



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)



**Approved by AICTE, Recognized by UGC & Affiliated to Anna University
Accredited by NBA-AICTE, NAAC-UGC with 'A+' Grade**

Saravanampatti , Coimbatore -641035

**CURRICULA AND SYLLABI
REGULATION 2019
CHOICE BASED CREDIT SYSTEM**

DEPARTMENT OF FOOD TECHNOLOGY

B.Tech – FOOD TECHNOLOGY



SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution)
COIMBATORE-35
DEPARTMENT OF FOOD TECHNOLOGY
R 2019 – CURRICULUM
B.TECH FOOD TECHNOLOGY



Description / Semester	AICTE	SNSCT – FT Suggested	Sem 1	Sem 2	Sem 3	Sem 4	Sem 5	Sem 6	Sem 7	Sem 8
Humanities , Social Science and Management Courses (HSMC)	12	21	3	2	4	4	4	2	2	
Basic Science (BSC)	25	24	8	8	3	3			2	
Engineering Science Courses (ESC)	24	21	8	9	2	2				
Professional Core Courses (PCC)	48	65		3	14	17	18	8	3	2
Professional Elective Courses (PEC)	18	9					3	3	3	
Open Elective Courses (OEC)	18	6						3	3	
Project/Seminar/Internship (EEC)	15	24	3	1	1	2	1	2	2	12
Mandatory Courses (MC)	Non Credit									
TOTAL	160	170	22	23	24	28	26	18	15	14

SEMESTER I											
S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	
Theory Courses											
1.	19MAT101	Linear Algebra and Calculus	3	1	0	0	4	4	50/50	BSC	
2.	19MET101	Engineering Drawing	1	0	4	0	5	3	50/50	ESC	
3.	19EET101	Basics of Electrical and Electronics Engineering	3	0	0	0	3	3	50/50	ESC	
Theory Integrated Practical Courses											
4.	19CHB101	Chemistry for Engineers	3	0	2	0	5	4	60/40	BSC	
5.	19ENB101	Communicative English	2	0	2	0	4	3	60/40	HSMC	
6.	19GEB101	Design Thinking and Innovation	1	0	0	4	5	3	100/0	EEC	
Practical courses											
7.	19GEP101	Workshop Practices Laboratory	0	0	4	0	4	2	60/40	ESC	
Mandatory Course											
8.	19HST103	Indian Constitution	2	0	0	0	2	0	100/0	MC	
9.	19HST101	Induction Program								MC	
Total			15/1/12/4				32	22	800		

SEMESTER II											
S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	
Theory Courses											
1.	19ITT101	Programming in C and Data Structures	3	0	0	0	3	3	50/50	ESC	
2.	19MET102	Engineering Mechanics	3	1	0	0	4	4	50/50	ESC	
3.	19FTT101	Fundamentals of Food Processing	3	0	0	0	3	3	50/50	PCC	
Theory Integrated Practical Courses											
4.	19MAB102	Integral Calculus and Laplace Transforms	3	0	2	0	5	4	60/40	BSC	
5.	19PYB103	Physics for Engineers	3	0	2	0	5	4	60/40	BSC	
Practical courses											
6.	19ENP101	Professional Communication	0	0	4	0	4	2	60/40	HSMC	
7.	19ITP101	Programming in C and Data Structures Laboratory	0	0	4	0	4	2	60/40	ESC	
8.	19FTP101	Mini Project - I	0	0	0	2	2	1	100/0	EEC	
Mandatory Course											
9.	19HST102	Environmental Science	2	0	0	0	2	0	100/0	MC	
Total			17/1/12/2				32	23	900		

SEMESTER III												
S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	PRE-REQUISITES	
Theory Courses												
1.	19MAT201	Transforms and Partial Differential Equations	3	0	0	0	3	3	50/50	BSC	19MAT101	
2.	19MET201	Engineering Thermodynamics	3	0	0	0	3	3	50/50	PCC		
3.	19GET275	VQAR-I	2	0	0	0	2	2	50/50	HSMC		
Theory Integrated Practical Courses												
4.	19MEB201	Fluid Mechanics and Machinery	3	0	2	0	5	4	60/40	PCC		
5.	19FTB201	Unit Operations in Food Processing - I	3	0	2	0	5	4	60/40	PCC		
6.	19FTB202	Biochemistry for Food Technology	2	0	2	0	4	3	60/40	PCC		
Practical Courses												
7.	19ITP202	Python Programming	0	0	4	0	4	2	60/40	ESC		
8.	19FTP201	Mini Project - II	0	0	0	2	2	1	100/0	EEC		
9.	19GEP275	Personality Development	1	0	2	0	3	2	60/40	HSMC		
Total			17/0/12/2				31	24	900			

SEMESTER IV											
S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	PRE-REQUISITES
Theory Courses											
1.	19MAT202	Statistics and Numerical Methods	3	0	0	0	3	3	50/50	BSC	19MAT201
2.	19FTT201	Heat and Mass Transfer for Food Products	3	0	0	0	3	3	50/50	PCC	
3.	19FTT202	Food Plant Layout and Management	3	0	0	0	3	3	50/50	PCC	
4.	19GET276	VQAR-II	2	0	0	0	2	2	50/50	HSMC	
5.		Language Elective	1	0	2	0	3	2	60/40	HSMC	
Theory Integrated Practical Courses											
6.	19FTB203	Engineering Properties of Food Materials	2	0	2	0	4	3	60/40	PCC	

7.	19FTB204	Unit Operations in Food Processing -II	3	0	2	0	5	4	60/40	PCC	
8.	19FTB205	Food Microbiology	3	0	2	0	5	4	60/40	PCC	
Mandatory Course											
9.	19FTP202	Internship - I	4 Weeks				2	100/0	EEC		
10	19FTP203	CAD / CAM	0	0	4	0	4	2	60/40	ESC	
Total			20/0/12/0				32	28	1000		

SEMESTER V

S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	PRE-REQUISITES
Theory Courses											
1.	19FTT301	Refrigeration and cold chain Management	3	0	0	0	3	3	50/50	PCC	
2.	19FTT302	Food safety and Quality Regulations	3	0	0	0	3	3	50/50	PCC	
3.	19FTT303	Application of sensors in Food Industry	2	0	0	0	2	2	50/50	PCC	
4.		Professional Elective – I	3	0	0	0	3	3	50/50	PEC	
5.		Career course - I & II						4		HSMC	
Theory Integrated Practical Courses											
6.	19FTB301	Processing of Milk and Milk products	3	0	2	0	5	4	60/40	PCC	
7.	19FTB302	Post Harvest Technology	3	0	2	0	5	4	60/40	PCC	
Practical Courses											
8.	19FTP301	Mini Project –III	0	0	0	2	2	1	100/0	EEC	
9.	19FTP302	SCADA	0	0	4	0	4	2	60/40	PCC	
Total			21/0/8/2				31	26	800		

SEMESTER VI

S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	PRE-REQUISITES
Theory Courses											
1.	19FTT304	Baking and Confectionery Technology	2	0	0	0	2	2	50/50	PCC	
2.	19FTT305	Fruit and Vegetable Technology	2	0	0	0	2	2	50/50	PCC	
3.	19FTT306	Application of Artificial Intelligence in Food Industries	2	0	0	0	2	2	50/50	PCC	
4.		Professional Elective - II	3	0	0	0	3	3	50/50	PEC	
5.		Open Elective - I	3	0	0	0	3	3	50/50	OEC	
6.		Career Course -III						2		HSMC	
Practical Courses											

7.	19FTP303	Baking and Confectionery Technology Lab	0	0	2	0	2	1	60/40	PCC	
8.	19FTP304	Fruit and Vegetable Technology Lab	0	0	2	0	2	1	60/40	PCC	
Mandatory Course											
9.	19HST105	Essence of Indian Traditional Knowledge	2	0	0	0	2	0	100/0	MC	
10	19FTP305	Internship - II	4 Weeks				2	100/0	EEC		
Total			16/0/4/0				20	18	900		

SEMESTER VII											
S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	PRE-REQUISITES
Theory Courses											
1.	19GET277	Biology for Engineers	2	0	0	0	2	2	50/50	BSC	
2.	19FTT401	Food Packaging Technology	2	0	0	0	2	2	50/50	PCC	
3.	19GET201	Professional Ethics and Human Values	2	0	0	0	2	2	50/50	HSMC	
4.		Professional Elective - III	3	0	0	0	3	3	50/50	PEC	
5.		Open Elective - II	3	0	0	0	3	3	50/50	OEC	
Practical courses											
6.	19FTP401	Project - I	0	0	0	4	4	2	60/40	EEC	
7.	19FTP402	Packaging Materials Lab	0	0	2	0	2	1	60/40	PCC	
Total			12/0/2/4				18	15	700		

SEMESTER VIII											
S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category	PRE-REQUISITES
Theory Course											
1.		MOOC / NPTEL	2	0	0	0	2	2	50/50	PCC	
Mandatory Course											
2.	19FTP403	Project – II	0	0	0	24	24	12	60/40	EEC	
Total			2/0/0/24				26	14	200		

Humanities and Social Science Courses

S.No	Course Code	COURSES OFFERED	L	T	P	J	C	Sem
1.	19ENB101	Communicative English	2	0	2	0	3	I
2.	19ENP101	Professional Communication	0	0	4	0	2	II
3.	19GET275	VQAR-I	2	0	0	0	2	III
4.	19GEP275	Personality Development	1	0	2	0	2	III
5.	19GET276	VQAR-II	2	0	0	0	2	IV
	Language Elective							
6.	19GEB202	Hindi	1	0	2	0	2	IV
7.	19GEB203	Japanese						
8.	19GEB204	German						
9.	19GEB205	French						
10.		Career Course- I	4	0	0	0	4	V
11.		Career Course – II						V
12.		Career Course – III						VI
13.	19GET201	Professional Ethics and Human Values	2	0	0	0	2	VII
TOTAL							21	

Basic Science Courses

S.No	Course Code	COURSES OFFERED	L	T	P	J	C	Sem
1.	19MAT101	Linear Algebra and Calculus	3	1	0	0	4	I
2.	19CHB101	Chemistry for Engineers	3	0	2	0	4	I
3.	19MAB102	Integral Calculus and Laplace Transforms	3	0	2	0	4	II
4.	19PYB103	Physics for Engineers	3	0	2	0	4	II
5.	19MAT201	Transforms and Partial Differential Equations	3	0	0	0	3	III
6.	19MAT202	Statistics and Numerical Methods	3	0	0	0	3	IV
7.	19GET277	Biology for Engineers	2	0	0	0	2	VII
TOTAL							24	

Engineering Science Courses

S.No	Course Code	COURSES OFFERED	L	T	P	J	C	Sem
1.	19MET101	Engineering Drawing	1	0	4	0	3	I
2.	19EET101	Basics of Electrical and Electronics Engineering	3	0	0	0	3	I
3.	19GEP101	Workshop Practices Laboratory	0	0	4	0	2	I
4.	19ITT101	Programming in C and Data Structures	3	0	0	0	3	II
5.	19MET102	Engineering Mechanics	3	1	0	0	4	II
6.	19ITP101	Programming in C and Data Structures Laboratory	0	0	4	0	2	II
7.	19ITP202	Python Programming	0	0	4	0	2	III
8.	19FTP203	CAD / CAM	0	0	4	0	2	IV
		TOTAL					21	

Professional Core Courses

S.No	Course Code	COURSES OFFERED	L	T	P	J	C	Sem
1.	19FTT101	Fundamentals of Food Processing	3	0	0	0	3	I
2.	19MET201	Engineering Thermodynamics	3	0	0	0	3	III
3.	19MEB201	Fluid Mechanics and Machinery	3	0	2	0	4	III
4.	19FTB201	Unit Operations in Food Processing - I	3	0	2	0	4	III
5.	19FTB202	Biochemistry for Food Technology	2	0	2	0	3	III
6.	19FTT201	Heat and Mass Transfer for Food Products	3	0	0	0	3	IV
7.	19FTT202	Food Plant Layout and Management	3	0	0	0	3	IV
8.	19FTB203	Engineering Properties of Food Materials	2	0	2	0	3	IV
9.	19FTB204	Unit Operations in Food Processing -II	3	0	2	0	4	IV
10.	19FTB205	Food Microbiology	3	0	2	0	4	IV
11.	19FTT301	Refrigeration and cold chain Management	3	0	0	0	3	V
12.	19FTT302	Food safety and Quality Regulations	3	0	0	0	3	V
13.	19FTT303	Application of sensors in Food Industry	2	0	0	0	2	V
14.	19FTB301	Processing of Milk and Milk products	3	0	2	0	4	V
15.	19FTB302	Post Harvest Technology	3	0	2	0	4	V
16.	19FTP302	SCADA	0	0	4	0	2	V
17.	19FTT304	Baking and Confectionery Technology	2	0	0	0	2	VI
18.	19FTT305	Fruit and Vegetable Technology	2	0	0	0	2	VI
19.	19FTT306	Application of Artificial Intelligence in Food Industries	2	0	0	0	2	VI

20.	19FTP303	Baking and Confectionery Technology Lab	0	0	2	0	1	VI
21.	19FTP304	Fruit and Vegetable Technology Lab	0	0	2	0	1	VI
22.	19FTT401	Food Packaging Technology	2	0	0	0	2	VII
23.	19FTP402	Packaging Materials Lab	0	0	2	0	1	VII
24.		MOOC / NPTEL	2	0	0	0	2	VIII
		TOTAL					65	

Professional Electives

S.No	Course Code	COURSES OFFERED	L	T	P	J	C	Sem
1.		Professional Elective – I	3	0	0	0	3	V
2.		Professional Elective – II	3	0	0	0	3	VI
3.		Professional Elective – III	3	0	0	0	3	VII
		TOTAL					9	

S. No	Course Code	Courses Offered	L	T	P	J	C
Professional Elective - I							
1.	19FTE301	Design of Food processing machinery	3	0	0	0	3
2.	19FTE302	Technology of snack and extruded foods	3	0	0	0	3
3.	19FTE303	Milling Technology	3	0	0	0	3
4.	19FTE304	Food Additives and Nutraceuticals	3	0	0	0	3
5.	19FTE305	Food Preservation	3	0	0	0	3
Professional Elective – II							
1.	19MEE304	Total Quality Management	3	0	0	0	3
2.	19FTE306	Separation Techniques in Food Processing	3	0	0	0	3
3.	19FTE307	Modeling, Simulation and Soft tools for Food Technologists	3	0	0	0	3
4.	19FTE308	Processing of Spices and Plantation crops	3	0	0	0	3
5.	19FTE309	Fundamentals and Applications of Nanotechnology	3	0	0	0	3
Professional Elective – III							
1.	19FTE401	Enzyme Engineering and Technology	3	0	0	0	3
2.	19FTE402	Meat, Fish and Poultry Process Technology	3	0	0	0	3
3.	19FTE403	Food Product Development	3	0	0	0	3
4.	19FTE404	Fermentation Technology	3	0	0	0	3
5.	19FTE405	Food Supply Chain Management	3	0	0	0	3

Open Electives

S.No	Course Code	COURSES OFFERED	L	T	P	J	C
1.	19FTO301	Beverage Technology	3	0	0	0	3
2.	19FTO302	Food Nutrition	3	0	0	0	3
3.	19FTO303	Fruit and vegetable based value added products	3	0	0	0	3
4.	19FTO304	Sensory evaluation of food products	3	0	0	0	3
		TOTAL					6

Employability Enhancement Courses [EEC]

S.No	Course Code	COURSES OFFERED	L	T	P	J	C	Sem	
1.	19GEB101	Design Thinking and Innovation	1	0	0	4	3	I	
2.	19AGP101	Mini Project – I	0	0	0	2	1	II	
3.	19AGP201	Mini Project – II	0	0	0	2	1	III	
4.	19AGP202	Internship - I	2 Weeks					2	IV
5.	19AGP301	Mini Project –III	0	0	0	2	1	V	
6.	19AGP305	Internship - II	2 Weeks					2	VI
7.	19AGP401	Project - I	0	0	0	4	2	VII	
8.	19AGP404	Project - II	0	0	0	24	12	VIII	
		TOTAL					24		

Career Courses (UG)

S.No	Course Code	Courses Offered	Sem	L	T	P	J	C
Track 1 Job (6 Credits)	19GEP375	Technical Interviewing	V Semester	0	0	4	0	2
	19GEB375	Personnel Psychology	V Semester	1	0	2	0	2
	19GEB379	Employable Skill Development	VI Semester	1	0	2	0	2
Track 2 Entrepreneurship (6 Credits)	19GEB376	Entrepreneurship & Business Canvas Model	V Semester	2	0	4	0	4
	19GET376	Economics, Finance & Accounting	VI Semester	1	0	0	0	1
	19GET377	Intellectual Property Rights	VI Semester	1	0	0	0	1
Track 3 Higher Education	19GEB377	Advanced Verbal Quantitative Aptitude & Reasoning	V Semester	2	0	2	0	3

(6 Credits)	19GET375	Networking	V Semester	1	0	0	0	1
	19GEB380	Higher Studies in Abroad & India	VI Semester	1	0	2	0	2
Track 4 Govt. /RRB/ Bank (6 credits)	19GEB378	Foundation Course on Competitive Exams	V Semester	2	0	4	0	4
	19GEB381	Personnel Psychology for Govt Jobs	VI Semester	1	0	2	0	2

MANDATORY NON CREDIT COURSES (UG)

Course Code	Course Title
19GEP101	Workshop practices Laboratory
19GEB101	Design Thinking and Innovation
19HST105	Essence of Indian Traditional Knowledge
19HST103	Indian Constitution
19HST101	Induction Programme
19HST102	Environmental Sciences
19GET275	VQAR– I
19GEP275	Personality Development
19GET276	VQAR – II
19GEB202	Additional Language -Hindi
19GEB203	Additional Language – Japanese
19GEB204	Additional Language – German
19GET201	Professional Ethics and Human Values
19GET277	Biology for Engineers

ONE CREDIT COURSES

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	19FTOC1	3D and 4D printing of food	15	-	-	-	1	-
2.	19FTOC2	Design and formulation of foods	15	-	-	-	1	-
3.	19FTOC3	Ready to Eat Food	15	-	-	-	1	-

SEMESTER I

19MAT101	LINEAR ALGEBRA & CALCULUS	L	T	P	J	C
	(Common to all B.E. / B. Tech. Courses)	3	1	0	0	4
UNIT I	MATRIX EIGEN VALUE PROBLEM					9+3
Determining Eigen values and Eigenvectors – Properties of Eigen values and Eigenvectors - Some applications of Eigen value problems – Eigen value problems arising from population models (Leslie model) – Elastic deformations – Cayley Hamilton Theorem (statement only) and its applications.						
UNIT II	ORTHOGONAL TRANSFORMATION OF REAL SYMMETRIC MATRIX					9+3
Diagonalization of a real symmetric matrix–Quadratic form– Canonical form – Nature of the quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation – Some Applications: Transformation to Principal axes- Conic sections – Solving first order linear system using diagonalization.						
UNIT III	APPLICATIONS OF DIFFERENTIAL CALCULUS					9+3
Radius of Curvature in Cartesian co-ordinates – Centre and circle of curvature in Cartesian co-ordinates – Evolutes – Envelopes.						
UNIT IV	FUNCTIONS OF SEVERAL VARIABLES					9+3
Partial derivatives –Total derivatives – Jacobians – Taylor’s expansion of functions of two variables – Errors and Approximations – Maxima and Minima of functions of two variables – Lagrange’s method of undetermined multipliers.						
UNIT V	SECOND ORDER LINEAR ORDINARY DIFFERENTIAL EQUATIONS					9+3
Homogeneous Linear ODEs with constant coefficients – Linear ODE with variable coefficients - Cauchy’s and Legendre’s Equations – Method of variation of parameters – Methods of undetermined coefficients - Applications: Modelling of Free Oscillations of a Mass-Spring system.						
L : 45 T:15 P: 0 J: 0 Total: 60 PERIODS						

TEXT BOOKS

- 1 B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015.
2. James Stewart, Calculus, 7th Edition, Cengage Learning, 2012.

REFERENCES

- 1 Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2018.
- 2 Howard Anton, Elementary Linear Algebra, 11th Edition, Wiley, 2013.
- 3 David C Lay, Linear Algebra and its applications, Pearson, 2018.
- 4 G.B.Thomas, Calculus, 12th Edition, Pearson Education India, 2015.
- 5 T.Veerarajan, Engineering Mathematics, 3rd Edition, Tata McGraw-Hill, New Delhi, 2011.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about Eigen values and Eigen vectors and its role in the system of equations.
- CO2** Transform the real symmetric matrix from quadratic form to canonical form by means of orthogonal transformation.
- CO3** Determine the radius, centre and circle of curvature of any curve.
- CO4** Expand the given function as series and locate the maximum and minimum for multivariate function and also using mathematical software.
- CO5** Solve the second order linear differential equations with various methods and apply them in some physical situations.

19MET101

ENGINEERING DRAWING
(Common to all Non Circuit Branches)

L T P J C
1 0 4 0 3

UNIT I PROJECTION OF POINTS, LINES AND PLANE SURFACES 3+12

Projection of points - Projection of straight lines located in the first quadrant -Determination of true lengths and true inclinations - Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT II PROJECTION OF SOLIDS 3+12

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method

UNIT III SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 3+12

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other -Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids -Prisms, pyramids, cylinders and cones.

UNIT IV PICTORIAL PROJECTIONS AND FREE HAND SKETCHING 3+12

Principles of isometric projection -isometric scale -isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray method (Not for Examination).

Free hand sketching:

Representation of Three Dimensional objects -Need for importance of multiple views and their placement -First angle projection -layout views -Developing visualization skills through free hand sketching of multiple views from pictorial drawing.

UNIT V BUILDING DRAWING 3+12

Drawing of a plan, Elevation and sectioning of security room and residential building (Two bed rooms, kitchen, hall, etc.)

L : 15 T: 0 P: 60 J: 0 Total: 75 PERIODS

TEXT BOOKS

1. N.D. Bhatt and V.M. Panchal, "Engineering Drawing", Charotar Publishing House, 53rd Edition,2016.
2. K. R. Gopalakrishnan, "Engineering Drawing" (Vol.I & II), Subhas Publications,2014.

REFERENCES

- 1 K.V.Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai ,2015.
- 2 M.S.Kumar, "Engineering Graphics", D.D. Publications, 2011.
- 3 K.Venugopal & V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited ,2014.
- 4 M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education ,2011.
- 5 K.L. Narayanan and P. Kannaiah, "Engineering Drawing" SciTech Publications, 2nd edition, 2012.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Sketch the projections of a points, straight lines and plane surfaces.
- CO2** Illustrate top view and front view of the solids
- CO3** Sketch sectioned views and develop area required.
- CO4** Demonstrate knowledge about isometric, perspective and orthographic projections
- CO5** Design simple buildings with detailed plan and sectional elevation.

19EET101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	J	C
	(Common to all Non circuit branches)	3	0	0	0	3
UNIT I	ELECTRICAL CIRCUITS & MEASUREMENTS				9	
Elementary concepts of electric circuits - Ohm's Law – Kirchoff's Laws – Introduction to AC Circuits – Peak value and RMS values – Power and Power factor						
Operating Principles of Moving coil and Moving iron instruments (Ammeters and Voltmeters), Dynamometer type wattmeter, Energy meter						
UNIT II	ELECTRICAL MACHINES				9	
Construction, Principle of operation, Basic equations and applications of DC Generator, DC Motor- Elementary treatment of Single phase Transformer , Single and three phase Induction Motors						
UNIT III	WIRING, GROUNDING AND SAFETY				9	
Wiring: General Rules, materials and accessories, Types of wiring - Conduit wiring – Wiring layout of Residential building, Grounding: Importance of grounding, Types of grounding - Safety: Causes of accidents, Accident prevention.						
Design of residential wiring using DT concept.						
UNIT IV	ANALOG ELECTRONICS				9	
Construction, working principle and VI characteristics of Diode, Zener diode, BJT, MOSFET, Applications: Half wave and Full wave Rectifiers , Voltage regulators, UPS						
UNIT V	LINEAR AND DIGITAL ELECTRONICS				9	
Ideal OP-AMP characteristics, Inverting and Non-inverting Amplifiers, Applications: summer, clipper and clamper						
Boolean Algebra-Theorems-Logic Gates - Half Adder and Full Adders - Flip flops, A/D and D/A Conversion (Any one concept)						

L : 45 T: 0 P:0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Muthusubramanian R, Salivahanan S, “Basic Electrical and Electronics Engineering”, Tata McGraw Hill Publishers,(2009).
2. Bhattacharya. S.K, “Basic Electrical and Electronics Engineering”, Pearson Education, (2017).

REFERENCES

- 1 V. Mittle “Basic Electrical Engineering”, Tata McGraw Hill Publishers, (2017)
- 2 Mehta V K, Mehta Rohit, “Principles of Electrical Engineering and Electronics”, S.Chand & Company Ltd, (2010)
- 3 Black & Decker , “The complete guide to Electrical Wiring” , S.Chand & Company Ltd,(2012)
- 4 Nagrath. I.J, “Electronics: Analog and Digital”, Prentice Hall India Pvt. Ltd., (2013),
- 5 Mehta V K, Mehta Rohit, “Principles of Electronics”, S.Chand & Company Ltd, (2005)

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Familiarize the elementary concept of electric circuits and measuring instruments
- CO2** Understand the construction , operation and applications of electrical machines
- CO3** Apply the concept of wiring and acquire the importance of grounding and safety
- CO4** Gain knowledge on electronic devices and its applications
- CO5** Acquire knowledge on basics of linear and digital electronics

10. Estimation of Iodine in common salt by Iodometry

L :45 T: 0 P: 30 J: 0 T:75 PERIODS

TEXT BOOKS

- 1 O.G.Palanna, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi.2017.
2. Wiley, "Engineering Chemistry", John Wiley & Sons, Inc, USA (2014]

REFERENCES

- 1 B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2009).
- 2 R. Sivakumar and N Sivakumar, "Engineering Chemistry" Tata McGraw-Hill, Pub.Co.Ltd. New Delhi.2009
- 3 Dr.Sivanesan and Nandagopal, "Engineering Chemistry-I" V.K.Pub.Pvt.Ltd. 2011.
- 4 P.C.Jain & Monicka Jain, "Engineering Chemistry" ,Dhanapat Rai Publishing Company Pvt.Ltd. 2017.
- 5 Engineering chemistry (NPTEL e-Web book) by B.L.Tembe, Kamaluddin and M.S.Krishnan

COURSE OUTCOMES :

At the end of the course student should be able to:

- CO1** Develop new strategy for protection of metals and to improve engineering design
- CO2** Design environmentally benign method for nanoparticle synthesis
- CO3** Acquire knowledge on various types of fuels and applications of engineering materials.
- CO4** Develop innovative and eco-friendly method for water purification .
- CO5** Develop analytical proficiency through lab skill sets to demonstrate in professional practice

19GEP101	WORKSHOP PRACTICES LABORATORY	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	0	0	4	0	2

LIST OF EXPERIMENTS

GROUP A (CIVIL & MECHANICAL)	30
CIVIL ENGINEERING	12
Study of plumbing tools and Components	
Preparation of threads in pipes	
Preparation of single and multi-tap connections for domestic	
Study of carpentry tools and its applications	
Preparation of Cross Lap and Dove Tail Joints.	
MECHANICAL ENGINEERING	18
Study of different types of Welding and its applications	
Preparation of Butt, Lap and Tee joints	
Study of sheet metal and its applications	
Preparation of Rectangular, Square Trays and Funnel	
Demonstration of Lathe and Drilling Operations	
Demonstration of Smithy and Foundry tools.	
GROUP B (ELECTRICAL AND ELECTRONICS)	30
ELECTRICAL ENGINEERING PRACTICE	18
Residential house wiring using switches, fuse, miniature circuit breaker, indicator, Lamp and energy meter.	
Fluorescent lamp wiring.	
Stair-case wiring.	
Measurement of electrical quantities –voltage, current, power & power factor in RL Circuit.	
Measurement of energy using single phase energy meter.	
Measurement of insulation resistance to earth of electrical equipment.	
Measurement of single and three phase voltages.	
Study of Iron Box, Emergency Lamp and Fan.	
ELECTRONICS ENGINEERING PRACTICE	12
Study of Electronic components and equipments –Resistor, color coding, measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.	
Verification of logic gates: AND, OR, Ex-OR and NOT.	
Generation of Clock Signal.	
Soldering practice –Components Devices and Circuits Using general purpose PCB.	
Characteristics of a PN Junction diode	

L : 0 T: 0 P: 60 J: 0 Total:60 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Demonstrate plumbing system and Carpentry for the required applications.
- CO2** Relate the basic machining operations with engineering problems.
- CO3** Apply different types of Welding processes and Sheet metal processes for the Industrial applications.
- CO4** Illustrate Residential House wiring and simple wiring circuits.
- CO5** Employ knowledge on measuring electrical quantities and usage of energy meters.

19HST103	INDIAN CONSTITUTION	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	2	0	0	0	0

UNIT I INTRODUCTION 6

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT 6

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT 6

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS 6

Indian Federal System – Center – State Relations – President’s Rule – Constitutional Amendments – Constitutional Functionaries – Assessment of working of the Parliamentary System in India.

UNIT V ELECTION COMMISSION 6

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

L :30 T: 0 P: 0 J: 0 T:30 PERIODS

TEXT BOOKS

- 1 Durga Das Basu, “Introduction to the Constitution of India”, Prentice Hall of India, New Delhi.
- 2 R.C.Agarwal, “Indian Political System”, S.Chand and Company, New Delhi. (1997)

REFERENCES

- 1 Maciver and Page, “ Society: An Introduction Analysis “, Mac Milan India Ltd., New Delhi.
- 2 K.L.Sharma, “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, New Delhi. (1997)
- 3 Sharma, Brij Kishore, “Introduction to the Constitution of India”, Prentice Hall of India, New Delhi.
- 4 U.R.Gahai, “Indian Political System”, New Academic Publishing House, Jalaendhar.
- 5 R.N. Sharma, “Indian Social Problems”, Media Promoters and Publishers Pvt. Ltd.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Understand the functions of the Indian government
- CO2** Know the structure and functioning of central government.
- CO3** Understand functioning of Indian constituent.
- CO4** Analyze the functions of the Indian government
- CO5** Summarize the functioning of election commission.

STRUCTURE FOR STUDENT INDUCTION PROGRAM**STUDENT INDUCTION PROGRAM - PURPOSE & CONCEPT**

Purpose of the Student Induction Program is to help new students adjust and feel comfortable in the new environment, inculcate in them the ethos and culture of the institution, help them build bonds with other students and faculty members, and expose them to a sense of larger purpose and self exploration. The term induction is generally used to describe the whole process whereby the incumbants adjust to or acclimatize to their new roles and environment. In other words, it is a well planned event to educate the new entrants about the environment in a particular institution, and connect them with the people in it. Student Induction Program engages with the new students as soon as they come into the institution; regular classes start only after that. At the start of the induction, the incumbants learn about the institutional policies, processes, practices, culture and values, and their mentor groups are formed. Then the different activities start, including those which are daily.

Here is a list of activities:

- Physical Activity
- Creative Arts and Culture
- Mentoring & Universal Human Values
- Familiarization with College, Dept./Branch
- Literary Activity
- Proficiency Modules
- Lectures & Workshops by Eminent People
- Visits in Local Area
- Extra-Curricular Activities in College
- Feedback and Report on the Program

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. These are included under Proficiency Modules.

There will be a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

DAILY ACTIVITY

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

PHYSICAL ACTIVITY

This would involve a daily routine of physical activity with games and sports. There would be games in the evening or at other suitable times according to the local climate. These would help develop team work besides health. Each student could pick one game and learn it for the duration of the induction program and hopefully, continue with it later.

CREATIVE ARTS

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, music, dance, pottery, sculpture etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

MENTORING AND UNIVERSAL HUMAN VALUES

Mentoring and connecting the students with faculty members is the most important part of student induction. Mentoring takes place in the context and setting of *Universal Human Values*. It gets the student to explore oneself and experience the joy of learning, prepares one to stand up to peer pressure and take decisions with courage, be aware of relationships and be sensitive to others, understand the role of money in life and experience the feeling of prosperity. Need for character building has been underlined by many thinkers, universal human values provide the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but by getting the students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the Induction program. Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

OTHER ACTIVITY

Activities that are not there on a daily basis, but are conducted for 3-4 days (typically in the afternoons) and change thereafter.

FAMILIARIZATION WITH COLLEGE, DEPARTMENT/BRANCH

The incoming students should be told about the credit and grading system, and about the examinations. They should be informed about how study in college differs from study in school. They should also be taken on a tour of the college and shown important points such as library, canteen, and other facilities. They should be shown their department, and told what it means to get into the branch or department. Describe what role the technology related to their department plays in society and after graduation what role the student would play in society as an engineer in that branch. A lecture by an alumnus of the Dept. would be very helpful in this regard. They should also be shown the laboratories, workshops and other facilities. The above should be done right in the first two days, and then over the afternoons thereafter, as appropriate.

LITERARY ACTIVITY

Literary activity would encompass reading a book, writing a summary, debating, enacting a play etc.

PROFICIENCY MODULES

The induction program period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

LECTURES & WORKSHOPS BY EMINENT PEOPLE

Lectures by eminent people should be organized, say, once a week. It would give the students exposure to people who are eminent, in industry or engineering, in social service, or in public life. Alumni could be invited as well. Motivational lectures about life, meditation, etc. by Ramakrishna Mission, Art of Living, Vivekananda Kendra's, S-VYASA, etc. may be organized. Workshops which rejuvenate or bring relief to students would also be welcome, such as, Art of Living workshops (3 sessions, 9 hours).

VISITS IN LOCAL AREA

A couple of visits to the local landmarks including historical monuments should be organized. This would familiarize the students with the area together with bonding with each other, like in a picnic. Visits should also be organized to a hospital, orphanage or a village. These would expose them to people in suffering or to different lifestyles. This might also sensitize them to engineering needs in these areas.

EXTRA-CURRICULAR ACTIVITIES IN COLLEGE

The new students should be introduced to the extra-curricular activities at the college university. They should be shown the facilities and informed about activities related to different clubs etc. This is when selected senior students involved in or leading these activities can give presentations, under faculty supervision.

FEEDBACK AND REPORT ON THE PROGRAM

Students should be asked to give their mid-program feedback. They should be asked to write their opinions about the program at the end of the first week or so. The feedback should be used to make any mid-course correction, if any. Finally, at the end of the program, each group (of 20 students) should be asked to prepare a single report on their experiences of the program. On the second last day, each group should present their report in front of other groups. Immediately after their presentation, they should submit their written report. This will also serve as a closure to the program. Finally, a formal written or online anonymous feedback should be collected at the end of the program.

SEMESTER II

19ITT101	PROGRAMMING IN C AND DATA STRUCTURES	L	T	P	J	C
	(Common to Aero, Agri, Auto, Civil, FT, Mech, MCT)	3	0	0	0	3
UNIT I	INTRODUCTION TO C					8
	Basic blocks of computers – Algorithm, Pseudo code, Flowchart - Structure of C program- Data types - Variables - Constants, Operators - Input and Output Statements					
UNIT II	DECISIONS STATEMENTS AND FUNCTIONS					11
	Decision making and Branching statements - Looping statements, Functions, Call by value, Call by reference					
UNIT III	ARRAYS AND INTRODUCTION TO DATA STRUCTURES					10
	Arrays - One dimensional arrays - Two dimensional Arrays - Structures – Pointers Introduction to Data structures - Types of Data structures - ADT					
UNIT IV	STACK AND QUEUE					9
	Stack ADT - Queue ADT - Array implementation of Queue and Stack ADT - Infix to Postfix conversion - Postfix expression evaluation					
UNIT V	TREES					7
	Trees - Binary Tree - Binary Search Tree - Insertion and Deletion Operation - Tree Traversal					
	L : 45 T: 0 P:0 J: 0 Total: 45 PERIODS					

TEXT BOOKS

- 1 Kamthane Ashok, "Programming in C, Pearson Education India 3/e, 3rd Edition, 2015.
- 2 Aaron M. Tenenbaum, Yedidiah Langsam, Moshe Augenstein, "Data Structures Using C", Prentice-Hall of India, 2003

REFERENCES

- 1 A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, 2nd Edition, 2007. (Unit III-V)
- 2 A. M. Tenenbaum, Y. Langsam and M. J. Augenstein, "Data Structures using C", Pearson Education, 2nd Edition, 1998.(Unit III-V)
- 3 E. Balagurusamy, "Fundamentals of Computing and Computer Programming", Tata McGraw-Hill Publishing Company Limited, (2011). (UNIT I, II)

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand and describe the role of front-end development in modern web applications
- CO2** Act like a professional front-end developer.
- CO3** Able to analyze problems, seek for needed information, apply a solution, verify it
- CO4** See the alternative ways for creating a front-end
- CO5** Able to discuss and take into use more front-end technologies.

19MET102	ENGINEERING MECHANICS	L	T	P	J	C
	(Common to All Non Circuit Branches)	3	1	0	0	4
UNIT I	BASICS & STATICS OF PARTICLES					9+3
Introduction -Units and Dimensions -Vectorial representation of forces and moments -Coplanar Forces -Laws of Mechanics -Lame's theorem, Parallelogram and triangular Law of forces - Resolution and Composition of forces -Equilibrium of a particle - Principle of transmissibility - Single equivalent force - Free body diagram						
UNIT II	EQUILIBRIUM OF RIGID BODIES					9+3
Types of supports and their reactions -requirements of stable equilibrium -Moments and Couples- Moment of a force about a point and about an axis -Vectorial representation of moments and couples - Scalar components of a moment -Varignon's theorem -Equilibrium of Rigid bodies in two dimensions -Forces in space -Equilibrium of a particle in space - Equivalent systems of forces - Equilibrium of Rigid bodies in three dimensions -Examples						
UNIT III	PROPERTIES OF SURFACES AND SOLIDS					9+3
Determination of centroid of areas, volumes and mass - Pappus and Guldinus theorems - moment of inertia of plane and areas- Parallel axis theorem and perpendicular axis theorem, radius of gyration of area- product of inertia- mass moment of inertia.						
UNIT IV	DYNAMICS OF PARTICLES					9+3
Displacements, Velocity and acceleration, their relationship - Relative motion -Curvilinear motion - Newton's law -Work Energy Equation of particles -Impulse and Momentum -Impact of elastic bodies.						
UNIT V	FRICTION AND RIGID BODY DYNAMICS					9+3
Friction force - Laws of sliding friction - equilibrium analysis of simple systems with sliding friction - wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.						
		L : 45	T: 0	P: 15	J: 0	Total: 60 PERIODS

TEXT BOOKS

1. Ferdinand P.Beer, E.Russell Johnston Jr "Vector Mechanics for Engineers", 11th Edition, McGraw-Hill Education, (India) Pvt Ltd, 2016.
2. J.L.Meriam & L.G. Karidge, "Engineering Mechanics: Dynamics", 8th edition, Wiley student edition, 2016.

REFERENCES

- 1 Vela Murali, "Engineering Mechanics", Oxford University Press ,2010
- 2 D.P.Sharma "Engineering Mechanics", Dorling Kindersley (India) Pvt. Ltd, New Delhi,2010.
- 3 Dr.I.S Gujral "Engineering Mechanics",Second edition, , Lakshmi Publication (P).Ltd,2011.
- 4 Arthur P.Boresi and Richard J.Schmidt, "Engineering Mechanics : Statics and Dynamics",Thomson Asia Private Limited, Singapore, 2010.
- 5 Hibbeler, R.C., "Engineering Mechanics", 14th edition, Prentice hall ,2016.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Recognize the basics of equilibrium of particles in 2D and 3D
- CO2** Review the requirements of equilibrium of rigid bodies in 2D and 3D
- CO3** Compute the center of mass and moment of inertia of surfaces and solids
- CO4** Predict displacement, velocity and acceleration of dynamic particles
- CO5** Solve for friction force and rigid body dynamics

19FTT101

**FUNDAMENTALS OF FOOD
PROCESSING**

L T P J C

3 0 0 0 3

UNIT I PROCESSING OPERATIONS

11

Post-harvest losses in field crops – cleaning –Wet and Dry cleaning, Air screen cleaners. Peeling – Flash steam, knife, Abrasion, Caustic and flame peeling. Grading and Sorting – Principles, Types and equipment. Moisture content – free moisture, bound and unbound moisture. Equilibrium moisture content – determination methods, models, Importance and hysteresis effect. Water activity and its importance

UNIT II DRYING

11

Theory and mechanism of drying – drying characteristics of material. Psychrometric chart – application. Thin layer and deep bed drying. Methods of drying agricultural materials – batch and continuous drying. Drying equipment design and performance of various drying equipments

UNIT III TYPES OF DRYERS

10

Tunnel Dryer, Belt Dryer, Drum Dryer, Spray Dryer, Fluidized Bed Dryer, Spouted bed Dryer, Pneumatic Dryer, Rotary Dryer, Vacuum Drying, Freeze Drying, Heat pump drying, Di-electric drying and Micro wave drying

UNIT IV PRESERVATION BY HEATING

6

Methods of applying heat to food – Blanching, Pasteurization, Sterilization. Thermal death time relations (D, Z and F values). Process calculation : General method, Ball's formula method. Sterilization – methods and equipment. UHT sterilization.

UNIT V PRESERVATION BY COOLING

7

Chilling – equipments, cold storage. Freezing – Thermodynamics of food freezing, Phase diagram, Ice crystals formation, Properties of frozen foods. Freezing time calculations, Freezing equipments. Freeze concentration

L :45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 P.J. Fellows, Food processing Technology: Principles and practice, Second edition, Wood head publishing limited, Cambridge,2009.
- 2 Sahay K.M. and Singh K.K., - Unit Operations of Agricultural Processing, 2nd Edition, Vias Publishing House Pvt. Ltd. New Delhi, 2012

REFERENCES

- 1 R.L. Earle, Unit Operations in Food Processing, Pergamon Press, New York,1989
- 2 Paul Singh R. and Dennis R. Heldman, -Introduction to Food Process Engineering, 5th Edition, Academic Press, USA,2014
- 3 James G Brennan – Food Processing Handbook 2nd Edition, Wiley VCH, Weinheim 2011

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Adapt specific pre-processing operations and estimate the moisture content of food materials
- CO2** Infer the concepts of food drying
- CO3** Classify the dryers and illustrate the working of dryers
- CO4** Appraise the techniques of preservation by heating
- CO5** Elaborate the techniques of preservation by cooling

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Evaluate area and volume in Cartesian coordinates using double and triple integrals and also using mathematical software.
- CO2** Evaluate gradient, divergence and curl and solve engineering problems involving cubes, rectangular parallelepipeds by applying various integral theorems. Apply mathematical software to find gradient, divergence and curl.
- CO3** Test the analyticity, construct the analytic function and transform complex functions from z-plane to w-plane graphically by using conformal mapping.
- CO4** Evaluate real and complex integrals over suitable closed path using various integral theorems.
- CO5** Apply Laplace transform techniques, transform functions in time domain to frequency domain and solve ordinary differential equation by using mathematical software.

UNIT I CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures.

UNIT II QUANTUM PHYSICS 9

Black body radiation – Planck’s theory (derivation) – Deduction of Wien’s displacement law and Rayleigh – Jean’s Law from Planck’s theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Physical significance of wave function - Schrödinger’s wave equation – Time independent and time dependent equations– Particle in a one dimensional box –Electron microscope-Tunnelling electron microscope.

UNIT III ELASTICITY 9

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT IV NON-DESTRUCTIVE TESTING 9

Introduction- Types of defects-Methods of NDT-Visual inspection- Liquid/Dye penetrant testing- Magnetic particle testing-Eddy current testing- Ultrasonic inspection method-Advantages-X-Ray radiography- X-ray fluoroscopy-Comparison of conventional and real time radiography.

UNIT V VACUUM TECHNOLOGY 9

Introduction-Units of Vacuum- Vacuum ranges- Production of Vacuum- Classification of Vacuum pumps-Rotary Oil pumps-Diffusion oil pump-turbomolecular pump-cryopumps-Vacuum gauges-thermocouple gauge- vacuum technology-Application of vacuum-High vacuum systems- Thin film deposition.

LIST OF EXPERIMENTS(ANY FIVE)

1. Determination of Young’s modulus of the material – uniform bending.
2. Tensional Pendulum - determination of rigidity modulus of wire and moment of inertia of disc.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4. Determination of viscosity of liquid – Poiseuille’s method.
5. Determination of thickness of a thin wire – Air wedge method.
6. Determination of Band gap of semiconductor material.

L :45 T: 0 P: 30 J: 0 T: 75 PERIODS**TEXT BOOKS**

- 1 Gaur R.K. And Gupta S.L, “Engineering Physics”, Dhanpat Rai publishers, 2013
- 2 Dr.M.N.Avandhanulu, Dr.P.G.Kshirsagar, “A Text book of Engineering Physics”, S.Chand,

REFERENCES

- 1 Rajendran.V, Engineering Physics,Tata Mcgraw-Hill Publishing Company Limited, New Delhi.2017
- 2 Engineering Physics, Wiley, 2013
- 3 A.S.Vasudeva, “Modern Engineering Physics”, S.Chand, 2001
- 4 B.K.Pandey Chaturvedi, “Engineering Physics”, Cengage Learning, 2012
- 5 Charles Kittel, “Solid State Physics”, Wiley(2009),

COURSE OUTCOMES :

At the end of the course student should be able to:

- CO1** Understand the properties of the crystalline materials.
- CO2** Understand the basics of quantum mechanics
- CO3** Analyze the elastic properties of the materials.
- CO4** Understand various Non-Destructive testing methods.
- CO5** Understand various Non-Destructive testing methods.

19ENP101	PROFESSIONAL COMMUNICATION	L	T	P	J	C
	(Common to all B.E. / B. Tech. Courses)	0	0	4	0	2
UNIT I	INTRODUCTION TO COMMUNICATION					10
	Introduction to communication, The process of communication, Barriers to communication – Verbal & Nonverbal communication, Body language.					
UNIT II	READING AND LISTENING SKILLS					10
	Reading and Summarizing – Precis writing – Phrase Reading – Listening to TED Talks – Listening to conversations.					
UNIT III	PROFESSIONAL WRITING					10
	Resume & cover letter – Proposal writing (Project/Business proposal) - Business Letter (Quotations, Clarification, Placing orders & Complaint letter).					
UNIT IV	SPEAKING					15
	Persuasive Speaking – Public Speaking – Negotiation Skills – Telephone Etiquettes – Group Discussion - Team building – Interview skills.					
UNIT V	SOFT SKILLS					15
	Time Management - Stress Management – Inter & Intra personal skills – Professional ethics - Professional Networking & Social Skill.					

L : 0 T: 0 P:60 J: 0 Total: 60 PERIODS

TEXT BOOKS

- 1 Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi, 2011.
2. Professional Communication - Aruna Koneru—Oxford University Press, New Delhi.

REFERENCES

- 1 A Modern Approach to Verbal and Non-verbal Reasoning-R.S.Agarwal- S.Chand & Co., New Delhi.
- 2 Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007.
- 3 Mitra K. Barun, “ Effective Technical Communication – A Guide for Scientists and Engineers”, Oxford University Press, New Delhi, 2006.
- 4 Jeff Butterfield, “Soft skills for everyone”, Cengage Learning, New Delhi, 2011.
- 5 Leo Jones, Richard Alexander, New International Business English, updated Edition, Cambridge University Press, NY, USA.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Perceive the importance of verbal and non-verbal communication in the professional world along with its uses.
- CO2** Develop reading skills and listening skills by familiarizing them with different strategies.
- CO3** Acquire letter writing skills for effective communication both in formal and informal situations.
- CO4** Speak clearly, confidently, comprehensively, and communicate with one or many listeners using appropriate communicative strategies.
- CO5** Face the challenges of the globalized world with confidence and with the best communicative skills.

19ITP101	PROGRAMMING IN C AND DATA STRUCTURES LABORATORY	L	T	P	J	C
	(Common to Aero, Agri, Auto, Civil, FT, Mech,MCT)	0	0	4	0	2

LIST OF EXPERIMENTS

1. Algorithms and Flow Chart
 - i) Sequential
 - ii) Branching and Looping
2. Operators & Expressions
 - i) Arithmetic
 - ii) Logical
 - iii) Relational
3. Condition Statements
 - i) Nested if else
 - ii) Else-if Ladder
4. Looping
 - i) For
 - ii) While
 - iii) Do-while
5. Functions
 - i) With and without arguments
 - ii) With and without return type
 - iii) Call by value and Call by reference
6. Arrays
 - i) Searching element in one dimensional array
 - ii) Matrix multiplication
7. Structures
8. Pointers
9. Implementation of Stack ADT
10. Implementation of Queue ADT
11. Implementation of Tree Traversal
12. Implementation of Binary Search Tree ADT

L :0 T: 0 P: 60 J: 0 Total:60 PERIODS

HARDWARE / SOFTWARE REQUIRED

(For a Batch of 30 Students)

- | | |
|-----------------|---|
| Hardware | <ul style="list-style-type: none"> • 30 PCs with Processor-2.0 GHz orHigher • RAM-1 GB orHigher • Hard disk-20 GB orHigher |
| Software | <ul style="list-style-type: none"> • TURBO C version 3 (or) GCC version3.3.4 • OS-Windows2000/WindowsXP/NT |

COURSE OUTCOMES

At the end of the course students should be able to

- CO 1:** develop algorithm and draw flow chart to solve problem.
- CO 2:** write simple programs using basic concepts and control statements in C language.
- CO 3:** write programs using arrays, structures and pointers.
- CO 4:** implement stack and queue data structure
- CO 5:** implement binary search tree ADT

19FTP101

MINIPROJECT - I

L	T	P	J	C
0	0	0	2	1

LIST OF EXPERIMENTS

A batch of four students will carry out the mini project on emerging areas of Food Technology under the guidance of a faculty. The project outlines the involvement of the students to utilize the knowledge of Mathematics, Science and Engineering for different applications in Food Technology. Three reviews will be conducted throughout the semester and a combined project report to be submitted along with a viva voce for the end semester evaluation.

L : 0 T : 0 P : 0 J : 30 Total:30 PERIODS

19HST102	ENVIRONMENTAL SCIENCE	L	T	P	J	C
	(Common to all B.E / B.Tech)	2	0	0	0	0
UNIT I	ECOSYSTEM					6
Ecosystem- Foodchains, Foodwebs and Ecological pyramids - (a) Forest ecosystem (b) Aquatic ecosystems (Ponds & Oceans). Field study of simple ecosystems– pond, river, hill slopes.						
UNITII	BIODIVERSITY					6
Introduction to biodiversity– Values of biodiversity– threats to biodiversity–endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds, etc.,						
UNIT III	ENVIRONMENTALPOLLUTION					6
Definition–causes, effects and control measures of:(a) Air pollution(b) Water pollution (c) Soil pollution (d) Noise pollution (e) Nuclear hazards.Field study of local polluted site–Urban/ Rural / Industrial/ Agricultural.						
UNIT IV	ENERGY RESOURCES					6
Introduction – (a) Solar energy (b) Wind energy (c) Tidal energy (d) Geothermal energy (e) Nuclear Energy Field study of local area.						
UNIT V	ENVIRONMENTAL MANAGMENT					6
Sustainable development - Role of information technology in environment and human health – environmental protection Acts -Solid waste management and Rain water harvesting - E -waste and Concepts of Green Chemistry-Radiation hazards- Case studies.						
		L :30	T: 0	P: 0	J: 0	T: 30 PERIODS

TEXT BOOKS

- 1 Dr.A.Ravikrishnan, “Environmental Science &Engineering”Sri Krishna Hitech Pub.Co.Pvt.Ltd.2013
2. Benny Joseph, “Environmental Science & Engineering” Tate McGraw-Hill Pub.Co.Ltd, New Delhi.2009

REFERENCES

- 1 G.Tyler Miller, “Environmental Science” Cengage Learning India Pvt.Ltd.New Delhi.2011
- 2 Dr.DebangSolanki, “Principles of EnvironmentalChemistry” Prateeksha Pub. Jaipur.2011.
- 3 Gilbert M. Masters and Wendell. P.Ela, “Introduction to EnvironmentalEngineering and Science” PHI Learning Pvt. Ltd. New Delhi.2010
- 4 Deeksha Dave and S.S. Katewa, “Environmental Science & Engineering” Learning India Pvt.Ltd.New Delhi.2011
- 5 Benny Joseph “Environmental Science & Engineering” Tata McGraw-Hill Pub.Co.Ltd, New Delhi. 2009

COURSE OUTCOMES :

At the end of the course student should be able to:

- CO1** Gain basic knowledge of Ecosystem.
- CO2** Understand the role and conservation of biodiversity
- CO3** Gain competency in solving environmental issues of pollution
- CO4** Adopt the methodologies in find the changes in renewable energy
- CO5** Understand the development and improvement in standard of living has led to serious Environmental management.

SEMESTER III

19MAT201	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	J	C
	(Common to all B.E. / B. Tech. Courses)	3	0	0	0	3
UNIT I	FOURIER SERIES					9
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.						
UNIT II	FOURIER TRANSFORMS					9
Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.						
UNIT III	PARTIAL DIFFERENTIAL EQUATIONS					9
Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second order with constant coefficients (Homogeneous Problems).						
UNIT IV	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS					9
Classification of partial differential equations - Solutions of one dimensional wave equation – One dimensional equation of heat Conduction – Steady state solution of two-dimensional equation of heat conduction (Excluding Infinite plate & Insulated edges).						
UNIT V	Z -TRANSFORMS					9
Z-transforms – Elementary properties – Inverse Z - Transform – Convolution theorem – Formation of difference equation – Solution of difference equations using z-transforms.						
		L : 45	T:0	P: 0	J: 0	Total: 45 PERIODS

TEXT BOOKS

- 1 Grewal, B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publications, Delhi, 2017.
2. Ramana, B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2014.

REFERENCES

- 1 Bali, N.P. and Manish Goyal, "A Textbook of Engineering Mathematics", Fifth Edition, Laxmi Publications (P) Ltd., 2014.
- 2 Glyn James, "Advanced Modern Engineering Mathematics", Fourth Edition, Pearson Education, 2013.
- 3 Erwin Kreyszig, "Advanced Engineering Mathematics", Tenth Edition, Wiley India, 2015.
- 4 Dr. Sanjay Sharma., "Signals and Systems", S.K.Kataria & Sons, Publisher of Engineering & Computer Books, New Delhi, 2012.
- 5 Whlie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics" Tata Mcgraw Hill Education Pvt.Ltd, 6th Edition, New Delhi, 2012.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- CO2** Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- CO3** Form partial differential equations and solve certain types of partial differential equations.
- CO4** Know how to solve one dimensional wave equation, one dimensional heat equation and two dimensional heat equation in steady state using Fourier Series.
- CO5** Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

19MET201	ENGINEERING THERMODYNAMICS	L	T	P	J	C
	(Use of approved Steam tables is permitted)					
	(Common to Mech, Agri & FT)	3	0	0	0	3
UNIT I	BASIC CONCEPTS AND FIRST LAW					9
	Basic concepts - concept of continuum - comparison of microscopic and macroscopic approach - Path and point functions - Intensive and extensive - total and specific quantities - System and their types - Thermodynamic Equilibrium State - path and process - Quasi - static - reversible and irreversible processes - Heat and work transfer - definition and comparison - sign convention - Displacement work and other modes of work - P - V diagram - Zeroth law of thermodynamics - First law of thermodynamics –application to closed and open systems -steady flow processes and its applications.					
UNIT II	PROPERTIES OF PURE SUBSTANCE					9
	Formation of steam and its thermodynamic properties - P-V, P-T, T-V, T-s, h-s diagrams. P -V-T surface - Use of Steam Table and Mollier Chart - Determination of dryness fraction using Throttling, Separating and Throttling - Application of I law for pure substances.					
UNIT III	SECOND LAW					9
	Second law of Thermodynamics - Statements of second law and its corollaries - Carnot cycle - Reversed Carnot cycle - Performance - Carnot theorem - Clausius equality – inequality. Qualitative Treatment only: Concept of Entropy -T-s diagram -entropy change for pure substance - ideal gases - different processes - principle of increase in entropy - Applications of II Law –exergy analysis and its applications					
UNIT IV	STEAM POWER CYCLES					9
	Ideal and actual Rankine cycles - Cycle Improvement Methods - Reheat and Regenerative cycles, Qualitative Treatment only: Economiser - preheater – Superheater- Condenser- Cogeneration Introduction - Binary and Combined cycles.					
UNIT V	IDEAL AND REAL GASES, GAS MIXTURE, THERMODYNAMIC RELATIONS					9
	Mole and Mass fraction - Dalton’s. Properties of gas mixture -Molar mass - gas constant - density. Properties of Ideal gas - Ideal and real gas comparison - Equations of state for ideal and real Gases - Reduced Properties - Compressibility Factor - Maxwell relations - Tds Equations - Difference and ratio of heat Capacities - Energy Equation -Joule -Thomson Coefficient - Clausius - Clapeyron equation and its applications.					
		L : 45	T: 0	P: 0	J: 0	Total: 45 PERIODS

TEXT BOOKS

1. Nag.P.K., “Engineering Thermodynamics”, 5th Edition, Tata McGraw - Hill, New Delhi, 2013.
2. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 8th Edition, Tata McGraw Hill 2014.

REFERENCES

- 1 Moran, Shapiro, Boettner & Bailey"Principles of Engineering Thermodynamics:" Wiley & Sons,2015.
- 2 Holman.J.P. "Thermodynamics", 3rd Edition, McGraw - Hill, 1995.
- 3 Rathakrishnan. E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice - Hall of India Pvt. Ltd, 2006
- 4 Arora C.P, “Thermodynamics”, Tata McGraw - Hill, New Delhi, 2007.
- 5 Kau - Fui Vincent Wong, "Thermodynamics for Engineers", CRC Press, 2010 Indian Reprint.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Describe the laws of thermodynamics and their application to a open and closed of systems.
- CO2** Determine dryness fraction of pure substances undergoing processes using Mollier entropy in real time applications.
- CO3** Demonstrate Carnot, Clausius equality and Inequality theorems and apply the principles of entropy in real time applications
- CO4** Illustrate the principles of various steam power cycles and to solve problems related to steam undergoing various processes
- CO5** Analyze the properties of ideal, real and its gas mixtures and apply the knowledge of mathematical relations in thermodynamic equations.

UNIT-I FLUID PROPERTIES AND FLOW CHARACTERISTICS 9 + 6

Units and dimensions - Properties of fluids - mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity. Pascal's law and hydrostatic law. Absolute, gauge and vacuum pressures. Pressure measurement devices - U-tube manometers, pressure gauges. Flow characteristics -concept of control volume - application of continuity equation, energy equation and momentum equation.

Lab Experiments:

- Verification of Bernoulli's equation
- Determination of the coefficient of discharge of given Orifice meter/Venturimeter.

UNIT-II FLOW THROUGH CIRCULAR CONDUITS 9 + 6

Hydraulic and energy gradient - Laminar flow through circular conduits - Boundary layer concepts - types of boundary layer thickness -Darcy Weisbach equation -friction factor - Moody diagram commercial pipes - minor losses -Flow through pipes in series and parallel.

Lab Experiments:

- Determination of friction factor for a given set of pipes
- Determination of major and minor losses in pipes

UNIT-III DIMENSIONAL ANALYSIS AND SIMILITUDE 9

Need for dimensional analysis -dimensional analysis by using Buckingham's π theorem method-Similitude -types of similitude - Dimensionless parameters - Reynold's Number - Froude's Number - Euler's Number - Weber's Number - Mach's Number - application of dimensionless Parameters-Model analysis.

UNIT-IV PUMPS 9 + 6

Impact of jets -Euler's equation - Theory of rotodynamic machines- various efficiencies-velocity components at entry and exit of the rotor - velocity triangles -Centrifugal pumps-working principle - work done by the impeller - Reciprocating pump - working principle. Rotary pumps - classifications.

Lab Experiments:

- Performance studies on centrifugal pump
- Performance studies on reciprocating pump

UNIT-V TURBINES 9 + 10

Classification of turbines -heads and efficiencies -velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines - working principles - work done by water on the runner -draft tube. Specific speed - unit quantities - performance curves for turbines - governing of turbines

Lab Experiments:

- Performance studies on Pelton wheel
- Performance studies on Francis turbine
- Performance studies on of Kaplan turbine

L : 45 T: 0 P: 30 J: 0 Total: 45 PERIODS

TEXT BOOKS

1. Yunus A. Çengel, John M. Cimbala., Fluid Mechanics: Fundamentals and Applications, McGraw - Hill Higher Education, 2010, 2nd edition.
2. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi. 2011. 10th Edition.

REFERENCES

- 1 Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi 2013. 19thEditon

- 2 Robert W. Fox, Alan T. McDonald, Philip J. Pritchard, "Fluid Mechanics and Machinery", 2011
- 3 Kumar. K.L., Engineering Fluid Mechanics, Eurasia Publishing House (P) Ltd., New Delhi, 2010. 8th Edition
- 4 Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 2010. 9th Edition
- 5 Rajput. R. K, "A text book of Fluid Mechanics and Hydraulic Machines", S. Chand & Company Ltd., New Delhi, sixth edition, 2010

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Explain the fundamental concepts of fluid mechanics with different properties of fluids.
- CO2** Analyse and calculate major and minor losses associated with pipe flow in piping networks.
- CO3** Predict the nature of physical quantities and to predict the behavior of the prototype/model by applying model laws
- CO4** Analyse the performance of pumps.
- CO5** Analyse the performance of hydraulic turbines.

REFERENCES

- 1 Paul Singh, R. and Dennis R. Heldman. 2009. Introduction to Food Engineering fourth edition. Academic press, New York, USA.
- 2 Albert Ibarz and Gustavo V. Barbosa-Cánovas. 2003. Unit Operations in Food Engineering. CRC Press LLC, Florida.
- 3 C.J.Geankoplis, Transport Process and Unit Operations, Prentice-Hall of India Pvt. Ltd, New Delhi. 1999.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Become acquainted with different unit operations of processing industries
- CO2** Evaluate the performance of size reduction, mixing and blending equipments
- CO3** Apply the knowledge gained on crystallisation in industrial processes
- CO4** Use the knowledge obtained on distillation and membrane separation
- CO5** Develop new food processes and modify the existing ones

UNIT I INTRODUCTION TO PYTHON**12**

Features of Python- Fundamentals of Python – Variables – Data Types

Suggested Experiments

1. Use interactive Shell to print the Hello Example : print ‘Hello World’
2. Write a Python Program Using String Variable
3. Write a Python program to store data in list and then try to print them
4. Write a Python Program to display the following messages “Hello World, Python is High level, General-purpose Programming language”

UNIT II CONTROL FLOW & ARRAYS**12**

Conditional Statements – Iteration - List and Arrays

Suggested Experiments

1. Write a Python program to find SUM and MULTIPLICATION of any three numbers.
2. Write a Python program to find the average of any five numbers.
3. Write a Python program to find simple interest.
4. Scenario: A courier company has number of items to be delivered to its intended customers through its salesman. The salesman visits following cities to deliver the respective items:

S. NO.	CITIES	NO. OF ITEMS
1	Aligarh	18
2	Agra	25
3	Baroda	13
4	Banaras	43
5	Chennai	8
6	New Delhi	67
7	New Jalpaiguri	29
8	Howrah	11
9	Kolkata	56
10	Mumbai	33

Solve the following problems based on the above mentioned scenario using Python:

- a) Write a Python program to store and display the above mentioned cities and corresponding items using arrays.
- b) Write a Python program to display name of cities where salesman has delivered maximum and minimum number of items.
- c) Write a Python program to search the number of items to be delivered for a user
- d) Suppose the cover price of a book is Rs 240.95, but bookstores get a 40% discount. Shipping costs Rs 30 for the first copy and 75 cents for each additional copy. What is the total wholesale cost for 60 copies? Calculate using Python Code.

Classes – Built-in Functions – Type Conversion – User Defined Functions – Flow of Execution

Suggested Experiments

Scenario: A university has different entities such as Department, Programs and Student whose data members and member functions are given below:

Teacher- { **Data Members:** Name, department, hours, programs Taught; **Member Function:** setDetails(), getDetails() }

Program- {**Data Members:** Name, department, duration; **Member Functions:** setDetails(), getDetails() }

Student- {**Data Members:** Name, RollNo, Program, Department; **Member Function:** setDetails(), getDetails() }

Solve the following problems based on the above mentioned scenario using Python:

1. Write a Python program to create Teacher, Program and Student Classes with above mentioned data members and member functions.
2. Add following functionalities in the above program, the default department of Teacher, Program and Student should be Computer Science; however a different department could be assigned at run time.
3. Write a Python program to overload “+” operator to add the hours of two teachers.
4. Write a Python program to create two subclasses Residential Student and Non Residential Student inherited from Student class. Residential Student would have a data member Hall of Residence and Non-Residential Student would have Address as its data member.

UNIT IV FILE HANDLING

12

Files and exception: text files, reading and writing files, handling exceptions

Suggested Experiments

1. Write a Python program to print number of days in a month.
2. Write a Python program to find the area of triangle
3. Write a Python program which takes a character as input from the keyboard and convert it into capital letter, if it is a small letter and Vice-Versa.
4. Write a Python program to find those numbers which are divisible by 7 and multiple of 5, between 1500 and 2700 (both included)
5. Write a Python program that asks the user for a number. Depending on whether the number is even or odd, print out an appropriate message to the user

UNIT V TEMPLATES

12

Function Template – Class Template – Infinite Recursion in Python

1. Write a function in Python to swap two numbers using function template. The numbers could be Integer or float that depends on the user inputs
2. Create a class Matrix with data members and member functions. Write a program in Python to perform Matrix operations (2-D array implementation), Add and Multiplication using class template
3. Write a Program Python to check whether the given number is Armstrong number or not
4. Write a Python Program to print factorial of a number
5. Write a Python Program to generate first n Fibonacci terms recursively
6. Write a Python Program to compute factorial of an integer n recursively

L:0 T:0 P:60 J:0 Total:60 Periods

COURSE OUTCOMES

At the end of the course the student should be able to :

- CO 1 Write clear and effective python code
- CO 2 Create applications using python programming
- CO 3 Define Python functions and call them
- CO 4 Use Python data structures -- lists, tuples, dictionaries
- CO 5 Understand the object oriented features using Python

19FTP201

MINI PROJECT - II

L T P J C

0 0 0 2 1

LIST OF EXPERIMENTS

A batch of four students will carry out the mini project on emerging areas of Food Technology under the guidance of a faculty. The project outlines the involvement of the students to get exposed to the different skills in the domains of Food Technology such as Food microbiology, Food biochemistry, food processing methods etc. and their applications. Three reviews will be conducted throughout the semester and a combined project report to be submitted along with a viva voce for the end semester evaluation

L : 0 T: 0 P: 0 J: 30 Total:30 PERIODS

19GEP275 **PERSONALITY DEVELOPMENT** **L T P J C**
(Common to All B.E. / B. Tech. Courses) **1 0 2 0 2**

UNIT I SELF-AWARENESS & PERSONAL DEVELOPMENT 3+6

Self-Awareness: Key Areas -Personality, Values, Habits, Needs & Emotions, Impact of Self Awareness on Personal Development.

Personality –Definition, Elements, Determinants, Needs and Benefits, Personality traits.ersonality development skills, Positive traits for effective people, SWOT :Analysing Strength and weakness (SWOT), Building Esteem & Self-Confidence, Working on attitudes (aggressive, assertive, submissive), Self-Motivation

UNIT II BODY LANGUAGE 3+6

Body Language-Postures and Gestures, Personal Grooming, Personal Hygiene, Social Effectiveness, Business Etiquettes, Interpersonal Relationship

UNIT III COMMUNICATION AND LEADERSHIP 3+10

Communication: LRSW, Verbal & Non-Verbal Communication, Communication Barriers, Resume Building, Video Resume, Email writing, Presentation Skills, Self-Introduction, Extempore speech, Group Discussion, Mock Interview.

Leadership: Leadership Styles, Leadership Traits, Group Dynamics, Team Building - Conflict management, Time Management, Stress management.

UNIT IV SOCIAL IMAGE TRAITS 3+6

Social etiquettes -Positive Social Image, Social Graces, Online Etiquettes, , Dinning Etiquettes, Public speaking, Voice Modulation, Telephone etiquettes, Interview etiquettes – Networking - Case Study and Company website References

UNIT V PERSONALITY TEST 3+2

Big Five Personality Test, Open DISC Assessment Test.

L :15 T: 0 P: 30 J: 0 T:45 PERIODS

TEXT BOOKS

- 1 Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
- 2 Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition: Prentice Hall.

REFERENCES

- 1 Smith, B. Body Language. Delhi: Rohan Book Company. 2004
- 2 Personality Development and Career management: By R.M.Onkar (S Chand Publications)

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Evaluate the quality of personality for self-development in career perspective.
- CO2** Apply the body languages in his professional interview modes.
- CO3** Apply the communication and leadership styles in the public speaking.
- CO4** Apply the social imaging qualities in their presentation skill.
- CO5** Demonstrate the personality development in mock interview.

SEMESTER IV

19MAT202	STATISTICS AND NUMERICAL METHODS	L	T	P	J	C
	(Common to Agri, Auto, Food Technology, Mech)	3	0	0	0	3
UNIT I	TESTING OF HYPOTHESIS					9
Sampling distributions – Statistical hypothesis – Tests for single mean and Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.						
UNIT II	DESIGNS OF EXPERIMENTS					9
Completely randomized design – Randomized block design – Latin square design-Applications of ANOVA.						
UNIT III	SOLUTIONS OF EQUATIONS					9
Newton Raphson method – Pivoting Gauss Jordan methods – Iterative methods of Gauss – Seidal – Matrix Inversion by Gauss – Jordan method.						
UNIT IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION					9
Lagrange’s interpolation – Newton’s forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson’s 1/3 rd rule.						
UNIT V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS					9
Single step methods: Taylor’s series method – Euler’s method – Modified Euler’s Method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods: Milne’s predictor-corrector methods for solving first order equations.						
L : 45 T:0 P: 0 J: 0 Total: 45 PERIODS						

TEXT BOOKS

- 1 Johnson, R.A. and Gupta, C.B., Miller and Freund’s, “Probability and statistics for Engineers”, Pearson Education Asia, 8th Edition, 2011.
2. Grewal, B.S and Grewal, J.S, “Numerical methods in Engineering and Science”, 9th Edition, Khanna Publishers, New Delhi, 2012.

REFERENCES

- 1 Spiegel M.R , Schiller J and Srinivasan R.A , "Schaum’s Outlines Probability and Statistics", Tata McGraw Hill edition, 3rd Edition, 2011.
- 2 Chapra S.C and Canale R.P. “Numerical Methods for Engineers”, 6th Edition, Tata McGraw Hill Edition, 2014.
- 3 Gerald C.F. and Wheatley P.O. “Applied Numerical Analysis”, 8th Edition, Pearson Education, Asia, New Delhi, 2014
- 4 Walpole R.E., Myers. R.H., Myers. S.L., and Ye. K., “Probability and Statistics for Engineers and Scientists”, 8th Edition, Pearson Education, Asia, 2007.
- 5 Kandasamy P, Thilagavathy K and Gunavathy K., "Numerical Methods", 3rd Edition, S. Chand & Company Pvt. Ltd, 2013.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Apply the statistical concepts and tools for engineering applications and to use different types of research methodology techniques for decision making under uncertainty.
- CO2** Perform the ANOVA calculation which is needed for engineering research and project management.
- CO3** Solve a set of algebraic equations representing steady state models formed in engineering problems.
- CO4** Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration.
- CO5** Predict the system dynamic behaviour through solution of ODEs modeling the system.

19FTT201

HEAT AND MASS TRANSFER FOR FOOD PRODUCTS

L T P J C

3 0 0 0 3

UNIT I CONDUCTION

9

Basic concepts - Mechanism of Heat transfer. Conduction - Fourier's Law, General differential equation in Cartesian and cylindrical coordinates, one dimensional steady state heat conduction, conduction through plane wall, cylinders and spherical systems.

UNIT II CONVECTION

9

Basic Concepts - Heat transfer coefficients, boundary layer concept. Types of convection - Forced convection, dimensional analysis, non-dimensional numbers, external flow, flow over plates, cylinders and spheres, internal flow, laminar and turbulent flow, combined laminar and turbulent.

UNIT III RADIATION

9

Radiation heat transfer - concept of black and grey body-Laws of Radiation - Stefan-Boltzmann Law, Kirchoff's Law Black body radiation - Grey body radiation - Shape factor algebra - Radiation shields

UNIT IV HEAT EXCHANGERS

9

Heat exchangers - Types, heat exchanger analysis, fouling factor, LMTD (Logarithmic mean temperature difference) and Effectiveness-NTU (number of transfer units) Method - Overall Heat Transfer Coefficient

UNIT V MASS TRANSFER

9

Mass transfer- introduction - Fick law for molecular diffusion - molecular diffusion in gases - equimolar counters diffusion in gases- diffusion through a varying cross sectional area- diffusion coefficients for gases - molecular diffusion in liquids

L : 45 T: 0 P: 30 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 R. C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New Age International private limited, New Delhi, 2010
- 2 Yunus A. Cengel, Heat and Mass Transfer: a Practical Approach, Tata McGraw Hill publishing Company private limited, New Delhi, 2007

REFERENCES

- 1 J. P. Holman, Heat Transfer, Tata McGraw Hill publishing Company private limited, New Delhi, 2009
- 2 C. P. Kothandaraman and S. Subramanyan, Fundamentals of Heat and Mass Transfer, New Age International private limited, New Delhi, 2014
- 3 Frank P. Incropera, Fundamentals of Heat and Mass Transfer, John Wiley, New Delhi, 2007
- 4 Heat and Mass Transfer, S Chand and Company, New Delhi, 2009

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand conduction, students will able to in different geometries
- CO2** Asses the concepts and types of convection in heat transfer mechanism
- CO3** Recognize the radiation problems in various geometrics
- CO4** Analyze the performance of heat exchangers and evaporators
- CO5** Understand the various modes of mass transfer and apply them in engineering problems

19GET276	VQAR-II	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	2	0	0	0	2
UNIT I	QUANTITATIVE ABILITY III					6

Time, speed & distance-Average speed- Relative speed- Train problems- Boats and streams- Races, Chain rule, Time and work -Pipes and cisterns

UNIT II	QUANTITATIVE ABILITY IV					4
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Permutation & Combination, Probability, Mensuration

UNIT III	VERBAL REASONING II					7
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Machine Input and Output, Coded Inequalities, syllogisms, Problems on Cubes, Data sufficiency.

Critical Reasoning -Statement and Argument, Statement and Assumption, Statement and Conclusion, Cause and effect, Course of action.

UNIT IV	NON- VERBAL REASONING					5
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Figure series, Odd man out, Mirror Image, Water image, Embedded Image, Cubes and Dices, Insert the Missing Characters, Analytical reasoning.

UNIT V	LINGUISTICS SKILLS III					8
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Sentences - Simple, Compound, Complex & Mixed sentences, Sentence Rearrangement, Idioms & Phrases, Reading Comprehension at higher level, Word Substitution, Synonyms & Antonyms, Error Spotting.

L :30 T: 0 P: 0 J: 0 T: 30 PERIODS

TEXT BOOKS

- 1 Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications.
- 2 M.K.Panday, "Analytical Reasoning", Magical Series.
- 3 BS Sijwali- Indu Sijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.
- 4 S.P.Bakshi, "Objective English" Arihant Publications.

REFERENCES

- 1 R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
- 2 R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited.
- 3 R.S.Agarwal, "A modern approach to Verbal & Non-verbal reasoning", S.Chand & Company Pvt Limited.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Learn the time and distance for solving application orientated concepts in quantitative aptitude
- CO2** Apply the financial ability for solving application orientated concepts in quantitative aptitude
- CO3** Analyze the verbal reasoning and the critical reasoning in quantitative aptitude.
- CO4** Analyze the non-verbal reasoning in verbal aptitude applications
- CO5** Apply appropriate LSRW skills

19GEB202

LANGUAGE ELECTIVE- HINDI

L T P J C
1 0 2 0 2

UNIT I INTRODUCTION

3+6

Importance of Hindi Language- Devanagari Alphabet (Read/Write) – Numbers (Read & Write) - Vowels & their abbreviated forms-consonants-Conjuncts- Parts of speech- Gender

UNIT II WORDS

3+6

Pronoun-Adjective-Verb-Tenses-Voice- Secondary verbs- Indeclinable- Cardinal numerals- Daily life words

UNIT III CLASSIFIED SENTENCES

3+6

Expressions- Useful Expressions- Imperative sentences-Past tense- Present tense-Future tense- Interrogative sentences and negative sentences

UNIT IV SITUATIONAL SENTENCES

3+6

Situational Sentences: At home-Shopping- Craftsman-Food & Drink- Hotel & Restaurant- Post office/Telephone/Bank- While Travelling- Health & Hygiene- Weather-Time.

UNIT V CONVERSATION

3+6

Conversation between friends- About money- On the bus- Asking the way- Making a Trunk Call- About a Trips- The villager and the urban- The doctor & the patient- Self Introduction.

L :15 T: 0 P: 30 J: 0 T: 45 PERIODS

TEXT BOOKS

- 1 Hindi for beginners by Sunita Narain mathur “ Tuttle Publisher”
- 2 Learn hindi through English in 30 Days by Krishna gopal vikal “ Diamond Pocket books”

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Know about the language Hindi and parts of speech
- CO2** Understand the verbs and tenses of Hindi language
- CO3** Experience the expression and classified sentences in Hindi Language.
- CO4** Practice the Hindi speaking at suitable situations.
- CO5** Converse in Hindi with your friends & neighbours.

EXERCISES PROCEDURE FOR PRACTICALS

Assessment (Mandatory)

S.No	Exercises	Based on Report Submission	Based on Exercises/Presentation
1	Alphabets –Read & Write	5	5
2	Numbers-Read & Write	5	5
3	Vowels-Read & Write	5	5
4	Consonant Conjuncts		10
5	Parts of Speech & Gender		10
6	Verbs, tenses & Daily Life words		10
7	Verbs, tenses & Daily Life words		10
8	Tenses-Past Present & Future		10
9	Interrogative & negative sentences		10
10	Conversation practices 1 (Different cases to different batch)		10
11	Conversation practices 2 (Different cases to different batch)		10
12	Conversation practices 3 (Different cases to different batch)		10

19GEB203

LANGUAGE ELECTIVE- JAPANESE

L T P J C

1 0 2 0 2

**UNIT I SELF INTRODUCTION AND BASIC CONVERSATION, 3+6
JAPANESE SCRIPTS AND NUMBERS**

Introduction to Japanese Syllables (phonetic alphabet), greetings & Self-introduction, Identifying things, point objects and listening to their names, Listen to things and places etc. Creating shopping lists. Numbers. Three Different types of Japanese Scripts : Hiragana, Katakana, Kanji.

**UNIT II TIME, DAY, MONTH AND YEARS, TRAVEL , WORK 3+6
ENVIRONMENT, PARTICLES**

Introduction to Time, day of the week, simple inquiries on telephone, Means of transport, Basic conversations of everyday life., Office Environment, Japanese Particles

**UNIT III LOCATION AND OBJECTS ALONG WITH EXPRESSIONS , 3+6
PRESENT / PAST FORMS**

Frame questions in Japanese. Vocabulary of giving and receiving objects, Stating impressions/things surrounding us, Expressing likes and dislikes, good/bad, possessions, Talking about the country, town and the environment

**UNIT IV COUNTERS , DIRECTIONS, COLORS, FAMILY & 3+6
RELATIONSHIP**

Quantity, number of people, time, period etc., Stating thoughts and impressions, Conveying movement (e.g. go / come). Colors, Family and Relationship.

**UNIT V BASIC AND DAY TO DAY CONVERSATIONS WITH 3+6
MULTIPLE SCENARIOS**

Conversational practices: Between Friends, Customer and Seller, & Business Conversation

L :15 T: 0 P: 30 J: 0 T: 45 PERIODS

REFERENCE BOOKS

1. MINNA NO NIHONGO 1-1 Translation & Grammatical notes in English elementary
2. SHIN NIHONGO NO KISO 1 (Grammatical Notes in English)

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Know about the language Japanese and parts of speech
- CO2** Understand the Japanese language on time and travel
- CO3** Experience the Conversation about location and expression.
- CO4** Practice Conversation about family and relationship
- CO5** Converse in Japanese in day to day conversations

EXERCISES PROCEDURE FOR PRACTICALS

Assessment (Mandatory)

S.No	Exercises	Based on Report Submission	Based on Exercises/Presentation
1	Alphabets –Read & Write	5	5
2	Numbers-Read & Write	5	5
3	Vowels-Read & Write	5	5
4	Consonant Conjuncts		10
5	Parts of Speech & Gender		10
6	Verbs, tenses & Daily Life words		10
7	Verbs, tenses & Daily Life words		10
8	Tenses-Past Present & Future		10
9	Interrogative & negative sentences		10
10	Conversation practices 1 (Different cases to different batch)		10
11	Conversation practices 2 (Different cases to different batch)		10
12	Conversation practices 3 (Different cases to different batch)		10

19GEB204

LANGUAGE ELECTIVE- GERMAN

L T P J C

1 0 2 0 2

UNIT I

INTRODUCTION

3+6

Introduction to German Language- Alphabets-Greetings and goodbye - Introduce yourself and others - numbers -how to give your telephone number and email address -Speak about countries- languages - words.-Vowels-Read & Write-Tenses.

UNIT II

CONVERSATIONS WITH FRIENDS COLLEAGU

3+6

Speaking about hobbies - fixing meetings and appointments - name days of the week - about work. Speak about Professions and working hours

UNIT III

CONVERSATION ABOUT CITY

3+6

Name places and buildings - Ask questions about places - Assigning texts to a picture story - Enquire about things - Name means of transport - ask for directions and describe a way -understand texts with international words - learn articles

UNIT IV

CONVERSATION ABOUT FOOD AND SHOPPING

3+6

Speak about food - plan for shopping - conversations while shopping - conversations while eating - Understand texts with W questions -Organize and learn words

UNIT V

CONVERSATION ABOUT TIME WITH FRIENDS

3+6

Understanding and saying the time -Specify times - to talk about family -To plan something together n to talk about birthdays - Understand and write an invitation -to Order and pay in the restaurant n to talk about an event

L :15 T: 0 P: 30 J: 0 T: 45 PERIODS

TEXT BOOKS

1. Netzwerk Deutsch als fremdsprache A1.1 Kursbuch
2. Netzwerk Deutsch als fremdsprache A1.1 Arbeitsbuch

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Know about the German language and parts of speech.
- CO2** Understand the Conversations with Friends Colleagues
- CO3** Experience the Conversation about city
- CO4** Practice Conversation about food and shopping
- CO5** Converse in German about time with friends

EXERCISES PROCEDURE FOR PRACTICALS

Assessment (Mandatory)

S.No	Exercises	Based on Report Submission	Based on Exercises/Presentation
1	Alphabets –Read & Write	5	5
2	Numbers-Read & Write	5	5
3	Vowels-Read & Write	5	5
4	Consonant Conjuncts		10
5	Parts of Speech & Gender		10
6	Verbs, tenses & Daily Life words		10
7	Verbs, tenses & Daily Life words		10
8	Tenses-Past Present & Future		10
9	Interrogative & negative sentences		10
10	Conversation practices 1 (Different cases to different batch)		10
11	Conversation practices 2 (Different cases to different batch)		10
12	Conversation practices 3 (Different cases to different batch)		10

19GEB205

LANGUAGE ELECTIVE - FRENCH

L T P J C

1 0 2 0 2

UNIT I INTRODUCTION

3+6

Introduction to the French Language- Alphabets -Consonants-Greetings and goodbye –Daily life words- Introduce yourself and others - numbers -how to give your telephone number and email address -Speak about countries- languages - words.-Vowels-Read & Write-Tenses

UNITII CONVERSATIONS WITH FRIENDS COLLEAGUES

3+6

Speaking about hobbies - fixing meetings and appointments - name days of the week - about work. Speak about Professions and working hours

UNIT III CONVERSATION ABOUT CITY

3+6

Name places and buildings - Ask questions about places - Assigning texts to a picture story - Enquire about things - Name means of transport - ask for directions and describe a way -understand texts with international words - learn articles

UNIT IV CONVERSATION ABOUT FOOD AND SHOPPING

3+6

Speak about food - plan for shopping - conversations while shopping - conversations while eating - Understand texts with W questions -Organize and learn words

UNIT V CONVERSATION ABOUT TIME WITH FRIENDS

3+6

Understanding and saying the time -Specify times - to talk about family -To plan something together n to talk about birthdays - Understand and write an invitation -to Order and pay in the restaurant n to talk about an event

L: 15 T: 0 P: 30 J: 0 TOTAL :45

REFERNCE BOOKS

- 1 G.Mauger Cours DE Languet De Civilisation Francaises
- 2 Annie Heminway, Complete French all in one Premium Second Edition, Tata McGraw Hill Education.
- 3 Diamond French-Aprenons Le Francois New Saraswathi House (India)Private Limited
- 4 A.Monnerie Beinvenue En France. Documentation Marrie Franchoise Boullet

COURSE OUTCOMES

At the end of the course, students should be able to

CO1: Know about the French language and parts of speech.

CO2: Understand the Conversations with Friends Colleagues

CO3: Experience the Conversation about the city

CO4: Practice Conversation about food and shopping.

CO5: Converse in French about time with friends

EXERCISES PROCEDURE FOR PRACTICALS

Assignment (Mandatory)

S.No	Exercises	Based on Report Submission	Based on Exercises/Presentation
1	Alphabets –Read & Write	5	5
2	Numbers-Read & Write	5	5
3	Vowels-Read & Write	5	5
4	Consonant Conjuncts		10
5	Parts of Speech & Gender		10
6	Verbs, tenses & Daily Life words		10
7	Verbs, tenses & Daily Life words		10
8	Tenses-Past Present & Future		10
9	Interrogative & negative sentences		10
10	Conversation practices 1 (Different cases to different batch)		10
11	Conversation practices 2 (Different cases to different batch)		10
12	Conversation practices 3 (Different cases to different batch)		10

19FTB203

**ENGINEERING PROPERTIES OF FOOD
MATERIALS**

L T P J C

2 0 2 0 3

UNIT I PHYSICAL PROPERTIES OF FOODS

6

Methods of estimation of Shape, Size, volume, density, porosity and surface area, sphericity, roundness specific gravity. Frictional properties-coefficient of friction, Storage and flow pattern of agricultural crops

Lab Experiments:

- Determination of size, roundness, sphericity and 1000 grain weight of food grains
- Determination of true density, bulk density and porosity of grains

UNIT II RHEOLOGICAL PROPERTIES OF FOODS

6

Definition – classification – Newton’s law of viscosity – momentum-diffusivity-kinematic viscosity – viscous fluids – Newtonian and Non Newtonian fluids- Viscosity Measurements-Viscometers of different types and their applications-Texture measuring instruments-Hardness and brittleness of Food materials.

Lab Experiments:

- Study on hardness of grains using hardness tester
- Determination of coefficient of friction

UNIT III THERMAL PROPERTIES OF FOODS

6

Definitions of Heat capacity, specific heat, enthalpy, conductivity and diffusivity, surface heat transfer coefficient, Measurement of thermal properties like specific heat, enthalpy, conductivity and diffusivity, DTA, TGA, DSC.

Lab Experiments:

- Determination of angle of repose of grains

**UNIT IV AERODYNAMIC AND HYDRODYNAMIC PROPERTIES OF
FOODS**

6

Drag and lift coefficient, terminal velocity and their application in the handling and separation of food materials. Water activity- measurement-vapor pressure method –freezing point depression method-Effect of temperature, and pressure on water activity-moisture sorption isotherms- models-Henderson, PET and GAB models.

Lab Experiments:

- Determination of water activity of grains and food materials
- Measurement and estimation of some textural parameters of a solid food properties of parboiled and raw rice

UNIT V ELECTRICAL PROPERTIES OF FOODS

6

Dielectric properties-dielectric constants-, Dielectric measurements-Ionic Interaction-Dipolar rotation. Effect of moisture, temperature and pressure on dielectric properties. Microwave heating-Infrared and Ohmic heating, Irradiation

L : 30 T: 0 P: 30 J: 0 Total: 60 PERIODS

TEXT BOOKS

- 1 Serpil Sahin and Servet Gulum Sumnu “Physical Properties of Foods”, Springer,USA, 2006
- 2 Nuri N. Mohsenin: “Thermal Properties of Food & Agricultural materials”, Gordon and Reach science publishers, 1970.

REFERENCES

- 1 Rao, M.A and S.S.H. Rizvi:”Engineering Properties of Foods”, Mercel Dekker inc., New York 1998
- 2 Lewis M.J, “Physical properties of foods and food processing systems” Woodhead publishing Cambridge, UK, 1990
- 3 Micha Peleg and Edward B. Bagley, “Physical Properties of Foods” AVI publishing company inc, Westport USA, 1983.
- 4 Kachru R.P.and R.K. Gupta, “Physico – Chemical Constituents and Engineering Properties of Food crops”,

Scientific publishers, Jodhpur.

5 Reyonnd Jewitt and others: "Physical properties of foods "Allied sciene publishers, 1983

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Identify the engineering properties of food materials
- CO2** Identify the structure and chemical composition of food
- CO3** Calculate the water activity, food stability sorption and desorption isotherm of food materials
- CO4** Examine the thermal properties, electrical and magnetic properties of food
- CO5** Measure the aero- and hydrodynamic characteristics and the application of frictional properties in grain handling, processing and conveying

UNIT-I EVAPORATION

9

Evaporation: Principles of evaporation, mass and energy balance, factors affecting rate of evaporation, thermodynamics of evaporation (phase change, boiling point elevation, Dühring plot; Heat and mass transfer in evaporator, factors influencing the overall heat transfer coefficient, influence of feed liquor properties on evaporation Evaporation equipment: Natural circulation evaporators, horizontal/vertical short tube, natural circulation with external calandria, long tube, forced circulation; Evaporator ancillary plant, design of evaporation systems, single effect, multiple effect evaporators, feeding methods of multiple effect evaporation systems, feed preheating, vapour recompression systems Fouling of evaporators and heat exchangers; Recompression heat and mass recovery and vacuum creating devices

Lab Experiments:

- Performance evaluation of evaporators and estimation of heat or mass balance during concentration of liquid
- To study simple distillation process and determine the rate of distillation.

UNIT-II DRYING

9

Basic drying theory, heat and mass transfer in drying, drying rate curves, calculation drying times, dryer efficiencies; classification and selection of dryers; tray, vacuum, osmotic, fluidized bed, pneumatic, rotary, tunnel, trough, bin, belt, microwave, IR, heat pump and freeze dryers; dryers for liquid: Drum or roller dryer, spray dryer and foammat dryers

Lab Experiments:

- To study the process of roasting / To study the effect of time -temperature combination of roasting
- Estimation of drying characteristics of processed and unprocessed vegetable or fruit using thin layer

UNIT-III CONTACT-EQUILIBRIUM PROCESSES

9

Introduction phase distribution equilibrium distribution coefficients contact equilibrium separation. Concentrations mole fraction partial pressure Avogadro's Law Gas/Liquid Equilibria partial vapour pressure Henry's Law solubility of gases in liquids Solid/Liquid Equilibria solubility in liquids solubility/temperature relationship saturated solution supersaturated solution Equilibrium-Concentration Relationships overflow/underflow equilibrium diagram Operating Conditions contact stages mass balances Calculation of Separation in Contact/Equilibrium Processes combining equilibrium and operating relationships deodorizing/steam stripping McCabe/Thiele plot.

Lab Experiments:

- Performance evaluation on Drying characteristics of LSU dryer using grains
- Experiments on oil expeller
- Visit sugar processing industry

UNIT-IV CRYSTALLIZATION

9

Gas Absorption Rate of Gas Absorption Lewis and Whitman Theory Stage-equilibrium Gas Absorption number of contact stages Extraction and Washing Rate of Extraction Stage-equilibrium Extraction equilibrium and operating conditions McCabe Thiele diagram Gas-absorption Equipment Washing Extraction and Washing Equipment extraction battery Crystallization mother liquor Crystallization Equilibrium solubility and saturation nucleation metastable region seed crystals heat of crystallization Rate of Crystal Growth Stage-equilibrium Crystallization Equipment scraped surface heat exchanger evaporative crystallizer Membrane Separations osmotic pressure ultrafiltration reverse osmosis Rate of Flow Through Membranes van't Hoff equation Diffusion equations Sherwood number Schmidt number Membrane Equipment Distillation Equilibrium relationships boiling temperature/concentration diagram

azeotropes Steam Distillation Vacuum Distillation Batch Distillation Equipment

UNIT-V EXTRACTION AND LEACHING

9

Extraction process, rate of extraction, stage-equilibrium extraction, solvent extraction, supercritical fluid extraction, extraction equipment. Leaching: Principles of continuous leaching, counter-current leaching, leaching equipment.

Lab Experiments:

- Determination of extraction efficiency of leaf filter.
- Determination of rate of extraction of oil from a mixture of hexane and oil cake using soxhlet apparatus.
- Study the process of roasting / Study the effect of time temperature combination on roasting.

L : 45 T: 0 P: 30 J: 0 Total: 75 PERIODS

TEXT BOOKS

- 1 R.L. Earle, Unit Operations in Food Processing, Butterworth-Heinemann Ltd; 2nd Revised edition, Pergamon Press, 1983
- 2 C.J. Geankoplis, Transport Process and Unit Operations, 3rd edition, Prentice-Hall of India Private Limited, New Delhi, 1993

REFERENCES

- 1 J.M. Coulson and J.F. Richardson, Chemical Engineering, Volume I to V, The Pergamon Press, New York, 1999
- 2 K. M. Sahay and K.K. Singh, Unit Operation of Agricultural Processing, Vikas Publishing House Pvt. Ltd., New Delhi, 2004
- 3 Albert Ibarz, Gustavo V. Barbosa-Canovas, Unit Operations in Food Engineering, Food Preservation Technology Series, CRC Press, London, 2003

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Analyse the principle and operation of different types of evaporators and explain the drying of principles
- CO2** Assess the suitable process technology such as sedimentation, filtration, cyclone and membrane for separation of different kind of particles present in foods
- CO3** Differentiate the operation of different kind of mixing and size reduction equipment
- CO4** Implement the leaching and extraction techniques to transform raw materials into value added products
- CO5** Apply the mechanism of crystallization and distillation process in food industries

UNIT I MICROBES IN CEREALS, FRUITS AND VEGETABLES**9**

Microbiology of cereal and cereal products, Microbiology of fruits and vegetables and canned foods, Microbiology of sugar and sugar products and salts and spices

Lab Experiments:

- Introduction, Laboratory Safety, Use of Equipment; Sterilization Techniques.
- Culture Media-Types and Use; Preparation of Nutrient broth and agar.

UNIT II MICROBES IN MILK, MEAT, FISH AND POULTRY**9**

Microbiology of milk and milk products, meat and meat products, poultry and eggs, fish and other sea foods

Lab Experiments:

- Culture Techniques, Isolation and Preservation of Cultures- Broth: flask, test tubes; Solid: Pour plates, streak plates, slants, stabs.

UNIT III MICROBES IN FOOD FERMENTATIONS**9**

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

Lab Experiments:

- Microscopy – Working and care of Microscope.
- Staining Techniques- Simple Staining.

UNIT IV CONTROL OF MICROBES IN FOODS**9**

Use of antimicrobial chemicals- organic acids, sugars, sodium chloride, nitrites, phosphates, sulphites, benzoates, sorbates / propionates naturally occurring antimicrobials; physical methods- low and high temperatures, drying, radiation and high pressure; tolerance of microbes to chemical and physical methods in various foods.

Lab Experiments:

- Staining Techniques- Gram's Staining.
- Quantification of Microbes: Sampling and Serial Dilution.

UNIT V MICROBIAL EXAMINATION OF FOODS**9**

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

Lab Experiments:

- Effect of pH, Temperature, UV radiation on Growth Bacteria.

L : 45 T: 0 P: 30 J: 0 Total: 75 PERIODS**TEXT BOOKS**

- 1 Banwart, G.J., Basic Food Microbiology, 2nd Edition. CBS Publishers, 1998.
- 2 Vijaya Ramesh. Food Microbiology. MJP Publishers, Chennai, 2007.

REFERENCES

- 1 Jay, J.M. Modern Food Microbiology. 4th Edition. CBS Publishers, 2003
- 2 Adams, M.R. and M.O. Moss. Food Microbiology. New Age International, 2002
- 3 Khetarpaul, Neelam. Food Microbiology, Daya Publishing House, 2006.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Classify the microorganism and identify the microorganism associated with foods
- CO2** Analyse the microorganism responsible for spoilage of foods and its assessments
- CO3** Apply the preservation methods to control the spoilage and assess the microbial growth in foods
- CO4** Analyze the importance of microorganism in food fermentation and fermented products
- CO5** Assess the cause for food borne illness and Understand the quality control for safety of foods

19FTP202

INTERNSHIP-I

L T P J C

- - - - 2

LIST OF EXPERIMENTS

A batch of four students will carry out this summer internship under the guidance of a faculty. The internship will be attended during May/ June month for the duration of two weeks in a reputed Food Processing Industry / Agro-based Industry / Dairy Industry to learn field experience and problems faced by the Industry, and find solutions to them. A project report on the experience gained in the Industry should be submitted for evaluation.

2 Weeks

LIST OF EXPERIMENTS

1. Introduction to modeling software: Practicing sketching, Dimensioning and Modelling Tools and Creating simple 3D models by using any CAD Modelling Software
2. Create a orthographic views of Food processing machine components from isometric component drawing
3. Create a two dimensional sketch diagrams of simple Food processing machine components
4. Create a three dimensional assembly model of bearing from detailed orthographic drawings
5. Create a three dimensional assembly model of Food processing machine components from detailed orthographic drawings
6. Create a three dimensional assembly model of gear box from detailed orthographic drawings
7. Create a three dimensional assembly model of Food processing machinery from detailed orthographic drawings
8. Create a three dimensional assembly model of valves from detailed orthographic drawings
9. Create a three dimensional assembly model of simple mechanism and animate its working in modeling software
10. Create a three dimensional assembly model of simple energy conversion/power transmission system and animate its working using modeling software

L : 0 T: 0 P: 60 J: 0 Total:60 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Draw two dimensional drawings of engineering components using standard CAD Modelling package
- CO2** Develop a three dimensional assembly model consisting of many components with tolerances.
- CO3** Generate animations from three dimensional assembly models by applying various motion constraints.

SEMESTER V

19FTT301 REFRIGERATION AND COLD CHAIN MANAGEMENT

L T P J C
3 0 0 0 3

UNIT I INTRODUCTION TO REFRIGERATION

9

Introduction to refrigeration, unit of refrigeration capacity. Review of Second law of thermodynamics and interpretation. Production of low temperatures - principles and process. Refrigerants - classification and thermodynamic properties. Ozone depletion potential. Reversed Carnot cycle. Limitations of reversed Carnot systems

UNIT II REFRIGERATION SYSTEMS

9

Refrigeration cycle – simple vapour compression, vapour absorption cycle, p-h and T-s diagrams, COP. Energy ratios and Power consumption of a refrigerating machine. Standard rating cycle and effect of operating conditions. Air refrigeration system – reversed Brayton cycle.

UNIT III COMPONENTS OF A REFRIGERATION

9

Evaporator- dry and flooded type, liquid cooling evaporator. Condenser- water cooled, air cooled and evaporative condenser. Compressor - Reciprocating type compressors. Expansion valve - thermostatic expansion valve

UNIT IV LOW TEMPERATURE STORAGE SYSTEMS

9

Pre-cooling systems, Cold storage- construction, insulation and operation. Design of cold storage unit. Calculation of refrigeration load in cold store. Prefabricated systems, walk-in-coolers. Frozen storage, Cryogenics – Linde and Claude system for liquefaction of air.

UNIT V COLD CHAIN MANAGEMENT

9

Introduction, Components of cold chain. Refrigerated distribution and transport systems, Cold chain in retail, Traceability- Application of RFID in cold chain. Role of refrigeration in food production - candy manufacture, beverage processing, bakery products, meat products, poultry products, fishery products, fruit /vegetables and dairy products

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Rajput R.K., —Refrigeration And Air-conditioning, 3rd Edition, S.K. Kataria and Sons (Publishers), Delhi, 2012.
- 2 Dellino C.V.J., —Cold and Chilled Storage Technology, 2nd Edition, Springer, US, 2011.

REFERENCES

- 1 Arora, C.P., —Refrigeration and Air Conditioning, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., Delhi, 2008.
- 2 Khurmi, R.S. and Gupta J.K., —Textbook of Refrigeration and Air Conditioning, 5th Edition, S. Chand Publishers, New Delhi, 2006.
- 3 Narayanan, K.V., —A Textbook of Chemical Engineering Thermodynamics, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2013.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1 Interpret the basics of refrigeration with thermodynamic principles and Carnot cycle
- CO2 Make use of the concept of refrigeration cycles
- CO3 Identify various components of refrigeration system and its types
- CO4 Adapt low temperature storage systems for foods
- CO5 Apply cold chain and refrigeration for food products

19FTT302 FOOD SAFETY AND QUALITY REGULATIONS L T P J C

3 0 0 0 3

UNIT I FOOD SAFETY 9

Food safety - General principles of food safety. Characterization of food Hazards - physical, chemical and biological. Food spoilage and food borne infection hazards-sources of food spoilage and microorganisms-microbial problems in food safety-food toxicants and food poisoning - prevention. Cross contamination, Limits for pesticide and metal contamination of food. Adulteration, Food additives- types- usage, permissible limits, concept of safe food

UNIT II FOOD QUALITY AND QUALITY EVALUATION OF FOODS 9

Food Quality - its need and its role in Food Industry. Food Quality and Quality Attributes- Classification of Quality Attributes and their role in food Quality. Quality Assessment of Food materials-Fruits, vegetables, cereals, legumes, dairy products, meat, poultry, egg and processed food. Sensory Evaluation of Food Quality. Requirements for conducting Sensory Evaluation, Methods of Sensory Evaluation and Evaluation cards, Different methods of Quantitative descriptive analysis.

UNIT III QUALITY CONTROL 9

Objectives, Importance and Functions of Quality Control, Quality control specifications, training of food technologists for quality control, implementation of standards and specifications. Quality control, principles of quality control - raw material control, process control, finished product inspection, process control, quality problems and quality improvement techniques- mechanization, future of quality control, Total quality management. Objective/Instrumental analysis of Quality Control.

UNIT IV NATIONAL AND INTERNATIONAL FOOD LAWS AND STANDARDS 12

Standards for food packaging and labeling - FSSAI, Bureau of Indian Standards (BIS), Agricultural Grading and Marketing (AGMARK), The Agricultural and Processed Food Product Export Development Authority (APEDA), MPEDA. Food and Drug Administration Act (FDA), International Organization for Standards (ISO), National Accreditation Board for Testing and Calibration Laboratory (NABL) and its implication, Generally recognized as safe (GRAS), European Council (EU), Codex Alimentarius Commission (CAC), Total Quality Management (TQM), Good Manufacturing Practices (GMP), Good Agricultural Practices (GAP), and Good Hygienic Practices (GHP), GMP, Hazard Analysis Critical Control Point (HACCP), FSMA

UNIT V QUALITY CONTROL MEASURES IN INDUSTRIAL AND MARKETING CENTRES 6

Quality control system in storage, Quality control aspects in food industries, Importance of quality control in marketing of Food products - domestic and export markets. International standards for export and quarantine requirements for export of Agricultural and Horticultural produce.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Manoranjan Kalia, Food analysis and Quality control, Kalyani Publishers, Ludhiana,2002.
- 2 Mehta, Rajesh and J. George, Food Safety Regulation Concerns and Trade: The Developing Country Perspective, Macmillan, 2005.

REFERENCES

- 1 P.A. Luning, F. Devlieghere and R. Verhe, Safety in the agri - food chain, Wageningen Academic Publishers, Netherland, 2006.
- 2 Leo and M.L. Nollet, Handbook of food analysis - Methods and Instruments in applied food analysis, Marcel Dekker Inc., 2004.
- 3 J. Andres Vasconcellos, Quality Assurance for the Food Industry: A Practical Approach, 1st Edition, 2003.
- 4 V Ravishankar Rai, Jamuna A Bai, Food Safety and Protection 1st Edition, CRC Press, 2017

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Analyze the sources of food spoilage and food toxicants
- CO2** Identify the food quality evaluation methods
- CO3** Execute the food inspection procedures to evaluate the food quality
- CO4** Select the National and International Food laws and regulations
- CO5** Evaluate the quality control measures in food processing industry and marketing centers

19FTT303 APPLICATION OF SENSORS IN FOOD INDUSTRY L T P J C

2 0 0 0 2

UNIT I SENSORS AND TRANSDUCERS 6

Introduction to measurement system - Resistive Transducers: Strain gauges - Resistance thermometers - Thermistors - Hotwire anemometer - Piezo resistive sensors - Humidity sensors - Inductive Transducers: LVDT - Induction potentiometer - Electromagnetic sensors - Capacitive Transducers: Variable air gap type - Variable permittivity type

UNIT II SAMPLING TECHNIQUES 6

Calibration and standardization of different instruments, water activity- its measurements and significance in food quality. Spectroscopic techniques using UV/Vis, fluorescence, IR, FTIR, NIR, NMR, atomic absorption, ICP, polarimetry, refractometry, microscopic techniques in food analysis (light microscopy, SEM, TEM, XRD, particle size analysis, image analysis etc.). Color measurements in raw and processed foods.

UNIT III CHROMATOGRAPHIC AND SEPARATION TECHNIQUES 6

Adsorption, column, partition, affinity, ion exchange, size exclusion, GC, GLC, HPLC, HPTLC, GCMS, LCMS. Gel filtration, Dialysis, Electrophoresis, Sedimentation, ultrafiltration and ultracentrifugation, solid phase extraction, supercritical fluid extraction, isoelectric focusing, manometric techniques-membrane separation techniques

UNIT IV SPECIAL TECHNIQUES 6

Immunoassay techniques; isotopic, non-isotopic and enzyme immunoassays; surface tension and its significance in food analysis - enzymatic methods of food analysis; thermal methods in food analysis - differential scanning calorimetry. Texture analysis of foods- viscosity measurements and its significance in food quality.

UNIT V INSTRUMENTATION AND SENSORS FOR THE FOOD INDUSTRY 6

Optical Inspection Systems: Computer Vision system, Colour sorter. Food component analysis using NIR and FTNIR. Principles of measurement - Calibrations application in food industry. Practical considerations for implementing online measurements. Radiation thermometers: Principles of measurements and applications. Introduction to automation in food processing. Biosensors - equipment - e nose, NIR.

L : 30 T: 0 P: 0 J: 0 Total: 30 PERIODS

TEXT BOOKS

- 1 AOAC International. 2003. Official methods of analysis of AOAC
- 2 International. 17th Ed. Gaithersburg, MD, USA, Association of Analytical Communities

REFERENCES

- 1 Kirk RS & Sawyer R. 1991. Pearson's Chemical Analysis of Foods. 9th Ed.
- 2 Leo ML. 2004. Handbook of Food Analysis. 2nd Ed. Vols. I-III.
- 3 Linden G. 1996. Analytical Techniques for Foods and Agricultural Products. VCH.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Identify reasons for determine composition and characteristics of food
- CO2** Give basic knowledge on instrumental methods of chemical analysis
- CO3** Understand the principles behind analytical techniques associated with food
- CO4** Know methods of selecting appropriate analytical techniques when presented problem
- CO5** Provide an understanding of and skills in advanced methods of separation and analysis

2000.

3 H.G. Kessler, Food engineering and dairy technology, Verlag A. Kessler, Freising, (F.R. Germany.) 1981.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the composition of milk and physical and chemical properties of milk
- CO2** Apply the principles of different thermal processing of milk
- CO3** Apply the principles and process of Homogenization and cream separation in milk processing
- CO4** Analyse the process flow for the preparation of different dairy products
- CO5** Analyse the process and equipments used for the manufacturing of ice-cream and milk powder production

19FTB302

POST HARVEST TECHNOLOGY

L T P J C

3 0 2 0 4

UNIT I THRESHING, MOISTURE MEASUREMENT AND PHYSICAL PROPERTIES OF AGRICULTURAL PRODUCE 9 + 6

Post harvest engineering - introduction - objectives - post harvest losses of cereals, pulses and oilseeds - importance - optimum stage of harvest. Threshing - traditional methods mechanical threshers - types-principles and operation-moisture content - measurement - direct and indirect methods - moisture meters - equilibrium moisture content. Engineering properties of agricultural produce.

Lab Experiments:

- Determination of moisture content by direct and indirect methods
- Determination of true density, bulk density, porosity of grains

UNIT II CLEANING, GRADING AND DRYING 9 + 6

Principles, air screen cleaners: types, adjustments. Cylinder separator, spiral separator, magnetic separator, colour sorter, inclined belt separator, length separators, effectiveness of separation and performance index. Different types of graders for cereals, pulses and oil seed crops. Drying: principles and theory of drying, thin layer and deep bed drying, hot air drying, methods of producing hot air, types of grain dryers, selection, construction, operation and maintenance of dryers, design of dryers

Lab Experiments:

- Experiment on drying characteristics of grains
- Performance evaluation of separators (Spiral and Specific Gravity)
- Performance evaluation of fluidized bed dryer

UNIT III MATERIAL HANDLING AND STORAGE 9 + 6

Material handling: belt conveyor, screw conveyor, chain conveyor, bucket elevators, pneumatic conveying. Direct and indirect types of damages, sources of infestation, traditional and modern types of storage structures: vertical, horizontal and underground storages, storage structure Designs

Lab Experiments:

- Determination of shelling efficiency of groundnut decorticator
- Determination of the efficiency of bucket elevator and screw conveyor

UNIT IV PROCESSING OF CEREALS, PULSES AND OILSEEDS 9 + 6

Paddy processing: parboiling of paddy, methods, merits and demerits, dehushing of paddy: methods, merits and demerits; rice polishers: types, constructional details, polishing, layout of modern rice mill, performance evaluation of modern mills. Wheat milling, pulse milling methods. Oil seed processing, Sugarcane crushing, extraction recovery and processing of jaggery. Principles and operation: maize sheller, husker sheller for maize, groundnut decorticator, castor sheller.

Lab Experiments:

- Performance evaluation of paddy parboiling drum
- Performance evaluation of a grain cleaning cum grading machine

UNIT V PROCESSING OF FRUITS AND VEGETABLES 9 + 6

Physical and thermal properties of fruits and vegetables, maturity indices for fruits, cleaning and grading of fruits and vegetables. Electronic colour sorting of fruits and vegetables. Unit operationoffruitprocessing:blanchingoffruitsandvegetables, thermalprocessingoffruitpulp. Controlled and Modified atmospheric storage and shrink film storage of fruits and vegetables

Lab Experiments:

- Evaluation of shelling efficiency of rubber roll sheller
- Performance evaluation of seed separators (inclined belt and winnower)
- Visit to modern rice mill

L : 45 T : 0 P : 30 J : 0 Total: 75 PERIODS

TEXT BOOKS

- 1 Chakraverty,A., Post Harvest Technology of cereals, pulses and oilseeds, Third Edition, Oxford & IBH publishing & Co. Pvt. Ltd., New Delhi, 2000
- 2 Sahay, K.M. and K.K. Singh. Unit operations in Agricultural Processing, VikasPublishing House Pvt. Ltd.,

New Delhi, 1994

REFERENCES

- 1 W.L. McCabe and J.C. Smith and P.Harriot Unit Operations in Chemical Engineering, McGraw Hill Inc. Kosaido Printing Ltd. Tokyo, Japan, 2001.
- 2 Mohsenin, N.N., Physical Properties Of Plant And Animal Materials, Gordon and Breach publishers, New York, pp-1206, 1986.
- 3 Pande, P.H. Principles of Agricultural Processing, Kalyani Publishers, Ludhiana, pp-278, 1994.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Possess better exposure to the different engineering properties of biological materials and their importance
- CO2** Recognize the working principles of grain cleaning and grading devices and able to select suitable equipment for cereal grains, oilseeds, and pulses
- CO3** Identify conveying and storage systems used for agricultural products and apply knowledge on properties of product to identify systems for the better processing
- CO4** Apply the knowledge on the various properties of the cereals, pulses, and oil seeds for Processing
- CO5** Identify post-harvest operations for horticultural crops utilize the skills on post-harvest Machines to increase the market value of the processed food products

19FTP301

MINI PROJECT - III

L T P J C

0 0 0 2 1

LIST OF EXPERIMENTS

A batch of four students will carry out the mini project on emerging areas of Food Technology under the guidance of a faculty. The project outlines the involvement of the students to get exposed to the different skills in the domains of Food Technology such as Food microbiology, Food biochemistry, food processing methods etc. and their applications. Three reviews will be conducted throughout the semester and a combined project report to be submitted along with a viva voce for the end semester evaluation

L : 0 T: 0 P: 0 J: 30 Total:30 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Identify the basic requirements of real world state.
- CO2** Survey on the relevant field of study selected
- CO3** Implement the project with software and hardware
- CO4** Test the results of project with existing models
- CO5** Demonstrate and manage to explicate the work carried out

19FTP302

SCADA

L	T	P	J	C
0	0	4	0	2

LIST OF EXPERIMENTS

1. Study of Programmer Logic Controller
2. Construction of Ladder programming for Boolean operations and Math operations using PLC
3. Linear actuation of hydraulic cylinder with timer and counter
4. Hydraulic rotation with timer and speed control using PLC
5. Traffic light controller using PLC
6. Testing of Relays using PLC
7. Study on supervisory control and data acquisition
8. Develop a SCADA screen program for plant operation

L : 0 T: 0 P: 60 J: 0 Total:60 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Build and simulate PLC programming for discrete and analog I/Os
- CO2** Develop hard wiring with PLC and field I/Os
- CO3** Develop plant level automation for real process plant control using PLC and SCADA

19FTT305

**FRUIT AND VEGETABLE
TECHNOLOGY**

L T P J C

2 0 0 0 2

UNIT I INTRODUCTION TO PROCESSING OF FRUITS AND VEGETABLES 5

Exposure to commercially important fruits and vegetables, their regions, season, morphology, texture and composition. Production and processing scenario of fruits and vegetable: India and World. Scope of Fruit and Vegetable Preservation Industry in India - Present status, constraints & prospectus. Overview of principles and preservation methods of fruits and vegetables; Supply chain of fresh fruits and vegetables.

UNIT II POSTHARVEST PROCESSING AND STORAGE 8

Maturity standards; Importance and methods of Maturity determinations; maturity indices for selected fruits and vegetables. Harvesting of important fruits and vegetables. Chemical changes during fruit ripening, its methods and regulations. Primary processing and pack house handling of fruits and vegetables - Peeling, slicing, cubing and cutting. Commodity pre-treatments – Pre-cooling, chemicals, wax coating, pre-packaging, cleaning and grading. Physiological post harvest diseases including chilling and freezing injury. Storage practices: Control atmospheric, hypotactic storage, cool store, Zero energy cool chamber, stores striation. Handling and packaging of fruits and vegetables.

UNIT III MINIMAL PROCESSING AND CANNING 5

Minimal processing of fruits and vegetables; Blanching operations and equipment. Canning: Definition, processing steps and equipment, cans and containers, quality assurance and defects in canned products. Indian Food Regulation and Quality assurance. Exposure to canned products in Indian market.

UNIT IV FREEZING & DEHYDRATION OF FRUITS AND VEGETABLES 6

Freezing - General pre-processing, different freezing methods and equipments, problems associated with freezing; Dehydration – General pre-processing, different methods of drying including sun, tray, spray drying and low temperature, osmotic dehydration and other modern methods; Processing of dried and dehydrated fruits and vegetable products including wafers, soup powder, dried leafy vegetables, pickles, sauerkraut and papad. Indian Food Regulation and Quality assurance.

UNIT V FRUIT AND VEGETABLE PRODUCTS 6

Processing of RTE fruit and vegetable products – Candies/Jelly/Jam/Marmalades, Squashes/cordials, Juice/RTS, pulp/purees/pastes/concentrates, Ketchup/sauces, Chutneys, Fruit Bar, Candied Fruits, Natural colors, Fruit and Vegetable Fibres, starch. Production of pectin and vinegar; Commercial processing technology for production of various value added processed products. Indian Food Regulation and Quality assurance.

L : 30 T: 0 P: 0 J: 0 Total: 30 PERIODS

TEXT BOOKS

- 1 Salunke, D. K and S. S Kadam “Hand Book of Fruit Science and Technology: Production, Composition, Storage and Processing”. Marcel Dekker, 1995.
- 2 Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.
- 3 Srivastava, R P. Fruit and Vegetable Preservation Principles and Practices. III Edition. CBS Publisher.

REFERENCES

- 1 Fellows, P J. “Food Processing Technology: Principles and Practice”. 2nd Edition, CRC/ Woodhead, 1997.
- 2 M. Shafeiur Rahman (1999). Handbook of Food Preservation, Marcel Dekker, Inc.
- 3 Khetarpaul N. “Food Processing and Preservation”. Dya Publishing House, New Delhi. 2005.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Better understanding of the concepts of physiological characteristics of fruits and vegetables
- CO2** Better insight about fruit ripening, postharvest processing losses and storage
- CO3** Thorough Knowledge on minimal processing and canning of fruits and vegetables
- CO4** Understanding of freezing and dehydration technologies in processing and preservation of fruits and vegetables
- CO5** Exposure to various fruits and vegetable products and their processing

19FTT306

**APPLICATION OF ARTIFICIAL
INTELLIGENCE IN FOOD INDUSTRIES**

L T P J C

2 0 0 0 2

UNIT I INTRODUCTION TO ARTIFICIAL INTELLIGENCE

6

Issues and challenges in food and agriculture - efficient routing protocols and ambient energy harvesting. Introduction to the basic principles, techniques, and applications of Artificial Intelligence. Overview of different modes of AI (expert systems, neural networks, fuzzy logic, robotics, natural language processing, and computer vision).

UNIT II MACHINE VISION SYSTEM IN FOOD INDUSTRY

6

Introduction to Machine Vision system – concept - components - Advantages - Metal detectors – Electronic color sorters – Bar code readers – Code detection cameras – Scope and Limitations of Machine Vision system – Applications in Food industry - 3D machine vision technology.

UNIT III AI IN NON-DESTRUCTIVE FOOD QUALITY EVALUATION

6

Role of AI in augmenting food safety and quality. Advantages of AI over analytical food quality measurements. Non-destructive technologies – X-ray Inspection – Ultrasound - hyper spectral imaging – NIR Spectroscopy. Electronic noses and e-tongues. Applications of NDT in food quality for grains, fruits and vegetables, meat, poultry and sea foods.

UNIT IV AI IN CONSUMER SERVICE

6

AI-Based Customer Satisfaction - Decision-Making System for Customers - Launching new products - Reinventing Food Delivery - Customer Feedback System - Food-Vending Terminals and Applications - AI-Based Online Restaurant Search Engine - Self-Ordering Kiosk System.

UNIT V AI IN FOOD SUPPLY CHAIN

6

Product Sorting and Packaging – Food Traceability - Demand-supply chain management - Equipment Cleaning and Maintenance - Personal Health Sanitation - Food Waste Management - Future Application of AI in Food Industry - Robotics for the Food Industry.

L :30 T: 0 P: 0 J: 0 Total: 30 PERIODS

TEXT BOOKS

- 1 Stuart J Russell & Peter Norvig, “Artificial Intelligence: A Modern Approach”. 3rd Edition. Pearson. 2015.
- 2 Da-Wen Sun, “Computer Vision Technology for Food Quality Evaluation”, 2nd Edition, Academic Press, London, 2011.
- 3 Davis E. R., “Image Processing for the Food Industry”, 1st Edition, World Scientific, Singapore.

REFERENCES

- 1 Alexander Hornberg, “Handbook of Machine and Computer Vision: The Guide for Developers and Users”, 2nd Edition, John Wiley & Sons, Germany, 2017.
- 2 Shi Y, Wang X, Borhan MS, Young J, Newman D, Berg E, Sun X. A Review on Meat Quality Evaluation Methods Based on Non-Destructive Computer Vision and Artificial Intelligence Technologies. Food Sci Anim Resour. 2021 Jul; 41(4):563-588. doi: 10.5851/kosfa.2021.e25. Epub 2021 Jul 1. PMID: 34291208; PMCID: PMC8277176.
- 3 Agbai, Chidinma Mary. (2020). Application of artificial intelligence (AI) in food industry. GSC Biological and Pharmaceutical Sciences. 13. 171-178. 10.30574/gscbps.2020.13.1.0320.
- 4 Pulkit Mathur, “Food Safety and Quality Control”, The Orient Blackswan. 2018.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Outline the basic concepts of AI
- CO2** Understand the concept of machine vision technology
- CO3** Gain knowledge on non-destructive technologies
- CO4** Apply the concept of AI in consumer service
- CO5** Make use of appropriate AI concepts for food industry

19FTP303

**BAKING AND CONFECTIONERY
TECHNOLOGY LAB**

L	T	P	J	C
0	0	2	0	1

LIST OF EXPERIMENTS

1. Study on identification and composition of various ingredients for bakery and confectionery products
2. Determination of dough rising capacity of yeast
3. Preparation of cookies - different types.
4. Preparation of bread - different types
5. Preparation of toffees
6. Preparation of sugar boiled confectionery
7. Preparation, packaging and quality evaluation of crystalline and non-crystalline candies
8. Preparation, packaging and quality evaluation of cake
9. Preparation, packaging and quality evaluation of chocolates
10. Preparation, packaging and quality evaluation of pastries
11. Preparation of traditional milk based Indian confectionery
12. Visit to bakery, confectionery and snack units (industry)

L : 0 T : 0 P : 30 J : 0 Total:30 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the concepts and principles of preparation of bakery
- CO2** Understand the concepts and principles of preparation of confectionery
- CO3** Understand the concepts and principles of preparation of snack foods

19FTP304

FRUIT AND VEGETABLE TECHNOLOGY

LAB

L	T	P	J	C
0	0	2	0	1

LIST OF EXPERIMENTS

1. Preparation of orange squash and cordial.
2. Preservation and processing of certain vegetables by osmotic dehydration
3. Preparation of Jam/Jelly/marmalades.
4. Preparation of pickles Preparation of toffees
5. Preparation of dehydrated leafy vegetables/sauerkraut
6. Preparation of dehydrated products - dried ginger, onion and garlic
7. Preparation of puree/paste and its preservation by chemical Preservatives/ thermal processing.
8. Preparation of tomato sauce/ketchup and its preservation by chemical preservatives
9. Experiment on preparation of fruit candies/bar.
10. Experiment on preparation of fruit juice/Ready to serve beverages.
11. Visit to fruit and vegetable processing plant.

L : 0 T: 0 P: 30 J: 0 Total:30 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Have hands on experience in the preparation of fruit and vegetable products
- CO2** Understand the principles of fruit and vegetable preservation by thermal processing, juicing and fermentation
- CO3** Understand the principles of vegetable preservation by drying and dehydration

19HST105 **ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE** **L T P J C**

(Common to All B.E. / B. Tech. Courses) **2 0 0 0 0**

UNIT I ANCIENT INDIA & STATE POLITY 6

State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions' of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage.

UNIT II INDIAN LITERATURE, CULTURE, TRADITION, AND PRACTICES 6

Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali,Prakrit And Sanskrit, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature,Malayalam Literature ,Sangama Literature Northern Indian Languages & Literature, Persian And Urdu ,Hindi Literature

UNIT III INDIAN RELIGION, PHILOSOPHY, AND PRACTICES 6

Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.

UNIT IV INDIAN KNOWLEDGE SYSTEM ON SCIENCES & TRADE 6

Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India ,Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Trade in Ancient India

UNIT V INDIAN CULTURAL HERITAGE & ARTS 6

Indian architect, engineering and architecture in ancient India, sculptures, seals, coins, pottery, puppetry, dance, music, theatre, drama, painting, martial arts traditions, fairs and festivals, current developments in arts and cultural, Indian's cultural contribution to the world. Indian cinema, yoga.

L :30 T: 0 P: 0 J: 0 T: 30 PERIODS

REFERENCES

- 1 V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
- 2 S. Baliyan, Indian Art and Culture, Oxford University Press, India
- 3 Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
- 4 Romila Thapar, Readings In Early Indian History Oxford University Press , India
- 5 Fritz of Capra, Tao of Physics
- 6 Fritz of Capra, The wave of Life
- 7 V N Jha (English Translation), Tarkasangraha of Annam Bhatta, International Chinmay Foundation,Velliarnad,Amaku,am
- 8 Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
- 9 GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi,2016
- 10 RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
- 11 R Sharma (English translation), Shodashang Hridayam
- 12 Basham, A.L., The Wonder that was India (34th impression), New Delhi, Rupa & co
- 13 Sharma, R.S., Aspects of Political Ideas and Institutions in Ancient India(fourth edition), Delhi, Motilal Banarsidass,

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** To understand the Ancient India and State Polity
CO2 Understand the Indian Literature, Culture, Tradition, and Practices
CO3 Understand the Indian Religion, Philosophy, and Practices
CO4 Understand the Indian Knowledge System on Sciences & Trade
CO5 Understand the Indian Cultural Heritage & Arts

19FTP305

INTERNSHIP-II

L T P J C

- - - - 2

LIST OF EXPERIMENTS

A batch of four students will carry out this summer internship under the guidance of a faculty. The internship will be attended during May/ June month for the duration of two weeks in a reputed Food Processing Industry / Agro-based Industry / Dairy Industry to learn field experience and problems faced by the Industry, and find solutions to them. A project report on the experience gained in the Industry should be submitted for evaluation.

2 Weeks

SEMESTER VII

19GET277	BIOLOGY FOR ENGINEERS	L	T	P	J	C
		2	0	0	0	2

UNIT I INTRODUCTION TO LIFE 6

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell-Introduction to biomolecules: definition-general classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome

UNIT II BIODIVERSITY 6

Plant System: basic concepts of plant growth-nutrition-photosynthesis and nitrogen fixation-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions-Microbial System: history-types of microbes-economic importance and control of microbes

UNIT III GENETICS AND IMMUNE SYSTEM 6

Evolution: theories of evolution - Mendel's cell division-mitosis and meiosis-evidence of e laws of inheritance-variation and speciation-nucleic acids as a genetic material-central dogma immunity-antigens-antibody-immune response

UNIT IV HUMAN DISEASES 6

Definition-causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis

UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION 6

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines-cloning-drug discovery-biological neuralnetworks-bioremediation-biofertilizer-biocontrol-biofilters-biosensors-biopolymers-bioenergy-biomaterials-biochips-basic biomedical instrumentation.

L :30 T: 0 P: 0 J: 0 T:30 PERIODS

TEXT BOOKS

- 1 A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
- 2 Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
- 3 Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

REFERENCES

- 1 Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- 2 Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
- 3 Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Grasp and apply biological engineering principles, procedures needed to solve real-world problems
- CO2** Apply the concept of plant, animal and microbial systems and growth in real life situations
- CO3** Comprehend genetics and the immune system
- CO4** Know the cause, symptoms, diagnosis and treatment of common diseases
- CO5** Give a basic knowledge of the applications of biological systems in relevant industries

UNIT I FUNCTIONS OF FOOD PACKAGING AND FLEXIBLE PACKAGING MATERIALS 6

Functions of Packaging, Packaging of foods, requirement, importance and scope, environmental considerations. Flexible packaging materials - Plastic packaging - types of polymers in food packaging and their barrier properties – Manufacturing types. Paper and paper board - characteristics - packaging - manufacture process - modification of barrier properties - Corrugated fiberboard boxes, Relative advantages and disadvantages of different packaging materials. Testing methods for flexible packaging materials

UNIT II RIGID PACKAGING MATERIALS 6

Metal cans, manufacture of two piece and three piece cans - Container designs - Raw materials for can-making – End-making processes - Easy-open ends – Coatings. Glass containers - types of glass in food packaging - manufacture of glass and glass containers, closures for glass containers - effect of these materials on packed commodities. Testing methods for rigid materials and semi rigid materials.

UNIT III PACKAGING SYSTEMS 6

CAP and MAP - novel gases - applications, shrink and cling packaging, vacuum packaging, Aseptic packaging – requirements - shallow and deep path sterilization of Aseptic packaging, Tetra packaging, Retort packaging – principles and application. Edible film packaging, Shrink and stretch packaging,

UNIT IV ACTIVE PACKAGING TECHNIQUES 6

Active packaging - Controlled release packaging – process, structure, property and food variables, target release rate. Antimicrobial packaging - Natural non-toxic insect repellent packaging materials. Active nanocomposite packaging – free radical scavenging, oxygen scavenging and antimicrobial nanocomposites. Flavor release packaging – mechanism of flavor release, practical applications.

UNIT V INTELLIGENT AND SMART PACKAGING, LABELING AND SHELF LIFE STUDIES 6

Smart and intelligent packaging – components and applications. Interactive packaging using internet, Smart Labeling - Labeling to detect changes in temperature, monitor freshness, changes in oxygen and carbon dioxide concentration. Shelf life studies - Shelf life models – constant and variable H₂O and O₂ driving forces. Advances in freshness and safety indicators in food packaging.

L :30 T: 0 P: 0 J: 0 T:30 PERIODS

TEXT BOOKS

- 1 Gorden L. Robertson. 2005. Food Packaging Principles and Practices, Marcel and Deckker, Inc., New York.
- 2 Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi.

REFERENCES

- 1 Coles, R., McDowell, D., Kirwan, M .J. 2003. Food Packaging Technology. Blackwell Publishing Co.
- 2 Hand book on modern packaging industries. NIIR Board. Asia Pacific Press Inc. Delhi, India 2000.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Identify flexible packaging materials and understand its application
- CO2** Identify rigid packaging materials and understand its application
- CO3** Differentiate among the packaging systems
- CO4** Keen knowledge on active, intelligent and smart packaging
- CO5** Explore more on shelf life studies

19FTP401

PROJECT - I

L T P J C

0 0 0 4 2

GUIDELINES

1. Project periods shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned.
2. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.
3. The students will take up research on topics pertaining to food technology and conduct the research, Analyze data, evaluate the results and conclude the appropriate solution, suggestion for future work.
4. The continuous assessment shall be made as prescribed in the regulations.
5. The progress of the project is evaluated based on a minimum of three reviews.
6. The review committee may be constituted by the Head of the Department.
7. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.
8. This final report shall be typewritten form as specified in the guidelines.

L : 0 T: 0 P: 0 J: 30 Total:30 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Learn the process of research systematically
- CO2** Develop new ideas into practice
- CO3** Take up projects relating to industrial problems and find solutions to them.
- CO 4** The research may lead to a product development

19FTP402

PACKAGING MATERIALS LAB

L T P J C

0 0 2 0 1

LIST OF EXPERIMENTS

1. Identification of different types of packaging materials
2. Determination of thickness and GSM for different packaging material
3. Determination of tensile strength of given material/package
4. Determination of drop test of food package
5. Experiment on friction testing
6. Experiment on puncture test of fruits and vegetables
7. Experiment on freshness tester
8. Experiment on canning of food and testing of cans
9. Experiment on form fill seal machine for solids and liquids
10. Experiment on retort packaging
11. Effect of moisture content on packaging of food materials
12. Experiment on Vacuum packaging of agricultural produce
13. Visit to food packaging material manufacturing unit

L : 0 T: 0 P: 30 J: 0 Total:30 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Identify different packaging materials
- CO2** Gain knowledge on different packaging material tests
- CO3** Understand the process of canning, form fill sealing and retort packaging

SEMESTER VIII

MOOC / NPTEL

L	T	P	J	C
2	0	0	0	2

GUIDELINES

The students should take up any course in the domain of Food Technology in MOOC / NPTEL platform offered by the experts in that area. The course registered should not be covered in R2019 curriculum. The student should produce the Grade sheet obtained from NPTEL for awarding the credit. On completion of the course, the students should appear for an evaluation conducted by the team of expert members and Head of the Department.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the basic concepts on the chosen topic
- CO2** Explore deeply into the topic
- CO3** Gain intense knowledge on the topic
- CO4** Applications of the topic in the food industry.

19FTP403

PROJECT - II

L	T	P	J	C
0	0	0	24	12

GUIDELINES

1. The students will continue the research on topics pertaining to food technology and conduct the research, develop prototypes and will submit reports.
2. The scope of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies.
3. Every project work shall have a guide who is the member of the faculty of the institution.
4. Shall consist of identification of the project after literature survey.
5. Students should present a review paper and submit it to the internal examiners.
6. Report should summarise the methodology to be adopted, work plan for the proposed project work.
7. The final report shall be type written form as specified in the guidelines.
8. The continuous assessment shall be made as prescribed in the regulations.
9. Awarding Credit value is based on the performance of the above said criteria.
10. 25% of the project work and its methodologies are to be completed.

L : 0 T: 0 P: J: 300 Total:300 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Learn the process of research systematically
- CO2** Develop new ideas into practice
- CO3** Take up projects relating to industrial problems and find solutions to them.
- CO4** The research may lead to a product development

PROFESSIONAL ELECTIVE - I

19FTE301 **DESIGN OF FOOD PROCESSING MACHINERY** **L T P J C**

3 0 0 0 3

UNIT I **DESIGN OF PRESSURE VESSELS, STORAGE TANKS AND PULPER** **9**

Introduction to design - principles and selection of food processing equipment - design of pressure vessels - design aspects of storage tanks, design of sterilizers and process vats – design of pulper - design considerations - materials of construction - installation and operation

UNIT II **DESIGN OF HEAT EXCHANGERS AND EVAPORATORS** **9**

Design of heat exchangers –parallel flow, counter flow types-LMTD- efficacy of heat exchangers-plate heat exchanger, shell and tube heat exchangers - materials of construction - installation and operation - design of single effect evaporators - applications - multiple effect evaporators- entrainment separators.

UNIT III **DESIGN OF DRYERS AND EXTRUDERS** **9**

Design of dryers - cabinet dryer, fluidized bed dryer, heat pump dryer, foam mat dryer - freeze dryer - Spray dryer - design considerations, installation, operation and maintenance - design considerations of food extruders - single and twin screw extruders

UNIT IV **DESIGN OF COLD STORAGE AND FREEZERS** **9**

Design of cold storage - estimation of cooling load - construction, operation and maintenance of cold storage -design consideration for controlled atmospheric storage and modified atmospheric storage of perishables - design of freezers - types of freezers - design considerations - construction and operation- design of frozen storage.

UNIT V **DESIGN OF SIZE REDUCTION AND CONVEYING EQUIPMENTS** **9**

Design consideration of size reduction equipments- installation and maintenance-design consideration of material conveying equipments- belt conveyor- screw conveyor - bucket elevator- pneumatic conveyor- performance

L :45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 P.S. Phirke, Processing and conveying equipment design, Jain Brothers, New Delhi, 2004.
- 2 M.V. Joshi and V.V. Mahajani, Process Equipment Design (3rd edition), New India Publishing Agency, New Delhi, 2004.

REFERENCES

- 1 K.M. Sahay and K.K. Singh, Unit operations of Agricultural Processing, Vikas Publishing House Pvt. Ltd., New Delhi, 2004..
- 2 Jasim Ahmed and Mohammad Shafiur Rahman (Editors), Handbook of Food Process Design, John Wiley and Sons, Ltd., U.K., 2012.
- 3 Zacharias B. Maroulis and George D. Saravacos, Food Process Design, Marcel Dekker, Inc. U.S.A, 2003.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Analyze the process parameters of equipment and design pressure vessels, storage tanks and pulper
- CO2** Select the suitable products and materials for designing heat exchangers and evaporator
- CO3** Design and analyze the performance of dryers and extruders
- CO4** Estimate the cooling load of cold storage and design a cold storage for fruits and vegetables
- CO5** Analyze and determine the parameter for designing size reduction and conveying equipment

19FTE302

**TECHNOLOGY OF SNACK AND
EXTRUDED FOODS**

L T P J C

**3 0 0 0 3
9**

UNIT I INTRODUCTION

Current status of snack food industry in India. Types of snack food – Raw Vegetable Snack, Formed dough products from potato and maize derivatives, Half Products, Directly expanded extruded snack, Puffed Snacks and other. Types and Functions of ingredients – structure forming materials, dispersed phase/filling materials, plasticizers/lubricants, soluble solids, nucleating substances, coloring and flavouring substances.

UNIT II POTATO AND RICE BASED SNACKS

9

Potato Chip - Pre cleaning and peeling, slicing, drying/frying, salting and seasoning, quality control. Fabricated potato snacks – potato flakes, potato granules, potato starch, ground and crushed dehydrated potato. Rice based Snacks – Products using whole grains – Gun puffed rice. Products using flours.

UNIT III CORN BASED SNACKS

9

Tortilla chip – Corn soaking and smoking, Grinding, Masa flour, Sheeting and Cutting, Baking and Frying. Popcorn – Popping methods, oil popping and dry popping. Commercial and industrial popcorn process. Flavorings and Applicators

UNIT IV EXTRUSION BASED SNACKS

9

Extruder components – Single and Twin screw, Single and Multiple die extruders – Hot extrusion and Cold extrusion methods – Second generation and Third generation snacks, Co extruded snacks, Masa based snacks, Flat bread, Crisp bread.

UNIT V PASTA PRODUCTS

9

Raw materials. Preparation of raw materials for extrusion. Spaghetti, noodles, macaroni and similar products. Dry and frozen pasta products. Pretzel – Types – Formulation and Processing - mixing, extrusion, proofing, cooking, surface salting, baking and drying. Problems in pretzel manufacture.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Edmund W. Lusas and Lloyd W. Rooney, —Snack Food Processing I, 1st Edition, CRC Press, Florida, 2001.
- 2 Robin Guy, —Extrusion cooking: Technologies and Applications I, 1st Edition, CRC Press, Florida, 2001.

REFERENCES

- 1 Panda H., —The Complete Technology Book on Snack Foods, National Institute of Industrial Research, New Delhi, 2003.
- 2 Sergio O. Serna-Saldivar, —Industrial Manufacture of Snack Food I, Woodhead Publishing, New Delhi, 2008.
- 3 Mian N. Riaz., —Extruders in Food Application I, CRC Press, Florida, 2000.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Choose appropriate ingredient based on their functionality
- CO2** Infer the production of potato and rice based snacks
- CO3** Apply suitable techniques for corn based snacks production
- CO4** Elaborate the production of extruded snack foods
- CO5** Categorize and formulate pasta products

19FTE303

MILLING TECHNOLOGY

L T P J C

3 0 0 0 3

9

UNIT I GRAIN PROPERTIES

Importance of cereals and legumes- Grain structure and Composition. Physicochemical properties of grains and nutritional value. Pre-milling operations of grains. Grading. Storage of grains in relation to maintaining grain quality and types of storage structures. Losses during storage and Prevention method

UNIT II RICE MILLING

9

Rice - Structure and nutritional value, Traditional rice milling machineries. Modern Rice milling flow chart, operations and equipments used- Cleaning, Dehusking, Husk and paddy separation, Whitening, Polishing, Bran separation, Grading and Colour sorting. Parboiling- Physicochemical changes during Parboiling and effects on rice quality, Methods of Parboiling – CFTRI Method, Processed rice products - Rice flour, Puffed rice, Rice flakes, Instant Rice, Fermented Rice Products - Rice, Dosa and Dhokla. Byproducts utilization.

UNIT III WHEAT AND CORN MILLING

9

Wheat: Structure, Composition and nutritional value. Wheat milling operations - Cleaning, conditioning, grinding. Components of wheat mill- Sifters, Roller milling - Break rolls and reduction rolls, purifying. Equipments - Destoner, Entoleters. Parboiling of wheat. Efficiency of milling process. Corn: Structure, Composition and nutritional value. Dry and wet milling of corn-flow sheet, Products from corn milling - corn starch, corn syrup, corn flakes, corn meal, cornoil, corn gluten.

UNIT IV PULSE AND MILLET MILLING

9

Structure and Importance of Pulses and Millets. Unit operations of pulse and Millet milling. Dehulling losses and effect on nutritive value. Milling Methods of pulses and Millets. Problems of Pulse milling industry. Factors affecting Pulse milling outturn. Efficiencies of Pulse and Millet milling.

UNIT V OIL SEED MILLING

9

Oil seed processing- natural sources of oil, Seed composition and nutritive value of oil. Pretreatments before oil extraction- Cleaning, dehulling, Size reduction, flaking, Cooking. Extraction techniques - Ghanies, Screw press, Solvent Extraction. Refining of oil, hydrogenation, winterization. Deoiled seed flour.

L : 45 T : 0 P : 0 J : 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Chakraverty, A. - Post Harvest Technology of Cereals, Pulses and Oil Seeds, Third Edition, Oxford & IBH publishing & Co., New Delhi, 2000
- 2 Sahay, K.M. and Singh. K.K - Unit operations of Agricultural Processing, Vikas Publishing House, New Delhi, 1996.

REFERENCES

- 1 Khader, Vijaya and Vimala, V., - Grain Quality and Processing, Agrotech Publishing, Udaipur, 2007
- 2 Jasim Ahmed and Mohammad Shafiur Rahman (Editors), Handbook of Food Process Design, John Wiley and Sons, Ltd., U.K., 2012.
- 3 Kulp K and Pont J G, - Handbook of Cereal Science and Technology, Second Edition, Chips Ltd. USA, 2000.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1 Assess the structure, nutritional value and storage of cereals and legumes
- CO2 Apply the milling techniques, parboiling methods and equipment used in rice milling
- CO3 Analyze the milling efficiency in milled wheat and corn products
- CO4 Compare the efficiency of dry and wet milling techniques in pulse milling
- CO5 Evaluate the extraction and refining methods of oil from oilseeds

19FTE304

**FOOD ADDITIVES AND
NUTRACEUTICALS**

L T P J C

3 0 0 0 3
9

UNIT I FOOD ADDITIVES

Definition; their function in food processing and preservation; Preservatives –definition; natural preservatives; chemical preservatives; acidulants and low pH –organic acids and esters; sulphur dioxide and its salts; nitrites; antibiotics; surface preservation; Permitted preservatives in foods – Antioxidants; natural and chemical antioxidants; mechanism of antioxidant function; primary and secondary antioxidants; application of antioxidants in foods

UNIT II FOOD COLORS, EMULSIFIERS AND STABILIZERS 9

Natural and synthetic colors; fake colors; inorganic pigments; application of colors in food industry; restriction on the use of colors in foods. Flavoring agents –concept of flavors in foods; natural flavors; nature identical flavors; artificial flavoring substances; restrictions on the use of flavoring agents in Foods. Definition, and function of emulsifiers and stabilizers in foods; permitted emulsifiers and stabilizers used in foods

UNIT III SAFETY, REGULATION AND QUALITY STANDARDS 9

Safety limits of Food additives; Risk assessment and risk benefit Indices of human exposure, acute toxicity, mutagenicity and carcinogenicity, reproductive and developmental toxicity, teratogenicity, neurotoxicity and behavioral effect, immune toxicity. Determination of the limit for addition – NOEL – Method of determining toxicity

UNIT IV NUTRACEUTICALS 9

Introduction, definition and difference from nutrients. Plant and animal based nutraceuticals. Health benefits of antioxidants, Flavonoids, Omega-3 Fatty Acids, Carotenoids. Technologies to recover Nutraceuticals compounds: Distillation, ultrahydrostatic pressure treatment, dense Carbon dioxide treatment, encapsulation of nutraceuticals – materials, mechanical processes and chemical based processes, nano encapsulation.

UNIT V ROLE IN HEALTH PROMOTION AND DISEASE PREVENTION 9

Nutraceuticals in prevention and treatment of gastrointestinal disorder, Cardiovascular and Chronic Diseases. End User Market Products - supplements forms- tablets, capsules, powders, soft gels, gel caps, liquids; Nutraceuticals currently available in the market, regulation for nutraceuticals.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Belitz H.D., Grosch W. and Schieberle P., —Food Chemistry, 3rd Edition, Springer-Verley, Berlin, 2004.
- 2 Wildman, Robert E.C., —Handbook of Nutraceuticals and Functional Foods, 2nd Edition, CRC Press, New York, 2006.

REFERENCES

- 1 Clare M. Hasler, —Regulation of Functional Foods and Nutraceuticals: A Global Perspective, 1st Edition, Wiley, Chicago, 2008.
- 2 Yashwant Pathak, —Handbook of Nutraceuticals, Volume 1, 1st Edition, CRC Press, USA, 2011.
- 3 Lockwood, Brian, and Rapport, Lisa, —Nutraceuticals: A Guide for Healthcare Professionals, 2nd Edition, Pharmaceutical Press, London, 2007.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Acquire insight on various food additives
- CO2** Choose suitable food colors, emulsifiers and stabilizers
- CO3** Identify the safety, regulations and quality standards of food additives
- CO4** Develop nutraceutical products
- CO5** Infer the effect of nutraceuticals in health promotion and disease prevention

19FTE305

FOOD PRESERVATION

L T P J C
3 0 0 0 3

UNIT I HIGH AND LOW TEMPERATURE PROCESSING OF FOODS 9

Methods of applying heat to food - Blanching, Pasteurization, Sterilization - thermo bacteriology, commercial sterility, calculation of process time –determination of thermal death time- methods of sterilization - equipment. Methods of low temperature preservation - Chilling, Freezing, freeze drying and freeze concentration - theory and principles

UNIT II DRYING, DEHYDRATION AND EXTRUSION 9

Drying - types of dryers. Dehydration-Osmotic dehydration-theory and principles. Water activity - sorption behaviour of foods - water activity and food stability - Relationship between water activity and moisture - Equilibrium moisture content. Extrusion cooking - principles and types of extruders - single and double screw extruder- construction and working. Effect of different parameters - quality of the extruded products.

UNIT III PROCESSING AND PRESERVATION OF FOODS BY CHEMICALS 9

Food preservation by sugar, salt, acid - Principles - mechanism- antimicrobial activity. Preservation by chemicals- type of chemical preservatives- sulphur dioxide, benzoic acid, etc; use of other chemicals like acidulants, antioxidants, mold inhibitors, antibodies, etc. Factors affecting antimicrobial activity of preservatives.

UNIT IV NON THERMAL PROCESSING 9

Food Irradiation - High Pressure Processing- Pulsed electric field processing, pulsed light treatment and Ultrasound - Theory and Principles - effect on microorganisms- Application in Processing of foods.

UNIT V NOVEL METHODS OF FOOD PROCESSING 9

UV treatment, Ozone treatment, dielectric heating- microwave, radio frequency, ohmic and infrared heating theory, equipment, applications and effect on foods. Hurdle technology and Nano-technology - principle - application in food processing.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 P.J. Fellows, Food processing Technology: Principles and practice, Second edition, Wood head publishing limited, Cambridge, 2009.
- 2 Da-Wen Sun, Emerging Technologies for food processing, 2nd Edition, Academic Press, 2014.

REFERENCES

- 1 Dennis R. Heldman and R. Paul Singh, Introduction to food engineering, Fourth edition, CRC Press, 2006.
- 2 Howard Q. Zhang, Gustavo V. Barbosa-Canovas, V.M.Balasubramaniam, C. Patrick Dunne, Daniel F.Farkas and James T.C.Yuan. Nonthermal processing Technologies for food, IFT Press, 2011.
- 3 Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Pilar Cano, Novel Food Processing Technologies, CRC Press, 1st Edition, 2004

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Acquire insight on various food apply different methods of high and low temperature processing techniques over raw foods and analyze the process time of that food properties of food
- CO2** Understand and apply the suitable dryers to different food to increase the shelf life and analyse the working of extrusion process and their features
- CO3** Analyze the shelf life of foods processed and preserved by natural and chemical agents
- CO4** Understand the operations and features of different non-thermal processing techniques and applying to improve the shelf life of product
- CO5** Infer the effect of nutraceuticals in health promotion and disease p infer the effect of nutraceuticals in health promotion and disease pre Apply the principle of advanced novel techniques in food processing industries

PROFESSIONAL ELECTIVE - II

19MEE304	TOTAL QUALITY MANAGEMENT	L	T	P	J	C
	(Common to Mech, Agri & FT)	3	0	0	0	3

UNIT I INTRODUCTION **9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM – Industrial Examples of Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, and Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES **9**

Leadership - Strategic quality planning - Employee involvement and engagement initiatives in industries - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - Case studies on 5S and Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III STATISTICAL PROCESS CONTROL (SPC) **9**

Statistical fundamentals – Measures of central Tendency and Dispersion - Population and Sample, Control Charts for variables and attributes, Industrial Examples. Process capability. 5's Principles and Six Sigma Process – Case studies – New seven Management tools.

UNIT IV TQM TOOLS **9**

Benchmarking - Reason to benchmark, Best Practices and case studies of Benchmarking process - FMEA - Stages, Types. Quality Function Deployment (QFD) - House of Quality - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures in various industries.

UNIT V QUALITY SYSTEMS **9**

Need for ISO 9000 and Other Quality Systems - ISO 9001-2015 Quality System - Elements, Implementation of Quality System Documentation, Quality Auditing in industries - QS 9000 – BS-OHSAS 18001: 2007, ISO 20000, ISO 22000 IATF 16949: 2016, ISO 14001:2015, AS9100– Concept, Requirements and Benefits - Case studies.

L: 45 T:0 P:0 J:0 TOTAL: 45 PERIODS

TEXT BOOKS

1. Dale H. Besterfield, "Total Quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2016.
2. Subburaj Ramasamy "Total Quality Management" Tata Mcgraw hill edition, 2015.

REFERENCES

1. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2010.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
3. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2016.
4. Dr S. Kumar, "Total Quality Management", Laxmi Publications Ltd., New Delhi 2006.
5. P. N. Muherjee, "Total Quality Management", Prentice Hall of India, New Delhi, 2015.

COURSE OUTCOMES

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

CO1 State about the recent techniques followed in quality approach.

CO2 Improve Leadership Skills and raise the employee involvement.

CO3 Implement the Concepts of SPC Tools in Industrial Activity.

CO4 Examine the TQM Tools in Several Engineering fields.

CO5 Explain about the ISO and QS certification process and its need for the industries.

19FTE306

**SEPARATION TECHNIQUES IN
FOOD PROCESSING**

L T P J C

3 0 0 0 3

UNIT I RECENT ADVANCEMENTS IN SEPARATION TECHNIQUES 9

Recent advances in separation techniques based on size, surface properties, ionic properties and other special characteristics of substances. Process concept, theory and equipment used in cross flow filtration, cross flow electro filtration and dual functional filter. Surface based solid – liquid separations involving a second liquid, Sirofloc filter

UNIT II ADSORPTION BASED AND OTHER SEPARATION PROCESSES 9

Types and choice of adsorbents, Mechanisms of Affinity chromatography and immuno chromatography. Application of adsorption process in food processing industry. Zone melting, Adductive crystallization, Oil spill Management, Foam separation, Aqueous two phase extraction and Industrial effluent treatment by modern techniques

UNIT III SOLID SEPARATION PROCESS 9

Concept of size, Shape, Magnetic separation, Eddy-current separation, , Ballistic separation, Color separation, Wet Separation Process, liquid-solid and liquid- liquid separation by hydrocyclones, Surface velocity classifier, Elutriators, Impingement separator, Electrostatic precipitation membrane

UNIT IV MEMBRANE TECHNOLOGY 9

Mechanism and equipments employed for micro-filtration, Ultrafiltration, Nanofiltration, Reverse osmosis, Concentration polarization, Operation layout of the modules, Pervaporation and Application of membrane technology in food industry

UNIT V IONIC SEPARATION PROCESSES 9

Working principle, controlling factors, equipment employed for for electrophoresis, Dielectrophoresis, ion exchange chromatography, electro dialysis and permeation techniques for solids, liquids and gases

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 King, C.J., “Separation Processes”, Tata McGraw–Hill Publishers, New Delhi, 1982
- 2 Ronald. W. Rousseau., “Handbook of Separation Process Technology”, Wiley India Pvt. Ltd, 2009

REFERENCES

- 1 Osadar and Varid Nakagawal., “Membrane Science and Technology”, Marcel Dekkar,1992
- 2 Jimmy L. Humphery and George E. Keller., “Separation Process Technology”, McGraw-Hill Publishers, 1997.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Infer the concepts of separation techniques
- CO2** Acquire knowledge on separation by membrane and adsorption
- CO3** Familiarize with ionic separation and other commercial process
- CO4** Concept of separation using different phase materials
- CO5** Understand the latest techniques and concept

19FTE307 MODELING, SIMULATION AND SOFT TOOLS FOR FOOD TECHNOLOGISTS L T P J C

3 0 0 0 3

UNIT I INTRODUCTION TO MODELING 9

Physical, Mathematical and Chemical Systems. Modeling - Principles of model Formulation, Representation of Model, Fundamental Laws, Types of Modeling Equations, Black Box Principles, Boundary Condition, Validation of model. Benefits of modeling in food process.

UNIT II MODELS IN FERMENTATION 9

Introduction, Biological models - Genetic models, growth models, killingoff models and productions models. Technological models - heat transfer models, oxygen transfer models and mixing models. Economic models and mixed models. Models in MAP: Principle and methods, macro, micro and meso level models.

UNIT III MODELING OF COOLING AND FREEZING PROCESSES 9

Introduction, modeling product heat load during cooling - single tank model and tank network model. Modeling product heat load during freezing. Numerical solution of heat conduction equation with phase change. Finite different models and element model. Modeling of combined heat and mass transfer - porous, non-porous foods, foods with impermeable skin and frozen foods.

UNIT IV MODELING OF THERMAL PROCESS 9

Types, basic equations - Microbiological and quality kinetics, thermal transport equations. Conduction equations, complex models for non-uniformity and convective flows, sterilization of liquids foods and foods containing particulates. Models for microwave and ohmic heating

UNIT V SOFT TOOLS FOR MODELING OF FOOD PROCESSES 9

Soft tools for Sensory analysis, Mathematical analysis, data treatment tools, design tools, Simcad Pro simulation software, COMSOL, gPROMS.

L : 45 T : 0 P : 0 J : 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Luyben W.L., —Process Modeling, Simulation and Control for Chemical Engineers, 2nd Edition, McGraw Hill Book Co., New York, 1990
- 2 Tijskens L.M.M., Hertog T.M. and Nicolai B.M., —Food Process Modeling, CRC Press, 2001

REFERENCES

- 1 Babu B.V., —Process Plant Simulation, Oxford University Press, New Delhi, 2004
- 2 Farid M.M., —Mathematical Modeling of Food Processing, CRC Press, 2010.
- 3 Jun S. and Irudayaraj J.M., —Food Processing Operations modeling: Design and analysis, CRC Press, 2009

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Apply the concepts of modeling in food processing
- CO2** Adapt suitable mathematical models in fermentation and MAP
- CO3** Illustrate the modeling concepts in cooling and freezing processes of foods
- CO4** Infer the models used in thermal processing of foods
- CO5** Make use of appropriate software for modeling processes

PROFESSIONAL ELECTIVE - III

19FTE401	ENZYME ENGINEERING AND TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3

UNIT I INTRODUCTION TO ENZYMES 9

Classification and nomenclature of enzymes according to IUB. Mechanisms of enzyme action, concept of active site and energetic of enzyme substrate complex formation, specificity of enzyme action, Mechanism of enzyme catalysis- electrostatic proximity and orientation effect, role of entropy in catalysis. Co-enzyme, cofactor and prosthetic group – reaction involving TPP, Pyridoxal phosphate, Nicotinamide, Flavin Nucleotides, Co-A, Biotin and Vitamin K dependent carboxylation. Isozymes, abzymes, synzymes.

UNIT II KINETICS OF ENZYME ACTION 9

Order of reaction, Activation energy, Kinetics of single substrate reactions, Estimation of Michaelis-Menten parameters, Lineweaver burk plot, multi substrate reactions-mechanisms and kinetics, turn over number, pH and temperature effect on enzymes and deactivation kinetics.

UNIT III ENZYME INHIBITION 9

Reversible inhibition –Kinetics of competitive, non-competitive and uncompetitive inhibition. Irreversible inhibition – suicide inhibition. Allosteric regulation of enzymes, Monod Wyman Changeux model. Enzyme Immobilization - Physical and chemical techniques for enzyme immobilization-adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding - examples, advantages and disadvantages.

UNIT IV APPLICATION OF ENZYME EXTRACTS 9

Plant, animal and microbial sources, methods of characterization of enzyme extract, development of enzymatic assays. Enzyme application in food processing, meat industry, fruit and vegetable industry, dairy industry, health care and environment

UNIT V ENZYME ENGINEERING AND BIOSENSOR 9

Enzyme engineering- design and construction of novel enzymes, random mutagenesis, site directed mutagenesis, rational and computational design, artificial enzymes. Design of enzyme electrodes and their application as biosensors in industry

L: 45 T:0 P:0 J:0 TOTAL: 45 PERIODS

TEXT BOOKS

1. O.G.Palanna, "Enzyme technology". Tata McGraw-Hill Pub. Co. Ltd, New Delhi.2017.

REFERENCES

1. Young Je Yoo, Yan Feng, Yong Hwan Kim, Camila Flor J. Yagonia, "Fundamentals of Enzyme Engineering", 1st edition, Springer Netherlands, 2017
2. Parmjit S. Panesar, Satwinder S. Marwaha, Harish K. Chopra, "Enzymes in Food Processing: Fundamentals & Potential Applications", 1st edition, I.K. International Publishing House, 2010.
3. Whitehurst R. and Law B., "Enzymes in Food Technology", 2nd edition, Blackwell Publishing, 2010.
4. Trevor Palmer, "Enzymes: Biochemistry, Biotechnology and Clinical Chemistry", 2nd edition, Horwood Publishing, 2008

COURSE OUTCOMES

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

- CO1** Outline about enzyme classification
- CO2** Interpret the enzyme inhibition and enzyme kinetics
- CO3** Apply suitable methods for enzyme inhibition
- CO4** Identify suitable enzymes for processing.
- CO5** Make use of concepts of enzymes and biosensors

19FTE402 MEAT, FISH AND POULTRY PROCESS TECHNOLOGY

L T P J C
3 0 0 0 3

UNIT I MEAT PROCESSING

9

Types of Meat and its sources, composition, structure of meat. Ante mortem handling, slaughtering of animals, inspection and grading of meat. Introduction to Halal. Post-mortem changes of meat. Meat -Tenderization, Aging. Meat quality evaluation. Wholesale and retail cuts. Preservation of meat- curing, smoking, drying, freezing. Processed meat products- Hamburgers, sausages and meat balls

UNIT II FISH PROCESSING

9

Types of fish, composition and nutritive value of fish. Harvesting of fish. Spoilage factors of fish. Post-mortem changes in fish. Preservation- Freezing and Individual quick freezing, Canning and smoking operations, Salting and drying of fish, pickling

UNIT III POULTRY PROCESSING

9

Types and characteristics of poultry products. Unit operation in poultry processing. Pre-slaughter factors affecting poultry meat quality. Types of poultry cuts. Factors affecting the shelf-life of poultry meat. Sensory quality of poultry meat- color, texture and flavor. Preservation techniques: chemical treatments, heating, drying and irradiation

UNIT IV EGG PROCESSING

9

Structure, composition, nutritive value of egg. Functional properties of eggs, Factors affecting egg quality and measures of egg quality. Preservation of egg by different methods. Egg powder processing-spray drying, Foam mat drying.

UNIT V HYGIENE AND SANITATION

9

Handling and maintenance of tools and core equipment. Meat plant layout. Meat processing hygiene. Cleaning and sanitation in meat plants. Food safety measures –GMP and GHP.

L: 45 T:0 P:0 J:0 TOTAL: 45 PERIODS

TEXT BOOKS

1. Panada P.C., Textbook on Egg and Poultry Technology, 1st Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 1996.
2. Gunter Heinz and Peter Hautzinger,—Meat Processing Technology, 1st Edition, Rap Publication, Montepplier, 2007

REFERENCES

1. Ionnis S. Boziaris, —Seafood Handbook: Technology, Quality and Safety, Wiley Blackwell, UK, 2014.
2. MeadG.C.,—PoultryMeatProcessingandQuality, 1stEdition, CRCPress, London, 2004
3. Alan R. Sams, —Poultry Meat Processing, 1st Edition, CRC Press, London, 2001

COURSE OUTCOMES

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

CO1 Elaborate handling and processing of meat

CO2 Recommend fish processing and preservation techniques

CO3 Categorize poultry products and apply suitable processing techniques

CO4 Select appropriate techniques for egg processing

CO5 Adapt hygiene and sanitation procedures in meat industry

19FTE403 **FOOD PRODUCT DEVELOPMENT** **L T P J C**

3 0 0 0 3

UNIT I PRINCIPLES OF FOOD PRODUCT DEVELOPMENT **9**

Introduction, concept, need and definition of Food Product Development. Strategies and steps in new food product development. Idea generation and its transformation into formulation of recipes.

UNIT II CONSUMER PREFERENCES, MARKET TRENDS & SENSORY **9**
PROPERTIES

Consumer preferences, Market trends and creativity Role of nutritional and sensory properties in food product development. Sensory properties of food and their role in product development. Formulation and evaluation of recipes at laboratory level. Evaluation of food- Objective and subjective methods, selection and training of judges, development of score cards and analysis of data.

UNIT III BULK PREPARATION **9**

Bulk preparation of new food products – strategies and methods. Basics unit of operation. Bulk food preparation for food institutions and enterprises: servings, nutritive value

UNIT IV ANALYSIS OF PACKAGING AND LABELLING **9**

Economic Feasibility analysis, Levels of Packaging, Steps to determining packaging, Packaging material, Food labeling.

UNIT V IPR AND SAFETY CONCERNS **9**

Confidentiality and Intellectual Property rights Shelf life testing and data coding. Controlling the quality of new food product, safety concerns for new food product. quality control and HACCP

L: 45 T:0 P:0 J:0 TOTAL: 45 PERIODS

TEXT BOOKS

1. Panada P.C., Textbook on Egg and Poultry Technology, 1st Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 1996.
2. Gunter Heinz and Peter Hautzinger,—Meat Processing Technology, 1st Edition, Rap Publication, Montepplier, 2007

REFERENCES

1. Loesecke. H.W. 1998. Drying and Dehydration of Foods. Allied Scientific Publishers. Bikaner.
2. Desroisier. N.W. 1997. Elements of Food Technology, AVI Publishing. Co. USA.

COURSE OUTCOMES

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

CO1 Apply the Strategies and steps in developing a new product

CO2 Understand the consumer requirements, market trends and sensory properties

CO3 Apply the strategies in Bulk preparation

CO4 Demonstrate the analysis involved in packaging and labeling

CO5 Understand the IPR and safety concerns in food product development

19FTE404	FERMENTATION TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3
UNIT I	FOOD FERMENTATION					9

Origin and history of food fermentation, Micro-organisms for fermentation, Starter Cultures and Fermented Products, Manufacture of fermented products, Quality and flavour of fermented products

UNIT II TYPES OF FERMENTATION 9

Types of fermentation submerged/solid state. Sterilization-air sterilization, media sterilization. Batch/continuous fermentation, scale up in fermentation. Maintenance of aseptic conditions.

UNIT III AERATION AND AGITATION IN FERMENTATION 9

Aeration and agitation in fermentation: Oxygen requirement, measurement of adsorption coefficients, bubble aeration, mechanical agitation, correlation between mass-transfer coefficient and operating variables

UNIT IV PRODUCTION OF FERMENTED PRODUCTS 9

Principle and preparation of Fermented foods: Sauerkraut, yoghurt, cheese, miso, tempeh, tofu, idli, dosa, pickles. Semi solid cultured dairy products - principles and applications- packaging quality assurance and sanitation. Meat fermentation- principles and application.

UNIT V INDUSTRIAL FERMENTATION PROCESSES 9

Production of vitamins, amino acids, organic acids, enzymes and antibiotics, alcohols. Industrial production of beer, wine, enzymes - amylase, pectinase, proteases, vitamins, antibiotics, baker's yeast, single cell protein.

L: 45 T:0 P:0 J:0 TOTAL: 45 PERIODS

TEXT BOOKS

1. Y. H. Hui, Lisbeth Meunier-Goddik, Jytte Josephsen, Wai-Kit Nip and Peggy S. Stanfield., "Handbook of Food and Beverage Fermentation Technology", CRC Press,UK, 2004.
- 2 Robert W. Hutkins., "Microbiology and Technology of Fermented Foods", CRC Press,UK, 2004.

REFERENCES

1. Gutierre, Gustavo F.,—Food Science and Food Biotechnology, CRC Press, New York,2003
2. Crueger W. and Crueger A., “Biotechnology: A Textbook of Industrial Microbiology”, Science Tech. Madison, USA, 1984.
- 3 Stanbury P.F.,and Whitake S.A., “Principles of Fermentation Technology”, Pergamon Press, Oxford, UK, 1984

COURSE OUTCOMES

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

- CO1** Apply the principles of microbiology in the production of fermented foods
- CO2** Classify fermentation process and maintain aseptic conditions in a fermentation process
- CO3** Relate the process parameters in aeration and agitation of a fermentation operation
- CO4** Make use of concepts of fermentation in dairy, meat, cereal and beverage products
- CO5** Identify processes involved in production of various fermented products

19FTE405	FOOD SUPPLY CHAIN MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

UNIT I INTRODUCTION & STRATEGIC DECISIONS- IN SUPPLY CHAIN MANAGEMENT 9

Introduction, Generic Types of supply chain, Various Definitions and Implications, Major Drivers of Supply chain. Introduction, Business Strategy, Core Competencies in Supply Chain, Strategic SC Decisions, Customer Relationship Management Strategy, Supplier Relationship Management Strategy.

UNIT II INVENTORY & LOGISTICS IN SUPPLY CHAIN MANAGEMENT 9

Introduction, Types of Inventory, Supply/ Demand Uncertainties, Inventory costs, Selective Inventory Control, Vendor Manage Inventory system, Inventory Performance Measure. Introduction, Strategy, Transportation Selection, Trade-off, Models for Transportation and Distribution, Third Party Logistics,, Overview of Indian Infrastructure for Transportation.

UNIT III INFORMATION TECHNOLOGY & INFORMATION SUPPLY IN SUPPLY CHAIN 9

Introduction, Types of IT Solutions like Electronic Data Inter change (EDI), Intranet/ Extranet, Data Mining/ Data Warehousing and Data Marts, E-Commerce, E- Procurement, Bar Coding Technology. Introduction, Computer Based Information Systems, Computer Models and Perceptions about ERP, ERP & SCM.

UNIT IV REVERSE SUPPLY CHAIN 9

Introduction, Reverse Supply Chain v/s Forward Supply Chain, Types of Reverse Flows, Issues in Management of Reverse Supply Chain, Reverse Supply Chain for Food items, Reverse Logistic and Environment Impact.

UNIT V APPLICATION OF MATHEMATICAL MODELING IN SUPPLY CHAIN 9

Introduction, Modeling, Consideration in Modeling SCM System, Structuring the Logistic chain, Concept of Modeling.

L: 45 T:0 P:0 J:0 TOTAL: 45 PERIODS

TEXT BOOKS

1. Supply Chain Management Theories & Practices, R. P. Mohanty, S. G. Deshmukh, Dreamtech Press, 19-A, Anari Road, Daryaganj, New Delhi
2. Supply Chain Management Strategy, Planning & Operation by Sunil Chopra, Peter Meindl

REFERENCES

1. Total Supply Chain Management by Ron Basu, J. Nevan Wright
2. Supply Chain Management, Chopra, Pearson
3. Logistics Engineering and Management, Blanchard, Pearson

COURSE OUTCOMES

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

- CO1** Understand about Supply chain management
- CO2** Implement information system in supply chain
- CO3** Analyze Mathematical modeling of Supply Chain
- CO4** Understand basics of Reverse & Agile supply chain
- CO5** Analyze various case studies on supply chain

OPEN ELECTIVES

19FTO301	BEVERAGE TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3
UNIT I	INTRODUCTION TO BEVERAGES					9

Beverage – Definition, Ingredients, types. Water for beverages: Types of water required for beverages, treatment of water. Quality control of beverages: Quality standards for beverages, chemical, microbial and sensory evaluation, product shelf life.

UNIT II	CARBONATED BEVERAGES					9
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Carbonation equipment-ingredients-preparation of syrups-Filling system-packaging. Containers and closures, Additives for beverages: natural and synthetic, color, emulsifiers, preservatives, flavours and flavour enhancers.

UNIT III	NON-CARBONATED BEVERAGES					9
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Coffee bean preparation-processing-brewing-decaffeination- instant coffee-Tea types- black, green and oolong- fruit juices, nectars, quash, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages.

UNIT IV	ALCOHOLIC BEVERAGES					9
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Beer manufacturing process - Ingredients- Malt- hops- adjuncts- water, yeast, distillation, malting, preparation of sweet wort, brewing, fermentation, pasteurization and packaging. Beer defects and Spoilage. Wine – fermentation - types - red and white. Wine defects and spoilage – medicinal value – nutritional value. Comparison of Red, white and sparkling wine. Overview of distilled alcoholic beverages.

UNIT V	QUALITY CONTROL					9
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Effective application of quality controls, brix, acidity to brix ratio, single strength of juice- sanitation and hygiene in beverage industry - Quality of water used in beverages – threshold limits of various ingredients according to PFA, EFSA and FDA – Absolute requirements of Soluble solids and titrable acidity in beverages.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Ashurst, P.R, “Chemistry and technology of Soft drink and fruit juices”, 2nd edition, Blackwell Publishing Ltd. 2005.
- 2 Steen, D.P and Ashurst, P.R, “Carbonated soft drinks – Formulation and manufacture”, Blackwell Publishing Ltd. 2000.
- 3 Shankunthala Manay, N. and Shadakhtharaswamy, M, “Foods – Facts and Principles”, New Age International Pvt. Ltd, 3rd revised edition 2000.

REFERENCES

- 1 Amalendu Chakraverty et al, “Handbook of Post Harvest Technology”, Ed:., Marcel Dekker Inc. (Special Indian edition) 2000
- 2 Robert. W. Hutkins, “Microbiology and Technology of Fermented foods”, IFT Press, Blackwell Publishing Ltd. 2006
- 3 Charles, W.Bamforth, Food, fermentation and microorganisms, Blackwell Science Publishing Ltd. 2005.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Comprehend the growth of beverage industry
- CO2** Gain in-depth knowledge on carbonated beverages
- CO3** Gain in-depth knowledge on non-carbonated beverages
- CO4** Gain in-depth knowledge on alcoholic beverages
- CO5** Understand the quality control of beverages

19FTO302

FOOD NUTRITION

L T P J C
3 0 0 0 3

UNIT I INTRODUCTION TO NUTRITION SCIENCE

9

Definition of the term - Food, Nutrition, Nutrients, Dietetics, Balance Diet, Health, Energy, Adequate Nutrition, Optimal Nutrition, Malnutrition, Under Nutrition, Over Nutrition, Phytochemicals, Prebiotics, Probiotics. Balance diet. Food as a source of macro (Carbohydrate, fat & protein) and micronutrients (Vitamins & Minerals). Physiological, Psychological & social functions of food.

UNIT II FOOD GUIDE – BASIC FIVE FOOD GROUPS

9

Basic five food groups: Cereals & grains, pulses & legumes, milk & meat products, Fruit & vegetable, Fats & sugars. RDA & its use. Planning balance diet with the use of five food group system according to RDA

UNIT III CARBOHYDRATE, PROTEIN, AND FAT

9

Introduction- Classification Functions, digestion and absorption, sources and dietary recommended dietary allowance. Energy value of food- determination. Protein – classification, functions of digestion and absorption, source and requirements. Protein quality of foods – supplementary value of protein. Fat-classification of function, digestion and absorption, sources and requirements. Rancidity- types of rancidity and prevention. Deficiency states of proteins, carbohydrates and fat nutrition- signs and symptoms

UNIT IV VITAMIN AND MINERAL NUTRITION

9

Introduction to vitamins, types of vitamins, source and deficiency. Minerals- types of minerals- functions, sources, deficiency and requirements. Importance of water- maintenance of electrolyte balance. Dietary fibre- importance, health benefits, sources and requirements

UNIT V EFFECT OF HEAT PROCESSING ON NUTRITIVE VALUE OF FOODS

9

Effect of cooking & heat processing on various micro and macro nutrients of cereals, legumes, oil seeds, nuts fats, oils, milk fish/flesh, vegetables and fruits and products. Effect of cooking & heat processing on the nutritive value (micro & macro nutrients) of foods.

L : 45 T : 0 P : 0 J : 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Srilaskhmi, B. 2005. Food science. New Age Internatonal (P) Ltd., Publishers, New Delhi.
- 2 Srivastava, R.P., and Sanjeevkumar. S. 2013. FRUITS and Vegetables Preservation. International Book Distributing Co.Lucknow.
- 3 Srilakshmi .B. 2015. Nutrition Science. New Age International Pvt. Ltd. New Delhi.

REFERENCES

- 1 H.-D. Belitz, W. Grosch and P. Schieberle. 2009. Food Chemisry, 4th Ed. Springer-Verlag Berlin Heidelberg.
- 2 Mahtab S Bamji, N. Pralhad Rao and Vinothini Reddy. 1998. Text book of Human Nutrition Oxford and IBH Publishing CO. Pvt. Ltd., New Delhi.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Acquire knowledge on nutrition that are available in food
- CO2** Design a meal plan with acquired knowledge
- CO3** Apply the knowledge in designing a new product
- CO4** Acquire knowledge on vitamins and minerals
- CO5** Apply knowledge the of Effect of heating effect on nutritional in processing

19FTO304

**SENSORY EVALUATION OF
FOOD PRODUCTS**

L T P J C

3 0 0 0 3

UNIT I INTRODUCTION TO SENSORY EVALUATION 9

Sensory evaluation – Definition, Sensory perception – Vision, Gustation, olfaction, touch, audition, multimodal perception, Factors affecting sensory measurements, Role of sensory evaluation, Factors contributing to successful sensory evaluation

UNIT II PLANNING A SENSORY PROJECT 9

Requirements for sensory testing - Professional conduct in sensory testing: health, safety, ethical and legal considerations, Good working and laboratory practices, Setting objectives, Resources needed for sensory testing, Product type, Assessors, Budget, Timings, Selecting the test method, Setting action standards, Experimental design, Data analysis

UNIT III DISCRIMINATIVE TEST METHODS 9

Overall Difference tests - Triangle test, Duo-trio test, Difference from control test, Same & different test, ‘A’ ‘not A’ test, Attribute specific test - Paired comparison, Alternative forced choice, Ranking test, Similarity test - The power of the test, Proportion of true discriminators

UNIT IV DESCRIPTIVE AND AFFIRMATIVE TESTS 9

Descriptive analysis tests - Consensus profiling, Flavor Profiling, Texture Profiling, Quantitative Descriptive Analysis, Spectrum method, Free choice profiling, Flash profiling. Affective tests - Focus groups, Preference tests, Acceptance tests, Attribute diagnostics

UNIT V BASIC STATISTICAL CONCEPTS FOR SENSORY EVALUATION 9

Introduction, Hypothesis Testing and Statistical Inference, Variations of the t-Test, Introduction to Nonparametric Tests - Binomial-Based Tests on Proportions, Chi-Square, Rank Order Tests, Analysis of Variance, Correlation, Regression & Measures of Association. Commonly used software for sensory evaluation. Face Readers for sensory evaluation.

L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Harry. T. Lawless and Hildegard Heymann., “Sensory Evaluation of Food: Principle and Practices” 2nd Edition, Springer, 2010.
- 2 Morten C. Meilgaard, B. Thomas Carr, Gail Vance Civille, “Sensory Evaluation Techniques”, 4th Edition, CRC Press, 2010.

REFERENCES

- 1 Jian Bi, “Sensory Discrimination Tests and Measurements”, Blackwell Publishers, 2008.
- 2 Sarah Kemp, Tracey Hollowood, and Joanne Hort, “Sensory Evaluation: A Practical Handbook”, Wiley-Blackwell Publishers, 2011.
- 3 Roland P. Carpenter, David H. Lyon, Terry A. Hasdell, “guidelines for sensory analysis in food product development and quality control”, Springer, 2000.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Demonstrate an understanding of the concepts in sensory evaluation
- CO2** Plan a sensory evaluation session
- CO3** Outline the Discriminative test methods
- CO4** Select suitable descriptive and affirmative tests
- CO5** Elaborate on the basic statistical concepts for sensory evaluation

19GEB375

PERSONNEL PSYCHOLOGY

L T P J C

(Common to All B.E. / B. Tech. Courses)

1 0 2 0 2

UNIT I

FRAMEWORK OF PERSONNEL PSYCHOLOGY

3+6

Nature and scope of personnel psychology-Functions of personnel psychologist-Importance of human Resource Management- Role in Providing for Equal Employment Opportunity-Objectives of personnel management.

UNIT II

JOB ANALYSIS

3+6

Introduction to Job analysis-Job Descriptions- Job Specifications-Sources of Job Information-Position Analysis Questionnaire - Fleishman Job Analysis System -Importance of Job Analysis-Self-Managing Work Teams - Flexible Work Schedules - Job sharing-Selection & Interview Process- Psychometric Test.

UNIT III

PERFORMANCE ANALYSIS

3+6

Methods for Measuring Performance: Making Comparisons-Rating Individuals -Rating Behaviors - Behaviorally anchored rating scale -Behavioral observation scale.
Measuring Results: Management by objectives (MBO)-Total Quality Management, Sources of Performance Information-Managers-Peers- Subordinates- Self.

UNIT IV

RESUME BUILDING

3+6

Introduction - SWOT- Online learning -Preparing to Write, Writing a Winning Resume, Choosing a Resume Format, Writing a Winning Cover Letter, Professional objective and Educational section, - Canva Resume, Video Resume.

UNIT V

JOB SEARCH & NETWORKING

3+6

Introduction to Job search-Job search platforms- Social Media Job Search- Introduction to job analysis- Job Evaluation- Self Screening- Importance of Networking-Types of Networking - Networking platforms.

L :15 T: 0 P: 30 J: 0 T: 45 PERIODS

REFERENCES

- 1 Dr.Nishi Goyal "Industrial Psychology" Krishna's Educational Publisher.
- 2 Dr.S.S Khanka, Human Resource Management, S.Chand Publications
- 3 Parul Singh 'Writing Effective resume for effective resume for job applications" Fortune Institute of International Business"
- 4 Andrea R Nirenberg" Essentials of Business networking" Tips, Tools and Tactics you can use, Pearson Education
- 5 Miriam Salpter "Social Networking for career success "Learning express, New York
- 6 Joshua Waldman, Job searching with social media, John Wiley & Sons, Inc

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** To know about the framework of Personnel Psychology
- CO2** To understand the job analysis for Job search
- CO3** To understand the performance analysis in job
- CO4** To know about resume building qualities
- CO5** To experience the job search and networking

List of Exercises

S.No	Exercises
1	Mock Interview
2	Portfolio creation
3	Psychometric test
4	Video Resume
5	Cover letter and thank you letter
6	Attending business career fair
7	Empathy on Job Analysis/Search
8	Business card creation
9	Networking –Online/offline
10	Online Image & Branding
11	Exercises in career portals

19GEB379

EMPLOYABLE SKILL DEVELOPMENT

L T P J C

1 0 2 0 2

UNIT I QUANTITATIVE ABILITY III

3+6

Algebra, Power, Surds and Indices, Inverse, Logarithms, Equations, Progressions, Functions and Graphs, Perimeter, Geometry, Coordinate Geometry, Direction Sense, Logical Connectives, Venn Diagrams

UNIT II QUANTITATIVE ABILITY IV

3+6

Puzzles, Physics, Base conversion, Trigonometry, Divisibility, Series, Simple Equations, Simplification, Quadratic Equations

UNIT III VERBAL REASONING II

3+6

Sentence correction and completion, Para-Jumbles, Cloze Passage, Vocabulary, Voices & Forms of Speech, Multidimensional arrangement

UNIT IV NON- VERBAL REASONING

3+6

The Embedded figure, Logical Games, Incomplete Pattern, Missing letters, Data arrangement, Mathematical orders, Inferred meaning

UNIT V LINGUISTICS SKILLS III

3+6

Sentence improvement, Subject-Verb agreement, Speech & voices, Preposition & Conjunctions, Selection words, Comprehension ordering

L :15 T: 0 P: 30 J: 0 T:45 PERIODS

TEXT BOOKS

- 1 Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications.

REFERENCES

- 1 R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
- 2 M.K.Panday, "Analytical Reasoning", Magical Series.
- 3 BS Sijwali- Indu Sijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.
- 4 S.P.Bakshi, "Objective English" Arihant Publications.(Unit V)
- 5 R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited.
- 6 R.S.Agarwal, "A modern approach to Verbal & Non-verbal reasoning", S.Chand & Company Pvt Limited.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Apply the time and distance for solving application oriented concepts in quantitative aptitude
- CO2** Apply the financial ability for solving application oriented concepts in quantitative aptitude
- CO3** Analyze the verbal reasoning and the critical reasoning in quantitative aptitude
- CO4** Analyze the non-verbal reasoning in verbal aptitude applications
- CO5** Apply appropriate LSRW skills

List of Exercises

S.No	Exercises
1	Business Model Analysis 1
2	Business Model Analysis 2
3	Idea Generation & Validation
4	BMC Value Proposition Pitch
5	BMC- Customer Segments Pitch
6	BMC- Channels Pitch
7	BMC- Revenue Model and Streams Pitch
8	BMC- Key Resources & Key Activities Pitch
9	BMC- Key Partners & Cost Structure Pitch
10	BMC- Customer Relationships Pitch
11	Final BMC Pitch
12	Report on Investors/Funding agency
13	Report on Business License & Permits
14	Digital Marketing Exercises
15	Case study on Business Process Automation

19GET376	ECONOMICS, FINANCE & ACCOUNTING	L	T	P	J	C
	TRACK 2 (ENTREPRENEURSHIP)	1	0	0	0	1

UNIT I Managerial Economics **3**

Introduction to Engineering Economics – Scope of Engineering Economics - Break Even Analysis- Elementary economic analysis- Demand and Supply

UNIT II Financial Accounting **3**

Introduction to Financial Accounting-Book Keeping-Journal-Ledger- Trial Balance- Trading Account- Profit and Loss Account- Balance sheet statement - Working capital management

UNIT III Cost Accounting **3**

Introduction to Cost Accounting- Elements of cost- Types of cost -Cost Accounting systems: Job costing-Process costing

UNIT IV Budget **3**

Introduction to budgeting- Characteristics of a sound budget-Fixed budget-Production. Budget- Sales budget-Flexible budgets- Zero base budgeting and budgetary control-ROI

UNIT V Purchase Management **3**

Role of Purchase department-Vendor selection- Purchase- Documents related to Purchase: Invoice Generation-Material Inward & Outward-Introduction to ERP & SAP

L :15 T: 0 P: 0 J: 0 T:15 PERIODS

REFERENCES

- 1 R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication.
- 2 M.K.Panday, “Analytical Reasoning”, Magical Series.
- 3 BS Sijwali- Indu Sijwali, A New Approach to “Reasoning Verbal, Non-Verbal & Analytical”, Arihant Publications.
- 4 S.P.Bakshi, “Objective English” Arihant Publications.(Unit V)
- 5 R.S.Agarwal, “Quantitative Aptitude for Competitive Examinations”, S.Chand& Company Pvt Limited.
- 6 R.S.Agarwal, “A modern approach to Verbal & Non-verbal reasoning”, S.Chand & Company Pvt Limited.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Understand about Managerial economics for Entrepreneurship
- CO2** Learn about Financial accounting for Entrepreneurship
- CO3** Know about Cost accounting for Entrepreneurship
- CO4** Understand Budget for Entrepreneurship
- CO5** Apply the Purchase Management for Entrepreneurship

UNIT I INTRODUCTION

3

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge - Trade Secret - IPR in India– IPR in abroad

UNIT II PATENTS

3

Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

UNIT III**COPYRIGHT**

3

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

UNIT IV**TRADEMARK**

3

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

UNIT V**OTHER FORMS OF IP**

3

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection

Geographical Indication (GI): meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection

L :15 T: 0 P: 0 J: 0 T:15 PERIODS

TEXT BOOKS

- 1 Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
- 2 Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

REFERENCES

- 1 Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets, Cengage Learning, Third Edition, 2012.
- 2 Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.
- 3 Prabuddha Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, McGraw Hill Education, 2011
- 4 Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: LexisNexis.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Know about Intellectual property rights and classification.
- CO2** Understand about Patents, Registration & Procedure and other information
- CO3** Learn about Copyrights, Registration & Procedure and other information
- CO4** Understand about Trademark, Registration & Procedure and other information
- CO5** Know about other forms of IP, Registration & Procedure and other information

19GEB377	ADVANCED VERBAL QUANTITATIVE APTITUDE REASONING	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	2	0	2	0	3

UNIT I QUANTITATIVE ABILITY III 6+6

Algebra, Power, Surds and Indices, Inverse, Logarithms, Equations, Progressions, Functions and Graphs, Perimeter, Geometry, Coordinate Geometry, Direction Sense, Logical Connectives, Venn Diagrams

UNIT II QUANTITATIVE ABILITY IV 6+6

Puzzles, Physics, Base conversion, Trigonometry, Divisibility, Series, Simple Equations, Simplification, Quadratic Equations

UNIT III VERBAL REASONING II 6+6

Sentence correction and completion, Para-Jumbles, Cloze Passage, Vocabulary, Voices & Forms of Speech, Multi dimensional arrangement

UNIT IV NON- VERBAL REASONING 6+6

The Embedded figure, Logical Games, Incomplete Pattern, Missing letters, Data arrangement, Mathematical orders, Inferred meaning

UNIT V LINGUISTICS SKILLS III 6+6

Agile Entrepreneurship, Business Process Management & Automation, Taking Business to Digital World via Digital Marketing & e Commerce, HRM and Keeping it lean with Freelancers

L :30 T: 0 P: 30 J: 0 T: 60 PERIODS

TEXT BOOKS

- 1 Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications.

REFERENCES

- 1 R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
- 2 M.K.Panday, "Analytical Reasoning", Magical Series.
- 3 BS Sijwali- Indu Sijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.
- 4 S.P.Bakshi, "Objective English" Arihant Publications.
- 5 R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand& Company Pvt Limited
- 6 R.S.Agarwal, "A modern approach to Verbal & Non-verbal reasoning", S.Chand & Company Pvt Limited.

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Apply the time and distance for solving application orientated concepts in quantitative aptitude
- CO2** Apply the financial ability for solving application orientated concepts in quantitative aptitude
- CO3** Analyze the verbal reasoning and the critical reasoning in quantitative aptitude
- CO4** Analyze the non-verbal reasoning in verbal aptitude applications
- CO5** Apply appropriate LSRW skills

List of Exercises

S.No	Exercises
1	Assessment 1 from Quantitative Ability III
2	Assessment 2 from Quantitative Ability III
3	Assessment 3 from Quantitative Ability III
4	Assessment 1 from Quantitative Ability IV
5	Assessment 2 from Quantitative Ability IV
6	Assessment 3 from Quantitative Ability IV
7	Assessment 1 from Verbal Reasoning II
8	Assessment 2 from Verbal Reasoning II
9	Assessment 3 from Verbal Reasoning II
10	Assessment 1 from Non Verbal Reasoning II
11	Assessment 2 from Non Verbal Reasoning II
12	Assessment 3 from Non Verbal Reasoning II
13	Assessment 1 from Linguistics Skills III
14	Assessment 2 from Linguistics Skills III
15	Assessment 3 from Linguistics Skills III

19GET375

NETWORKING

L T P J C

(Common to All B.E. / B. Tech. Courses)

1 0 0 0 1

UNIT I INTRODUCTION

3

Networking, Benefits, Quality vs Quantity in Networking, Networking for new opportunities, Networking for Professional Partnership, Local and In-person networking

UNIT II DIGITAL NETWORKING

3

Tools for Online Networking – LinkedIn, Facebook, Twitter, Google+, LMS, Open Learning Networks

UNIT III EMPATHIZING

3

Art of Listening, Empathy, Listening Models, Networking etiquette, Digital Storytelling, Lead Generation

UNIT IV COMMUNICATION

3

Interpersonal Skills, Personality and Emotional Intelligence, Business Communication, Copyrights, Networking Plan

UNIT V DIGITAL FOOTPRINTS

3

Introverts & Extroverts, Maintain Your Connections, Long-Term Networking Strategies, Case Studies- Scholarship for higher education in various countries –Case study

L :15 T: 0 P: 0 J: 0 T: 15 PERIODS

REFERENCES

- 1 Andrea R Nirenberg "Essentials of Business networking" Tips, Tools and Tactics you can use, Pearson Education
- 2 Miriam Salpter "Social Networking for career success "Learning express, Newyork
- 3 Andrea R Nirenberg "Network like you means it" handbook for business and personal networking.
- 4 S.P.Bakshi, "Objective English" Arihant Publications.
- 5 Peter W Cardon "Business Communication" Tata Mcgraw Hill Publications, Third edition
- 6 Elizabeth A Segal "Social Empathy-Art of understanding others" Columbia University press, New York

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Understand the networking and its significance
- CO2** Apply the digital tools for networking with overseas professors
- CO3** Empathize the need and prepare themselves for overseas education
- CO4** Apply the communication skills for the overseas education
- CO5** Apply the networking strategies for scholarship in overseas education

19GEB380

HIGHER STUDIES IN ABROAD & INDIA

L T P J C

1 0 2 0 2

UNIT I OVERVIEW OF HIGHER STUDIES

3+6

Higher education in India & Examinations- Higher Education in abroad:Introduction-Admission process- Identification & Procedure - SOP-LOR-Desirable Characteristics - Introduction to Proficiency test

UNIT II SELECTION & SCHOLARSHIP

3+6

Top Universities in world- Cost of overseas education- Funding & Scholarships-Case studies
Higher Education in USA, UK, France, Singapore, Germany, Norway, Sweden, Australia & Netherland

UNIT III GRE & GMAT

3+6

GRE & GMAT: Importance of GRE & GMAT- Syllabus- Assessment pattern- Analytical reasoning- Quants-Verbal-Integrated Reasoning-Analytical writing assessment

UNIT IV TOEFL & IELTS

3+6

Importance of TOEFL & IELTS - Syllabus-Assessment Pattern-Reading-Speaking -Writing

UNIT V GATE

3+6

Importance of GATE- Syllabus -Assessment Pattern- Weightages in the different domain-General Aptitude- Candidate selected subject

L :15 T: 0 P: 30 J: 0 T:45 PERIODS

REFERENCES

- 1 B.S.Warrier “Studying Abroad” Tata Mcgraw Hill Education Private Limited, New Delhi
- 2 Dr.T.P.Sethumadhavan “Study abroad” iRank publishers , India
- 3 General Aptitude & Engineering Mathematics 2022 , Pearson Education

COURSE OUTCOMES :

At the end of the course students should be able to

CO1 To know about the Indian constitution and Government services

CO2 To understand about the civil services post and selection process

CO3 To understand about the RRB & Public sector banks post and selection process

CO4 To understand about the central and state public sector companies post and selection process

CO5 To experience the resume building and networking

19GEB378	FOUNDATION COURSE ON COMPETITIVE EXAMS	L	T	P	J	C
	(Common to All B.E. / B. Tech. Courses)	3	0	2	0	4

UNIT I QUANTITATIVE ABILITY III 6+12

Algebra, Power, Surds and Indices, Inverse, Logarithms, Equations, Progressions, Functions and Graphs, Perimeter, Geometry, Coordinate Geometry, Direction Sense, Logical Connectives, Venn Diagrams, Puzzles, Physics, Base conversion, Trigonometry, Divisibility, Series, Simple Equations, Simplification, Quadratic Equations

UNIT II VERBAL REASONING II 6+12

Sentence correction and completion, Para-Jumbles, Cloze Passage, Vocabulary, Voices & Forms of Speech, Multi dimensional arrangement

UNIT III NON- VERBAL REASONING II 6+12

The Embedded figure, Logical Games, Incomplete Pattern, Missing letters, Data arrangement, Mathematical orders, Inferred meaning

UNIT IV GENERAL AWARENESS FOR CIVIL SERVICE EXAMS 6+12

Current events of National & International importance, History of India & Indian National Movement, Indian & World Geography – Physical, Social, Economic Geography of India & the World, Indian Polity & Governance – Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, Economic & Social Development – Sustainable Development, Poverty, Inclusion, Demographics, Social Sector Initiatives, Environmental ecology, Bio-diversity & climate change, General Science.

UNIT V GENERAL AWARENESS FOR BANKING SECTORS 6+12

Current Affairs (National and International), Major Financial/Economic News, Budget and Five Year Plans, Who's Who, Sports, Books and Authors, Awards and Honors, Science – Inventions and Discoveries, Abbreviations, Important Days, International and National Organizations

L :30 T: 0 P: 60 J: 0 T:90 PERIODS

REFERENCES

- 1 R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
- 2 R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand& Company Pvt Limited
- 3 BS Sijwali- Indu Sijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.
- 4 R.S.Agarwal, "A modern approach to Verbal & Non-verbal reasoning", S.Chand & Company Pvt Limited.
- 5 NIOS course books for classes XI and XII on - Ancient India, Medieval India, Modern India, National Movement & Contemporary World and Culture of India.
- 6 The Story of Civilization, Part 2 by Arjun Dev, NCERT

COURSE OUTCOMES :

At the end of the course students should be able to

- CO1** Apply the quantitative ability for competitive exams.
- CO2** Apply the verbal reasoning for competitive exams
- CO3** Apply the non-verbal reasoning for competitive exams.
- CO4** Apply the general awareness in the civil service exams
- CO5** Apply the general awareness in the banking exams

List of Exercises

S.No	Exercises
1	Assessment 1 from Quantitative Ability III
2	Assessment 2 from Quantitative Ability III
3	Assessment 3 from Quantitative Ability III
4	Assessment 1 from Verbal Reasoning II
5	Assessment 2 from Verbal Reasoning II
6	Assessment 3 from Verbal Reasoning II
7	Assessment 1 from Non Verbal Reasoning II
8	Assessment 2 from Non Verbal Reasoning II
9	Assessment 3 from Non Verbal Reasoning II
10	Assessment 1 from General Awareness for Civil Service
11	Assessment 2 from General Awareness for Civil Service
12	Assessment 3 from General Awareness for Civil Service
13	Assessment 1 from General Awareness for Banking
14	Assessment 2 from General Awareness for Banking
15	Assessment 3 from General Awareness for Banking

List of Exercises

S.No	Exercises
1	Assessment for Group A Services
2	Assessment for Group B Services
3	Assessment for Group C Services
4	Assessment for Uniformed Services
5	Assessment 1 for RRB
6	Assessment 2 for RRB
7	Assessment 1 for Banking Exams
8	Assessment 2 for Banking Exams
7	Assessment for Public sector company 1
8	Assessment for Public sector company 2
9	Resume Preparation for Government Jobs
10	Video Resume for Government Jobs
11	Networking Exercises using Linked In

ONE CREDIT COURSES

19FTOC1

3D AND 4D PRINTING OF FOOD

1. Food Customization
2. Emerging trends
3. 3D Printing of foods
4. Materials and Ingredients
5. 3D Printing Techniques
6. Rheological behaviour of foods
7. Applications of Food 3D printing
8. Post processing methods
9. 4D printing of foods
10. 4D Printing Techniques
11. Applications of Food 4D printing
12. Challenges of Food printing

L : 15 T: 0 P: 0 J: 0 Total: 15 PERIODS

TEXT BOOKS

- 1 Fundamentals of 3D Food Printing and Applications, Academic Press, 2019.<https://doi.org/10.1016/C2017-0-01591-4>

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Picturise the new trends in food technology
- CO2** Understand the rheological behavior of foods
- CO3** Gain knowledge of 3D Food printing
- CO4** Gain knowledge of 4D Food printing
- CO5** Know about the applications of 3D food printing

19FTOC2**DESIGN AND FORMULATION OF FOODS**

1. Nutritive value and anti-nutritional factors present in cereals, pulses, oil seeds , fruits, vegetables, fish, meat and eggs, effect of processing on nutritive value of foods.
2. Principles of planning menus,
3. Steps involved in planning menus, Food guide pyramid
4. Formulation of weaning foods
5. Protein energy malnutrition
6. Formulating diet for preschool going (2-5 years) children
7. Diets during normal life cycle, Nutrition from infancy to adolescence
8. Nutritional requirements of different age groups, Geriatric nutrition, Nutrition for athletes
9. Diet therapy and types of therapeutic diet
10. Diet for diabetic mellitus
11. Diet for cardio vascular disease
12. Diet for gastro intestinal disease
13. Concepts for functional foods design, prebiotics & probiotics, nutraceuticals, designer foods.
14. Trypsin inhibitors, Phytins, Tannins, Oxalates, Goitrogens, Aflatoxins, Process induced toxins.
15. Preparation and maintenance of microbial cultures for food fermentation, Nutritional significance of traditional fermented foods.

L : 15 T: 0 P: 0 J: 0 Total: 15 PERIODS

TEXT BOOKS

- 1 Nutritive value of Indian Foods by Gopalan C, Ramshastri BV, Balasubramaniam SC. National Institute of Nutrition, Hyderabad.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know the nutritional value of different food groups
- CO2** Identify the nutritional requirements of infants, preschool going children and athletes
- CO3** Learn the principles of menu planning process and understand and use the concept of food exchange lists
- CO4** Design therapeutic diets for diseases like diabetes, and CHD
- CO5** Identify anti-nutritional factors present in different foods with their properties and ill effects

19FTOC3**READY TO EAT FOODS**

1. Introduction- Raw Materials
2. Processing steps-Corn cooking and soaking
3. Washing and Draining
4. Grinding Equipment
5. Reconstitution of Dry Masa Flour
6. Mass feeding- Pumping
7. Preheating - Sheeting/Cutting
8. Baking Conditioning/Equilibration-Frying
9. Introduction- Raw popcorn selection and preparation
10. Popping Methods
11. Home preparation of Popcorn
12. Equipments-Industrial manufacturing process
13. Flavorings and Applicators
14. Popcorn Packaging
15. Relative Nutrition- Marketing

L : 15 T: 0 P: 0 J: 0 Total: 15 PERIODS

TEXT BOOKS

- 1 Panda, H, The Complete Technology Book on Snack Foods, National Institute of Industrial Research, Delhi, 2013.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Outline the current production and marketing status of Snack foods
- CO2** Show the manufacturing steps involved in the production of potato chips and value added products from potato
- CO3** Construct the flowchart for the processing steps and equipment's involved in the Tortilla chips processing
- CO4** Carryout the selection and preparation of popcorn by industrial manufacturing process
- CO5** Analyse the methods of sensory evaluation and packaging technologies in Snack Food Industries