CURRICULUM FOR

DIPLOMA IN

FOOD TECHNOLOGY

SEMESTER I, II, III, IV, V, VI & VII

PROGRAMME STRUCTURE

SET I

Semester - I

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
GN102	Engg. Maths - I	4	2	-	6	75	25			100
GN103	Applied Physics-I	4		2	6	75	25	-	50	150
GN106	Basic Engg.Skills	-	-	6	6	-	-	50	100	150
GN105	Comp. Fund & App.	-	-	4	4	-	-	50	50	100
GN203	Environmental Studies	3			3	75	25	-	-	100
Total		11	2	12	**25**	**225**	**75**	**100**	**200**	**600**

Semester - II

Course code	Name of Course	TEACHING SCHEME				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
GN202	Applied Physics-II	4	-	2	6	75	25	-	50	150
GN201	Engg. Maths II	4	2	-	6	75	25	-	-	100
GN104	Applied Chemistry	3		2	5	75	25	-	50	150
GN101	Communication skills	-	-	2	2	-	-	50	50	100
GN205	Engg. Materials	4	-		4	75	25	-	-	100
GN204	Engg. Drawing	2	-	4	6	-		50	50	100
Total		**17**	**2**	**10**	**29**	**300**	**100**	**100**	**200**	**700**

SEMESTER I

GN 102 ENGINEERING MATHEMATICS- I

1. RATIONALE

There are variable and constant concepts in the engineering phenomena and problems, which need to be understood, analyze and predict their behaviour. For instance, motion and acceleration of an object under applied known force, effect of temperature and pressure under constant volume, etc. All these situations require modeling of constants and variables into a relationship known as formula (formulating) and solving problems of engineering by substituting the values of constants and variables. Thus mathematics is used to understand, analyse and find solutions. There are some standard principles and formulae, which should be understood by students and apply as per needs of situations in real life.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-102	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Engineering Mathematics	4	2	-	6	75	25	-	-	**100**

Minimum passing % : Theory 40%

Legends:

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

Unit 0 Fundamentals of algebraic mathematical operations

- Use of scientific calculator
- Recall of algebraic operations & formulae
- Solving of simultaneous equations with two variables

Unit 1 Co-ordinate Geometry/ Analytic Geometry;

Purposes/Applications of Co-ordinate Geometry. Coordinate systems. *Straight Line*- Distance between two points. Internal & external division of a line. Area of triangle. Slope of line. Angle between two lines. Various forms of equation of line-parallel to axis, point-slope form, slope intercept form, two point form, intercepts form & normal form. General equation of line. Distance of a point from a line. - Equations of circle, Equations of tangent & normal to circle.

Unit 2 Trigonometry

Purposes/Applications of Trigonometry. Radian. Radian & degree. Area of sector & length of an arc. Trigonometric ratios of any angle & Trigonometric identities. Trigonometric ratio of allied angles, compound angles, & Multiple angles(only 2A). Sum & product formulae. Sine, Cosine rules. Solution of triangles

Unit 3 Limits & Functions

Functions- constants, variables. Kinds of functions (question not to be asked). Concepts of limits- algebraic, trigonometric, logarithmic & exponential functions (No question on method of substitution and Inverse Trigonometric function)

Unit 4 Differential Calculus

Purposes/Applications of Differential Calculus. Definition of Derivative. Derivatives of standard functions-applications. Derivative of sum, difference, product & quotient of a function. Derivative of composite, implicit & parametric functions with reference to - algebraic, logarithmic, trigonometric, inverse circular functions, exponential functions & logarithmic differentiations. Introduction to Second order derivatives.

Unit 5 Application of derivatives

Geometrical meaning of derivatives. Equation of tangent & normal to curves. Derivatives as rate, motion, related rates. Maxima & minima.

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Co-ordinate Geometry	**14**	**20**
2	Trigonometry	**17**	**16**
3	Limits & Functions	**8**	**12**
4	Differential Calculus	**15**	**20**
5	Application of derivatives	**10**	**07**
		64	**75**

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1.	Deshpande S.P.,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
2.	Grewal B.S;	Engineering Mathematics	Khanna Pub., New Delhi1995 or latest
3.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi1997 or latest
4.	TTTI, Bhopal	Mathematics for Polytechnics Vol. – I & Vol. – II	TTTI, Bhopal Latest
5.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

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GN 103 APPLIED PHYSICS-I

1. RATIONALE:

Being the basis of all engineering branches, the students must acquire knowledge of basic principles; laws and facts of Physics This knowledge will improve their ability to apply it in solving engineering problems and overall growth of their disciplines.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-103 Applied Physics I	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	**150**
	4	-	2	6	75	25	50	-	

Minimum passing % : Theory 40% *Duration of Theory Paper: 3 Hrs.*

Legends:
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

Unit 1 UNITS & DIMENSIONS

Fundamental and Derived Physical Quantities and their SI units. Dimensions and Dimensional formula, Principle of Homogeneity, use of Dimensional Analysis for checking the correctness of an equation. Definition of least count of Vernier Caliper, Micrometer Screw Gauge.

Unit 2 KINEMATICS

Vectors and Scalars-Definition, Difference between vectors and scalars, types of vectors with example.
Definition - Displacements and distance, Velocity and speed, uniform and average velocity, Uniform acceleration and retardation, problems based on kinematic equations for uniform acceleration. $V=u+at$, $S=ut + ½ at^2$, $v^2 = u^2 + 2as$. Velocity- time diagram, Motion under gravity.

Unit 3 PROPERTIES OF MATTER

Definition of Elasticity, Stress, Strain and Elastic limit. Hooke's Law. Definition of Young's modulus, Bulk modulus, Rigidity modulus. Determination of Young's modulus by Searle's method. Behaviour of wire under continuously increasing stress. Definition of Yield Point, Breaking Stress, and Factor Of Safety. Adhesive and Cohesive forces. Angle of contact. Concept and definition of Surface Tension, Surface Tension by Capillary rise method. Application of Surface Tension. Definition and explanation of Viscosity. Statement of Newton's law of viscosity, Terminal Velocity (no derivation) Stokes Law. Determination of Viscosity by Stokes method. Streamlined and Turbulent flow. Definition of Critical Velocity, Reynolds Number.

Unit 4 HEAT

Definition of specific heat and units of specific heat. Modes of transfer of heat transfer, Conduction, Convection and Radiation. Law of thermal conductivity. Definition of co-efficient of thermal conductivity. Determination of coefficient of thermal conductivity of a good conductor

Statement of Charles's law, Boyle's law and Gay Lussac's law. Derivation of general gas equation.

Unit 5 ELECTROSTATICS

Coulomb's Law of Electrostatics, Electric Field, Intensity of Electric Field, Electric Potential and its unit, Potential difference between two points (no derivation), Potential of a sphere, Potential of Earth, Definition and units of Capacitance, Principle of Capacitor, Capacitors in series, Capacitors in Parallel.

Unit 6 MAGNETISM

Magnetic Effect of Electric current (Oersted's Experiment) Magnetic Field, Intensity of Magnetic Field. Coulomb's Law of Magnetism, Magnetic lines of Force, Magnetic Induction, Expression for Magnetic Induction at the centre of a Circular coil carrying current (no derivation), Force acting on straight conductor placed in Magnetic Field (no derivation).

Unit 7 (A) LAWS OF FORCES & FRICTION (MECHANICAL AND ALLIED GROUPS)

Triangle law of forces, parallelogram law of forces (expression only), graphical & analytical representation of force, resolution of forces, resolving force into rectangular components.

Definition & concept of friction, types of friction, Force of friction, Laws of static friction, Coefficient of friction, angle of friction (expression only), angle of repose(only qualitative aspects)

OR

UNIT 7(B) : SEMICONDUCTORS (ELECTRONICS AND ALLIED GROUPS)

Energy Band structure of electronic material(conductor , semiconductor and insulator)

Definition of semiconductors, types of impurities added to the semiconductors, intrinsic and extrinsic semiconductors.

Types of semiconductors P- type and N- type, Structure of P- type and N- type,

Extrinsic semiconductor using pure Si and Ge semiconductors.

Types of carriers; N- type and P- type

Process of recombination of carriers.

Formation of P-N junction and depletion region.

4.SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	Units and Dimensions	5	5
2	Kinematics	9	12
3	Properties of Matter	13	14
4	Heat & Gas Laws	9	10
5	Electrostatics	12	12
6	Magnetism	8	10
7A	Laws of Forces & Friction	8	12
	OR		
7B	Semiconductors	8	12
	Total	**64**	**75**

7A-Mechanical and allied branches **7BFor Electronics and allied branches**

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	LIST OF EXPERIMENTS
1	Use of Vernier Caliper
2	Use of Micrometer Screw gauge
3	Determination of Surface tension by capillary rise method using Travelling Microscope.
4	Determination of coefficient of viscosity by stroke's method.
5	Determination of acceleration due to gravity ('g') by simple pendulum.
6	Determination of Young's modulus by Searle's method.
7	Determination of Coefficient of thermal conductivity by Searle's method.
8A	Find resultant force using parallelogram of forces
8B	Draw and interpret band structure of Insulator, Semiconductor and conductor, Band structure of P-type & N-type extrinsic semiconductor, Drawing PN junction.

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1.	Halliday D and Resnickr	Physics Part-I & II	Latest
2.	Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M.,	Physics Part-I & II for 10+2 Students	Latest
3.	B.G. Dhande	Applied physics for polytechnics	Latest
4.	Bhandarkar	Applied Physics for polytechnics	Latest
5.	Saxena HC & Singh Prabhakaer	Applied Physics Vol. I & II	Latest
6.	Rao, B.V.N.	Modern Physics	Latest
7.	R.K.Guar and S.L. Gupta.	Engineering Physics	Latest
8.	B.L. Thereja.	Engineering Technology	Latest
9.	Modern Publishers.	ABC of Physics	Latest
10.	V.K Mehta	Elements of electronic engineering	Latest
11	R S Khurmi	Applied Mechanics	Latest

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GN-105 - COMPUTER FUNDAMENTALS & APPLICATIONS

1. RATIONALE

The course on Computer Fundamentals & Applications will enable the students to understand the basic concepts related to computer fundamentals, Data Representation & Number Systems, Computer Languages, operating system, Computer Software and Internet Technology and will be able to apply the same in different areas of electronics engineering. Laboratory practice will help in developing the requisite skills.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-105	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Computer Fundamentals & Applications	-	-	4	4	-	-	50	50	**100**

Minimum passing % : Theory 40%

Legends:
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

UNIT 1 Computer Fundamentals

1.Introduction to Computer

2. History, Evaluation, Classification and Generations of computers

3.Organisation of the Computer System

4. Hardware

Input device, Memory or Storage Devices, Processing Unit, Output device, Scanner

Printers.

5. Communication technology and evolution of communication mediums

6. Software

System software

Application Software

Shareware

Freeware

Open Source

7. Concept of Computer Viruses

Definition

Types

Preventive Measures

UNIT 2 Operating System

1. Introduction to operating system

Definition Functions , Types, Examples, Comparisons of Various Operating Systems

2. Windows Operating System-

GUI(Graphical user Interface), desktop, Start Menu, Task Bar, Status Bar, Scroll Bar, Title Bar, Toolbar, Menu Bar. File Organization: Creating, Saving, Deleting, Renaming, Cutting, Pasting, copying, moving, Searching Files and Folders. Applications: My Computer, Recycle Bin, Windows Explorer, Control Panel.

UNIT 3 Application Software

1. MS Word

- Introduction
  - Starting MS Word
  - Creating, saving and opening a document
  - Editing commands-Cut, Copy, Paste, Paste Special
  - Text Formatting, Bullets and Numbering, Borders and shading etc.
  - Tabs, Style, Views
  - Insert Table, Picture, OLE Objects, etc.
  - Checking Spelling and Grammar, Thesaurus
  - Page Layout & Printing
  - Mail Merge**.**

2. MS Excel

- Create, Save and open a worksheet
- Entering data – text, numbers and formulae in a worksheet, Hyperlink
- Navigating within a Worksheet and also between different Worksheets of a Workbook
- Inserting and deleting cells, rows and columns in a worksheet
- Select, copy, paste and delete cell data within the worksheet
- Using various formulae and inbuilt functions like Trigonometric, Statistical, Logical, Data Sorting
- Update worksheets using special tools like spell check and auto correct.
- Setup the page and margins of worksheets for printing
- Enhance worksheets using charts & graphs

3. MS Power Point

- Introduction and starting the program
- Starting a presentation
- Adding new slide
- Saving and Opening presentation
- Text formatting options
- Copy, Move and delete slides and text
- Applying designs
- Using Animations
- Slide Transitions, Hyperlink
- Insert clip art
- Viewing the presentation

UNIT 4 The Internet

Networks, Advantages of networking, Types of networks.

- History and Functions of the Internet
- Working with Internet
- Web Browsers, World Wide Web, Uniform Resources Locator and Domain, Names, Issues related to web security.
- Uses of Internet
- Search for information, Email, Chatting, Instant messenger services, News Group, Teleconferencing, Video-Conferencing, E-Commerce and M-Commerce.

Email

- Manage an E-mail Account
  E-mail Address, Configure E-mail Account, log to an E-mail, Receive E-mail, Sending mails, sending files an attachments and Address Book

- Downloading Files

4. SUGGESTED LIST OF EXPERIMENTS

S. No.	Unit No.	List of Experiments
1	**1**	Identify Input and output devices
2	**1**	Calculate capacity of different storage device
3	**2**	Identify OS and different application software s loaded on that OS
4	**3**	Load Windows operating system. Configure and load relevant device drivers

5	**4**	Practice on Windows 95/98/2000 ; o Starting Windows, Exploring the desktop, Arranging windows, My Computer, The start button, Creating Shortcuts, Practice on moving and sizing of windows o Study of file organization: creating, copying, moving, renaming and deleting o Practice on Windows Accessories- Notepad, Word Pad and Paint o Editing document & formatting text, Previewing and printing document/Image file o Practice on Windows Explorer **o** Recycle bin **o** Shutting down windows
6	**4**	Practice on MS-Word ; o Create and format document o Edit and Modify text- changing font size type and style o AutoText, AutoComplete, AutoCorrect, grammar and spellchecker, Find and replace of text o Open save and print a document o Insert, modify table o Insert graphics o Mail merge
7	**5**	Practice on Microsoft Excel o Create, save & format worksheet o Open and save worksheet file o Edit & modify data o Use formula and functions o Split windows and freeze pans o Data sort and security features o Create, edit, modify and print worksheet. o Create and edit charts
8	**5**	Practice on PowerPoint o Create, edit, insert, move, slides o Open and save presentation o Insert picture, audio slide layout, action button o Apply custom animation o Present slide show
9	**6**	Practice on: o Identification of type of Account. o Connecting to internet o Dial up access o Web browsing o Searching websites o Information searching o Email services **o** Creating email accounts & Receiving and sending mails

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1	Norton Peter	Introduction to Computers (special Indian edition)	Tata McGraw Hills New Delhi, 6th Edition, 2005 ISBN: 0070593744
2	Kahate Atul	Information Technology	Tata McGraw Hills New Delhi, ISBN-13:9780070593718
3	Williams Stalling	Using Information technology: A Practical Introduction to Computers and Communication	Tata McGraw Hills New Delhi,
4	Curtin	Information Technology: The Breaking Wave (book only)	Tata McGraw Hills New Delhi, ISBN:0074635581
5	Ravichandran, D	Introduction to Computers and Communication	Tata McGraw Hills New Delhi, ISBN: 0070435650
7	Douglas E.	The Internet Book	Prentice Hall of India, New Delhi, 3rd Edition, ISBN: 812032286X
8	Basanbhara S.K.	Computer Today	Nita Mehta Publications, 2003 ISBN: 8186340742

GN 106 BASIC ENGINEERING SKILLS

1. **Rationale**:

A technician is expected to work on the shop floor. It therefore becomes essential for him to have a through exposure to safety aspects, fire fighting, first aid as he is the guide for the skilled and unskilled personnel working under him. From technical knowledge and skills point of view he is also expected to have knowledge on proper ways of using various hand tools, measuring devices etc. in addition to other engineering skills.

The course on Basic Engineering skills is aimed at providing him the knowledge and skills in all those areas through shop instructions, demonstrations and skill development exercises. This course is also aimed at providing the student the exposure to engineering equipment which will help him to assimilate the teaching which takes place at higher semesters.

2. **Teaching And Examination Scheme**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(GN106) Basic Engineering Skills	L	T	P	C	TH	TM	PR/OR	TW	150
	0	0	6	6	-	-	50	100	

Legends: L-Lectures; P-Practical; C-Credits; TH-End Semester Theory; TM-Test Marks;

PR/OR-End Semester Practica/Oral Examinations TW- Term Work

3. **Detailed Course Contents**

Unit 1: General Safety, Housekeeping, Fire Fighting & First Aid Introduction to General Safety aspects of engineering workshop, meaning and importance of housekeeping, possible fire hazards, fire triangle, types of fire extinguishers – selection and use, basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies.
Unit 2: Fitting Workshop Practice Introduction to the trade, Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools, Types of files and filing methods. Drill bits and drilling Processes, using portable and pillar drilling machine. Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling tapping and deing. Use of spirit level and plumb bob.
Unit 3: Carpentry Workshop Practice Introduction to the trade, types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools, wood working processes. Different types of joints and their usage. Introduction to wood working machines- lathe , circular saw, band saw, wood planner, universal wood working machine.
Unit 4: Electrical Workshop Practice

Brief introduction to power distribution, different hand tools used in electrical trade, different measuring instruments. Making of cable joints. Measurement of current, voltage, frequency and Power Consumption. Connecting and starting of Induction Motor. Changing of Direction of rotation of induction motor. Introduction to commonly used electrical Fittings (Domestic & Industrial). Reading of simple electrical drawings.
Unit 5: Basic Electronics Workshop Practice Introduction to basic electronic components, Introduction to use of Multimeter in measuring voltage, current, resistance, capacitance. Checking of connectivity. Introduction to soldering process. Soldering Irons- Types and wattage. Reading of basic electronic circuits.

Note: during first 20 minutes of the practical session, Instructor shall provide theoretical knowledge as prescribed in the curriculum. (Shop Talk)

Unit No.	Topic	Hours/ Semester
1.	General Safety, Housekeeping, Fire Fighting & First Aid	06
2.	Fitting Workshop Practice	36
3.	Carpentry Workshop Practice	18
4.	Electrical Workshop Practice	18
5.	Basic Electronics Workshop Practice	18
	Total	**96**

GN203 ENVIRONMENTAL STUDIES

1. RATIONALE

Due to various developmental activities carried out by man, our environment is continuously being abused and getting degraded. The air we breathe, water we drink, food we eat, land we live on, all are getting spoiled day by day. The purity of our environment is of prime importance for survival of human race on the earth. Man should not go for developmental activities at the cost of environment. This subject has been introduced in the Diploma Programme to bring about awareness towards the environmental purity amongst the students.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN203	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	**100**
Environmental Studies	3	-	-	3	75	25	-	-	

Minimum passing %: Theory 40% ***Duration of Theory Paper: 3 Hrs.***

3. DETAILED COURSE CONTENT

Unit 1 Multidisciplinary Nature Of Environmental Studies.

Definition, scope and importance. Need for public awareness.

Unit 2 Natural Resources

Renewable and nonrenewable resources. Natural resources and associated problems.

- Forest resources: Use and overexploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, droughts, conflicts over water, dams- benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Case studies.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer & pesticide problems, water logging, salinity, case studies.
- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

- Land resources: Land as a source, land degradation, man induced land slides, soil erosion and desertification.

Role of an individual in conservation natural resources. Equitable use of resources for sustainable life styles.

Unit 3 Ecosystems.

Concept of an ecosystem. Structure and function of an ecosystem. Producers, Consumers and Decomposers. Energy flow in the ecosystem. Ecological succession. Food chains. Food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems: (a) Forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) Aquatic ecosystems (Ponds, streams, lakes, rivers, oceans, and estuaries).

Unit 4. Biodiversity And Its Conservation.

Introduction – Definition: genetic, species and ecosystem diversity.

Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels. India as a mega-diversity nation. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wild life, man-wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Unit 5. Environmental Pollution.

Definition. Causes, effects and control measures of: Air pollution, water pollution, soil pollution, marine pollution, noise pollution, Thermal pollution, Nuclear hazards. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of individual in prevention of pollution. Pollution case studies. Disaster management: flood, earthquakes, cyclone and landslides.

Unit 6. Social Issues And The Environment.

From unsustainable to sustainable development. Urban problems related to energy. Water conservation rainwater harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns; case studies. Environmental ethics: Issues and possible solutions. Climatic change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; case studies. Wasteland reclamation. Consumerism and waste products. Environmental protection act. Air (Prevention and control of pollution) Act. Water (Prevention and control of pollution) Act. Wildlife protection Act. Forest conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

Unit 7. Human Population And The Environment.

Population growth, variation amongst nations. Population explosion – Family welfare programme. Environment and human health. Human rights. Value education. HIV /

AIDS. Women and child welfare. Role of Information technology in environment and human health. Case studies.
Unit 8. Field Work. Visit local area to document environment assets – river / forest / grassland / hill / mountain. Visit to a local polluted site – urban / rural / industrial / agricultural. Study of common plants, insects, birds. Study of simple ecosystems – ponds, river, hill slopes, etc. (field work equal to 6 lecture hours).

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours	Marks
1)	Multidisciplinary Nature Of Environmental Studies.	01	03
2)	Natural Resources.	10	12
3)	Ecosystems.	06	08
4)	Biodiversity And Its Conservation.	06	09
5)	Environmental Pollution.	08	12
6)	Social Issues And The Environment.	07	12
7)	Human Population And The Environment.	04	09
8)	Field Work.	06	10
		48	75

5. MANDATORY ACTIVITIES

In addition to the class room instruction, visits should be arranged in any 2 of the following areas:

1. Visit to NIO or Science Centre.
2. Visit to Selaulim/ Anjunem Dam.
3. Visit to study ecosystem (Pond, Stream, River, and Forest).
4. Visit to show Hill cuttings, mining areas.
5. Visit to show Rain water harvesting project / Vermicomposting plant / Watershed management project. (Krishi Vigyan Kendra – Old Goa)
6. Visit to water treatment/ waste water treatment plant.

6. SUGGESTED VIDEOS

In addition to the class room instruction, video films on environment may be shown.

7. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication
1	Erach Bharucha	Textbook of Environmental Studies for Undergraduate courses	University Press
2	P. Meenakshi	Elements of Environmental Science and Engineering	Prentice Hall of India (PHI)
3	S. Deswal & A. Deswal	A Basic Course in Environmental Studies.	Dhanpat Rai & Co.
4	Pandya and Camy	Environmental Engineering	Tata McGraw Hill
5	Asthana D.K. and Asthana Meera	Environmental Problems and Solutions.	S. Chand & Co
6	Centre for Environmental education	Video Film	Thaltej Tekra, Ahme
7	Dr. S.K. Dhameja	Environmental Studies	

SEMESTER II

GN 101 COMMUNICATION SKILLS

1. RATIONALE

This course deals with Student's proficiency in English by developing their skills in reading, writing and speaking. They will be able to appreciate the usage of grammar. Acquiring proficiency in English is absolutely essential for effective communication while serving on the job. It also deals with applications of the concepts and principles learnt. Using visuals in written communication and body language in oral communication highly enhances the effectiveness of the communication process. These and some other important aspects are discussed in this course. The practice-feedback-practice cycle is of utmost important for developing the communication competencies/skills.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-101	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	**100**
Communication Skills		-	2	2	-	-	50	50	

Minimum passing % : Practical 40%

Legends:

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

Unit 1 - Fundamental of Communication skills

Definition, components (message, sender, receiver, transmission medium and protocol), types(verbal & no-verbal, technological & non-technological, etc), importance of communication skills, effective communication skills (phatic stage, personal stage and intimate stage), barriers in effective communications(verbal, non-verbal), barriers while speaking, other barriers (individual's viewpoints, emotional block, etc.) methods of and hint to increase communication skills, body language.

Unit 2 – Presentation Skills

Methods and styles of presentations (seminars, speeches, etc), the plan, objectives, audience, structure (sequential, hierarchical, question oriented pyramid, meaty sandwich), tips for good beginning and end, aids to presentation (visual, verbal), delivery style (eyes, voice, expression, appearances, stance, etc), techniques for a good speech (repeat, draw (signs, pictures), jokes, etc).

Unit 3 - Technical Reports, Letter Writing, CVs

Functions of Reports (information, initiate action, recommend new procedures, recording, coordinating project), techniques (basic format, steps, appendices), types of reports (emphasis on progress reports, industrial visit reports, inspection reports, accident reports, survey report, report on seminars, workshop, technical gathering, etc).

Types of letters, format function, qualities of a good letter, examples of job applications, leave applications, complaints, purchase orders, enquiries replies etc.

Brief mention of importance of etiquette in email communication, importance of careful proofing the documents sent.

Curriculum Vitae – definition, sample, tips for a good CV, covering letter

Unit 4 - Soft Skills

Importance of values, attitude and etiquettes in communication, ethics and manners, courtesy, honesty and reliability; personal integrity, flexibility – adaptability, team skills – cooperation; ability to follow regulations; willingness to be accountable; Ability to relate to co workers in a close environment, non verbal communication, leadership skills – self directed, ability to direct and guide others, self-supervising; ability to relate to co workers in a close environment; positive attitude; positive work ethic, written communication Skills- basic spelling and grammar; reading and comprehension, personal hygiene and energy, interpersonal skills – communication skills with public, fellow employees, supervisors, and customers, motivation – willingness to learn; caring about seeing the company succeed; understanding what the world is all about; commitment to continues training and learning; critical thinking skills, grooming – good personal appearance.

Unit 5 - Language Workshop

The Reading, Listening, Writing, Speaking Skills will be tested

1. **Reading Skills:**

   Articles from the newspapers, magazines, journals etc. will be given to the students to read aloud thus checking their pronunciation, clarity and their style of reading.

2. **Listening Skills:**

   Passages, Topics, Stories, Speeches of eminent people will be read or played. The students have to listen and their listening skills will be tested.

3. **Writing Skills:**

   a) Students to write on any given topic

   b) Students to compose their own stories

   c) Students will be given a particulars situation i.e. accident, college gathering etc. and asked to write a report

4. Speaking Skills:

a) Students to speak on any given topic

b) Narrate a story written by them.

Group discussions in the classroom. This could include debates, discussion on current issues, role-playing.

4. List of Experiments :

- Oral presentation about technical products for five minutes.
- Seminar Presentation/Report writing and presentation on identified topics from science and technical subjects for short duration.
- Group discussion on science and technical topics.
- Organise mock interviews.
- Organise debates.
- Extempore speech for three minutes on a topic.
- Observe a process and reproduce orally in own words for three to five minutes.
- Arrange video recording of presentations for self-feedback.

5. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Year of Publication
1	Wren and Martin	Practical English Grammar	1992
2	John Sinclair (ed.),	Collins Cobuild English Grammar	William Collins & Sons Cp., London 1990
3	Krishna & Mohan,	Effective English Communication	Tata McGraw Hill, New Delhi 2000
4	Randolf, Quirk & Sidney Greenbaum	University Grammar of English	1993
5	Tiwari, N.P. et al ,	Communication Skills for Technical Students – Book	Somaiya Publications, 1995
6	Tiwari, N.P. et al,	A Communicative Grammar of English	Somaiya Publications, 1989

GN 104 APPLIED CHEMISTRY

1. RATIONALE

Applied Chemistry is multi-disciplinary science having wide applications in all the branches of engineering and technology. In simple terms, it is the science of chemical phenomena in various engineering situations. An understanding of the basic concepts of applied chemistry is essential not only for all chemists but also for engineers. Therefore it forms an indispensable base for them. The emphasis is given more on applications of principles of chemistry to engineering situations rather than fundamental principles only. It also develops in the students the habit of scientific enquiry, ability to investigate the cause and effect relationship, ability to interpret and analyze the results under given conditions.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-104 Applied Chemistry	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	**150**
	3	-	2	5	75	25	50	-	

Minimum passing % : Theory 40%

Legends:
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

Unit 1 Atomic Structure and Chemical Bonding

Fundamental particles and their characteristics, Energy levels - definition, designation of energy levels, Bohr- Bury's laws for distribution of electrons in shells (1^{st} three laws only), concept and shape of orbitals (s and p only), Quantum numbers-designation, definition, values, Aufbau and Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, orbital electronic configuration of elements with atomic number 1 to 20, Lewis and Langmuir concept of stable configuration. Concept of electrovalent, covalent and co-ordinate bond, Formation, properties and examples of electrovalent compounds (NaCl, MgO, $CaCl_2$) covalent compounds (Cl_2, 0_2, N_2, $C0_2$)and coordinate compounds (0_3, $S0_2$).

Unit 2 Electrochemistry

Arrhenius theory of electrolytic dissociation., Degree of Ionisation- definition, factors affecting degree of ionisation , Nature of solute and solvent, concentration of solution, and temperature, Strong and weak electrolytes - definition and examples, Concept of the terms involved in electrolysis –conductor, insulator, electrolyte, non-electrolyte, electrolysis, electrodes, electrolytic cell, cathode, anode and current density, electrochemical series- concept and significance. Mechanism of electrolysis, Ionisation, primary reactions at the cathode, activity series of cations, primary reactions at the anode, activity series of anions, electrolysis of i. Fused NaCI using carbon electrodes, ii. aqueous NaCI using platinum electrodes iii. aqueous $CuS0_4$ using platinum electrodes iv. aqueous $CuS0_4$, using copper electrodes);

UNIT 3 Water and its treatment

Hard and soft water, types of hardness and its causes, disadvantages of hardness of water (i) for industrial use - dyeing, textile, sugar, paper, bakeries, (ii) in boilers for steam generation with special reference to sludge and scale formation (no chemical equations), zeolite and ion exchange process for water softening, desalination by electro dialysis and reverse osmosis, concept of pH

Unit 4 Corrosion and Its Control

Definition, Atmospheric corrosion (direct chemical corrosion) - definition, Oxidation corrosion, the nature of the oxide film, stable, unstable and volatile, mechanism of oxidation corrosion, corrosion due to other gases. Immersed corrosion (electrochemical corrosion) - definition, factors necessary for electrochemical corrosion , Galvanic cell corrosion, concentration cell corrosion- metal ion concentration and differential aeration. Mechanism of electrochemical corrosion- Hydrogen evolution mechanism, Oxygen absorption mechanism, Protection of metals from corrosion; galvanising, tinning, metal spraying , proper designing , using pure metals, using metal alloys, Cathodic protection- sacrificial anode and impressed current .Modifying the environment- De-aeration, De-activation, De-Humidification and alkaline neutralization.

Unit 5 Lubricants

Definition, functions of Lubricants, Types of Lubrication, Fluid Film, Boundary, Extreme Pressure, Classification of Lubricant - solid, semi- solid, liquid synthetic oils. Characteristics of Lubricants, Definition and Its significance -Viscosity. Viscosity Index, Flash and Fire Point, Oiliness, Pour Point, Volatility, Acidity, Emulsification and Saponification Value. Selection of Lubricants for Delicate Instruments, High Pressure and Low Speed Machines, Extreme Pressure and Low Speed Machines, Mechanisms of Lubrications.

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)

Unit No.	Name of the unit	Hours	Marks
1	Atomic Structure and Chemical bonding	10	15
2	Electrochemistry	08	13
3	Water and its treatment	09	15
4	Corrosion and its control	16	25
5	Lubricants	05	07
	Total	**48**	75

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No.	Unit No.	List of Experiments
1.		Double titration of acid and base using phenolphthalein
2.		Double titration of acid and base using methyl orange
3.		Redox titration of potassium permaganate, ferrous sulphate and oxalic acid.
4.		Determination of degree of hardness of water by EDTA method
5.		Determination chloride content of water by Mohr's method
6.		Determination of total alkalinity of water sample
7.		Titration of strong acid and strong base using pH meter
8.		Determination of conductivity of water
9.		Titration of strong acid and strong base using conductometer
10.		Corrosion susceptibility of aluminium to acid or base.

6. SUGGESTED LIST OF ACTIVITIES

S.No.	Title
1.	Quiz on Electronic configuration of atoms.
2.	Demonstration of process of electrolysis
3.	Demonstration of purification of water by domestic/economical method.
4.	Identification and application of lubricants in different equipment/glasswares used in different laboratories
5.	Visit to some metallurgical industries for demonstration of different processes of metallurgy.
6.	Preparation of chart of different alloys of steel and their uses
7.	Seminar on different aspects of fuel, properties and usages
8.	Use of pH paper for testing different samples of water, blood etc.
9.	Demonstration and use of different samples of paints, varnishes, drying oils, pigments, thinners, dryers, fillers, plasticizers and anti-skinning agents.

7. SUGGESTED LEARNING RESOURCES

Sl. No.	Author	Title	Publication and Year
1.	M.M. Uppal	A text book of Engineering Chemistry,	Khanna Publishers
2	V.P. Mehta	A textbook of Engineering Chemistry,	Jain Bros. Delhi
3	S.N. Narkhede	A Textbook of Engineering Chemistry	Nirali Prakashan
4	R.A. Banawat, S.K. Mahajan, S.K.Mehta	Textbook of Applied Chemistry	India Book House
	V.S. Godbole	Applied Chemistry	
5	R.S. Sharma	Textbook of Engineering Chemistry	Khanna Pubnlishers
	P.C. Jain and M. Jain	Engineering Chemistry	
6	J.C. Kuriacose and J. Rajaram	Chemistry in Engineering	Tata McGraw Hill Publishing Co.Ltd., New Delhi
7	Dr.S. Rabindra and Prof.B.K. Mishra	Engineering Chemistry:	Kumar and Kumar Publishers (P) Ltd., Bangalore -40
8	S.S.Kumar	A Text book of Applied Chemistry-I	Tata McGraw Hill, Delhi
9	Sharma	A Text book of Applied Chemistry -I	Technical Bureau of India, Jalandhar
10	S.S.Dhara	A Textbook of Engineering chemistry	S.Chand & Company, New Delhi
11	Dr. G.H. Hugar	Progressive Applied Chemistry – I & II	Eagle Prakashan, Jalandhar

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GN201 ENGINEERING MATHEMATICS- II

1. RATIONALE :

Mathematics is the backbone of all areas of engineering and technology and hence technician / engineers need to study relevant theories and principles of mathematics to enable them to understand and grasp the concept of advance courses of the curriculum. With above in mind, the necessary content for the engineering mathematics is derived to understand advance use of mathematics in solving engineering problems.

2. TEACHING AND EXAMINATION SCHEME :

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	
GN-201 Engineering Mathematics-II	4	2	-	6	75	25	-	-	100

Minimum passing % : Theory 40% *Duration of Theory Paper: 3 Hrs.*

Legends:
***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*
***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT :

Unit 1 Determinants Determinants of the second order and third order, solutions of equations in two or three variables using Cramer's Rule
Unit 2 Binomial Theorem - Binomial Theorem for a rational index, general term of binomial expansion, middle term (s).
Unit 3 Mensuration - Volume and surface area of - Prism, pyramid, frustrum of a sphere, frustrum of pyramid, frustrum of cone, Area and volume by Simpsons Rule
Unit 4 Matrices Definition and Notations, Elements of Matrix, Types of matrices, Special matrices - Square, Diagonal, Row, Column, Scalar Unit, Zero or null, upper and lower triangular matrices, Symmetric, Skew symmetric matrices . Addition, Subtraction and multiplication of matrices, Inverse of matrix using Adjoint method only Application of matrices in solving simultaneous equations in 2 or 3 variable.
Unit 5 Integral Calculus Definition, fundamental properties. Methods of Integration - Integration by substitution, Integration by parts, Integration by partial fractions.. Definition of Definite Integral Properties of definite integrals, Application of integration**,** area under a plane curve, volume of revolution.(simple sums only)

Unit 6 Differential Equations Definition, order and degree of a differential equation, solutions of differential equations of first order and first degree-variable separable type only. Second order differential equation of type $d^2y/dx^2 = f(x)$ only, Application of differential equation in engineering problems
Unit 7 Statistics (Mechanical and Allied Engg. Branches) . Measures of central tendency for grouped and ungrouped data - Mean, Median and Mode . Measures of dispersion for grouped and ungrouped data -range , mean deviation, standard deviation, variance and co-efficient of variation
OR
Unit 7 Complex Numbers. (Electronics engg and Allied branches) Definitions, Argand diagrams , polar form of a complex number, Addition, Subtraction, Multiplication & Division of a complex number. Exponential and circular function, De-moivres theorem, roots of a complex number- Cube roots of unity, n th roots of unity, , hyperbolic functions

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY):

Unit No.	Topic	Teaching Hours/ Semester	Marks
1.	Determinants	**5**	**7**
2.	Binomial Theorem	**7**	**10**
3.	Mensuration	**7**	**10**
4.	Matrices	**11**	**08**
5.	Integral Calculus	**17**	**20**
6.	Differential equations	**08**	**10**
7.	Statistics	**09**	**10 $**
	OR		
7	Complex Numbers	**09**	**10 #**
	Total :	**64**	**75**

$- for Mechanical and allied branches

 # - For Electronics and allied branches

5. SUGGESTED LEARNING RESOURCES :

S.No.	Author	Title of Books	Publication & Year
1.	Deshpande S.P,	Mathematics for Polytechnics	Griha Prakashan, Pune, 1996 or latest
2.	Grewa, I B.S;	Engineering Mathematics	Khanna Pub., New Delhi1995 or latest
3.	Prasad, I.B.;	Engineering Mathematics	Khanna Pub., New Delhi1997 or latest
4.	Wartiker P.N.,	Applied Mathematics	Griha Prakashan Pune, 1996 or latest

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GN 202 APPLIED PHYSICS-II

1. RATIONALE:

Physics is one of the basic building blocks for engineering sciences. Therefore, the students need to describe and explain the basic principles, laws & facts of physics. These skills will enhance their ability to apply it in solving engineering problems related to their respective branches of engineering

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-202 Applied Physics-II	**L**	**T**	**P**	**C**	TH	**TM**	TW	PR/OR	**150**
	4	-	2	6	75	25	50	-	

Minimum passing % : Theory 40% and Practical 40% *Duration of Theory Paper: 3 Hrs.*

Legends:

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENTS

Unit 1 FORCE, WORK, POWER, AND ENERGY

Definition of Force and its units. Types of Forces with example- Direct, Remote action e.g. Gravitational Force, Magnetic Force, Electric Force. Effect of Forces on body-External, Internal.

Work-definition and units, Graphical Representation of workdone, Energy definition and units.

Types of Mechanical Energies- K.E. & P.E. Law of Conservation of Energy, Total Energy, Power-definition and units, Power (Force X Velocity)

Unit 2 CURRENT ELECTRICITY

Ohms law, General equation of Ohms law, Factors affecting resistance, specific resistance and units. Effect of temperature on resistance, Law of resistance in series and parallel. Internal resistance and EMF of the cell. Potential drop along a uniform wire. Principle of potentiometer. Comparison of EMF of a given cell by single cell method. Camparision of EMF of a given cell by sum and difference method. Use of meter bridge to determine the unknown resistance.

Definition of Electric power and energy in d.c. circuit. Concept of Kilowatt hour, calculation of energy bills.

Unit 3 ELECTROMAGNETISM

Electromagnetic Induction, Faraday's Laws of Electromagnetic Induction, Lenz's Law, Self Induction & Mutual Induction.

Unit 4 LOGIC GATES

Introduction to Binary Number System, Concept of '0' and '1' in Binary System. Binary equivalent of Decimal numbers from 0 to 10

Logic Gates: 1. 'NOT' Gate , 2. 'OR' Gate 3. 'AND' Gate. NAND , NOR GATE Their Logic Representation & Truth Table

Unit 5 SOUND

Definition and examples of Free and Forced Vibrations, Resonance. Determination of velocity of sound using Resonance Tube.

Definition of Beats (No derivation), Beat frequency & application of Beats, Definition of Echo, Reverberation & Reverberation time, Sabine's Formula, Acoustical Planning of an Auditorium. Factors affecting Reverberation Time, Ultrasonic waves, Piezo Electric Effect, Applications of Ultrasonic waves.

Unit 6 CIRCULAR MOTION AND GRAVITATION

Defination of Uniform Circular Motion, Angular Displacement, Angular Velocity, Relation between Linear and Angular velocity, Defination and concept of Centripetal and Centrifugal Force.(No derivation), Expression for velocity of a vehicle moving on a curved Horizontal Road, Expression for Angle of Banking & Super Elevation of Road. Newton's Law of Gravitation, Force of Gravity. Acceleration due to Gravity, Expression for Acceleration due to gravity.

Unit 7(A) FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES (MECHANICAL AND ALLIED GROUPS)

Definition of efforts, velocity ratio, mechanical advantage & efficiency of machine and their relationship. Laws of machines, examples of simple machine, definition of ideal machine, systems of pulleys (First & Second). Determination of velocity ratio ,Mechanical Advantage & Efficiency.

OR

Unit 7 (B) RECTIFIERS (ELECTRONICS AND ALLIED GROUPS)

V-I characteristics of P-N junction. Diode as a rectifier. Half wave rectifiers, working, input and output waveforms, percentage regulation,((V NL – V FL) / V FL)x 100

Full wave rectifier with centre tap transformer, working, input and output waveforms, percentage regulation

Bridge rectifier, working, input and output waveforms, percentage regulation

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS(THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	FORCE, WORK,POWER & ENERGY	10	12
2	CURRENT ELECTRICITY	16	16
3	ELECTROMAGNETISM	6	8
4	LOGIC GATES & AWARNESS TO NANO SCIENCE	4	6
5	SOUND	8	9
6	CIRCULAR MOTION & GRAVITATION	10	12
7A	FUNDAMENTAL CONCEPTS OF SIMPLE MACHINES	10	12
	OR		
7B	RECTIFIERS	10	12
	Total	**64**	**75**

7A- for Mechanical and allied branches **7B- For Electronics and allied branches**

5. LIST OF EXPERIMENTS

1. Determination of Specific resistance of a material wire by Voltmeter and Ammeter.
2. Determination of Internal resistance of a given cell by using Potentiometer.
3. Calibration of Voltmeter by using Potentiometer.
4. Comparison of E.M.F. of two given cells by single cell method using potentiometer.
5. Determination of specific resistance by meter bridge.
6. Verify the law of resistances in series by meter bridge.
7. Verify the laws of resistances in parallel by meter bridge.
8. Determination of velocity of sound by Resonance tube.

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title	Publication and Year
1.	Halliday D and Resnickr	Physics Part-I & II	Latest
2.	Das S.K., Sisodiya M.L., Neher P.K., Kachhawa C.M.,	Physics Part-I & II for 10+2 Students	Latest
3.	B.G. Dhande	Applied physics for polytechnics	Latest
4.	Bhandarkar	Applied Physics for polytechnics	Latest
5.	Saxena HC & Singh Prabhakaer	Applied Physics Vol. I & II	Latest
6.	Rao, B.V.N.	Modern Physics	Latest
7.	R.K.Guar and S.L. Gupta.	Engineering Physics	
8.	B.L. Thereja.	Engineering Technology	
9.	Modern Publishers.	ABC of Physics	
10.	V.K Mehta	Elements of Electronic Engineering	

GN 204 ENGINEERING DRAWING

1. RATIONALE:

Drawing is a graphical language of engineering field. Engineering technician irrespective of his field of operation in an industry is expected to possess a thorough understanding of drawing, which includes clear spatial 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 on a piece of paper. Besides this he is also expected to possess a certain degree of drafting skill- depending upon his job functions-in his day-to-day activities. This course of Engineering Drawing for Diploma courses is aimed at developing basic knowledge and skills of engineering drawing and use of computer in the field of Engineering Drawing.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GN-204	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Engineering Drawing	2	-	4	6	-	-	50	50	**100**

Minimum passing % : Theory 40% and Practical 40% *Duration of Theory Paper: 3 Hrs.*

Legends:

***L**-Lecture; **T** - Tutorial; **P** - Practical; **C**- Credit; **TH**- End Semester Theory; **TM** – Test Marks:*

***PR/OR** - End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT

Unit 1 Introduction

- Importance of Engineering drawing as a means of communication.
- Introduction to drawing equipment, instruments and their uses.
- Planning of drawing sheet as per I.S. 696 - 1972.
- Indian standard practices of laying out and folding of drawing
- Different types of lines used in engineering drawing.
- Importance of scale in Engineering Drawings.
- Lettering

Unit 2 Dimensioning techniques and standard conventions

- Methods of dimensioning, Dimensioning terms and notation (use of I.S. code 696 and 2709), General rules for dimensioning, Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, counter sunk hole, screw thread, taper etc.
- Conventional representation of various materials.

Unit 3 Engineering Curves & Shapes

- Construction of an Equilateral and Isosceles triangle, Square, Rhombus, Regular pentagon & Regular hexagon given distance across the corners/ flats and given length of a side using general method of construction
- Types of Engineering curves
- Construction of Engineering curves like
  - Ellipse- by focus & directrix method and arcs of circles method
  - Parabola- by focus & directrix method and rectangular or oblong method
  - Hyperbola- by transverse axis & Focus and directrix method
  - Cycloid- by generating circle rolling on a straight line
  - Involutes of a triangle ,circle & pentagon
  - Draw normal & tangents to the above curves from given point on the curve
- Practice problems of drawing various engineering curves

Unit 4 Orthographic projection

- Definitions of various terms associated with orthographic projections.
- Planes of projections.
- Concept of Quadrants.
- First and third angle method of projection.
- Projection of points
- Projection of lines
  - (i) Parallel to both Principal planes
  - (ii) Parallel to one and Perpendicular to other Principal plane.
  - (iii) Inclined to one plane and parallel to other plane.
- Projection of Triangle, Square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.
- Introduction to the following solids
  Cylinder, cone, cube.

  Right regular solids such as

  (i) Prism: Triangular & Square
  (ii) Pyramid: Square & Pentagonal.
    - Projections of above mentioned solids when axis is inclined to one principal plane & Parallel to other principal plane.
    - Conversion of simple pictorial views into orthographic views.
    - Practice problems on projection of points, lines and planes.

• *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 projection of plane are given, true shape & slope angle are to be drawn are excluded.*
Unit 5 Section of solids • Concept of sectioning planes • Auxiliary planes and true shape of section. • Drawing projections and section of solids like square prism, square pyramid, pentagonal 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)
Unit 6 Development of lateral surfaces • Concept and importance of surface development in the engineering field. Methods of development of surfaces-Radial & Parallel line method. Development of surfaces for the following right regular solids- • Cylinder • Prism • Cone • Pyramids • Development of solids standing on its base & cut by a plane inclined to either VP/HP and perpendicular to the other is also included. • *Practice problems on above with top & bottom of the solid is excluded*
Unit 7 Isometric Views • Limitations of orthographic projections. • Procedure for preparing isometric projections. • Difference between Isometric projection & Isometric view. • Isometric view of geometrical solids and simple machine parts. • Conversion of orthographic views into isometric views. • Construction of Isometric view for any real object. Conversion of orthographic views of simple components into isometric views.

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS

Unit No.	Unit	Teaching Hours / Semester
1	Introduction	**1**
2	Dimensioning techniques & standard conventions	1
3	Engineering Curves & Shapes	4
3	Orthographic projections	**13**
4	Section of solids	3
5	Development of surfaces	4
6	Isometric projections	2
-	Revision	4
	Total	**32**

5. SUGGESTED LIST OF ACTIVITIES

Following shall be the list of sheets to be prepared as Engineering drawing lab work

Sheet No.	TITLE	Contents	Hours
1.	TYPES OF LINES, LETTERING, DIMENSIONING.	All types of lines, Single stroke vertical capital letters, Methods of Dimensioning-Aligned & unidirectional System, Conventional representation of materials.	4
2.	GEOMETRICAL CONSTRUCTIONS	Construction of Equilateral and Isosceles triangle, Square, Rhombus, Regular pentagon & hexagon	4
3.	ENGINEERING CURVES	Construction of ellipse, parabola, hyperbola by given methods. Involutes, cycloid. Draw normal and Tangent to curves.	8
4.	PROJECTION OF POINTS & LINES	Drawing projection of points in all 4 quadrants. Drawing of projections of lines in following positions (i) Parallel to both Principal planes (ii)Parallel to one and Perpendicular to other Principal plane. (iii) Inclined to one plane and parallel to other plane.	6
5	PROJECTION OF PLANES	Drawing the projection of Triangle square, Rhombus, regular Pentagon when inclined to one principal plane & perpendicular to other plane.	6
6	PROJECTIONS OF SOLIDS	Drawing projection of following solids Cylinder, cone, cube. Right regular solids such as Prism: Triangular & Square,Pyramid: Square & Pentagonal,when axis is inclined to one principal plane & parallel to other principal plane.	8
7	ORTHOGRAPHIC PROJECTIONS	Simple problems on conversion of pictorial into orthographic views.(atleast 2 problems each in 1st angle and 3rd angle)	4
8	SECTIONS OF SOLIDS	Drawing projections and section of solids like square prism, square pyramid, pentagonal 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)	8

9.	DEVELOPMENT OF LATERAL SURFACES	Draw the Development of surfaces for the following right regular solids- Cylinder, Cone, Prism & pyramids (square, triangular, pentagonal).	8
10	ISOMETRIC VIEWS	Conversion of orthographic views of simple components into isometric views.	8

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title	Publisher
1.	BIS, India	IS. 696. (Latest revision).	BIS, India
2.	N.D. Bhatt	Engineering Drawing	Charoter Publisher,Anand
3.	R. K. Dhawan	Engineering Drawing & Machine Drawing	Kumar
4.	R.B. Gupta	Engineering Drawing	Satya Prakashan, Delhi
5.	P.S. Gill	Geometrical Drawing	Ketson & Sons
6.	P.S. Gill	Machine Drawing	Ketson & Sons
8.	TTTI, Bhopal	Work Book in Mechanical Drafting	TTTI, Bhopal
9.	T. Jeyapoovan	Engineering Drawing & Graphics Using AutoCAD 2000	Vikas Publishing House Pvt. Ltd, New Delhi.
10	N.D. Bhatt	Machine Drawing	Charoter Publisher,Anand

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GN 205 ENGINEERING MATERIALS

1. RATIONALE:-

Adequate knowledge of different types of engineering materials, their properties & applications are very essential for the engineers. This course content is designed to provide basic insight knowledge regarding engineering material and their applications which will be useful for the students to learn subjects of higher semesters. The range of materials available for engineering applications is quite vast, hence only the basic groups of ferrous non-ferrous, non-ferrous & other engineering materials with their general properties and uses have been stressed upon.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
G-205	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Engineering Materials	4	-	-	4	75	25	-	-	**100**

Minimum passing % : Theory 40% *Duration of Theory Paper: 3 Hrs.*

Legends:

L*-Lecture;* ***T*** *- Tutorial;* ***P*** *- Practical;* ***C****- Credit;* ***TH****- End Semester Theory;* ***TM*** *– Test Marks:*

PR/OR *- End Semester Practical / Oral Examinations;* ***TW-*** *Term Work*

3. COURSE CONTENTS

Unit 1 Introduction to Engineering Materials

Classification of Materials

- Metal, Non-metal
- Ferrous Metal & Non-ferrous Metals.

Differences between Metals & non-metals.

Properties of Materials.

- Physical properties – Melting point, freezing point, boiling point, Density, Linear co-efficient of expansion, Thermal conductivity, Electrical resistivity.
- Mechanical properties – Strength, Elasticity, Plasticity ductility,

Malleability, Toughness, Brittleness, Hardness, fatigue, creep.

- Electrical properties – Resistivity, conductivity, Temperature coeff. of resistance, dielectric strength, Thermo electricity, super conductivity.
- Magnetic properties – permeability, coercive force, magnetic stresses.
- Chemical properties - Corrosion resistance, chemical composition, acidity, alkalinity.

Unit 2 Ferrous & Non-Ferrous Metals & its Alloys

- **Ferrous alloys.**
  - Low carbon steel, medium carbon steel, High carbon steel, their carbon percentage, properties & uses.
  - Cast iron – Grey cast iron, white cast iron, spheroidal grey cast iron, their properties & uses.
  - Alloy steels.
    - Constituents of alloy steels such as phosphorous sulphur, Silicon, Manganese and their effect on properties of materials.
    - Stainless steel, chromium – Nickel steel, Nickel-chromium-molybdenum steel, Nitriding steel, Manganese steel, its properties & uses.
  - Tool steel – composition, HSS, High carbon steel, properties & uses.
- **Non-ferrous Metals & alloys**
  - Aluminium – Properties & uses.
  - Aluminium alloys – constituents of alloy & their effect on properties of metal
  - Properties & uses of Duralumin, Y-alloy, Al-si alloy, Al-Zn-Mg alloys.
  - Copper – Properties & uses.
  - Copper alloys – Constituents of alloy & their effect on properties of metal.
  - 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.
  - Properties & uses of lead & its alloys.

Unit 3 Non – Metallic materials

- Refractory
- Desirable properties.
- Difference between acid, basic & neutral refractories.
- Properties & uses of Fire clay refractory, silica refractory.
- Plastic
- Classification table only.
- Properties & uses of Thermosetting & Thermoplastic.
- Natural & Synthetic abrasive materials.
- Introduction, Properties & uses.
- Rubber
- Properties & uses of natural, neoprene, synthetic & butyl rubber.

- Vulcanization process.
    - Glass
- Properties & uses of soda glass, Borosilicate glass, fibre glass.
- Glass wool – composition, properties & uses.

    - Introduction to composite materials.Classification diagram only.

Unit 4 **Conductor, Semi Conductor, Insulating and Magnetic Materials.**

- Classification of Materials as conductor, Semiconductor and Insulating materials.
- Conductor Materials.
    - High conductivity materials
        - Copper, Aluminium, Carbon, Silver, Lead, Brass, Bronz, Tungsten & Gold.
        - Their properties as conducting materials and applications.
    - High resistivity materials
        - hichrome, constantan, manganin
        - Their applications
- Insulating materials
    - Introduction
    - Characteristics of Good Insulating materials
    - Solid Insulating materials
        - Wood, paper, rubber, mica, glass tibre, porcelain, varnish, PVC, Resins.
    - Their characteristics as insulating materials and applications.
    - Liquid insulating materials
    - Mineral oil, its properties as insulating material and applications.
    - Gaseous insulating materials like air, Nitrogen, Sulphur hexafloride & their applications.
- Semiconductor Materials.
    - Silicon & Germanium. Their specifications as semiconductor material and uses
- Magnetic Materials.

  Classification as:
    * Dia Magnetic
    * Para Magnetic
    * Ferromagnetic
    * Non magnetic

List of these materials and their applications.

Unit 5 Construction Materials

- Building Stones : Classification of rocks, Characteristics of good building stones, common building stones & their uses.
- Cement: Chemical composition of port land cement, outline of manufacturing process, types of cements, uses.
- Bricks: Bricks – Constituents, properties, classification, special bricks – refractory and flyash bricks; uses.
- Other materials:
  - Lime – Sources. Properties, uses.
  - Clay – Different building products from clay like tiles, pipes etc.
  - Timber – Common varieties of timber, uses wood products, veneer, plywood, etc.
  - Sand – Sources: rivers, crushed aggregates, characteristics uses.

4. SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	Marks
1	Introduction to Engineering Materials	**04**	**09**
2	Ferrous & Non-Ferrous Metals & its Alloys	**16**	**18**
3	Non – Metallic materials	**12**	**12**
4	Conductor, Semi Conductor, Insulating and Magnetic Materials.	**16**	**18**
5	Construction Materials	**16**	**18**
		64	**75**

Semester - III

Course code	Name of Course	TEACHING SCHEME in hours				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
FT301	General Microbiology	2	-	3	5	75	25	25	25	150
FT302	Organic Chemistry	2	-	3	5	75	25	25	25	150
FT303	Methods of Food Preservation - I	3	-	2	5	75	25	-	25	125
FT304	Food Engineering-I	3	1		4	75	25	-	25	125
CS302	Elements of Electrical & Electronics Engg.	3	-	2	5	75	25	-	25	125
CS307	Elements of Mechanical Engg.	3	-	1	4	75	25	-	25	125
Total					28					800

FT 301 GENERAL MICROBIOLOGY								
Teaching Schedule Per Week			TM	TW	Examination Schedule (Marks)			
Lectures	Practical	Credits			Theory		Practical Examination	Total
2	3	5	25	25	3hrs	75	25	150

Rationale: Knowledge of General Microbiology is an essential prerequisite for the subject such as Food Microbiology, Quality Control Analysis, Fermentation Technology etc. The subject of General Microbiology is the study of different types of microorganisms, their classification and activities including the effects, either detrimental or beneficial caused by them in various environments. The theory as well as practical course is aimed at developing the basic knowledge and skills in microscopy, sterilisation methods, dilution techniques, use of different media as well as the study of morphological and cultural characteristics of different micro-organisms commonly encountered in Food Microbiology. These skills also form the basis for microbiological studies in different subjects and for technology subjects such as Dairy Technology, Marine Product Technology, Fruit and Vegetable Technology etc.

COURSE CONTENT	Hrs	Mks
1. HISTORY OF MICROBIOLOGY & MICRO-ORGANISMS	4	12
History of microbiology: Place of microorganisms in living world: Protists, Monera, Procaryotes, Definition of eucaryotic and procaryotic cells. Discoveries of the scientist: Antony Van Leeuwenhoek, Louis Pasteur, John Tyndell, Robert Koch, Joseph Lister, and Edward Jenner.		
Microorganism as allies and foes: Distribution of micro organism in nature. Applied areas of microbiology; Medical, Aquatic, Domestic water and sewage, Air, Milk, Food, Soil, Industrial, Insects Species, Geochemical transformation.		
2. CLASSIFICATION OF MICROORGANISMS	6	10
Differentiating characteristics of Eucaryotes and procarytoes:		
Examples of eucaryotic and procaryotic cells.		
Characteristics of individual groups: Yeast: Importance, Distinguishing characteristics, Morphological and cultural characteristics, Physiology and nutrition, Cultivation. Types of yeasts: Baker's yeast, and Brewer's yeast. Fungi: Importance of fungi, Distinguishing characteristics, Morphological and culture characteristics, Physiology and nutrition, Cultivation. Important fungi: Mucor, Rhizopus, Aspergillus, Penicillum, Trichoderma, Fusarium. Algae: Economic importance of algae, soil fertility, vitamin synthesis algae and disease. Occurrence of algae, Morphological and cultural characteristics, Algal pigments, photosynthesis, Motility, Important algae. Protozoa: Morphology; circular structure, locomotor organelles. Important Protozoa; Amoeba, Paramecium, Euglena, Plasmodium. Viruses: History – living / non-living, Characteristics – animal virus, plant virus, bacterial virus. Cultivation – isolation, chick embryo, plasma clots, tissue culture. Important viruses, Small pox, TVM Yellow fever virus.		
3. MORPHOLOGY AND CULTURAL CHARACTERISTICS	2	8
Morphology: Size, Shape, Arrangement of cell. Colonies on agar plate: Size, Shape, Margin, Elevation, Opacity, Pigmentation, and Consistency. Growth of agar slant:		

Amount of growth, Margin, Consistency, Pigmentation. Growth in Broth: Amount of growth, Distribution of growth, Odour.		
4. VEGETATIVE CELLS AND SPORES	4	8
Vegetative cell structure: Cell wall. External to cell wall: Flagella, Fimbriae, and Capsule. Internal to cell wall: Cytoplasm, Cytoplasmic membrane, Cytoplasmic inclusions, and Nuclear material. Endospore: Fine structure, Factors responsible for spore formation. Germination, Comparison of spores and vegetative cells.		
5. MICROSCOPE, METHODS OF MICROSCOPIC EXAMINATION	4	8
Microscope: Compound microscope; Construction, Working, Maintenance. Definition of: Resolving power, Numerical aperture. Principles of: Dark field microscopy, Phase contrast microscopy, Electron microscopy. Methods of microscopy: Wet mount, Hanging drop preparation, Stained smears. Staining procedures: Chemistry of dyes, Monochrome staining, Gram staining, Negative staining, Differential staining procedure: Spore staining, Acid fast staining, Capsule staining, Flagella staining.		
6. ISOLATION OF PURE CULTURE, CULTURING TECHNIQUES & MAINTENANCE	3	6
Isolation and culturing techniques: Streak plate method; Perpendicular method, Parallel method. Pour plate method, Surface plate method, Single cell isolation, Serial dilution method, Enrichment culture technique; Selective media, Differential media. Maintenance of culture: Periodic transfer, Mineral oil, Lyophilization, Storage at low temperature. Maintenance of media: Bacteria – Nutrient agar, Yeast – Wickerham's media, Fungi – Sabouraud's media.		
7. ASEPSIS AND STERILIZATION	5	10
Importance of microbial control. Definitions of: Sterilization, Disinfectant, Antiseptic, Sanitizer, Germicide, Bactericide, Bacteriostasis, Antimicrobial agents. Patterns of microbial growth. Condition influencing antimicrobial action. Control by physical agents: Temperature; High temperature, Low temperature, Moist heat, Dry Heat, Definitions of TDT, TDP, DRT. Radiation, Osmotic pressure – dessication, Filtration. Control by chemical agents: Characteristics of an ideal disinfectant, Selection of antimicrobial chemical agent, Major groups of chemical agents; Phenol and Phenolic compounds, Alcohols, Halogens, Heavy metals and their compounds, Dyes, Synthetic detergents, Acids / alkalines, Gaseous chemosterilizers.		
8. PHYSIOLOGY OF MICRO – ORGANISMS	1	4
Oxygen requirement: Obligate aerobes, Obligate anaerobes, Facultative aerobes / anaerobes, Microaerophilic. Carbon source requirement: Autotrophs, Heterotrophs. Source of energy: Chemotrophs, Phototrophs. Saprophytes. Parasites. Temperature requirement: Mesophilic, Psychrophilic, Thermophilic.		
9. GROWTH OF MICRO – ORGANISMS	3	9
Growth curve: Phase of growth, Synchronous growth, Growth rate and generation time, and cell fission. Measurement of growth: Direct methods; Cell count – counting chamber, Smear count, and Membrane filter count. Indirect methods: Turbidity, Dry weight, Total volume and Chemical methods. Dilution methods: Serial dilution method (colony count), Roller tube methods. Factors affecting growth: Temperature, pH, Nutritional requirements, and Oxygen requirement.		
TOTAL	32	75

PRACTICALS

1. Microscope: Construction, Working and Maintenance.
2. Microscopy of standard cultures for morphology: Bacillus subtilis, E. Coli, Staphylococcus aureus, Salmonella, Saccharomyces Cereviciae, Aspergillus, Penicillium, Mucor, Rhizopus.
3. Motility of Micro-organisms: Hanging drop preparation.
4. Preparation of media: Nutrient broth, Nutrient agar.
5. Isolation of pure culture from water, milk, fruit, juice, fish and meat: Streak plate methods; Pour plate method, Surface plate method.
6. Cultural characteristics of standard culture: Colonies on nutrient agar plate.
7. Staining procedure: Monochrome staining
8. Gram staining
9. Viable count of micro-organisms: Serial dilution method; Surface plate method, Pour plate method.
10. Total count of micro-organisms: Smear count.

REFERENCE BOOKS:

Fundamental of Microbiology by M. Frobisher
Microbiology by M. J. Pelczar and R. D. Reid
Microbes in action by Harry W. Seeley and Paul J. Van Demaark
Microbiological methods by C. H. Collein and P. M. Lyne
Microbiology by Salle

FT 302 ORGANIC CHEMISTRY								
Teaching Schedule Per Week			TM	TW	Examination Schedule (Marks)			
Lectures	Practical	Credits			Theory Examination		Practical Examination	Total
2	3	5	25	25	3 hrs.	75	25	150

Rationale: Knowledge of Organic Chemistry is very essential for the study of Food Chemistry, Biochemistry and Nutrition and Food Technology in the higher semesters. Various food commodities are composed of organic substances and to have proper understanding of their nature and properties as well as the changes occurring during processing, it is necessary to have adequate knowledge of the nature and properties of organic molecules. This course in Organic Chemistry covers various classes of organic compounds including their structural formulae, nomenclature, physical and chemical properties. The topics in theory are supplemented with practical work aimed at developing skills in the students for systematic analysis, which would be necessary for quality control testing in the higher semesters.

COURSE CONTENT	Hrs	Mks
1. CLASSIFICATIONS AND SYSTEMATIC NOMENCLATURE	8	23

Classification into compounds: Acyclic or open chain, Cyclic or Ring Compounds comprising of Carboxylic and Hetero-cyclic compounds.

Open Chain compounds: Classes of hydrocarbons; Definitions and general structure, saturated and unsaturated compounds with examples. Functional groups: Types of functional groups in organic compounds. Homologous series: Definition, characteristics, examples of various classes of compounds such as hydrocarbons, halogen compounds, alcohols, aldehydes, ketones, acids, esters etc.

Nomenclature: I. U. P. A. C. system of nomenclature with common name and systematic name of alkanes, alkenes, alkynes, halogen Compounds, alcohols and other classes of aliphatic compounds. I. U. P. A. C. rules of naming hydrocarbon chain compounds and functional compounds i.e. mono-functional and poly-functional.

2. ALIPHATIC COMPOUNDS	14	30

Alkanes: General formula and structure with reference to methane, types of carbon atoms in alkanes, i.e. primary, secondary, tertiary, quaternary, isomerism in alkanes taking butane as example, occurrence in nature, physical and chemical properties of alkanes taking methane as example; Halogenations, Nitration, Sulphonation, Oxidation.

Alkenes: Physical and chemical properties of alkenes taking Ethylene as example; Addition of hydrogen, halogen acid, oxygen, oxidation reaction, substitution reaction.

Alkynes: Physical and chemical properties of alkynes taking acetylene as examples: Addition of halogen, halogen acid, water, hydrogen, oxidation reaction, polymerisation reaction.

Halogen Derivatives: Examples with structure of mono, di, tri and tetra halogen derivatives.

Aliphatic Alcohol: Definition, examples with and structure of monohydric, dihydric and trihydric alcohols. Method of production of ethyl alcohol by fermentation from Molasses, Starchy materials. Other methods of production of ethyl alcohol: Hydrolysis of alkyl ethyl halides, Hydration of alkenes, Hydrolysis of esters. Types of alcohol: Primary, Secondary and Tertiary alcohols. Physical and Chemical properties of alcohols: Action of acids, Oxidation of alcohols.

Aldehydes: Structural formula and examples, oxidation and reduction reaction Aldehydes taking acetaldehyde as examples.

Ketones: Structural formula and examples of simple and mixed Ketones, oxidation and reduction reactions of Ketones, taking acetone as example. Carboxylic acids: Structural formula and examples of mono, di and tri-carboxylic acids. Physical and chemical properties of monocarboxylic acids Halogenations, Oxidation – Reduction formation of Esters, Formation of Aldehydes and Ketones. Ethers: Structural formula and examples of simple and mixed ethers. Aliphatic Amines: Structural formula and examples of primary, secondary and Aliphatic tertiary Amines. 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.		
3. AROMATIC COMPOUNDS	10	22
Meaning of the term 'Aromatic'. Sources of aromatic compounds. Benzene: Structure of benzene (Kekule's structure), Homologues (side chain derivatives) of benzene,Toluene, Halogen derivative, xylene (structure with ortho, meta, and para position). Aryl radical: Examples with structure formula of phenyl, benzyl and benzal radical. Methods of production benzene: Distillation of coal tar, polymersiation of acetylene, and distillation of sodium benzoate with soda lime. Physical and chemical properties of benzene: Reactions of benzene with hydrogen, halogen, nitration of benzene, sulphonation of benzene, Friedel crafts reaction. Physical and chemical properties of Toluene: Halogenation, nitration, sulphonation and oxidation.		
Total	32	75

PRACTICALS:

Qualitative tests for identifying carbon, nitrogen, oxygen, phosphorous, chlorine.
Identification of organic compounds: Simple qualitative tests for analysis of functional groups.

REFERENCE BOOKS:

Text Book of Organic Chemistry by B. S. Bahl.
Elementary Organic Chemistry by R. A. Kulkarni, R. V. Bhagwat, C. T. Bhastana.

FT 303METHODS OF FOOD PRESERVATION – I								
Teaching Schedule Per Week			TM	TW	Examination Schedule (Marks)			
Lectures	Practical	Credits			Theory Examination		Practical Examination	Total
3	2	5	25	25	3Hrs	75	-	125

Rationale: Food preservation is an essential subject in Food Technology, which forms the basis of all processing technologies taught in the higher semesters. This subject has been covered in two parts. In the first part, the students will be made aware of different food spoilage, spoilage agencies and spoilage processes. Subsequently they will be exposed to the different principles of preservation. Due weightage also has been given to the traditional methods of preservation, insects in stored grains, their control and improved methods of grain storage in warehouses, with reference to tropical conditions. The topics in theory are supplemented with practical work aimed at developing the skills in preserving the food by an adequate method.

COURSE CONTENT	Hrs	Mks
1. FOOD SPOILAGE	10	9
Perishability of foods and contamination. Types of spoilage- Physical – moisture absorption, desiccation, mechanical injury. Chemical spoilage- Changes in chemical composition due to oxygen, light etc. Biochemical spoilage- Due to enzymes present in food or from external agency (insect, micro-organisms). Contamination by dirt, dust, chemicals, rodents etc.		
2. TRADITIONAL METHODS OF PRESERVATION	4	6
Use of sugar, salt, drying, smoking, and curing.		
3. PRESERVATION OF LOW MOISTURE FOODS	13	20
Spoilage of food grain- physical, biological and chemical. Spoilage insects of stored grain and flour, (beetles, weevils and moths). Techniques in detecting grain infestation. Insect control methods- Traditional methods. Chemical methods – Use of insecticides and fumigants, properties, dose, method of application, toxicity. Rodent control methods- Methods of grain storage- Traditional and improved methods. Modern warehouses principles and storage.		
4. METHODS OF FOOD PRESERVATION	18	35
Cold storage – Principle, cold storage of fruits and vegetables, specific heat, heat of respiration, refrigeration requirements, refrigeration load. Modified gas storage – Principles. Freezing of foods- Principles, pre-treatments. Methods of freezing-slow v/s quick-freezing. Changes during freezing thawing, drip loss. Dehydration- Principles and pretreatment required. Sun drying and mechanical drying. Advantages and limitations of different mechanical dehydrators. Dehydration and Rehydration ratio. Case hardening and texture losses. Freeze drying – Triple point, applications. Concentration – Principle. Recent advances, osmotic dehydration, freeze concentration, microwave drying. Irradiation - Principles, advantages. Comparison with other methods of preservation. Action of irradiating rays - Direct effects and indirect effects, Irradiation sources. Units of irradiation. Electron accelerators. Attempts to limit indirect effects. Gross effect of Irradiation. Safety and wholesomeness of irradiated foods. Irradiation dose, determining factors. Dosimeters. Fermentation- Principle and definition. Additional benefits from fermentation. Controlling fermentation in various foods.		
5. PULSED ELECTRIC FIELDS, HIGH HYDROSTATIC PRESSURE PROCESSING	3	5
Principles, advantages and limitations		
Total	48	75

PRACTICALS

1) Detection of spoilage in food
2) Preparation and analysis of brine
3) Demonstration of enzymatic browning in food and its effect on product quality
4) Study of dehydration and rehydration ratio
5) Dehydration of fruit pulps
6) Potato dehydration
7) Examination of insect in stored grain
8) Detection and estimation of insect, infestation of food grain
9) Demonstration of infestation control, handling of different appliances
10) Visit to grain storage warehouse
11) Demonstration of effect of sulphuring before processing
12) Storage study of fruits and vegetables - open air, low temperature and waxing
13) Preservation of Fruits/Vegetables in brine

REFERENCE BOOKS

1. Food Science by Norman N. Potter
2. Grain Storage Part I by R.N. Sinha.
3. Handling & Storage of Food Grain in Tropical and Sub-tropical Areas by D. W. Hall
4. Fundamentals of Food Freezing by Norman W. Desrosier.
5. Food Processing Technology, Principles and Practice by P. J. Fellows

FT 304 FOOD ENGINEERING - I								
Teaching Schedule Per Week			TM	TW	Examination Schedule (Marks)			
Lectures	Practical	Credits			Theory Examination		Practical Examination	Total
3	1	4	25	25	3Hrs	75	-	125

Rationale: This part of Food Engineering course deals with unit operations involving heat transfer. Design and mathematical aspects have been minimised. On the other hand, adequate emphasis has been given to maintenance aspect and factors to be considered in choosing appropriate equipment. Unit operations such as heat transfer, dehydration, concentration, freezing, etc. have been extensively dealt with. The course is supplemented by factory visits for study on the various equipments.

COURSE CONTENTS	Hrs	Mks
1. HEAT TRANSFER	6	8
Conduction- Thermal conductivity, conduction through plane homogeneous and composite walls. Concept of thermal resistance. Conduction through a hollow cylinder. Conduction through pipes, heat transfer coefficients, overall heat transfer coefficient, empirical correlations. Heat transfer with boiling liquids. Convection- free and forced. Radiation: Stefan Boltman law, emissivity and absorptivity.		
2. HEAT EXCHANGERS	7	15
Tube and plate heat exchangers: Characteristics and uses. Relative merits and demerits. Tube heat exchangers: Counter and parallel flow, log mean temperature difference. Mechanically aided heat exchangers: Votators, film, scraped surface, etc. Heat exchangers for gases: Extended surface, radiators.		
3. PSYCHROMETRY	4	6
Principles and definitions: Humidity, dry and wet bulb temperature, relative humidity, humid heat. Humidity measurement instruments. Humidity charts. Cooling by evaporation.		
4. CONCENTRATION AND DEHYDRATION	15	24
Moisture calculations: Dry and wet basis. Drying rate behaviour: Free and bound-moisture, critical and equilibrium moisture content. Drying curves: Materials characteristics, constant and falling rate periods. Factors affecting drying rate. Types of airflow and basis of material balance in drying and concentration. Concentration and dehydration equipment. Vacuum and atmospheric concentration – production of vacuum. Evaporators: Tubular, Flash, forced circulation, etc. Multi- effect evaporators. Vacuum and atmospheric dehydration. Dryers: Batch and continuous, drum, spray, tray, fluidised bed, roller. Freez drying - Principles and equipment.		
5. REFRIGERATION PRINCIPLES	6	7
Simple vapour compression refrigeration system: Thermodynamics and system components. Effect of sub cooling liquid, super-heating suction vapour, pressure losses, etc. Unit of refrigeration. Properties of common refrigerants, comparison, classification, basis of selection. Principle of absorption refrigeration.		
6. FREEZING	7	10
Principles of freezing: rate, heat transfer, storage of frozen foods. Freezing equipment: plate, fluidised bed, blast, etc.		
7. DISTILLATION	3	5
Outlines of batch distillation, flash vaporisation, fractionation and steam distillation. Stripping of flavour / essence.		
Total	48	75

PRACTICALS

Measurement of humidity by wet and dry bulb thermometers
Study experiments of the following, with drawings on sketchbook / journal

- Heat exchanger: Tube, plate, and scraped surface.
- Refrigeration system.
- Dehydration equipment: Spray dryer, shell dryer, drum dryer.
- Evaporators: Flashed, forced circulation, tubular, long tube, short tube external heating.
- Freezers: Plate, tunnel, cryogenic.

Visit to Goa Meat Complex, Sugar Factory, Freezing Plant.

REFERENCE BOOKS

1. Food Process Engineering by D. R. Heldman AVI Publications
2. Fundamentals of Food Engineering by S. E. Charm AVI Publications
3. Elements of Food Engineering by J. C. Harper AVI Publications
4. Unit Operations in Chemistry Engineering McCabe & Smith
5. Food Process Engineering by H. A. Leniger & W. A. Beverloo, D. Reidel Publishing Co.

(CS 302) ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

1. RATIONALE:

A Mechanical Engineering Diploma holder in his job in industry has to interact with many electricalmachines and electronics based controls in operation of various machine tools and machine control systems. Therefore a basic knowledge about electrical and electronics engineering relevant to his job requirement of operation and maintenance in industry is mandatory to perform his job efficiently.

2. TEACHING AND EXAMINATION SCHEME:

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
ELEMENTS ELECTRICALAND ELECTRONICS ENGINEERING.	3	-	2	5	75	25	25	-	125

Minimum passing % : Theory 40% **Duration of Theory Paper:** 3 Hrs.

Legends:

L-Lecture; T - Tutorial; P - Practical; C- Credit; TH- End Semester Theory; TM – Test Marks:

PR/OR - End Semester Practical / Oral Examinations; TW- Term Work

3. Unit- I–AC Fundamentals (2hrs) (3marks)

Sinusoidal AC voltage waveform.

Definition of terms related to AC wave-- average value, RMS value.

Definition of power factor and its significance.

Unit- II – Distribution of Electrical Energy (9hrs) (15marks)

Voltage levels in the various stages in the flow of electrical power from 110KV substation to 11KV/440V distribution transformer(using single line diagram only).

Method of laying underground cables for distribution of power.

Voltage levels for commercial and domestic use.

Conduit wiring system- surface and concealed, its advantages and disadvantages.

Definition of Earthing, its necessity .

Types of Earth electrodes—Pipe and Plate electrode.

Methods of reducing earth resistance.

Unit- III – Cables , Switching and Protective Devices (8hrs) (15marks)

Construction of three phase PVC insulated power cables.

Specifications of PVC cables.

Colour codes of single phase and three phase PVC cables.

Functions and symbols of Switch-Fuse Unit, Fuse-switch Unit, Contactors, MCB, MCCB and ELCB.

Fuses- Construction and Applications of Rewirable fuses and HRC fuses.

Construction and operation of a simple electromagnetic relay and limit switches.

Unit- IV – Transformers (4hrs) (06marks)

Principle of operation and basic construction of a single phase transformer (core and winding only).

EMF equation(no derivation and no numericals).

Losses in a transformer, efficiency and voltage regulation(no derivation and nonumericals).

Significance of KVA Rating of transformer.

Unit- V – DC Motors (6hrs) (09 marks)

Working principle of DC motors, main parts of DC motor and their functions,.

Classification of DC motors (shunt, series and compound and their applications).

Necessity of a starter for DC motors (No study of starters).

Methods of reversal of direction of rotation of DC shunt and series motor.

Unit- VI – AC Machines (6hrs) (09marks)

Principle of operation of three phase induction motor.

Main parts of three phasesquirrel cage & Slip Ring Induction motors.

Applications of induction motors.

Necessity of starter, Names of starters used, reversal of direction of rotation.

Working principle of an alternator.

Unit- VII – Basic Electronic Devices (9hrs) (12marks)

Semiconductor theory-Construction of Intrinsic and extrinsic semiconductor, P and N type semi conductors, working principle of Diode, diode V-I characteristics, Full wave centre-tap and bridge rectifiers- circuit diagram,operation and waveforms, capacitor filter to reduce ripple voltage.

Transistor -NPN and PNP, construction , symbol and operation. Transistor CE Amplifier-circuit diagram and operation using waveforms only. Applications of transistors (naming only)

Unit- VIII – Digital Logic Gates (5hrs) (06marks)

Binary number system, Symbols and Truth Tables of AND, OR,NOT,NAND,NOR,X-OR,X-NOR Gates

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (THEORY)

Unit No.	Unit	Teaching Hours / Semester	Marks
1	AC Fundamentals	2	03
2	Distribution of Electrical Energy	9	15
3	Cables,Switching and Protective Devices	8	15
4	Transformers	4	06
5	DC Motors	6	09
6	AC Machines	6	09
7	Basic Electronic Devices	8	12
8	Digital Logic Gates	5	06

5. SUGGESTED LIST OF EXPERIMENTS

(Any 8-10)

Sr. No.	LIST OF EXPERIMENTS
1	Identification of various components of a Diesel-Engine Generator set and study its operation.
2	Connection of a single phase Transformer and measurement of Input and Output voltages, currents and power for different loads.
3	Simulation of fuse failure on any one primary phase of a 3-phase transformer and study its effect on the secondary voltages.

3	Connection, Starting, speed controland reversal of direction of rotation of DC shunt motor
4	Connection and Starting of three phase induction motor using manual and automatic star delta starter
5	Connection, starting, running and speed control of Slip Ring induction motor
6	Calculations for selection of PVC cables for different currents.
7	Identification of Fuses ,MCBs and ELCBs and study of operation of MCB and ELCB for different simulated faults.
8	Circuit assembly, measurement of input and output voltages and fault simulation and trouble shooting of Bridge and Centre-tap Rectifiers
9	Circuit assembly for ON/OFF control of single phase loads such as lamps, home appliances,etc. using transistorized circuit and a Relay.
10	Verification of truth tables of Logic Gates

6. SUGGESTED LEARNING RESOURCES

Sr.No.	Author	Title	Publication and Year
1	B.L. Thereja.	Text book of Electrical Technology	Latest
2	V.K. Mehta	Principles of Electronics Engineering	Latest

CS307 ELEMENTS OF MECHANICAL ENGINEERING

1. RATIONALE:-

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 & machines from operational and safety point of view. Hence this subject is being introduced in the curricula as an interdisciplinary subject to provide basic knowledge of mechanical engineering to the students of other engineering disciplines.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	**Periods/ Week (In Hours)**			**Total Credits**	**Examination Scheme**				
					Theory Marks		**Practical Marks**		**Total Marks**
CS307 Elements of Mechanical Engineering	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	**125**
	3		**1**	**4**	**75**	**25**	**25**	**-**	

Minimum passing % : Theory 40% *Duration of Theory Paper: 3 Hrs.*

Legends:

L*-Lecture;* ***T*** *- Tutorial;* ***P*** *- Practical;* ***C****- Credit;* ***TH****- End Semester Theory;* ***TM*** *– Test Marks:*

PR/OR *- End Semester Practical / Oral Examinations;* ***TW-*** *Term Work*

3. DETAILED COURSE CONTENT

Unit 1 Mechanical Power Transmission (*No mathematical treatment)*

Introduction. Belt drives – classification & applications, technical specifications (power & cross sectional area). Chain drives – Types of chains and their applications. Gear drives – classification and applications, gear trains (simple & compound only) and their speed ratio. Couplings – rigid coupling (marine type only), flexible coupling (bush pin type only), fluid coupling. Bearings – Definition & function of bearings, rolling and sliding contact bearings (their functions and applications), bearing specification (4 digit bearing number).

Unit 2 Internal Combustion (I.C.) Engines (*No mathematical treatment)*

Introduction, classification & basic engine components. Construction and working of 4 stroke and 2 stroke engines (petrol & diesel). Difference between petrol and diesel engines. Difference between 2stroke and 4 stroke engines. Technical specification of I.C. engines – Stroke volume, speed (rpm) & torque, power. Criteria for selection of I.C. Engines.

Unit 3 Thermal Engineering

Introduction. Basic components of a thermal power station and their function

(Condenser, Turbine, Boiler).

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- Safety valve, water level indicator, Economiser and superheater. Awareness to Indian Boiler Regulations i.e. IBR (Brief introduction only).

Unit 4 Refrigeration & Air conditioning (*No mathematical treatment)*

Introduction. unit of refrigeration (Ton), Working and operation of simple vapour compression system (p-h & t-s diagrams to be excluded).

Air Conditioning- definition, working of Window and split Air conditioner, procedural steps in installation of Air conditioner.

Unit 5 Pumps (*No mathematical treatment)*

Introduction, working principle, classification. Centrifugal and reciprocating pump - construction & working. Common faults in working of pump and troubleshooting. Technical specifications - power, discharge, head.

Unit 6 Maintenance Engineering (*No mathematical treatment)*

Definition, types -preventive, breakdown and predictive maintenance. Necessity of lubrication. Common types of lubricants. Methods of lubrication – wick/drip type, grease gun, grease cup. Importance of lubrication schedule. Maintenance tools and their functions (no construction & working) – bearing puller, spanners (open end & ring type), screw jack, gauges, screw driver, torque wrench, allen key, chain pulley block, tripod.

Note to paper setters:-
Internal details of subcomponents of the following should not be asked-
i) I. C. Engine systems.
ii) Pumps.
iii) Turbines and condensers

4. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS (Theory)

Unit No	Name of the Unit	Hours	Marks
1	**Mechanical Power Transmission**	8	15
2	**Internal Combustion (I.C.) Engines**	12	18
3	**Thermal Engineering**	8	12
4	**Refrigeration & Air Conditioning**	8	12
5	**Pumps**	06	09
6	**Maintenance Engineering**	06	09
	TOTAL	**48**	**75**

5. SUGGESTED LIST OF EXPERIMENTS

Sr. No	UNIT No.	LIST OF EXPERIMENTS
1	1	Study of different types of gears.
2	1	Removal and mounting of belt. Checking tension in the belt.
3	1	Demonstration of mounting and removal of ball/roller bearing.
4	2	Study of petrol/diesel engine construction.
5	2	Study of petrol/diesel engine working.
6	3	Study of water tube and fire tube boiler (Babcock & Wilcox and Cochran).
7	4	Study of any one refrigeration Air conditioning equipment working on simple vapour compression system.
8	5	Study of centrifugal and reciprocating pumps.
9	6	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. **OR** Field visit to maintenance work shop and detailed report on maintenance to be presented by students.

6. SUGGESTED LEARNING RESOURCES

Sr. No.	AUTHOR	TITLE	PUBLICATION & YEAR
1	R.K. Rajput	Elements of mechanical engineering	Laxmi pub.
2	A.A. Karad & K.B. Kale	Elements of mechanical engineering	Technical Pub., Pune.
3	R.K. Rajput	A text book of Hydraulic Machines	S. Chand
4	K.R. Gopalkrishna	A text book of elements of Mechanical Engineering.	Subhash pub., Bangalore
5	S.N. Bhattacharya	Installation, Servicing & Maintenance	S. Chand
6	H.P. Garg	Industrial Maintenance	S. Chand
7	V. K. Manglik	Elements of Mechanical Engineering	PHI

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Semester - IV

Course code	Name of Course	TEACHING SCHEME in hours				EXAMINATION SCHEME				Total marks
		L	T	P	C	Theory Marks		Practical Marks		
						TH	TM	PR/OR	TW	
FT401	Food Chemistry	2	-	4	6	75	25	25	25	150
FT402	Food Engineering-II	3	1	-	4	75	25		25	125
FT403	Food Microbiology	2	-	4	6	75	25	25	25	150
FT404	Methods of food Preservation-II	3	-	2	5	75	25	-	25	125
FT405	Technology of food Products	3	-	2	5	75	25	-	25	125
FT406	Industrial Water and waste treatment	2	-	2	4	75	25	-	25	125
Total		**15**	1	**14**	**30**	**450**	**150**	**50**	**150**	**800**

(FT401) FOOD CHEMISTRY								
Teaching Schedule Per Week			TM	TW	Examination Schedule (Marks)			
Lectures	Practical	Credits			Theory		Practical Ex.	Total
2	4	6	25	25	3Hrs	75	25	150

Rationale: 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.

COURSE CONTENT	Hrs	Mks
1. INTRODUCTION	1	-
Significance of food chemistry in food processing and preservation.		
2. PROXIMATE COMPOSITION OF FOOD	1	3
Definition. Examples of proximate composition of various food commodities.		
3. CARBOHYDRATES	10	20
Definition, occurrence, classification. Monosaccharides: Definition, important naturally occurring monosaccharides (pentoses and hexoses), structure (open chain and cyclic) of glucose, fructose, mannose and galactose with D and L configuration, structure of xylose, arabinose and ribose. Properties of monosaccharides: 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. Degree of sweetness of various sugars. Oligosaccharides: Definition. Disaccharides: Definition. Sucrose, lactose, maltose and occurrence, structure and properties. Polysaccharides: Definition. Starch: Occurrence, structure and properties (gelatinisation, retro gradation, physical properties), comparison of properties of amylose and amylopectin starch giving sources of both. 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. Cellulose: Occurrence, structure and properties. Non-enzymatic browning. Maillard reaction, Ascorbic acid oxidation and caramelisation of sugars in alkaline solution. Conditions favouring the above three types of reactions and end products formed.		

4. PROTEIN	9	20
Definition; Amino acid: Definition. Classification of amino acid: Essential and non- essential, based on chemical nature. Structure of protein molecular weight, amino acid composition, peptide bond conformation. Classification of proteins (simple protein, conjugated protein and derived protein). Properties: Colloidal nature, amphoterism, solubility, hydrolysis, colour reactions, oxidation-reduction, hydration, sensory characteristics. Protein denaturation. Outline of mechanism. Factors affecting protein denaturation.		
5. OILS AND FATS	6	20
Definition of lipids, types of lipids (simple lipids, compound lipids and derived lipids) with example. Definition of oils and fats, occurrence. Composition of oils and fats. Structure of triglyceride. Fatty acids. Definition of saturated and unsaturated fatty acids. Composition of edible oils - saturated and unsaturated fatty acid contents. Physical properties of oils and fats. Hydrolysis of oils and fats: Outline of mechanism and product formed. Oxidation of oils and fats: Outline of mechanism and product formed. Flavour reversion in oil. Phospholipids. Definition, occurrence. Structure of lecithin, cephalin. Uses of phospholipids in food.		
6. PIGMENTS AND FLAVOUR COMPOUNDS	5	12
Pigments and flavour compounds. Chlorophyll, Carotenoids, Anthocyanin and Myoglobin: Chemical characteristics and stability to processing conditions. Essential oils and tannins: Chemical characteristics with examples of each in food commodities e.g. Peel oil of citrus, mint oil, geranium oil, tea, etc.		
Total	32	75

NOTE: Chemical structures in topic (6) is not included for examination purpose.

PRACTICALS

1) Use of monopan balance, pH meter and analytical balance.
2) Determination of moisture in food sample by oven drying method.
3) Determination of ash in food sample: Total ash. Acid soluble ash. Acid insoluble ash. Alkalinity of ash.
4) Preparation of standard solution. Preparation and standardisation of alkali solution. Preparation and standardisation of acid solution. Preparation and standardisation of sodium thiosulphate solution
5) Determination of acidity and pH of food sample. Liquid food. Solid food. Fresh fruit.
6) Determination of salt content in food sample.
7) Qualitative tests for identification of various sugars.
8) Determination of sugar content in food sample by Lane-Eynon method.
9) Qualitative tests for identification of various proteins.
10) Estimation of crude protein in food sample by Kjeldahl method.

11) Determination of specific gravity of oil sample.
12) Determination of saponification value of oils and fats.
13) Determination of peroxide value of oil.
14) Determination of acid value and free fatty acid content of oils and fats.
15) Determination of iodine value of fats and oils.

REFERENCE BOOKS

1. Food Chemistry by Aurand Woods
2. Food Chemistry by L. H. Meyer
3 Food Chemistry by Deman
4. Laboratory Manual in Food Chemistry by Aurand Woods
5. Analysis of Fruit and Vegetable Products by Dr. S. Ranganna

(FT402) FOOD ENGINEERING-II								
Teaching Schedule Per Week			TM	TW	Examination Schedule (Marks)			
Lectures	Tutorial	Credits			Theory Examination		Practical Examination	Total
3	1	4	50	25	3 Hrs	75	-	125

Rationale: A technician on a shop floor is expected to supervise the normal processing operations to carry out or supervise routine maintenance work. Therefore, an understanding of unit operations in engineering and of the machinery involved therein is essential. This course in Food Engineering includes all unit operations, which don't involve direct heat transfer such as mixing, size reduction, separation, material handling etc. The course aims at giving sufficient knowledge and skills for understanding the engineering aspects of various fields of food processing. The practical work supplements the theoretical knowledge of the students and develops skills to cope with daily production/maintenance requirements and select suitable equipment/machinery for processing.

COURSE CONTENT	Hrs	Mks
1. TRANSPORTATION OF SOLIDS, LIQUIDS & GASES	10	15
Solid: Conveyors (apron, screw, open link, belt, pneumatic) and elevators. Fluids: Flow of fluids, Bernoulli's equation manometer, Venturimeter, pressure gauge. Pumps: Construction and applications. Gases: Blowers, compressors, chimneys and vacuum producing devices, metering and filling devices.		
2. MECHANICAL SEPARATIONS	20	22
Sorting and grading: Types of graders, screening and screen analysis. Floating and sedimentation. Filtration: Types (batch and continuous) equipment (plate and frame, leaf, rotary) filter aids and filter media. Centrifugation: Principles and basis of design of equipment (basket, bowl, tubular, etc.). Crystallisation: Equipment in food processes. Expression: Equipment, solvent extraction, osmosis, reverse osmosis, membrane separation – Osmosis, reverse-osmosis and ultra filtration.		
3. MIXING AND BLENDING	9	15
Different types of mixers for liquids, pastes, dry powders and specific food operations such as kneaders, conchers, beaters, etc. Emulsions: Theory and equipment, homogenisation.		
4. SIZE REDUCTION	6	15
Methods of sieving and size reduction, equipment (grinding, pulverising, pulping, juicing, mincing, etc)		
5. PACKAGING MACHINES	3	8
Principles of filling of solids on weight and volume basis, filling of liquids.		
Total	48	75

PRACTICALS

Study experiments of the following, with appropriate factory visits:

Conveyors and elevators, Measurements and control devices for fluid flow, pumps, vacuum producing devices, filtration and centrifugation equipment, size reduction equipment, mixing equipment, emulsifying and homogenising equipment.

REFERENCE BOOKS

1. Unit Operations in Chemical Engineering by Maccabe Smith
2. Food Engineering by S. E. Charm
3. Introduction to Chemical Engineering by Badger and Banchero

(FT403) FOOD MICROBIOLOGY								
Teaching Schedule Per Week			TM	TW	Examination Schedule (Marks)			
Lectures	Practical	Credits			Theory Examination		Practical Examination	Total
2	4	6	25	25	3Hrs	75	25	150

Rationale: A technician in the food industry is involved in processing, preserving and storing foods in a wholesome manner. Adequate knowledge of the microorganisms commonly found in foods and their effect on them is therefore essential. This course is designed to give the student sufficient knowledge of food groups in general of common food microorganisms, their role in processing and spoilage, toxin formation and infection. Special attention has been given to the importance of microbiological standards and adequate laboratory techniques used in detection/enumeration and identification of organism from various food groups.

COURSE CONTENT	Hrs	Mks
1. MICRO–ORGANISM IN FOOD	8	10
Classification as spoilage, pathogenic beneficial and inert organisms. Factors affecting microbial growth in foods: Moisture, temperature, pH, oxidation reduction potential, type of food and presence of inhibitory substances. Groups and genera of bacteria playing significant role in foods, proteolytic, saccharolytic, lipolytic, pectolytic, halophilic, thermophilic and psychrophilic.		
2. ROLE OF MICRO–ORGANISMS IN FOOD	6	10
Spoilage of various foods: Causes, sources and effect of spoilage. Action on carbo-hydrates, nitrogenous compounds and lipids. Production of toxins and infections. Processing of foods: Standard organisms involved and the biochemical changes brought about during processing of bread, idli, pickles, curds, cheese, butter, wine, beer and vinegar.		
3. FOOD POISONING AND PREVENTION	4	10
Types of food poisonings – Chemical, biological, bacterial and fungal. Bacterial toxins of Clostridium botulinum, Clostridium perferingens: Characteristics of the toxin, symptoms caused and preventive measures. Mycotoxins, different fungi producing toxins, characteristics of aflatoxin, symptoms caused and preventive measures. Prevention of food poisoning: Pest control, waste disposal and hygienic condition.		
4. FOOD BORNE INFECTIONS	2	10
Micro-organisms causing infections: Salmonella, Shigella, E. Coli, Streptococci, Vibrio, Bacillus, Proteus, Klebsello and Mycobacterium. Diseases caused, their symptoms and preventive measures: Dysentery, typhoid, cholera, tuberculosis, brucellosis and parasitic worms.		
5. MICROBIOLOGICAL DETERIORATION OF SPECIFIC FOODS	8	20
Natural flora, sources of contamination, types of spoilage, principles of		

preservation methods used, quality standards required and various specific tests for following foods: Cereal and cereal products, sugar and sugar products, fruits and vegetables, meat and meat product, fish and fish products, poultry and eggs, milk and milk products, miscellaneous foods – oils, spices, condiments etc.		
6. MICROBIOLOGICAL AND BIOCHEMICAL TESTS	4	15
Principles and procedures of standard laboratory tests used for detection /estimation of microbial flora in various foods. Sampling methods, total plate count, selective media, direct microscopic counts. Test for pathogens: Salmonella, Staphylococcus and biochemical tests for identification of bacteria.		
Total	32	75

PRACTICALS

1) Total plate count of the given samples- Raw and pasteurised milk, Spices/Meat/Fish
2) Total yeast and mould count for tomato ketchup / squash / fruit juice.
3) Preparation and use of selective media. Detection of coliforms in milk samples.
4) Direct microscopic counts of yeast by- Simple staining methods- Differential staining for living and dead cells.
5) Isolation and identification of bacterial cultures (standard cultures available in the laboratory)
   Gram positive Bacillus, Staphylococcus, Streptococcus and Micrococcus
   Gram negative E. Coli, Salmonella, Pseudomonas and Serratia.
6) Test for phosphatase in pasteurised and unpasteurised milk.
7) Methylene blue reduction test and Resazurin reduction test of milk samples.
8) Examination of canned foods- External examination, total plate count, identification of the contaminant.
9) Sampling methods for microbial analysis handling of samples- Meat- TPC, Fish-TPC.

REFERENCE BOOKS

1. Food Microbiology by W. C. Frazier
2. Microbiological Methods by C. H. Collins & P.M. Lyne.
3. Food Microbiology by James Jay
4. Medical Microbiology by Cruickshank
5. Society of American bacteriologist Manual of Microbiological Methods by Harrigan and Mc Canee.

(FT404) METHODS OF FOOD PRESERVATION- II								
Teaching Schedule Per Week			TM	TW	Examination Schedule (Marks)			
Lectures	Practical	Credits			Theory Examination		Practical Examination	Total
3	2	5	25	25	75	3 Hrs	-	125

Rationale: This is the continuation of Methods of Food Preservation- I. In this subject more emphasis is given on chemical additives, packaging and canning. Chemical additives play an important role in nation's economy of food. In processing and preservation of food their use is indispensable in maintaining nutritional quality, in retarding the rate of deterioration, in improving aesthetic appeal and convenience of food processing. Packaging plays an important role in finished product and increasing the marketability. The topics covered in theory are supplemented with practical to provide appropriate skills.

COURSE CONTENT	Hrs	Mks
1. METHOD OF FOOD PRESERVATION	18	25
Preservation by heat. Principles of preservation by heat, blanching, sterilisation, pasteurisation, Preservation by canning- Canning principle, classification of foods for processing, Types of can and can terminology, Lacquered cans. Outline of manufacture of can from tin plate, Electrolytic and Hot Dip Tinning Method for tin plate manufacture. Canning operation and equipment. Procedures and equipment involved in- Filling, Exhausting, Seaming, Retorting, Cooling. Common problems in above equipment- Causes and remedial action to be taken, Examination of can - cut out report.		
2. PRESERVATION BY CHEMICALS	15	30
Chemical preservatives- Antioxidants, chemistry, application, mode of action, limits. Antibiotics, mold inhibitors – Chemistry, application, mode of action, limits. Food additives – Outline of mode of action, application and limits in the following additives- Colours, flavours, acidulants, bases and buffers, sweeteners, nutritive additives, flour and bread additives, emulsifiers and thickeners, Anti-caking agents, Humectants, Enzymes, Firming agents.		
3. PACKAGING	15	20
Packaging of food – Functions of packaging, primary elements of package form, material and decoration. Various package forms – Pouches, tubes. Package materials: Aluminium, glass, tinned steel plate, carton board paper, flexible films, laminates. Properties of above and their advantages and limitations. Suitable printing methods in brief. Shipping containers – Secondary containers, wooden boxes, crates, baskets, etc. Testing of packaging material.		
Recent Advances in packaging technology in brief		

Total	48	75

PRACTICALS

1) Examination of tin plate
2) Can seam examination
3) Cut out report for typical product such as: Fruit in syrups, vegetables in brine, puree / paste
4) Identification of plastic films
5) Estimation of shelf life of packaged food
6) Demonstration on efficiency of antioxidants in storage of fatty food
7) Demonstration on addition of emulsifiers and stabilisers in squash / juice
8) Demonstration on effect of adding thickening agents in products like ketchup, sauce, etc.
9) Addition of anti-caking agents in dehydrated powdered foods
10) Addition of humectant in coconut shreds.

REFERENCE BOOKS

1. Food Science by Potter
2. Storage, Processing and Nutritional Quality of Fruits and Vegetables by D.K. Salunkhe
3. Food Packaging by Stanley Sacharow
4. Fundamentals of Food Processing Operations by J. L. Heid
5. Fundamentals of Food Packing by F. A. Payne
6. Food Processing Technology: Principles and Practice P. J. Fellows

(FT405) TECHNOLOGY OF FOOD PRODUCTS - I								
Teaching Schedule Per Week			TM	TW	Examination Schedule (Marks)			
Lectures	Practical	Credits			Theory Examination		Practical Examination	Total
3	2	5	25	25	3Hrs	75	-	125

Rationale: This subject covers the technology of varied processed foods of special interest in the food industry i.e. soft drinks, confectionery, starch, sugar, spices, oilseeds, tea and coffee. Adequate knowledge in processing and necessary care in developing the laboratory skills, have been incorporated so as to enable the technician to start a small scale industry or work as a supervisor in a larger unit.

COURSE CONTENT	Hrs	Mks
1. SOFT DRINKS	14	20
Carbonated Beverages: Classification and food value. Common varieties, composition. Ingredients- Sugar, acid, colour, preservatives, extract, flavour, carbon-dioxide. Water requirements- Typical water treatment plant, containers and closures. Manufacture of carbonated beverages: Methods of syrup making and dilution. Acidulation and flavour addition. Premix and post-mix: Their relative advantages, mixing, carbonation, bottle washing, bottle filling, testing. Ready-to-serve beverages (fruit based), types and manufacture.		
2. CONFECTIONERY	9	15
Chocolate and cocoa products: Outline of cocoa manufacture from cocoa beans- Cleaning, roasting, winnowing, grinding, dutching and pressing. Chocolate manufacture- Mixing, refining, conching, moulding and packaging. Cocoa beverages and basic composition. Sugar confectionery: Hard boiled sweets, toffee and caramels, chewing gum.		
3. STARCH	5	7
Manufacture of starch from maize and tapioca. Quality evolution of starch. Uses in food products – Modified starches and their uses. Brief outline of corn syrup and caramel manufacture and their uses.		
4. TEA	4	6
Types and characteristics. Processing of tea: Withering, rolling, fermentation and firing. Packaging of tea.		
5. COFFEE	4	6
Common varieties and characteristics. Processing, roasting, commercial blends, packaging. Manufacture of instant coffee.		
6. SPICES	4	6
Major varieties produced in India, their composition, active principles and oil content. Size reduction: Method and equipment. Oleoresins and extract: Outline of manufacture. Packaging and storing.		

7. OILSEEDS	5	10
Major oilseeds and their composition. Oil extraction- Mechanical and solvent. Outline of processed coconut products: Desiccated coconut, coconut milk and cream. processing of cashew-nut.		
8. PULSES	3	5
Commonly cultivated pulses in the country. Process of milling of pulses. Uses of pulses in protein enriched foods and traditional snack-foods such as sev, chakli, etc.		
Total	48	75

PRACTICALS

1) Syrup making (Pearson method) and dilution, use of hydrometer and Refractometers.
2) Preparation of ready- to- serve beverage (fruit based)
3) Preparation of carbonated beverage
4) Preparation of hard- boiled sweets
5) Preparation of toffee
6) Preparation of starch
7) Preparation of golden syrup
8) Preparation of pulse based Indian sweets
9) Preparation of desiccated coconut, coconut milk / cream and study of their shelf-life

REFERENCES

1. Foods Facts and Principles by Shakuntala Maney
2. Production and Packaging of Non Carbonated Fruit Juices and Fruit Beverages by D Hickes
3. Chocolate and Confectionery by Minnifie
4. Handbook of Confectionery and formulations by EIRI
5. Spices, Condiments and Seasonings by Kenneth T. Farrel
6. Handbook of Spices Packaging with Formulas EIRI
7. Encyclopaedia of Food Technology

(FT406) INDUSTRIAL WATER & WASTE TREATMENT								
Teaching Schedule Per Week			TM	TW	Examination Schedule (Marks)			
Lectures	Practical	Credits			Theory Examination		Practical Examination	Total
2	2	4	25	25	3 Hrs	75	-	125

Rationale: Water is widely used in food industries as ingredients in processing and for cleaning purposes. It may therefore become one of the source contaminants in the food products. Treatment of raw and wastewater is therefore essential and technician should know various quality evaluation techniques and treatment methods for raw and wastewater. The course includes chemical and microbiological evaluation techniques, treatment methods and standards required for potable water and water used in food industries and wastewater.

COURSE CONTENTS	Hrs	Mks
1. WATER Introduction- Sources, common impurities, contaminants in water; Examination of water: Physical- Colour, odour, turbidity, pH. methods of estimation. Chemical -Total solids, alkalinity, acidity, hardness, chlorides, sulphates, nitrogen, carbonates, bicarbonates, calcium, iodine, fluorine, iron and magnesium; Microbiological sources of contamination- index organisms and their significance, routine bacteriological analysis of water.	12	28
2. MUNICIPAL AND INDUSTRIAL WATER Uses of water for municipal and industrial purposes; Quality requirements for potability, general purification methods; Filter plants and types of filters, maintenance, disinfection methods, significance of chlorine demand, residual chlorine and break point chlorination; General purification; Methods used in industries. Methods used for water softening, specific treatment methods for water used in soft drinks, dairy and canning industries; Typical treatment methods for municipal water.	10	24
3. WASTE TREATMENT Industrial and municipal waste water - characteristics, pollution hazards on disposal without treatment, treatment methods for municipal water; Analysis of treated and untreated water sample for - Dissolved oxygen, BOD, COD, Coliform and TPC; Characteristics of water in dairy, fruit, vegetable, brewery, meat and fish processing Industries.	10	23
Total	32	75

PRACTICALS

1) Estimation of total solids in water.
2) Determination of acidity of water.
3) Determination of alkalinity of water.
4) Determination of total hardness of water.
5) Estimation of temporary and permanent hardness.
6) Estimation of residual chlorine in water.
7) Estimation of chlorides in water
8) Determination of Total Plate Count in water
9) Determination of coliform count by M. P. N. method
10) Presumptive test for coliform in water
11) Chemical Oxygen Demand of effluent
12) Biological Oxygen Demand of effluent
13) Visit to Water and Effluent treatment plant
14) Visit to sewage treatment plant

REFERENCE BOOKS

1. Handbook of Analysis and Quality Control for Fruit and Vegetable Products by S. Ranganna
2. Fundamentals of Microbiology by M. Frobisher
3. Standard Methods of Chemical Analysis by N.H. Furman.
4. ISI standards I. S 2488 (part III) – 1968 and I. S. 1622 – 1964.
5. Official Method of Analysis of the Association of Official Analytical Chemistry.
6. Encyclopaedia of Food Technology by AVI Publication
7. Water and Waste Water Treatment by Schroeder.

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/ OR	
FT501	Elementary Food Analysis	2	-	4	6	75	25	25	25	150
FT502	Fruits & Vegetables Technology	4	-	4	8	75	25	25	-	125
CS601	Industrial Organisation and Management	3	-	-	3	75	25	-	-	100
FT503	Biochemistry & Nutrition	2	-	2	4	75	25	25	25	150
E1	Elective I	3	-	2	5	75	25	25	-	125
CS501	Entrepreneurship Development	-	-	2	2	-	-	50	-	50
IT502	FoodTechnology Training I*	-	-	-	-	-	-	35	15	Grade
TOTAL		**14**	**-**	**14**	**28**	**375**	**125**	**150**	**50**	**700**

Elective I
FT511 Animal products Technology
FT512Marine Product Technology
*Industrial Training – I Four weeks Industrial training after fourth semester

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/OR	
FT601	Food Safety and Standards	2	-	4	6	75	25	25	25	150
FT602	Food Technology Project	-	-	4	4	-	-	50	50	100
FT603	Technology of Food Products - II	2	-	2	4	75	25	25	-	125
FT604	Cereal Technology	3	-	2	5	75	25	25	-	125
FT605	Dairy Technology	3	-	2	5	75	25	25	-	125
E2	Elective - II	3	-	2	5	75	25	25	-	125
TOTAL		**13**	**-**	**16**	**29**	**375**	**125**	**175**	**75**	**750**

Elective II -
FT611Soft Drink and Packaging Technology
FT612 Fermentation Technology
FT613 Food Processing Applications

SEMESTER V

(FT501) ELEMENTARY FOOD ANALYSIS

1. **Rationale:** The technologist in a food industry is expected to supervise production or implement quality control procedures or take up both these functions. Analysis of raw material, intermediate product, food additives, packaging material and final product is one of the most important tasks of meaningful quality control. With this in view, the course in food analysis has been devised to cover the basic principles of important analytical techniques used In food industries along with extensive practical work to develop necessary skills and accuracy in each of these techniques. A few items in Indian food may be also taken for analysis.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FT501 ELEMENTARY FOOD ANALYSIS	L	T	P	C	TH	TM	TW	PR/OR	150
	4	-	2	6	75	25	25	25	

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT

	Hrs	Mks
1. INTRODUCTION	2	5
Purpose of food analysis: Determination of proximate composition and nutritive value of food composite. Detect food adulteration and presence of toxic components, extraneous matter in food. Quality control of raw material, intermediate product and final product.		
2. DETERMINATION OF PROXIMATE COMPOSITION	8	16
Principles of following analyses: Determination of moisture content and ash content of food (total ash, acid soluble, and insoluble ash and alkalinity of ash). Determination of crude protein by Kjeldahl method. Determination of crude fat by Soxhlet method. Determination of crude fibre in food sample. Determination of total sugar, reducing and non-reducing sugar in food. Determination of starch content of food by hydrolysis.		
3. DETECTION OF ADULTERATION	4	10
Definition of adulteration. Detection of adulteration in tea, coffee, oils and fats, spices by simple, physical and chemical methods and visual examination.		
4. VOLUMETRIC ANALYSIS	4	12
Principle of acid-base titration. Principle of oxidation – reduction titration. Principle of Iodometry, Iodimetry.		

5. COLORIMETRIC ESIMATIONS	3	8
Principles of colorimetry Statement of Beer's Law and Lambert's Law. Main components of colorimeter and their functions. Procedure followed in colorimetric estimation (taking example of Biuret method for protein estimation).		
6. CHROMATOGRAPHY	6	10
Principle of chromatographic techniques. Components of chromatographic techniques- Inert phase, stationary phase, mobile phase. Definition of Rf value. Types of chromatography (outline of each techniques)- Paper chromatography, thin layer chromatography, column chromatography, gas-liquid chromatography. Paper chromatography: Procedure used for analytical work: Type of paper used, preparation of sample, spotting, chromatographic chamber, solvents, types of paper chromatography- Ascending and descending chromatography, two dimensional chromatography, circular paper chromatography.		
7. INSTRUMENTAL METHODS OF ANALYSIS		
1) Measurement of consistency of liquid products	3	7
2) Measurement of colour using Munsel Disc Colorimeter, LovibondTintometer	2	7
Total	**32**	**75**

4. PRACTICALS

1) Determination of preservatives in food sample- Determination of sulphur dioxide content of squash and preserved pulp. Determination of benzoic acid in tomato product.
2) Determination of calcium in food by volumetric analysis.
3) Determination of crude fat by Soxhlet method.
4) Detection of adulteration in food sample- Spices (chilli powder, pepper, turmeric), Oils and fats.
5) Analysis of coffee (moisture, solubility, water soluble ash, alkalinity of soluble ash)
6) Microscopic study of starch for structure of granules.
7) Estimation of total sugar, reducing and non-reducing sugar by Lane-Eynon Method.
8) Paper Chromatography (detection of various sugars in mixture)
9) Determination of iodine value of oil sample.
10) Detection and estimation of rancidity of oil sample by Kreis test and TBA number.
11) Determination of consistency of fruit pulp, using Brooke field Synchrolectric Viscometer

5. REFERENCE BOOKS

1. Food Analysis Theory & Practice by Pomeranz and meloan
2. Chemical Analysis of Food by David Pearson
3. Analysis of Fruit & Vegetable Products by Dr. S. Ranganna / Handbook of Analysis and Quality Control of Fruit and Vegetable products by Dr. S. Ranganna.
4. Quality Control for the Food Industry Vol I & II by Kramer &Twigg.
5. The Chemical Analysis of Foods & Food Products by Jacobs.

(FT502) FRUITS AND VEGETABLE TECHNOLOGY

1.Rationale: - Fruits and vegetable industry is a very large sector of food industry of India and hence detail knowledge and practical skill in this field is very essential for a technician in food technology. This course has been designed to impart the required knowledge right from purchasing of appropriate material, storage, processing and packaging of the final product. The practical periods support the theoretical knowledge of students and develop the confidence in them to work in any fruit and vegetable Industry.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FT502 FRUITS AND VEGETABLE TECHNOLOGY	L	T	P	C	TH	TM	TW	PR/OR	125
	4	-	4	8	75	25	25	-	

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT

	Hrs	Mks
1. IMPORTANT FRUIT AND VEGETABLE VARIETIES	4	5

Detection of maturity of fruits and vegetables. Harvesting procedures for important fruits and vegetables. Transportation of fruits and vegetables, aim, methods.

2. CANNING OF FRUITS AND VEGETABLES	10	12

Washing and peeling methods. Blanching and syruping. Filling and exhausting and processing. Typical processing procedures for common fruit and vegetables.

3. FRUITS BEVERAGES/CONCENRATES	8	10

Manufacture of fruit juice – Extraction, clarification, de-aeration, storage and concentration, squashes, fruit syrups, cordials – formulation and manufacture. Changes during storage of juice and squashes.

4. HIGH ACID AND HIGH SUGAR PRODUCTS	10	12

Manufacture of jam – Process, effect of pH, sugar, pectin's, determination of end point. Manufacture of jelly – Attributes of good jelly, selection of fruit, manufacturing process. Manufacture of marmalades. Common defects in jam, jelly and marmalades. Manufacture of guava cheese.

5. PRESERVATION OF CANDIES	4	5

Preservation of candies of crystallised and glaced fruits. Process of manufacture.

6. TOMATO PRODUCTS	10	11
Introduction – Common varieties in India, characteristics. Manufacture of juice, extraction and processing. Manufacturing of tomato puree and paste. Manufacture of tomato ketchup. Standards for tomato juice, tomato ketchup and common defects.		
7. PICKLES AND CHUTNEYS	6	6
Pickles – Types, formulation, and manufacture of oil and vinegar pickle. Chutneys – Varieties and process of manufacture.		
8. FREEZING OF FRUITS AND VEGETABLES	6	6
Freezing of fruits – Methods of manufacture of frozen fruit in syrup, freezing of fruit pulp and juice. Freezing of vegetables – Process for freezing of peas, corn.		
9. DEHYDRATION OF FRUITS AND VEGETABLES	6	8
Process for dehydration of fruit and vegetables: Selection, grading, pre-treatment and dehydration conditions. Factors determining choice of equipment. Commercial process for the dehydration of peas, onions, raw mangoes, grapes, packaging requirements and materials.		
Total	64	75

4. PRACTICALS

1) Canning of fruits and vegetables - Canning of two varieties of fruit / fruit cocktail. Canning of variety of vegetable. Canning of vegetable curry
2) Preparation of lime juice- Preparation of limejuice cordial. Preparation of lime / mango / pineapple squash
3) Preparation of jam-mixed fruit jam
4) Preparation of fruit jelly
5) Preparation of marmalade
6) Preparation of guava cheese
7) Preparation of candied fruit
8) Preparation of mango / apple preserve
9) Preparation of tutti fruity
10) Preparation and storage of tomato juice, preparation of tomato ketchup, canning of tomato soup
11) Preparation of mango and lime pickle. (of any two varieties)
12) Preparation of mango chutney
13) Freezing of fresh green peas
14) De-hydration of fruits and vegetables (Potato / Carrot / Onion /Chillies / Mango / Grapes)
15) Research and development of products (Method of formulation of new product).

5. REFERENCE BOOKS

1. Commercial Preservation of Fruits & Vegetables by Girdharilal
2. Storage, Processing & Nutritional Quality of Fruits & Vegetables by D. K. Salunkhe
3. Fruits and Vegetables Preservation by W. Cruess.

(FT503) BIOCHEMISTRY AND NUTRITION

1. Rationale- This course emphasises the importance of enzymes in food, their application in food processing industries and the changes brought about in various foods due to their action. These changes are very important as they affect directly the consumer acceptability of the raw materials or the products. Examples are changes due to enzymatic browning, post mortem changes occurring in meat and fish and the degree of ripening of fruits. The course also covers the basic nutritional aspects such as nutritional quality of different foods, importance of vitamins and minerals as nutrients, effects of their deficiency and the importance of balanced diets. The effect of processing methods on various constituents of foods is also covered with reference to the changes in their nutritive value.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FT503 BIOCHEMISTRY AND NUTRITION	L	T	P	C	TH	TM	TW	PR/OR	150
	2	-	2	4	75	25	25	25	

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT	Hrs	Mks
1. ENZYMES	3	7
Definition, nomenclature, classification, properties, mechanism of action, effect of temperature, pH, substrate and enzyme concentration, significance of coenzyme, cofactors, activators and inhibitors. Method of estimation: Biuret and Lowry method.		
2. ROLE OF ENZYMES IN FOOD	1	3
Enzymes in food: Milk, milk products, meat, fish, cereal products, fruits and vegetables		
3. RIPENING IN FRUITS AND VEGETABLES	3	5
Ripening: Definition, rate, measurement, effect on ripening, climatic pattern, factors affecting ripening. Production of ethylene, various pathways, its effect on ripening. How ripening takes place, changes in ripening, inhibitors and activators of ripening, artificial ripening.		
4. ENZYMIC BROWNING	2	5
Mechanisms of enzymic browning, control of browning by thermal in-activators, use of acids, ascorbic acid, sulphur dioxide, use of salts, prevention of contact with oxygen.		

5. APPLICATION OF ENZYMES IN FOOD PROCESSING	3	6
Carbohydrates – Amylases, invertases, pectinases and cellulases. Proteolytic enzymes, lipases, oxido-reductases – glucose oxidose, catalase, peroxidase. New developments in enzyme technology. Use of enzymes in food analysis. Commercialisation of industrially important enzymes. Concept of biotechnology.		
6. ENZYMES AND DIGESTION	1	4
Alimentary canal – Enzymes and breakdown of carbohydrates, protein and fats. Absorption processes.		
7. VITAMINS	3	8
Definitions, classification, water soluble, fat soluble, properties, functions and Recommended Dietary Allowances (R D A) distribution in foods. Effect of deficiency / excesses and their prevention. Estimation of vitamin C and B complex.		
8. MINERALS	3	6
Sources, functions, deficiencies, RDA of sodium, calcium, iron, phosphorous, potassium, iodine and fluorine. Methods of estimation of calcium, phosphate, iron.		
9. FOOD AND ENERGY	4	8
Food: Functional, classification and essential constituents. Function of essential constituents. Factors affecting dietary protein, digestibility coefficient, biological value of protein, protein efficiency ratio, net protein utilisation, energy – units used in the body. Determination of fuel value of foods.		
10. EFFECT OF PROCESSING	4	8
Effect of heat processing – Blanching, pasteurisation, sterilisation and baking; Freeze preservation; Removal of moisture; Fermentation. Processing with additives, salting curing, smoking, high sugar, chemical additives; Ionising radiation; Packaging.		
11. DIETS	2	10
RDA of different nutrient, balanced diets, under-nutrition. Protein- calorie malnutrition. Disorders of malnutrition. Prevention of under nutrition / malnutrition, modification of diets for specific conditions-obesity, hypertension and coronary heart diseases.		
. Infant nutrition and infant foods	1	2
. Nutrition of pregnant and lactating mothers	1	2
. Applied nutrition programmes	1	1
Total	32	75

4. PRACTICALS:

1) Estimation of protein by: Biuret's method, Lowry's method.
2) Determination of amylase activity of saliva
3) Estimation of glucose by Folin – Wu method
4) Determination of the effect of incubation time, temperature and pH on amylase activity
5) Demonstration of respiration process in sprouted seeds.
6) Determination of the effects of substrate concentration and enzyme concentration on amylase activity
7) Estimation of Vitamin C in lime using 2, 6 – di-chloro-indophenol method
8) Estimation of phosphate from food samples by calorimetric or volumetric method
9) Estimation of iodine in salt by volumetric methods
10) Estimation of iron by the calorimetric method
11) Estimation of Calcium from food samples by volumetric method

5. REFERENCE BOOKS:

1. Bravermen's Introduction to the Biochemistry by Food Berk Z.
2. Biochemistry of Foods by Eskin et al
3. Nutrition of Foods by Swaminathan M
4. Nutritional Evaluation of Food Processing by Harris R & Kramer E
5. Official Method of Analysis of the association of Official Analytical Chemists
6. The Science Methods of Foods by Gaman et al
7. Standard Methods of Chemical Analysis by N. H. Furman
8. Analysis of Fruit and Vegetable Product by S. Rangana

(CS601) INDUSTRIAL ORGANISATION AND MANAGEMENT

1. RATIONALE

When a diploma pass out will start working in the wok place in any office or shop floor, he /she has to perform work or get work done from subordinates on day to day basis as well as for ongoing week or month. This performance has to be very efficient and effective in order to achieve the set goals. The work performance demands proper manaegement of all kinds of resources (money, material, men, machines, methods, time) for achievement of goals. This management has a science part as techniques of planning, organising, directing &controling. It has an art part, how well these techniques are applied to get the desired results. The student should have a good knowledge of art & science of management, so that he is able to motivate himself & others to work.

2. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CS601 Industrial Organisation and Management	L	T	P	C	TH	TM	PR/OR	TW	100
	3	-	-	3	75	25	-	-	

Minimum passing % : Theory 40% and Practical 40% Duration of Theory Paper: 3 Hrs.

3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency **– *' Use principles of industrial management in production, operation & maintenance of mechanical components & systems'.***

4. DETAILED COURSE CONTENT

Unit 1 Business Organisation

Types of business organizations: Individual Proprietorship Organisation, partnership organization, Joint Stock Companies : Private Ltd and Public Ltd , Co-operative societies, Public sector Organisation

Structure of business organization: Line Organisation, Functional Organisation , Line and staff Organisation, Project organization

Unit 2 Business Management

Functions of management: Concept of management and administration, management as an art and science, evolution and growth of scientific management- contribution of F.W Taylor, management functions such as forecasting, planning, organizing, directing, communicating, controlling, co-ordinating, motivating, guiding, counseling and decision- making.

Functions in Industry: Procuring, store- keeping, inventory control, material handling, manufacturing or production, supervision, quality assurance, packing and forwarding, marketing- sales promotion, research and development, supervisory skills. Introduction to ISO.

Unit 3 Financial Analysis

Finance: Introduction, sources of finance, important financial statement such as profit and loss, balance sheet and cash flow.

Cost Concepts: Introduction, necessity of costing, elements of cost- direct and in direct, variable and fixed, prime cost, overhead cost, total cost, marginal costing, break- even chart analysis, angle of Incidence.

Materials management: Economic Order quantity, reordering system, base stock and lead time, inventory valuation , ABC Analysis

Definition of Budget and Budgetory control

Depreciation: Methods of calculating depreciation charges : Straight Line Method , Sinking Fund Method, Diminishing Balance Method.

Obsolescence- definitions and reasons.

Unit 3 Personnel Management

Functions of Personnel Department: Human resource Planning, selection and recruitment, training and placement, promotion and transfer, motivation and morale of workers, welfare of employees.

Industrial Relations: Relations with Individual worker, relations with unions, relations with government, settlement of disputes of employees, collective bargaining, conciliation, arbitration, grievance handling mechanism, domestic inquiry.

Wages and Incentives: Types of wage plans – Time rate and piece rate, characters of good wage plan, incentive – objectives and advantages, character of good incentive plan, individual

and group, incentive plan, difference between incentive and wage.

Unit 4 ***Industrial Acts and Taxes***

Introduction to Following Industrial Acts:

Industrial Disputes Act 1947/1956;

The Indian Factories Act 1948

The Workmens Compensation Act 1923;

Introduction to sales tax, Custom and excise duty , VAT.

Unit 5 ***Project Management : Network Analysis***

(Introduction to basic concepts with simple problems)

PERT- Programme Evaluation and Review Technique: Definition, network diagrams, advantages.

CPM- Critical Path Method: Definition, finding critical Path, advantages, Comparison of PERT and CPM.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Minimum Teaching Hours perSemester	Total Marks
1	Business Organisation	**6**	**9**
2	Business Management	**10**	**15**
3	Financial Analysis	**13**	**21**
4	Personnel Management	**10**	**15**
5	***Industrial Acts and Taxes***	**4**	**6**
6	***Project Management*** ***Network Analysis***	**5**	**9**
	Total	**48**	**75**

6. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Publication & Year
1	T R Banga , S.C. Sharma	Industrial organization & Engineering Economics	Khanna Publishers Latest
2	O.P. Khanna	Industrial engineering & management	Khanna Publishers
3	Awate, Chunawala, Bhandarkar, Shrinivasan	Industruial Organisation & Management	Latest
4	M.C. Shukla	Bussines Organisation & management	Latest
5	M. Mahajan	Industrial Engineering & Production Management	DhanpatRai& co.
6	O.P. Khanna	Industrial engineering & management	Khanna Publishers
7	Satya saran Chatterji	Modern Business- Organisation & Management	Latest

(CS501) ENTREPRENEURSHIP DEVELOPMENT

1. RATIONALE

The course on Entrepreneurship Development focuses on creating awareness regarding entrepreneurial traits, entrepreneurial support system, opportunity identification, project report preparation and understanding of legal and managerial aspects related to setting up of enterprise. This can be helpful in motivating technical students to start their own small-scale business/enterprise.

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	50
	-	-	2	2	-	-	-	50	

Minimum passing % Practical 40%

3. COMPETENCY TO BE DEVELOPED THROUGH THIS COURSE

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the competency – ***Prepare a detailed project report for an identified product/service.***

4. DETAILED COURSE CONTENT

Unit 1:Introduction (7 Hours, 12 Marks)

Meaning of entrepreneurship, need in the present scenario, definition of an entrepreneurship, qualities of an entrepreneur, functions of an entrepreneur, risks and rewards of entrepreneurship.

Definition of Micro, Small And Medium Enterprises (MSME).Classification of Micro, Small And Medium Enterprises (MSME). Types of Enterprises - manufacturing, service and franchisee.

Unit 2:Forms of Business Organisation (2 Hours, 9 Marks)

Main features of Sole Proprietorship, Partnership, Private Limited Company, Public Limited Company, Co-operative Society.

Unit 3:Entrepreneurial Support System (6 Hours, 9 Marks)

Central Government Agencies: Functions of Small Industries Development Bank of India(SIDBI), National Bank for Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC), Micro, Small And Medium Enterprises -Development Institute (MSME- DI), Technology Business Incubator (TBI), Khadi& Village Industries Commission (KVIC).

State Government Agencies: Functions of District Industries Centre(DIC), Goa Industries Development Corporation (GIDC), Economic Development Corporation (EDC), Financial Institutions-Banks, Goa Handicrafts and Rural Small Scale Industries Development Corporation (GHRSSIDC), Rural Development Agency (RDA), Khadi and Village Industries Board (KVIB).

Unit 4: Business Opportunity Identification(7 Hours, 6 Marks)

Evaluation of business opportunity:- selection of industry, initial prospects study, product marketing concept, decision to proceed, feasibility study, project evaluation.

Unit 5: Market Research (6 Hours, 12 Marks)

Definition of demand, factors affecting demand, law of demand,demand curves

Definition of supply, factors affecting supply,law of supply, supply curves.

Preparation of questionnaire. Data collection for setting up a small enterprise.

Unit 6: Legal Aspects (4 Hours, 9 Marks)

Procedure of registration of Micro, Small And Medium Enterprise (MSME), meaning and registration of Value Added Tax(VAT), Service Tax, PAN. Slabs of Income tax.

Unit 7: Project Report (16 Hours, 18 Marks)

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,scheme, profitability and projections, infrastructure, break- even point, names and addresses of suppliers, remarks.

Project Profile.

Project appraisal criteria:- technical feasibility, financial feasibility, economic viability, commercial viability, managerial competency, political and labour considerations.

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	Introduction	7	12
2	Forms of Business Organisation	2	9
3	Entrepreneurial Support System	6	9
4	Business Opportunity Identification	7	6
5	Market Research	6	12
6	Legal Aspects	4	9
7	Project Report	16	18
TOTAL		**48**	**75**

5. MANDATORY ASSIGNMENTS

1. Preparation of a Case Study on leading entrepreneurs of Goa. (To be taken while conducting Unit 1)
2. Preparation of a Case Study on leading entrepreneurs of India. (To be taken while conducting Unit 1) Unit 1)
3. Filling of template of “Business Model Canvas”
4. Prepartion of Project Profile.
5. Preparation of Project Report.

6. SUGGESTED ACTIVITIES:

1. Visits to related departments (DIC,Banks,Tecnology Business Incubators, MSME-DI, NSIC, KVIC, KVIB).
2. Study visits to industries.
3. Organise entrepreneurship related event / activities.
4. Organise lectures/seminars with successful entrepreneurs.
5. Organise brainstorming sessions on ideation.
6. Establish an Entrepreneurship Development Cell.

7. SUGGESTED LEARNING RESOURCES

S.No.	Author	Title of Books	Year of Publication
1.	*Sharadjawadekar, shobhadodlani,*	*Business entrepreneurship*	*Suvicharprakashanmandalpune,*
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*
6.	*PM Bhandari*	*Handbook of Small Scale Industry*	

(IT502) FOOD TECHNOLOGY TRAINIG-I

1. **RATIONALE**: Rationale: This training has been included as a compulsory component of the curriculum as it will give an insight into the industrial activities and processes which cannot be taken up in the institution and also expose them to an industrial environment thereby developing the required attitudes.

2. **TEACHING AND EXAMINATION SCHEME**

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
IT502 FOOD TECHNOLOGY TRAINING-I	L	T	P	C	TH	TM	TW	PR/OR	Grade
	-	-	4	4	-	-	35	15	

Minimum passing %: 40% .

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT

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.

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

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

4. TERM WORK & PRACTICALS

Evaluation Scheme					
TW				PR/OR	TOTAL Marks
Attendance Marks*	Industrial Mentor's assessment Marks	Institute Mentor's assessment Marks	Training Report	Report Assessment & Seminar/Viva	
05	10	10	10	15	50

* 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
b) Seminar / Oral: To be assessed by faculty in charge of training and expert ofTraining 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.

(FT511) ANIMAL PRODUCTS TECHNOLOGY

1. **Rationale**- Meat and poultry is a rapidly growing industry in India, with a vast scope for internal and external export market expansion. This course is designed to impart to the technician 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. The theory knowledge is suitably supplemented with practical to provide proper skills at shop floor level.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FT511ANIMAL PRODUCTS TECHNOLOGY	L	T	P	C	TH	TM	TW	PR/OR	125
	3	-	2	5	75	25	25	-	

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT	Hrs	Mks
1. INTRODUCTION		
Meat animals and meat production, potential of meat and meat products in the Indian context.	1	--
2. EXAMINATION & SLAUGHTERING OF ANIMALS		
Ante-mortem and post-mortem examination of animals.	2	2
Slaughter house practices, slaughtering methods, dressing and packaging	3	4
3. COMPOSITION, STRUCTURE OF MEAT		
Composition of meat and nutritive value, mutton, pork, beef, poultry.	3	4
Structure of meat muscle	3	3
Chemical and bio-chemical changes in meat colour, on set of rigor mortis.	4	4
Factors of spoilage, chemical and microbial spoilage.	4	4
Grading of meat and meat cuts. (whole-sale, retail cuts)	2	3
4. PRESERVATION OF MEAT		
Methods of preservation- Thermal- Pasteurisation, sterilisation. Low temperature storage- Artificial tenderisation and ageing, storage of meat above freezing point, storage of meat below freezing point, changes in frozen storage. Preservation by lowering moisture- Drying and de-hydration, freeze-drying.	10	18

Preservation by direct microbial inhibition- Irradiation, antibiotics. Preservation by curing and smoking.		
Packaging of meat and meat products.	2	4
Beef- Corned beef. Pork- Sausages, frankfurters, salami, ham bacon, luncheon meat. Chicken-barbeque.	5	8
5. EGG AND POULTRY		
Introduction & production in India	1	
Egg: Structure, composition and nutritive value of egg.	2	4
Transportation of egg: Transportation and grading of egg.	1	3
Increase in shelf life: Increase in shelf life of shell egg by physical and chemical method	1	3
Freezing of Albumin and yolk: Changes due to freezing of albumin and yolk.	1	2
Egg products: Dehydrated egg powder, frozen egg.	1	3
6. POULTRY PROCESSING & OTHER PRODUCTS		
Slaughtering and bleeding, scalding, de-feathering, evisceration, chilling, packaging and storage.	1	3
Sources and uses of bone meal, gelatine, casing, plasma and lard.	1	3
Total	48	75

4. PRACTICALS:

1). Dressing of Chicken (broiler).
2). Canned meat products.
3). Curing and Smoking of meat.
4). Freezing storage of chicken, meat and storage life study under various package materials.
5). Preparation of Sausages.
6). Preparation of Chicken barbeque.
7). Grading of market egg (shape, size, weight, visual examination of shell, egg contents).
8). Quality evaluation of egg (appearance, weight, Haugh unit of yolk and albumin, porosity and thickness of egg shell)
9). Preparation of meat pickles.
10). Preparation of corned mutton/beef/meat loaf.
11). Preparation of pre-cooked frozen hamburgers.
12). Visit to slaughterhouses.
13). Visit to model Poultry farm.
14). Visit to model Piggery.

(FT512) MARINE PRODUCTS TECHNOLOGY

1. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FT512 MARINE PRODUCTS TECHNOLOGY	L	T	P	C	TH	TM	TW	PR/OR	125
	3	-	2	5	75	25	25	-	

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

2. DETAILED COURSE CONTENT

	Hrs	Mks
1. INTRODUCTION / FISHERY RESOURCES		
Survey of important commercial species of India	3	2
2. CHEMICAL COMPOSITION AND SPOILAGE OF FISH		
Classification of fish on the basis of fat content (lean fish, semi-fatty fish and fatty fish); Chemical composition of above types of fish; Nutritional value of fish with reference to quality of fish protein.	2	3
Outline of sequence of changes leading to the spoilage and end products of spoilage in marine fish and fresh water fish. Subjective method of evaluation of freshness of fish. Objective method of evaluation of freshness of fish. (Determination of TVB and TMA).	4	4
3. HANDLING AND TRANSPORTATION OF FISH		
Handling and transportation of fish after landing.	3	3
4. HEAT PROCESSING OF FISH		
Canning of fish in oil (e.g. canning of sardines and mackerels). Canning of prawns in brine. Spoilage of canned fish and prawns (visual defects in stored cans and products, honey combing and formation of struvite crystals). Quality control and quality standards in canned fish and prawns.	5	12
5. COLD STORAGE & FREEZING OF FISH		
Process of freezing and frozen storage of fish (whole fish and fish fillet). Process of freezing and frozen storage of prawns. Changes in fish during freezing and frozen storage (desiccation drip loss, rancidity, protein denaturation). Measures to minimise changes during freezing and frozen storage of fish. Quality control and quality standards of frozen fish and prawns (for export). Procedure for evaluation of bacteriological quality of frozen fish and prawns (for export).	6	12
6. SALT CURING & DRYING OF FISH		
Quality requirements for salt for curing of fish. Methods of salt curing of fish (pickle cure, brine cure and kench cure). Process of sun drying of salted fish. Process of mechanical dehydration of salted fish. Comparison of sun drying and mechanical dehydration (Advantages and limitations of both methods). Microbiological spoilage of salt cured fish and measure to prevent spoilage.	3	10

7. FISH PRODUCTS AND BY-PRODUCTS		
Specialised fish products and by-products of sea-food processing industry Process of production of fish sausage; Process of production of fish fingers; Production of fish pickle & prawn pickle; Production of fish flakes; Production of fish fingers.	3	3
Definition of fish protein concentrate; Types of fish protein concentrate and quality standards of each; Principle of process of production of fish protein concentrate.	2	3
By-products of seafood processing industry – uses of fishmeal, fish oil, chitin, gelatin and isinglass.	1	2
8. PACKAGING MATERIALS AND CONTAINERS Packaging materials required. Properties and criteria for the selection of the packaging materials for the following marine products –Fresh and frozen marine products. Dried, salted and other types of seafood products. Canned fish. Fish paste and fish sausage. Containers required for Bulk packaging of marine products, testing of packaging materials	8	9
9. MICROBIOLOGICAL ANALYSIS OF FROZEN SEA-FOOD Vibrio – Vibrio parahaemolyticus, vibrio cholerae. Foods to be examined – Oysters and foods other than oysters e.g. fish, squid, prawns, muscles, etc. Sampling Methods – preparation of food samples, isolation, identification and confirmation.	4	6
Isolation and detection of Salmonella and Shigella in frozen seafood. Examination of shellfish, prawns, squid and other seafood. Sampling Methods – preparation of food samples, isolation – enrichment media and selective media, identification and confirmation.	4	6
Total	48	75

3. PRACTICALS

1. Study of morphological characteristics of typical fish.
2. Preparation of specialised fish products such as fish pickle, prawn pickle, fish flakes, fish fingers, etc.
3. Evaluation of bacteriological quality of frozen fish – Isolation and detection of- Salmonella, Shigella, Vibrio.
4. Visit to seafood freezing unit.

4. REFERENCE BOOKS

1. Food Science by Potter.
2. Food Processing Operation by JoslinHeid.
3. Elementary Food Science by NickesonRonsivalli.
4. Fish as Food, Vol. I, II, III & IV – Associated Press.
5. Fish Curing and Processing – Mir Publications, Soviet Union.

SEMESTER VI

(FT601) FOOD SAFETY AND STANDARDS

1. RATIONALE:

In any commercial food-processing unit, quality control occupies a very important position in the organised working of the unit. Implementation of an effective quality control programme ensures maintenance of high quality standards and efficient performance. This course includes routine quality control procedures and laboratory tests followed in various food processing industries and covers the food laws and standards in our country. It will also provide necessary theoretical and practical knowledge of different areas of quality control.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FT601 FOOD SAFETY AND STANDARDS	L	T	P	C	TH	TM	TW	PR/OR	150
	2	-	4	6	75	25	25	25	

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT

SR. No	Topic	Hrs	Marks
1.	Introduction	1	3
2.	Sampling for Quality Evaluation: Why sampling is necessary, Sampling terminology, Sampling techniques for Food products	2	3
3.	Laboratory requirements – layout, equipments, safety	1	3
4.	Laws and Standards: Our national laws related to Food Industry: FSSAI: its role in Food Safety, its Composition, how it differs from earlier PFA, its domain in Food Industry Our National standards & Controlling agencies: BIS, AGMARK, MPEDA, APEDA. : history, voluntary/mandatory and uses International standards: ISO: short profile of ISO, Food Industry related ISO standard ISO 22000, Codex Alimentarius- General	4	7

	description, Various Codex guidelines in Food Industry, FAO-WHO Joint committee on Food Additives (GRAS)- its importance and uses in the application of Food Additives		
5.	Quality Control and Quality Assurance a) How Quality assurance differs from the traditional Quality Control?- assurance through quality plan for various stages to assure the Food quality b) 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) c) Root cause analysis: How to analysis defects, complaints and take corrective actions	4	12
6.	Good Food Manufacturing Practices, Hygiene Practices as per FSSAI, CIP systems (Cleaning in Place) HACCP: Principles, its importance in Food Safety, Outline about implementation	3	6
7.	Sensory Evaluation: Tastes, Importance of Sensory Evaluation, Assessors training, Sensory Evaluation tests, Uses of Sensory Evaluation	3	5
8.	Quality Assurance, plan for various Food Processing Industries: Critical Quality Control Points in these industries related to Quality defects and how to monitor/control and prevent. a) Cereals, grains and legumes products b) Meat, Fish and Poultry Products c) Fruits and Vegetable products d) Milk and Milk Products e) Aseptic and Non aseptic Processed Products f) Confectionary products	14	36
	Total	**32**	**75**

4.PRACTICALS

1) Planning of laboratory layout for food processing unit with requirements of glassware and equipment.
2) Analysis of squash, jam and tomato ketchup based on F. P. O specifications.
3) Testing of wheat flour based on P. F. A specifications
4) Evaluation of baking quality of wheat flour.
5) Test baking
6) Testing quality of roasted, ground coffee based on P. F. A specifications
7) Evaluation of quality of confectionery products based on P. F. A specifications

5. REFERENCE BOOKS

1. Quality Control for the Food Industry- Vol-I & II by A. Krammer AVI Publications.
2. Food Quality Assurance by W. A. Gould, AVI Publications.
3. Prevention of Food Adulteration Act (1954) with rules.
4. Chemical Analysis of Food Products by M. B. Jacobs.
5. I. S. I. Specifications for various Food Products.
6. The Chemical Analysis of Foods by David Pearson Churchill Livingstone Publications.
7. Handbook of Analysis and Quality Control of Fruit and Vegetable Products by Dr. S. Ranganna, Tata, McGraw Hill Publications.

(FT602) FOOD TECHNOLOGY PROJECT

1. **Rationale**: Student is introduced to more intensive laboratory work with regard to product development including formulation and standardisation in a particular area of food processing. Besides laboratory work the student is expected to provide information regarding equipment and machinery requirements, raw material and ingredients for a particular level of production.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FT602FOOD TECHNOLOGY PROJECT	L	T	P	C	TH	TM	TW	PR/OR	100
	-	-	4	4	-	-	50	50	

Minimum passing %: Practical40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT

Project Work – involves 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.

(FT603) TECHNOLOGY OF FOOD PRODUCTS – II

1. Rationale: The course contents would remain flexible so as to include new topics as the needs of the industry change. Areas like extrusion technology, aseptic packaging, dietary foods, fast foods, soya products, etc. particularly relevant today have been included. Due importance has also been given to traditional Indian foods and their commercialisation. The processing of these foods in the laboratory will develop the skills in formulation and techniques needed by a technician.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FT603 TECHNOLOGY OF FOOD PRODUCTS II	L	T	P	C	TH	TM	TW	PR/OR	125
	2	-	2	4	75	25	25	-	

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT	Hrs	Mks
1. INTRODUCTION	1	-
2. ASEPTIC PROCESSING - Principle	6	16
Retail, Bulk aseptic processing systems, Process Layouts, Form Fill seal Machines		
3. EXTRUSION – Principle	6	15
Single screw and twin screw extruders, Low shear and high shear Extruders. Processing layouts for various extruded foods – Expanded snacks, Texturised vegetable protein, breakfast cereals, co-extruded product, Pasta products etc.		
4. SOYA & GROUNDNUT PRODUCTS	6	15
Soyabean – Nutrition, Soya Protein concentrate, Soya Protein isolate, Soya Protein hydrolysate – Manufacturing processes, properties and uses, Preparations of products like milk, cheese, and partially de-fatted products. Ground nut – nutrition Protein concentrate and Protein isolate– Manufacturing processes, properties and uses, Peanut butter, Aflatoxin		
5. DIETARY FOODS	4	8
Principles, Safety FSSAI guidelines. Dietary Food Components, Dietary Fiber, Low calorie sweeteners. Different type of dietary foods- Prebiotic, probiotic, sports drink (energy drink)		
6. CONVENIENCE FOOD	3	8
Principle, scope in India, Ready to eat foods, Ready to cook foods-Plant and machinery Process of deep frying and changes during deep frying.		

7. COMMERCIALISATION OF INDIAN FOODS	3	7
Principle ,scope of commercialising Traditional Foods Emphasis on National and Goan major traditional foods like Bibinca, Dodol etc..		
8. COMPUTER APPLICATIONS IN THE FOOD INDUSTRY	3	6
Application in Processing, in quality control, in material handling and in distribution.		
Total	**32**	**75**

PRACTICALS

1) Recovery of protein from oilseed cake
2) Preparation of groundnut- soya based flavoured milk.
3) Preparation of soya flour enriched food.(bread / biscuit / Indian snack food).
4) Preparation and finishing of papad.
5) Preparation and finishing of any commercial variety of masala mix (dry or wet) and study of its shelf life.
6) Preparation and standardisation of any fast food. Adaptation required for franchising
7) Preparation of a dietary food (jam/soft drink).

REFERENCE BOOKS

1. Convenience Fast Food Handbook by M. E. Thormer AVI Publishers.
2. Textured Protein Products by M. H. Gutcho, NDC.
3. Extrusion of Foods, Vol. I & II by J. M. Harper, CRC Press
4. Encyclopaedia of Food Technology, AVI.

(FT604) CEREAL TECHNOLOGY

1. **Rationale**: The field of technology includes a number of process technologies. Cereal Technology constitutes a very important area of food technology covering a large group of food processing industries such as bakery and related industries. The syllabus in this subject aims at providing students with necessary knowledge of the basic principles and procedures in the production of important bakery and other cereal product. Theory classes are substantiated with practical work to impart knowledge and skills in the production and quality control of cereal products.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FT604 CEREAL TECHNOLOGY	L	T	P	C	TH	TM	TW	PR/OR	125
	3	-	2	5	75	25	25	-	

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT

	Hrs	Mks
1. INTRODUCTION	2	4
Main cereal crops grown in the country. Importance of cereals as food commodity.		
2. TECHNOLOGY OF RICE	15	18
Important groups of cultivated rice and their regional distribution, Structure and composition of rice grain, Distribution of nutrients in rice grain, Mechanical drying of harvested paddy, drying and milling quality of rice. Parboiling of paddy: Definition. Traditional methods of parboiling. Modern method of parboiling- C.F.T.R.I. process, advantages of parboiling of paddy.		
Physio-chemical properties of rice: Comparison of gelatinisation temperature, cooking quality and loss of nutrients in cooking water of raw and parboiled rice. Curing of rice- Cooking quality of new and old rice, method of curing rice. Milling of rice- moisture content of rice for optimum milling quality, cleaning procedure of rice prior to milling and equipment used in cleaning, modern milling process of rice and equipment used in milling, evaluation of quality in milled rice, effect of milling on quality of rice, by-products of rice milling (uses only) rice products- Production of canned rice, production of enriched rice, production of instant mixes from rice- idli mix, dosa mix, etc., rice based infant food.		
3. TECHNOLOGY OF WHEAT PRODUCTS		
Main groups of cultivated wheat and their regional distribution (spring wheat and winter wheat). Important varieties of wheat grown in the country.	2	4
Structure and composition of wheat grain: Distribution of nutrients in wheat		

grain.		
Milling of wheat: Comparison of milling quality of hard and soft wheat, cleaning procedures of wheat milling, modern process of wheat milling, products of wheat milling and their uses.	4	4
Baking technology: Ingredients used in baking of bread, quality requirements of flour in baking of bread, laboratory tests for evaluating quality of wheat flour for baking, role of various ingredients in baking of bread, 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, common defects (appearance and texture in bread and a remedial measures), production of enriched bread, spoilage of bread and measures to prevent spoilage.	7	12
Biscuit production: Quality requirements of flour in biscuit production, role of various ingredients in biscuit production, process and equipment used in production of biscuit, common defects (appearance and texture) in biscuit and remedial measure.	4	6
Production of cake: Ingredients used in production of plain sponge cake, role of various ingredients in production of cake, balancing of cake formula, process of production of cakes, equipment used in production of cake.	3	6
Production of paste goods: Various types of paste products (noodles, spaghetti, macaroni and vermicelli), requirements of wheat semolina and flour for production of paste products, ingredients used in production of paste products, process and equipment used in production of paste products, quality evaluation of paste products.	4	6
4. PRODUCTION OF BREAKFAST FOODS	4	9
Process of manufacture of puffed and flaked products from maize and rice.		
5. MALTING OF CEREALS	3	6
Process of production of malted wheat flour, Uses of malted cereal flour.		
Total	48	75

4. PRACTICALS

1) Study of hydration characteristics of raw and parboiled rice: At constant temperature, with increasing temperature.
2) Parboiling of paddy.
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.
4) Determination of dough raising capacity of yeast
5) Test baking.
6) Production of bread and quality evaluation
7) Production of biscuit and quality evaluation
8) Baking of cake and quality evaluation
9) Visit to Modern Bakery
10) Visit to roller flour mill

5. REFERENCE BOOKS

1. Baking Technology and Engineering by Matz
2. Cereal Technology by Matz
3. Bread Science and Technology by Pomeranz and Shellenberger.
4. Cookie and Cracker Technology by Matz
5. Food Science by Potter
6. Food Processing Operations by Joslyn and Heid.
7. Quality Control for the Food Industry Vol. I & II by Kramer
8. Cereal Chemistry by Kent-Jones.
9. Food Facts and Principles by ShakuntalaManey

(FT605) DAIRY TECHNOLOGY

1. **Rationale**- Dairy industry is a major food industry in India; hence knowledge of milk procurement, processing, distribution and technology of milk products is essential. This subject aims at giving the food technician the basic theoretical and practical knowledge, required by a supervisor in the milk or milk processing industry. Sufficient coverage has therefore, been given to market milk, processing and distribution, ice-cream, various indigenous milk products, milk powder, butter, milk based beverages, etc.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FT605 DAIRY TECHNOLOGY	L	T	P	C	TH	TM	TW	PR/OR	125
	3	-	2	5	75	25	25	-	

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT

	Hrs	Mks
1. MARKET MILK	4	8
Milk industry in India. Definition of milk, source as food composition and nutritive value. Properties of milk- Physical and chemical.		
2. PROCESSING OF MILK	4	8
Receiving of milk, platform tests, filtration, clarification, cooling, storage, standardisation, pasteurisation, homogenisation, packaging and distribution of milk. Definitions- Standardised milk, single toned, double toned. Manufacture and shelf life of sterile bottled milk and flavoured milk.		
3. CREAM	3	6
Cream separation, cream separator, and methods of cream separation. Factors governing richness of cream, factors governing fat percentage.		
4. BUTTER	5	8
Introduction, composition. Process involved- Cream neutralisation, addition of starter, creams ripening, churning, working of butter, printing, packaging. Factors influencing churning, over-run in butter, butter defects, their causes and prevention.		
5. CHEESE	7	8
Introduction, history, definition, classification, composition, nutritive value, legal standards. Manufacture of processed cheese, Swiss cheese, cottage cheese, their defects and control. Manufacture of cheddar cheese, packaging, marketing, defects of cheese.		
6. CONDENSED MILK	4	8
History, composition, types of condensed milk, method of manufacture, vacuum pan, condensing, defects in condensed milk.		

7. DRY MILK History, types of dry milk, composition of each dry milk. Methods of manufacture, drum drying, spray drying, freeze drying, packaging of milk powder. Properties of dry milk, bulk density, solubility, solubility index, wettability, dispersability. Defects in dry milk, reconstitution. Instant milk powder manufacture. Malted milk beverages like Horlicks, Viva, etc.	7	8
8. ICE-CREAM History, definition, classification, composition, ingredients used-sweeteners, stabilisers, flavours, etc. Preparation of ice-cream, calculation of ice-cream mix, pasteurisation of milk, homogenisation, ageing, freezing and packaging of ice-cream. Defects and over-run in ice-cream.	5	8
9. INDIGENOUS & CULTURED MILK PRODUCTS Rubbery, khoa, channa, rasgulla, ghee, paneer, shrikhand, lassi, kalakand. Methods of preparation and composition. Dahi, yoghurt- their composition, changes in constituents during fermentation and flavour development.	7	9
10. BY-PRODUCTS Process of manufacture and uses of by-products, lactose, whey powder and casein.	2	4
Total	48	75

4. PRACTICALS

1) Platform tests in dairy industry- Acidity, odour, taste, flavour, alcohol, C. O. B.
2) Chemical analysis of milk to find adulteration and detecting efficiency of pasteurisation. Test for starch, bicarbonate, glucose, specific gravity of milk, preservatives, acidity, phosphates test, MBR test.

3) Determination of total solids and Solid Non Fat (SNF).	4) Estimation of fat from milk by Gerber butyrometer.
5) Manufacture of dahi and ghee.	6) Manufacture of butter.
7) Manufacture of ice-cream.	8) Demonstration of cream separation in dairy
9) Manufacture of channa.	10) Manufacture of paneer.
11) Manufacture of rubbery.	12) Manufacture of shrikhand.
13) Manufacture of rasgulla.	

5. REFERENCE BOOKS:

1. Outlines of Dairy Technology by Sukumar De.
2. Milk and Milk Products by Clarence Henry Eckles.
3. Principles of Dairy Processing by James N. Warner.
4. Milk Production and Processing by Henry F. Judkin.

(FT611) SOFT DRINK AND PACKAGING TECHNOLOGY

1. **Rationale**: Soft drink Industry is a prominent sector among the food industries. There is plenty of scope for employment within the country as well as overseas. It also encourages students for self employment at a small scale level. The syllabus of soft drink technology equips the students to handle Production, Quality Control and even selection of raw materials.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FT611 SOFT DRINK AND PACKAGING TECHNOLOGY	L	T	P	C	TH	TM	TW	PR/OR	125
	3	-	2	5	75	25	25	-	

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT

	Hrs	Mks
1. INTRODUCTION:	2	4
History, Definition. Legal standards and specifications. Nutritive value of soft drinks. Classification of soft drinks.		
2. INGREDIENTS USED IN SOFT DRINKS:	4	9
Various ingredients used, including stimulants, antioxidants, vitamins and buffer salts. Their quality characteristics. Nutritive value of different ingredients. Permitted levels. Importance of Brix : acid ratio. Storage and handling of ingredients.		
3. WATER TREATMENT AND SPECIFICATIONS:	6	9
Sources of water. Composition of water. Different water treatment methods such as: Filtration, chemical treatment, Ion exchange, demineralisation, reverse osmosis, deodourisation, U. V. rays. Water specifications.		
4. SWEETNERS:	3	4
Function of Sweeteners. Nutritive sweeteners: sucrose, glucose, cornsyrup, glucose, high fructose cornsyrup, sorbitol, fructose, lactose, their properties, advantages and disadvantages. Non nutritive sweeteners: Saccharine, cyclamates, acesulfamek, aspartame – their properties, advantages and limits. High intensity sweeteners: Alitame, sucralose.		
5. ACIDULANTS:	2	4
Functions. Different types of acids used, properties, level used. Equivalent sourness produced.		

6. COLOURANTS, FLAVOURS, PRESERVATIVES AND OTHER ADDITIVES	4	6
Natural, Nature identical, synthetic, flavour extracts, essential oils, emulsions, caffeine. Preservatives: Preservative action of various ingredients, various chemical preservatives used. Antioxidants like BHA, Ascorbic acid. Hydrocolloids: Carageenan, alginates and polysaccharides – their functions and levels used.		
7. CARBON DIOXIDE:	3	6
Properties of CO_2 gas. Specifications. CO_2 gas treatment. Gas volume in various soft drinks.		
8. COMPOSITION OF SOFT DRINK:	2	4
Composition of various carbonated, non-carbonated, fruit based and energy drinks.		
9. SOFT DRINK PRODUCTION:	7	8
Plant layout. Preparing of carbonated soft drink. Preparing of non carbonated soft drink. Aseptic packaging of soft drink. Plant sanitation and housekeeping.		
10. QUALITY CONTROL IN SOFT DRINKS:	7	8
Quality standards for sugar and acids. Online quality control, Tests for treated water, syrup clarity, inspection of washed bottles, inspection of filled bottles, gas volume, brix organoleptic tests, etc. Microbiological tests for water, syrup, washed bottles and beverage. Quality test for finished product brix, gas volume, acidity, invert sugar, organoleptic tests, etc.		
10. PACKAGING: Packaging materials used for soft drinks, advantages and limitations	5	8
11. TESTING, IDENTIFICATION AND ESTIMATION OF PACKAGING MATERIAL:	3	5
Testing and identification of packaging material. Estimation of shelf – life of packaged foods.		
Total	48	75

4. PRACTICALS:

1. Identification and qualitative analysis of citric, malic, fumaric, phosphoric acids.
2. Analysis of sugar: Moisture, Flocculation test, Sedimentation, Colour, Turbidity, Odour, ash.
3. Qualitative tests for buffer and preservatives.
4. Qualitative tests for caramel Density, Colour, Solubility, Stability.
5. Water analysis: Iron residue, chlorine tests, total hardness, total dissolved solids, total alkalinity, P & M Value.
6. Testing of gas-volume, brix, invert sugar, acidity, total volume – of any two soft drinks available in the market.

5. REFERENCE BOOKS:

1. Formulation and Production of Carbonated soft drinks, Edited by, A. J. Mitchell
2. Production and Packaging of Non Carbonated Fruit Juices and Fruit Beverages, Edited by, D. Hicks
3. Beverage Carbonated &Non Carbonated, Edited by, Woodroof& Phillips

4. Food Packaging, Edited by Stanley Sacharow

5. Fundamentals of Food Packaging, Edited by F. A. Patne

6. Food Packaging & Preservation, Edited by, M. Mathlouthi

7. Food Packaging, Edited by Takashi Kadoya

(FT612) FERMENTATION TECHNOLOGY

1. **Rationale**: Fermentation Technology is an important branch of Food Industry, involving the production of various fermented foods, such as alcoholic beverages, vinegar, dairy products and also preservation of vegetables and fruits. The technician is required to have knowledge of these processes and types of equipment used for these processes. The subject covers major fermentation processes the equipment used and quality standards for their production. The chapter on mushroom cultivation is included as this is gaining the interest of large number of industrialists.

2. TEACHING AND EXAMINATION SCHEME

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	
FT612 FERMENTATION TECHNOLOGY	3	-	2	5	75	25	25	-	125

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT

	Hrs	Mks
1. GENERAL INTRODUCTION	5	4
Definition of fermentation, respiration, anaerobic respiration. Significance of glycolysis in fermentation. Maintenance and preservation of industrially important cultures. General media used in fermentation. Typical fermentor and its accessories, batch and continuous type.		
2. YEAST MANUFACTURE	4	7
Types of yeast and their uses. Process of manufacture – raw materials, media, starter culture separation of cells, drying. Methods of maintenance, preservation and quality control analysis.		
3. PICKLES	4	9
Introduction, organisms involved, reactions and changes occurring. Role of salt. Brine curing of mango, onion, and cucumber. Salt stock process for sauerkraut. Chemical and biological spoilage. Analysis for acidity and culture.		
4. BEER BREWING	7	10
Introduction, yeast, maintenance and cultivation. Process: raw materials, malting and brewing. Bottling and packaging. By-product from beer fermentation. Analysis for specific gravity, alcohol content, total acidity, reducing sugars, carbon dioxide and foam collapse rate. Quality control standards specific sanitary requirement.		

5. WINE	8	16
Introduction- Types of wines, microbiological aspects, yield of alcohol, effect of temperature, use of sulphur dioxide, yeast nutrition, autolysis de-acidification of wines. Process- Selection of fruits, yeast, fermentation ageing, maturation and bottling, by-products. Analysis- Sensory evaluation – appearance, odour, aroma taste, flavour. Microbiological – check for acetic, lactic acid bacteria, wild yeast and spoilage organisms. Chemical – acidity, alcoholic content, chemical additives, SO_2, benzoate and sorbic acid. Quality control standards for wines e.g. white, red, port, cider and sherry. Specific sanitary requirements.		
6. DISTILLED ALCOHOLIC BEVERAGES	8	9
Introduction – Common types, culture, raw materials. Processing – General process – Mashing, milling, cooking of starch, source. Saccharification with malt enzymes or microbial enzymes. Fermentation, distilling, drying and bottling. Analysis of distilled beverages – Colour, odour, taste, specific gravity, alcohol content .Quality control standards and specific sanitation programme.		
7. VINEGAR	8	13
Introduction – Types of vinegar, mechanism of acetic acid fermentation, organisms used, culturing and maintenance of Acetobacter. Processing- Slow process, Orleans process and quick process. Filtration, clarification, concentration of vinegar, bottling and packaging. Defects of vinegar. Analysis- Acidity, oxidation value, alkaline oxidation value, ester value, colour, odour, taste, flavour. Quality control standards and specific sanitary requirements.		
8. CULTIVATION OF MUSHROOM, SINGLE CELL PROTEIN (SCP)	4	7
Introduction, spawn production, mushroom formation, processing problems – contamination and its control. SCP- Cultivation, harvesting, composition and uses.		
Total	**48**	**75**

4. PRACTICALS

1) Preservation methods of various cultures – on slant, stab method, under wax and in soil.
2) Manufacture of yeast using Wickerham's media.
3) Brine curing of raw mangoes and onions. Microbiological and chemical analysis.
4) Preparation of sauerkraut. Microbiological and chemical analysis.
5) Preparation of wine from grape juice and cashew apple juice. Analysis of wine.
6) Preparation of vinegar from- Pure ethyl alcohol, grape wine, chemical analysis of vinegar.
7) Cultivation of mushrooms in bags using available spawn.
8) Visits to relevant industries.

5. REFERENCE BOOKS

1. Microbiology by Frobisher.
2. Industrial Microbiology by Miller &Litsky W.
3. Industrial Microbiology by Casida L.
4. Industrial Fermentation by Prescott & Dunn.
5. Microbial Technology by Peppler H. S. &Perlmam D.

(FT613) FOOD PROCESSING APPLICATIONS

1. **Rationale**- The aim of this course is to provide an opportunity to the students to apply the principles of Food Processing in the commercial manufacture of processed food product. It will give an exposure to material handling and production techniques on larger scale which would develop their knowledge & skill in the relevant areas of production technology.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
FT613 FOOD PROCESSING APPLICATIONS	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	**125**
	3	**-**	**2**	**5**	**75**	**25**	**25**	**-**	

Minimum passing %: Theory 40% *Duration of theory paper: 3 Hrs.*

Legends:

***L**-Lecture; **T**- Tutorial; **P**-Practical; **C**-Credit; **TH**-End Semester Theory; **TM**– Test Marks:*

***PR/OR** -End Semester Practical / Oral Examinations; **TW-** Term Work*

3. DETAILED COURSE CONTENT

Sl. No	Topic	Hrs	Marks
1.	Baking Technology Requirements of raw material and quality aspects, manufacture of fermented Bakery products like bread , buns ,pizzas Commercial aspects of production of cake biscuits & cookies	16	25
2.	Fruits and Vegetable products Pickle manufacture – Types of pickles , curing of locally available fruits & vegetables, pickle making and shelf life studies Dehydration of fruits & vegetables pre treatment process control, analysis & packaging of dehydrated fruits.	18	25
3.	Indian Traditional Sweets Formulation, process standardisation quality control measures, packaging storage and shelf- life studies.	14	25
	Total	**48**	**75**

Semester: VII

Course code	Name of Course	EXAMINATION SCHEME				Total
		TW		PR/OR		
		Daily Dairy	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
FT701	Food Tech. Training - II	50	50	50	50	Grade

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 detailed report on training. Evaluation will be done on the basis of a seminar and oral examination to be conducted by internal and external examiners.

FOR INDUSTRIAL TRAINING OF VIITH SEMESTER:

1. Grades will be awarded based on marks scored as follows:
   a. 80% and above Marks – Grade 'A'
   b. 60% to 79% Marks – Grade 'B'
   c. 40% to 59% Marks – Grade 'C'
   d. 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.

3. Student with Grade D, under the Head TW, shall be declared T.N.G. and a student whose term is granted but obtains Grade D, under the Head PR/OR, shall be declared Failed/ATKT.

SEMESTER VII

(FT701) FOOD TECHNOLOGY TRAINING-II

1. **RATIONALE**: During the training period, students are expected to work in different established food industries. They will carry out various activities as per the instruction of the industry. Here the students will use the theoretical knowledge and laboratory skills gained in different courses for testing, working of equipments etc. The training helps in bridging the gap between theory and actual practice. The process will also help in improving communication skills, decision-making, managing men, material handling, etc. which are of prime importance for a supervisor.

2. TEACHING AND EXAMINATION SCHEME

Course code & course title	EXAMINATION SCHEME				Total
	TW		PR/OR		
	Daily Dairy	Progressive Assessment	Training Report	Report Assessment & Seminar/Viva	
FT701 Food Technology Training-II	50	50	50	50	Grade

Minimum passing %: 40% .

Legends:

L*-Lecture;* ***T****- Tutorial;* ***P****-Practical;* ***C****-Credit;* ***TH****-End Semester Theory;* ***TM****– Test Marks:*

PR/OR *-End Semester Practical / Oral Examinations;* ***TW-*** *Term Work*

3. COURSE CONTENTS

Students are expected to develop job experience in the following areas of a food processing plant where they are undergoing training.

- Receipt and handling of raw material,
- Storage of raw materials and ingredients,
- Processing and production of the various products in the industry,
- Maintenance of important machinery and equipment,
- Packaging,
- Quality control procedures,
- Sanitation and hygiene procedures being followed,
- Procurement and marketing procedures,
- Water treatment for use in production,
- Waste disposal measures,
- Management aspects of the industry.

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

4. Evaluation Scheme

Unit No.	Marks
	DIARY AND REPORT ASSESSMENT -The Daily-diary and Report prepared shall be assessed by the internal examiner/teacher
	PROGRESSIVE ASSESSMENT- The assessment will be done periodically once a month during training by the industry expert/trainer.
	SEMINAR/VIVA-assessment carried out in the institute by internal examiner along with industry expert (external examiner).