, MORPHOLOGY AND CELL STRUCTURE OF MICROORGANISMS			16	7	**CO1 CO2**

3.1 Microscope: 3.1.1Compound microscope: Construction, working, maintenance. Definition of: Resolving Power, Numerical Aperture. 3.1.2 Principles of Dark field microscopy, Phase contrast microscopy 3.1.3 Electron microscopy. 3.1.4 Methods of microscopy: Wet mount, Hanging drop preparation, Stained smears			**CO3** **CO4**
3.2. Staining procedures: 3.2.2 Chemistry of dyes, monochrome staining. 3.2.3 Differential staining procedure: Gram staining, Negative staining, Spore staining 3.2.4 Acid fast staining, Capsule staining, Flagella staining. 3.2.5 Morphology of microorganisms: Size, Shape, Arrangement of cells of microorganisms under the microscope.			
3.3 Vegetative cell structure: 3.3.1 Cell wall. Structures external to the cell wall: Flagella, fimbriae, and Capsule. 3.3.2 Structures Internal to cell wall: Cytoplasmic membrane, cytoplasmic inclusions, and nuclear material. 3.3.3 Endospore: Fine structure, Factors responsible for the germination of spores			
UNIT 4.0. ASEPSIS AND STERILIZATION	10	5	
4.1 Microbial control. 4.1.1 Importance, Definitions of Sterilization, disinfectant, antiseptic, sanitizer, germicide, bactericide, bacteriostasis, 4.1.2 Antimicrobial agents. 4.1.3 Patterns of microbial growth. Condition influencing antimicrobial action.			
4.2 Control by physical agents: 4.2.1 High Temperature: Moist heat, dry heat and equipment working on these principles. Definitions of TDT, TDP, DRT. 4.2.2 Low Temperature: Chilling, Freezing. 4.2.3 Radiation, Osmotic Pressure, 4.2.4 Desiccation and Filtration			**CO1** **CO2** **CO3** **CO4**
4.3 Control by chemical agents: 4.3.1 Characteristics of an ideal disinfectant. Selection of an antimicrobial agent.. 4.3.2 Major groups of chemical agents: Phenol and Phenolic compounds, alcohols, halogens, heavy metals and their compounds, dyes, synthetic detergents, acids / alkalis, gaseous chemosterilizers			
UNIT 5.0 GROWTH AND PHYSIOLOGY OF MICROORGANISMS	13	5	**CO1** **CO2** **CO3** **CO4**
5.1 Growth of microorganisms: 5.1.1 Phase of growth, Synchronous growth, Growth rate and generation time, and cell fission. 5.1.2 Growth rate and generation time, cell fission.			
5.2. Measurement of growth: 5.2.1Direct methods: cell counts and membrane filter count. 5.2.2Indirect methods: Turbidity, dry weight, total volume 5.2.3 Chemical methods. 5.2.4 Dilution methods: Serial dilution method (colony count), Roller tube methods.			
5.3 Factors affecting growth: 5.3.1Temperature, pH, 5.3.2 Nutritional requirements and Oxygen requirement			

5.4 Physiology of microorganisms: 5.4.1 Oxygen requirement: Obligate aerobes, obligate anaerobes, facultative aerobes /anaerobes, microaerophilic. 5.4.2 Carbon source requirement: Autotrophs, heterotrophs. 5.4.3 Source of energy: Chemotrophs, phototrophs. 5.4.4 Temperature requirements: Mesophiles, Psychrophiles, Thermophiles 5.4.5 Saprophytes. Parasites.			
Total	75	32	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	History and classification of microorganisms	9	22
2	Isolation and culturing techniques, maintenenace and colony characteristics of microorganisms	6	14
3	Microscopy , staining methods , morphology and cell structure of microorganisms	7	16
4	Asepsis and sterilization	5	10
5	Growth and physiology of microorganisms	5	13
	Total	**32**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Microscope: Construction, Working and Maintenance.	25
2	Microscopy of standard cultures for morphology: Bacillus subtilis, E. Coli, Staphylococcus aureus, Saccharomyces cereviciae, Aspergillus, Penicillium, Mucor, Rhizopus	25
3	Motility of Micro-organisms: Hanging drop preparation.	25
4	Preparation of media: Nutrient broth, Nutrient agar.	25
5	Isolation of pure culture from water, milk, fruit, juice, fish and meat: Streak plate methods; Pour plate method, Surface plate method	25
6	Cultural characteristics of standard culture: Colonies on nutrient agar plate	25
7	Staining procedure: Monochrome staining	25
8	Gram staining	25
9	Viable count of micro-organisms: Serial dilution method; Surface plate method, Pour plate method.	25
10	Total count of micro-organisms: Smear count.	25
	Total (Average)	25
No	**Class room Assignments**	**Marks**
1	Differences between Gram positive and Gram negative bacteria	25
2	Important bacteria, Molds , Yeasts and Algae to the food industry.	25
3	Important microbiological laboratory equipment	25
4	Microorganisms as Allies and Foes	25
5	Different Enrichment media, Selective media and Differential media	25
6	Media for the isolation of Coliforms, Staphylococcus, Salmonella and Clostridium.	25
7	Experiment to measure bacterial growth in the laboratory.	25
8	Importance of Molds and Yeasts to the Food Industry	25
9	Difference between Phase Contrast and Electron Microscope.	25
10	Contribution of Scientists to microbiology	25
...	Total (Average)	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	M. Frobisher	Fundamental of Microbiology	Saunders
2	M. J. Pelczar and R. D. Reid	Microbiology	Tata McGraw-Hill
3	Salle	Microbiology	Tata McGraw-Hill

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Harry W. Seeley and Paul J. Van Demaark	Microbes in action	W.H.Freeman
2	C. H. Collein and P. M. Lyne	Microbiological methods	W.H.Freeman

(FD302) ORGANIC CHEMISTRY

1. COURSE OBJECTIVES:

The subject deals with a study of the physical and chemical properties of organic compounds and their role in bimolecular interactions in foods. It enables us to understand the different classes of organic compounds and their importance in food processing, the effect of different organic compounds used in food processing and preservation, and also to develop skills in the systematic analysis of organic compounds present in foods.

2. TEACHING AND EXAMINATION SCHEME

Semester	III								
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(FD302) ORGANIC CHEMISTRY		L	T	P	Hrs	TH	TM	TW	PR/OR	
		2	-	3	5	75	25	25	25	150

3. COURSE OUTCOMES:

FD 302.CO1: Understand the fundamental concepts of organic compounds and apply this knowledge in the manufacture of processed foods.
FD 302.CO2: Identify the different organic compounds in foods.
FD 302.CO3: Understand the effects of organic compounds and their reaction to food components.
FD 302.CO4: Co-relate the use different organic compounds based on their properties in the processing of foods.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	1	1	1	2
CO2	2	1	2	2	1	1	1
CO3	3	1	2	1	2	1	3
CO4	3	1	2	1	2	1	2

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems
PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	1	2
CO4	1	2

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
UNIT 1.0 CLASSIFICATIONS AND SYSTEMATIC NOMENCLATURE			**23**	**10**	**CO1 CO2 CO3 CO4**
1.1 Classification into compounds: 1.1.1 Acyclic or open chain with examples 1.1.2 Cyclic or Ring Compounds comprising of Carboxylic and Hetero-cyclic compounds with examples.					
1.2 Open chain compounds: 1.2.1 Classes of hydrocarbons; Definitions and general structure. saturated and unsaturated compounds with examples. 1.2.2 Functional groups: Types of functional groups in organic compounds. 1.2.3 Homologous series: Definition, characteristics, examples 1.2.4 Different classes of compounds such as hydrocarbons, halogen compounds, alcohols, aldehydes, ketones, acids, esters etc.					
1.3 Nomenclature 1.3.1 I.U. P. A. C. system of nomenclature with common name and systematic names of alkanes, alkenes, alkynes, halogen Compounds, alcohols and other classes of aliphatic compounds. 1.3.2 I. U. P. A. C. rules of naming hydrocarbon chain compounds and functional compounds i.e. mono-functional compounds.					
UNIT 2.0 ALIPHATIC COMPOUNDS – ALKANES , ALKENES AND ALKYNES			10	4	**CO1 CO2 CO3 CO4**
2.1 Alkanes: 2.1.1 General formula and structure with reference to methane, types of carbon atoms in alkanes, i.e. primary, secondary, tertiary, quaternary, 2.1.2 Isomerism in alkanes taking butane as example, occurrence in nature, 2.1.3 Physical and chemical properties of alkanes taking methane as example; Halogenations, Nitration, Sulphonation, Oxidation.					
2.2. Alkenes : 2.2.1 Physical and chemical properties of alkenes taking Ethylene as example; Addition of hydrogen, halogen acid, oxygen, oxidation reaction, substitution reaction. 2.2.2 Alkynes: Physical and chemical properties of alkynes taking acetylene as examples: Addition of halogen, halogen acid, water, hydrogen, oxidation reaction, polymerisation reaction.					
UNIT 3.0 ALIPHATIC COMPOUNDS – ALCOHOLS , ALKYL HALIDES, ALDEHYDES AND KETONES			10	5	
3.1 Aliphatic alcohols: 3.1.1 Definition, examples with and structure of monohydric, dihydric and trihydric alcohols. 3.1.2 Method of production of ethyl alcohol by fermentation from Molasses, Starchy materials. 3.1.3 Other methods of production of ethyl alcohol: Hydrolysis of alkyl ethyl halides, Hydration of alkenes, Hydrolysis of esters. 3.1.4 Types of alcohol: Primary, Secondary and Tertiary alcohols. 3.1.5 Physical and Chemical properties of alcohols: Action of acids, Oxidation of alcohols.					

Halogen Derivatives: Example with structure of mono, di , tri and tetra halogen derivatives.			
3.2 Aldehydes and Ketones 3.2.1 Aldehydes: Structural formula and examples, oxidation and reduction reaction taking acetaldehyde as examples 3.2.2 Ketones: Structural formula and examples of simple and mixed Ketones, oxidation and reduction reactions taking acetone as example.			
UNIT 4.0 ALIPHATIC COMPOUNDS – CARBOXYLIC ACIDS, ESTERS, ETHERS AND AMINES.	10	5	
4.1 Carboxylic acids: 4.1.1 Structural formula and examples of mono, di and tri carboxylic acids. 4.1.2 Physical and chemical properties of mono carboxylic acids. 4.1.3 Halogenations, Oxidation – Reduction formation of Esters, Formation of Aldehydes and Ketones.			
4.2 Ethers, esters ,amines and halogen derivatives 4.2.1 Ethers: Structural formula and examples of simple and mixed ethers. 4.2.2 Esters: Structural formula and examples, methods of production of ester from alcohol and acid. Physical and chemical properties of esters taking Ethyl-acetate as example 4.2.3 Aliphatic Amines: Structural formula and examples of primary, secondary and Aliphatic tertiary 4.2.4 Halogen Derivatives: Examples with structure of mono, di, tri and tetra halogen derivatives			
UNIT 5.0 AROMATIC COMPOUNDS	22	8	
5.1 Benzene 5.1.1 Structure of benzene (Kekule's structure), Homologues (side chain derivatives) of benzene, Toluene, Halogen derivative, xylene (structure with ortho, meta, and Para position). 5.1.2 Aryl radical: Examples with structure formula of phenyl, benzyl and benzal radical.			
5.2 Preparation of benzene 5.2.1 Methods of production benzene: Distillation of coal tar 5.2.2 Polymerization of acetylene and distillation of sodium benzoate with soda lime.			
5.3 Physical and chemical properties of benzene 5.3.1 Physical properties. 5.3.2 Chemical Properties: Reactions of benzene with hydrogen, halogen, nitration of benzene, sulphonation of benzene, Friedel crafts reaction.			
5.4 TOLUENE Physical and chemical properties of Toluene: Halogenation, nitration, sulphonation and oxidation.			
Total	**75**	**32**	

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Classifications and systematic nomenclature	10	23
2	Aliphatic compounds – alkanes , alkenes and alkynes	4	10
3	Aliphatic compounds – alkyl halides, alcohols , aldehydes and ketones aromatic compounds	5	10
4	Aliphatic compounds – carboxylic acids, esters, ethers and amines.	5	10
5	Aromatic compounds	8	22
	Total	32	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Qualitative Analysis of Organic Compound :Ethyl alcohol	25
2.	Qualitative Analysis of Organic Compound: citric acid	25
3	Qualitative Analysis of Organic Compound: oxalic acid	25
4	Qualitative Analysis of Organic Compound: nitrobenzene	25
5	Qualitative Analysis of Organic Compound: acetone	25
6	Qualitative Analysis of Organic Compound: Ethyl acetate	25
7	Qualitative Analysis of Organic Compounds: Aniline	25
8	Qualitative Analysis of Organic Compound: salicylic acid	25
9	Qualitative Analysis of Organic Compound: glucose	25
10	Qualitative Analysis of Organic Compound: benzaldehyde	25
11	Qualitative Analysis of Organic Compound: aniline	25
	Total(Average)	25
No	**Class room Assignments**	**Marks**
1	Flow chart of Ethyl alcohol manufacture from molasses .	5
2	Flow chart of Ethyl alcohol manufacture from starchy foods.	5
3	Tollen's test and Fehling's test for detecting aldehyde group in a organic compound.	5
4	Applications of PVC, Polythene and benzene derivatives in food technology.	5
5	Role of organic chemistry in food processing	5
...	Total	25

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	B. S. Bahl	Text Book of Organic Chemistry	S.Chand and Company
2			

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	R. A. Kulkarni, R. V. Bhagwat, C. T. Bhastana	Elementary Organic Chemistry	

(FD303) METHODS OF FOOD PRESERVATION – I

1. COURSE OBJECTIVES:

The students will able to understand about food spoilage, spoilage factors and their effects. They will also be able to learn different preservation principles in Food Processing and Storage of low moisture foods.

2. TEACHING AND EXAMINATION SCHEME

Semester	III								
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks	Total Marks
(FD303) METHODS OF FOOD PRESERVATION – I		L	T	P	Hrs	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	50	-	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FD303 CO1: Identify the root cause of spoilage in various foods

FD303 CO2: Understand the methods of preservation and their appropriate application.

FD303 CO3: Select the right techniques of storage and pest control methods.

FD303 CO4: Supervise the execution of medium and large scale preservation techniques.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	2	1	1	1	1	3
CO2	3	2	1	2	1	1	3
CO3	3	2	1	1	2	1	3
CO4	3	2	1	2	1	2	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
UNIT 1: FOOD SPOILAGE			**14**	**13**	**CO1**
1.1 Perishability 1.1.1 Perishability of foods 1.1.2 Classification of foods based on Perishability					**CO2** **CO3** **CO4**
1.2 Types of spoilage 1.2.1 Physical Spoilage: Due moisture absorption, desiccation, mechanical injury 1.2.2 Chemical Spoilage: Due to chemical reactions-Oxidation of fat, Non Enzymatic browning-Maillard reaction, caramelization, ascorbic acid oxidation, strecker degradation, aggregation of proteins, light, time, heat and cold etc 1.2.3 Biochemical Spoilage: Due to enzymes present in food or from external agency i.e. insect, micro-organisms 1.2.4 Microbial Spoilage: Due to growth of microorganisms and enzyme production 1.2.5 Spoilage by Contamination Dirt, dust, chemicals, insects, rodents and parasites					
UNIT 2: TRADITIONAL METHODS OF FOOD PRESERVATION			**6**	**4**	**CO1**
2.1 Principle and Methods of Preservation 2.1.1 By use of sugar 2.1.2 By use of salt 2.1.3 Drying 2.1.4 Smoking 2.1.5 Curing					**CO2** **CO3** **CO4**
UNIT 3: PRESERVATION OF LOW MOISTURE FOODS			**20**	**13**	**CO1**
3.1 Spoilage of food grain 3.1.1 Physical Spoilage: Due to temperature, moisture and humidity 3.1.2 Chemical Spoilage: Due to Oxygen, metabolic activities and pesticides 3.1.3 Biological factors: Spoilage insects of stored grain and flour-beetles, weevils and moths Techniques in detecting grain infestation-sampling methods					**CO2** **CO3** **CO4**
3.2 Insect Control Methods: 3.2.1 Traditional methods 3.2.2 Chemical methods Use of insecticides and fumigants properties, dose, method of application, toxicity					
3.3 Rodent Control Methods 3.3.1 Methods of grain storage- traditional and improved methods. 3.3.2 Modern warehouses principles and storage					
UNIT 4: METHODS OF FOOD PRESERVATION			**35**	**18**	**CO1**

4.1 Refrigeration and Cold Storage 4.1.1 Principle of refrigeration and cold storage 4.1.2 Cold storage of fruits and vegetables 4.1.3 Specific heat and heat of respiration 4.1.4 Refrigeration requirements- refrigeration load 4.1.5 Modified Gas Atmosphere Storage 4.1.6 Principle of controlled atmosphere storage			**CO2** **CO3** **CO4**
4.2 Freezing Of Foods 4.2.1 Principle of preservation by freezing 4.2.2 Pre-treatments 4.2.3 Methods of freezing-slow v/s quick-freezing 4.2.4 Changes during freezing, thawing, drip loss			
4.3 Dehydration 4.3.1 Principle 4.3.2 Pre-treatment required 4.3.3 Sun drying and mechanical drying 4.3.4 Advantages and limitations of different mechanical dehydrators 4.3.5 Dehydration and Rehydration ratio 4.3.6 Case hardening and texture losses 4.3.7 Freeze drying –Triple point, applications 4.3.8 Concentration – Principle. Recent advances, osmotic dehydration, freeze concentration, microwave drying.			
4.4 Fermentation 4.4.1 Principle and definition. 4.4.2 Additional benefits from fermentation Controlling fermentation in various foods			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No.	Unit	Number of lectures	Marks
1	Food Spoilage	13	14
2	Traditional Methods Of Food Preservation	4	6
3	Preservation Of Low Moisture Foods	13	20
4	Methods Of Food Preservation	18	35
	Total	**48**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Detection of spoilage in food	25
2	Preparation and analysis of brine	25
3	Demonstration of enzymatic browning in food and its effect on product quality	25
4	Study of dehydration and rehydration ratio	25
5	Dehydration of fruit pulps	25
6	Potato dehydration	25
7	Examination of insect in stored grain	25
8	Detection and estimation of insect, infestation of food grain	25

9	Demonstration of infestation control, handling of different appliances	25
10	Visit to grain storage warehouse	25
11	Demonstration of effect of sulphuring before processing	25
12	Storage study of fruits and vegetables - open air, low temperature and waxing	25
13	Preservation of Fruits/Vegetables in brine	25
	Total	25
No	**Class room Assignments**	**Marks**
1	Natural and other contaminating source	25
2	Curing and smoking of meats	25
3	Insects of stored grains	25
4	Traditional and Modern storages	25
5	Dryers used in Food industry	25
6	Temperature and humidity required for storage of Fruits and Vegetables	25
7	Freeze drying	25
8	Concentration of Foods	25
9	Dehydration of Foods	25
10	Fermentation Controlling methods	25
	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Norman N. Potter	Food Science	CBS pubs
2	R.N. Sinha.	Grain Storage Part I	AVI Pub .co
3	D. W. Hall	Handling & Storage of Food Grain in Tropical and Sub-tropical Areas	South Asia Books
4	Norman W. Desrosier	Fundamentals of Food Freezing	AVI Pub Co
5	P. J. Fellows	Food Processing Technology, Principles and Practice	Blackwell

(FD304) FOOD ENGINEERING-I

1. COURSE OBJECTIVES:

The students will able to study various Unit Operations carried out and Equipments Used in the Food Industry. They will be able to understand unit operations involving heat transfer with minimized Design and mathematical aspects, maintenance aspect and factors to be considered in choosing appropriate equipment. They will be able to gain Extensive Knowledge on Unit operations such as heat transfer, dehydration, concentration, freezing, etc. as the course is supplemented by factory visits for study on various equipment.

2. TEACHING AND EXAMINATION SCHEME

Semester	III								
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(FD304)		L	T	P	Hrs	TH	TM	TW	PR/OR	
FOOD ENGINEERING-I		-	-	3	3	-	-	25	25	50

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FD 304 CO1: Apply design and mathematical aspects of heat transfer in thermal processing

FD 304 CO2: Select the right equipments for various unit operations in food industry involving heat transfer.

FD 304 CO3: Supervise and maintain the working of machinery used in food industry.

FD 304 CO4: Supervise the operations of cold storage.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	2	1	2	1	1	3
CO2	3	2	1	1	1	1	3
CO3	3	2	1	1	1	1	3
CO4	3	2	1	1	1	1	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	2	2
CO2	3	2
CO3	3	3
CO4	3	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1: HEAT TRANSFER & HEAT EXCHANGERS	**23**	**13**	
1.1 Heat transfer 1.1.1 Modes Of Heat Transfer 1.1.1. Thermal conductivity, Conduction through plane, homogeneous and composite walls **1.1.2.** Concept of thermal resistance **1.1.3.** Conduction through a hollow cylinder, Conduction through pipes **1.1.4.** Heat transfer coefficients, and overall heat transfer coefficient, empirical correlations. **1.1.5.** Convection Heat transfer with boiling liquids, Convection-free and forced. **1.1.6.** Radiation Stefan Boltman law, emissivity and absorptivity			**CO1** **CO2** **CO3** **CO4**
1.2 Heat Exchangers 1.2.1 Tube And Plate Heat Exchangers: Characteristics and uses 1.2.2 Relative merits and demerits of Tube heat exchangers: Counter and parallel flow, log mean temperature difference. 1.2.3 Mechanically Aided Heat Exchangers: Votators, film, scraped surface, etc. 1.2.4 Heat Exchangers For Gases: Extended surface, radiators.			
UNIT 2: PSYCHROMETRY	**6**	**4**	
2.1 Psychrometry Principles And Definitions 2.1.1 Humidity, dry and wet bulb temperature, relative humidity, humid heat. 2.1.2 Humidity measurement instruments. Humidity charts. 2.1.3 Cooling by evaporation			**CO1** **CO2** **CO3** **CO4**
UNIT 3: REFRIGIRATION PRINCIPLES & FREEZING	**17**	**13**	
3.1 Refrigeration System 3.1.1 Simple vapour compression refrigeration system: Thermodynamics and system components. 3.1.2 Effect of sub cooling liquid, super-heating suction vapour, pressure losses, etc. Unit of refrigeration. 3.1.3 Principle of absorption refrigeration 3.1.4 Refrigerants: Properties of common refrigerants, comparison, classification, basis of selection.			**CO1** **CO2** **CO3** **CO4**
3.2 Freezing 3.2.1 Principles of freezing: rate, heat transfer, storage of frozen foods 3.2.2 Freezing Equipment: Plate Freezers, Immersion Freezing, Fluidised bed Freezers, Blast Freezers, etc.			
UNIT 4: CONCENTRATION AND DEHYDRATION	**24**	**15**	
4.1 Concentration: 4.1.1 Vacuum and atmospheric concentration – production of vacuum 4.1.2 Evaporators: Tubular, Flash, forced circulation, etc. 4.1.3 Multi- effect evaporators			**CO1** **CO2** **CO3** **CO4**

4.2 Drying: 4.2.1 Moisture calculations: Dry and wet basis 4.2.2 Drying rate behaviour: Free and bound- moisture, critical and equilibrium moisture content 4.2.3 Drying curves: Materials characteristics, constant and falling rate periods, Factors affecting drying rate. 4.2.4 Types of airflow and basis of material balance in drying and concentration.			
4.3 Dehydration Equipments: 4.3.1 Vacuum and atmospheric dehydration. 4.3.2 Dryers: Batch and continuous, drum, spray, tray, fluidised bed, roller. 4.3.3 Freeze drying - Principles and equipment.			
UNIT 5: DISTILLATION	**5**	**3**	
5.1 Distillation: 5.1.1 Outlines of batch distillation, flash vaporization, fractionation and steam distillation. 5.1.2 Stripping of flavour / essence			**CO1** **CO2** **CO3** **CO4**
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**Heat Transfer & Heat Exchangers**	13	23
2	**Psychrometry**	4	6
3	**Refrigeration Principles & Freezing**	13	17
4	**Concentration & Dehydration**	15	24
5	**Distillation**	3	5
	Total	**48**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Measurement of humidity by wet and dry bulb thermometers	25
2.	Study experiments of the following, with drawings on sketchbook / journal Heat exchanger: Tube, plate, and scraped surface.	25
3.	Refrigeration system	25
4.	Dehydration equipment: Spray dryer, shell dryer, drum dryer.	25
5.	Freezers: Plate, tunnel, cryogenic.	25
6.	Evaporators: Flashed, forced circulation, tubular, long tube, short tube external heating.	25
7.	Visit to Goa Dairy, Frozen fish Plant, Distillery	25
	Total	25
No	**Class room Assignments**	**Marks**
1	Tubular and plate heat exchangers –types & application in Food Industry	25

2	Mechanically aided heat exchangers- types & application in Food Industry	25
3	Heat exchangers for gases- types & application in Food Industry	25
4	Types of Refrigeration System	25
5	Ice Plant	25
6	Types of Freezers	25
7	Problems using Psychrometry Chart	25
8	Evaporators-types & application in Food Industry	25
9	Dryers- types & application in Food Industry	25
10	Application of distillation in Food Industry	25
...	Total	

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	D. R. Heldman	Food Process Engineering	AVI Publications
2	S. E. Charm	Fundamentals of Food Engineering	AVI Publications
3	J. C. Harper	Elements of Food Engineering	AVI Publications
4	McCabe & Smith	Unit Operations in Chemistry Engineering	Mc Graw Hill
5	H. A. Leniger & W. A. Beverloo,	Food Process Engineering	D. Reidel Publishing Co.

(CC304) BASIC ELECTRICAL ENGINEERING

1. COURSE OBJECTIVES:

1. To understand basic concepts in Electrical Engineering
2. To understand working & use of Transformer, DC & AC motors
3. To understand importance of safety precautions and use of protective devices

2. TEACHING AND EXAMINATION SCHEME

Semester	III									
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
(CC304)		L	T	P	Hrs	TH	TM	TW	PR/OR	
BASIC ELECTRICAL ENGINEERING		3	-	2	5	75	25	25	--	125

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Explain terms related to ac waveform, operating principle and functions of parts of transformer, motors, need for earthing and operation of protective devices
2. Describe the procedure for starting and speed control of different motors
3. Differentiate between types of motors, types of earthing, protective devices, star and delta connection
4. Test & Compute parameters of transformers

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	2	0	0	0	0	1
CO2	3	2	0	3	0	3	1
CO3	2	2	3	3	2	3	1
CO4	2	2	0	0	2	0	1

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
1 AC CIRCUITS			15	9	CO1,3
1.1 Sinusoidal AC voltage waveform. Definition and numerical Values of, average value, RMS value, form factor, peak factor, frequency of Sinusoidal quantities. Principle of single phase alternator					

1.2 Three-phase circuits. Concept of phase sequence, balanced system and unbalanced system Relation between line and phase quantities for star and delta connections.			
1.3 Concept & definition of Real, reactive and apparent power in three-phase system.			
2 TRANSFORMER	15	10	CO1,4
2.1 Principle of operation and basic construction (Core & Shell type) of a single phase transformer. EMF equation, Calculations of Rated Currents & Voltages & Turns using emf equation			
2.2 Losses in transformer (Hysteresis, Eddy Current & copper loss, their brief description), efficiency and voltage regulation. Rating of transformer , Applications of transformer			
3 DC MOTORS	15	10	CO 1,2,3
3.1 Working principle of DC motors, main parts of DC motor and their functions(Yoke ,pole core ,pole shoe, armature core, armature winding ,Commutator& Brushes), classification of DC motors (shunt, series and compound and their applications).			
3.2 Necessity of starter, methods of reversal of direction of rotation of DC shunt and series motor.			
3.3 Speed Equation , Armature resistance control & Field resistance control method for DC shunt Motor			
4 AC MOTORS	15	10	CO1,2,3
4.1 Principleof three phase induction motor, main parts, classification (squirrel cage & Slip ring), torque-slip characteristics and application (only diagram).			
4.2 Necessity of starter, Starters - Direct On Line starter, star delta starter(Manual) and autotransformer starter(Maual), (w.r.t. circuit diagram, working and application). Method of reversal of direction of rotation.			
4.3 Working principle and application of - Single phase induction motor (split phase only) - Universal motor -Stepper motor (Variable reluctance type & permanent Magnet type.)			
5 EARTHING & PROTECTIVE DEVICES	15	09	CO1,3
5.1 Electric shock, precautions against shock. Necessity of earthing, types of earthing- equipment earthing& system earthing (definitions only).Types of earthing electrodes- Pipe and Plate. Methods of reducing earth resistance.			
5.2 Fuse- Definition, Types of Fuses- Rewirable fuse, HRC fuse & Cartridge fuse. Rating for fuse such as Voltage ratings, Current ratings, Breaking capacity (Rupture capacity) & Minimum fusing current. MCB- Principle of operation and application. ELCB- Current operated type. Principle of operation and application.			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	AC CIRCUITS	09	15
2	TRANSFORMER	10	15
3	DC MOTORS	10	15
4	AC MOTORS	10	15
5	EARTHING & PROTECTIVE DEVICES	09	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical (Minimum 8)	Marks
1	Connection of single transformer & Measure its Voltages, Currents, Voltage Regulation & Efficiency	
2	Verify relationship between phase & line quantities in star connected load	
3	Speed control of DC motor	
4	Starting of DC shunt motor and reversal of direction of rotation	
5	Starting of three phase induction motor using star delta starter	
6	Verify relationship between phase & line quantities in Delta connected load	
7	Study of MCB & ELCB (Current Operated)	
8	Study of stepper motors	
9	Study of servo motors	
10	Study of universal motors	
11	Study of rotor resistance starter for starting of Slip ring induction motor.	
12	Checking of Ceiling fan using series test lamp	
13	Measurement of voltages in a single phase system(between phase and neutral, phase and earth and neutral and earth)	
	Total	25
No	**Class room Assignments**	**Marks**
1	At least 2 Assignments	
2		
...		

No	Tutorial Exercise	Marks
1	NIL	
2		
...	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	B. L. Theraja	Electrical Technology (Vol I and Vol II)	S. Chand
2	V. K Mehta	Principles of Electrical Engineering & Electronics	S. Chand
3	J. B. Gupta	Fundamentals of Electrical Engineering	S.K. Kataria & sons

(CC307) ELEMENTS OF MECHANICAL ENGINEERING

1. COURSE OBJECTIVES:

In this modern scientific era, the field of engineering and technology is continuously expanding with many newer branches of engineering being added day by day. Under present circumstances it is highly essential for an engineer and technician to acquire basic knowledge of some other relevant engineering fields, along with his own discipline of study. Also the technician carrying out plant maintenance requires basic knowledge of functions of mechanical elements and machines from operational and safety point of view. Hence this subject is being introduced in the curriculum as an interdisciplinary subject to provide basic knowledge of mechanical engineering to the students of Food technology.

The students will able to:

1. Understand use of different mechanical power transmission devices
2. Explain functions of various components of IC engines, boilers, pumps air conditioning systems etc.
3. Demonstrate use of different maintenance tools

2. TEACHING AND EXAMINATION SCHEME

Semester	III								
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(CC307)		L	T	P	Hrs	TH	TM	TW	PR/OR	
ELEMENTS OF MECHANICAL ENGINEERING		3	0	0	3	75	25	25	-	125

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

CC307.CO1 Explain power transmission devices, parts of I.C. engines, boilers, pumps and refrigeration equipments

CC307.CO2 Identify various parts and uses of I.C. engines, boilers accessories and refrigeration components

CC307.CO3 Distinguish between various types of I.C. engines, boilers and pumps

CC307.CO4 Discuss the application of various types of lubricants, maintenance tools, couplings and bearings.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society ,Sustainability &	Project Management	Life -long Learning
CO1	2	1	0	3	0	3	0
CO2	2	0	1	1	0	0	0
CO3	2	2	2	0	0	2	0
CO4	3	3	3	2	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	0	2
CO2	0	2
CO3	0	2
CO4	0	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**		
Unit		**M**	**Thr**	**CO**
1 MECHANICAL POWER TRANSMISSION		**15**	**8**	**CO 1,4**
1.1 Belt drives – classification & applications Chain drives – Power transmitting chains (Block chain, Bush roller chain) and their applications. Gear drives –Spur, Helical & Bevel gear drives and their applications Gear trains (simple & compound only) and their speed ratio.		9	5	CO1
1.2 Couplings – rigid coupling (marine type only), flexible coupling (bush pin type only) Bearings – Definition & function of bearings, rolling and sliding contact bearings (their functions and applications.)		6	3	CO1 CO4
2 I.C. ENGINES		**18**	**12**	**CO 2,3**
2.1 Introduction, classification & basic engine components.		6	3	CO2
2.2 Construction and working of 4 stroke and 2 stroke engines (petrol & diesel). Difference between petrol and diesel engines. Difference between 2 stroke and 4 stroke engines. Technical terms of I.C. engines – Stroke volume, Compression ratio, Brake power.		12	9	CO2 CO3
3 THERMAL ENGINEERING EQUIPMENTS & PUMPS		**21**	**14**	**CO 1,2,**

			3
3.1 Introduction. Basic components of a thermal power station and their function (Condenser, Turbine, Boiler).	6	4	CO1
3.2 Boiler – Introduction, function, classification (water tube, fire tube), Construction and working of Babcock & Wilcox boiler and Cochran boiler. Comparison between fire tube and water tube boiler. Boiler mountings and accessories like-, water level indicator, and super heater. Awareness to Indian Boiler Regulations i.e. IBR (Brief Introduction)	9	6	CO2 CO3
3.3 Introduction, working principle, classification. Centrifugal and reciprocating pump -construction & working. Comparison between Centrifugal pump & Reciprocating pump. Technical specifications - power, discharge, head.	6	4	CO1 CO3
4. REFRIGERATION & AIR CONDITIONING	**12**	**7**	**CO 1,2**
4.1 Introduction, unit of refrigeration (Ton), COP, Working and operation of simple vapour compression system (p-h & t-s diagrams to be excluded).	6	4	CO1 CO2
4.2 Air Conditioning- definition, working of Window and split Air conditioner	6	3	CO2
5. MAINTENANCE ENGINEERING	**9**	**7**	CO1 CO4
5.1 Definition, types -preventive, breakdown and predictive maintenance. Necessity of lubrication. Common types of lubricants. Methods of lubrication – wick/drip type, grease gun, grease cup.	6	4	CO1 CO4
5.2 Maintenance tools and their functions (no construction & working) – spanners (open end & ring type), screw jack, gauges, screw driver, torque wrench, allen key, chain pulley block.	3	3	CO4
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	MECHANICAL POWER TRANSMISSION	08	15
2	I.C. ENGINES	12	18
3	THERMAL ENGINEERING EQUIPMENTS & PUMPS	14	21
4	REFRIGERATION & AIR CONDITIONING	07	12
5	MAINTENANCE ENGINEERING	07	09
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Study of different types of gears.	
2.	Removal and mounting of belt. Checking tension in the belt.	
3.	Demonstration of mounting and removal of ball/roller bearing., Knowing	

	its bearing number	
4.	Study of petrol/diesel engine construction.	
5.	Study of petrol/diesel engine working.	
6.	Study of water tube and fire tube boiler (Babcock & Wilcox and Cochran).	
7.	Study of any one refrigeration Air conditioning equipment , method of installation for AC	
8.	Study of centrifugal and reciprocating pumps and common faults in pumps with their troubleshooting	
9.	Literature survey and seminar (A brief power point presentation of around 15 min on any topic relevant to mechanical engineering). It may be done individually or in groups depending on class strength.	
	Total	25
No	**Class room Assignments**	**Marks**
1	3 to 5 Assignments covering all units above	
No	**Tutorial Exercise**	**Marks**
1		
	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.S. Khurmi	Theory of Machines	
2	R.S. Khurmi	Thermal Engineering	S. Chand
3	R.K. Rajput	Textbook of Hydraulic Machines	Laxmi
4	R.K. Rajput	Refrigeration & Air Conditioning	Laxmi
5	S.N. Bhattacharya	Installation, Servicing & Maintenance	S. Chand

Semester – IV

Course Code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total Marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
FD401	Food Chemistry	2	0	4	6	75	25	25	25	150
FD402	Food Engineering – II	0	0	3	3	0	0	25	25	50
FD403	Food Microbiology	2	0	4	6	75	25	25	25	150
FD404	Methods of Food Preservation - II	3	0	2	5	75	25	0	25	125
FD405	Technology of Food Products	4	0	2	6	75	25	0	50	150
FD406	Cereal Technology	3	0	2	5	75	25	0	25	125
Total		14	0	17	31	375	125	75	175	750

(FD401) FOOD CHEMISTRY

1. COURSE OBJECTIVES:

This course in Food Technology is designed to give the student a proper understanding of the chemical constituents of food and the chemical changes these constituents undergo. This is very essential for the students to comprehend the alterations that occur in food commodities during processing and the measures that should be taken to attain a high product quality. Practical work is designed to develop skills in basic techniques in food analysis such as gravimetric and volumetric analysis and also in the use of simple instruments such as monopan balance, pH meter, etc.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV									
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
(FD401) FOOD CHEMISTRY		L	T	P	Hrs	TH	TM	TW	PR/OR	
		2	-	4	6	75	25	25	25	150

3. COURSE OUTCOMES:

FD401.CO1: Identify different chemical constituents in the Food.
FD401.CO2: Analyze different changes that Chemical constituents undergo during processing
FD401.CO3: Develop basic skills of analysis of the chemical constituents
FD401.CO 4: Use basic instruments required in the laboratories.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7

	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	1	1	1	1	1	3
CO2	3	2	1	1	1	1	3
CO3	3	1	1	2	1	1	3
CO4	3	1	1	2	1	1	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	2	3
CO2	3	3
CO3	2	3
CO4	2	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**
UNIT 1.0 INTRODUCTION AND PROXIMATE COMPOSITION OF FOOD			**3**	**2**	**CO1 CO2 CO3 CO4**
1.2 Significance of food chemistry in food processing and preservation.					
1.2 Proximate composition of food: 1.2.1Definition. 1.2.2 Examples of proximate composition of various food commodities.					
UNIT 2.0 CARBOHYDRATES			**20**	**10**	**CO1 CO2 CO3 CO4**
2.1 Definition, occurrence, classification. 2.1.1 Definition of Carbohydrates 2.1.2 Occurrence of Carbohydrates 2.1.3 Classification of Carbohydrates					
2.2 Monosaccharide: 2.2.1Definition, important naturally occurring monosaccharide (pentoses and hexoses) 2.2.1 Structure (open chain and cyclic) of glucose, fructose, mannose and galactose with D and L configuration, structure of xylose, arabinose and ribose. 2.2.2 Properties of monosaccharide: Optical activity, Reactions of carbonyl group: Oxidation, reduction and reducing action of sugars in alkaline solution. Reactions of hydroxyl group. Formation of glycosides, formation of esters. 2.2.3 Degree of sweetness of various sugars.					
2.3 Oligosaccharides: 2.3.1 Definition. Disaccharides 2.3.2 Definition. Sucrose, lactose, maltose 2.3.3 Occurrence, Structure and properties.					
2.4 Polysaccharides:					

2.4.1Definition. 2.4.2 Starch: Occurrence, structure and properties (gelatinization, retro gradation, physical properties), comparison of properties of amylose and amylopectin starch giving sources of both. 2.4.3 Pectic substances: Occurrence, definition of various types of pectic substances, definition of high methoxy and low methoxy pectin, Factors affecting gel formation of low and high methoxy pectin, uses of low methoxy and high methoxy pectin in foods. 2.4.4 Cellulose: Occurrence, Structure and properties.			
2.5. Non-enzymatic browning: 2.5.1 Maillard reaction, 2.5.2Ascorbic acid oxidation 2.5.3 Caramelisation of sugars in alkaline solution. 2.5.4 Conditions favoring the above three types of reactions and end products formed			
UNIT 3.0 PROTEIN	**20**	**9**	**CO1 CO2 CO3 CO4**
3.1 Definition 3.1.1 Amino acid: Definition. 3.1.2 Classification of amino acid: Essential and non- essential, based on chemical nature.			
3.2 Structure of protein molecular weight, amino acid composition and properties 3.2.1 Peptide bond conformation. 3.2.2 Classification of proteins (simple protein conjugated protein and derived protein). 3.2.3 Properties: Colloidal nature, amphoterism, solubility, hydrolysis, color reactions, oxidation-reduction, hydration, sensory characteristics. 3.2.4 Protein denaturation. Outline of mechanism. Factors affecting protein denaturation.			
UNIT4.0 OILS AND FATS	**20**	**6**	**CO1 CO2 CO3 CO4**
4.1 Definition of lipids, types of lipids, structure and composition 4.1.1 Definition of oils and fats and occurrence. 4.1.2 Classification: Simple lipids, compound lipids and derived lipids with example. 4.1.3 Composition of oils and fats. 4.1.4 Structure of triglyceride. Fatty acids. Definition of saturated and unsaturated fatty acids. 4.1.5 Composition of edible oils - saturated and unsaturated fatty acid contents.			
4.2 Physical properties of oils and fats 4.2.1 Hydrolysis of oils and fats: Outline of mechanism and product formed. Oxidation of oils and fats: Outline of mechanism and product formed. 4.2.2 Flavour reversion in oil. 4.2.3 Phospholipids: Definition, occurrence. Structure of lecithin, cephalin. Uses of phospholipids in food.			
UNIT 5.0 PIGMENTS AND FLAVOUR COMPOUNDS	**12**	**5**	**CO1 CO2 CO3 CO4**
5.1 Pigments and flavour compounds 5.1.1 Chlorophyll: Chemical characteristics and stability to processing conditions. 5.1.2 Carotenoids: Chemical characteristics and stability to processing conditions. 5.1.3 Anthocyanin: Chemical characteristics and stability to processing conditions.			

5.1.4 Myoglobin: Chemical characteristics and stability to processing conditions. **5.2** Essential oils and tannins 5.2.1 Chemical characteristics with examples of each in food commodities e.g. Peel oil of citrus, mint oil, geranium oil, tea, etc.			
Total	**75**	**32**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction and Proximate composition of Foods	2	3
2	Carbohydrates	10	20
3	Protein	9	20
4	Oils and Fats	6	20
5	Pigments and flavour Compounds	5	12
	Total	32	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Use of monopan balance, pH meter and analytical balance.	25
2.	Determination of moisture in food sample by oven drying method.	25
3.	Determination of ash in food sample: Total ash. Acid soluble ash. Acid insoluble ash. Alkalinity of ash.	25
4.	Preparation of standard solution. Preparation and standardisation of alkali solution. Preparation and standardisation of acid solution. Preparation and standardisation of sodium thiosulphate solution	25
5.	Determination of acidity and pH of food sample. Liquid food. Solid food. Fresh fruit.	25
6.	Determination of salt content in food sample.	25
7.	Qualitative tests for identification of various sugars.	25
8.	Determination of sugar content in food sample by Lane-Eynon method.	25
9.	Determination of specific gravity of oil sample.	25
10	Determination Of Acid Value of Oil sample	25
11.	Determination Of Peroxide value of Oil sample	25
	Total Marks(Average): 25	
No	**Class room Assignments**	**Marks**
1	Note on Proximate Composition	25
2	Non enzymatic Browning reactions	25
3	Pectin and its use in food Industry	25
4	Essential Amino acids	25
5	Food Proteins	25
6	Factors affecting Protein denaturation	25
7	Composition of Various Oils	25
8	Hydrogenation of Fat	25
9	Natural coloring pigments and their sources	25
10.	Flavoring Compounds in different Fruits	25
	Total Marks(Average): 25	

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Aurand Woods	Food Chemistry	AVI Publications
2	L.H. Meyer	Food Chemistry	CBS Publishers
3	John M. DeMan	Principles of Food Chemistry	Springer
4	Aurand Woods	Laboratory Manual in Food Chemistry	AVI Publications
5	Dr. S. Ranganna	Analysis of Fruit and Vegetable Products	Mc Graw Hill

(FD402) FOOD ENGINEERING -II

1. COURSE OBJECTIVES:

The students will able to study Food Engineering unit operations and equipments required in Food Industry. As technician on a shop floor they will be able supervise the normal processing operations to carry out or supervise routine maintenance work. They will be able to develop sufficient knowledge and skills for understanding the engineering aspects of various fields of food processing.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV								
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(FD402)		L	T	P	Hrs	TH	TM	TW	PR/OR	
FOOD ENGINEERING -II		-	-	3	3	-	-	25	25	50

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FD 402 CO1: Select the right conveyors and pumps required in the Food Processing Line

FD 402 CO2: Understand the use of Mixing and Blending equipments for liquid, paste and dry mixes

FD 402 CO3: Understand the use of equipments used for mechanical separation and size reduction

FD 402 CO4: Select the right filling machine based on volume or weight basis.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	2	1	1	1	1	3
CO2	3	2	1	1	1	1	3
CO3	3	2	1	1	1	1	3
CO4	3	2	1	1	1	1	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems
PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	3	3
CO4	3	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1: TRANSPORTATION OF SOLIDS, LIQUIDS & GASES	**15**	**10**	**CO1 CO2 CO3 CO4**
1.1 Transportation Of Solids: 1.1.1 Conveyors -apron, screw, open link, belt, pneumatic and elevators.			
1.2 Transportation Of Fluids: 1.2.1 Flow of fluids, Bernoulli's equation, 1.2.2 Manometer, Venturimeter, pressure gauge. 1.2.3 Pumps: Construction and applications.			
1.3 Transportation Of Gases: 1.3.1 Construction and applications. Gases: Blowers, compressors, chimneys and vacuum producing devices, metering and filling devices.			
UNIT 2: MECHANICAL SEPARATION	**22**	**20**	**CO1 CO2 CO3 CO4**
2.1 Sorting And Grading: 3.1.1 Types of graders, screening and screen analysis. 3.1.2 Floating and sedimentation. 3.1.3 Filtration: Types (batch and continuous) equipment (plate and frame, leaf, rotary) 3.1.4 Filter aids and filter media			
2.2 Centrifugation: 2.2.1 Principles and basis of design of equipment (basket, bowl, tubular, etc.)			
2.3 Crystallisation: 2.3.1 Equipment in food processes			
2.4 Expression: 2.4.1 Solvent extraction 2.4.2 Membrane separation – Osmosis, reverse-osmosis and ultrafiltration.			
UNIT 3: MIXING & BLENDING	**15**	**9**	**CO1 CO2 CO3 CO4**
3.1 Mixers 3.1.1 Different types of mixers for liquids, pastes, dry powders and specific food operations such as kneaders, conchers, beaters, etc.			
1.2 Emulsions: 1.2.1 Theory and equipment, homogenization			
UNIT 4: SIZE REDUCTION	**15**	**6**	**CO1 CO2 CO3 CO4**
4.1 Sieving And Size Reduction: 4.1.1 Methods of sieving 4.1.2 Size reduction equipment (grinding, pulverising, pulping, juicing, mincing, etc)			
UNIT 5: PACKAGING MACHINES	**8**	**3**	**CO1**

5.1 Principles of filling of solids on weight and volume basis, filling of liquids.			**CO2 CO3 CO4**
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Transportation of Solids, Liquids and Gases	10	15
2	Mechanical Separation	20	22
3	Mixing & Blending	9	15
4	Size Reduction	6	15
5	Packaging Machines	3	8
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Study experiments of the following, with appropriate factory visits: Conveyors and elevators,	25
2	Measurements and control devices for fluid flow	25
3	Pumps, vacuum producing devices	25
4	Filtration and centrifugation equipment	25
5	Size reduction equipment	25
6	Mixing equipment	25
7	Emulsifying and homogenizing equipment.	25
	Total	25
No	**Class room Assignments**	**Marks**
1	Types of Conveyors and their application in food industry	25
2	Types of Pumps and their application in food industry	25
3	Types of filtration equipment	25
4	Types of filter aids and application	25
5	Solvent extraction and application	25
6	Types of graders	25
7	Types of kneaders and application	25
8	Types of mixers and blenders for dry foods	25
9	Spice milling equipments	25
10	Form Fill Seal Machines (FFS)	25
...	Total	

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	McCabe Smith	Unit Operations in Chemical Engineering	McGraw Hill
2	S. E. Charm	Food Engineering	AVI Pubs
3	Badger and Banchero	Introduction to Chemical Engineering	McGraw Hill

(FD403) FOOD MICROBIOLOGY

1. COURSE OBJECTIVES:

The students will able to study the role of microorganisms in foods, their contribution to food fermentations, food spoilage and toxin production, to microbiologically test the quality of foods by detection and identification of foods pathogens.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV								
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(FD403) FOOD MICROBIOLOGY		L	T	P	Hrs	TH	TM	TW	PR/OR	
		2	-	4	6	75	25	25	25	150

4. COURSE OUTCOMES:

FD 403.CO1: Understand the storage of raw materials and processing operations in the food industry to prevent contamination.
FD 403.CO2: Select appropriate microorganisms for food fermentations.
FD 403.CO3: Apply different methods of preservation to prevent contamination and spoilage of foods.
FD 403.CO4: Analyze the food samples using standard laboratory tests for the detection of food pathogens.

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	2	1	1	1	1	3
CO2	3	1	1	1	2	1	2
CO3	3	2	2	1	1	2	3
CO4	3	3	2	1	1	2	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems
PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	3	3
CO2	1	1
CO3	3	2
CO4	3	3

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			**M**	**Th**	**CO**
UNIT 1.0 MICROORGANISMS IN FOOD			10	8	
1.1 Classification of microorganisms: 1.1.1 spoilage, pathogenic, 1.1.2 beneficial and inert organisms.					
1.2 Factors affecting microbial growth in foods: 1.2.1 Intrinsic factors: 1.2.1.1 Water activity, pH, oxidation reduction potential, type of food and presence of inhibitory substances. 1.2.2 Extrinsic factors: 1.2.2.1 Temperature, presence or absence of gases, relative humidity, biological. Structure					**CO1** **CO2** **CO3** **CO4**
1.3. Groups and genera of microorganisms playing a significant role in foods: 1.3.1 Proteolytic, saccharolytic, lipolytic, pectolytic, halophilic, thermophilic and psychrophilic					
UNIT 2.0 ROLE OF MICROORGANISMS IN FERMENTED FOODS			10	6	**CO1** **CO2** **CO3** **CO4**
2.1 General introduction to fermentation 2.1.1Definition of fermentation, respiration, anaerobic respiration. 2.1.2 Significance of glycolysis.					
2.2 Media used in fermentation 2.2.1 General media used in fermentation. 2.2.2 Typical fermentor and its accessories 2.2.3 Batch fermentation and Continuous fermentation					
2.3 Fermented foods 2.3.1Standard organisms involved and the biochemical changes brought about during processing of: 2.3.1.1 bread, idli, 2.3.1.2 pickles, curds, 2.3.1.3 cheese, butter, 2.3.1.4 wine, beer and vinegar.					
UNIT 3.0 MEDICAL MICROBIOLOGY			17	6	
3.1 Food poisoning and prevention 3.1.1Types of food poisonings: 3.1.2 Chemical, biological, bacterial and fungal. 3.1.3 Bacterial food poisonings - Characteristics of the toxin, symptoms caused and preventive measures : 3.1.3.1 Clostridium botulinum, Staphylococcus aureus, 3.1.3.2 Clostridium perferingens:					**CO1** **CO2** **CO3** **CO4**
3.2 Mycotoxins, 3.2.1 Different fungi producing toxins 3.2.2 Characteristics of Aflatoxin, symptoms caused and preventive measures. Other mycotoxins.					
3.3 Food borne infections 3.3.1Microorganisms causing infections, Disease caused , their symptoms and preventive measure:- 3.3.1.1 Salmonella, Shigella, E. Coli, 3.3.1.2 Streptococci, Vibrio, Bacillus, , Klebsello , 3.3.1.3 Listeria monoctogenes and Mycobacterium					
3.4. Prevention of food poisoning: 3.4.1 Pest control, waste disposal, and hygienic condition.					

UNIT 4.0 MICROBIOLOGICAL DETERIORATION OF SPECIFIC FOODS	17	8	**CO1 CO2 CO3 CO4**
4.1 FRUITS AND VEGETABLES 4.1.1Natural flora, sources of contamination, 4.1.2 Types of spoilage, principles of preservation methods used, 4.1.3 Quality standards required and various specific tests for following foods:			
4.2 Meat and meat product 4.2.1 Natural flora, sources of contamination, 4.2.2 Types of spoilage, principles of preservation methods used, 4.2.3 Quality standards required and various specific tests for following foods:			
4.3 Fish and fish products 4.3.1 Natural flora, sources of contamination, 4.3.2 Types of spoilage, principles of preservation methods used, 4.3.3 Quality standards required and various specific tests for following foods:			
4.4. Poultry and eggs 4.4.1 Natural flora, sources of contamination, 4.3.2Types of spoilage, principles of preservation methods used, 4.3.3 Quality standards required and various specific tests for following foods:			
4.5. Milk and milk products 4.5.1 Natural flora, sources of contamination, 4.5.2 Types of spoilage, principles of preservation methods used, 4.5.3 Quality standards required and various specific tests for following foods:	3	2	
UNIT 5.0 MICROBIOLOGICAL AND BIOCHEMICAL TESTS	11	4	
5.1 Biochemicla tests for identificatioin of bacteria: 5.1.1 Carbohydrate fermentation tests, H&L Test indole, methyl Red , Vogus - Proskauer and citrate test, 5.1.2 Test for enzymes: 5.1.2.1Catalase, nitrate reductase, amylase, 5.1.2.2 Gelatinase, caseinase, oxidase ,urease, 5.1.2.3 Motility test, TSI test.			
5.2. Standard laboratory tests used for detection of bacteria 5.2.1 Estimation of microbial flora in various foods: 5.2.1.1Sampling methods, total plate count, 5.2.1.2enrichment media, selective media, direct microscopic counts.			
5.3 Test for pathogens: 5.3.1Salmonella, 5.3.2 Staphylococcus aureus			
Total	**75**	**32**	

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies.

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Microorganisms in food	8	10
2	Role of microorganisms in fermented foods	6	10
3	Medical microbiology	6	17
4	Microbiological deterioration of specific foods	8	17
5	Microbiological and biochemical tests	11	4
	Total	32	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Direct microscopic counts of yeast by- Simple staining methods- Differential staining for living and dead cells	25
2	Total yeast and mould count for tomato ketchup / squash / fruit juice	25
3	Preparation and use of selective media. Detection of coliforms in milk samples	25
4	Sampling methods for microbial analysis TPC – Meat	25
5	Detection of coliforms in milk samples	25
6	Test for phosphatase in pasteurised and unpasteurised milk.	25
7	Methylene blue reduction test and Resazurin reduction test of milk samples.	25
8	Isolation and identification of bacterial cultures (standard cultures available in the laboratory) Gram positive Bacillus,Staphylococcus, Streptococcus Gram negative E. Coli, Salmonella, Pseudomonas and Serratia.	25
9	Examination of canned foods- External examination, total plate count, identification of the contaminant	25
10	Sampling methods for microbial analysis TPC- Fish	25
	Total	25
No	**Class room Assignments**	**Marks**
1	Role of microorganisms in food spoilage with example and types of spoilage.	25
2	Standard Laboratory tests to check the quality of with specific ISI standards: a)Milk and its products b) canned foods	25
3	Standard Laboratory tests to check the quality of with specific ISI standards: a)Meat and meat products b) Fruit and Vegetable products.	25
4	HACCP and its significance to food fermentations. Flow charts of 2 fermented food products.	25
5	Sanitation Practices used in food industries.	25
6	Typhoid, Cholera, Tuberculosis, Shigellosis, Salmonellosis, Botulism: – causative agent, foods involved, incubation period, symptoms, treatment and prevention of outbreaks.	25
7	Biochemical and serological tests used for the detection of enzymes present in pathogens.	25
8	Food pathogen detecting kits- principal and working.	25
9	Modern Microscopy techniques to detect pathogens .	25
10	Enrichment, Selective and Differential media used for the isolation and detection of E.coli, Salmonella, Staphylococcus, Vibrio, Shigella, Clostridiun in foods.,	25
...	Total	25

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	W. C. Frazier	Food Microbiology	McGraw Hill Education
2	James Jay	Food Microbiology	Springer Science
3	Cruickshank	Medical Microbiology	E&S Livingstone
4	Anantanarayan	Medical Microbiology	Universities Press (India)Pvt.Ltd.

(FD404) METHODS OF FOOD PRESERVATION-II

1. COURSE OBJECTIVES:

The students will able study Various Food Preservation Techniques using Heat Treatment, Canning, Food additives, Food Irradiation and Advanced Preservation Methods. They will be able to understand how Chemical additives play an important improving quality of various food products and their role in preservation and processing,

2. TEACHING AND EXAMINATION SCHEME

Semester	IV								
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(FD404) METHODS OF FOOD PRESERVATION-II		L	T	P	Hrs	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	25	-	125

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FD 404 CO1: Select the right method of heat preservation in Food Industry

FD 404 CO2: Understand canning operation and Conduct Quality Analysis of Canned Food Products and Tin Cans

FD 404 CO3: Select the right Preservatives and Food Additives as per our National Standards

FD 404 CO4: Understand Irradiation and other Advanced Methods of Preservation Currently used in Food Processing

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	1	1	1	1	1	3
CO2	3	1	1	1	1	1	3
CO3	3	1	1	1	1	1	3
CO4	3	1	1	1	1	1	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**	**M**	**Thr**	**CO**
UNIT 1: PRESERVATION BY HEAT	**25**	**18**	**CO1 CO2 CO3 CO4**
1.1 Principle of various degrees of preservation by heat: 1.1.1 Blanching 1.1.2 Pasteurization 1.1.3 Sterilization			
1.2 Selecting Heat Treatments 1.2.1 Heat resistance of microorganisms 1.2.2 Thermal death curves, determining process time and process lethality, inoculated pack studies			
1.3 Preservation By Canning 1.3.1 Canning principle and classification of foods for processing 1.3.2 Types of can, can terminology, and lacquer 1.3.3 Outline of manufacture of can from tin plate 1.3.4 Canning operation and equipment 1.3.5 Procedures and equipment involved in- filling, exhausting, seaming, retorting and cooling. 1.3.6 Common problems in above equipment-Causes and remedial action to be taken 1.3.7 Examination of can - cut out report.			
1.4 Retorting 1.4.1 Heating food in containers- still retort, agitating retorts, hydrostatic cooker and cooler, 1.4.2 Direct Flame Sterilization			
UNIT 2: PRESERVATIVES	**30**	**10**	**CO1 CO2 CO3 CO4**
2.1 Chemical Preservatives: 2.1.1 Classification of preservatives 2.1.2 Outline of mode of action, application and FSSAI limits of the following Chemical preservatives: sulphurous acid and its salts, benzoic acid and its salts, mold inhibitors-propionates & sorbates, curing agents-nitrates, nitrites & phosphates			
2.2 Natural Preservatives: 2.2.1 Outline of mode of action, application and FSSAI limits of the following Antibiotics: Nisin, Pimaricin/Natamycin, Tetracyclines,			
2.3 Preservation of oils using antioxidants: 2.3.1 Outline of mode of action, application and FSSAI limits of the following Chemical Antioxidants: BHA, BHT, TBHQ, PG, Natural Antioxidants			
UNIT 3: FOOD ADDITIVES	**20**	**10**	**CO1 CO2 CO3 CO4**
3.1 Modifiers of appearance & organoleptic character: 3.1.1 Colouring Matter 3.1.2 Flavouring Agents 3.1.3 Flavour Enhancers			
3.2 Modifiers of physical character: 3.2.1 Emulsifiers & Stabilizers 3.2.2 Thickening and Jellying Agents 3.2.3 Humectants 3.2.4 Anti-caking Agents			

3.2.5 Modified Starches 3.2.6 Acid Regulators (Acid, Bases, Buffers & Salts)			
3.3 Other additives: 3.3.1 Artificial sweeteners 3.3.2 Nutritive Additives 3.3.3 Flour and Bread additives 3.3.4 Enzymes 3.3.5 Antifoaming Agents			
UNIT 4: IRRADIATION	**15**	**7**	**CO1**
4.1 Irradiation: Principles and advantages 4.1.1 Comparison with other methods of preservation. 4.1.2 Action of ionizing radiations - Direct effects and indirect effects 4.1.3 Radiation sources, units of radiation, electron accelerators 4.1.4 Attempts to limit indirect effects 4.1.5 Gross effect of irradiation 4.1.6 Safety and wholesomeness of irradiated foods 4.1.7 Irradiation dose, determining factors and dosimeters			**CO2** **CO3** **CO4**
UNIT 5: ADVANCED TECHNIQUES IN FOOD PRESERVATION	**5**	**3**	**CO1**
5.1 Principles, advantages and limitations of: 5.1.1 Pulsed Electric Field 5.1.2 Ohmic Heating 5.1.3 High Hydrostatic Pressure Processing			**CO2** **CO3** **CO4**
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Preservation By Heat	18	25
2	Preservation By Chemicals	10	15
3	Food Additives	10	15
4	Irradiation	7	15
5	Advanced Techniques In Food Preservation	3	5
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Can seam examination	25
2	Cut out report for typical product such as: Fruit in syrups, vegetables in brine, puree / paste	25
3	Estimation of shelf life of packaged food	25
4	Demonstration on efficiency of antioxidants in storage of fatty food	25
5	Demonstration on addition of emulsifiers and stabilizers in squash / juice	25
6	Demonstration on effect of adding thickening agents in products like ketchup, sauce, etc.	25
7	Addition of anti-caking agents in dehydrated powdered foods	25
8	Addition of humectant in coconut shreds.	25

	Total	25
No	**Class room Assignments**	**Marks**
1	Sterilization Equipment	5
2	Types of Can	5
3	Defects in Double Seam and Causes	5
4	Lacquers used in can	5
5	Food Colours and Flavours	5
6	Emulsifiers, Stabilizers & Thickeners	5
7	Natural Antioxidants used in foods	5
8	Enzymes used in Food processing	5
9	Food irradiation- Direct & indirect effects	5
10	High pressure processing	5
...	Total	5

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Potter	Food Science	CBS
2	D.K. Salunkhe	Storage, Processing and Nutritional Quality of Fruits and Vegetables	CRC Press
3	Stanley Sacharow	Food Packaging	AVI Pubs
4	J. L. Heid	Fundamentals of Food Processing Operations	AVI Pubs

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	P. J. Fellows	Food Processing Technology: Principles and Practice	AVI
2	F. A. Payne	Fundamentals of Food Packing	AVI

(FD405) TECHNOLOGY OF FOOD PRODUCTS

1. COURSE OBJECTIVES:

The students will able to learn about the different processing techniques for varied food products like Extrusion, various plantation crops and its processing and about the computer applications in the food industries. The students will also be able to learn techniques required to commercialize various traditional food products.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV								
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(FD405) TECHNOLOGY OF FOOD PRODUCTS		L	T	P	Hrs	TH	TM	TW	PR/OR	
		4	-	2	6	75	25	50	-	150

3. COURSE OUTCOMES:

FD405.CO1: Work in the Different areas of Food Processing.
FD405.CO2: Commercialize different Food products especially traditional Food Products.
FD405.CO3: Understand basic Computer applications in Food Industry.
FD405.CO4: Learn and Understand scope of Convenience foods and their processing.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	2	1	1	1	1	3
CO2	3	2	2	1	1	1	3
CO3	3	1	1	2	1	1	3
CO4	3	1	1	1	1	1	3

Relationship : Low-1 Medium-2 High-3
PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems
PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	3
CO4	3	2

5. DETAILED COURSE
CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			**M**	**Thr**	**CO**
UNIT 1.0 EXTRUSION			**10**	**7**	**CO1 CO2 CO3 CO4**
1.1 Introduction 1.1.1Extrusion Principle 1.1.2 Application, Advantages and Disadvantages			2	1	
1.2 Types of extruders: 1.2.1Single screw 1.2.2 twin screw extruders 1.2.3 Low shear and high shear Extruders			4	3	
1.3 Processing layouts for various extruded foods : 1.3.1Expanded snacks 1.3.2 Texturised Vegetable Protein 1.3.3 Breakfast Cereals 1.3.4 Co-Extruded product 1.3.5 Pasta Products Etc.			4	3	
UNIT 2.0 PLANTATION CROPS AND PRODUCTS			**22**	**21**	**CO1 CO2 CO3 CO4**
2.1 Cocoa processing and chocolate confectionary: 2.1.1Outline of cocoa manufacture from cocoa beans- Cleaning, roasting, winnowing, grinding, dutching and pressing. 2.1.2 Chocolate manufacture- Mixing, refining, Conching, moulding and packaging. 2.1.3 Defects in Chocolates and remedies to prevent it. 2.1.4 Cocoa beverages and basic composition. 2.1.5 Sugar confectionery: Hard boiled sweets, toffee and caramels, chewing gum: Ingredients and their functions			12	10	
2.2 Tea: 2.2.1 Types and characteristics. 2.2.2 Processing of tea: Withering, rolling, fermentation, and Firing. 2.2.3 Packaging of Tea			2	2	
2.3 Coffee: 2.3.1 Common varieties and characteristics. 2.3.2 Processing, roasting, commercial blends, packaging. 2.3.3Manufacture of instant coffee.			3	2	
2.4 Spices: 2.4.1 Major varieties produced in India, their composition, active principles and oil content. 2.4.2 Size reduction: Method and equipment. 2.4.3 Oleoresins and essential oils: Outline of manufacture. 2.4.4 Packaging and Storage			5	5	
UNIT 3.0 STARCH, PULSES, OILSEEDS AND NUTS			**21**	**08**	**CO1 CO2 CO3 CO4**
3.1 Starch: 3.1.1Manufacture of starch from maize and tapioca. 3.1.2 Quality evolution of starch. 3.1.3 Uses in food products – Modified starches and their uses. 3.1.4 Brief outline of corn syrup and caramel manufacture and their uses.			**7**	**4**	
3.2 Pulses: 3.2.1 Commonly cultivated pulses in the country. 3.2.2 Process of milling of pulses.			5	3	

3.2.3 Uses of pulses in protein enriched foods and traditional snack-foods such as sev, chakli, etc.			
3.3 Oilseeds and nuts 3.3.1 Major oilseeds and their composition. 3.3.2 Oil extraction- Mechanical and solvent. 3.3.3 Outline of processed coconut products: Desiccated coconut, coconut milk and cream. 3.3.4 Processing of cashew-nut. 3.3.5 Groundnut Products: Protein concentrate and Protein isolate– Manufacturing, processes, properties and uses, Peanut butter 3.3.6 Soyabean products: Soya Protein concentrate, Soya Protein isolate, Soya Protein hydrolysate -Manufacturing processes, properties and uses, Outline of products like Soya milk, Soy cheese, and partially de-fatted products from Soya.	9	5	
UNIT 4.0 CONVENIENCE FOOD AND COMMERCIALISATION OF INDIAN FOODS	**12**	**7**	**CO1 CO2 CO3 CO4**
4.1 Convenience Foods: 4.1.1 Principle, scope in India 4.1.2 Ready to eat foods, Ready to cook foods-Plant and machinery. 4.1.3 Process of deep frying and changes during deep frying.	6	4	
4.2 Commercialisation Of Indian Foods: 4.2.1 Principle, Scope of Commercialisation 4.2.2 Traditional Foods, Emphasis on National and Goan major traditional foods like Bibinca, Dodol Etc.	6	3	
UNIT 5.0 COMPUTER APPLICATIONS IN THE FOOD INDUSTRY	**10**	**5**	**CO1 CO2 CO3 CO4**
5.1 Introduction to computer and related hardware used in food industry: 5.1.1 Touch Screens, Hand Held Devices, Palm Tops 5.1.2 Barcode Printers and Scanners, RFID Tags, etc.	4	2	
5.2 Introduction to various softwares: 5.2.1 Software application in Processing, Quality Control, Material handling and Distribution (like SAP, justFoodERP, FoodWorks, SERVE, etc.) with relevant case studies	3	1	
5.3 Statistical Quality Control: 5.3.1 Control charts Sensory evaluation: Statistical descriptors of a population estimated from sensory data obtained for a sample.	3	2	
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Extrusion	7	10
2	Plantation crops and products	21	22
3	Starch, Pulses, Oilseeds and Nuts	8	21
4	Convenience food and commercialisation of indian foods	7	12
5	Computer applications in the food industry	5	10
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Preparation of Snack food (Extruded)	25
2	Preparation of hard- boiled sweets	25
3	Preparation of toffee	25
4	Preparation of starch	25
5	Preparation of golden syrup	25
6	Preparation of Groundnut-Soyabased flavoured Milk	25
7	Preparation and finishing of papad.	25
8	Recovery of protein from oilseed cake	25
9	Preparation and finishing of any commercial variety of masala mix (dry or wet) and study of its shelf life.	25
10	Demonstrations on ERP (Enterprise Resource Planning)	25
	Total(Average)Marks	
No	**Class room Assignments**	
1	To collect information on Extruded products available in the market and brands	25
2	List of Commercially available Modified Starches and its uses in Food	25
3	Tea and Coffee standards as per FSSAI	25
4	Formulation of various sugar based confectionary	25
5	Formulation for various spice mixes (any 2)	25
6	Difference between Oleoresins and essential oils	25
7	Byproduct utilization of Cashew Nut processing industry	25
8	Traditional Snack Foods from Pulses- Procedure and techniques(any 2)	25
9	Commercialisation of Goan traditional Food Products- Procedure and Techniques (any 2)	25
10	Collect information on Various ERP systems used in Food Industries	25
	Total(Average)Marks	

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Shakuntala Maney	Foods Facts and Principles	New Age International
2	J. M. Harper	Extrusion of Foods, Vol. I & II	CRC Press
3	M. E. Thormer	Convenience Fast Food Handbook	AVI
4	Minifie, Bernard	Chocolate , cocoa and Confectionery: Science and technology	AVI
5		Handbook of Confectionery and formulations	EIRI

6	Kenneth T. Farrel	Spices, Condiments and Seasonings	Aspen Publishers
7		Handbook of Spices Packaging with Formulas	EIRI
8	R. Paul Singh, AP.	Computer Applications in Food Technology: Use of Spreadsheets in Graphical, Statistical and Process Analysis	Academic Press
9	Vedpal Yadav, i-proclaim.com	Computer Applications in Food Technology	-
10		Encyclopedia of Food Technology	

(FD406) CEREAL TECHNOLOGY

1. COURSE OBJECTIVES:

The students will able to study the area of food technology covering a large group of food processing industries such as bakeries and related industries. They will be able to learn about principles and procedures in the production of Bakery and other cereal products and Quality Control of Cereal products. They will also be able to develop skills in the production of Bakery products.

2. TEACHING AND EXAMINATION SCHEME

Semester	IV								
Course Code & Course Title		Periods/Week (in hours)			Total Hours	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(FD406) CEREAL TECHNOLOGY		L	T	P	Hrs	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	25	-	125

3. COURSE OUTCOMES:

FD406.CO1: Understand different crops cultivated in India
FD406.CO2: Understand Milling of rice and Products manufactured from rice
FD406.CO3: Understand milling of wheat and wheat based products
FD406.CO4: Understand technology behind Breakfast Cereals and Malted Cereals

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	1	1	1	1	1	3
CO2	3	1	1	1	1	1	3
CO3	3	1	1	1	1	1	3
CO4	3	1	1	1	1	1	3

Relationship : Low-1 Medium-2 High-3
PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems
PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	03	03
CO2	03	03
CO3	03	03
CO4	03	03

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives			
Unit			**M**	**Thr**	**CO**
UNIT 01 INTRODUCTION			**4**	**2**	**CO1 CO2 CO3 CO4**
1.1 Cereal Crops in India 1.1.1Main cereal crops grown in the country. 1.1.2 Importance of cereals as food commodity.					
UNIT 2.0 TECHNOLOGY OF RICE			**18**	**15**	**CO1 CO2 CO3 CO4**
2.1 Rice 2.1.1 Important groups of cultivated rice and their regional distribution, Structure and composition of rice grain, distribution of nutrients in rice grain, 2.1.2 Mechanical drying of harvested paddy, drying and milling quality of rice. 2.1.3 Parboiling of paddy: Definition. Traditional methods of parboiling. Modern method of parboiling- C.F.T.R.I. process, advantages of parboiling of paddy.					
2.2 Physio-chemical properties of rice: 2.2.1 Comparison of gelatinization temperature, cooking quality and loss of nutrients in cooking water of raw and parboiled rice. 2.2.2 Curing of rice- Cooking quality of new and old rice, method of curing rice					
2.3 Milling of rice 2.3.1 Moisture content of rice for optimum milling quality, cleaning procedure of rice prior to milling and equipment used in cleaning. 2.3.2 Modern milling process of rice and equipment used in milling. 2.3.3 Evaluation of quality in milled rice, effect of milling on quality of rice 2.3.4 By-products of rice milling (uses only)					
2.4 Rice products 2.4.1 Production of canned rice 2.4.2 Production of enriched rice 2.4.3 Production of instant mixes from rice- idli mix, dosa mix, etc. 2.4.4 Rice based infant food.					
UNIT 3.0 TECHNOLOGY OF WHEAT PRODUCTS			**38**	**24**	**CO1 CO2 CO3 CO4**
3.1 Wheat 3.1.1Main groups of cultivated wheat and their regional distribution (spring wheat and winter wheat). 3.1.2 Important varieties of wheat grown in the country 3.1.3 Structure and composition of wheat grain 3.1.4 Distribution of nutrients in wheat grain					
3.2 Milling of wheat: 3.2.1 Comparison of milling quality of hard and soft wheat 3.2.2 Cleaning procedures of wheat milling, 3.2.2 Modern process of wheat milling 3.2.3 Products of wheat milling and their uses.					
3.3 Baking technology: 3.3.1 Ingredients used in baking of bread 3.3.2 Quality requirements of flour in baking of bread, laboratory tests for evaluating quality of wheat flour for baking 3.3.3 Role of various ingredients in baking of bread 3.3.4 Commercial methods of baking of bread: Straight dough method					

sponge and dough method, continuous bread making process (Do maker, Am Flow methods), equipment used in bread productions, 3.3.5 Common defects (appearance and texture in bread and a remedial measures) 3.3.6 Production of enriched bread, spoilage of bread and measures to prevent spoilage.			
3.4 Biscuit and cake production: 3.4.1 Quality requirements of flour in biscuit production, role of various ingredients in biscuit. 3.4.2 Production, process and equipment used in production of biscuit 3.4.3 Common defects (appearance and texture) in biscuit and remedial measure. 3.4.4 Production of cake: Ingredients used in production of plain sponge cake 3.4.5 Role of various ingredients in production of cake 3.4.6 Balancing of cake formula, process of production of cakes, equipment used in production of cake.			
3.5 Production of pasta goods 3.5.1 Various types of paste products (noodles, spaghetti, macaroni and vermicelli) 3.5.2 Requirements of wheat semolina and flour for production of pasta products 3.5.3 Ingredients used in production of pasta products, process and equipment used in production of paste products 3.5.4 Quality evaluation of pasta products.			
UNIT 4.0 PRODUCTION OF BREAKFAST FOODS	**9**	**4**	**CO1 CO2 CO3 CO4**
4.1 Manufacturing process 4.1.1 Process of manufacture of puffed and flaked products from maize and rice.			
UNIT 5.0 MALTING OF CEREALS	**6**	**3**	**CO1 CO2 CO3 CO4**
5.1 Process 5.1.1 Process of production of malted wheat flour 5.1.2 Uses of malted cereal flour.			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction	2	4
2	Technology of rice	15	18
3	Technology of wheat products	24	38
4	Production of breakfast foods	4	9
5	Malting of cereals	3	6
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Study of hydration characteristics of raw and parboiled rice: At constant temperature, with increasing temperature.	25
2	Parboiling of paddy.	25
3	Tests for evaluating baking quality of wheat flour: Moisture content, ash content, gluten content, sedimentation value, alcoholic acidity, maltose figure, water absorption power of flour.	25
4	Determination of dough raising capacity of yeast	25
5	Test baking.	25
6	Production of bread and quality evaluation	25
7	Production of biscuit and quality evaluation	25
8	Baking of cake and quality evaluation	25
9	Visit to Modern Bakery	25
10	Visit to roller flour mill	25
	Total (average) Marks	
No	**Class room Assignments**	
1	Cereal Crops and Nutritional importance	25
2	Rice Parboiling Advantages and Disadvantages	25
3	Ageing of rice	25
4	Flow Analysis	25
5	Bread baking Quality evaluation	25
6	Biscuit Ingredients and functions	25
7	Cake ingredients and functions	25
8	Various Pasta products and extruders used for Pasta Manufacture	25
9	Manufacture of Breakfast cereals	25
10	FSSAI standards for Pasta and Breakfast Cereals	25
	Total (average) Marks	

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Matz	Baking Technology and Engineering	Springer
2	Matz	Cereal Technology	PAN TECH International Incorporated
3	Pomeranz and Shellenberger	Bread Science and Technology	AVI
4	Matz	Cookie and Cracker Technology	Springer
5	Potter	Food Science	CBS
6	Joslyn and Heid.	Food Processing Operations	AVI
7	Kramer	Quality Control for the Food Industry Vol. I & II	AVI
8	Kent-Jones.	Cereal Chemistry	London, Food trade
9	Shakuntala Maney	Food Facts and Principles	New Age International

PROGRAMME STRUCTURE

SEMESTER – V

Course Code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total Marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	TW	PR	
FD501	Elementary Food Analysis	3	0	2	5	75	25	25	25	150
FD502	Fruit and Vegetable Technology	3	0	2	5	75	25	0	50	150
FD503	Dairy Technology	3	0	2	5	75	25	0	50	150
FD504	Food Packaging Technology	3	0	2	5	75	25	0	25	125
CC501	Entrepreneurship Development	0	0	2	2	0	0	0	25	25
E1	Elective 1	3	0	2	5	75	25	0	50	150
AC101	Essence of Indian Knowledge and Tradition	2	0	0	2	0	0	0	0	0
TR502	Food Technology Training – I*	0	0	0	0	0	0	15	35	GRADE
	Total	17	0	12	29	375	125	25	225	750

ELECTIVE

FD511 Animal Products Technology
FD512 Marine Products Technology
FD513 Refrigeration and Air Conditioning Technology
FD514 By-Product Utilization Technology

(FD501) ELEMENTARY FOOD ANALYSIS

1. COURSE OBJECTIVES:

The students will able to learn basic principles involved in Analytical techniques and Quality Control. They will be able to learn adulterants in different food commodities and its identification and also working principles of different instruments involved in Food Analysis.

2. TEACHING AND EXAMINATION SCHEME

Semester	V								
Course Code & Course Title		Periods/Week (in hours)			Total Credits	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
FD501 ELEMENTARY FOOD ANALYSIS		L	T	P	C	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

FD501.CO1: Learn basic principles of different analytical techniques.

FD501.CO2: Develop skills to analyze raw materials, intermediate products, food additives and Final products.

FD501.CO3: Identify and analyze different food adulterants.

FD501.CO4: Use different instruments required to carry out analysis.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	3	1	1	2	1	1	3
CO2	3	1	1	2	1	1	3
CO3	3	2	1	2	1	1	3
CO4	3	1	1	1	1	1	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	1	3
CO2	2	3
CO3	2	3
CO4	2	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1.0 INTRODUCTION AND DETERMINATION OF PROXIMATE COMPOSITION AND DETECTION OF ADULTERATION OF FOODS	**31**	**18**	**CO1 CO2 CO3 CO4**
1.1 Introduction 1.1.1 Purpose of food analysis 1.1.2 Determination of proximate composition and nutritive value of food composite. 1.1.3 Detect food adulteration and presence of toxic components, extraneous matter in food. 1.1.4 Quality control of raw material, intermediate product and final product.			
1.2 Determination of proximate composition 1.2.1 Principles of following analyses: Determination of moisture content and ash content of food (total ash, acid soluble, and insoluble ash and alkalinity of ash). 1.2.2 Determination of crude protein by Kjel dahl method. Determination of crude fat by Soxhlet method. Determination of crude fibre in food sample. . 1.2.3 Determination of total sugar, reducing and non-reducing sugar in food. Determination of starch content of food by hydrolysis.			
1.3 Detection of adulteration 1.3.1 Definition of adulteration. 1.3.2 Detection of adulteration in tea, coffee, oils and fats, spices by simple, physical and chemical methods and visual examination.			
UNIT 2.0 VOLUMETRIC ANALYSIS	**12**	**6**	**CO1 CO2 CO3 CO4**
2.1 Acid base titration 2.1.1 Principle 2.1.2 Indicators used			
2.2 Oxidation reduction titration 2.2.1 Principle of oxidation reduction titration. 2.2.2 Principle of Iodometry, Iodimetry.			
UNIT 3.0 COLORIMETRIC ESTIMATIONS	**8**	**6**	**CO1 CO2 CO3 CO4**
3.1 Introduction 3.1.1Principles of colorimetry 3.1.2 Statement of Beers Law and Lamberts Law. 3.1.3 Main components of colorimeter and their functions.			

3.2 Colorimetric estimations 3.2.1 Procedure followed in colorimetric estimation (taking example of Biuret method for protein estimation).			

UNIT 4.0 CHROMATOGRAPHY	**10**	**10**	**CO1 CO2 CO3 CO4**
4.1 Introduction 4.1.1 Principle of chromatographic techniques. 4.1.2 Components of chromatographic techniques- Inert phase, Stationary phase, mobile phase. 4.1.3 Definition of Rf value.			
4.2 Chromatography techniques 4.2.1 Types of chromatography (outline of each techniques)- Paper chromatography, thin layer chromatography, column chromatography, gas-liquid chromatography. 4.2.2 Paper chromatography: Procedure used for analytical work: Type of paper used, preparation of sample, spotting, chromatographic chamber, solvents. 4.2.3 Types of paper chromatography- Ascending and descending chromatography, two dimensional chromatography, circular paper chromatography.			
UNIT 5.0 INSTRUMENTAL METHODS OF ANALYSIS	**14**	**8**	**CO1 CO2 CO3 CO4**
5.1 Measurement of consistency 5.1.1 Measurement of Consistency of liquid products 5.1.2 Types of Viscometers			
5.2 Measurement of color 5.2.1 Measurement of Color using Munsel Disc Colorimeter, Lovibond Tintometer			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction, Determination of Proximate composition, Detection of Adulteration	18	31
2	Volumetric Analysis	6	12
3	Colorimetric Estimations	6	8
4	Chromatography	10	10
5	Instrumental Methods of Analysis	8	14
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Determination of preservatives in food sample- Determination of sulphur dioxide content of squash and preserved pulp. Determination of benzoic acid in tomato product.	25
2	Determination of calcium in food by volumetric analysis.	25
3	Determination of crude fat by Soxhlet method.	25
4	Detection of adulteration in food sample- Spices (chili powder, pepper, turmeric), Oils and fats.	25
5	Analysis of coffee (moisture, solubility, water soluble ash, alkalinity of soluble ash)	25
6	Microscopic study of starch for structure of granules	25
7	Estimation of total sugar, reducing and non-reducing sugar by Lane-Eynon Method.	25
8	Paper Chromatography	25
9	Determination of iodine value of oil sample.	25
10	Detection and estimation of rancidity of oil sample by Kreis test and TBA number.	25
11	Determination of consistency of fruit pulp, using Brooke field Synchro electric Viscometer	25
	Total(average) marks	25
No	**Class room Assignments**	
1	FSSAI specifications for Jams and Jellies	25
2	FSSAI specification for Tomato ketchup	25
3	FSSAI specification for Various Flours	25
4	FSSAI specification for Coffee	25
5	FSSAI specification for Various oils	25
6	Indicators used for Different titrations and their pH ranges	25
7	Adulterants in Milk and identification methods	25
8	Terminologies used in Color estimation	25
9	Advance Color measurement instruments	25
10.	Working Principle of any 2 Viscometers	25
	Total(average) marks	25

9. LEARNING RESOURCES Text Books

Sr. No.	Author	Title of Books	Publishers
1	Pomeranz and meloan	Food Analysis Theory & Practice	AVI
2	David Pearson	Chemical Analysis of Food	Churchill Livingstone
3	Dr. S. Ranganna	Handbook of Analysis and Quality Control of Fruit and Vegetable products	Mc Graw Hill
4	Kramer & Twigg.	Quality Control for the Food Industry Vol I & II	AVI
5	Jacobs.	The Chemical Analysis of Foods & Food Products	CBS

(FD502) Fruit and Vegetable Technology

1. COURSE OBJECTIVES:

The students will able to get the basic theoretical and practical knowledge required by a supervisor in the Fruit and Vegetable Processing industry. They will be able to learn processing of fruits and vegetables, how to manufacture various fruit and vegetable products and Quality control tests for fruit and vegetable products.

2. TEACHING AND EXAMINATION SCHEME

Semester	**V**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(FD502) Fruits And Vegetable Technology		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**
		3	**-**	**2**	**5**	**75**	**25**	**50**	**0**	**150**

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FD 502 CO1: To know the various commercial varieties of fruits and vegetables suitable for processing and transport them with minimum spoilage

FD 502 CO2: Carry out canning of fruits and vegetables

FD 502 CO3: Make important fruit and vegetable products and by-products and pack them in appropriate packaging material.

FD 502 CO4: Carry out freezing and dehydration of fruits and vegetables for preservation.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life-long Learning
CO1	3	1	1	1	2	1	1
CO2	2	2	2	3	2	1	1
CO3	2	2	3	3	2	1	1
CO4	2	2	3	3	2	1	1

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	1	2
CO2	3	2
CO3	3	2
CO4	3	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1: CANNING OF FRUITS AND VEGETABLES	**17**	**10**	**CO1**
1.1 Canning Process: 1.1.1 Commercial varieties of fruits and vegetables suitable for canning 1.1.2 Detection of maturity of fruits and vegetables 1.1.3 Harvesting procedures for important fruits and vegetables 1.1.4 Transportation of fruits and vegetables 1.1.5 Washing and peeling methods 1.1.6 Blanching and syruping 1.1.7 Filling and exhausting and processing 1.1.8 Typical processing procedures for common fruits and vegetables			**CO2** **CO3** **CO4**
UNIT 2: HIGH ACID AND HIGH SUGAR PRODUCTS	**17**	**10**	**CO1**
2.1 Manufacture of Jam: 2.1.1 Manufacturing Process, 2.1.2 Effect of pH, sugar, pectin‟s 2.1.3 Determination of end point 2.1.4 Common defects in jam			**CO2** **CO3** **CO4**
2.2 Manufacture of jelly and marmalade: 2.2.1 Attributes of good jelly 2.2.2 Selection of fruit 2.2.3 Manufacturing process 2.2.4 Manufacture of marmalades 2.2.5 Common defects in jelly and marmalade			
2.3 Manufacture of guava cheese			
2.4 Manufacture of candies: Process for manufacture of: 2.4.1 Crystallized candies 2.4.2 Glazed fruit candies			
UNIT 3: FRUIT BEVERAGES/CONCENTRATES. PICKLES AND CHUTNEYS	**16**	**10**	**CO1** **CO2**
3.1 Manufacture of fruit juice: 3.1.1 Extraction			**CO3**

3.1.2 Clarification 3.1.3 De-aeration 3.1.4 Storage and concentration.			**CO4**
3.2 Formulation and manufacture of: 3.2.1 Squashes 3.2.2 Fruit syrups 3.2.3 Cordials 3.2.4 Changes during storage of juice and squashes			
3.3 Pickles: 3.3.1 Types, 3.3.2 Formulation 3.3.3 Manufacture of oil and vinegar pickle.			
3.4 Chutneys – Varieties and process of manufacture.			
UNIT 4: TOMATO PRODUCTS	**11**	**8**	**CO1**
4.1 Manufacture of: 4.1.1 Tomato juice, puree and paste 4.1.2 Manufacture of tomato ketchup 4.1.3 Standards for tomato juice, puree, paste and ketchup 4.1.4 Common defects in tomato products			**CO2** **CO3** **CO4**
UNIT 5: FREEZING AND DEHYDRATION OF FRUITS AND VEGETABLES	**14**	**10**	**CO1** **CO2** **CO3** **CO4**
5.1 Freezing of fruits: 5.1.1 Methods of manufacture of frozen fruit in syrup 5.1.2 Freezing of fruit pulp and juice 5.1.3 Freezing of vegetables – Process for freezing of peas, corn.			
5.2 Process for dehydration of fruits and vegetables: 5.2.1 Selection, grading, pre- treatment and dehydration conditions 5.2.2 Commercial process for the dehydration of peas, onions, raw mangoes, grapes 5.2.3 Factors determining choice of equipment 5.2.4 Packaging requirements and materials			
	75	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Canning of Fruits and Vegetables	10	17
2	High Acid and High Sugar Products	10	17
3	Fruit Beverages/concentrates. Pickles and chutneys	10	16
4	Tomato Products	8	11
5	Freezing and dehydration of fruits and vegetables	10	14
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Canning of fruits and vegetables - Canning of two varieties of fruit / fruit cocktail. Canning of variety of vegetable.	25
2	Preparation of lime juice- Preparation of lime juice cordial.	25
3	Preparation of lime / mango / pineapple squash	25
4	Preparation of jam-mixed fruit jam	25
5	Preparation of fruit jelly	25
6	Preparation of marmalade	25
7	Preparation of guava cheese	25
8	Preparation of mango / apple preserve	25
9	Preparation of tutti fruity	25
10	Preparation and storage of tomato juice, preparation of tomato ketchup, canning of tomato soup	25
11	Preparation of mango and lime pickle. (of any two varieties)	25
12	Preparation of mango chutney	25
13	Freezing of fresh green peas	25
14	De-hydration of fruits and vegetables (Potato / Carrot	25
	Total	25
No	**Class room Assignments**	**Marks**
1	Enlist commercial varieties of fruits suitable for canning	25
2	Enlist commercial varieties of vegetables suitable for canning	25
3	Give the attributes of a good jelly	25
4	What are the differences between jam, jelly and cheese	25
5	What are the differences between crystallized and glaced fruits	25
6	Write the various uses of Puree	25
7	List out and explain the common defects of tomato ketchup	25
8	Explain the concentration of orange juice	25
9	Describe the fluidized bed freezer	25
10	Explain the process for production of raisins	25
	Total (Average)Marks	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	Girdhari Lal & Siddappa	Commercial Preservation of Fruits & Vegetables	ICAR
2	D. K. Salunkhe	Storage, Processing & Nutritional Quality of Fruits & Vegetables	CRC Press
3	W. Cruess.	Fruits and Vegetables Preservation	Agro bios India
4	EIRI Board of consultants	Preservation & canning of fruits and vegetables	EIRI

(FD503) DAIRY TECHNOLOGY

1. COURSE OBJECTIVES:

The students will able to get the basic theoretical and practical knowledge required by a supervisor in the milk processing industry. They will be able to learn processing of milk, manufacture of various dairy products and quality control tests for dairy products.

2. TEACHING AND EXAMINATION SCHEME

Semester	V								
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(FD503) DAIRY TECHNOLOGY		L	T	P	C	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	50	-	150

3. COURSE OUTCOMES:

FD503.CO1: Define various dairy products.

FD503.CO2: Explain the manufacturing process of dairy products.

FD503.CO3: Choose proper raw material for manufacture of dairy products.

FD503.CO4: Examine the quality of finished dairy products.

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life-long Learning
CO1	1	1	1	1	1	1	3
CO2	2	2	2	1	1	1	3
CO3	1	2	1	1	2	1	3
CO4	2	2	1	3	2	1	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1 Products	PSO2 Nutrition
CO1	3	3
CO2	3	2
CO3	3	3
CO4	3	2

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1.0 MILK	**16**	**8**	**CO1 CO2 CO3 CO4**
1.1 Milk and its Processing 1.1.1 Definition of Milk 1.1.2 Source as food composition and nutritive value			
1.2 Properties of milk 1.2.1Physical properties of milk 1.2.2Chemical properties of milk			
1.3 Types of Milk 1.3.1 Definition of Standardized milk 1.3.2 Single toned 1.3.3 Double toned milk			
1.4 Manufacture of Milk 1.4.1Manufacture of pasteurized milk 1.4.2Sterilized milk 1.4.3 Flavored milk			
UNIT 2.0 MANUFACTURE OF CREAM AND BUTTER	14	8	**CO1 CO2 CO3 CO4**
2.1 Cream Manufacture: 2.1.1 Separation, cream separator, and methods of cream separation. 2.1.2 Factors governing richness of cream 2.1.3 Factors governing fat percentage.			
2.2 Butter Manufacture: 2.2.1 Introduction, composition. 2.2.2 Process involved- Cream neutralization, addition of starter, cream ripening, churning, working of butter, printing, packaging. 2.2.3 Factors influencing churning and over-run in butter 2.2.4 Butter defects, their causes and prevention.			
UNIT 3.0 MANUFACTURE OF CHEESE AND CONDENSED MILK	16	11	**CO1 CO2 CO3 CO4**
3.1 Cheese manufacture 3.1.1 Introduction, History, definition, classification, composition, 3.1.2 Nutritive value and legal standards. 3.1.3 Manufacture of processed cheese, Swiss cheese, cottage cheese 3.1.4 Manufacture of cheddar cheese.			
3.2 Cheese packaging and defects			

3.2.1 Packaging 3.2.2 Marketing 3.2.3 Defects of cheese.			
3.3 Condensed Milk 3.3.1 History, composition, types of condensed milk 3.3.2 Method of manufacture, vacuum pan and condensing 3.3.3 Defects in condensed milk.			
UNIT 4.0 MANUFACTURE OF DRY MILK AND ICE-CREAM	16	12	**CO1 CO2 CO3 CO4**
4.1 Dry Milk 4.1.1 History, types of dry milk, composition of each dry milk. 4.1.2 Methods of manufacture, spray drying and freeze drying 4.1.3 Packaging of milk powder. 4.1.4 Properties of dry milk: bulk density, solubility, solubility index, wettability, dispersability. 4.1.5 Defects in dry milk and reconstitution. 4.1.6 Instant milk powder manufacture and Malted milk beverages like Horlicks, Viva, etc.			
4.2 Ice Cream 4.2.1 History, definition, classification and composition 4.2.2 Ingredients used: sweeteners, stabilizers, flavours, etc. 4.2.3 Preparation of ice-cream, calculation of ice-cream mix, pasteurization of milk, homogenization and ageing 4.2.4 Freezing and packaging of ice-cream. 4.2.5 Defects and over-run in ice-cream.			
UNIT 5.0 MANUFACTURE OF INDIGENOUS DAIRY PRODUCTS AND BY-PRODUCTS OF DAIRY INDUSTRY	13	9	**CO1 CO2 CO3 CO4**
5.1 Manufacture of Indigenous dairy products 5.1.1 Rabri, khoa, channa and rasgulla, 5.1.2 Ghee, paneer, shrikhand, lassi and kalakand.			
5.2 Preparation of Dahi, Yoghurt 5.2.1 Methods of preparation and composition of Dahi, yoghurt-their composition 5.2.2 Changes in constituents during fermentation and flavour development.			
5.3 By-products of dairy industry and its utilization 5.3.1 Process of manufacture and uses of by-products, lactose, whey powder and Casein.			
Total	**75**	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Milk	8	16
2	Manufacture of Cream and Butter	8	14
3	Manufacture of Cheese and Condensed Milk	11	16
4	Manufacture of Dry Milk and Ice cream	12	16
5	Manufacture of Indigenous Dairy products and By-Products of Dairy Industry	9	13
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Platform tests	25
2	Detection of adulteration and efficiency of pasteurization	25
3	Determination SNF, Total Solids and Fat.	25
4	Manufacture of Dahi and Gee.	25
5	Manufacture of Channa and Paneer	25
6	Manufacture of Rabri , Shrikhand and Gulab jamun	25
	Total(average) Marks	25
No	**Class room Assignments**	
1	Milk situation in India	25
2	Diagram for Aseptic Processing of Milk	25
3	Diagram of Cream Separator	25
4	Various materials used in the Packaging of Butter	25
5	Improvement of Indian cottage cheese	25
6	Control of crystallization in condensed milk	25
7	Quality characteristics of dry milk	25
8	Diagram of Ice cream freezer	25
9	Micro flora present in Lassi	25
10	Utilization of byproducts of the Dairy Industry	25
...	**Total(average) Marks**	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	Sukumar De.	Outline of Dairy Technology	Oxford University Press Indian Branch
2	Clarence Henry Eckles	Milk and Milk Products	Tata McGraw Hill
3	James N. Warner	Principles of Dairy Processing	Wiley and Sons
4	Henry F. Judkins	Milk Production and Processing	Wiley and Sons

(FD 504) FOOD PACKAGING TECHNOLOGY

1. COURSE OBJECTIVES:

The students will able to get knowledge of packaging materials, properties and their appropriate uses for specific food products. They will also learn different techniques and advancements in the field of Packaging and different identification methods and analysis of packaging material.

2. TEACHING AND EXAMINATION SCHEME

Semester	**V**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
FD504 FOOD PACKAGING TECHNOLOGY		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**25**	**-**	**125**

3. COURSE OUTCOMES:

FD504.CO1: Identify different packaging materials.

FD504.CO2: Design a packaging material as per the requirement of the food product.

FD504.CO3: Design a packaging label as per FSSAI standards.

FD504.CO4: Perform basic analysis for various Packaging requirements.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	3	1	1	1	1	1	3
CO2	3	3	1	1	1	1	3
CO3	3	1	1	1	1	1	3
CO4	3	1	1	2	1	1	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	3	2
CO4	3	1

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1.0 INTRODUCTION TO PACKAGING AND PACKAGING MATERIALS	**30**	**20**	**CO1 CO2 CO3 CO4**
1.1 Packaging: 1.1.1 Definition and functions. 1.1.2 Characteristic of ideal packaging material, 1.1.3 Factors affecting selection of packaging material. 1.1.4 Classification of Packaging material. 1.1.5 Terminologies related to Packaging: Tensile Strength, Bursting Strength, Tearing resistance, Puncture resistance, Impact Strength, Tear strength, Permissibility(GTR, WTR)			
1.2 Packaging materials 1.2.1 Properties, advantages and Limitations of the Following packaging materials: Glass, Aluminium cans, Paper and Paperboards 1.2.2 Plastics, Laminates and Multilayer composition; Flexible and retortable pouches- (a) LDPE, (b) HDPE, (c) HMHDPE,(d) LLDPE, (e) PP, (f) BOPP, (g) PVC, (h) PET, (i) Polyamides, (j) Ionomers, (j) EVOH, (k) Epoxy Resins (l) Polyesters, (m) Cellophane, (n) Aluminium Foil, (o) Cellulose acetate, (p) Retortable pouches			
1.3 Modified atmospheric packaging, controlled atmospheric packaging, edible packaging 1.3.1 Modified atmospheric packaging 1.3.2 Controlled atmospheric packaging 1.3.3 Edible packaging			
1.4 Shipping containers used in food packaging			
UNIT 2.0 MANUFACTURING PROCESS OUTLINE	**13**	**8**	**CO1 CO2 CO3 CO4**
2.1 Manufacturing, advantages and limitations of the following packaging materials: 2.1.1 Rigid packaging materials 2.1.2 Rigid Plastic Packages 2.1.3 Metal Containers 2.1.4 Wooden boxes and Crates			

2.1.5 Solid and Corrugated Fibre boards;			
2.2 Semi rigid packaging materials: 2.2.1Aluminium Containers 2.2.2 Paper board cartons, Moulded paper containers.			
UNIT 3.0 SPECIAL FEATURES IN THE PACKAGING MATERIALS AND PACKAGE DESIGN	**15**	**8**	**CO1 CO2 CO3 CO4**
3.1 Study on the special features of the packaging materials: 3.1.1Shrink Packages 3.1.2 Boil in Bag 3.1.3 Aerosol Containers 3.1.4 Skin Packaging			
3.2 Smart packaging: 3.2.1Selective permeable 3.2.2 Self heating and Self Cooling			
3.3 Intelligent packaging: 3.3.1 Indicators, Sensors 3.3.2 RFID(Radio Frequency Identification Tags)			
3.4 Package design: 3.4.1 Package design consideration 3.4.2 Cushioning materials and their properties. 3.4.3 Labeling, Printing, Symbols used in Packaging as per FSSAI standards 3.4.4 Adhesives used in Packaging.			
UNIT 4.0 SELECTION OF PACKAGING MATERIAL	**10**	**8**	**CO1 CO2 CO3 CO4**
4.1 Packaging materials used and criteria for selection of packaging materials of following foods: 4.1.1 Fresh Fruits and Vegetables, Fruit products, Vegetable products 4.1.2 Fish and Fish products; Meat and Meat products; 4.1.3Beverages: Carbonated, Malted milk products, Tea and Coffee; Alcoholic beverages 4.1.4 Confectionary: Chocolates and Sugar based sweets 4.1.5 Dairy Products: Cheese, Butter, yoghurt etc 4.1.6 Bakery Products: Biscuits, Cakes, Bread etc. Food Grains			
UNIT 5.0 TESTING, IDENTIFICATION AND ESTIMATION	**7**	**4**	**CO1 CO2 CO3 CO4**
5.1 Testing and identification of packaging materials. Estimation of shelf life of packaged foods. 5.1.1 Testing and identification of packaging material 5.1.2 Estimation of Shelf life			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction to packaging and packaging materials	20	30
2	Manufacturing process outline	8	13
3	Special features in the packaging materials and package design	8	15
4	Selection of packaging material	8	10
5	Testing, identification and estimation	4	7
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Determination of GSM of Packaging Material.	25
2.	Determination of thickness of different Packaging Material using Dial Thickness guage micrometer	25
3.	Thermal Shock Resistance test for glass bottles.	25
4.	Detail Study of Corrugated Fibre Board boxes.	25
5.	Study of Stacking Strength for CFB boxes.	25
6.	Study of Drop test for Milk Pouches.	25
7.	Study of Bursting Strength of Packaging Material.	25
8.	Determination of Paper Alkalinity.	25
9.	Leakage test for Pouches.	25
10.	Label design for Food Products as per FSSAI standards	25
11.	Activity: To collect different packaging materials used for different Food Products	25
12.	Visit to industry	25
	Total(average) Marks	25
No	**Class room Assignments**	
1	Ideal Package	25
2	Advantages and Disadvantages of edible packaging	25
3	Adhesives used in Food packaging	25
4	Types of Paper used for packaging	25
5	Glass Colors	25
6	Intelligent Packaging	25
7	Packaging of fresh fruits and vegetables	25
8	Mandatory requirements for Labelling	25
9.	Symbols used for Labelling	25
10.	Identification methods for various packaging materials	25
	Total(average) Marks	**25**

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	Stanley Sacharow	Food Packaging	AVI
2	F.A. Paine	Fundamentals of Food Packing	Blackie Academic and Professional

(CC501) ENTREPRENEURSHIP DEVELOPMENT

1. COURSE OBJECTIVES:

Student will be able to start his own venture with all fundamentals of business. Today Entrepreneurship is given importance by the government to bring the youth of our country to overcome the problem of unemployment and bring them in the main stream of global business to strengthen Indian economy by Make in India philosophy. Government has announced various financial schemes for young youth and women to support them for setting up an enterprise. To fulfill this, youth are to be prepared for setting an enterprise. The students undergoing this course will develop entrepreneurial traits and confidence within themselves and choose entrepreneurship as a career to brighten their future.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CS501 Entrepreneurship Development	**L**	**T**	**P**	**C**	**-**	**-**	**PR/OR**	**TW**	25
	-	-	2	2	-	-	-	25	

3. COURSE OUTCOMES:

CC501CO1: List the terms associated with Entrepreneurship Development.

CC501CO2: Explain the terminologies and procedures involved in Entrepreneurship Development

CC501CO3: Identify legal implications for Entrepreneurs.

CC501CO4: Develop the project report for new enterprise.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	1	0	0	0	2	3	2	1	1
CO2	1	0	0	0	1	3	2	1	1
CO3	0	1	2	0	0	0	2	1	1
CO4	3	2	2	0	2	0	2	1	1

Relationship : Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS

M=Marks	Phr= Practical hours	CO – Course Outcomes			
Unit			M	Phr	CO
1 Introduction to Entrepreneurship Development				**4**	
1.1 Introduction to Entrepreneurship Development (EDP)					
1.2 Entrepreneur definition, Types of Entrepreneur, Characteristics of entrepreneur and entrepreneurship					**CO1 CO2**

1.3 Enterprises: Micro, Small and Medium Enterprises (MSME), Service industry, Manufacturing Industry, Franchises and Start up.			**CO3 CO4**
1.4 Organisations: Sole proprietorship, Partnership, Public, Co-operative Society.			
2. Identification of business opportunity		**6**	
2.1 Business ideas- Exploring business ideas in terms of marketability, technical feasibility, financing and authorities			**CO1 CO2 CO3 CO4**
2.2 Business terms: - Clients, vendors market description, demand, supply, banking& non-banking, financing companies, Loans of various types, GST, peers Promoters, Lenders, Consortium.			
2.3Government Departments: - IDC, EDC, Civic Body, Pollution Control department.			
3. Market Research		**4**	
3.1 Data Collection: - Data collection of Business idea such as Number of players, Total demand, Total supply			**CO1 CO2 CO3 CO4**
3.2 Analysis of Data: - Analysis of data and projection of data with respect to various factor (such as GDP, Climate etc through case studies).			
3.1 Questionnaire: - Preparing a questionnaire for business idea to assess business opportunity.			
4. Legal Aspect		**10**	
4.1 Legal Financial Term: - Know the various terms such as Resources, Assets, Liabilities, Advances, Depreciations, Investments, Fixed Capital, Working Capital (cash credit), Employee Cost, Miscellaneous Expense, Other Income, Profit & Loss Statement, Cash Flow Analysis, and Balance Sheet.			**CO1 CO2 CO3 CO4**
4.2 Legal Aspects: - Procedure for Registration with various government agencies, GST, PAN, Slab of Income Tax. Difference in use of electricity, water & LPG for domestic purpose and industrial applications			
4.3 Business Analyses: - 1) Swot Analysis 2) Break – Even Analysis			
5. Project Report		**8**	
5.1 Need for project report, Importance of Project report, Scope of project report: Economic aspects, Technical aspects, Financial aspects, Managerial aspects, Production aspects. List the contents of a project report. Proforma of a project report which includes: -Introduction, Schemes, Profitability and Projections, Infrastructure, Break Even Point, Names and Addresses of suppliers, remarks.			**CO1 CO2 CO3 CO4**

5.2 Project Profile: - Project appraisal criteria: - Technical feasibility, Financial feasibility, Economic viability, Commercial viability, Managerial competency, Political and Labour considerations			
5.3 Scope of Business: - Further scope with Capital infusion, Exit plan Analysis.			
Total	**25**	**32**	

6. COURSE DELIVERY:

Videos / Lectures/ Practicals /Expert lectures / Industry visits

7. SPECIFICATION TABLE FOR PRACTICALS

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	**Entrepreneurship Development**	4	3
2	**Identification of business opportunity**	6	5
3	**Market Research**	4	3
4	**Legal Aspect**	10	8
5	**Project Report**	8	6
TOTAL		**32**	**25**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICAL HOURS

No	Classroom Assignments	Marks
1.	Prepare a Case Study on leading enterprise	
2.	Prepare a Case Study on small scale unit	
3.	Prepare a report on various government schemes for startup.	
4.	Prepare SWOT analysis for a new business idea.	
5.	Prepare Project Report for a new business idea.	
	Total	**25**

9. LEARNING RESOURCES

S.No.	Author	Title of Books	Publisher
1.	Sharad Jawadekar, Shobha Dodlani,	Business entrepreneurship	Suvicharprakashanmandal, pune,
2.	S.S. Khanna	Entrepreneurship development	S. Chand & Co. Ltd, New Delhi,
3.	Vasant Desai	Management of small-Scale Industry in India	Himalaya Publishing House
4.	DilipSarwate	Entrepreneurial development Concepts and practices	Everest Publication House, Pune
5.	CB Gupta and P Srinivasan	Entrepreneurship Development	S. Chand and Sons, New Delhi

(FD511) Animal Products Technology

1. COURSE OBJECTIVES:

The students will able to acquire sufficient knowledge in the fields of meat, poultry and egg technology to enable him to supervise a meat processing / slaughtering plant and egg processing industry as Meat and Poultry is a rapidly growing industry in India, with a vast scope for internal and, external export market expansion.

2. TEACHING AND EXAMINATION SCHEME

Semester	**V**								
		Periods/Week (in hours)			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(FD511) Animal Products Technology		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**50**	**-**	**150**

3. COURSE OUTCOMES:

FD511.CO1: Know the various meat animals and understand the slaughter

processFD511.CO2: Preserve meat by applying heat, freezing and dehydration

FD511.CO3: Select a proper packaging material for meat products

FD511.CO4: Slaughter poultry scientifically and extend shelf life of eggs

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	1	1	1	1	1	1	1
CO2	1	1	1	2	2	1	1
CO3	1	1	2	2	2	1	1
CO4	1	1	1	2	2	1	1

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1.0 INTRODUCTION, EXAMINATION & SLAUGHTERING OF ANIMALS	6	6	**CO1 CO2 CO3 CO4**
1.1.Introduction: 1.1.1 Meat Animals and meat production 1.1.2 Potential of meat and meat products in the Indian context.			
1.2 Examination & slaughtering: 1.2.1 Ante-mortem and post-mortem examination of animals. 1.2.2 Slaughter house practices, slaughtering methods, dressing and packaging			
UNIT 2.0 COMPOSITION, STRUCTURE OF MEAT	18	16	**CO1 CO2 CO3 CO4**
2.1 Meat structure and Composition 2.1.1 Composition of meat and nutritive value, mutton, pork, beef, poultry. 2.1.2 Structure of meat muscle Chemical and bio-chemical changes in meat color, onset of rigor mortis.			
2.2 Spoilage and grading in Meat 2.2.1 Factors of spoilage, chemical and microbial spoilage. 2.2.2 Grading of meat and meat cuts.(whole-sale, retail cuts)			
UNIT 3.0 PRESERVATION OF MEAT	30	17	**CO1 CO2 CO3 CO4**
3.1 Preservation by heat: 3.1.1 Thermal-Pasteurization, sterilization. 3.1.2Lowtemperaturestorage-Artificialtenderisationandageing,storageofmeatabovefreezingpoint,storageofmeatbelowfreezingpoint 3.1.3 Changes in frozen storage.			
3.2 Preservation by lowering moisture- 3.2.1 Drying and de-hydration, freeze-drying. 3.2.2 Preservation by direct microbial inhibition-Irradiation, antibiotics. 3.2.3 Preservation by curing and smoking			
3.3 Packaging: 3.3.1 Packaging of meat and meat products Beef-Corned beef.			

3.3.2 Pork-Sausages,frankfurters,salami,hambacon,luncheon meat 3.3.3 Chicken-barbeque			
UNIT 4.0 EGG SCIENCE	15	6	**CO1** **CO2** **CO3** **CO4**
4.1 Introduction and production of egg in india : 4.1.1 Egg - structure, composition 4.1.2 Nutritive value			
4.2 Transportationandgradingof egg, increase in shelf life: 4.2.1 Transportation of egg. 4.2.2 Increase in shelf life of shell egg by physical and chemical method 4.2.3 Freezing of Albumin and yolk. 4.2.4 Changes due to freezing of albumin and Yolk			
4.3 Eggproducts: 4.3.1 Dehydrated egg powder ,frozen egg.			
UNIT 5.0 POULTRY PROCESSING & OTHER PRODUCTS	6	3	**CO1** **CO2** **CO3** **CO4**
5.1 Introduction 5.1.1 Slaughtering and bleeding, scalding, de-feathering, evisceration, chilling Packaging and storage.			
5.2 Other products 5.2.1 Sourcesandusesofbone meal, gelatin, casing, plasm and lard.			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction, Examination & Slaughtering Of Animals	6	6
2	Composition, Structure Of Meat	16	18
3	Preservation Of Meat	17	30
4	Egg Science	6	15
5	Poultry Processing & Other Products	3	6
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Dressing of Chicken (broiler).	25
2.	Canned meat products.	25
3.	Curing and Smoking of meat.	25
4.	Freezing storage of chicken ,meat and storage life study under various package materials.	25
5.	Preparation of Sausages.	25
6.	Preparation of Chicken barbeque.	25
7.	Grading of market egg (shape, size, weight, visual examination of shell, egg contents)	25
8	Quality evaluation of egg (appearance, weight, Haugh unit of yolk and albumin, porosity and thickness of eggshell)	25
9	Preparation of meat pickles	25
10	Preparation of corned mutton/beef/meatloaf	25
11	Preparation of pre-cooked frozen hamburgers.	25
12	Visit to slaughterhouses.	25
13	Visit to model Poultry farm	25
14	Visit to model Piggery	25
	Total(average) Marks	25
No	**Class room Assignments**	**Marks**
1	Potential for growth of meat processing industry in India	25
2	Process for export of meat	25
3	List various cured and smoked meat products available in the market	25
4	Flexible packaging materials used for packing meat products	25
5	Various kinds of cans used for packing meat products	25
6	Diagram of various meat cuts	25
7	Procedure for barbecued chicken	25
8	Scope for frozen egg products in India	25
9	Manufacture of gelatine from bones	25
10	Diagram of egg	25
...		
...	**Total(average) Marks**	25

(FD512) Marine Products Technology

1. COURSE OBJECTIVES:

The students will able to get the basic theoretical and practical knowledge required by a supervisor in the Fish Processing industry. They will be able to learn processing of fish, manufacture various fish products and quality control tests for fish products.

2. TEACHING AND EXAMINATION SCHEME

Semester	**I**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(FD512) Marine Products Technology		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**50**	**-**	**150**

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FD 512 CO1: Identify the various Indian fish species of commercial importance and evaluate its freshness.

FD 512 CO2: Preserve fish by heat processing, cold storage and salt curing.

FD 512 CO3: Make important fish products and by-products and pack them in appropriate packaging material.

FD 512 CO4: Analyze the microbial quality of fish.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	3	1	1	1	1	1	3
CO2	1	2	1	3	2	1	3
CO3	1	2	1	3	2	1	3
CO4	2	3	2	2	2	1	1

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	1	2
CO2	3	1
CO3	3	2
CO4	1	1

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1: FRESH FISH AND ITS SPOILAGE	**9**	**9**	**CO1**
1.1 Important commercial fish species of India 1.1.1 Survey of important commercial species of India 1.1.2 Classification of fish on the basis of fat content (lean fish, semi-fatty fish and fatty fish);			**CO2** **CO3** **CO4**
1.2 Quality evaluation and spoilage: 1.2.1 Chemical composition of above types of fish 1.2.2 Nutritional value of fish with reference to quality of fish protein 1.2.3 Outline of sequence of changes leading to the spoilage and end products of spoilage in marine and fresh water fish 1.2.4 Subjective method of evaluation of freshness of fish 1.2.5 Objective method of evaluation of freshness of fish. (Determination of TVB and TMA).			
UNIT 2: PREVENTION OF SPOILAGE OF FISH AND ITS PRESERVATION	**37**	**17**	**CO1** **CO2**
2.1 Handling and transportation of fish after landing.			**CO3** **CO4**
2.2 Preservation by Canning: 2.2.1 Canning of fish in oil (e.g. canning of sardines and mackerels) 2.2.1 Canning of prawns in brine. 2.2.2 Spoilage of canned fish and prawns (visual defects in stored cans and products, honey combing and formation of struvite crystals) 2.2.3 Quality control and quality standards in canned fish and prawns.			
2.3 Preservation by Freezing: 2.3.1 Process of freezing and frozen storage of fish (whole fish and fish fillet) 2.3.2 Process of freezing and frozen storage of prawns 2.3.3 Changes in fish during freezing and frozen storage (desiccation drip loss, rancidity, protein denaturation) 2.3.4 Measures to minimize changes during freezing and frozen storage of fish 2.3.5 Quality control and quality standards of frozen fish and prawns (for			

export) 2.3.6 Procedure for evaluation of bacteriological quality of frozen fish and prawns (for export)			
2.4 Preservation by Curing and Drying: 2.4.1 Quality requirements for salt for curing of fish. 2.4.2 Methods of salt curing of fish (pickle cure, brine cure and kench cure). 2.4.3 Process of sun drying of salted fish 2.4.4 Process of mechanical dehydration of salted fish 2.4.5 Comparison of sun drying and mechanical dehydration (Advantages and limitations of both methods) 2.4.6 Microbiological spoilage of salt cured fish and measure to prevent spoilage.			
UNIT 3: FISH PRODUCTS AND BY-PRODUCTS	8	6	**CO1**
3.1 Specialized fish products and by-products of sea-food processing industry 3.1.1 Process of production of fish sausage 3.1.2 Process of production of fish fingers 3.1.3 Production of fish pickle & prawn pickle 3.1.4 Production of fish flakes 3.1.5 Production of fish fingers 3.1.6 Definition of fish protein concentrate 3.1.7 Types of fish protein concentrate and quality standards of each 3.1.8 Principle of process of production of fish protein concentrate 3.1.9 By-products of seafood processing industry – uses of fishmeal, fish oil, chitin, gelatin and isinglass			**CO2** **CO3** **CO4**
UNIT 4: PACKAGING MATERIALS AND CONTAINERS	9	8	**CO1**
4.1 Properties and criteria for the Selection of packaging materials for: 4.1.1 Fresh and frozen marine products 4.1.2 Dried, salted and other types of seafood products 4.1.3 Canned fish 4.1.4 Fish paste and fish sausage.			**CO2** **CO3** **CO4**
4.2 Containers required for Bulk packaging of marine products, testing of packaging materials			
UNIT 5: MICROBIOLOGICAL ANALYSIS OF FROZEN SEA-FOOD	12	8	**CO1** **CO2**
5.1 Sources, sampling methods, isolation and detection of microorganisms in frozen sea food: 5.1.1 Vibrio – Vibrio parah aemolyticus, vibrio cholerae. Examination of – Oysters and foods other than oysters e.g. fish, squid, prawns, muscles, etc. 5.1.2 Salmonella and Shigella in frozen seafood Examination of shellfish, prawns, squid and other seafood			**CO3** **CO4**
5.2 Sampling Methods – preparation of food samples, isolation – enrichment media and selective media, identification and confirmation.			
Total	**75**	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Fresh fish and its spoilage	9	9
2	Prevention of spoilage of fish and, its preservation	17	37
3	Fish products and by-products	6	8
4	Packaging materials and containers	8	9
5	Microbiological analysis of frozen sea-food	8	12
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Study of morphological characteristics of typical fish	25
2	Visit to local fish market	25
3	Preparation of specialized fish products such as fish pickle, prawn pickle, fish flakes, fish fingers, etc.	25
4	Evaluation of bacteriological quality of frozen fish – Isolation and detection of-Salmonella.	25
5	Evaluation of bacteriological quality of frozen fish – Isolation and detection of Shigella, Vibrio.	25
6	Evaluation of bacteriological quality of frozen fish – Isolation and detection of Vibrio.	25
7	Visit to seafood freezing unit.	25
	Total(Average) Total	25
No	**Class room Assignments**	**Marks**
1	Enlist various fishing gear required to catch fish in inland water	25
2	Draw a typical fish and indicate its various parts	25
3	Write a note on different kinds of lacquers used in can for canning of fish	25
4	Give a detailed flow chart for canning of sardines in oil	25
5	Suggest improvements in production of sun dried fish	25
6	Various uses for fish Protein Concentrate	25
7	Flexible packaging material for frozen fish	25
8	Detailed procedure for detection of Vibrio cholera	25
9	Selective media used for detecting Salmonella and Shigella in fish	25
10	Symptoms of spoilage of canned food	25
	Total (Average) Total	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	Potter	Food Science	CBS Pubs
2	Joslyn heid	Food Processing Operations	
3	Nickeson Ronsivalli	Elementary Food Science	
4		Fish as Food	Associated Press
5		Fish Curing and Processing	Mir Publications

(FD513) FOOD REFRIGERATION AND COLD CHAIN

1. COURSE OBJECTIVES:

Food Refrigeration and Cold chain is a specialized area of Food Technology and is of prime importance in today‟s context. This course provides basic knowledge and skills to the students in the area of refrigeration, principle of refrigeration systems, refrigerants, air distribution system, their types, principle and working.

2. TEACHING AND EXAMINATION SCHEME

Semester V									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
(FD513) Food Refrigeration and Cold Chain	3	-	2	5	75	25	50	-	150

3. COURSE OUTCOMES:

FD513.CO1: Understand various refrigerants, their properties and refrigeration system

FD513.CO2: Understand various refrigeration components and their construction

FD513.CO3: learn and understand the properties of air and various air distribution system and its components

FD513.CO4: Learn and Understand cold chain requirements

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	3	2	3	1	2	2	3
CO2	3	2	3	1	2	2	3

CO3	3	2	3	2	2	2	3
CO4	3	2	3	1	2	2	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	2	3
CO2	2	2
CO3	2	3
CO4	2	3

5. DETAILED COURSE

CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1.0 FUNDAMENTALS OF REFRIGERATION	**6**	**3**	**CO1 CO2 CO3 CO4**
1.1 Definition of Refrigeration, unit of Refrigeration & Coefficient of Performance			
1.2 Standard rating of a refrigeration machine (1TR). Types of Refrigeration systems (Brief Classification).			
1.3 Types of Refrigeration systems (Brief Classification).			
UNIT 2.0 REFRIGERANTS AND REFRIGERANT COMPONENTS AND REFRIGERATION CYCLES	**35**	**25**	**CO1 CO2 CO3 CO4**
2.1 Refrigerants 2.1.1 Classification of refrigerants and Designation of refrigerants. 2.1.2Desirable properties of refrigerants. 2.1.3 Properties, uses and Applications of commonly used refrigerants like R-22, R 134 –A and Ammonia. 2.1.4 Effect of Refrigerants on Environment:- Ozone depletion & Global warming.			
2.2. Refrigerant Components 2.2.1 Construction, working & Applications of Hermetically-sealed compressor, open type compressor, screw compressor, scroll, and centrifugal compressors. 2.2.2 Condensers: Types- air & water-cooled, Shell & tube, Evaporative. 2.2.3Cooling towers, and spray ponds. 2.2.4Expansion Devices: Thermostatic expansion valve, Capillary tube, Low – side & high side floats valve. 2.2.5.Evaporators- Types- Flooded & dry expansion, bare tube, plate & tube, finned tube.			

2.2.6Defrosting.			
2.3 Vapour Compression Refrigeration Cycle 2.3.1 Schematic layout & working of VCRs. 2.3.2Functions of components of vapour compression system. 2.3.3Representation of vapour compression cycle on (T-S) and (P-h) diagram. 2.3.5Determination of theoretical & actual COP of VCRs. 2.3.5Factors affecting the performance of vapour compression system 2.3.6Applications of vapour Compression System. 2.3.7Cascade system of refrigeration: introduction & application.			
2.4 Vapour Absorption Refrigeration System 2.4.1Schematics layout & working of vapour absorption system. 2.4.2 Functions of components of vapour absorption system. 2.4.3 Electrolux refrigerator construction and working. 2.4.4 Applications of vapour absorption system.			
UNIT 3.0 PSYCHROMETRICS AND PSYCHROMETRIC PROCESS	**18**	**11**	**CO1 CO2 CO3 CO4**
3.1 Psychrometrics 3.1.1Definition of Pscychometry, Psychometrics, Purpose of air conditioning. 3.1.2 Psychometrics of air: Definitions of i) Dry air, ii) Moist air, iii) Saturated air, iv) DBT, v)WBT, vi) DPT, vii)Specific humidity, viii) relative humidity, ix)wet bulb depression x)Dew point depression xi)Enthalpy of Moist air 3.1.3 Construction & working of sling psychrometer. 3.1.4 Reading properties of moist air from Psychrometric charts.			
3.2 Psychrometric Process 3.2.1 Description and representation of following psychrometric processes on psychrometric charts: Sensible heating, Sensible cooling, humidification, dehumidification, Cooling and dehumidification, Cooling and humidification, Heating and dehumidification, heating & humidification, Mixing of air streams. 3.2.2 Simple numerically to be solved by using Psychrometric charts for above processes. 3.2.3 Definition of sensible heat factors such as RSHF & GSHF.			
UNIT 4. AIR DISTRIBUTION	**6**	**4**	**CO1 CO2 CO3 CO4**
4.1 Air Distribution 4.1.1 Air handling unit- Construction and Working. 4.1.2 Room Air Distribution: Requirements of good room air distribution, Draft, Types of supply air outlets. 4.1.3. Duct system: Layout & description, Perimeter, loop, extended plenum systems.			
UNIT 5.0 COLD STORAGE	**10**	**5**	**CO1 CO2**
5.1 Introduction 5.1.1 Need for Cold storage			

5.1.2 Cold storage Classification			**CO3 CO4**
5.2 General Considerations of Cold Storage			
5.3 Heat Load Calculations			
5.4 Fundamentals for implementing Cold storage Project			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Fundamentals of refrigeration	3	6
2	Refrigerants and refrigerant components	25	35
3	Psychrometrics and psychrometric process	11	18
4	Air distribution	4	6
5	Cold storage	5	10
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	**Practical**	**Marks**
1.	Identification, use & functions of various components of a vapor compression refrigeration system.	25
2	Demonstrations of various Psychrometric processes on a Test-Rig	25
3	Determination of C.O.P. of a Refrigeration System Test rig	25
4	Dismantling/Assembly of Hermetically Sealed compressor to understand the construction.	25
5	Dismantling/Assembly of an Open Type compressor to understand the construction.	25
6	Visit to industries	25
	Total(Average)Marks	25
Sr.No	**Class room assignments**	**Marks**
1	Refrigerant properties	25
2	Diagram for Vapour Compression refrigeration system	25
3	Diagram for Vapour absorption refrigeration system	25
4	Numericals on Psychrometric principles	25
5	Numericals on Heat Load calculations	25
	Total(Average)Marks	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	R.K. Rajput	Refrigeration and Air conditioning (S.I) units)	, S.K. Kataria& Sons, Delhi-11006
2	Domkundwar &Arora	Refrigeration & air conditioning	Dhanpatrai and sons
3	C.P. Arora	Refrigeration & air conditioning	Tata McGraw Hill Pub.
4	P.N. Ananthnarayan	Basic refrigeration & air conditioning	Tata McGraw Hill Pub.
5	P.L.ballaney	Refrigeration & air conditioning	Khanna Publishers

FD514 By- Product Utilization Technology

1. COURSE OBJECTIVES:

By-product utilization is the study of food industry waste utilization for preparing byproducts and management of waste material. It is the treatment of waste to safely dispose the waste materials. The emphasis is on studying food waste generation, their characteristics and requirements of disposal, productions of useful by-products like colour, alcohol, protein, fat, biogas etc along with case studies of byproducts utilization, food waste treatment methods, Legal and statutory requirement of waste disposal and handling.

2. TEACHING AND EXAMINATION SCHEME

Semester	**V**								
		Periods/Week (in hours)			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(FD514) By-Product Utilization and Management		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**50**	**0**	**150**

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FD514.CO1: Understand the origin and type of waste and by products, waste identification, classification and composition.

FD514.CO2: Understand the need for treatment and utilization, impact of waste disposal on environment.

FD514.CO3: Understand utilization of waste in specific food industries.

FD514.CO4: Understand the legal and statutory requirements for food waste handling, treatment and disposal.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	2	1	1	1	3	1	3
CO2	1	1	1	1	3	1	3
CO3	1	1	1	1	3	1	3
CO4	1	1	1	1	3	1	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	1	3
CO2	1	3
CO3	1	3
CO4	1	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1: FOOD INDUSTRY BY-PRODUCTS AND WASTE	**12**	**10**	
1.1 Introduction 1.1.1 Status in India 1.1.1. Definition 1.1.2. Origin and type of waste and by products 1.1.3. Their identification, classification, composition and characterization 1.1.4. Need for treatment and utilization, impact on environment 1.1.5. Food waste as source of biogenic raw material and energy utilization			**CO1** **CO2** **CO3** **CO4**
UNIT 2: FOOD WASTES AND BY-PRODUCTS RELATED TO SPECIFIC PROCESSING INDUSTRIES	**30**	**18**	
2.1 Food waste and by-products in: 2.1.1 Fruit and vegetables (apple, orange, mango, potato etc.) 2.1.2 Dairy industry 2.1.3 Oil and oil seeds industry 2.1.4 Sugar industry 2.1.5 Grains and milling industry 2.1.6 Fermentation (alcohol and beer) 2.1.7 Livestock and poultry 2.1.8 Fish & meat			**CO1** **CO2** **CO3** **CO4**
UNIT 3: BRIEF CASE STUDIES	**23**	**16**	
3.1 Involving 3.1.1 Utilization of whey from dairy industry. 3.1.2 Utilization of specific plant by- products for recovery of proteins, pectin, dietary fibers, antioxidants, colorants etc 3.1.3 Utilization of biomass for production of animal feed, compost and bio-gas.			**CO1** **CO2** **CO3** **CO4**
UNIT 4: INTRODUCTION TO FOOD PACKAGING WASTE	**5**	**2**	
4.1 Handling and treatment, Farm wastes. Incineration of solid food waste and			**CO1**

its disposal.			**CO2 CO3 CO4**
UNIT 5: FUTURE TRENDS	**5**	**2**	
5.1 Introduction to legal and statutory requirements for food waste handling, treatment and disposal.			**CO1 CO2 CO3 CO4**
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Food Industry By-Products and Waste	10	12
2	Food Wastes and By-Products Related to Specific Processing Industries	18	30
3	Brief Case Studies	16	23
4	Introduction to Food Packaging Waste	2	5
5	Future Trends	2	5
	Total	**48**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	**Practical**	**Marks**
1.	Production of Banana fiber from banana pseudostem	25
2.	Production of ethyl alcohol from molasses	25
3.	Isolation of starch from mango kernels	25
4.	Extraction of pectin from fruit waste	25
5.	Extraction of oil from citrus peel	25
6.	Preparation of whey beverage	25
7.	Production of pineapple peel vinegar	25
	Total (Average)	25
No	**Class room Assignments**	**Marks**
1	Production of cellulosic polymers from agricultural waste	25
2	Food waste utilization for sustainable development	25
3	Manufacture of pectin from citrus peel	25
4	Manufacture of pectin from apple pomace	25
5	By products utilization of grain industry	25
6	Isolation of casein from whey	25
7	Industrial uses of casein	25
8	Applications of whey protein	25

9	Processing and utilization of fish meal	25
10	Processing and utilization of ghee residue	25
...	Total(Average)	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	Ioannis S. Arvanitoyannis	Waste Management for the Food Industries	Elsevier Inc, USA
2	Sean X. Liu	Food and Agricultural Wastewater Utilization and Treatment	Blackwell Publishing
3	Robert R. Zall	Managing Food Industry Waste	Blackwell Publishing

AUDIT COURSE

(AC101) ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

1. COURSE OBJECTIVES:

This course aims at imparting basic principles of thought process, reasoning and inferencing by human being. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of Yogis, science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course thus focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system.

2. TEACHING AND EXAMINATION SCHEME

<table>
<tr><td colspan="2">Semester</td><td>V</td><td colspan="2"></td><td></td><td colspan="5"></td></tr>
<tr><td rowspan="2" colspan="2">Course code & course title</td><td rowspan="2" colspan="3">Periods/Week (in hours)</td><td rowspan="2">Total Credits</td><td colspan="5">Examination Scheme</td></tr>
<tr><td colspan="2">Theory Marks</td><td colspan="2">Practical Marks</td><td rowspan="2">Total Marks</td></tr>
<tr><td rowspan="2" colspan="2">(AC101) Essence of Indian Knowledge and Tradition</td><td>L</td><td>T</td><td>P</td><td>C</td><td>TH</td><td>TM</td><td>TW</td><td>PR/OR</td></tr>
<tr><td>2</td><td>-</td><td>-</td><td>2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
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CourseContent:

(i) वेद, (ii) उन्नवेद (आयुवेद, धनुवेद, गन्धवेद, स्थान्नत्य आदद) (iii) वेदांग (शिक्षा, कल्न, ननरुत, व्याकरण, ज्योनतष छांद), (iv) उन्नाइग (धर्म ास्त्र, ीरांासा, नुराण, तकमिास्त्र)

BasicStructureofIndianKnowledgeSystem:

- ModernScienceandIndianKnowledgeSystem
- YogaandHolisticHealthcare
- CaseStudies.

S. No.	Title of Book	Author	Publication
1.	Cultural Heritage of India- Course Material	V. Sivaramakrishna	BharatiyaVidyaBhavan, Mumbai, 5th Edition, 2014

2.	Modern Physics and Vedant	Swami Jitatmanand	BharatiyaVidyaBhavan
3.	The wave of Life	Fritzof Capra	
4.	Tao of Physics	Fritzof Capra	
5.	Tarkasangraha of Annam Bhatta, Inernational	V N Jha	Chinmay Foundation, Velliarnad, Amaku,am
6.	Science of Consciousness Psychotherapy and Yoga Practices	RN Jha	VidyanidhiPrakasham, Delhi, 2016

(TR502) FOOD TECHNOLOGY TRAINING-I

1. COURSE OBJECTIVES

To familiarize the students with industry environment and synergies industry institute requirements. Students will get an insight of industrial activities and processes and they will be able to develop required attitudes to work in an industry.

2. TEACHING AND EXAMINATION SCHEME

Semester	**V**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
TR502 Food Technology Training II		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		-	**-**	**-**	**-**	**-**	**-**	**35**	**15**	**GRADE**

3. COURSE OUTCOMES:

TR502.CO1: Co-relate the knowledge of theory learnt in academics with practical work at industry

TR502.CO2: Understand functioning of various departments and processes in the industry

TR502.CO3: Generate suitable industrial report

TR502.CO4: Understand basic skills and techniques for analysis.

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	3	2	0	1	0	3	2
CO2	3	1	1	1	1	2	3
CO3	3	0	0	0	0	0	3
CO4	3	2	0	2	0	0	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems
PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	2	2
CO2	3	2
CO3	2	2
CO4	2	3

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
	M	**Thr**	**CO**
Students are expected to develop job experience in the following areas of a food processing plant where they are undergoing training. HANDLING: Handling of raw materials and ingredients. PROCESSING: Processing of various food products in the industry, including necessary control measures. MAINTENANCE: Maintenance and operation of important machinery in the processing line. SANITATION AND HYGIENE: Measures taken to implement plant sanitation and hygiene PACKAGING: Packaging of food products. TESTING: Testing of packaging material. WATER TREATMENT: Water treatment and testing of treated water. STORAGE: Storage of raw material ingredients and finished products PERSONNEL HYGIENE: Personal hygiene measures in the industry.			**CO1** **CO2** **CO3** **CO4**

7. COURSE DELIVERY:

Training is during summer vacations prior to odd term comprising of one week each at four processing industries.

NOTE: Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.

8. TERM WORK & PRACTICALS

Evaluation Scheme					
TW				PR/OR	
Attendance Marks	**Industrial Mentor's assessment Marks**	**Institute Mentor's assessment Marks**	**Training Report**	**Report Assessment & Seminar/Viva**	**Total Marks**
05	10	10	10	15	GRADE

* 01 mark shall be deducted for every Absence (with or without permission).

Evaluation Scheme:

a) TW Assessment- To be assessed by Industrial and Academic Mentor"s

Seminar / Oral: To be assessed by faculty in charge of training and expert of Training industry, in each of the four processing industries.

Note:

1. For Industrial training Grades will be awarded based on marks scored as follows:

   80% and above Marks – Grade „A"
   60% to 79% Marks – Grade „B"
   40% to 59% Marks – Grade „C"
   Marks below 40% - Grade „D"

2. TW and PR/OR shall be separate heads of passing. Student has to secure minimum Grade „C" for passing.

SEMESTER – VI

Course Code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total Marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	TW	PR	
FD601	Food Standards and Safety	3	0	2	5	75	25	25	25	150
FD602	Industrial Water and Waste Treatment	0	0	2	2	0	0	25	25	50
FD603	Biochemistry and Nutrition	3	0	2	5	75	25	25	25	150
FD604	Food Technology Project	0	0	6	6	0	0	50	100	150
CC601	Industrial Organization and Management	3	0	0	3	75	25	0	0	100
E2	Elective 2	3	0	2	5	75	25	25	25	150
AC102	Indian Constitution	2	0	0	0	0	0	0	0	0
	Total	14	0	14	28	300	100	150	200	750

ELECTIVE 2

FD611 Soft Drink and Alcoholic beverage Technology
FD612 Food Processing Applications
FD613 Computer Applications in Food Technology
FD614 Food Marketing Management

SEMESTER SIXTH

(FD601) Food Safety and Standards

1. COURSE OBJECTIVES:

The students will able to study implementation of an effective food safety management system for production of safe and quality food products. They will be able to understand National and International Food Safety Regulatory standards and requirements for Food Business Operators. They will also gain necessary theoretical and practical knowledge of different areas of Food Safety Management System.

2. TEACHING AND EXAMINATION SCHEME

Semester	VI									
		Periods/Week (in hours)			Total Credits	Examination Scheme				
						Theory Marks		Practical Marks		Total Marks
(FD601) Food Safety and Standards		L	T	P	C	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FD 601 CO1: Design a Food Analysis Laboratory and carry out sampling in a Food Industry

FD 601 CO2: Apply Food Safety and Quality Management System in a Food Industry

FD 601 CO3: Understand Sensory analysis and Design a Quality Plan for a Food Industry

FD 601 CO4: Carry out Analysis of Foods for Quality Assurance

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	3	1	3	1	1	1	3
CO2	3	1	1	1	2	1	3

CO3	3	1	2	3	1	1	3
CO4	3	1	1	3	1	1	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems
PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	2	3
CO2	3	3
CO3	2	3
CO4	3	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1: INTRODUCTION TO FOOD SAFETY & FOOD LABORATORY DESIGN	**10**	**6**	**CO1 CO2 CO3 CO4**
1.1 Introduction to food safety and security 1.1.1 Safe food 1.1.2 Hygienic design of food plants 1.1.3 Food contaminants (Microbial, chemical and physical)			
1.2 Quality assurance laboratory requirements 1.2.1 Layout- general, microbiological and safety requirements 1.2.2 Various equipments required			
UNIT 2: FOOD LAWS AND STANDARDS	**10**	**6**	**CO1 CO2 CO3 CO4**
2.1 Indian regulations for Food Industry 2.1.1 FSSAI: acts merged, its composition, how it differs from PFA and its role in food safety			
2.2 Indian standards & controlling agencies: History, voluntary/mandatory certifications and role of: 2.2.1 BIS 2.2.2 AGMARK 2.2.3 MPEDA 2.2.4 APEDA			
2.3 Global Standards: 2.3.1 ISO: short profile of ISO, Food Industry related ISO standard ISO 22000 2.3.2 Codex Alimentarius- general description, various codex guidelines for food industry 2.3.3 FAO- WHO Joint committee on Food Additives			

2.3.4 (GRAS)- its importance and uses in the application of Food Additives			
UNIT 3: QUALITY ASSURANCE AND FOOD SAFETY MANAGEMENT	**15**	**11**	**CO1 CO2 CO3 CO4**
3.1 Quality assurance 3.1.1 Quality assurance v/s traditional quality control 3.1.2 Assurance through quality plan for various stages to assure the Food quality, 3.1.3 Quality Plan: How to control Quality in Raw material, Packing material, Work in process and Finished Products – specifications, sampling and testing (approved testing procedures as per FSSAI manuals, AOAC etc) 3.1.4 Quality Management Systems: ISO 9000, 5S system, Kaizen			
3.2 Food Plant Cleaning and sanitation: 3.2.1 CIP systems (Cleaning in Place) 3.2.2 Good Food Manufacturing Practices (GMP) 3.2.3 Good Hygiene Practices (GHP)			
3.3HACCP: 3.3.1 Principles, its importance in Food Safety, Outline about Implementation 3.3.2 Root Cause Analysis: How to analysis defects, complaints and take corrective actions			
UNIT 4: SAMPLING &SENSORY EVALUATION	**10**	**6**	**CO1 CO2 CO3 CO4**
4.1 Sampling for quality evaluation 4.1.1 Sampling terminology 4.1.2 Importance of sampling 4.1.3 Sampling techniques			
4.2 Sensory evaluation of foods: 4.2.1 Importance, uses and applications of Sensory Evaluation 4.2.2 Sensory Threshold 4.2.3 Sensory Evaluation tests 4.2.4 Criteria for selection of sensory panel members 4.2.5 Taste Assessors training			
UNIT 5: QUALITY ASSURANCE PLAN FOR VARIOUS FOOD PROCESSING INDUSTRIES	**30**	**19**	**CO1 CO2 CO3 CO4**
5.1 Critical Quality Control Points in Different industries related to quality defects and how to monitor/control and prevent: 5.1.1 Cereals, grains and legumes products 5.1.2 Meat, Fish and Poultry Products 5.1.3 Fruits and Vegetable products 5.1.4 Milk and Milk Products 5.1.5 Aseptic and Non aseptic Processed Products 5.1.6 Confectionary products			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction to Food safety & Food Laboratory Requirements	6	10
2	Food Laws and Standards	6	10
3	Quality Assurance and Food Safety Management	11	15
4	Sampling & Sensory Evaluation	6	10
5	Quality Assurance Plan for Various Food Processing Industries	19	30
	Total	**48**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Planning of laboratory layout for food processing unit with requirements of glassware and equipment	25
2.	Analysis of Squash, Jam and Tomato Ketchup as per F.S.S.A.I specifications.	25
3.	Testing of wheat flour as per F.S.S.A.I specifications	25
4.	Evaluation of baking quality of wheat flour	25
5.	Test baking	25
6.	Testing quality of roasted, ground coffee as per F.S.S.A.I specifications	25
7.	Evaluation of quality of confectionery products as per F.S.S.A.I specifications	25
8.	Sensory Evaluation Test	25
	Total(Average) Marks	25
No	**Class room Assignments**	**Marks**
1	Design Layout for Quality Assurance Lab for an SME	25
2	Current Activities, Schemes and updates by FSSAI	25
3	FSSAI GMP requirements for different Food Business Operators	25
4	Codex Alimentarius Commission	25
5	Application of 5S system in Food Industry	25
6	Application of Kaizen In Food Industry	25
7	Food processing layout for different Food Industries	25
8	Sensory Evaluation in different Food Industries	25
9	Preparation of Sensory Evaluation Sheet	25
10	FSSAI Specifications for different products	25
...	Total+(Average)Marks	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	A. Krammer	Quality Control for the Food Industry-Vol-I & II	AVI Publications.
2	W. A. Gould	Food Quality Assurance	AVI Publications
3	FSSAI	Food Safety and Standards Act 2006	Commercial law publication (India)
4	M. B. Jacobs.	Chemical Analysis of Food Products	CBS
5	ISI	I. S. I. Specifications for various Food Products	

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	David Pearson	The Chemical Analysis of Foods	Churchill Livingstone Publications.
2	Dr. S. Ranganna,	Handbook of Analysis and Quality Control of Fruit and Vegetable Products	Tata McGraw Hill Publications.

(FD602) INDUSTRIAL WATER & WASTE TREATMENT

1. COURSE OBJECTIVES:

The students will able to study the characteristics of raw water, treated water and waste water, the treatment methods and the chemical and microbiological methods of analysis. They will be able to understand waste treatment methods to be used for different food industry waste and to Analyze waste water samples in the laboratory.

2. TEACHING AND EXAMINATION SCHEME

SEMESTER VI									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(FD602) INDUSTRIAL WATER & WASTE TREATMENT	L	T	P	C	TH	TM	TW	PR/OR	
	-	-	2	2	-	-	25	25	50

3. COURSE OUTCOMES:

FD602.CO1: Select suitable methods for treating water.

FD602.CO2: Perform different chemical and microbial tests for water quality.

FD602.CO3: Adopt different methods for treating waste water.

FD602.CO4: Analyze the waste samples and examine if safe for disposal.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	2	1	1	1	1	2	3
CO2	3	3	2	2	1	2	3
CO3	3	1	2	1	2	1	2
CO4	3	1	2	2	3	1	2

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	1	3
CO2	2	3
CO3	2	2
CO4	3	3

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1.0 WATER		**12**	**CO1 CO2 CO3 CO4**
1.1 Introduction 1.1.1 Sources, common impurities 1.1.2 Contaminants in water .			
1.2 Physical characteristics of water and methods of estimation 1.2.1Colour, odour, turbidity, pH. 1.2.2 Methods of estimation.			
1.3 Chemical characteristics of water and methods of estimation:- 1.3.1Total solids, alkalinity, acidity 1.3.2 hardness, chlorides 1.3.3 sulphates, nitrogen 1.3.4 carbonates, bicarbonates 1.3.5calcium, iodine, fluorine, iron and magnesium.			
1.4 Microbial Analysis of water 1.4.1 Microbiological sources of contamination, index organisms and their significance. 1.4.2 Routine bacteriological analysis of water :– 1.4.2.1TPC, MPN, 1.4.2.2Test for presence of Coliforms.			
UNIT 2.0 MUNICIPAL AND INDUSTRIAL WATER		10	**CO1 CO2 CO3 CO4**
2.1 Municipal water 2.1.1 Uses of water for municipal purposes. 2.1.2 Quality requirements for portability. 2.1.3 Typical treatment methods for municipal water with flow chart			
2.2 General purification methods: 2.2.1 Filtration – Filtration plants 2.2.2 Types of filters – sand filters, RO filters, activated carbon filters. 2.2.3 Maintenance of filters.			
2.3 Water softening and disinfection 2.3.1 Water Softening methods – physical , chemical and ion exchange methods 2.3.2 Disinfection methods - significance of chlorine demand, residual			

chlorine and break point chlorination			
2.4 Water used in a soft drink industry 2.4.1 Quality requirements 2.4.2 General purification methods , 2.4.3 Flow chart.			
2.5 Water used in a dairy and canning Industry 2.5.1Water used in a dairy 2.5.1.1 Quality requirements, 2.5.1.2 General purification methods 2.51.3 Flow chart 2.5.2 Water used in a canning Industry 2.5.2.1Quality requirements, 2.5.1.2 General purification methods 2.51.3 Flow chart			
UNIT 3.0 MUNICIPAL AND INDUSTRIAL WASTE AND ITS TREATMENT METHODS		10	**CO1** **CO2** **CO3** **CO4**
3.1 Municipal waste water: 3.1.1Characteristics, 3.1.2 pollution hazards on disposal without treatment, 3.1.3 general treatment methods for municipal water; 3.1.4 Analysis of treated and untreated water sample for: - 3.1.4.1 Dissolved oxygen, BOD, 3.1.4.2 COD, Coliforms and TPC.			
3.2 Industrial waste water: 3.2.1 General characteristics, 3.2.2 pollution hazards on disposal without treatment, 3.2.3 General treatment methods for industrial waste water.			
3.3 Dairy waste ,fruit and vegetable waste and treatment methods 3.3.1 Dairy waste : 3.3.1.1 Characteristics 3.3.1.2 treatment methods 3.3.2 Fruit and vegetable waste: 3.3.2.1 Characteristics 3.3.2.2treatment methods			
3.4 Brewery waste and treatment methods 3.4.1Characteristics 3.4.2 treatment methods			
3.5 Meat and fish processing industry waste and treatment 3.5.1Meat processing industry waste: 3.5.1.1Characteristics 3.5.1.2 Treatment methods. 3.5.2 Fish processing industry waste: 3.5.2.1Characteristics 3.5.2.2 Treatment methods.			
Total		**32**	

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	WATER	12	--
2	MUNICIPAL AND INDUSTRIAL WATER	10	--
3	MUNICIPAL AND INDUSTRIAL WASTE AND ITS TREATMENT METHODS	10	--
	Total	32	--

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Estimation of total solids in water.	25
2	Determination of acidity and alkalinity of water	25
3	Determination of total hardness of water.	25
4	Estimation of temporary and permanent hardness	25
5	Estimation of residual chlorine in water	25
6	Estimation of chlorides in water	25
7	Determination of Total Plate Count in water	25
8	Determination of coliform count by M. P. N. method	25
9	Chemical Oxygen Demand of effluent	25
10	Biological Oxygen Demand of effluent	25
11	Visit to Water treatment plant	25
12	Visit to sewage and Effluent treatment plant	25
	Total (Average) Marks	25
No	**Class room Assignments**	**Marks**
1	Equipments used in water testing and their operating procedures.	5
2	Physical ,chemical and microbiological permissible limits in portable water	5
3	Water softening equipment used in a soft drink plant	5
4	Chlorine dosage application for the disinfection of different water samples	5
5	Report writing of visit to Water treatment Plant	5
6	Chemical and microbial analysis of different water samples.	5
7	Characteristics of waste discharged of fruit and vegetable industry. Analysis of the waste.	5
8.	Characteristics of waste discharged of dairy. Analysis of the waste	5
9	Characteristics of waste discharged from a canning unit. Analysis of the waste	5
10	Report writing of visit to Waste Treatment Plant	5
	Total (Average) Marks	5

11. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	1. S. Ranganna	Handbook of Analysis and Quality Control for Fruit and Vegetable Products	Mac Graw Hill Education India Pvt Ltd
2	M. Frobisher	Fundamentals of Microbiology	
3	Schroeder.	Water and Waste Water Treatment	

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	N.H. Furman	Standard Methods of Chemical Analysis	
2		Encyclopedia of Food Technology	AVI Publication

(FD603) BIOCHEMISTRY AND NUTRITION

1. COURSE OBJECTIVES:

The students will able to understand the biochemical changes taking place in foods during processing and role of enzymes in food processing. They will also comprehend and remember the nutritive value of different foods and deficiency disorders. They will be able to evaluate and analyze the diet charts for individuals of different age groups and with different physiological conditions.

2. TEACHING AND EXAMINATION SCHEME

Semester	VI								
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
FD603 BIOCHEMISTRY AND NUTRITION		L	T	P	C	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

FD 603.CO1: Understand the biochemical changes taking place during foods during processing.

FD 603.CO2: Identify the activity of enzymes in foods.

FD 603.CO3: Apply different methods to overcome enzymatic changes in foods there by increasing the shelf life of foods.

FD 603.CO4: Select different processing methods to retain the nutritional quality of foods.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	2	1	3	1	1	1	2
CO2	3	2	1	2	2	2	3
CO3	3	3	3	2	2	2	2
CO4	3	2	2	2	2	1	2

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	2	1
CO2	2	2
CO3	2	1
CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1.0 ENZYMES	**19**	**12**	CO1 CO2 CO3 CO4
1.1 Nomenclature, classification ,properties and factors affecting catalytic activity 1.1.1 Definition, nomenclature 1.1.2 Classification, properties, mechanism of action 1.1.3 Factors affecting catalytic activity of enzymes : 1.1.3.1 Effect of temperature, pH 1.1.3.2 Substrate and enzyme concentration.			
1.2 Coenzymes and cofactors 1.2.1 Coenzymes ,cofactors 1.2.2 Activators and inhibitors - Definition, significance and examples. 1.2.3 Method of estimating proteins – principal, procedure and graphical representation: 1.2.3.1 Biuret‟s method 1.2.3.2 Lowry „s method			
1.3 Enzymes in foods 1.3.1 Enzymes in Milk, milk products, 1.3.2 Meat, fish and its products. 1.3.3 Cereals and its products, 1.3.4 Fruits and vegetables and its products			
1.4 Enzymic browning 1.4.1Mechanisms of enzymic browning 1.4.2 Control of browning: 1.4.2.1 Thermal inctivation, use of acids, ascorbic acid, 1.4.2.2 Sulphur dioxide treatment. 1.4.2.3 Use of salts, prevention of contact with oxygen.			
1.5 Application of enzymes in food processing 1.5.1 Carbohydrates: amylases, invertases, pectinases and cellulases. 1.5.2 Proteolytic enzymes, lipases, 1.5.3 Oxidoreductases: glucose oxidase, catalase, peroxidase. 1.5.4 New developments in enzyme technology. 1.5.5 Use of enzymes in food analysis. Commercialization of industrially important enzymes. Concept of biotechnology			
UNIT 2.0 RIPENING IN FRUITS AND VEGETABLES	8	6	CO1 CO2 CO3
2.1 Respiration 2.1.1 Definition, rate, measurement, 2.1.2 Significance of respiration during ripening.			

2.2 Effects of ripening and climateric pattern of fruits 2.2.1Physical and chemical changes during ripening. 2.2.2 Factors affecting ripening.			CO4
2.3 Ethylene as a ripening hormone 2.3.1Production of ethylene, 2.3.2 Various pathways, its effect on ripening.			
2.4 Inhibitors and activators of ripening: 2.4.1activators of ripening and examples 2.4.2 inhibitors of ripening and examples			
UNIT 3.0 HUMAN NUTRITION	24	13	CO1 CO2 CO3 CO4
3.1 Enzymes and digestion 3.1.1 Alimentary canal 3.1.2 Enzymes and breakdown of carbohydrates, protein and fats. 3.1.3 Absorption processes.			
3.2 Vitamins 3.2.1 Definitions, classification of vitamins, 3.2.2 water soluble vitamins: 3.2.2.1 properties, functions 3.2.2.2 Recommended Dietary Allowances (R D A), distribution in foods. 3.2.2.3 Effect of deficiency / excesses and their prevention 3.2.3 fat soluble vitamins: 3.2.3.1 properties, functions 3.2.3.2 Recommended Dietary Allowances (R D A) distribution in foods. 3.2.3.3 Effect of deficiency / excesses and their prevention. 3.2.4 Estimation of vitamin C and B complex.			
3.3 Minerals 3.3.1 Study of different minerals: 3.3.1.1 Sodium, calcium: Sources, functions, deficiencies, RDA 3.3.1.2 Iron, phosphorous: Sources, functions, deficiencies, RDA 3.3.1.3 Potassium, iodine and fluorine. 3.3.2 Methods of estimation of calcium, phosphate, iron.			
3.4 Food and energy 3.4.1 Food: Functional classification and essential constituents. Function of essential constituents. 3.4.2 Factors affecting dietary protein: 3.4.2.1 digestibility coefficient, biological value of protein 3.4.2.2 Protein efficiency ratio, net protein utilization.			
3.5 Energy: 3.5.1 Units used in the body. 3.5.2 Determination of fuel value of foods.			
UNIT4.0 EFFECT OF PROCEESING ON THE NUTRITIVE EVALUATION OF FOODS	9	8	CO1 CO2 CO3 CO4
4.1 Effect of high and low temperature: 4.1.1High temperature: 4.1.1.1 Blanching, pasteurization 4.1.1.2 Sterilization and baking 4.1.2.1 Chilling 4.1.2.2 Freezing			
4.2 Effect of dehydration and fermentation: 4.2.1 Removal of moisture			

4.2.2 Fermentation			
4.3 Effect of natural additives and chemical additives: 4.3.1 Processing with additives: salting curing, smoking, high sugar, 4.3.2 Chemical additives.			
4.4 EFFECT OF IONIZING RADIATION Processing with different ionizing radiations.			
4.5EFFECT OF PACKAGING Effects of different packaging materials.			
UNIT 5.0 DIETS	15	9	CO1 CO2 CO3 CO4
5.1 Balanced diet and malnutrition 5.1.1 Balanced diet: RDA of different nutrients, balanced diets of different age groups adolescents, adults , 5.1.2 Malnutrition: Protein- calorie malnutrition. 5.1.3 Other disorders of malnutrition. 5.1.4 Prevention of malnutrition			
5.2 Modification of diets for specific conditions: 5.2.1 Obesity 5.2 .2 Hypertension 5.2.3 Coronary heart diseases.			
5.3 Infant nutrition 5.3.1 Important sources of foods for infants 5.3.2 Nutritional requirements 5.3.3 Balance diet charts			
5.4 Nutrition of pregnant and lactating mothers: 5.4.1 Important sources of foods for pregnant and lactating mothers 5.4.2 Nutritional requirements 5.4.3 balance diet charts			
5.5 Applied Nutrition Programmes 5.5.1 Government funded nutrition supplementation programmes at the state level 5.5.2 Government funded nutrition supplementation programmes at the national level			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	ENZYMES	12	19
2	RIPENING IN FRUITS AND VEGETABLES	6	8
3	HUMAN NUTRITION	13	24
4	EFFECT OF PROCEESING ON THE NUTRITIVE EVALUATION OF FOODS	8	9
5	DIETS	9	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Estimation of protein by Biuret‟s Method	25
2	Estimation of protein by Lowry‟s method.	25
3	Determination of amylase activity of saliva	25
4	Determination of the effect of incubation time, temperature and pH on amylase activity	25
5	Estimation of glucose by Folin – Wu method	25
6	Estimation of Vitamin C in lime using 2, 6 – dichloroindophenol method	25
7	Estimation of phosphate from food samples by calorimetric or volumetric method	25
8	Estimation of iodine in salt by volumetric methods	25
9	Estimation of iron by the calorimetric method	25
	Total(Average)	25
No	**Class room Assignments**	**Marks**
1	Latest developments in enzyme technology	25
2	Different activators and inhibitors of ripening with their permissible limits.	25
3	Digestive disorders and their treatment	25
4	Enzymes used in Food Processing	25
5	Diet charts for patients suffering Diabetes Mellitus	25
6	Diet charts for patients suffering from Hypertension	25
7	Diet charts for children of low income group, moderate income group and high income group – vegetarian and non vegetarian	25
8	Diet charts for adults, males and females ,from low income group, moderate income group and high income group – vegetarian and non vegetarian	25
9	Different nutritional programmes in the state– a survey	25
10	Role of enzymes cereals, milk and fruits and vegetables.	25
	Total (Average)	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	Bravermen	Introduction to the Biochemistry	J.Wolf
2	Eskin et al	Biochemistry of Foods	AVI
3	Swaminathan M	Nutrition of Foods	
4	Harris R & Kramer E	Nutritional Evaluation of Food Processing	AVI
5	S. Rangana	Analysis of Fruit and Vegetable Product	Mac Graw Hill

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1		Official Method of Analysis of the association of Official Analytical Chemists	
2	Gaman et al	The Science Methods of Foods	

(FD604) FOOD TECHNOLOGY PROJECT

1. COURSE OBJECTIVES:

To familiarize the students with product development and intensive laboratory work. They will be able to formulate a new product by applying theoretical and laboratory skills to standardize the developed product. They will also learn the machineries and equipments, raw materials needed for NPD(New Product Development)

2. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FD604 Food Technology Project	L	T	P	C	TH	TM	TW	PR/OR	
	-	-	6	6	-	-	100	50	150

3. COURSE OUTCOMES:

1. FD604.CO1:Formulate New product.
2. FD604.CO2:Standardise the New developed product.
3. FD604.CO3:Analyse the New Developed Product
4. FD604.CO4:Understand machineries and raw materials needed for the production ofNDP

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	3	2	2	0	0	3	3
CO2	3	2	1	1	0	2	3
CO3	3	0	0	2	0	1	3
CO4	3	1	0	3	0	1	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	1	3
CO4	2	2

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
	M	**Thr**	**CO**
Project Work – library and laboratory work with emphasis on the latter. Each student will be assigned to a staff member and will be required to report on the work done by him and discuss plans for further work every week. This will enable periodic assessment by the staff of students working under them. On completion of work the students will submit a report on their project. AREAS: Elementary product development and formulation in different areas such as dairy, fruits a vegetables, cereals, beverages, confectionery, fish, animal products, spices, coconut processing, etc special emphasis on locally available raw materials subject to seasonal availability.			

(CC 601) INDUSTRIAL ORGANISATION AND MANAGEMENT

1. COURSE OBJECTIVES:

Management is the basic need of any organization. Organization consists of multiple activities which are to be systematically managed for effective output. The course covers various principles related to organization and management. The areas covered are finance, human resource, project management etc. After completion of the course, the student will be acquainted with management and other related aspects so that he/she will be able to apply this knowledge in order to achieve the organizational goals.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (in hours)			Total Hours	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CC601 INDUSTRIAL ORGANISATION AND MANAGEMENT	L	T	P	H	TH	TM	TW	PR/OR	100
	3	-	-	3	75	25	-	-	

3. COURSE OUTCOMES

On successful completion of the course, the student will be able to:
CC601.CO1: Describe types of business organizations.
CC601.CO2: Apply the principles of managing Men, Machines, and Materials in an industry.
CC601.CO3: Evaluate financial status of an industrial organization.
CC601.CO4: Develop problem solving skills in project management**.**

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO1	PSO2
CO1	2	0	0	0	0	1	0	0	2
CO2	2	1	1	1	1	2	2	0	3
CO3	3	2	1	2	3	3	2	0	3
CO4	3	3	2	2	2	3	3	2	3

Relationship: Low-1 Medium-2 High-3

5. DETAILED COURSE CONTENTS/ MICRO-LESSON PLAN

M=Marks | Thr= Teaching hours | CO= Course Outcomes			
Unit	**M**	**Thr**	**CO**
1.BUSINESS ORGANIZATION **1.1** Types of business organizations: Individual proprietorship, Partnership, Joint Stock Companies: Private Ltd and Public Ltd, Co-operative societies, Public sector **1.2** Structure of business organization: Line organization, Functional Organisation, Line and staff organization, Project	10	6	CO1 CO2

organization			
2.BUSINESS MANAGEMENT **2.1:** Concept of management and administration, management as an art and science, evolution and growth of scientific management- contribution of F.W Taylor. **2.2** Basic functions of management: planning, organizing, staffing, directing, controlling. Other functions: forecasting, coordinating and decision- making. **2.3** Functions in Industry: Basics of Procuring, store- keeping, material handling, production, packing and forwarding, marketing and sales, supervision, research and development. **2.4** Supervisory skills required in industry	16	9	CO1 CO2 CO3
3.BASICS OF FINANCE **3.1** Sources of finance **3.2** Cost Concepts: Necessity of costing, elements of cost: material, Labour and expense; prime cost, overhead cost, total cost, And break- even analysis. **3.3** Materials management: Inventory control-standard order, reserve stock, reorder point, lead time. Economic order quantity, ABC Analysis. Introduction to Just in time (JIT) system **3.4** Depreciation: Definition and causes. Methods of calculating depreciation charges: Straight Line Method, Diminishing Balance Method, Sinking Fund method .(Simple Numericals) **3.5** Obsolescence- definitions and reasons. **3.6** Introduction to GST.	18	13	CO1 CO2 CO3 CO4
4.HUMAN RESOURCE MANAGEMENT **4.1** Functions of Personnel Department**:** Human resource planning, selection and recruitment, training, promotion and transfer, welfare of employees. **4.2** Industrial Relations**:** Employer-employee relations, trade union, settlement of disputes of employees, collective bargaining, conciliation, arbitration, grievance handling mechanism. **4.3** Wages and Incentives**:** Factors influencing wages, types of wage plans – time rate and piece rate, Incentive – objectives and types, individual and group incentive plan, characteristics of a good wage or incentive plan, difference between incentive and wage. **4.4** Industrial Acts: Introduction to the following Industrial Acts: Industrial Disputes Act 1947/1956; The Indian Factories Act 1948 The Workmen's Compensation Act 1923	21	14	CO1 CO2 CO3 CO4
5.PROJECT MANAGEMENT **5.1** Introduction to Project Management **5.2** Network Analysis (Introduction to basic concepts with simple Numericals) CPM- Critical Path Method: Definition, network diagrams, critical path, advantages PERT- Programme Evaluation and Review Technique:	10	6	CO1 CO2 CO3 CO4

Definition, network diagrams, advantages. Comparison of PERT and CPM.			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Business Organization	6	10
2	Business Management	9	16
3	Basics of Finance	13	18
4	Human Resource Management	14	21
5	Project Management	6	10
	Total	**48**	**75**

8. LEARNING RESOURCESText Books

S. No	**Author**	**Title of Book**	**Publisher**
1	O.P. Khanna	Industrial Engineering and Management	Dhanpat Rai Publications
2	T. R. Banga ,S.C. Sharma	Industrial Organisation and Engineering Economics	Khanna Publishers
3	Awate, Chunawala, Patel, Bhandarkar, Sriniwasan	Industrial Organisation and Management	Vrinda Publication
4	Martand Telsang	Industrial Engineering and Production Management	S.Chand & Company Ltd

(FD611) Soft Drink and Alcoholic Beverage Technology

1. COURSE OBJECTIVES:

The students will able to get the basic theoretical and practical knowledge required by a supervisor in the Non Alcoholic and Alcoholic Beverage Industry. They will be able to know the various ingredients required for manufacture of certain beverages, the process for the manufacture of certain beverages and learn the various quality control procedures in beverage manufacture.

2. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(FD611) Soft Drink and Alcoholic Beverage Technology	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

FD611.CO1: Manufacture Alcoholic and non alcoholic beverages

FD611.CO2: Test various beverages for quality control

FD611.CO3: Develop new beverages

FD611.CO4: Do trouble shooting in the process line and rectify the faults.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	3	2	2	2	1	1	1
CO2	3	3	2	3	1	1	1
CO3	3	2	3	2	1	1	1
CO4	3	3	2	3	1	1	1

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	1	3
CO2	2	3
CO3	2	2
CO4	3	3

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1 SOFT DRINK AND ITS MAJOR INGREDIENTS	**15**	**10**	**CO1 CO2 CO3 CO4**
1.1 Introduction: 1.1.1 History, Definition. Legal standards and specifications. 1.1.2 Nutritive value of soft drinks. 1.1.3 Classification of soft drinks. 1.1.4 Various ingredients used. Permitted levels. Storage and handling of ingredients.			
1.2 Water used in Soft drink industry 1.2.1 Sources of water. 1.2.2 Composition of water. 1.2.3 Different water treatment methods such as: Filtration, chemical treatment, Ion exchange, demineralization reverse osmosis, deodorization, U. V. rays. 1.2.4 Water Specifications			
1.3 Sweeteners used in Soft drinks 1.3.1 Function of Sweeteners. 1.3.2 Nutritive sweeteners: Sucrose, Glucose, Corn syrup, High Fructose Corn Syrup, Sorbitol, Fructose, their properties, advantages and disadvantages. 1.3.3Non nutritive sweeteners: Saccharine, Acesulfame K, Aspartame-their properties, advantages and limits. 1.3.4 High Intensity sweetener: Sucralose			
UNIT 2.0 ACID, CARBON DIOXIDE, COLOR, FLAVOR, PRESERVATIVES AND OTHER ADDITIVES USED	10	6	**CO1 CO2 CO3 CO4**
2.1 Acids, Colors, and Flavors 2.1.1 Functions of acids. Different types of acids used, properties, level used. Equivalent sourness produced. 2.1.2 Colors: Natural, Nature identical, synthetic. 2.1.3 Flavors: Flavor extracts, essential oils, emulsions. Caffeine.			

2.2 Preservatives: 2.2.1 Preservative action of various ingredients 2.2.2 Various chemical preservatives used. 2.2.3 Antioxidants like BHA, Ascorbic acid. 2.2.4 Hydrocolloids: Carageenan, alginates and polysaccharides – their functions and levels used.			
2.3 Carbon di oxide 2.3.1 Properties of CO2 gas. 2.3.2 Specifications. 2.3.3 CO2 gas treatment. 2.3.4 Gas volume.			
UNIT 3.0 COMPOSITION , PRODUCTION AND QUALITY STANDARDS OF SOFT DRINKS	18	12	
3.1 Composition 3.1.1 Composition of various carbonated beverages 3.1.2 Non-carbonated, fruit based and energy drinks.			
3.2 Production 3.2.1 Preparing of carbonated and non-carbonated soft drink. 3.2.2 Aseptic packaging of soft drink. 3.2.3 Plant sanitation and housekeeping.			**CO1** **CO2** **CO3** **CO4**
3.3 Quality control tests and standards 3.3.1 Quality standards for sugar and acids. 3.3.2 Online quality control: Tests for treated water, syrup clarity, inspection of washed bottles, inspection of filled bottles, gas volume, brix, organoleptic tests, etc. 3.3.3 Microbiological tests for water, syrup, washed bottles and beverage. 3.3.4 Quality test for finished product brix, gas volume, acidity, invert sugar, organoleptic tests, etc.			
UNIT 4.0 BEER BREWING AND WINE MAKING	24	12	**CO1** **CO2** **CO3** **CO4**
4.1 Beer manufacture 4.1.1 Process: raw materials, malting and brewing. 4.1.2 Bottling and packaging. 4.1.3 By-product from beer fermentation. 4.1.4 Analysis for specific gravity, alcohol content, total acidity, reducing sugars, carbon dioxide and foam collapse rate. 4.1.5 Quality control standards specific sanitary requirement.			
4.2 Wine manufacture 4.2.1 Introduction- Types of wines, microbiological aspects, yield of alcohol, effect of temperature, use of sulphur dioxide, yeast nutrition, autolysis de-acidification of wines. 4.2.2 Process- Selection of fruits, yeast, fermentation ageing, maturation and bottling, by-products. 4.2.3 Sensory evaluation: appearance, odour, aroma taste, flavour. Microbiological analysis: check for acetic, lactic acid bacteria, wild yeast and spoilage organisms. 4.2.4 Chemical Analysis: acidity, alcoholic content, chemical additives, SO2, benzoate and sorbic acid.			
4.3 Quality control standards for wines 4.3.1 White wine, red wine, port wine, cider and sherry. 4.3.2 Specific sanitary requirements.			

UNIT 5.0 DISTILLED ALCOHOLIC BEVERAGES-MANUFACTURE AND QUALITY CONTROL.	8	8	**CO1 CO2 CO3 CO4**
5.1 Introduction 5.1.1 Common types, culture, raw materials.			
5.2 Processing 5.2.1 General process – Mashing, milling, cooking of starch, source. Saccharification with malt enzymes or microbial enzymes. 5.2.2 Fermentation, distilling, drying and bottling.			
5.3 Analysis of distilled beverages 5.3.1 Colour, odour, taste, specific gravity, alcohol content . 5.3.2 Quality control standards and specific sanitation programme.			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Soft Drink and its major ingredients	10	15
2	Acid, Carbon Dioxide, Color, flavor, preservatives and other additives used	6	10
3	Composition , Production and Quality Standards of Soft Drinks	12	18
4	Beer brewing and wine making	12	24
5	Distilled alcoholic beverages-Manufacture and Quality control.	8	8
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Identification and qualitative analysis of citric, malic, fumaric, phosphoric acids	25
2.	Analysis of sugar: Moisture, Flocculation test, Sedimentation, Colour, Turbidity, Odour, ash.	25
3.	Water analysis: Iron residue, chlorine tests, total hardness, total dissolved solids, total alkalinity, P & M Value.	25
4.	Testing of gas-volume, brix, invert sugar, acidity, total volume – of any two soft drinks available in the market.	25
5.	Analysis of beverages from the market	25
6.	Formulation of a Soft Drink	25
7.	Formulation of an alcoholic drink	25
8.	Preparation of wine from grape juice and cashew apple juice. Analysis of wine.	25
	Total (average) marks	25
No	**Class room Assignments**	
1	Consumption of soft drink in India	25
2	Role of stimulants in soft drinks	25
3	Storage of raw materials in a soft drink plant	25
4	Advantages and disadvantages of High fructose corn syrup	25
5	Citric acid as an universal acidulant	25
6	Significance of salt in Soft Drinks	25
7	Selection of fruits for wine making	25
8	Control of acetic acid in fermentation	25
9	Utilization of Beer waste	25
10	Quality control of alcohol	25
	Total (average) marks	**25**

9. LEARNING RESOURCES

Text books

S. No.	Author	Title of Books	Publishers
1	Edited by, A. J. Mitchell	Formulation and Production of Carbonated soft drinks,	Blackie
2	Edited by, Woodroof & Phillips	Beverage Carbonated &Non Carbonated,	AVI
3	Prescott & Dunn.	Industrial Fermentation by	Agrobios
4	Casida L.	Industrial Microbiology	New Age International

(FD612) Food Processing Applications

1. COURSE OBJECTIVES:

To provide an opportunity to the students to apply the principles of Food Processing in the commercial manufacture of processed food products. They will be able to learn Material handling techniques required for commercial production of processed foods, Production Techniques for large production of food products and Develop skills required in different areas of Food products

2. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(FT612) Food Processing Applications	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FD 612 CO1: Carry out commercial production of processed foods

FD 612 CO2: Execute techniques required for large production

FD 612 CO3: Develop skills needed to maintain Quality during production

FD 612 CO4: Commercialization of Indian Snacks and Sweets.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	3	1	1	1	1	1	3
CO2	3	1	1	1	1	1	3
CO3	3	1	1	2	1	1	3
CO4	3	1	1	1	1	1	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	2	3
CO2	2	3
CO3	3	3
CO4	2	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**	**M**	**Thr**	
UNIT 1: BAKING TECHNOLOGY	**15**	**18**	**CO**
1.1 Raw Materials Requirements of raw material and quality aspects			**CO1**
1.2 Fermented Bakery Products Manufacture of fermented Bakery products like bread , buns ,pizzas			**CO2**
1.3 Commercialization Commercial aspects of production of cake, biscuits & cookies			**CO3** **CO4**
UNIT 2: FRUITS AND VEGETABLE PRODUCTS	**15**	**10**	
2.1 Pickle Manufacture: 2.1.1 Sampling techniques 2.1.2 Types of pickles 2.1.3 Curing of locally available fruits & vegetables 2.1.4 Pickle making and shelf life studies			**CO1** **CO2**
2.2 Jams Manufacture: 2.2.1 Sampling techniques 2.2.2 Types of Jams 2.2.3 Process 2.2.4 Ingredients 2.2.5 Packaging and Shelf Life studies			**CO3** **CO4**
UNIT 3: DEHYDRATION OF FRUITS & VEGETABLES	**15**	**10**	**CO1**
3.1 Pretreatment, process control, analysis & packaging of dehydrated fruits.			**CO2** **CO3** **CO4**
UNIT 4: INDIAN TRADITIONAL SWEETS	**15**	**05**	
4.1 Manufacturing Of Indian Traditional Sweets 4.1.1 Sampling techniques 4.1.2 Formulation, process standardization quality control measures 4.1.3 Packaging storage and shelf- life studies			**CO1** **CO2** **CO3** **CO4**
UNIT 5: INDIAN TRADITIONAL SNACKS	**15**	**05**	**CO1**
5.1 Pulse Based Indian Traditional Foods: 5.1.1 Sampling techniques 5.1.2 Pulse based traditional snack products like Sev, Chakli, Farsan etc.			**CO2** **CO3** **CO4**

5.1.3 Formulation, process standardization 5.1.4 Quality Control measures 5.1.5 Packaging and Shelf Life studies			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Baking technology	18	15
2	Fruits and vegetable products	10	15
3	Dehydration of fruits and Vegetables	10	15
4	Indian traditional sweets	05	15
5	Indian traditional snacks	05	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	**Practical**	**Marks**
1.	Preparation of Bread	25
2	Preparation of Biscuits	25
3	Preparation Of Cakes	25
4	Jam preparation	25
5	Preparation of Tooty fruity	25
6	Preparation of Petha	25
7	Preparation of Rosgulla	25
8	Preparation of Sev	25
9	Preparation of Soy based Snack	25
10	Preparation of any Goan traditional sweet	25
	Total (Average) Marks	25
No	**Class room Assignments**	**Marks**
1	FSSAI Standards for Bread	25
2	FSSAI standard for Cookies and Biscuits	25
3	Equipments required for Baking and their suppliers in India	25
4	Project report for Bakery industry setup	25
5	Project report for Jam manufacturing Unit	25
6	FSSAI standards for Jams	25
7	List of Dehydrated fruits and vegetables	25
8	Types of driers	25
9	List of Goan Traditional Sweets	25
10	Packaging requirement for Snacks	25
	Total (Average) Marks	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	Girdhari Lal & Siddappa	Commercial Preservation of Fruits & Vegetables	ICAR
2	EIRI Board of consultants	Preservation & canning of fruits and vegetables	EIRI
3	EIRI Board of consultants	Handbook of modern bakery products	EIRI

(FD613) Computer Applications in Food Technology

1. COURSE OBJECTIVES

The main objective of introducing this subject in the diploma course of food technology is to expose the student with fundamental knowledge on hardware and software of computers. It will also impart knowledge related to the applications of computation in food industries. The relevant theory instructions may be imparted along with practical exercises.

.2. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
		Periods/Week (in hours)			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(FD613) Computer applications in Food Technology		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

3. COURSE OUTCOMES:

FD613.CO1: Learning uses of MS excel in solving various food technology problems.
FD613.CO2: Study hardware used in various Food technology operations
FD613.CO3: Learning Statistical methods and its application
FD613.CO4: Understand the basic software and its application in food Industries.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	2	1	1	2	1	2	3
CO2	2	1	2	2	1	2	3
CO3	2	1	1	2	1	2	3
CO4	2	1	2	2	1	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	2	2
CO2	3	2
CO3	3	2
CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1.0 INTRODUCTION	11	8	**CO1 CO2 CO3 CO4**
1.1.Introduction to computer and related hardware used in food industry(Touch Screens,Hand Held Devices, PalmTops, Barcode Printers and Scanners, RFID Tags,etc.)			
1.2 Introduction to various soft wares for their application in food technology (like SAP, just FoodERP,Food Works, SERVE,etc.)with relevant case studies.			
1.3 ApplicationofMSExcel(latest version) to solve the problems of Food Technology			
1.4. MS Excel Basics 1.4.1 Introduction to different menus and commands commonly used in solving problems. 1.4.2 Use of Add-In Tools like Mega Stat, etc. for statistical data analysis.			
UNIT 2.0 APPLICATION OF MSEXCEL TO SOLVE THE PROBLEMS OF FOOD TECHNOLOGY	18	18	**CO1 CO2 CO3 CO4**
2.1 Chemical kinetics in food processing 2.1.1Determining rate constant of zero order reaction 2.1.2First order rate constant and half-life of reactions			
2.2Microbial destruction in thermal processing of foods 2.2.1Determining decimal reduction time from microbial survival data			
2.3Statistical quality control in food processing 2.3.1Control Charts			
2.4Sensory evaluation of foods 2.4.1Statistical descriptors of a population estimated from sensory data obtained for a sample			
UNIT 3.0 FAMILIARIZATION WITH THE APPLICATION OF COMPUTER IN SOME COMMON FOOD INDUSTRIES	25	15	**CO1 CO2 CO3 CO4**
3.1 Milk Plant 3.1.1 Application starting from the receiving of raw material up to the storage and dispatch f finished product with relevant case studies			
3.2 Bakery 3.2.1 Application starting from the receiving of raw material up to the storage and dispatch of finished product with relevant case studies			
3.3 Fruit and Vegetable processing 3.3.1 Application starting from the receiving of raw material up to the storage and dispatch of finished product with relevant case studies			

UNIT 4.0 CAD, CAM, CIM and CAE	12	4	**CO1 CO2 CO3 CO4**
4.1. Introduction 4.1.1. Basic Introduction to CAD(Computer Aided Designing) 4.1.2.CAM(Computer Aided Manufacturing), 4.1.3. CIM (Computer Integrated Manufacturing) 4.1.4. CAE (Computer Aided/ Assisted Engineering) application of different softwares (like AutoCAD, Pro-E, Google Sketch up, etc.)in the same.			
UNIT 5.0 SEARCH ENGINES, MS WORD AND ERP	9	3	**CO1 CO2 CO3 CO4**
5.1 Useofsearchenginesandonlineresearchdatabasesforresearchonfoodrelatedtopics.			
5.2 Use of word processing software (like MS Word)for creating reports and technical papers with the help of reference managers (like End Note, Reference Manager, Ref Works, etc.)			
5.3 Familiarization with software related to food industry (like SAP, just Food ERP, LIMS(Laboratory Information Management System),etc.			
Total	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction	8	11
2	Application of ms excel to solve the problems of food technology	18	18
3	Familiarization with the application of computer in some common food industries	15	25
4	CAD, CAM, CIM and CAE	4	12
5	Search engines, ms word and erp	3	9
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Introduction to MS Excel, MS word	25
2.	Use of Ms Excel to solve problems in food Industry	25
3.	Study of Various Search Engines	25
4.	Demonstration of Various ERP softwares	25
5.	Development of Statistical charts for sensory evaluation	25
6.	Demonstration of various softwares for CAD/ CAM	25
7.	Industry visits	25
	Total(average) Marks	25
Sr.No	**Class room assignments**	**Marks**
1	Functions of various parts of Computer	25
2	Note on ERP softwares	25
3	Numericals on sensory evaluation and its representation on MS Excel	25
4	Case Study on automation in dairy industry	25
5	Case study on automation in Beverage industry	25
	Total(average) Marks	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	R. Paul Singh, AP.	Computer Applications in Food Technology: Use of Spreadsheets in Graphical, Statistical and Process Analysis	Academic Press
2	Vedpal Yadav, i-proclaim.com	Computer Applications in Food Technology	-

(FD614) Food Marketing Management

1. COURSE OBJECTIVES:

In this day of competitive business, a course in Food marketing management is of great importance to the entrepreneur, industrialists, and person working in marketing related department. It is said that producing itself is not difficult, but to make people buy the produce is. Marketing begins before the product exists and continues long after the product is sold. The student will be able to understand the nature and scope of marketing management.

2. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
		Periods/Week (in hours)			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(FD614) Food Marketing Management		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

FD 614.CO1: Understand the fundamentals of marketing management

FD 614.CO2: Understand market segmentation, targeting, positioning, and marketing mix

FD 614.CO3: Conduct market research

FD 614.CO4: Understand consumer behavior and marketing channels

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	1	2	3	1	1	2	2
CO2	1	2	3	1	1	2	2
CO3	1	2	3	1	1	2	2
CO4	1	2	3	1	1	2	2

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	3	1
CO2	3	1
CO3	3	1
CO4	3	1

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
UNIT 1: FUNDAMENTALS OF MARKETING MANAGEMENT	**10**	**12**	
1.1 Marketing Management 1.1.1 Define: marketing, market and marketing management 1.1.2 Explain simple model of marketing process 1.1.3 Understand various stakeholders of business: customers, employees, shareholders, society, government, suppliers, distributors etc. 1.1.4 Marketing Management orientations:- Discuss :(a) production concept (b) the product concept (c) the selling concept (d) the marketing concept (e) the societal marketing concept 1.1.5 Building customer relationships: Definition of Customer relationship management (CRM), importance of CRM, customer value and customer satisfaction 1.1.6 Changing nature of customer relationship in modern times: discuss with examples (a)selective relationship management (b) long term relationships (c)relating directly 1.1.7 Discuss about Customer loyalty programs and customer retention programes with few examples			**CO1 CO2 CO3 CO4**
UNIT 2: MARKETING SEGMENTATION, TARGETING, POSITIONING AND MARKETING MIX	**20**	**14**	
2.3 Market segmentation, targeting and marketing mix 2.3.1 Discussion on segmentation based on: (a) Geographic factors (b) demographic factors (c) psychographic factors (d) behavioral factors. Explain with real world examples. Definition of target marketing. Brief discussion on target marketing with examples. 2.3.2 Understand the concept of Market Positioning with examples from corporate world 2.3.3 Marketing Mix: discuss in detail, with examples, the four P‟s of marketing. 2.3.4 Marketing Environment: discuss in detail, with examples, (a) Political environment, (b)economic environment, (c) social			**CO1 CO2 CO3 CO4**

environment, (d) technological environment and (e) natural environment			
UNIT 3: MARKET RESEARCH &CONSUMER BEHAVIOR	**25**	**14**	
3.1 Definition and scope of Marketing research 3.1.1 Discuss various steps involved in marketing research (a) Defining the problems and research objectives (b) Developing the research plan (c) Gathering and analysing the data (d) Interpreting and reporting the findings 1.1.1 Brief discussion on gathering of secondary data and primary data 1.1.2 Research approaches for gathering primary data, which shall include: observational research, survey research, marketing research and online marketing research.			**CO1** **CO2** **CO3** **CO4**
3.2 Factors influencing consumer behavior: 3.2.1 Discuss, with examples or case studies, various factors influencing consumer behavior: Cultural factors, social factors, personal factors, psychological factors. 3.2.2 Discuss in detail ,with examples, following types of buying decision behavior: (a) Complex buying behavior (b) Dissonance –reducing buying behavior (c) Habitual Buying behavior (d) Variety seeking buying behavior 3.2.3 Brief discussion on stages in buyer decision process: recognition of need, information search, evaluation of alternatives, purchase decision, post purchase behavior.			
UNIT 4: SALES MANAGEMENT	**10**	**5**	
4.1 Sales management 4.1.1 Discuss functions of salespeople: Prospecting, targeting, communicating, selling, servicing, information gathering, allocating 4.1.2 What makes a good sales representative 4.1.3 Understand in detail various steps in selling process: Prospecting and qualifying, pre approach, approach, presentation and demonstration, handling objections, closing, follow-up 4.1.4 Direct Marketing: Definition and concept of direct marketing, Benefits and growth of direct marketing, Use of customer database in direct marketing, 4.1.5 Forms of direct marketing: telephone marketing, direct mail marketing, catalog marketing, direct response television marketing, kiosk marketing 4.1.6 Ethical issues in direct marketing: (a) Irritation, unfairness, deception and fraud (b) Invasion of privacy, etc.			**CO1** **CO2** **CO3** **CO4**
UNIT 5: MARKETING CHANNELS & MARKETING IN DEGITAL AGE	**10**	**3**	
5.1 The nature and importance of Marketing Channels (distribution channels): 5.1.1 Number of Channel Levels: Understand levels in Direct Marketing			**CO1** **CO2**

Channels and Indirect marketing Channels 5.1.2 Understand Consumer marketing channels and Business marketing channels			**CO3** **CO4**
5.2 Marketing in the digital age 5.2.1 Brief discussion on major force shaping the digital age: digitalization and connectivity, the explosion of the internet, new types of intermediaries, customization, etc. 5.2.2 Definition of E-business, E-commerce and E-marketing 5.2.3 Understand benefits of E-commerce to the buyers 5.2.4 Understand benefits of E-commerce to the sellers 5.2.5 E-marketing domains (discuss each domain with examples) 5.2.6 Business- to- Consumer (B2C) 5.2.7 Business-to- Business (B2B) 5.2.8 Consumer –to- Consumer (C2C) 5.2.9 Consumer –to – business (C2B) 5.2.10 Discuss the promise, challenges and issues in E-commerce			
Total	**75**	**48**	

64. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Fundamentals of marketing management	12	10
2	Marketing segmentation, targeting , positioning and marketing mix	14	20
3	Market research & Consumer behavior	14	25
4	Sales management	05	10
5	Marketing channels	03	10
	Total	**48**	**75**

8. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	**Practical**	**Marks**
1.	Visit a Marketing department of a business firm.	25
2.	Prepare a report on resources available at the above firm.	25
3.	List out the roles of various staff from the firm.	25
4.	What products are they marketing?	25
	Total	25
No	**Class room Assignments**	**Marks**
1	Sales & Marketing strategies adopted in Fruits and vegetable Processing industries	25
2	Sales & Marketing strategies adopted in bakery & confectionary industry	25
3	Sales & Marketing strategies adopted in dairy industries	25

4	Sales & Marketing strategies adopted ingredients & flavor industries	25
5	Case studies of consumer behavior with respect to processed food products	25
6	Role and importance of technical sales in Industry	25
7	Latest trends in digital marketing	25
8	Product Promotion and advertising	25
9	Sales Forecast Plan	25
...	Total(Average) Total	25

9. LEARNING RESOURCESText

Books

S. No.	Author	Title of Books	Publishers
1	Philip Kotler	Principles of marketing	prentice Hill (I) Ltd
2	J. C. Gandhi,	Marketing a managerial introduction	Tata McGraw Hil
3	R. S. Davar	Modern Marketing Management	progressive corporation pvt. Ltd
4	Philip-Kotler-	Marketing Management	prentice (I) Ltd
5	Alexander	Industrial Marketing	Cross & still-d. B. Taraporewala Pvt. Ltd
6	Boyd, Westfall and Stasch	Marketing Research	all India Traveller Book Seller, Delhi

(AC102) INDIAN CONSTITUTION

1. COURSE OBJECTIVES:

As a proud citizen of this country every student must be aware about the Indian Constitution to appreciate the provisions available for the people of this biggest democracy in Indian Constitution so that the youth of this country plays active role in development of the country by participating in the formation of sensitive and proactive Government at national and state level. This course intends to make students aware about various constituents of the Indian Constitution.

2. TEACHING AND EXAMINATION SCHEME:

Semester	**VI**								
Course Code & Course Title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(AC102) INDIAN CONSTITUTION		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**
		2	**0**	**0**	**2**	**0**	**0**	**0**	**0**

3. COURSE CONTENT

UNIT 1:The Constitution– Introduction

- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation
- State Policy Principles

UNIT 2:Union Government

- Structure of the Indian Union
- President- Role and Power
- Prime Minister and Council of Ministers
- LokSabha and RajyaSabha

UNIT 3: State Government

- Governor- Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

UNIT 4: Local Administration

- District Administration
- Municipal Corporation
- Zila Panchayat

UNIT 5: Election Commission

- Role and Functioning
- Chief Election Commissioner
- State Election Commissioner

Suggested Learning Resources:

S. No.	Title of Book	Author	Publication
1	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi,2008
2	The Constitution of India	B. L. Fadia	SahityaBhawan; New edition (2017)
3	Introduction to the Constitution of India	D DBasu	Lexis Nexis; Twenty – Third 2018 edition

Suggested Software/ Learning Websites:

a. https://www.constitution.org/cons/india/const.html
b. http://www.legislative.gov.in/constitution-of-india
c. https://www.sci.gov.in/constitution
d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

(TR701) FOOD TECHNOLOGY TRAINING-II

1. COURSE OBJECTIVES:

To familiarise the students with industry environment and synergies industry institute requirements. Students will use the theoretical knowledge and laboratory skills gained in different courses for testing and working of equipments .This training will help to bridge the gap between theory and actual practice. It will help in improving communication skills , decision making , managing man power and material handling which is of prime importance for a supervisor.

2. TEACHING AND EXAMINATION SCHEME

Semester VII									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
TR701 Food Technology Training II	-	-	-	-	-	-	100	100	GRADE

3. COURSE OUTCOMES:

TR701.CO1:Relate the knowledge of theory learnt in academics with practical work at industry

TR701.CO2:Understand functioning of various departments and processes in the industry

TR701.CO3: Prepare technical documents and give oral presentations related to the work undertaken or observed.

TR701.CO4:Perform analysis and Quality assurance activities wherever possible and applicable, under the guidance and mentor-ship of industry personnel.

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life - long Learning
CO1	3	2	0	1	0	3	3
CO2	3	1	1	1	1	2	3
CO3	3	0	0	2	0	1	3
CO4	3	2	2	3	1	1	3

Relationship : Low-1 Medium-2 High-3

PSO1: To Study the supply chain, Food production, sales and marketing and waste management systems

PSO2: To study the Quality Assurance of foods and New Product Development

	PSO1	PSO2
CO1	1	2
CO2	1	3
CO3	1	2
CO4	1	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
	M	**Thr**	**CO**
Students are required to study and have hands-on experience wherever possible in the following areas (depending on availability): 1. Company Profile 2. Organizational Structure 3. Company Product Range 4. Manufacturing Facilities Available /Services provided 5. Plant / Facility Layout 6. Operations / Production Processes 7. Production Planning and Control 8. Detail study of Latest Equipment/ Technologies Used 9. Packaging 10. Stores Functions 11. Material Handling Systems/ Equipments 12. Food Safety Quality Management Systems / Functions 13. Maintenance and Repair Practices 14. Safety Practices / Safety Equipments 15. Utilities: Water treatment and waste disposal management etc 16. Logistics 17. Sales and Marketing 18. Ethics, Statutory Rules and Regulations followed 19. Product Design and Development 20. Any other area specific to the Industry providing Training			CO1 CO2 CO3 CO4

6. COURSE DELIVERY:

The Course will be delivered through placement of the students in various industries

7. TERM WORK & PRACTICALS

EXAMINATION SCHEME				**TOTAL**
TW		PR/OR		
Daily Diary	Progressive assessment Marks	Training Report	Report Assessment & Seminar/Viva	
50	**50**	**50**	**50**	**GRADE**

* 01 mark shall be deducted for every absence (with or without permission). Inplant training will be for 16 weeks in food industries in Goa as well as outside the state.TW marks will be obtained from respective industries. Students will have to submit a detail report on training. Evaluation will be done on the basisof a seminar and an Oral examination to be conducted by internal and external examiners.

Daily Diary:

The daily diary should-be maintained in a book. It should reflect the day to day activities performed by the student (including task, men and materials involved). It should be countersigned by the Industry Mentor. It will become the basis for writing reports on the complete training.

Training Report

The training report should be submitted by the training students should include the following salient points- Certificate from institute, Certificate of training from company, detailed write up as per daily dairy, detailed drawings, working drawings, photographs, safety precautions, techniques for work minimization on site, organizational chart, Importance of project to the society, special methods/techniques/equipment should be separately high lightened, includingenvironmental aspects. The report should be informative and technical, typed with double spacing on good quality bond paper and bound. Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.

Note:

a. Student/s undergoing Industrial Training shall follow Rules and Regulations of theIndustry.

b. Industrial Training will generally be organized and conducted in accordance withIndustrial Training Manual duly prescribed by the Board.

Note:

4 For Industrial training Grades will be awarded based on marks scored as follows:

80% and above
Marks – Grade
„A“60% to 79%
Marks – Grade
„B“ 40% to 59%
Marks – Grade
„C“ Marks below
40% - Grade „D“

5 TW and PR/OR shall be separate heads of passing. Student has to secure minimum Grade

„C" for passing.

6 Students with Grade D, under Head TW, shall be declared T.N.G and a student whoseterm is granted but obtains Grade D, under the head PR/OR, shall be declared Failed/ATKT