KALASALINGAM
ACADEMY OF RESEARCH AND EDUCATION
(DEEMED TO BE UNIVERSITY)
Under sec. 3 of UGC Act 1956.
Anand Nagar, Krishnankoil - 626126. Srivilliputtur (Via), Virudhunagar (Dt), Tamil Nadu | info@kalasalingam.ac.in | www.kalasalingam.ac.in

DEPARTMENT OF FOOD TECHNOLOGY

B.TECH

FOODTECHNOLOGY

CURRICULUM AND SYLLABUS

(CHOICE BASED CREDIT SYSTEM)

2018

InstituteVision	**InstituteMission**
TobeaCenterofExcellenceofInternationalRepute inEducationandResearch	*ToProduceTechnicallyCompetent,SociallyCommittedTechnocrats and Administrators through Quality EducationandResearch*
DepartmentVision To be acenterofreputeinresearchandeducation in the frontier areas of FoodTechnology	**DepartmentMission** To impart knowledge through research and education and togroomthemasprofessionalleaderswithentrepreneurshipskillsin the field of food technology for ensuring sustainable growthin food processing and preservation to meet the ever increasingdemandofthesociety.

ProgramEducationalObjectives(B.Tech–Food Technology)

PEO1	Pursuehigher studiesortobeemployedinfoodtechnologyorrelateddisciplines.
PEO2	Beasuccessfulentrepreneurincreatingjobsrelatedtoappliedscienceandtechnology
PEO3	Promoteethics, sustainabilityandenvironmentalresponsibilityintheirpractice.

ProgrammeSpecificOutcomes(B.Tech–FoodTechnology)

AgraduateoftheFoodTechnologyprogramwilldemonstrate:

PSO1	ProfessionalSkills:Theabilitytounderstand, evaluateandpreparewaystoprocess,preserve,package,orstore food,accordingto industrialrequirements.
PSO2	ProblemSolvingSkills:Theabilitytoapplystandardpracticesandregulationindevelopingthefoodandalliedproducts.
PSO3	Careerand Entrepreneurship:Theabilitytoemploymoderntechnologiestoproduceneworvalue addedproducts inthe areaofFoodTechnology.

Program Outcome(s):Graduatesw illbeableto

PO 1	**Engineering knowledge**:Applytheknowledgeofmathematics, science,engineering fundamentals,andanengineeringspecializationtothesolutionofcomplex engineeringproblems.
PO 2	**Problemanalysis**:Identify, formulate,reviewresearchliterature,andanalyzecomplex engineeringproblemsreachingsubstantiatedconclusionsusingfirstprinciplesofmathematics,naturalsciences,andengineeringsciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems anddesign system componentsor processes thatmeet the specified needswith appropriateconsiderationforthepublichealthandsafety,andthecultural,societal,andenvironmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and researchmethodsincludingdesignofexperiments,analysisandinterpretationofdata,andsynthesis oftheinformationtoprovidevalidconclusions.
PO 5	**Moderntoolusage**:Create,select, andapplyappropriatetechniques, resources,andmodern engineering and IT tools including prediction and modelling to complexengineeringactivitieswithanunderstandingofthelimitations.
PO 6	**Theengineerandsociety**:Applyreasoninginformedbythecontextualknowledgetoassesssocietal, health, safety, legal and cultural issues and the consequent responsibilities relevanttotheprofessionalengineeringpractice.
PO 7	**Environment and sustainability**: Understand the impact of the professionalengineeringsolutionsinsocietalandenvironmentalcontexts, anddemonstratetheknowledge of,andneedforsustainable development.
PO 8	**Ethics**:Applyethicalprinciplesandcommittoprofessionalethicsandresponsibilitiesand normsoftheengineeringpractice.
PO 9	**Individualandteamwork**:Function effectivelyasanindividual,andasamemberorleader indiverseteams,andinmultidisciplinarysettings.
PO 10	**Communication**: Communicate effectively on complex engineering activities withtheengineeringcommunityandwithsocietyatlarge,suchas,beingabletocomprehend andwriteeffectivereportsanddesigndocumentation, makeeffective presentations,andgiveandreceiveclearinstructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of theengineeringandmanagementprinciplesandapplythesetoone'sownwork,asamemberand leader inateam, tomanageprojectsandinmultidisciplinaryenvironments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability toengageinindependent and life-long learning inthebroadestcontextoftechnological change.

CurriculumStructure

S.No	Category		Credits
I	BasicSciencesandMathematics		25
II	HumanitiesandSocialSciences		12
	SoftSkills	3	
	HumanitiesElective	6	
III	BasicEngineering		24
IV	**ProgramCore**		61
	a) CoreCourses	48	
	b)CommunityServiceProject	3	
	c)Projectwork	10	
V	**ElectiveCourses**		36
	a)ProfessionalElective	18	
	b) OpenElective	18	
VI	Internship/IndustrialTraining		2
VII	Mandatorycourses		--
Total			160

SCHEME OF INSTRUCTION

BasicSciencesandMathematics

Course Code	CourseName	Course Type	L	T	P	Credit
PHY18R175	Optics,Electromagnetismand QuantumMechanics	IC	3	1	2	5
CHY18R171	Chemistry	IC	3	1	2	5
MAT18R101	CalculusandLinearAlgebra	T	3	1	0	4
MAT18R102	MultipleIntegration,OrdinaryDifferentialEquationsandComplex variable	T	3	1	0	4
MAT18R201	BioStatistics	T	3	1	0	4
BIT18R101	BiologyforEngineers	T	3	0	0	3
Total						**25**

HumanitiesandSocialScience

Course Code	CourseName	Course Type	L	T	P	Credit
HSS18R151	Englishfortechnicalcommunication	TP	2	0	2	3
HSS18RXX	HumanitiesElectiveI	T	3	0	0	3
HSS18RXX	HumanitiesElectiveII	T	3	0	0	3
Total						**9**

SoftSkill

Course Code	CourseName	Course Type	L	T	P	Credit
HSS18R101	SoftSkill-I	T	3	0	0	1
HSS18R102	Soft Skill-II	T	3	0	0	1
HSS18R201	SoftSkill-III	T	3	0	0	1
Total						3

I BASICENGINEERING

S.NO	CourseCode	CourseName	CourseType	L	T	P	Credit
1	MEC18R211	EngineeringMechanics	T	3	1	0	4
2	EEE18R171	BasicElectricalandElectronicsEngineering	IC	3	1	2	5
3	MEC18R151	EngineeringGraphics &Design	T	3	0	2	3
4	CSE18R171	ProgrammingforProblemsolving	IC	3	1	2	5
5	MEC18R152	EngineeringPractice	TP	3	0	2	3
6	FT18R101	PrinciplesofChemicalEngineering	T	3	1	0	4
Total							**24**

II PROGRAMCORE

a) CoreCourses

S. No	Code	Subject Name	Course Type	Pre-requisite	Co-requisite	L	T	P	Credit
1	FT18R201	FoodAdditives	T			3	0	0	3
2	FT18R251	PrinciplesofFoodProcessingandPreservation	TP			3	0	1	3.5
3	FT18R271	FoodMicrobiology	IC			3	0	2	4
4	FT18R272	FoodBiochemistry	IC			3	0	2	4
5	FT18R202	Instrumental Methods ofAnalysis ofFoods	T			3	0	0	3
6	FT18R203	TechnologyofDairy Products	T			3	0	0	3
7	FT18R281	Bakery and ConfectionaryLaboratory	L		FT18R251	0	0	3	2
8	FT18R273	Unit Operations in FoodProcessing	IC	FT18R101		3	1	2	5
9	FT18R301	FoodPackagingTechnology	T	FT18R251		3	0	0	3

10	FT18R381	FoodEngineering Laboratory	L		FT18R251	0	0	2	1
11	FT18R371	FoodsafetyregulationsandQualityControl	IC	FT18R201		3	0	2	4
12	FT18R351	InstrumentationandProcess Control	TP			3	0	1	3.5
13	FT18R372	HeatandMassTransfer	IC	FT18R101		3	1	2	5
14	FT18R382	Instrumental methods ofanalysislaboratory	L		FT18R202	0	0	2	1
15	FT18R401	EmergingTechnologiesin FoodprocessEngineering	T	FT18R251		3	0	0	3
	Total								**48**

b) COMMUNITYSERVICEPROJECT

Code	Subject Name	Credit
FT18R399	CommunityServiceProject	3
Total		**3**

c) PROJECTWORK

Code	Subject Name	Credit
FT18R499	ProjectWork	10
Total		**10**

8VELECTIVECOURSES

a) ProfessionalElective

S.No	Code	CourseName	Course Type	Pre-requisite	L	T	P	Credit
PROCESSENGINEERING&FOODSAFETY								
1.	FT18R302	SugarcaneandBeverageTechnology	T		3	0	0	3
2.	FT18R303	TechnologyofAnimalFoods	T		3	0	0	3
3.	FT18R304	OilsandFatsProcessingTechnology	T		3	0	0	3
4.	FT18R305	FruitsandVegetablesProcessingTechnology	T	FT18R251	3	0	0	3
5.	FT18R306	TechnologyofFlavorsandColorants	T	FT18R201	3	0	0	3
6.	FT18R310	Food Plant Safety and Hazards in FoodIndustry	T	FT18R271	3	0	0	3
7.	FT18R402	SpicesandPlantationproducts	T		3	0	0	3
8.	FT18R403	MillingTechnologyforFoodMaterials	T	FT18R273	3	0	0	3
9.	FT18R404	Processing CommoditiesofFood	T	FT18R251	3	0	0	3
10.	FT18R409	FoodIndustryWasteManagement	T	FT18R251	3	0	0	3
DESIGN&DEVELOPMENT								
11	FT18R204	SensoryEvaluationof Foods	T		3	0	0	3
12	FT18R205	Engineeringpropertiesoffoodmaterials	T		3	0	0	3
13	FT18R307	FoodprocessEquipmentDesign	T	MEC18R151	3	0	0	3
14	FT18R405	FoodProductDevelopment	T	FT18R204	3	0	0	3
15	FT18R406	FoodPlantLayoutandDesign	T	FT18R310	3	0	0	3
16	FT18R308	ProteinchemistryandTechnology	T	FT18R272	3	0	0	3
17	FT18R309	NutritionalBiochemistry	T		3	0	0	3
18	FT18R407	Traditionalandfermentedfoods	T		3	0	0	3
19	FT18R408	Radiation Preservation and processing offoodproducts	T		3	0	0	3
Total								18

b) OPENELECTIVES

COURSESOFFEREDTOOTHERDEPARTMENTS								
S.NO	**Code**	**CourseName**	**Course Type**	**Pre-requisite**	**L**	**T**	**P**	**Credit**
1	FT18R206	FoodBiotechnology	T	-	3	0	0	3
2	FT18R207	TechnologyofConvenienceFoods	T	-	3	0	0	3
3	FT18R208	FoundationofFood and Nutrition	T	-	3	0	0	3
4	FT18R209	FoodProcessing Technology	T	-	3	0	0	3
5	FT18R210	Composition, Quality & Safety ofFoods	T	-	3	0	0	3
6	FT18R211	Bakery and ConfectionaryTechnology	T	-				
8	FT18R311	BeverageTechnology	T	FT18R209	3	0	0	3
9	FT18R312	Fermentedfoodproducts	T	-	3	0	0	3
10	FT18R313	FoodLawsandStandards	T	FT18R210	3	0	0	3
11	FT18R314	PackagingTechnologyofFoods	T	-	3	0	0	3
12	FT18R315	NutraceuticalsandFunctionalFoods	T	FT18R208	3	0	0	3
13	FT18R410	ProcessingofMarine Products	T	FT18R209	3	0	0	3
14	FT18R411	NanotechnologyinFoodProcessing	T	FT18R210	3	0	0	3
15	FT18R412	Environmentalpollutioncontrol	T	FT18R313	3	0	0	3
Total								18

HUMANITIESELECTIVES

Course Code	CourseName	Course Type	L	T	P	Credit
HSS18R001	ManagementConceptsandTechniques	T	3	0	0	3
HSS18R002	MarketingManagement	T	3	0	0	3
HSS18R003	OrganizationalPsychology	T	3	0	0	3
HSS18R004	ProjectManagement	T	3	0	0	3
HSS18R005	StressManagementandCopingStrategies	T	3	0	0	3
HSS18R006	EconomicsforEngineers	T	3	0	0	3
HSS18R007	HumanResourceManagementandLabourLaw	T	3	0	0	3
HSS18R008	EntrepreneurshipDevelopment	T	3	0	0	3
HSS18R009	CostAnalysisandControl	T	3	0	0	3
HSS18R010	ProductDesignandDevelopment	T	3	0	0	3
HSS18R011	BusinessProcessReengineering	T	3	0	0	3
HSS18R012	PoliticalEconomy	T	3	0	0	3
HSS18R013	ProfessionalEthics	T	3	0	0	3
HSS18R014	OperationsResearch	T	3	0	0	3
HSS18R015	TotalQualityManagement	T	3	0	0	3
HSS18R016	AdvancedsoftSkills	T	3	0	0	3
Total						6

INTERNSHIP/INDUSTRIALTRAINING

S.NO	Code	NameoftheTraining	Credit
1	FT18R397	IndustrialTraining	1
2	FT18R398	InternshipTraining	1
		Total	**2**

HONOURS COURSES

S.NO	Code	Subject Name	Course Type	Pre-requisite	L	T	P	Credit
1	FT18R413	TechnologyofFoodEmulsion,FoamsandGels	T	FT18R272	3	0	0	3
2	FT18R414	Nanotechnology In FoodProcessing	T	FT18R251	3	0	0	3
3	FT18R415	Drying Technology	T	FT18R372	3	0	0	3
4	FT18R416	FoodToxicology	T	FT18R371	3	0	0	3
5	FT18R417	ExtrusionTechnology	T	FT18R381	3	0	0	3
6	FT18R418	Refrigeration&Coldstorage	T	FT18R372	3	0	0	3
7	FT18R419	Post-harvestPestManagementinfoodsafety	T	FT18R371	3	0	0	3
8	FT18R420	FoodMaterialScience	T	FT18R272	3	0	0	3

TotalnumberofCredits =160

SubjectCode	Optics, Electromagnetism and Quantummechanics	L	T	P	C
PHY18R175		3	1	2	5

Pre-requisite:BasicKnowledgeinPhysics

CourseCategory:*BasicSciencesandMathematics*

CourseType: *IntegratedCourse*

CourseObjectives:

- Tounderstandthebasicconceptsofoptics,quantumphysicsanditsapplications.
- Toprovidethestudentsafirmunderstandingofthebasicsof Electricity,Magnetismanditsapplications.

CourseOutcomes:

Uponsuccessfulcompletionofthiscourse,studentswillbe able to

CO1: Understandtheconceptsofdiffractionandpolarization.

CO2: Applytheconceptsofopticsinlaser andfiberoptics.

CO3: Exploretheknowledgeonelectrostatistics.

CO4: Understandthefundamentalsofmagnetism.

CO5: Applytheknowledgeonsolvingthewaveequations

UnitI:DiffractionandPolarisation 9 Hours

Diffraction: Introduction to interference and example; concept of diffraction, Fraunhofer andFresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits; diffractiongrating,characteristicsofdiffractiongratinganditsapplications.

Polarisation:Introduction,polarisationbyreflection,polarisationbydoublerefraction,scatteringoflight,circularandellipticalpolarisation,opticalactivity

UnitII:LaserandFiberOptics 9 Hours

Einstein'stheoryofmatterradiationinteractionandAandBcoefficients; amplificationoflightbypopulationinversion,different typesoflasers:gaslasers(He-Ne),solid-statelasers(Neodymium),applications of lasers in science, engineering and medicine. Numerical aperture and Acceptanceangleof fibre–Typesofopticalfibre-Activeandpassivefibresensors-Endoscope.

Unit III: Electromagnetismanddielectrics 9Hours

Laws of electrostatics, electric current and the continuity equation, laws of magnetism. Ampere'sFaraday's laws. Maxwell's equations. Polarisation, permeability and dielectric constant, polar andnon-polardielectrics,internalfieldsinasolid,Clausius-Mossottiequation,applicationsofdielectrics,DielectricBreakdown–Types andRemedies

UnitIV:MagnetostaticsandMagneticmaterials 9 Hours Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoidcarrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere'scircuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction,permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magneticmaterials.

UnitV:QuantumMechanics 9Hours

Introduction to quantum physics, black body radiation, explanation using the photon concept,photoelectric effect, Compton effect, de Broglie hypothesis, wave-particle duality, verification ofmatterwaves,uncertaintyprinciple,Schrodingerwaveequation,particleinabox(1D).

ListofExperiments **15 Hours**

1. Todeterminethedispersivepowerofprismusingspectrometer andmercurysource
2. TodeterminethewavelengthofsodiumlightbyNewton'sRing
3. Todeterminethewavelengthofsodiumlightusingdiffractiongrating
4. To determine thenumeralaperture(NA)ofaOpticalFibre.
5. TofindthewavelengthofHe-NeLaserusingtransmissiondiffractiongrating.
6. Todeterminetherefractiveindexofaprism/liquidusingspectrometer.
7. Deflectionmagnetometer–MandBH–TANCposition
8. Todeterminethethicknessofamaterialusingairwedgemethod
9. MeasurementoffieldstrengthBandits variationinaSolenoid(DeterminedB/dx).
10. Determinationofdielectricconstantofliquids/Solids
11. DeterminationofMagneticSusceptibility

TextBook(s):

1. Ghatak,–Optics‖Fithedition,TataMcGraw-HillInc,2012.
2. N.SubrahmanyamandBrij Lal,–ATextBookofOptics‖,S.ChandLimited,2015.
3. MarikaniA.EngineeringPhysics. PHILearningPvt.,India,2009.
4. PalanisamyP.K.EngineeringPhysics.SCITECHPublications,2011
5. RajagopalK.EngineeringPhysics. PHI,NewDelhi, 2011

ReferenceBooks:

1. KailashK. SharmaOptics:PrinciplesandApplicationsElsevier,2006
2. William T. Silfvast, Laser Fundamentals, Cambridge University Press, New York, 2ndEdition,2004
3. GaurR. K, andGuptaS.L,EngineeringPhysics,DhanpatRai&Sons, NewDelhi, 7thEdition,1993
4. HallidayD,ResnickRandWalerJ,FundamentalsofPhysics,WileyandSons, NewYork,6thEdition,2001
5. RajputB.S,PragatiPrakashan,AdvancedQuantumMechanics, Pragatipublications,NewMarket,BegumBridge,Meerut,2009.
6. PracticalPhysics – S.L.Gupta &V.Kumar(PragatiPrakashan).
7. AdvancedPracticalPhysics–B.L.WorkshopandH.T.Flint(KPH)
8. AdvancedPracticalPhysicsVol.I&II– Chauhan &Singh(PragatiPrakashan)
9. PhysicsLaboratoryManual,preparedbyDepartment ofPhysics,KalasalingamUniversity.

CHY18R171	Chemistry	L	T	P	C
		3	1	2	5

Pre-requisite:Nil

CourseCategory:*BasicSciencesandMathematics*

CourseType: *IntegratedCourse*

Unit-I: AtomicandMolecularStructure 9Hours

Schrodingerwaveequation:DerivationoftimeindependentSchrodingerwaveequation,Representation of Schrodinger wave equation in polar coordinates - Radial distribution functiongraphsofs,p,dand forbitals.MolecularOrbitalTheory:MOTconcept,MOdiagramsofhomo-nucleardiatomicmolecules(hydrogen,nitrogen andoxygen)andhetero-nucleardiatomicmolecules (carbon monoxide and nitric oxide). Crystal field theory: CFT concept, weak andstrong ligands, energy level diagrams of transition metal ions (Fe^{2+}& Fe^{3+}) in octahedral andtetrahedral complexes and their magnetic properties. Intermolecular forces - Ionic, dipolar andvanderWaalsinteractions.

Unit-II:PeriodicProperties 9Hours

Effective nuclear charge - Factors affecting effective nuclear charge: Penetration or shieldingoforbitals - Variation of s, p, d and f orbital energies of atoms in the periodic table - Aufbauprinciple(Building-upprinciple)**:**ApplicationofAufbauprincipleinwritingelectronicconfiguration, Deviation from Aufbau principle - Periodicity of properties in a periodic table - Periodicproperties:Atomicandionicsizes,ionizationenergies,electronaffinityandelectronegativity - Variation of periodic properties in the periodic table - Hard soft acids andbases:Conceptandexamples.

Unit-III:FreeEnergyandChemicalEquilibria 9Hours

Thermodynamicfunctions:Definitionandmathematicalexpressionforwork,Energy,Enthalpy,Entropy and Free energy - Nernst equation: Derivation, apply Nernst equation to determine ofsolubilityproduct,pH(glasselectrode).Potentiometrictitrations:Acid-Base,Redoxandprecipitationreaction-Wateranalysis:HardnessbyEDTAmethodandchlorideionbyArgentomentric method - Corrosion: Definition, types (dry & wet) and mechanism. and controlofDryandWet corrosion.

Unit-IV:Organic Reactions 9 Hours

Nucleophilic substitution reactions: Definition, types and examples of nucleophile, Comparenucleophilicity and basicity of a nuceophile - Types of nucleophilic substitution (case RX and ArX):Mechanism of S_N1,S_N2,$S_Ni$andBenzyne.Electrophilicsubstitutionreactions:Definition,typesandexamplesof electrophile-Electrophilicsubstitutionreactionsofhydrocarbons:Halogenation,sulphonation,nitration.Friedelcraftsalkylationandacylationreaction.Nucleophilic addition reactions (case aldehydes and ketones): Polarity of C=O bond. Generalmechanism of nucleophilic addition reactions on aldehydes and ketones: HCN, HOH, ROH and$NaHSO_3$addition.Electrophilicadditionreactions(casealkenes):Generalmechanismofelectrophilicadditionreactionsonalkene-AdditionofHBr[Markownikoff&Anti-Markownikoff (peroxide effect)] - Addition of alkene (polymerization of ethylene). Eliminationreactions:Types

of elimination reactions (case alkyl halides): Dehydrohalogenation of alkyl halides - E_1 and E_2mechanism - Dehydration of alcohols to alkene and ethers. Greener synthesis of drug molecules(AspirinandIbuprofen)

Unit-V:Stereochemistry&SpectroscopicTechnique

9Hours

Stereochemistry **-** Definition with examples: Geometrical isomers (alkene) and stereoisomers,symmetry, chirality, enantiomers, diastereomers, meso and racemic mixture. Representation of3D structures: Wedge formula, Fischer projections, Newmann and Sawhorse formula (upto 2carbons) - Conformational analysis: Ethane, butane and cyclohexane - Configurational analysis:RulesofRSnomenclatureandapplicationofRSnomenclaturetomoleculescontainingonechiralcentre.Electronicspectroscopy:Principle,instrumentation,selectionrulesandmedicinalapplication of fluorescence spectroscopy. Nuclear magnetic resonance spectroscopy (^{1}H-NMR):Principle,instrumentation,chemicalshift,couplingconstantandapplication(structuralidentificationofthecompound$C_3H_6O$from^{1}H-NMRdata).X-raydiffraction:Principle,instrumentationandapplications X-raydiffraction.

<u>ListofExperiments(Any 10):</u> **<u>15 Hours</u>**

1. DeterminationofViscositybyOstwaldViscometer.
2. Determinationofsurfacetensionbystalagmometer.
3. Adsorptionofaceticacid bycharcoal.
4. Determinationofchloridecontentofwater.
5. Estimationofhardness ofwaterbyEDTAmethod.
6. Determinationoftherateconstantofareaction
7. Thinlayerchromatography.
8. Determinationofthepartitioncoefficientofasubstancebetweentwoimmiscibleliquids
9. DeterminationofSaponification/acidvalueofoil.
10. PreparationofAspirin
11. Potentiometrictitrationofstrongacidvsstrongbase.
12. Potentiometrictitrationofweakacidvsstrongbase.
13. Determinationofcellconstantand conductanceofsolutions.

TextBooks/

1. EngineeringChemistry,2nd Edition,WileyIndia(P)Ltd.,2018.
2. StereochemistryofOrganicCompounds, ErnestL.Eliel,SamuelH.WilenStudentedition,WileyIndia(P)Ltd.,2017.
3. UniversityChemistry,byB.M.MahanandR.J.Mayers,PearsonPublishers,11th Edition,Noida ,2017.
4. ChemistryLaboratoryManual,DepartmentofChemistry,KalasalingamUniversity,2018.

ReferenceBooks

1. FundamentalsofMolecularSpectroscopy,byC. N. BanwellandE.M.McCash,TataMcGraw-HillPublishers,4th Edition,NewDelhi,2008.
2. PhysicalChemistry,by<u>P.W.Atkins</u>and J.D.Paula,WHFreeman&CoPublishers,10th Edition,2014.
3. ModernInorganicChemistry,R.D.Madan,4th EditionS.Chand&CompanyLtd.,2009.
4. OrganicChemistry,PaulaY.Bruice,7th Edition,Pearson(DorlingKindersleyIndia(P)Ltd.)2014.

5. PrinciplesofPhysicalChemistry,B.R. Puri,L.R.Sharma,M.S.Pathania,47th Edition,VishalPublishingCo.,2017.

6. SpectrometricIdentificationofOrganicCompounds,RobertM.Silverstein,FrancisX.Webster,DavidJ.Kiemle,DavidL.Bryce,8th Edition,WileyIndia(P)Ltd.,2010.

7. Inorganic Chemistry, Peter Atkins, Mark Weller, Fraser Armstrong, Jonathan Rourke, TinaOverton,MichaelHangerman5th Edition,Oxfordpress,2015.

8. OrganicChemistry,Volume1,I.L.Finar,6th Edition,Pearson(ThomsonpressIndia(P)Ltd.) 2014.

MAT18R101	**CalculusandLinearAlgebra** (CommontoallBranchesofB.Tech) (ForthosewhohavejoinedinJune2018andlater)	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**
Pre-requisite:Nil **CourseCategory:***BasicSciencesandMathematics* ***CourseType:*** *Theory withtutorial*					

Course Objective:
To enable the students to acquire knowledge and skills in basic components of calculus, tohandlethe situations involving multivariable calculus, and to diagonalize a symmetric matrix usingeigenvaluesandeigenvectors.

CourseOutcomes:

Uponsuccessfulcompletionofthiscourse,studentswillbeable to
1. knowthefundamentaltheoremssuchasRolle'stheorem,Meanvaluetheorem,Taylor'stheoremanditsapplications.
2. understand the basicconceptsoflimit,continuity,derivative,partialderivativeandtotalderivativeanditsapplications.
3. solvetherealworldproblemsusingdifferentiationandintegration.
4. understandtheconceptsofsequence,convergentofsequences,seriesandtestingofconvergentofseriesusingdifferentmethods.
5. findthesolutionofsimultaneous linearequationsusingmatricesandtofindtheeigenvaluesandeigenvectorsofa matrix,Cayley-Hamilontheoremandorthogonaltransformations.

Unit1:Calculus:	***12 Hours***
Rolle'sTheorem- Meanvaluetheorems-Taylor'sandMaclaurintheoremswithremainders- indeterminateformsandL'Hospital'srule-Maximaandminima.	
Unit2:MultivariableCalculus(Differentiation):	***12 Hours***
Limit,continuityand partialderivatives-directionalderivatives-totalderivative - Maxima,minima andsaddle points-MethodofLagrangemultipliers.	

Unit 3:Calculus(Applications): ***12Hours***

Curvature (Cartesian coordinates) - Evolutes and involutes; Evaluation of definite and improperintegrals; Beta and Gamma functions and their properties; Applications of definite integrals toevaluate surfaceareas andvolumes ofrevolutions.

Unit4:Sequencesandseries: ***12Hours***

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series forexponential,trigonometricandlogarithmfunctions;

Unit 5:Matrices: ***12 Hours***

Systemoflinearequations;Symmetric,skew-symmetricandorthogonalmatrices;Determinants; Eigenvaluesandeigenvectors;Cayley-HamiltonTheorem-Diagonalizationofmatrices-Orthogonaltransformation-ReductionofQuadraticformtoCanonicalform.

TEXTBOOKS:

1.Grewal, B.S.,Grewal, J.S.,*HigherEngineeringMathematics*, KhannaPublishers, NewDelh43rdEdition,2015.

REFERENCEBOOKS:

1. Kreyszig, E, *Advanced Engineering Mathematics*, John Wiley and Sons (Asia) Limited,Singapore ,10thEdn.,2001.
2. Ramana B. V., *Engineering Mathematics*, Tata McGraw-Hill Publishing Company Limited,New Delhi,Edition2005.
3. Veerarajan,T.,*EngineeringMathematics(ForFirstYear)*, TataMcGraw-Hillpublishing companyLimited,2008.

MAT18R102	**MultipleIntegration,OrdinaryDifferentialEquationsandComplexVariable** (CommontoallBranchesofB.Techexceptfor CSE,EEEandE (ForthosewhohavejoinedinJune2018andlater)	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

Pre-requisite:Nil

CourseCategory:*BasicSciencesandMathematics*

CourseType:Theorywithtutorial

Course Objective:

Toenablethestudentstounderstandtheconceptsofmultipleintegrations,theirapplications,andto handle analyticfunctionsoncomplexplane andperformcomplexintegration.

CourseOutcomes:

Uponsuccessfulcompletionofthiscourse,studentswillbe able to

1. understandtheconceptsofdoubleandtripleintegralanditsapplications.
2. knowabouttheapplicationsofdoubleandtripleintegralinvectorcalculus.
3. knowthemethodsofsolvingdifferentialequationsoffirstandsecondorders.
4. understandtheconceptsofanalyticfunctions,conformalmappingsandbilineartransformations.
5. understandtheconceptsofsingularity,residuesandevaluationofcertainimproperintegrals.

Unit1:MultivariableCalculus(Integration): ***12Hours***

MultipleIntegration:Doubleintegrals(Cartesian), changeoforderofintegrationindouble

integrals, Change of variables (Cartesian to polar), Applications: areas and volume; Triple integrals(Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere andrectangularparallelepipeds;

Unit 2:Integraltheorems: ***12Hours***

Gradient, curl and divergence. Scalar line integrals, vector line integrals, scalar surface integrals,vectorsurfaceintegrals,Theorems ofGreen,GaussandStokes.

Unit3:Ordinarydifferentialequations: ***12Hours***

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equationssolvable for p, equations solvable for y, equations solvable for x and Clairaut's type. Second orderlinear differential equations with variable coefficients, method of variation of parameters, Cauchy-Eulerequations.

Unit4:ComplexVariable–Differentiation: ***12Hours***

Differentiation,Cauchy-Riemannequations,analyticfunctions,harmonicfunctions;elementaryanalytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings,Mobiustransformations andtheirproperties.

Unit 5:ComplexVariable– Integration: ***12Hours***

Contourintegrals,CauchyIntegralformula(withoutproof);Taylor'sseries,zerosofanalyticfunctions,singularities,Laurent'sseries;Residues,CauchyResiduetheorem(without proof),

Evaluationofdefiniteintegralinvolvingsineandcosine,
Evaluationofcertainimproperintegrals(Integrationaroundsmallsemicircles andrectangularcontours).

TEXTBOOKS:

2.Grewal,B.S.,Grewal,J.S.,*HigherEngineeringMathematics*,KhannaPublishers,NewDelhi,43rdEdition,2015.

REFERENCEBOOKS:

4. Kreyszig, E, *Advanced Engineering Mathematics*, John Wiley and Sons (Asia) Limited,Singapore ,10thEdn.,2001.
5. Ramana B. V., *Engineering Mathematics*, Tata McGraw-Hill Publishing Company Limited,New Delhi,Edition2005.
6. Veerarajan,T.,*EngineeringMathematics(ForFirstYear)*, TataMcGraw-HillpublishingcompanyLimited,2008.

MAT18R201	**Bio-Statistics** (forBioTech,BioMedicalandFoodtech) (ForthosewhohavejoinedinJune2018andlater)	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

Pre-requisite:Nil

CourseCategory:*BasicSciencesandMathematics*

CourseType: *Theory withtutorial*

Course Objective:
To enablethestudentstounderstand theconceptsofprobabilityand statisticsand to solverealworldproblemsusingstatisticaltools.

CourseOutcomes:
Uponsuccessfulcompletionofthiscourse,studentswillbe able to
1. knowthemethodsoffindingaverages,deviations,momentsandskewnessandkurtosis.
2. understandtheconceptsofprobabilityandtoknowaboutthediscreteandcontinuousdistributions.
3. understandtheconceptsofcorrelationandregressionanditsapplications.
4. fitthecurveoffirstandseconddegreeequationsbyleast squaremethodandknowthemethodofanalysofvariance.
5. studyaboutthetestingofhypothesisofsmallandlargesamples.

Unit1:StatisticalAverages ***12Hours***

Introduction – Diagrammatic representation of data – Graphic representation of data – Measures ofcentraltendency: Arithmeticmean,Geometricmean,Harmonicmean,MedianandMode– Measuresofdispersion:Range, MeandeviationandStandarddeviation– Moments,SkewnessandKurtosis.

Unit2:Probability ***12Hours***

Introduction–Probability–Theoremsonprobability-AdditionRule –Multiplicationrule – Probabilitydistributions:Binomial,PoissonandNormaldistributions.

Unit3:CorrelationandRegression ***12Hours***

Introduction – Types of correlation – coefficient of correlation – Rank correlation – Regression – Differencebetweencorrelationandregression– Regressionequations– Applicationsofregression***Unit4:FittingofCurvesandAnalysisofVariance***

12HoursPrinciples of least square techniques – Fitting a straight line – Fitting a second degree parabola – Fitting a curve ofthetypes $y = bx^a$, $y = ae^{bx}$, $y = ka^{bx}$-Analysis of variance (ANOVA)– onecriterionandtwocriterionofclassification

Unit5:TestingofHypotheses ***12Hours***

Test for single mean- mean difference – proportion – difference of proportions- small sample tests:based on t and F distributions – chi-square test for population variance – Chi-square test to goodnessoffit.

TEXTBOOKS:

1. KhanandKhanum,*FundamentalsofBiostatistics*,UkaazPublications, Reprint2004.
2. ArumugamandIssac,*Statistics*,NewGammaPublishers,July2013.

REFERENCEBOOKS:

1. Eason,G.,Coles,C.W.,Gittinby,G.,MathematicsandStatisticsfortheBiosciences,PearsonHigher education,NewYork,3rdEdition,1992
2. Kreyszig,E., AdvancedEngineeringMathematics,JohnWiley,Brisbane,9thEdition,2006

BIT18R101	BIOLOGYFORENGINEERS	L	T	P	C
		3	0	0	3
Pre-requisite:Nil		**CourseCategory:***BasicSciencesandMathematics*			
		CourseType:*theory*			

Courseoutcomes

CO1: Describethefundamentalsofcellstructureandcellcycle

CO2: Understandtheclassificationandfunctionsofbiomolecules

CO3: Elaboratethebasiccellularmechanismssuchasreplication,transcriptionandtranslation

CO4: Describetheunderlyingconceptsofinfectionandimmunity.

CO5: Explainvariousapplicationsofbiology

UnitI:INTRODUCTION **9hours**

Fundamental difference between science and engineering- comparison between eye and camera, Birdflying and aircraft; major discoveries in biology- ; Classification based on: Cellularity- Unicellular andMulticellular;Ultrastructure- prokaryotesandeukaryotes;threemajorkingdomsoflife;Cellstructure,intracellular organelles and their functions, comparison of plant and animal cells- Overview of Cellcycle andcell division

UnitII:BIOMOLECULES **9hours**

Chemistryofbiomolecules:Carbohydrates,Lipids,Proteins;classificationofaminoacids;classification of proteins based on structure and functions; Nucleic acids -types, structure and functionofDNAandRNA

UnitIII:GENESTOPROTEINS **9hours**

Gene, Genome and chromosome; Central dogma of molecular biology; Classical experiments of DNA:Griffith and, Avery, McCarty and MacLeod, Meselson and Stahl - DNA replication, Transcription andTranslation

UnitIV:MICROBIOLOGY 9hours

Microscopy; Microbes as infectious agents - malaria, tuberculosis, typhoid, polio, dengue, AIDS;;cultivation of bacteria. Immunity - innate and acquired immunity - organs and cells of the immunesystem-classificationofantibodies-typesofTcells -transplantation,autoimmunityoverview

Unit V:APPLICATIONSOFBIOLOGY 9hours

Healthcare-antibiotics, vaccines, monoclonal antibodies, insulin and interferons; Beneficial bacteria - probioticbacteria,nitrogenfixingbacteria,fermentationandfermentedfoodsandproductsEnvironmental - waste water treatment, bioremediation; Biomaterials and biopolymers for medical andenvironmentalapplications;Biosensors;

TEXTBOOKS:

1. DeRobertis,E.D.P.andDeRobertis,E.M.F.-CellandMolecularBiology-LippincottWilliams&Wilkins-Philadelphia-USA-8thEdition-2010.
2. Voet, D.,Voet,G.,-Biochemistry-JohnWileyandSons,Singapore-3rdEdition-2001.
3. PelczarMJ,ChanECSandKriegNR-Microbiology-TataMcGrawHill,India-7thEdition-2010

REFERENCES:

Friefelder.D.-MolecularBiology-McGraw-HillCompanies-NewYork,USA-5thEdition-2013.

BASICENGINEERING

MEC18R211	ENGINEERINGMECHANICS	L	T	P	Credit
		3	1	0	4
Pre-requisite: Nil		**Course Category:** BasicEngineering **CourseType:**Theory			

CourseOutcome(s):

Aftercompletingthis course,thestudentwillbeableto:

CO1:Explainthevectorialandscalarrepresentationofforces andmomentsofparticles andrigidbodiesbothintwodimensionsandinthreedimensions.

CO2:Applytheknowledgeoftrussesinframes,beamsand machinecomponents.

CO3:Contrasttheeffect offrictiononequilibrium.

CO4:Illustratetheimportanceofproperties ofsurfaces andsolids.

CO5:Demonstratethedynamicequilibriumequation.

MappingofCourseOutcome(s):

CO /PO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1											
CO2	3	2	2	1											
CO3	3	3	2	1											
CO4	3	2	2	1											
CO5	3	1	1	1											

3-StrongCorrelation-2-MediumCorrelation-1–LowCorrelation

Unit1.Statics ofParticlesandRigidbodies (9+3) 12Hours

SixFundamental principlesand concepts- vectoralgebra-Force SystemsBasic concepts,Particleequilibrium in 2-D & 3-D - System of Forces, Coplanar Concurrent Forces, Components in Space –Resultant - Equations of Equilibrium of Coplanar Systems and Spatial Systems.Rigid Body equilibrium in2-D&3-D - MomentofForcesanditsApplication-CouplesandResultantofForceSystem-Equilibriumof System of Forces, Free body diagrams - Equations of Equilibrium of Coplanar Systems and SpatialSystems.

Unit2.AnalysisofTrusses(9+3) 12Hours

Basic Structural Analysis- Equilibrium in three dimensions - Method of Sections- Method of Joints- Howto determine if a member is in tension or compression- Simple Trusses- Zero force members- Beams &typesof beams-Frames&Machines.

Unit3.Friction(9+3) 12Hours

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction - Motion of Bodies,simple contactfriction,slidingblock,wedgefriction,screwjack&differentialscrewjack,rollingresistance.

Unit4.PropertiesofSurfacesandSolids(9+3)

12Hours

Centroid of simple figures from first principle, centroid of composite sections - Centre of Gravity and itsimplications-Areamomentofinertia-Definition,Momentofinertiaofplanesectionsfromfirstprinciples,Theorems of moment of inertia, Moment of inertia of standard sections (T section and I section) - Massmomentinertiaofcircularplate,Cylinder,Cone,Sphere-Principalmomentofinertia.

Unit5.Dynamics(9+3) **12Hours**

Review of particle dynamics - Displacements, velocity and acceleration, their relationship - Equations ofmotions-Rectilinear motion-Planecurvilinear motion-Newton's2ndlaw-Impulse,momentum,impact -D'Alembert'sprincipleanditsapplicationsinplanemotionandconnectedbodies-Workenergyprincipleand its application in plane motion of connected bodies - Virtual Work and Energy Method - Virtualdisplacements,principleofvirtualworkforparticleandidealsystemof rigidbodies.

TextBook(s):

1.Beer, F.P.,andJohnson, E.R.,VectorMechanicsforEngineers– StaticsandDynamics,McGrawHill,TenthEditioninSI units

Reference(s):

1. Merriam,J.L.,EngineeringMechanics,VolumeI –Statics, andVolume– II,Dynamics2/e,WileyInternational,SeventhEdition.
2. Irving, H., Shames, Engineering Mechanics, Statics and Dynamics, Prentice Hall of India Ltd., FourthEdition

EEE18R171 Basic Electrical and Electronics Engineering(CommontoEEE,Food,Biomedical, Biotech&Chemical)	*Credits*			
	L	***T***	***P***	*Credit*
	3	***1***	***2***	***5***
Pre-requisite:--NIL	**CourseCategory:** BasicEngineering **CourseType:**IntegratedCourse			

CourseObjective(s):

To focus the fundamental ideas of the Electrical and Electronics Engineering by providing wide exposuretothebasicconceptsofElectricalandElectronicsEngineeringsuchasDCCircuits,ACCircuits,electrical machines, measuring instruments, electrical installation, Basic Electronic Devices and various electroniccircuitssuchasrectifiers,amplifiers,oscillators,etc.

CourseOutcome(s):

Aftercompletingthis course,thestudentwillbeableto:

CO1: Applythebasiclaws ofelectricityinDC andACcircuits
CO2: Describetheconstructionandoperationofstaticandrotatingelectrical machines
CO3: ExplainthefunctioningofmeasuringinstrumentsandLowVoltageElectricalInstallations**CO4:** Describe the constructional features and operation of fundamental electronic devices**CO5:** Explainthecharacteristicsof electroniccircuits

MappingofCourseOutcome(s):

CO / PO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	M	M		M	M	L		L	M	L			M		
CO2	M	M		M	M	L		M	L	M			M		
CO3	M			M	M	L		L	M	L			S		
CO4	S	M											M		
CO5	S	S	L	M	M	L	M	M	L	M			M		

CourseTopics:

Unit1:DCCircuits andACCircuits **9Hours**

Electricalquantities -resistors -inductors -capacitors -Ohm'sLaw-Kirchhoff'sLaws-series andparallelcircuits-analysisofDCcircuits-mesh,nodal-simpleproblems-Sinusoidalfunctions-phasorrepresentation - RMS and Average values - form and peak factors - RLC series circuits - power andpowerfactor-conceptof threephasesystem.

Unit2:ElectricalMachines **9Hours**

Construction and principle of operation of DC machines – DC generator – EMF equation – Types – DCmotor –Types-singlephasetransformer–Constructionandoperation–EMFequation-Alternator-threephase induction motor – Construction – Types - single phase induction motor – Construction – Working -types.

Unit3:MeasuringInstrumentsandElectricalInstallation

9Hours

Measuring Instruments: Moving coil and moving iron instruments - dynamometer type wattmeter - Inductiontype energymeter

Electrical Installation: ComponentsofLTSwitchgear -SwitchFuseUnit (SFU)– MCB–ELCB–MCCB -Domesticwiring-accessories-types-staircasewiring-fluorescenttubecircuits–Earthing

Unit4:ElectronicDevices **9Hours**

Basic concepts of PN junction diodes - Zener diode - bipolar junction transistor - Unipolar devices - FET,MOSFET,UJT-Thyristor–SCRandTriac,PhotoelectricDevices-PhotodiodeandPhototransistor

Unit5:ElectronicCircuits **9Hours**

Half wave and full wave rectifier –Transistor as an amplifier –RC- phase shift oscillator - RC integratorand differentiatorcircuits- diodeclampersandclippers-multivibrators-Schmitttrigger

TextBook(s):

1. V.K.Mehta,–Principlesof ElectricalEngineeringandElectronics‖,S.Chand&CompanyLtd,2012
2. KothariDPandNagrathIJ,"BasicElectricalEngineering",McGrawHill,2009.
3. MithalGK, ElectronicDevices&Circuits,KhannaPublications,1997

Reference(s):

1. T.Thyagarajan,–Fundamentalsof ElectricalandElectronicsEngineering‖,SciTechpublications(Ind.) Pvt.Ltd.,3rdEdition,2015.
2. Muraleedharan K.A, Muthususbramanian R and Salivahanan S, "Basic Electrical, Electronics andComputerEngineering"Tata McGrawHill,2006.
3. ShanthakumarS.R.J,BasicMechanicalEngineering, ThirdRevisedEdition(Reprint 2009),AnuradhaPublications,Kumbakonam,1999.
4. RajputR.K.,BasicMechanicalEngineering,Fourthedition,TataMcGrawHillPublishingCo.,NewDelhi,2007.

LISTOFEXPERIEMENTS: **15Hours**

1. VerificationofKirchoff'sLaws.
2. VerificationofMeshandNodalanalysis
3. Measurementofelectricalquantities-voltagecurrent,power&powerfactorinRLCcircuit
4. OpencircuitcharacteristicsofSeparatelyexcitedDCGenerator
5. Drawthecharacteristicbetweenoutputpower versusefficiencyofDCshuntmotor
6. Verificationofturnsratioonsinglephasetransformer
7. Studyofbasicelectricalinstallationcomponentsfor LT switchgear
8. Residentialhousewiringusingfuse,twowayswitchesandlamp
9. Wiringlayoutfor Fluorescentlamp
10. VIcharacteristicsof PNjunctiondiode
11. VICharacteristicsofZenerdiode
12. Construct anddemonstratetheLightsensorusingPhotoTransistor
13. DesignadiodebasedHalfwaveandFullwaverectifier
14. StudyofZenerdiodeas voltageregulator

MEC18R151ENGINEERINGGRAPHICS &DESIGN	Credits			
	L	T	P	Credit
	3	0	2	3
Pre-requisite: Nil	**CourseCategory:** BasicEngineering **CourseType**:TheorywithPractical			

15. StudyofClipping&Clampingcircuit

CourseObjective(s):

This course aims to introduce the concept of graphic communication, develop the drawing skillsfor communicatingconcepts,ideasanddesignsofengineeringproducts,Demonstrateskillsininterpreting,and producing engineering drawings accurately and to give exposure to national standards relating toengineeringdrawing

CourseOutcome(s):

Aftercompletingthis course,thestudentwillbeableto:

CO1: Createtheprojectionofpoints inallquadrants andstraightlines

CO2: Construct the projections of planes and solid objects with refer to reference planes**CO3:**Illustratethetrueshapeoftruncatedsolidsinboththe manualandcomputerizedmanner**CO4:**Developsurfacesof truncatedsolidsinboththe manualandcomputerizedman

CO5: Applyorthographicandisometricprojections in boththemanualandcomputerized man

MappingofCourseOutcome(s):

CO/ PO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		2												
CO2		3										1			
CO3	2		3		3		3					2			
CO4	1	2			3		3					3			
CO5	3		3		3		3					3			

3- StrongCorrelation; 2-MediumCorrelation; 1-LowCorrelation

CourseTopics:

Unit1:ProjectionofPointsandStraightLines

9Hours Importance of graphics – use of drafting instruments – BIS conventions and specifications – size, layoutand folding of drawing sheets – lettering dimensioning and scales - Projection of points, located in allquadrants - projection of straight lines located in the first quadrant, determination of true lengths and trueinclinations

Unit2:ProjectionofPlanesandSolids **9Hours**

Projection of polygonal surface and circular lamina located in first quadrant inclined to one or bothreference planes-Projection of solids like prisms, pyramids, cylinder and cone when the axis is inclined toonereferenceplanebychange of positionmethod

Unit3: SectionofSolids **9Hours**

Section ofsimplesolids likeprisms,pyramids,cylinderandconeinverticalpositionbycuttingplanesinclinedtoanyoneof thereferenceplanes,obtainingtrueshapeof section

Unit4:DevelopmentofSurfaces **9Hours**

Developmentoflateralsurfacesofsimpleandtruncatedsolids– prisms,pyramids,cylindersandcones

Unit5:OrthographicandIsometricProjection

9Hours Orthographicprinciples –missingview-freehandsketchinginfirstangleprojectionfrompictorial views.Principles of isometric projection – isometric view and projections of simple solids, truncated prisms,pyramids, cylinders and cones. Introduction to CAD software – menus and tools – drafting platformdemonstration

PracticalModules

1. Constructionofconicsections usingCADsoftware
2. Constructionofsimpleplanesusingexclusivecommandslike extend,trimetc.,
3. Constructionof3Dmodel–solidsandsectionalviews
4. Generating2Dorthographicblueprintsfrom3Dpartmodels
5. Vectorizationofsimplebuildingplanandelevation

TextBook(s):

1. BasantAggarwalandC. Aggarwal, EngineeringDrawing, McGraw-Hill,2013.
2. N.S.Parthasarathy,VelaMurali,EngineeringDrawing,OxfordUniversityPress,2015.
3. K.Venugopal,EngineeringDrawing+ AutoCAD,NewAge;Fifth edition,2011.

Reference(s):

1. Shah, M.B.,andRana,B.C.,EngineeringDrawing,Pearson2009
2. Natarajan,K.V.,ATextBookofEngineeringGraphics,21stEdition,DhanalakshmiPublishers,Chennai,2012.
3. PaulRichard,JimFitzgerald.,IntroductiontoAutoCAD 2017:AModernPerspective,Pearson,2016.
4. Bhatt,N.D., EngineeringDrawing,CharotarpublishingHouse,NewDelhi,53trdEdition,2014.
5. LuzadderandDuff,–Fundamentalsof EngineeringDrawing‖,PrenticeHallof IndiaPvt.Ltd.,2009.
6. Venugopal, K.,EngineeringGraphics,NewAgeInternational(P)Limited,2009.

CSE18R171	**PROGRAMMINGFORPROBLEMSOLVING**	**L**	**T**	**P**	**Credit**
		3	1	2	5

Prerequisite:NIL **CourseCategories:** BasicEngineering
CourseType: IntegratedCourse

CourseObjectives:

Tomakethestudentstounderstandthebasicconceptsofprogrammingusing Clanguage,syntaxandrulestobe followedwhilewritingaCprogramandhowtocompileandexecuteCprograms.

CourseOutcome(s)

CO1	Understandthebasicprogrammingconcepts andsyntax ofClanguage
CO2	SolvesimpleproblemsusingCusingarrays andstrings.
CO3	Applymodularprogrammingconcept ofC tosolvegivenproblem.
CO4	Developefficientcodeusingmemoryallocationtechniques.
CO5	Createuserdefined datatypes andfiles tosolverealworldproblems

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M										
CO2	M											
CO3	M											

CO4									M			
CO5												

CourseTopic(s)

Unit1:BASICSOFC **9Hours**

Structure of C program - concept of a variable-Data type in C - Program Statement – Declaration – Tokens - Operatorsand expressions-TypeConversion-Inputandoutput-Controlstatements :Selection-Iteration - Gotostatement-Specialcontrolstatement—Nestedloops

Unit2:ARRAYSANDSTRINGS **9Hours**

Introduction - One dimensional and two dimensional arrays – Declaration of arrays - Initializing andAccessingarrayelements–Strings:Onedimensionalcharacterarrays-DeclarationandStringInitialization - StringManipulation-MultidimensionalArrays-ArraysofStrings

Unit3:FUNCTIONS **9Hours**

Introduction-Conceptoffunction-UsingFunctions-CallbyValueMechanisms-Working withFunctions - PassingArrays toFunctions-ScopeandExtend-StorageClasses-InlineFunctions– SortingUsingFunctions:Bubblesort-Searching:Linear andBinarySearch–RecursiveFunctions.

Unit4:POINTERS **9Hours**

Introduction - Address of operands – Pointer: Declaration and Initialization - Arrays and Pointers - Pointersand Strings - Pointer Arithmetic - Pointers to Pointers - Array of Pointers - Pointer to Array - DynamicMemoryAllocation(DMA)

Unit5:USERDEFINEDDATATYPESANDFILES **9Hours**

Introduction – Structures - Declaration and Initialization of Structures - Arrays within Structure - StructureandPointers-StructuresandFunctions– Union-Enumerationtypes-UsingFilesinC-WorkingwithTextFiles-Workingwithbinaryfiles

LISTOFEXPERIMENTS **15Hours**

1. Programsusingcontrolandloopingstatements.
2. Programs using1-D and2-Darrays.
3. Programsusingstringhandlingfunctions.
4. Programsusingfunctionswithvariousparameter passingmechanisms.
5. Programsusingrecursivefunctions.
6. Programsusingpointersanddynamicmemoryallocationfunctionsfor1-Dand2-Darrays.
7. Programs to create user defined data like structures and unions to represent real worldproblemsProgramsforcreatingtextfilestostoreandmanipulatedata.

TextBook(s):

1. PradipDey,ManasGhosh,–Fundamentalsof ComputingandProgramminginC‖,OxfordUniversity Press,2ndEdition,2013.
2. ByronS.Gottfried,–ProgrammingwithC‖,SecondEdition,TataMcGrawHill,2006

Reference(s):

1. BrianW.KerninghanandDennisM.Richie,–TheCProgramminglanguage‖,PearsonEducation,2005.
2. JohnsonbaughR.andKalinM, –ApplicationsProgramminginANSI C‖,ThirdEdition,Pearson Education,2003.
3. E.Balagurusamy,–ProgramminginANSI C‖,FourthEdition,Tata McGrawHill2008.

MEC18R152 ENGINEERINGPRACTICE	Credits			
	L	T	P	Credit
	3	0	2	3
Pre-requisite: Nil	**CourseCategory:** BasicEngineering **CourseType:**TheorywithPractical			

Lectures&videos:

Detailedcontents

1. ManufacturingMethods-
casting,forming,machining,joining,advancedmanufacturingmethods(**3lectures)**

2. CNCmachining,Additivemanufacturing(**1lecture)**

3. Fittingoperations&powertools(**1lecture)**

4. Carpentry(**1lecture)**

5. Plasticmoulding, glasscutting(**1lecture)**

6. Metalcasting(**1lecture)**

7. Welding(arcwelding& gaswelding),
brazing(**1lecture)SuggestedText/ReferenceBooks:**

(i) HajraChoudhuryS.K.,HajraChoudhuryA.K. andNirjhar RoyS.K.,–Elementsof WorkshopTechnology‖,Vol.I 2008andVol.II 2010,Mediapromotersandpublishersprivatelimited,Mumbai.

(ii) KalpakjianS.AndStevenS.Schmid,–ManufacturingEngineeringandTechnology‖, 4thedition,PearsonEducationIndiaEdition, 2002.

(iii)GowriP.HariharanandA.SureshBabu,‖ManufacturingTechnology–I‖PearsonEducation,2008.

(iv) RoyA.Lindberg,–ProcessesandMaterialsofManufacture‖,4th edition,PrenticeHall India,1998.

(v) Rao P.N.,–ManufacturingTechnology‖,Vol.I andVol.II,Tata McGrawHill House, 2017.

CourseOutcomes

Uponcompletionofthiscourse,thestudentswillgainknowledgeofthedifferent manufacturingprocesseswhicharecommonlyemployedintheindustry,tofabricatecomponents usingdifferentmaterials.

(ii)WorkshopPractice:

1. Machineshop **(10hours)**

2. Fittingshop(**8hours)**

3. Carpentry(**6hours)**

4. Weldingshop(**8hours (Arcwelding 4 hrs+gas welding 4hrs)**

5. Casting(**8hours)**

6. Smithy(**6hours)**

7. Plasticmoulding&GlassCutting(6hours)

Examinationscouldinvolvetheactualfabricationofsimple components,utilizingoneormoreofthetechniquescoveredabove.

LaboratoryOutcomes

- Upon completion of this laboratory course, students will be able to fabricatecomponentswiththeirownhands.
- Theywill alsogetpracticalknowledge ofthedimensional accuraciesanddimensionaltolerancespossiblewithdifferentmanufacturingprocesses.
- Byassemblingdifferentcomponents,theywillbeabletoproducesmalldevicesoftheir interest.

FT18R101	PRINCIPLESOFCHEMICALENGINEERING	L	T	P	Credit
		3	1	0	4

Prerequisite:NIL **CourseCategories:**ProgramCore
Course Type: Theorywithtutorial

Objective(s)	Toacquaintthemwiththefundamentals oftheapplicationofmaterialand energybalancesinchemicalengineering

CourseOutcome(s)

CO1	ToattainbasicknowledgeaboutProcesscalculation
CO2	Tounderstandmaterialbalancecalculationforprocess
CO3	TounderstandEnergybalancecalculationforprocess
CO4	Tounderstandthefluidflowbehaviorandtransportation.
CO5	understandthermalprocessingoffoodsanditsequipment

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M										
CO2												
CO3												
CO4						H						
CO5												M

CourseTopic(s)

UNIT–IUNITSANDDIMENSIONS,FUNDAMENTALCALCULATIONS 12 hours
Unitsanddimensions,Conceptof moleandMolecule,CompositionofmixturesofSolids,liquidsandgases -Compositionofmixturesandsolutions-
Percentagebyweight,moleandVolume;normality,molarity,molality,ppm,pH andpKaBufferCalculations

UNIT–IIMATERIALBALANCEWITH ANDWITHOUTCHEMICALREACTIONS: **12 hours**Material balances in distillation, absorption, extraction, crystallization, drying, mixing and evaporationoperations,Materialbalancesinvolvingbypass,recycleandpurge.
Principlesofstoichiometry,
definitionsoflimitingandexcessreactants,fractionsandpercentageconversion,yieldandpercentage yield,Selectivityandrelatedproblems.

UNITIIIENERGYBALANCE 12hours
General energy balance equation for steady and unsteady state processes, Without Chemical Reaction, WithChemicalReaction,Enthalpycalculationprocedures,Heatofcombustion.

UNITIVFLUIDFLOWTHEORY 12hours
Properties of fluids: Fluid statics&Dynamics,Newtonian and non-Newtonian liquids, Reynolds number:Laminarflowandturbulentflow,stressinfluidflow, Pressuredropcalculationandfrictionfactor–Fluidflowmeasurements: variable head meter, variable area meter, Paddle flow meter, pitot tube.Forces on submergedbodies-Equationofcontinuityandmotion-
Bernoulli•sequationanditsapplications,influenceoftemperatureonviscosity.Pumps&Itsclassification,Pipefittings&valves.

UNIT VTHERMALPROCESSING 12hours

Decimal Reduction time (D), Thermal resistance constant, thermal death time (F), Relationship betweenchemical Kinetics and Thermal processing Parameters: Decimal reduction time, rate constants k and Q10Thermal resistance constant z, Activation energy Ea and their inter-relationship. Plate heat exchanger,Tubularheatexchanger,

TEXTBOOKS

1. McCabe,W.L., Smith, J.C., Harriott,P.,UnitOperationsof Chemical Engineering,McGraw-Hill,New York,7thed,2005.

2. Brennan,J.G.,Butters,J.R.,Cowell,N.D.andLilly,A.E.FoodEngineeringOperations,AppliedScience,London,3rdEdition,1990.

REFERENCEBOOKS

1. SKGhosal,SKSanyal,SDatta.–IntroductiontoChemicalEngineering‖ .TataMcGraw-Hill PublishingCompanyLimited.2011.

2. Narayanan,K.V.and LakshmiKutty.–StoichiometryandProcessCalculations‖,PHI,2006.

3. –ChemicalEngineering‖ byCoulson&Richardson.Vol.1&2

FT18R201	FOODADDITIVES	L	T	P	C
		3	0	0	3

Prerequisite:NIL **CourseCategories:**ProgramCore
CourseType: Theory

Objective(s)	Toenablethestudentstounderstand typesand chemicalpropertiesof preservative,emulsifiersandantioxidants

CourseOutcome(s)

CO1	ApplicationsoffoodadditivesinFoodIndustry
CO2	Identifyadulterantsinfoodadditives
CO3	Preservativeclassanditslimitationinfoodprocessing industries
CO4	Studyoncolorantandflavoroffood additives
CO5	Lawsandqualitystandardsrelatedtofoodadditives

Mapping ofCOsandPOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M														
CO2			M												
CO3										M					
CO4			M							M					
CO5			M							M				M	

CourseTopic(s)

Unit1:FOODADDITIVES **9 Hours**
Food additives definition – Determination of the limit for addition, functions of Acid, Base,Buffer systems, Salts and chelating /sequestering a g e n t s , Lowcalorie and non-n utritivesweeteners,Polyols.

Unit2:TYPESOFFOODADDITIVES **9 Hours**
Types, chemical properties, levels of additions in individual products, toxicity data ofAcidulates–Preservatives–Emulsifiersandgums–Antioxidants-Anti-cakingagents,thickeners,

Unit 3:PROPERTIESEAND ENZYMES **9Hours**
Types,chemicalproperties,levelsofadditionsinindividualproducts,toxicitydataofDoughconditioners-flourimprovers–Humectants –Enzymes,Starches-

Unit 4:COLOURANTSANDFLAVORANTS **9 Hours**
Types, chemical properties, levels of additions in individual products, toxicity data ofColourants–Naturalandartificial,Flavourants,Flavourenhancers,Fat substitutesandReplacers

Unit 5:NATURAL,SYNTHETICAGENTSANDLAW **9 Hours**
Types, chemicalproperties,levelsofadditionsinindividualproducts,toxicitydataSweeteners–Naturaland synthetic,Chelating agents,anti-browning agents, SWMA,MPO(1977),VCO(1978),AGMARK, BIS,US,Canadian,EU,ISOandCodexFood Standards, ExportQualityControlandInspectionact(1963),

TextBook(s):

1. Food additives by Brannen A.L., Davidson P.M., Salminen S. and Thorngate J.H.Second Edition,RevisedandExpanded.MarceldekkerInc.USA,2002.

ReferenceBook(s):

1.JimSmith,LilyHong–Shum.–FoodAdditives DataBook‖.JohnWiley&Sons.2nd Edition.2011.

2.RichardJ.Lewis,Sr.–FoodAdditives Handbook‖.InternationalThomsonPublication. 1989.

FT18R251	PRINCIPLESOFFOODPROCESSING&PRESERVATION	L	T	P	Credit
		3	0	1	3.5

Prerequisite:NIL **CourseCategories:**ProgramCore
CourseType: TheorywithPractical

Objective(s)	To Introducestudentsaboutthe methodsofprocessing and preservingfoodto preventwastageandlosses

CourseOutcome(s)

CO1	Understandtheneedsforpreservationandmechanismsofpreservation
CO2	Understandthe importanceoftheprocessingand formulationbottleneck organisms
CO3	Applypreservationprinciplesinproduct design
CO4	Calculatetheefficacyofaheatprocessandinterpretitskeyparameters(i.e.D-,z-,andF0- values)
CO5	Enhancetheeffectivenessofpreservation methodsand theefficiencyof production

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M			L							H		H
CO2			H			M	M						L		
CO3	M	M			M	M	M						L		M
CO4		L	M		L	M		L	M	M			H		
CO5		H	L			H	H	L		M	M			H	

CourseTopic(s)

Unit1:INTRODUCTION: 9Hours
Sources of food- plant, animal and microbial origin; Different groups of food; properties of food-physical,mechanical,thermalandsensory;Biochemicalchangesduringprocessingoffoods.Scopeandimportanceoffood processing.

Unit2:LOWTEMPERATUREPROCESSING 9 Hours
Chillingandfreezing:Freezing-Phasediagram,icecrystalformation,comparisonoffreezingandthawing. Freezing methods: air freezing, plate freezing, liquid immersion freezing and cryogenicfreezing.Freezeconcentrationofliquidfoods.

Unit3:HIGHTEMPERATUREPROCESSING 9Hours
Methods of applying heattofoods-sterilization,Blanching, Pasteurization. Basic concepts inthermal destruction of microorganisms -D, Z, F values. Sterilization- methods and equipments,UHT,Asepticprocessingandpackaging.

Unit 4:DRYINGANDDEHYDRATIONS 9Hours
Theory and mechanism of drying-water activity and its effect on the keeping quality, sorptionisothermsandtheiruse,factorsaffectingrateofdrying,methodsofdryingofvariousfoodproducts-batchandcontinuousdrying,spraydryer,fluidizedbeddryer,Freezedryingandvacuumdrying

Unit5:PRESERVATION 9 Hours
Introduction to food spoilage; Preservation of foods by use of sugar, salt, chemicals, smoking,pickling, curing, fermentation, baking, extrusion and canning, and Packaging-CAP, MAP. Hurdletechnology.

Text Book(s):

1.B.Sivasankar.–FoodProcessingandPreservation‖.PHILearningPrivate Limited.2015.

2.Fellows,P.J.–FoodProcessingTechnology:Principles andPractice‖.WoodheadPub. Ltd,2nd Edition,2002.

Reference(s):

1. M. ShafeiurRahman(1999).HandbookofFoodPreservation, MarcelDekker,Inc.
2. KhetarpaulN.–FoodProcessingandPreservation‖.DyaPublishingHouse,NewDelhi. 2005.

FT18R271	FOODMICROBIOLOGY	L	T	P	Credit
		3	0	2	4

Prerequisite: NIL **Course Categories:**ProgramCore
CourseType: IntegratedCourses

CourseObjective(s)	Recognizeanddescribethecharacteristicsofimportantpathogensandspoilagemicroorganism sin food
CourseOutcome(s)	
CO1	Explaintheinteractionsbetweenmicroorganismsandthefoodenvironment,andfactorsinfluencingtheirgrowthandsurvival
CO2	Explainthesignificanceandactivitiesofmicroorganisms infood.
CO3	Describethecharacteristicsoffood-borne,waterborneandspoilagemicroorganisms,andmethodsfortheir isolation,detectionandidentification
CO4	ExplaintheeffectsoffermentationinfoodproductionandhowitinfluencestheMicrobiologicalqualityandstatusofthefoodproduct.
CO5	Explainwhy microbiologicalqualitycontrolprogrammesarenecessaryinfoodProduction.

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M			L							H		H
CO2			H			M	M						L		
CO3	M	M			M	M	M						L		M
CO4		L	M		L	M		L	M	M			H		
CO5		H	L			H	H	L		M	M			H	

CourseTopic(s)

Unit1:INTRODUCTION **9Hours**

Introduction, historical developments in the food microbiology and its Significance, Microscopeanditstypes,Microbialgrowthpattern,Studyofmicroorganisms-Morphology,structure,classifications-bacteria,virus,fungi,yeastandmold,MicrobiologicalMethodsofenumerationandisolationofbacteriaandfungi.

Unit2:CONTAMINANTS&SPOILAGE **9 Hours**

Sources of contamination, Spoilage of foods-Factors affecting Spoilage, Biochemical changescaused by microorganisms, Contamination and spoilage of foods- Fruits &vegetables, cereals &pulses,milk,seafoodsandmeatduringHandlingandprocessing.

Unit3:MICROBES INFOODFERMENTATION **9 Hours**

Importance of microbes in food fermentation, batch, fed batch and continuous fermentation, Homoand hetro-fermentative bacteria, yeast & fungi; Biochemistry of fermentation-pathway involved,Typesoffermentation-lacticacidfermentation,alcoholicfermentations,Fermentedfoods–Sauerkraut, Cheese, Beer, Vinegar,yoghurt, soyproducts.

Unit4: FOODBORNEDISEASES **9 Hours**

Factors affecting growth of microorganism in food - intrinsic and extrinsic factors, foodbornePathogens- Bacterial food borne diseases, Food Borne Viral Pathogens, Food Borne AnimalParasites,Foodpoisoning,foodinfectionandintoxication.

Unit5:FOODSPOILAGECONTROL **9 Hours**

Control of microorganisms- physical and chemical agents, Anti-microbial agents- theirmechanismofaction, HACCP&foodsafety, HurdleTechnologyanditsapplications.

ListofExperiments **15 hours**

1. Microscopeitspartsandutilityinidentificationanddifferentiationofbacteria,yeastandmold.
2. Micrometryanddeterminationofsizeofdeferentdifferentmicrobes
3. Directtotal,viable,andnon-viablecountofmicroorganisms inmilk.
4. Preparationand sterilizationofculturemediaformicrobialcounts
5. Simpleanddifferentialstainingofmicroorganismsandtheirexamination.
6. DeterminationofStandardPlateCount(SPC)innaturalandprocessedfoods
7. Preparationofdifferenttypesofplatingtechniques
8. Isolationofbacteriainfood
9. DeterminationofStandardPlateCount(SPC)inmilk
10. Enumerationofyeastandmoldinfood
11. Microbiologicalexaminationofpotable water:Totalandcoliformcount.
12. Preparationofyoghurt

TextBook(s):

1. Frazier, W.C.and Westhoff. –Modern FoodMicrobiology‖. Tata McGrawHill PublishingCo.Ltd.,NewDelhi,4th Edition,2008.

Reference(s):

1. AdamsM.R.andMossM.O.–FoodMicrobiology‖.NewAge International Ltd Publication.2007.
2. BibekRay.–Fundamentalfoodmicrobiology‖.CRC Press.3rdEdition.2005.

FT18R272	FOODBIOCHEMISTRY	L	T	P	Credit
		3	0	2	4

Prerequisite:NIL **CourseCategories:**ProgramCore **CourseType:** IntegratedCourse

Objective(s)	1. To understandthechemistryoffoods-compositionoffood,roleofeachcomponentandtheirinteractions. 2. To study the properties of various food components which affect the quality offood.

CourseOutcome(s)	
CO1	Understandandcontrolthemajorchemicalandbiochemical(enzymatic)reactionsthat influencefoodqualitywithemphasisonfoodindustryapplications
CO2	Understand how the properties of different food components and interactions amongthesecomponentsmodulatethespecificqualityattributesoffoodsystems,andto understandtheprinciplethatunderliesthebiochemical/enzymatictechniquesused infoodanalysis.
CO3	Explainthechemistryunderlying thepropertiesand reactionsofvariousfoodcomponents.
CO4	Understand theneed ofbiochemistryand efficiencyofcarbohydratesand protein inthe industry.
CO5	Todeliversfoodpigmentandtheirapplicationinfoodprocessing

MappingofCourseOutcome(s)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	H												L		
CO2	M	L				M							L		
CO3	M	L				M							L		
CO4	M	L				M							L		
CO5	M	L				M							L		

CourseTopics:

Unit1:INTRODUCTION **9 Hours**

Importanceoffood,Scope offoodchemistry-Introductiontodifferentfoodgroups:theirclassification and importance -Water -Structure of water molecule, types and properties of water,wateractivityanditsimportance

Unit 2:CARBOHYDRATES **9 Hours**

Carbohydrates -Definition, classification, sources, chemical make-up, properties, nutritional andindustrialimportance-Proteins-Sources,chemicalmake-up,properties,nutritionalaspects– aminoacids, amino essential acids, biological value, PER (Protein Efficiency Ratio), and industrialimportance

Unit-3FATS **9Hours**

Fats -Sources, chemical make-up, properties, nutritional aspects – essential fatty acids, PUFA(Polyunsaturated Fatty Acids) hydrogenation, rancidity and industrial-importance - Deficiencydisordersandrequirementofdifferentnutrients

Unit4:MINERALS&VITAMINS **9Hours**

Minerals and Vitamins -Importance and sources of minerals and vitamins with special emphasison calcium, iodine, zinc, iron, floride, fat, and minerals soluble and water-soluble vitamins, effectof processing and storage on vitamins- Deficiency disorders and requirement of different vitamins**Unit5: FOODPIGMENTSANDENZYMES** **9Hours**

Food Pigments-Importance, types and sources of pigments - their changes during processing andstorage-Enzymes -Definition,importance,sources,nomenclature,classification –discuss theirapplicationinfoodprocessinginbrief.

ListOfExperiments **15 Hours**

1. Estimationofreducing,non-reducing,totalsugars.
2. EstimationofproteinbyLowry'smethod/ Biuretmethod
3. Estimationoffatusingsoxhletapparatus.
4. Estimationofmoisturecontentindifferentfoods.
5. Estimationofcarotenoidsinspices.
6. EstimationofStarchincereals.
7. DeterminationofpH andTitratable acidityoffoods

8. EstimationofAscorbicacidinfruits
9. Determinationofashinfoods
10. DeterminationofFiberinfoods
11. Estimationofenzymaticbrowningin food
12. Estimationofantioxidant(s)/polyphenol(s)infoodsample

Textbook(s):

1. Belitz,H.D.,Grosch.W.,Schieberle.P.―FoodChemistry‖.SpringerPublication,4th Edition,2009.
2. DulsyFatima.–Biochemistry‖.SarasPublication,2015.

Reference(s):

1. John M.deMan.–PrinciplesofFoodChemistry‖.AnAspenPublication.1999.
2. OwenR.Fennama.–FoodChemistry‖.MarcelDekker.3rdEdition.1996.

FT18R202	INSTRUMENTAL METHODS OFANALYSIS FORFOOD	L	T	P	Credit
		3	0	0	3

Prerequisite:NIL **CourseCategories:**ProgramCore **CourseType:**Theory

Course Objective(s)	Providesstudentswithanopportunitytoidentifydifferenttypesofanalyticalinstrumentsintheirrespectivelaboratories
CourseOutcome(s)	
CO1	Takeprofessionalsamplingandsampletreatmentpriortoanalysis
CO2	CalibrationofInstrumentalmethodsandtroubleshoot
CO3	Understandandcapableofperformingbasicchemicalprocessesinananalyticallaboratory
CO4	perform measurements on basic analytical instruments (photometers,spectrometers,chromatographs,ion-selective electrodes)
CO5	Evaluatetheresultofanalysisandidentifythecompoundspresentinit.

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			M												
CO2					M										
CO3			M												
CO4					M										
CO5					M										

CourseTopic(s)

Unit1:COMPONENTSANDCLASSIFICATIONSOFINSTRUMENTS 9Hours

Classification- Types of optical instruments- Fourier transform measurements, Calibration ofinstrumental Methods- precision, validity. Electrical components and Circuits, Signal to noiseratio- Signal-Noise enhancement -General Design-Sources of Radiation-Wavelength selectors-Sample containers-Radiationtransducers.

Unit 2:TRANSMITTANCEANDABSORBANCE 9Hours

Spectrometry:Electromagneticradiation–electromagneticspectrum,Interactionofelectromagneticradiationwithmatter.Spectrophotometeranalysis-MeasurementoftransmittanceandAbsorbance-Beer'slaw-QualitativeandquantitativeabsorptionMeasurements-Typesofspectrophotometers–UV-Visible-IR-RamanSpectroscopy-Principle,instrumentationandapplications.VisiblespectrometryandCalorimetry–Theory,Instrumentation (Line diagram alone) and applications. Ultra violet spectroscopy – Theory,instrumentation-SingleandDoublebeam,applications.Infra-redspectroscopy – Theory,FundamentalVibrations,Instrumentation,Applications.
Turbidimetry&Nephlometry.

Unit 3: ATOMIC ABSORPTION & PHOTO IONIZATIONMEASUREMENTS 9Hours

Atomic Absorption and NMR Spectroscopy: AAS - Principle, Instrumentation and applications.NMRspectroscopy–Principle,Instrumentation,Chemicalshiftandapplications.X-raydiffraction-Principle,instrumentation,detectorsandapplications.X-ray-photoelectronspectroscopy(XPS)-Ultravioletphotoelectronspectroscopy(UPS)- Electron impact spectroscopyand auger electron Spectroscopy-Instrumentation Radiation Sources-Energy Analysis-Detectorsandauxiliarysystems.Flamephotometer-Theory,Instrumentationandapplications.Polarimetry
- specific rotation, optical activity, Principle and instrumentation. Saccharimetery- Analysis ofSugar.

Unit 4:THERMOGRAVIMETRICAND CONDUCTOMETRY 9 Hours

Thermal methods: thermos balance, derivative thermos gravimetric analysis-Thermogravimetry,Differential thermal analysis, Differential Scanning Calorimetry – Principle, Instrumentation,Applications and difference. Conductance and Potential Measurements: Definitions, conductancemeasurements, applications, Types, advantages and disadvantages of Conductometric titrations.Potentialmeasurements,pHdetermination,PotentiometricTitrations.Basicprinciplesofelectrophoresis,theoryandapplicationofpaperandgel.

Unit5:SIZEEXCLUSIONANDIONEXCHANGECHROMATOGRAPHY 9Hours

Introduction to chromatography- principle, t ypes, applications, models, ideal separation,retention parameters, Van Deemter Equation-Gas chromatography, stationary phases, detectors-Kovatsindices-HPLC-reversephaseandnormalphase,pumps,columns,detectors-IonExchangeChromatography-SizeExclusionChromatography-Supercriticalchromatography-Capillaryelectrophoresis

TextBook(s):

1. Chatwal, GurdeepR.,andAnand, ShamK., ―InstrumentationMethodsofChemicalAnalysis‖,2ndEdition,Himalaya Publications,Bombay,2003.
2. Willard,H.,Merrit,L.,InstrumentalMethodsandAnalysis,CBSPublishersandDistributors, NewDelhi,7th Edition,2004
3. Skoog,HollerandNieman.,PrinciplesofInstrumentalAnalysis,ThomsonAsiaPvtLtd.,Singapore,5thedition,(Reprint)2003

Reference(s):

1. Chatwal,R.G.,Anand,K.S.,InstrumentalMethodofChemicalAnalysis,Himalaya PublishingHouse,Mumbai,5th Edition(Reprint),2006
2.Ewing,G.W.,InstrumentalMethodsofChemicalAnalysis,McGrawHillCompany, NewDelhi,5th Edition,1989
3. SkoogDouglasA.,WestDonaldM.,HollerFJames,andCrouchStanleyR.,―AnalyticalChemistry:AnIntroduction‖,7thEdition,South-Western,Australia,2000.
4. RouessacF.,―Chemical Analysis:ModernInternationalMethodandTechniques‖, 3rdEdition,Wiley,NewDelhi,1999.
5. BanwellG.C., ―FundamentalsofMolecularSpectroscopy‖, 2ndEdition, TataMcGraw-Hill,New Delhi,1992.

FT18R203	TECHNOLOGYOFDAIRYPRODUCTS	L	T	P	Credit
		3	0	0	3

Prerequisite:NIL **CourseCategories:**ProgramCore
CourseType: Theory

Objective(s)	1. Toenablethestudentstounderstandtheneedandimportanceof dairy 2. To knowthecompositionaland technologicalaspectsof milk
CourseOutcome(s)	
CO1	Thestudentslearnthetechnologyofmilkanditsprocessingmethods
CO2	Thestudentsgainknowledgeaboutthevarious milkprocessingequipments
CO3	Hands-onskills inmanufacturingselecteddairyproductsinapilotplantsetting
CO4	Anappreciationofthesafetyand quality factorsthatdeterminetheacceptabilityofthedairyproducts byconsumers
CO5	Abilitytoadaptnew technologyanddevelopqualityproducts

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M			L							H		H
CO2			H			M	M						L		
CO3	M	M			M	M	M						L		M
CO4		L	M		L	M		L	M	M			H		
CO5		H	L			H	H	L		M	M			H	

CourseTopic(s)

Unit1:INTRODUCTION 9Hours

Introduction, Milk – Types, composition, nutritive value, factors affecting composition, physico-chemical properties- Color, Flavour, Specific Gravity, Boiling point, Freezing point, Refractive Index,AcidityandpH,Viscosity,Surface Tension,Systemofpricingofmilk.

Unit2:PRIMARYPROCESSESOFMILK 9Hours

Rawmilkcollection–coolingandtransportation–milkreception–Platformtests-QualityandQuantitytestsatreception-contaminants,Smell,Appearance,Temperature,Sediment,Acidity,LactometerReading,Fat,Solids-Not-Fat,DyeReductionTest:MBRTtest,Resazurin tests, Mastitis test-Processing of milk, filtration, clarification, Bactofugation of milk,Coolingandstorageofrawmilk,Bulktransportationtechnologies–carbondioxideimpregnation.MilkStandardization,creamseparation,Homogenization,MilkPasteurization &heattreatmentofmilk-MilkSterilization

Unit3:MANUFACTUREOFDAIRYPRODUCTS 9Hours

Fluid Milk Processing, Milk product Processing – cream, Butter, Khoa, Paneer, Ice-cream, condensed milk & evaporated milk.Judging& grading of milk & its products.Dried milk products-Buttermilkpowder,WheyPowder,Ice Creammix Powder, Infant milk food, WMP& SMP.ManufacturingofFermented products – Yoghurt, Curd, acidophilusmilk, buttermilk, andCheddar cheese,Introduction, Manufacturing process, packaging, storage, defects and their prevention**Unit4:BYPRODUCTSUTILIZATION 9Hours**

Introduction, Classification & composition of byproducts, Principles & methods of Utilization – wheyutilization,Applications ofenzymesindairyindustry

Unit5:CLEANINGANDSANITATIONOFDAIRYEQUIPMENTS 9Hours

Dairy plant sanitization – Basic principles, Cleaning in place-types and design of CIP System, agentsand methods – bottle and can washing- Rotary type and Straight through type, cleaning of tankers andsilos – Energy use in Dairy plant - sources and cost of energy, Control of energy losses and Energyconservation.

Textbook(s):

1. SukumarDe,Outlines ofDairyTechnology,OxfordUniversityPress,2nd edition,1994.
2. JamesN.Warner,PrinciplesofDairyProcessing,WileyEasternLtd,3rd edition1998.
3. TufailAhmed,—DairyPlantEngineeringandManagement‖,KitabMahal,NewDelhi,2012.

REFERENCS

1. Y.H.Hui.–DairyScienceandTechnologyHandbook-‖.WileyPublication.2005.
2. JaneSeliadosReisCoimbra,JoseA.Teixeira,—EngineeringAspectsofMilkandDairyProducts‖,CRC Press,New York,2010.
3. Robinson R.K., —Modern Dairy Technology: Advances in Milk Products‖, Volume 2,SpringerLondonLtd.,2012.

FT18R281	BAKERY ANDCONFECTIONARYLABORATORY	L	T	P	Credit
		0	0	3	2

Corequisite: NIL

CourseCategories: ProgramCore
CourseType: LaboratoryCourse

CourseObjective(s)

To learntheformulationand processing ofbakeryandconfectionaryproducts

CourseOutcome(s)

CO1	Adaptthestandardsandregulations followedinbakeryandconfectionary industry
CO2	Graspbasicknowledgeaboutfoodingredientsanditsusedinbakeryproducts
CO3	Utilizebakeryunitprocessingmachineryeffectively
CO4	Handleconfectionaryproductsand check qualityinprocessline
CO5	Adaptvariousprocessflowlineinconfectionaryand bakeryproducts

MappingofCourseoutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			M											M	
CO2		M												M	
CO3										M					
CO4										M				M	
CO5														M	

Experiments 45Hours

1. Preparationofwholewheatbread&multigrain bread
2. Preparationofbun
3. Preparationofpuffsand pizza
4. Preparationofdoughnuts
5. PreparationofHard doughbiscuits&softdoughbiscuits
6. Preparationofmultigrainbiscuits&highfiberbiscuits
7. Preparationofmultigraincookies, ButterCookiesandPlaincookies
8. PreparationofSpongecake,ChocolateandFudgeCake
9. Preparationofcake[Eggless]
10. PreparationofMuffins
11. Preparationofhardboiledcandies
12. Preparationofchocolates

TextBook(s):

1.Beckette,IndustrialChocolateManufacture,Wiley-blackwellpublisher,3rdedition,20092.FaridiFaubion,Doughrheologyand baked producttexture,CBSpublications,1997

ReferenceBook(s):

1.Pyler,BakingscienceandTechnology,SoslandPubCo,2009

FT18R273	**UNITOPERATIONSINFOODPROCESSING**	**L**	**T**	**P**	**Credit**
		3	**1**	**2**	**5**

Prerequisite:FT18R101 **CourseCategories:**ProgramCore
CourseType: IntegratedCourse

Course Objective(s):	Thiscourseaimsatmakingthestudentsunderstandthefundamentalprinciplesand conceptsofheattransfer andmechanicaloperationinbiochemicalprocesses.

CourseOutcome(s)

CO1	Principlesandmechanismofheattransfer
CO2	Fundamentalsofconventionalheattransfers
CO3	Basicprinciplesofheatexchanger design
CO4	Conceptsofdrying and thermalprocessingofbiologicalmaterials

MappingofCourse(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M			L							H		H
CO2			H			M	M						L		
CO3	M	M			M	M	M						L		M
CO4		L	M		L	M		L	M	M			H		

CourseTopic(s)

UNITOPERATIONS

UNIT-ISIZEREDUCTIONANDSEPARATION **9Hours**

Size reduction principles, Need for size reduction and Laws: Kicks law, rittingers law and Bonds law,Size reduction operation: Compression & Attrition, Impact, Cutting & Grinding -various grindingequipments–SievingPrinciples andequipments.

UNIT-IIAGITATIONANDMIXING **9Hours**

Typesofimpellersandblades,Powerforagitation,Agitationofliquids- Gas-liquidsystems–Gas-solid,andliquid-solid**,**emulsificationsuspensions,Agitatorscale up,

UNIT-IIIFILTRATION&SEDIMENTATION **9Hours**

Constant pressure and constant volume filtration, batch filtration, continuous filtration – Industrialfiltrationequipments:Plate&frame, centrifugal, rotarydrumfilter,vacuumleaf filter, pressurefilter,gravityfilter-batchsedimentationtest–Centrifugation,Flocculation.

UNIT-IVEVAPORATORS **9Hours**

Steam economy, capacity, and boiling point elevation. Types of evaporators - Open pan evaporator,horizontal tube evaporator, vertical tube evaporator, long tube evaporator, forced circulationevaporator,Filmtypeevaporators– workingprincipleandapplications.Multipleeffectevaporators:Feedforwardandfeedbackwardoperations.

UNIT-VDISTILLATION **9Hours**

Vapour-liquidequilibria,Raoult'slawanddeviationsfromideality.Methodsofdistillation:Simpledistillation-calculations using Rayleigh equation, Flash vaporization, steam distillation. Design ofmultistage traytowersforbinarysystems usingMcCabe-Thielemethod.

ListOfExperiments **15Hours**

1. Experimentsonsizereductionoffibrousfood
2. Experimentsonpulsemilling
3. Experimentsongrindingmachinetodeterminethenewsurfacecreated.
4. Experimentsonpneumaticseparation
5. Experiment onsieveanalysis
6. Experimentondrying
7. Experimentonmixing index
8. Experimentonsimpledistillation
9. DeterminationofWorkIndexinSizereductionoperation.
10. Experimentonbatchsedimentation
11. Experimentonfiltration
12. ExperimentonOpenpanevaporator

TextBook(s):

1. McCabe,W.L.,Smith,J.C.,Harriott,P.,UnitOperationsofChemicalEngineering,McGraw-Hill,NewYork,7th edition.,2005.
2. Brennan ,J. G., Butters, J.R., Cowell, N.D. and Lilly, A.E., Food EngineeringOperations, Applied Science, London, 3rd Edition, 1990.

Reference(s):

1. Coulson, J.M., Richardson, J.F, Backhurst J.R. and Harker J.M., Coulson and Richardson'sChemicalEngineering,Volume-I,ButterworthHeinemann,Oxford,NewYork,5thEdition,2002
2. David,M.Himmelblau,BasicPrinciplesandCalculationsinChemicalEngineering,Prentice-HallofIndia,New Delhi,7thEdition,2004.

FT18R301	FOOD PACKAGINGTECHNOLOGY	L	T	P	Credit
		3	0	0	3

Prerequisite:FT18R251 **CourseCategories:**ProgramCore

CourseType: Theory

Course Objective (s)	Tostudyaboutthefunctionsofpackaging along withtheinfluenceofvarious factorsonfood
CourseOutcome(s)	
CO1	DescribethefunctionsofpackagingmaterialsandIts importanceinfoodIndustry
CO2	Explaintheproperties,typesandapplicationsofplasticsandpapersinpackaging
CO3	Explaintheproperties, typesandapplicationsofglassandmetals inpackaging
CO4	AdaptandutilizepackagingmaterialsforrightapplicationinFoodIndustry
CO5	Explain the laws, regulations and environmental standards pertaining to foodPackaging

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M			L							H		
CO2			H			M	M						L		
CO3	M	M			M	M	M						L		
CO4		L	M		L	M		L	M	M			H		
CO5		H	L			H	H	L		M	M			H	

CourseTopic(s)

Unit 1:INTRODUCTIONTOFOODPACKAGING 9 Hours

Packaging terminology –definition. Functions of Food Package, Packaging environment. Foodmarketing and role of packaging. Characteristics of food stuff that influences packaging selection -Packaged productqualityandshelflife.Currentstatusin foodpackaginginIndia.

Unit 2:PLASTICANDPAPERPACKAGING 9Hours

Types of plastics used in packaging – PE, PP, PET, PVC, EVOH, PVA. Secondary conversiontechniques – film, extrusion and thermal lamination. Printing of plastic films and rigid plasticcontainers. Food contact and barrier properties. Sealability and closure. Application of plastics forfoodpackaging.

Paper and Paperboard Packaging: Properties of paper andpaperboard.Paper and paperboardmanufacture-SBB,SUB,FBB,andWLC.Packagetypes–
paper,pouches,sachets,cartons,boxes,tubes, tubs, containers, drums, tapes, cushion, cap liners and diaphragm. Application of paper andpaperboardsforfood packaging.

Unit3:GLAS&METALPACKAGING 9 Hours

Glass - Composition, Glass bottle design and specification, Glass container manufacture – melting,forming, surface treatments, Closure selection. Application of glass containers in food industries.Metal cans: Raw materials for can making – steel, aluminium. Can making processes - three piecewelded cans, DWI, DRD cans – end making processes – coating. Film laminates and inks, metalpackages– corrosionandsulphurstaining.Latestdevelopmentsincanmaking,Applicationofmetalcontainersinfood industries

Unit-4TRENTSINPACKAGINGOFFRESHANDPROCESSED FOODS 9hours

Special packaging methods- TETRA Packs, modified atmosphere packaging, Inner gas & vacuumpackaging,Carbonation,EdiblePackaging,Biodegradablepackages,shrinkwrapping,retortpouches, nano packaging, antimicrobial packaging, self-heating and cooling cans. Convenientpackages-blisterpack,standupandziplockpouch.

fillingmachines–Asepticsystem,form andfill(volumetricandgravimetric),bottlingmachines. Form Fill Seal (FFS) and multilayer aseptic packaging machines. Packaging ofHorticultureproducts,Carbonated beveragesand dairyproducts–UHTmilk and Cheese.

Unit-5LAWS, REGULATIONSANDENVIRONMENTALISSUESINPACKAGING 9Hours

Packaging Laws and Regulations, Safety aspects of packaging materials; sources of toxicmaterials and migration of toxins into food materials; Packaging material residues in foodproducts;Environmental&Economicissues,recyclingand waterdisposal.

TextBook(s):

1. RichardColes andMarkJ.Kirwan,―FoodandBeveragePackagingTechnology‖,2ndEdition,BlackwellPublishingAsiaPtyLtd,CRCpress,USA,2011.

2. RobertsonGordonL.,―FoodPackaging:PrinciplesandPractice, 3rdEdition, MarcelDekkerInc,USA,2012.

Reference(s):

1. HanJungH., ―Innovations inFoodPackaging,2ndEdition, AcademicPress,USA2013.
2. Dong Sun Lee, Kit L. Yam and Luciano Piergiovanni, ―Food Packaging ScienceandTechnology,CRC press,USA,2008.
3. OttoG.PiringerandA.L.Baner,―PlasticPackagingMaterialsforFood‖,1stEdition,WileyVCH,Germany,2008.
4. Ahvenainen,R.―NovelFoodPackagingTechniques‖.CRCPress.2003.
Coles,R.,McDowell,D.andKirwan,M.J.-FoodPackagingTechnology‖.CRC Press.2003.

FT18R381	FOOD ENGINEERINGLA BORATORY	L	T	P	Credit
		0	0	2	1

Prerequisite:NIL **CourseCategories:**ProgramCore
CourseType: LaboratoryCourse

Objective(s)	Tounderstandtheprincipleandworkingofvarious foodengineeringoperationandmachinery

CourseOutcome(s)

CO1	Ability to describe the construction and operating principles of food andbeverage processing,handlingandpackagingsystemsusingengineeringterminology
CO2	Effectsofdryingrateinfoodsanditsimpact
CO3	Designing offreezersand preservationoffoodbyrefrigeration
CO4	Physicalandrheologicalpropertiesoffoodanditschangesduringprocessing
CO5	HeatandMasstransferinfoodprocessing

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M										
CO2						M						
CO3						M						
CO4		M										
CO5		M										

Experiments **45Hours**

1.Determinationofdrying rateofgiven food materials
3. Experimentsonextrusioncooking
4. Experimentsonmicrowavecooking
5. Experimentsonfreezing offoods–freezethawstability
6. Experimentsondeterminationofphysicalproperties offoods
7. Experiments on rheological properties of foods8.Experiments on thermal conductivity of materials9.Experiments on determination of firmness of foods10.Experiments on determination of hardness of foods11.Experimentsontearstrengthofpackagingmaterials

TextBook(s):

1. NuriN. Mohsenin: PhysicalPropertiesofPlantandAnimalMaterialsGordonandReachScience Publishers(1970)
2. NuriN.Mohsenin: ThermalPropertiesofFood&AgriculturalmaterialsGordonandReachScience Publishers(1970)

ReferenceBook(s):

1. M.A.RaoandS.S.H.Rizvi:EngineeringPropertiesofFoodsMercelDekkerinc.NewYork(1998)
2. M.J.Lewis:PhysicalPropertiesofFoodsandFoodProcessing SystemsWoodheadPublishingCambridge,UK(1990)
3. ShafiurRehman:FoodPropertiesHandBookCRCPressInc. NewYork(1995)

FT18R371	FOOD SAFETYREGULATIONSAND QUALITYCONTROL	L	T	P	Credit
		3	0	2	4

Prerequisite: FT18R201 **Course Categories:**ProgramCore
CourseType: IntegratedCourse

Course Objective(s):	Tolearnaboutqualitymanagementinfoodproductionchain.
CourseOutcome(s)	
CO1	Describeaboutphysical, chemicalcontaminantsinfoods
CO2	Describeaboutfood safetysystem
CO3	Describeinternationalfoodlawsandstandards
CO4	Describenationalfoodlawsandstandards
CO5	Describe foodlabellingregulations

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		L			H		L					L	L	
CO2			M		M	M		M		M	H			H	
CO3						M		H		M					
CO4		L				H		H		M				M	
CO5		M	M			H		M		H				M	

CourseTopic(s)

Unit1:INTRODUCTIONTOQUALITYCONTROL
Principlesoffoodsafetyandquality,foodsafetysystem,Introduction,SourcesofContamination,Control methods.quality attributesof food-Nutritional ,Microbial,Sensory,total qualitymanagement,GHP,GMP

Unit2:FOODSAFETYMANAGEMENT **9 Hours**
FoodQualityManagementsystem,QualityManagement Principles,Foodlaws–HACCP,AOQL,ISO/22000:FoodSafetymanagements system

Unit3:INTERNATIONALFOODLAWSANDREGUALTIONS **9Hours**
Structure,organizationandpracticaloperationofWTO,WHO,FAO,CAC(CodexAlimantariousCommission),ICGFI.
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Unit4:NATIONALFOODLAWSANDREGUALTIONS **9Hours**
Structure,organizationandpracticaloperationofBIS, AGMARK, PFA,FSSAI.

Unit 5:LABELLINGREGULATIONS
9 Hours.Needforlabelling,limitationsoflabelling-safetyissues,labellingforirradiatedfoods,genetically modifiedfoods,nutritionallabelling,healthclaims

ListofExperiments1
5Hours

1. Qualitativetestsforhydrogenatedfats,butter,andghee.
2. Qualityinspectionofvariousfoodstuffs- cereals,pulses,spicesandcondimentsetc.
3. Estimationofsulphur dioxideinfoods
4. Estimationofchromatographic estimationofcolour.
5. Analysisofediblecommonsaltfor moisturecontent,MIWandtotalchlorides.
6. Determinationofperoxide value,saponificationvalue,acid value inoils
7. Estimationofbenzoicacid/sorbicacidin foods.
8. Detectionofadulteration in food products
9. Detectionofmicroorganisminfoodprocessingequipmentsusingswabtest
10. Sensitivitytests(Threshold/Dilution) tomeasureindividualabilityforsensoryanalysis
11. Assessmentofqualityofwheatflour–sedimentationvalue, waterabsorption, alcoholacidity,glutencontent.
12. Assessmentofanalysisofwaterusedinfoodindustry–Alkalinity, acidity,PH,hardness.

TextBook(s):

1.S.Ranganna.–HandBookofAnlysisandQualityControlforFruitandVegetables Products‖.TataMcGraw–Hill.2nd Edition.1986.
2.ManoranjanKalia.–FoodQuality Management‖.AgrotechPublishingAcademy.2nd Edition.2014.

ReferenceBook(s):

1. Taxmann's.–GuidetotheFoodSafetyandStandardsAct2006‖. AlliedServicesPvt.Lt. 2006.
2. RajeshMehtaand J.George- FoodSafetyRegulationConcernsandTrade.PublishedbyMacmillanIndiaLtd.,NewDelhi.2005.

FT18R351	INSTRUMENTATIONANDPROCESS CONTROL	L	T	P	Credit
		3	0	1	3.5
Prerequisite:NIL		**Course Categories:**ProgramCore **CourseType:**TheorywithPracticalComponent			
CourseObjective(s)	1. Tostudyabout thebasicknowledgeofinstruments 2. Toenablehands-onenvironmentthatiscrucialfordevelopingstudentsunderstandingoftheoretical concept				
CourseOutcome(s)					
CO1	Understandtheprinciple, Constructionandoperationofinstruments				
CO2	Controlinstrumentsanditsfunctiontogiveaccurateoutputs				
CO3	Controlprocessinginstrumentsin foodindustry				
CO4	GiveLogicalreasoningandinterpretresultswithstandardvalues				
CO5	Troubleshootinstrumentstomaintainaccuracy				

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					M							
CO2					M							
CO3					M							
CO4								M				
CO5												

CourseTopic(s)

Unit1:INTRODUCTION 9 Hours

Introduction of process variables, static and dynamic characteristic of instruments and their Generalclassification. Elements of measuring system and their function, principles, construction and operationof instruments for the measurements, transmission, control/ indication/recording of process variableslike pressure, flow, level, humidity and composition. Principles of transducers: electro pneumatic,pneumatic,electricalandmultipressure.

Practical:Flowmeasurement,LevelMeasurement

Unit2:CONSTRUCTIONANDCHARACTERISTICSOFFINALCONTROLELEMENTS 9Hours

Proportional,integral,PD,PIDcontrollers,pneumaticcontrolvalve,principlesandconstructionofpneumatic andelectroniccontrollers.

Practical:PIDcontroller,ControlValveCharacteristics

Unit 3:PROCESS INSTRUMENTATION DIAGRAMSANDSYMBOLS 9 Hours

Process instrumentation for process equipments such as distillation column, heat exchangers, fluidstorage vessel. Dynamic behavior of first order, second order and two or more first order systems inseries.

Practical: MATLabExerciseforI&IIorder system

Unit4:LAPLACETRANSFORM 9 Hours

LaplaceTransform-Linearopenloopsystem,firstandsecondordersystemandtheir
Transient response. Interacting andnon-interacting system. Transportation lag, linear closed loopsystem, block diagram of closed loop transfer function, controllers, transient response of closed loopsystems.

Practical:Interactingsystemlevelcontrol,Noninteractingsystemlevelcontrol

Unit5:STABILITYCONCEPTANDINTRODUCTIONTOFREQUENCYRESPONSE 9HoursS

tability conceptRouthstabilitycriterion,relativestability,huwitzStabilitycriterion,Nyquist'scriterion. Root locus technique, introduction to frequency response, Bode diagrams, Bode stabilitycriterion,gainandphasemargins.

Practical:Stability analysisusingMATLab–RootLocus–Bodediagram

TextBook(s):

1. Coughnowr,D.R.,ProcessSystemsAnalysisandControl,McGrawHill,NewYork,

3rdEdition, 2013
2. George Stephanopolous, Chemical Process Control, Prentice-Hall of India Pvt-Ltd.,NewDelhi,1990

Reference(s):
1. DoeblinErnest,MeasurementSystems,McGrawHill,NewYork,6th edition2017
2. C.A.Smithand A.B.Corripio,PrinciplesandPracticeofAutomaticProcessControl,JohnWiley andSons,NewYork,3rdEdition,2005.
3. Luyben,M.L.,Luyben,W.L.,EssentialsofProcessControl,McGrawHill,NewYork,

FT18R372	HEATANDMASSTRANSFER	L	T	P	Credit
		3	1	2	5

Prerequisite:FT18R101 **CourseCategories:**ProgramCore
CourseType: IntegratedCourse

Objective(s)	Tointroduceabasicstudyofthephenomenonofheatand masstransfer Todevelopmethodologies forsolvingawidevarietyofpracticalengineeringproblems.
CourseOutcome(s)	
CO1	BasicHeat&massTransfermechanism
CO2	HeatTransfer byconductioninsolidfor steadystateconditionandconvection
CO3	HeatTransferinclosed, conduit, andonexternalsurface
CO4	Tounderstand thebasicsofdrying
CO5	Diffusivemasstransfer

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M										
CO2												
CO3												
CO4						H						
CO5										M		M

CourseTopic(s)

UNIT1: INTRODUCTION **9 Hours**
Introductiontovariousmodesofheattransfer,Fourier'slawofheatconduction,effectoftemperatureonthermal conductivity,convection-free&forced,Lawsof Radiation.Introductiontomasstransferoperation&its applicationinfoodindustries.

UNIT2: CONDUCTIONANDCONVECTION **9Hours**
Steady-stateconduction,compoundresistancesinseries,heat flowthroughacylinder,andcriticalradiusof insulation in pipes. Heat flux, average temperature of fluid stream, overall heat transfer coefficient,LMTD,individualheattransfercoefficients,relationshipbetweenindividualandoverallheattransfer coefficients.Applicationofdimensionalanalysisforconvection,heattransfertofluids

withoutphasechange:heattransfercoefficientcalculationfornaturalandforcedconvection,heattransfertofluid swithphasechange:heattransferfromcondensingvapours,drop-wiseandfilm-typecondensation,heattransfercoefficientscalculationforfilm-typecondensation.

UNIT3: HEATEXCHANGINGEQUIPMENTS 9 Hours

Typical heat exchange equipment, counter current and parallel-current flows, enthalpy balances in: heatexchanges,totalcondensers.Doublepipeexchanger,single-pass1-1exchanger,1-2parallel-counterflowexchanger, 2-4 exchanger, heat transfer coefficients in shell-and-tube exchanger, coefficients for crossflow, correction of LMTD foe cross flow. Condensers: shell-and-tube condensers, kettle-type boilers,Calculationofnumberoftubes&Heattransferareainheatexchangers.

UNIT4:DRYING 9Hours

Drying–Equilibrium; classification of dryers; batch drying–Mechanism and time of cross throughcirculationdrying,continuousdryers–material&energybalance,determinationoflengthofrotarydryerusingrateconcept-traydryer-spraydrying

UNIT5:DIFFUSION 9 Hours

Molecular diffusion, steady state molecular diffusion in fluids at rest and in laminar flow, moleculardiffusion in gases-steady state diffusion: of A through non-diffusing B, equimolal counter diffusion, inmulticomponentmixtures. Molecular diffusion in liquids-steady state diffusion: of A through non-diffusing B,equimolalcounterdiffusion.Effect oftemperature and pressureondiffusivity.

Experiments 15Hours

1. Separationfactorsoftheexperimentswithdistillation.
2. Separationfactorsoftheexperimentswithvapourliquidequilibrium.
3. Separationfactorsoftheexperimentswith liquid–liquidextraction.
4. Separation factorsofthe experimentswithsolid–liquidextraction.
5. ExperimentonShell&tubeheatexchangerforSurfacearea&Heattransfercoefficientdetermination
6. StudiesonBubblecap/tray/fractionalcolumn.
7. StudiesonHumidification/Dehumidificationcolumns.
8. Studiesoncrystallization
9. Experimentonadsorption
10. Experimenton
11. Diffusivitymeasurement
12. ExperimentonAtmosphericbatchdrying.

TEXTBOOKS

1. WarrenL.Mccabe,JulianC.SmithandpeterHarriott,"UnitOperationsofChemicalEngineering",7thEdition.,McGrawHillInternationalEdition,NewYork2014.
2. DonaldQ.Kern,"ProcessHeatTransfer", TataMcGrawHillBookCo.,NewDelhi,1997
3. RobertE.Treybal,"Mass-TransferOperations",3rdEdition.,McGrawHillInternationalEdition,Singapore, 1980

REFERENCEBOOKS

1.CoulsonJ.M.,RichardsonJ.F.,BackhurstJ.R.andHarkerJ.M.,"Coulson&Richardson'sChemicalEngineering",Vol.I,6thEdition.,ButterworthHeinemann,Oxford,

FT18R382	INSTRUMENTAL METHODSOFANALYSISLABORATORY	L	T	P	C
		0	0	2	1

Prerequisite:Nil **Course Categories:**ProgramCore
CourseType: Laboratory

Objective(s)	Providesstudentswithanopportunityto identifydifferenttypesofanalyticalinstrumentsintheirrespectivelaborotaries
CourseOutcome(s)	
CO1	Proficiencyinprofessionalsamplingandsampletreatment priortoanalysis
CO2	Capabilityoftreatmentand evaluationoftheresultsofanalysis
CO3	Understandingandcapabilityofperformingbasicchemicalprocessesinananalyticallaboratory
CO4	AbilitytohandlecomplexInstrumentstoidentify adulterantsinFood
CO5	AbilitytoidentifyTraceelementsinfoodusingchromatographytechniques.

Mapping ofCOsandPOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M									
CO2					M							
CO3			M									
CO4					M							
CO5					M							

CourseTopic(s)

ListofExperiments **45 Hours**

1. Precisionandvalidityinanexperimentusing absorptionspectroscopy
2. ValidatingLambert-Beer'slawusingKMnO4
3. Findingthemolar absorbtivityandstoichiometryoftheFe(1,10phenanthroline)3usingabsorptionspectrometry
4. Estimationofsuspendedparticlesusingnephlometry/turbidimetry
5. Limitsofdetectionusingaluminiumalizarincomplex
6. ChromatographyanalysisusingTLC
7. Chromatographyanalysisusingcolumnchromatography
8. Estimationofsuspendedsolidsanddissolvedoxygen
9. EstimationofBOD
10. EstimationofCOD
11. Gaschromatographyanalysis
12. Estimatingcoloroffoodusingspectrophotometer
13. Useofelectrophoresisin determinationofprotein
14. Useofflamephotometerinestimationoftracemetalslikesodiumandpotassium

TextBook(s):

1. Chatwal, GurdeepR.,andAnand, ShamK.,
―InstrumentationMethodsofChemicalAnalysis‖,2ndEdition,Himalaya Publications,Bombay,2003.

2. Willard,H.,Merrit,L.,InstrumentalMethodsandAnalysis,CBSPublishersandDistributors, NewDelhi,7th Edition,2004
3. Skoog,HollerandNieman.,PrinciplesofInstrumentalAnalysis,ThomsonAsiaPvtLtd., Singapore,5thedition,(Reprint)2003

Reference(s):

1. Chatwal,R.G.,Anand,K.S.,InstrumentalMethodofChemicalAnalysis,Himalaya PublishingHouse,Mumbai,5th Edition(Reprint),2006

FT18R401	**EMERGINGTECHNOLOGIESINFOODPROCESS ENGINEERING**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**3**

Prerequisite:FT17R251 **CourseCategories:**ProgramCore
CourseType: Theory

CourseObjective(s)	Toenablethestudenttounderstand: Emerging/alternativetechnologiesappliedtofoodprocessing Relativeadvantages/disadvantagesoverexistingtechnologiesEconomicsand commercializationofnewer technologies

CourseOutcome(s)	
CO1	Highpressureprocessingoffoodsandimpactonnutritionandmicrobes
CO2	Differentnonthermalprocessingoffoodanditsapplicationinfoodprocessing
CO3	Novelnonthermalmethodsforsterilizationoffood
CO4	Tounderstandthebasichurdletechnology,mechanismanditsactioninfood
CO5	Freezeconcentrationanditseffect onfood

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	M		H	L					L	M			H
CO2		M	M		H	L					L	M			H
CO3			M		H	L					L	M			H
CO4			M		H	L					L	M			H
CO5			M		H	L					L	M			H

Unit1: HIGHPRESSUREPROCESSING[HPP]OFFOODS **9Hours**

Introduction, principles, use of high pressure to improve food safety and stability. Effects of highpressure on food quality, Applications of high pressure. HPP of Salads/Ready Meals – effects onmicroorganisms,enzyme activity,texture andnutrients.

Unit2:NONTHERMALPROCESS **9 Hours**

Non thermal methods- its applications - in sterilization of foods and packaging materials – effectson food quality- effects on microorganisms, enzyme activity, texture and nutrients. Insight ontechnologieslikeosmoticdehydration,ohmicheating.ApplicationofRadiofrequency,microwave, Infrared, Pulsed electric field, Ultrasonic waves, Pulsed light, Pulsed X rays andOscillatingmagneticfield.

9Hours

Unit3:NOVELMETHOD

Foodirradiation-advantagesandapplications.–Supercriticalfluidextractionandseparation–Aseptic processinginfoods-extrusioncooking–equipment.

Unit4:HURDLETECHNOLOGY **9 Hours**

Basicsofhurdletechnology–Mechanism,Applicationtofoods-NewerChemicalandBiochemical hurdles- organic acids – Plant derived antimicrobials – Antimicrobial enzymes –bacteriocins – chitin / chitosan (only one representative example for each group of chemical andbiochemicalhurdle).

Unit 5:LOWTHERMALPROCESSING **9Hours**

Freeze drying (lyophilisation) **–** Frozen Foods**-** Freeze concentration -Cryogenic Grinding – Principle**–-**Equipment**-**Effectonfoods**-**

Textbook(s):

1. Da-Wen Sun,–Emerging Technologies for Food Processing‖, Academic press/ Elsiever,London,UK,2005.
2. Leistner L. and Gould G. Hurdle Technologies – Combination treatments for foodStabilitysafetyandquality,KluwerAcademics /PlenumPublishers,NewYork(2002)

ReferenceBook(s):

1. Da–WenSun,–ThermalFoodProcessing:New Technologies andQualityIssues,2nd Edition,CRCPress/Taylor&Francis,BocaRaton,Florida,USA,2012.
2. GustavoV.Barbosa-Canovas,MariaS.TapiaandM.PilarCano,–NovelFoodProcessing Technologies‖.CRC Press,2004.

PROFESSIONALELECTIVES
PROCESS ENGINEERING

FT18R302	SUGARCANEANDBEVERAGE TECHNOLOGY	L	T	P	Credit
		3	0	0	3

Prerequisite:NIL **CourseCategories:**ProfessionalElective
CourseType: Theory

Objective(s)	Togainknowledgeonmachineryandprocessinvolvedinsugarcanetechnologyandfermentationprocessinvolvedinmakingbeverage process
CourseOutcome(s)	
CO1	Preprocessingsugarcaneforbestresult
CO2	UtilizeclarifiersandpreservativestomaintainpHandcolorofjuice
CO3	Adaptfiltrationandevaporativetechniques for qualityoutput
CO4	Setupprocessflowlinewithqualitystandards insugarmanufacturingunit
CO5	Processfermentedbeverageswithalcoholandwithout alcohol

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M				L						L		L		
CO2	M				L	M					L		L		
CO3	M				L	M					L		L		
CO4		M			L		M			M	L		L		
CO5			M		L					M		L	L		M

CourseTopic(s)

Unit1:PREPROCESSINGOPERATIONSANDJUICEEXTRACTION 9Hours
Sugarcane-Constituents-Harvestingindices–Canecutting-Manual,Mechanical-Transportation-loading-Unloading-Caneconveyor-Washing-Shredders-Types.Crushing-Crushers-Types,Crushingefficiency-Extractionofjuice-methods,Accumulators-types-Maceration-Theoryofcanediffusivity-differentdiffuser-ringdiffuser-weighingofjuice.

Unit2:CLARIFICATION 9 Hours
Clarification-methods-clarifyingagent-bleachingagent-RoleofpH,non-sugars,colloids andgumsincanejuiceclarification.Limingofcanejuice-$CO_2P_2O_5$anditsimportance.Filtrationofmud.

Unit3:FILTERATIONANDEVAPORATION 9 Hours
Filter types –filter press, rotary vacuum filter-Rapi-Floc process. Filter cake washing.Evaporation-Evaporation rate-types of evaporators used in cane sugar industry-Cleaning ofevaporators

Unit4:SUGARPRODUCTION 9Hours
EntrainmentseparatorMethods-BoilinginVacuumpan-Footingmagma-Massecuite.A,B,C-Motherliquor,MolassesA,B,CMolassesexhaustibility.Crystallization-Supersaturation-Crystallizerstype-batchandcontinuous.Centrifuge-types.Dryingofsugar–conveyorsforsugar-by-productfromsugarmills-utilization.

Unit 5: TECHNOLOGY OF BEVERAGES MANUFACTURE (ALCOHOLIC AND NONALCOHOLIC) 9Hours

Manufacture of beer, wine and champagne - Quality characteristics, Manufacture of distilledbeverages including whisky, brandy, rum and gin – Quality aspects Manufacture of carbonatedbeverages–qualityaspects –Manufactureofsugar-free,sugarless,carbonatedbeverages.

TextBook(s):

1.RamBehari Lal and Mathur.1972., Hand book of cane sugar technology. Oxford and IBHPublishingcompanyNewDelhi

2.W.V.Cruees,Technologyofwinemakingfoodscience,AgrobiosPublishers,2009

Reference(s):

1. Baikow,V.E.1967.Manufacturingandrefiningofrawcanesugar.ElsevierPublishingCompany,NewYork
2. GirdhilalandSiddappa,PreservationofFruitsandVegetables,KalyaniPublishers2001.

FT18R303	TECHNOLOGYOFANIMALFOODS	L	T	P	Credit
		3	0	0	3

Prerequisite:NIL **CourseCategories:** ProfessionalElective **CourseType:**Theory

Objective(s)	Tounderstandneed andimportanceoflivestockandpoultryindustry Tostudystructure,compositionandnutritionalqualityofanimalproducts
CourseOutcome(s)	
CO1	Goodknowledgeabout physio-chemicalpropertiesofmilk anditsbyproducts
CO2	Knowledge regarding processing methods and its importance in milk basedproducts
CO3	AbilitytoOptimizeTechnologyforprocessingofmilkandits byproducts
CO4	KnowledgeregardinghandlingandtransportationofmeatandFish
CO5	Abilitytoadopt preservationtechniquesand Packagingforpoultryproducts

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M					L	L								
CO2	M	M	L		L	M	M	M					L		
CO3	M		M			M					M		M	M	
CO4		L	M			M	L	M					M	M	M
CO5	L					M	L	M			M		M	M	M

CourseTopic(s)

Unit1:INTRODUCTION 9 Hours

Meat composition from different sources; muscle structure and compositions; post-mortem musclechemistry;Factorsinfluencingthe qualityofmeat.MeatMicrobiologyandsafety.

Unit 2:SLAUGHTERINGANDSTUNNINGMETHODS 9 Hours

Ante mortem inspection and handling , Stunning types, Slaughtering types. Steps in slaughtering(Pig,Cattle,Sheep/Goat)anddressing.Slaughterhouseoperations-Hoistingrailandtravelingpulleysystem; .Modern abattoirs, typical layout and features, Offal handling and inspection. Grading ofmeat-retailandwholesalecuts.Operationalfactorsaffectingmeatquality.Byproductutilization .Meatplanthygiene–GMPandHACCP.

Unit3:PROCESSINGOFMEAT 9 Hours

Processing and preservation of meat: Chilling and freezing of meat, Canning, cooking, drying,pickling, curing and smoking; prepared meat products like sausages, kebabs, etc.. Intermediatemoisture anddriedmeatproducts,Packagingofmeatproducts.

Unit 4:POULTRYPRODUCTS 9 Hours

Poultry:methodsofslaughtering,Slaughteringequipmentandoperations,dressing,handling,storageand preservation of poultry meat . Spoilage and its control. Freezing and chilling of poultry. Wholesale andretailcuts.

Eggs:Composition,handling,candeling,washing, coating,packagingandstorage.Eggprocessing(Egg powdermanufacturing,pasteurization,etc.,Spoilage anditscontrol.

Unit 5:FISH PRODUCTS 9 Hours

Commercially important marine products from India, Proximate composition, Post mortem changesinfishmuscle.Handling,Preservationandtransportationoffish.Indicesoffishquality,Microbiologyoffishandshellfish,Freezingoffishandshellfish.

TextBook(s):

1.Legarreta,I.G.―HandbookofPoultryScienceandTechnology‖(VolumeIandVolumeII),John Wiley&Sons,Inc.,Hoboken,2010.

ReferenceBook(s):

1. MeadM.–PoultryMeatProcessingandQuality‖.WoodheadPubl.2004.
2. Pearson,A.M.&Gillett,T.A.–ProcessedMeat‖.3rdEd.Chapman&Hall,2006.

FT18R304	**OILSANDFATSPROCESSINGTECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Prerequisite:Nil		**CourseCategories:** ProfessionalElective **CourseType:**Theory			
Objective(s)	Toenablethestudentstounderstand 1. Physicaland chemicalpropertiesoffatsandoils 2. Extractionandrefiningprocesses 3. Packaging, qualitystandardsoffatsandoils.				
CourseOutcome(s)					

CO1	Check the physicalandchemicalpropertyofoilsandfats
CO2	Utilizedifferentmethodsofoilextractionfor ediblepurpose
CO3	Setupprocessflowlineforoilextraction
CO4	Differenttypesoffatand oilproducts
CO5	Storageandpackagingmaterialsusedinoil

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L				L							L		
CO2			M		L						L		M		
CO3	L				L	L					L		M		
CO4	L					L					L				H
CO5	L		M			L					L		M		

CourseTopic(s)

Unit 1:PHYSICALANDCHEMICALPROPERTIESOFOIL 9 Hours

Sources; chemical composition; physical and chemical characteristics; functional andNutritional importance of dietary oils and fats. Post-harvest and ling storage and processing ofoilseedsfordirectsuseandconsumption,importanceofoilseedsprocessinginIndia.

Unit 2:EXTRACTIONMETHODS 9 Hours

Extractionofoilbymechanicalexpellingandsolventextractionandobtainingdeoiledcakes Suitableforediblepurposes.Processingofotherplantsourcesofedibleoilsandfatslikecoconut,cotton seed,ricebran,mazegerm,etc.

Unit 3:REFININGOFOILS 9 Hours

Degumming,refining,bleaching,hydrogenation,fractionalcrystalization,interesterification,glycerolysis, molecular distillation, plasticizing and tempering Clarification,neutralization (alkalirefining),bleaching,deodorization techniques/processes. Blending of oils. Chemical adjuncts-lecithins,monoglycerides and derivatives, propylene glycolesters, polyglycoesters, Hydrogenation,fractionation,winterzation,inter-esterificationetc.forobtainingtailor-made fatsandoils.

Unit4:FATANDOILPRODUCTS 9 Hours

Productionofbutteroillard,tallow,Margarine,Cocoabutterequivalents,shortenings,low Fatspreads,peanutbutteretc.Specialityfatsanddesignerlipidsfornutritionanddietetics,especially by biotechnology.Mayonnaise and salad dressings.Confectionerycoatings. Immitationdairyproducts-peanutbutterandvegetableghee.

Unit5:PACKAGINGOFEDIBLEOILS 9 Hours

Packing and storage of fats and oils,cocoabutter,fatsubstitutes.Changes during storage of oil – rancidity – causes – atmospheric oxidation and enzyme action – free fatty acid – colour-non edibleoils–castoroil,linseedoil,vegetable waxes–productionandprocessing.

TextBook(s):

1. Bailey,IndustrialOilandFatProducts,JohnWileyandSons.6thedition2005

Reference(s):

1. M.M. Chakrabarty,ChemistryandTechnologyofOils&Fats,AppliedPublisher,2003.
2. WolfHamm,RichardJ.Hamilton,GijsCalliauw,EdibleOilProcessing,2ndEditionWiley-Blackwell,2013

FT18R305	FRUITS AND VEGETABLESPROCESSINGTECHNOLOGY	L	T	P	C
		3	0	0	3

Prerequisite:FT18R251 **CourseCategories:** ProfessionalElective
CourseType: Theory

Objective(s)	1. Tounderstandtheprocessingtechniquesinvolvedfruit andvegetabletechnology. 2. To havesmallscalecommercialpracticesaswellasto illustratethefundamentalscientific principlesinvolvedinprocessing.

CourseOutcome(s)

CO1	Analyzethenutritionalaspectsinfruitand vegetables
CO2	providesolutionforspoilageoffruitandvegetableswhilehandlingandstorage.
CO3	Setupnewprocessingflowlinefor newproductswithqualitystandards
CO4	setqualityassurancepolicyinprocessflow meetingthestandardsforeffectiveoutput
CO5	setupprocessingflowlinewithqualitystandards forchocolateandspices

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M				L	M						M		
CO2		L	M		L	L				M					H
CO3		M	H							M			M		M
CO4		M	M		L					M	M		M		
CO5		M				M		M		M	M			M	H

CourseTopic(s)

Unit1:INTRODUCTION **9 Hours**

Indian and global scenario on production and processing of fruits and Vegetable. Pre-processing:Fresh fruits and vegetables – Handling, grading, cleaning, pretreatments, transportation, pre cooling,chilling, modified atmosphere packaging, Controlled atmosphere storage, packaging, transportation,qualityassurance.

Unit2:FREEZINGOFFRUITSANDVEGETABLES **9 Hours**

Freezing of Fruits and Vegetables - Different freezing methods and equipments, problems associatedwithspecificfruits andvegetables.

Unit3:DEHYDRATIONOFFRUITSANDVEGETABLES 9 Hours

Dehydration – different methods of drying including sun, tray, cabinet, drum, spray, vacuum, tunnel,spray, low temperature drying process, process calculations ,osmotic dehydration and other modernmethods, choice of suitable methods, preserving the colour, flavour and nutrient content of theproducts.

Unit4:CANNING,JUICES&CONCENTRATES 9 Hours

Different unit operations involved in fruit and vegetable Pulp/juice extraction, concentration, Bulkaseptic packaging of fruit and vegetable pulps, juices and concentrates; aseptic packaging of fruitdrinks,juicesandotherproducts.FruitJuice/pulp/Nectar/Drinks,concentrates–Generalandspecificprocessing,differentpackingincludingaseptic.

Unit 5:FRUITANDVEGETABLEPRODUCTS&STANDARDS 12 Hours

Ready to eat vegetable products, Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys,Fruit Bar, Soup powders, Candied Fruits, Natural colors, Fruit and VegetableFibres - specificprocessing,differentpackingincludingaseptic,Productspecificationsandstandards;foodregulationswithrespecttofruitandvegetableproducts.

TextBook(s):

1. WimJongen.–FruitandVegetableProcessing‖.WoodheadPublishing.2002.

Reference(s):

1. RonB.H. Wills., John Golding. –Advances in Postharvest Fruit and VegetableTechnology‖.CRCPress.2015.
2. SueliRodrigues,FabianoAndreNArcisoFerandes.–AdvancesinFruitProcessing Technologies‖.CRC Press,2012.

FT18R306	TECHNOLOGYOFFLAVORSANDCOLORANTS	L	T	P	Credit
		3	0	0	3

Prerequisite:FT18R201 **CourseCategories:** ProfessionalElective **CourseType:**Theory

Objective(s)	Toenablethestudenttounderstandbasicchemistry&technologyofflavoursandpigments
CourseOutcome(s)	
CO1	Understand basics foodflavorsandcolours
CO2	Tounderstandflavorcompoundusedinfoodindustry
CO3	Todevelop chemicalsensorsand receptors
CO4	To developmethodsforstabilizationofnaturalcolorants

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M						H				M			
CO2			M				L						M		
CO3	M					L				L				M	
CO4		M				L					M	M			

CO5	M	L			L	L						M			

CourseTopic(s)

Unit1:INTRODUCTION **9 Hours**

Problemsinflavourresearch–classificationoffoodflavours;chemicalcompoundsresponsibleforflavour.Recenttrendsinflavorsandcolorants.

Unit 2:FLAVOURCOMPOUNDS **9 Hours**

Chemicalcompoundclassesandtheirflavourresponses;flavourdevelopment duringbiogenesis,flavour developmentduringfood processing;useofbiotechnologyto develop flavours.

Unit3:TASTE&FLAVORPERCEPTION **9 Hours**

Anatomyofthechemicalsenses;neuraldevelopmentofthechemicalsenses;receptor mechanisms,neuralcoding;the controlofeating,Taste maskers-Tastemodifiers,flavorEnhancers

Unit 4:COLOR ANDFLAVOUR ANALYSIS **9 Hours**

SubjectiveversusObjectivemethodsofanalysis;psychophysicsandsensoryevaluation;Instrumentalanalysis;samplehandlingandartifacts;data handling

Unit5:COLORANTS **9Hours**

Naturalandchemicalcolors,Naturalcolor synthesis,extractionand preservationmethods,factorsaffectingcolorstability.Chemicalsynthesisoffoodcolorsandhealthaspects

TextBook(s):

1. Fisher,Carolyn–FoodFlavours:BiologyandChemistry‖.RoyalSocietyofChemistry,1997
2. Ashurst,PhilipR.–FoodFlavorings‖.3rdEdition.AspenPublication,1999.

Reference(s):

1.Reineccius,Gary–FlavorChemistryandTechnology‖.2ndEdition.Taylor&Francis,2006.2. Hofman, Thomas, Chi-Tang-Ho and Wilhelm Pickenhagen–Challenges in Taste Chemistry and Biology–.ACSPublications,2003.

FT18R310	**FOODPLANTSAFETYANDHAZARDSINFOOD INDUSTRY**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**3**

Prerequisite:FT18R271 **CourseCategories:** ProfessionalElective **CourseType:**Theory

Course Objective(s)	Tostudyaboutwastemanagementinfoodindustry. ToStudyaboutthesafetyregulationsundertakeninfoodindustry.
CourseOutcome(s)	
CO1	Identifythe sourceofcontaminationinprocessline
CO2	Usequalitytools foreffectivequalityassurance
CO3	Implement and maintainHACCPprinciplesforqualityassurance
CO4	Identifyfoodsafetyissuesduetoadditives,toxicsubstancesandpreservatives
CO5	Identifyfoodallergy,foodintoleranceandcontaminantsinprocessedfood

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H				L		M			M			M	
CO2	L	M	M			M		H		M				M	
CO3		H	M		L	H		H	M	L	M	M		H	
CO4		M	M		L	H	M	M						M	
CO5		L	H		L	H	M	H						M	

CourseTopic(s)

Unit1:FOODSAFETY **9 Hours**

Principles of food safety-Historical developments-indicators of risk-risk analysis-riskmanagement-causesofmajorfailure-clothing andpersonalhygiene-sourceofcontamination-testforfoodsafety.

Unit 2:QUALITYCONTROLANDFOODLABELING **9 Hours**

Introduction to quality control-definition. Aspects of quality-Quality control tools. Qualitycontrolchart-Qualityfactorsinfood-Nutritionallabeling-Specification-Rulesand Regulations-need for food plant sanitation—cleaning and cleaners-Water supply-Good ManufacturingPractice.

9Hours

Unit 3:HAZARDANALYSIS-HACCP

HACCP-Historydefinition-preliminarytask-principles-hazardanalysis-recordkeeping -HACCPimplementationandmaintenance.Generalprincipleofmicrobialrisk-assessment -hazarddetermination-HACCPworksheet.CriticalControlPoint-identificationofcriticalpoints in the process-Methodsbywhichobstaclescanbeovercome.

9Hours

Unit 4:METALCONTAMINANTS ANDADDITIVES

Metal contaminants-Sources of health hazard of metallic contaminants-Assessment of foodsafety-Generalandacutetoxicity-Mutagenicityandcarcinogenicity.Additives(Intention - direct)-Preservatives-antioxidants, sweeteners, flavours, colours, vitamins, stabilizers- indirectadditives-organicresides-inorganicresiduesandcontaminants.

Unit5:FOODALLERGY **9 Hours**

Food allergy, food intolerance, contaminants of processed foods, solvent residue,Contaminantsofsmokedfoods.Cleaner foodindustry-fruitandvegetableprocessing,seafoodprocessing,brewingandwineprocessing.

TextBook(s):

1. MichaelM Cramer.,*Foodplantsanitation*.CRCPress,2016
2. Tatiana Koutchma., Food Plant safety: *UV Applications for food and nonfood surfaces*.Elsevier, 2014

Reference(s):

1. Y.H.Hui.*Plant sanitationforfood processing andfoodservice*.,CRCPress, 2014
2. SanjayBanerjee.,*Industrialhazardsandplantsafety*.,CRCPress,2002

FT18R402	SPICESANDPLANTATIONPRODUCTS	L	T	P	Credit
		3	0	0	3

Prerequisite:Nil **CourseCategories:**ProfessionalElective
CourseType: TheorywithPracticalComponent

Objective(s)	Toenablethestudenttounderstand 1. Theimportanceanddifferentbasicunitoperationsinprocessingofspices 2. Processingmethodsofplantationcrops. 3. Identifying the qualityaspectsofplantationcropsandspices
CourseOutcome(s)	
CO1	TounderstandaboutCoffee,itsprocessingtechniquesandcoffeeproducts.
CO2	Tolearnthedifferenttypesoftea, itsmanufacturingtechniquesandqualityparameters
CO3	TolearnCocoa,itsprocessingandchocolatemanufacturingtechnology
CO4	Toknowtheprocessingandchemistryofmajor andminor spices.
CO5	

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L				L	M						L		
CO2		L	M			L	M								L
CO3	L		M			L	M				L		L		L
CO4	H	M	L			L	M				L				M
CO5	H	M	L			L	M				L				

CourseTopic(s)

Unit1:CHEMISTRYANDTECHNOLOGYOFCOFFEE **9 Hours**
Coffee – Occurrence – chemical constituents – harvesting – fermentation of coffee beans – changes taking place during fermentation – drying – roasting – Process flow sheet for themanufacture of coffee powder – Instant coffee, technology – Chicory chemistry - Qualitygradingofcoffee

Unit 2:TEA– CHEMISTRYAND TECHNOLOGY **9 Hours**
Occurrence – chemistry of constituents – harvesting – types of tea – green, oolong and ctc – Chemistry and technology of CTC tea – Manufacturing process – Green tea manufacture – Instantteamanufacture–Gradingoftea

Unit 3:CHEMISTRYANDTECHNOLOGYOFCOCOAANDCOCOAPRODUCTS 9Hours
Occurrence – Chemistry of the cocoa bean – changes taking place during fermentation ofcocoabean–Processing ofcocoabean – cocoa powder– cocoa liquormanufacture

Chocolates – Types – Chemistry and technology of chocolate manufacture – Quality controlofchocolates

Unit 4:CHEMISTRYANDTECHNOLOGYOFMAJORSPICES 9Hours

Pepper,Cardamom,gingerandturmeric–Oleoresinsandessentialoils–Methodofmanufacture – Chemistry of the volatiles –Enzymatic synthesis of flavour identicals - Qualitycontrol

Unit 5:CHEMISTRYANDTECHNOLOGYOFMINORSPICES 9 Hours

Cumin, Coriander, Cinnamon, fenugreek, Garlic, Clove and Vanilla - Oleoresins andessential oils – Method of manufacture – Chemistry of the volatiles – Quality controlPresenttrendsinsynthesisofvolatiles –micro-organisms,plantsuspensioncultures

Text Book(s):

1. Minorspicesandcondiments:cropmanagementandpostharvesttechnology.,J.S.Purthi,ICAR Publication,Istedition2001
2. J.S.Purthi,Ist edition.,Majorspicesofindiacropmanagementandpostharvesttechnology.ICARP ublication.2003

ReferenceBook(s):

1. HandbookonSpices,NationalInstituteofIndustrialResearch(NIIR)Board,AsiaPacifi c Business Press Inc.,NewDelhi2004.
2. Kenjihirasaandmitsuotakemasam.,Spicescienceandtechnology,CRCPress, 1998
3. Minifie Bernard W.,Chocolate, Cocoa and Confectionery Technology, III Edition,AspenPublication,1999.

FT18R403	MILLINGTECHNOLOGYFORFOOD MATERIALS	L	T	P	Credit
		3	0	0	3

CourseCategories: ProfessionalElective

Prerequisite:FT18R273 **CourseType:**Theory

Objective(s)	Onsuccessfulcompletionofthe subject,studentswillgetexposureaboutProcessingofcereals,pulses andstorageofcereals
CourseOutcome(s)	
CO1	Understandthepostharvestpracticesandlossesoffoodgrains
CO2	Adapttherightpost harvest practiceforwheat
CO3	Understandphysicochemicalpropertiesofriceandbyproductsfromit
CO4	Developmentofsnacks frommillets
CO5	Developmentofsweetsandsavorybased productsfrompulses

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L			L	H			L			M		

CO2		M	M		L	L	H			L	M		M		
CO3	M		M		L		H			L	M		M		
CO4	M		M		L		H			L	M		M		
CO5			M		L		H			L	M		M		

CourseTopic(s)

Unit1:INTRODUCTIONANDPOSTHARVESTLOSSES 9Hours

Importanceofcerealsand legumes,Post-harvestqualityandquantitylosses.Recommendedpre-processing practices for handling of cereals and pulses for their safe storage, includingcontrolofinfestation,NationalandInternationalqualityandgradingstandards.

Unit2:MILLINGOFWHEAT 9Hours

Structure, types, composition, quality characteristics and physicochemical properties ofwheat. Cleaning, tempering and conditioning, and milling processes for different wheat's.Turbogriding& Air Classification. Blending of flours. Millingequipmentsandmillingproducts(Dalia,Atta,Semolinaandflour).Flourgradesandtheirsuit abilityforbakedgoods.
Qualitycharacteristicsandrheologicalproperties ofwheatmillingproductsandits assessment.Byproductutilization.

Unit3:RICEMILLING 9Hours

Structure, types, composition, quality characteristics and physicochemical properties of rice.Millingand parboiling ofpaddy,Curing and ageingofpaddyand rice.Criteriainassessmentofmilling, cooking, nutritional and storage qualities of raw & parboiled rice. Processed riceproducts(flaked,expanded and puffedrice).By-product (husk andricebran)utilization.

Unit4:MILLINGANDPROCESSINGOFMAIZEANDMILLETS 9 Hours

Structure, types and composition of corn. Dry and wet milling of corn. Starch and itsconversionproducts.Processedcornproducts(popped corn,cornflakesetc.)Structureandcomposition of barley, bajra, jowar and other cereal grains and millets. Malting of barley.Pearlingofmillets.Parchedandsnackproducts.

Unit5:MILLINGOFPULSES 9Hours

Structure,compositionandpropertiesoflegumes.Cleaning,grading,pretreatmentsfor difficult-to-mill(urad,arhar,moong,moth)andeasy-to-mill(chana,masoorandpea)legumes,milling practices and actual milling of different legumes. Sweet and savory products fromlegumesinIndia.

TextBook(s):

1. N.L.Kent,TechnologyofCereals,WoodHead Publishing,4th edition2004.
2. ShankuntalaN.Mannay,FoodFactsandPrinciples,NewageInternational(p)Ltd, 2008

Reference(s):

1. NormanN.Potter,Foodscience,Springerpublication,1995
2. DAVDendyandB.J.Dobraszerk,Cereals andcerealsProducts-ChemistryandTechnology,AspenPublication2001.

FT17R404	PROCESSINGCOMMODITIESOFFOOD	L	T	P	Credit
		3	0	0	3

Prerequisite: FT18R251 **CourseCategories:**ProfessionalElective
CourseType: Theory

CourseObjective(s)	ToIntroducestudentsaboutthemethodsofprocessingfoodto preventwastageandlosses
CourseOutcome(s)	
CO1	Tolearnaboutdifferentprocessingtechniquesoffruitsandvegetables
CO2	To learnaboutprocessing ofdairyproducts
CO3	Tostudyaboutbakerytechnologyandlearningqualityaspects ofbakeryproducts
CO4	Tolearnaboutslaughteringandprocessing methodsofmeatand marineprocessingtechnology
CO5	Tostudyabout milling processing ofcerealsand pulsesandlearnthegrainstoragepractices

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		L		L		L			L	M		M		
CO2	M		M		L		L			L	M		M		
CO3		M	M		L		L			L	M		M		
CO4		M	M		L		L			L	M		M		
CO5		M	M		L		L			L	M		M		

CourseTopic(s)

Unit1:FRUITSANDVEGETABLEPROCESSING **9Hours**
ProductionofFruitsandvegetables inIndia, Causefor heavylosses, preservationtreatments -CanningofFruitsandVegetables,Minimalprocessingand HurdletechnologyasappliedtoVegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic and othermethodsofprocessing.

Unit 2:DAIRYPROCESSING **9 Hours**
Basicdairyterminology,composition,QualityandQuantitytestsatreception,dairyProcessingEquipments ,variousdairyProducts,Packagingofmilkinbottlesand sachets.

Unit3:MILLING ANDBAKERYTECHNOLOGY **9 Hours**
FundamentalsofMarketAnalysisforWheatandWheatProducts,LaboratorytestingofWheatgrainQuality,Moisturetests,Outline ofthe WheatMilling Process,equipments

Unit 4:MEAT,FISHANDPOULTRY PROCESSING **9Hours**
Meatcompositionfromdifferentsources,Definitionsandmeasurements,Slaughteringand CarcassProcessing,MeatProducts,ProcessingofPoultryProducts,FishandotherMarine

ProductsProcessing.

Unit 5:CEREALTECHNOLOGY **9Hours**

PaddyProcessing - Varieties, theirCompositionandQualitycharacteristics, Curingof Paddy,ParboilingProcesses,ByProducts.Ricemillingandequipments,MillingofPulses,GrainStorageandHandling.

TextBook(s):

1. Srivastava,R.P.andKumar,S.:FruitandVegetablePreservation:PrinciplesandPractices.InternationalBookDistributingCo.Lucknow (2ndEdition1998).
2. Chakraverty,A., MujumdarA.S., RaghavanG.S.VandRamaswamyH.S. HandbookofPost-harvestTechnology:MarcelDekkerPress,USA(2001)

ReferenceBook(s):

1. W. JamesHarperandCarlW.Hall:DairyTechnologyandEngineeringAVIPublishing,Westport,USA (1976)
2. Karel Kulp and JosephP Pante:HandBookOfCerealScience and

FT18R409	**FOODINDUSTRYWASTE MANAGEMENT**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**3**

Prerequisite:FT18R251 **CourseCategories:** ProfessionalElective **CourseType:**Theory

CourseObjective(s)	Effective utilizationoffoodwaste
CourseOutcome(s)	
CO1	Understandthecharacterizationand chemicalpropertiesoffoodwaste
CO2	Handleindustrialwastewithnecessaryprecautionstoavoidinfectionandcrosscontamination
CO3	Toenablethestudenttounderstandthemethodsoftreatment
CO4	Monitorthesludgeandeffluentsdischargedfromfoodindustries meetthelimitationbylaw
CO5	Controlenvironmentalpollutionbypropertreatmentoffoodwaste

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H				L	H	M			H	M	L		
CO2		M	M			H	H	M				M	M		
CO3		H	M			H	H	M		M	H	M			L
CO4		M	M			H	H	M		M	H	M			L
CO5			M				H	M				M			M

CourseTopic(s)

Unit1:CHARACTERIZATIONOFFOODWASTE **9 Hours**

Characterizationofby-productsfromcereals,pulses,oilseeds,fruits,vegetables,plantation,dairy,eggs,meat,fishandpoultryprocessingindustries.Elementsofimportancein efficientmanagement of wastesfrom aforesaid food industries. Treatments of solid waste.StandardsBOD/CODWastefromvariousindustries.

Unit2:STANDARDSFOREMISSION/DISCHARGE **9 Hours**

StandardsforemissionordischargeofenvironmentalpollutantsfromfoodprocessingindustriescoveredunderEPAAct.Characterizationoffoodindustrieseffluentsin terms of parameters ofimportance

Unit3:TREATMENTOFFOODINDUSTRYEFFLUENTS 9**Hours**

Unitconcept oftreatment offoodindustryeffluents:Screening,sedimentation,floatationasperandprimary treatments, biological oxidations:– objectives, organisms, reactions, oxygen requirements,aerationdevices. Improved biocatalysts and innovative bioreactors for enhanced bioprocessing ofliquid food wastes. Effect on characteristic parameters of effluents in treatments using lagoons,tricklingfilters,activatedsludgeprocess,oxidationditches,rotatingbiologicalco ntr a cto r s an d t h e i r variations and advanced modifications. Occupational health and safety.**Unit4:ADVANCEDWASTEWATERTREATMENTSYSTEMS** **9 Hours**

Advancedwastewatertreatmentsystems:physical,physicochemical andchemical treatments.Genobiotics- Bio remediation, Coagulation and flocculation, disinfection, handling and disposal ofsludge andtreatedeffluents conformingtoEPAprovisions.

Unit 5:BYPRODUCTUTILIZATION **9 Hours**

ExtractionofPectin,color,collagen,Pharmaceuticalandfunctionalingredients,Biofertilizers,Foodingredients.

Textbook(s):

1.LawrenceK.Wang,Yung-TseHung.,Wastewatertreatmentinthefoodprocessingindustry,CRCpress,2ndedition,20062.N.F.Gray.,Watertechnology:anintroductionforenvironmentalscientistsandengineers, ElsevierButterworth-Heinemann,2ndEdition,2002

Reference(s):

1.Patwardhan.,IndustrialWasteWaterTreatment,Prentice-HallofIndiaPvtLtd,1stedition,20082.K.C.Agrawal.,Environmentalpollutionandlaw,AgroBotanicalPublishers,1995

FT18R204	**SENSORYEVALUATIONOFFOODS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Prerequisite:Nil **CourseCategories:**Professionalelective **CourseType:**Theory

Objective(s)	Theobjectiveofthecourseis forevaluatingprocessedfoods
CourseOutcome(s)	
CO1	Understandandapplyimportance oftaste
CO2	Understandandanalyzetheodorperception
CO3	Learnaboutdetectionofcolorin foodsubstances
CO4	Learnabouttextureandrheologicalproperties
CO5	Learnthemethodofpanelscreening andinstrumentalanalysis
Mapping ofCOsandPos	

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M				M	M					M		L		
CO2		H	M		M	M				M	M		L		L
CO3	H	L			M	M				M	M		L		
CO4					M	M				M	M		L		
CO5	M				M	M				M	M		L		

CourseTopic(s)

TASTE **9Hours**

Introductionandimportanceoftaste-Structureandphysiologyoftasteorgans-tongue, papillae, tastebuds, salivary glands - Mechanism of taste perception - Chemical dimensions of basic tastes-sweet,salt,sour,bitterandumami-
Factorsaffectingtastequality,reactiontime,tastemodification,absoluteandrecognition-thresholdTaste abnormalities-Tastemeasurement

ODOUR **9Hours**

Introduction, definition and importance of odour and flavor - Anatomy of nose, physiology of odourperception - Mechanism of odour perception - Odour classification, chemical specificity of odour. -Odourmeasurementusingdifferenttechniques–primitivetorecenttechniques.Meritsanddemeritsofeachmethod.Olfactoryabnormalities

COLOUR **9Hours**

Introduction and importance of colour. - Dimensions of colour and attributes of colour, appearancefactors, gloss etc. - Perception of colour. Colour abnormalities - Measurement of colour; Munsellcoloursystem, CIEcoloursystem,Huntercolour-system,spectrophotometryandcolorimetryetc.

TEXTURE **9Hours**

Introduction, definition and importance of texture - Phases of oral processing - Texture perception,receptors involved in texture perception - Texture classification - Texture measurement – basicrheologicalmodels,forcesinvolvedintexture measurement

SENSORYEVALUVATION **9 Hours**

Sensoryevaluation-introduction,panelscreening, Sensoryandinstrumentalanalysis inqualitycontrol,IPR andpatents

TEXTBOOK

1. RaoE.S.(2013).FoodQualityEvaluation,VarietyBooks.
2. Meilgard(1999).SensoryEvaluationTechniques,3rded.CRCPressLLC,1999

REFERENCEBOOK

1. deManJ.(2007).PrinciplesofFoodChemistry, 3rded.,Springer. 62

2. Brannenandetal.,(1990)FoodAdditives,MarcelDekker,NewYork,1990

FT18R205	ENGINEERINGPROPERTIESOFFOOD MATERIALS	L	T	P	Credit
		3	0	0	3

Prerequisite:Nil **CourseCategories:**ProfessionalElective
CourseType: TheorywithPractical

Objective(s)	To enablethestudentsunderstandtheeffectofvariousmethodsofprocessingonthe structureandtextureoffoodmaterials
CourseOutcome(s)	
CO1	Understandthephysicalcharactersoffoodstodesigntheformulation, processingequipments,qualityparameters
CO2	Understandthetextureandrheologicalpropertiesoffoodtodesignprocessingmethods andequipments
CO3	UnderstandtheThermalpropertiesoffoodtodesignpackmaterial,processingmethods andequipments
CO4	UnderstandtheAerodynamic propertiesoffoodtodesignprocessingmethods,equipments
CO5	UnderstandtheElectricalpropertiesoffoodtodesignformulation,processingmethods andequipments

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M				M	M					M		L		
CO2		H	M		M	M				M	M		L		L
CO3	H	L			M	M				M	M		L		
CO4					M	M				M	M		L		
CO5	M				M	M				M	M		L		

CourseTopic(s)

Unit 1:PHYSICALPROPERTIESOFFOODS **9Hours**
Methods of estimation of - Shape, size, volume, density, porosity, texture, viscosity, surface area,Structures of materials - gel structure, amorphous and crystalline, drag coefficient, glass transition**Unit 2:RHEOLOGICALPROPERTIESOFFOODS** **9Hours**
Rheological Classification and models, Static tests for solid foods, Creep, relaxation, Dynamictesting of solid foods, stress and strain in solid foods, stress-strain diagram, visco-elastic fluids,measurement methods, Viscometers and Rheometers of different design and their applications,texturemeasuringinstruments,Hardnessandbrittlenessoffoodmaterials.
Unit 3:THERMALPROPERTIESOFFOODS **9Hours**
Definitions - specific heat, enthalpy, conductivity and diffusivity, surface heat transfer coefficient.Absorptivity,transmissivity.Measurementofthermalpropertieslikespecificheat,enthalpy,conductivityanddiffusivity;
Unit4:AERODYNAMICANDHYDRODYNAMICPROPERTIESOFFOODS **9Hours**
Dragcoefficient,terminalvelocityandtheir applicationinthehandlingandseperationoffood

materials.

Unit5:ELECTRICALPROPERTIESOFFOODS **9Hours**

Dielectric properties, electric energy transmission properties, Electro-magnetic field effects,Dielectric measurements, Polar solvents, Ionic solutions. Reaction to electromagnetic radiation.Definition- Optical properties-method and light aborsorptance, light transmittance, color, intensity,lightreflectance.

TextBook(s):

1. Nuri N. Mohsenin: Physical Properties of Plant and Animal Materials Gordon and ReachScience Publishers(1970)
2. Nuri N. Mohsenin: Thermal Properties of Food & Agricultural materials Gordon and ReachScience Publishers(1970)

ReferenceBook(s):

1. M.A.Rao and S.S.H.Rizvi: Engineering Properties of Foods Mercel Dekker inc. New York(1998)
2. M.J.Lewis:PhysicalPropertiesofFoodsandFoodProcessingSystemsWoodheadPublishingCambridge,UK(1990)
3. ShafiurRehman:FoodPropertiesHandBookCRCPressInc. NewYork(1995)

FT18R307	**FOODPROCESSEQUIPMENTDESIGN**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Prerequisite: MEC18R151 **CourseCategories:**Professionalelective **CourseType:**Theory

Objective(s)	Todesignanddevelopequipmentsusedinfoodprocessingoperations
CourseOutcome(s)	
CO1	UsedetailsofMaterialcompositionfor effectiveconstructionofmachinesdependingonfoodproduct
CO2	Designequipmentsbased onmaterialhandlingcapacityandqualityofmaterials
CO3	Setupfoodtransportation withinprocessingunit withConveyorbelts andElevators
CO4	CheckFoodqualityanditsstandardlevelinfoodindustry
CO5	ImportanceofComputerapplicationsandInstrumentcalibrationforperfectionandautomation.

Mapping ofCOsandPOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	H	L		M	H				M		L		L
CO2		M	H		L	L					H		L		L
CO3	M	M	H								H		L		

CO4	M	M	H								H		L		
CO5	M	M	H	H	H						H				M

CourseTopic(s)

INTRODUCTION **9Hours**

Introduction to various mechanical properties of materials to be used as material ofconstruction, resistanceofmetalstocorrosionunder varyingconditionsoftemperatureandpressure etc.Applicationanduse ofvariouscodesandstandardsindesign.

DESIGNINGOFHANDLINGEQUIPMENT **9 Hours**

Design of material handling equipment: Belt conveyor, bucket elevator, screw conveyor,Cycloneconveyor,chainconveyor,pneumaticconveyor.Designofseedprocessingequipments:Air screen cleaner, rotary cleaner, graders based on size shape and surface produce and led, seedtreater.

DESIGNING OFSTORAGEVESSELS **9 Hours**

Designofnon-pressurestoragevessel, tallverticalvessels,unfiredpressurevesselswithInternalpressure:storage vessels andprocessvessels.

DESIGINGOFPRESSUREEQUIPMENTS **9 Hours**

Designofunfiredpressurevesselswithexternalpressures, endclosures,flatplates,domed ends,torispherical, ellipsoidal,hemisphericalandconicalends. Designofnozzles,openingsandreinforcements,Bolts,flanges,gaskets.

DESIGINGOFDRYERSANDHEAT EXCHANGERS **9 Hours**

Boltedflanges,pipelinedesignandMechanicaldesignofselectedprocessequipmentssuch Asheatexchangers,Evaporators,Distillationcolumns,Absorbers,ReactorsandDryersandCrystallizers; Useofsoftwares fordesignofequipments.

TEXTBOOKS

1.PetersMax.S.,TimmerhausKlausD.andRonaldEWest.,PlantDesignandEconomics forChemicalEngineers,VEditionMcGrawHill.20032.Coulson,J.M.andRichardsonJ.F.,ChemicalEngineering,PargamonPress,vol.6
1989.

REFERENCES

1. Evans,F.L.,–EquipmentDesignHandbook‖,GulfPublishingCompany,2nd Edition1979.
2. Perry,R.HandChitton,Perry'sChemicalEngineersHandbook,McGrawHill, NewYork,7th Edition,1997

FT18R405	FOODPRODUCTDEVELOPMENT	L	T	P	Credit
		3	0	0	3

Prerequisite:Nil **CourseCategories:** ProfessionalElective
CourseType: Theory

CourseObjective(s)	Toprovidetheopportunityforstudentstointegratetheirtraininginfoodscience andtechnologycoursesandrelateddisciplinesandtogainexperiencewiththetheoryandpracticeofdevelopingfoodproducts.
CourseOutcome(s)	
CO1	Understandaboutthefoodcompanyorganizationandmarketing.
CO2	Toanalyzethetechnicalaspectsofnewproductdevelopmentindairyandmeatindustry.
CO3	Toanalyzethetechnicalaspectsofnewproductdevelopmentinbeveragesindustry.
CO4	Toanalyzethetechnicalaspectsofnewproductdevelopmentinflavorindustry.
CO5	Understandthe conceptsofqualitycontrolaspects.

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M				M		M		M	M		M		
CO2			H			M		H		M	H		M		H
CO3		L	H			M		H		M	H		M		H
CO4		L	H			M		H		M	H		M		H
CO5		M	M			H		H		M	H		M	M	H

CourseTopic(s)

Unit1:INTRODUCTION **9 Hours**
CorporateOrganizationofFoodCompanies,OverviewofFoodProductDevelopment(FPD),ProductDevelopmentProcess,IdeationandScreeningProcess,FPMarketingandMarketResearch,LegalandFiscal,–TestMarkets andLaunches,SuccessesandFailure.

Unit 2:PRODUCTDEVELOPMENT **9 Hours**
TechnicalAspectsofNewProductDevelopment–Dairy, Meat,Poultry, EggProducts, FishandShellfishProducts.

Unit 3:PRODUCTDEVELOPMENT **9 Hours**
TechnicalAspectsofNewProductDevelopment–JuicesandNon-alcoholicBeverages, CerealsandGrains,Fats andOils.

Unit 4:PRODUCTDEVELOPMENT **9 Hours**
TechnicalAspectsofNewProductDevelopment–FlavorsandFlavorCompanies,Sugar,CandyandChocolate.

Unit5:QUALITYASPECTS **9 Hours**
QC/QA Aspects of Food Product Development, Microbial Aspects of New Product Development,PackageDevelopment , Shelf Life of Packaged Foods , Nutrients and Fortification, Labeling andPertinentRegulations

TextBook(s):

1. Brody,A.L.andLord,J.2008.DevelopingNewFoodProductsforaChangingMarketplace,2ndEdition.CRCPress,Boca Raton,FL.
2. Campbell-Platt,G.2009.FoodScienceandTechnology.BlackwellPublishingLtd.,Oxford,UK.

ReferenceBook(s):

1. Fuller,G.W.2011.NewFoodProductDevelopment,3rdEdition.CRCPress,BocaRaton,FL.
2. Moskowitz,H.,Saguy,I.S.,andStraus,T.2009.AnIntegratedApproachtoNewFoodProductDevelopment.CRCPress,Boca Raton,FL.

FT18R406	FOODPLANTLAYOUTANDDESIGN	L	T	P	Credit
		3	0	0	3

Prerequisite: FT18R310 **CourseCategories:** ProfessionalElective **CourseType:**Theory

CourseObjective(s)	Designalayoutforfoodprocessingplantandestimationofcost
CourseOutcome(s)	
CO1	DesignandsettingupofnewfoodprocessingplantasEntrepreneur and/orconsultant
CO2	TheimportanceHACCPandfoodsafetylawsgoverningfoodindustries
CO3	Implementthefoodsafetystandards infoodindustries
CO4	Preparecostestimateandeconomicanalysisoffoodindustry
CO5	Helptominimizethefoodindustrylossesandmaximizetheprocessedfoodproduction

MappingofCourseOutcome(s)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H	M				M			M	H	M	M		
CO2		H	H				M			L	H	M	M		
CO3		M	H					H		L	M	M	L	M	
CO4		M	M							M	H	M	L		
CO5	L	H	M							M	H	M	L		

CourseTopic(s)

Unit1:SITESELECTION **9 Hours**

Siteselection- Factors-CaseStudy:SiteSelection-ProductCapacityandquality–StorageofRawmaterials and Product - Waste Disposal, Utilities – Requirements for water, electricity, labor,transportation facilities, refrigeration, boiler- laboratory - Plans for Future Expansion- Hours ofOperation-CompletionDate-Safety

Unit 2:PLANTDESIGN **9Hours**

ManufacturingPlantDesign–Buildingdesign–Legalaspects–Buildingbylaws,Expansion–PlantLocation–Thestructure– FacilitiesLay-out Office,toilet,laboratory-classificationofdairy

andfoodplants, farmlevelcollectionandchillingCentre,spacerequirements

Unit3:OCCUPATIOALSAFETYANDHYGIENICDESIGN

Impactof technologicaldevelopmentsonworkingconditions,Occupationalhealthproblems-dermatitis,asthma,hearingdamage,stress&policies,OSHAregulationsforsafeworkingenvironments, Hygienic design principles and benefits- factory, utilities & equipment, process andmachineries, material of construction, Hygienic welding, Best practices of hygienic design as perGFSI-Cleaning anddecontamination,personalhygiene,drainages,hazardmanagement

Unit 4:LAYOUTANDCOSTESTIMATION 9Hours

NewPlantLayout-Productandprocesslayout-ExpansionandImprovementsofExisting/Facilities- Case Study: Layout and Warehouse Requirements – Inventory control - Cost Indexes -Capacity vis-a-vis Costs - Factored Cost Estimate – Break – even point - Improvements– ModuleCost Estimation - Unit Operations Estimate- Detailed Cost Estimate- Accuracy of Estimates- CaseStudy:CapitalCostEstimation.

Unit 5:ECONOMICANALYSIS 9 Hours

Cost of Producing a Product- Capital - Elementary Profitability Measures- Time Value of Money- Compound Interest-NetPresentValue-RateofReturn-ComparisonofNetPresent ValueandRateofReturnMethods-ProperInterestRates-ExpectedReturnontheInvestment- EconomicEvaluation – Depreciation – Amortization- Depletion Allowance- Investment Credit- Special TaxRules -Problems.

TextBook(s):

1. DennisR.Heldman andDarylB.Lund.–HandBookofFoodEngineering‖,Secondedition, CRCPress,TaylorandFrancis Group,2007.
2. William D.Baasel. –Preliminarychemicalengineeringplantdesign‖,SecondeditionVan NostrandReinhold,1990.

ReferenceBook(s):

1. R.K.Sinnot.–CoulsonandRichardsonsChemicalEngineering‖Vo.6.,4thEdition,Elsevier Publication.2005.
2. MaxS.Peters andKlaus D.TimmerhausandRonaldWest.–PlantDesignAndEconomicsFor ChemicalEngineers‖,5thEdition,TataMc-GrawHillEducation.2003.

FT18R308	**PROTEINCHEMISTRYAND TECHNOLOGY**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**3**
Prerequisite:FT18R272		**CourseCategories:** ProfessionalElective **CourseType:**Theory			
Objective(s)	Understandbasicchemistryandstructuresofproteinfoundinfoodanddevelopnewtechnologies andsources ofproteins				
CourseOutcome(s)					
CO1	Analyzeproteinqualityandidentifyproteinstructureandapplicationinfoodsector				
CO2					
CO3	Understandtheimportanceofproteinengineeringinimprovingthenutritionalandfunctionalproperties offood				
CO4	Isolateproteinfromsourcelikefish,legume,oilseedsandmicrobes				
CO5	StructuralandFunctionalpropertiesofprotein				
MappingofCourseOutcome(s):					

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H					L					L		L		
CO2	M					L					L		L		
CO3		M				L					M				H
CO4		M	M			L	M				M		L		
CO5	M					L	M				M		L		

CourseTopic(s)

Unit 1:BASICSOFAMINO ACIDSANDPROTEINCHEMISTRY 9 Hours

Aminoacids(thestudentsshouldbethoroughwiththreeandsinglelettercodes)andtheirmolecularproperties (size, solubility, charge, pKa), Chemical reactivity in relation topost- translationalmodification (involving amino, carboxyl, hydroxyl, thiol, imidazole groups) and peptide synthesis.Covalent, Ionic, Hydrogen, Coordinate, hydrophobic and Vander walls interactions in proteinstructure. Interaction with electromagnetic radiation (radio, micro, infrared, visible, ultraviolet, X-ray)andelucidationofproteinstructure.

Unit2:PROTEINARCHITECTURE 9Hours

Primary structure: peptide mapping, peptide sequencing - automated Edman method & mass-spec.High-throughputproteinsequencingsetup

Secondary structure: Alpha, beta and loop structures and methods to determine (Basics only)BasicsofSuper-secondarystructure:Alpha-turn-alpha, beta-turn-beta(hairpin), beta-sheets,alpha-beta-alpha, topology diagrams, up and down & TIM barrel structures nucleotide binding folds,predictionofsubstratebindingsites

Tertiarystructure:Domains,folding,denaturationandrenaturation,overviewofmethodstodetermine3Dstructures,Quaternarystructure: Modularnature,formationofcomplexes.

Unit3:PROTEINENGINEERING 9Hours

Advantages and purpose, overview of methods, underlying principles with specific examples:thermal stability T4-lysozyme, recombinantinsulin to reduce aggregation andinactivation, denovoproteindesign.

Unit 4: BASICS OF THE PROPERTIES OF FOOD PROTEINS – ANIMAL AND MARINESOURCESCASEINSANDWHEYPROTEINS 9 Hours

Caseins–HeterogeneityandMolecularproperties–caseins micelles–Mechanismofstabilization – Structure models – Structure of whey proteins and improvement of functionality Muscleproteins–Structureandfunctionality–ApplicationofmuscleproteinsinfoodsSeaweedproteins – Proteincontentandfunctionality,digestibilityofalgalproteins–applicationstofoodsystems

Unit5:BASICPROPERTIESOFFOODPROTEINS–PLANT SOURCES 9 Hours

Composition,functionalpropertiesofsoya, rapeseed,peanut.Leafasaproteinsource–BasicandFoodapplications ofrubisco

TextBook(s):

1.VoetD. andVoetG.,–Biochemistry‖,ThirdEdn.JohnWileyandSons,2001
2.ZidzisławE. Sikorski,ChemicalandFunctionalPropertiesofFoodProteins, CRCPress,2001.

ReferenceBook(s):

1. CreightonT.E.Proteins, FreemanWH,SecondEdition,1993
2. MoodyP.C.E.andWilkinsonA.J.–ProteinEngineering‖,IRLPress,Oxford,UK,1999

FT18R309	NUTRITIONALBIOCHEMISTRY	L	T	P	Credit
		3	0	0	3

Prerequisite:Nil **CourseCategories:** ProfessionalElective
CourseType: Theory

Objective(s)	To enable students understand the basics of food biochemistry and nutrition andimportanceofnutritionand enablethemtodevelop newproductsofhighnutritivevalue

CourseOutcome(s)

CO1	Understandchemicalprocessinvolvedincarbohydratesmetabolism
CO2	Groupamino acidsand lipid metabolism
CO3	Understandbasicconceptsofnutrition
CO4	Understandantinutritionalfactorsand itsaffectsinhealth
CO5	Designingnewrangeofproductswithimprovednutritionalcharacteristics

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M				L							L		
CO2	H					L							L		
CO3	H	M				L		L			L		L	M	
CO4	M	M				L		L					L		
CO5	M					H		L						M	

CourseTopic(s)

Unit1:CARBOHYDRATEMETABOLISM **9 Hours**

Electron transportchain - glycolysis, TCA cycle, gluconeogenesis, Pentose phosphate shunt,EmbdenMeyerhofPathway(EMP),ureacycle, interconnectionofpathways,Metabolicregulation,Bioenergetics:RespiratorychainATPcycle,energyrichcompounds

Unit2:AMINOACIDANDLIPIDMETABOLISM **9 Hours**

Biosyntheses and degradation of fatty acids, and cholesterol - Biosyntheses and degradation ofamino acids (one example each for sulphur containing, aliphatic, aromatic, heterocyclic, basic andacidic amino acids), peptides and proteins; Biosynthesis and degradation of purines, pyrimidinesandnucleicacids.

Unit 3:BASICCONCEPTSOFNUTRITION **9Hours**

Basicconcept ofnutrition–Importanceofnutritionanddietetics-Assessmentofnutritionalstatus – energyvalueofcarbohydrates,proteinsandfats–determinationofenergyvalue–balanceddiet – Recommended dietary intake – Acceptable dietary intake – Protein efficiency ratio – Net proteinutilisation and their determinations – Malnutrition and its problems – Nutrient supplementation –fortification - Nutritional labeling and its importance - Effect of processing on protein quality,essentialaminoacids-Digestibility,carbohydratesin foodanddietaryfibre

Unit 4:INBORNERRORSOFCARBOHYDRATE,PROTEINANDFATMETABOLISM 9 Hours Inbornerrorsofcarbohydrate,proteinandfatmetabolisms-Nutritionanddisordersassociatedwithorgans such as liver and kidney - Naturally occurring anti-nutritional factors – Cyanogens, lectins,enzymeinhibitors,phytoallexins,phytates

Unit5:NUTRITIONFORSPECIALIZEDPURPOSES 9 Hours

Nutrition for specialized purposes – Paediatric nutrition – geriatric nutrition – Sports nutrition – Nutritionduringpregnancy-FunctionalfoodsAgeing–Theoriesofageing–Nutritionandageing – Cancer and its prevention - Age-related metabolic disorders – Nutrition in the treatment of age-relateddisorderslikehypertension,diabetes,Alzheimer'sdisease

TextBook(s):

1. VoetD,VoetG,PrinciplesofBiochemistry, ThirdEdition, JohnWileyandSons,2008.
2. MartinEastwood. PrinciplesofHumannutrition–SecondEdition,Ed.Wiley-BlackwellPublishing,2003.

ReferenceBook(s):

1. RonaldRossWatson,FunctionalfoodsandNutraceuticalsinCancerPrevention,Ed.Wiley–Blackwell,2003.
2. LehningerA.L,NelsonD.L. andCoxM.M., PrinciplesofBiochemistry,W.H.FreemanandCompanyPublications,2008.

FT18R407	TRADITIONAL&FERMENTED FOODS	L	T	P	C
		3	0	0	3

Prerequisite:Nil **CourseCategories:** ProfessionalElective **CourseType:**Theory

Objective(s)	Tounderstandvariousconcepts,principlesandproceduresinvolvedintheareaofferm entedfoodproduction
CourseOutcome(s)	
CO1	UnderstandtheimportanceoffoodanditsrelationshipwithcultureinIndia
CO2	GraspgoodknowledgeofFermentedfoodsanditsrevolution inIndianfoodculture
CO3	Usebenefitsoftraditionalfoodsanditsexistenceatpresenttoexplore
CO4	AdapttheImpactoffermentedproductsanditsbenefits
CO5	PreserveTraditionalFoodsbyadaptingtechnologytomeetdemands.

Mapping ofCOsandPOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			H			H							M		
CO2	L		M			H		L					L		
CO3			M			H					L		H		
CO4	L		M			H					L		H		
CO5	L		M			H					M				

CourseTopic(s)

TRADITIONALFERMENTEDFOODS

Indiantraditionalsweet,savoryandsnackfoodproducts:Sweetmeats,Namkins,PapadsIdliandDosa.

CULTUREMAINTENANCE
Preparation and Maintenance of Bacterial, Yeast and Mold cultures for food fermentations.Probiotics-Lacticacidbacteria-activitiesandhealth-promotingeffects.Mushrooms:Cultivationandpreservation.

FERMENTEDPRODUCTS
Fermented Dairy Products: Cheeses, Curd and Yoghurt, Butter milk and the fermented milks.Spoilages and defects of fermented dairy products and their control. Fermented meat and fishproducts,Orientalfermentedfoods

FERMENTEDDRINKS
FermentativeProductionofBeer,Wines,CiderandVinegar,distilledspirits(eg.Rum,gin,whisky),FermentedVegetables(Pickles).

MICROBIALPROTEINS
ProductionofBaker'sYeast,MicrobialProteinsandfats,Foodenzymes(eg.Amylases,protease,lipases,pectinases,rennin),HFCS(HighFructoseCornSyrup)

TEXTBOOKS
1.K.H.Steinkrus, HandbookofIndigenousFermentedFoods,MarcelDekkerpublisher,1983.2.Sukumar De, Outlines of Dairy Technology ,Oxford University Press N Delhi , 1991.3.Prescott andDunn,IndustrialMicrobiology,Agrobios(India)publisher,2009

REFERENCES:
1.L.E.Casida, Industrial Microbiology, New Age International(p) Ltd N Delhi, 20072.W.C.frazierandD.C.Westhoff,FoodMicrobiology,TataMcgrawHillpublisher,3rd edition,2008.

FT18R408	RADIATIONPRESERVATION ANDPROCESSINGOFFOODPRODUCTS	L	T	P	Credit
		3	0	0	3

Prerequisite: Nil

CourseCategories: Professional Elective

CourseType: Theory

CourseObjective(s)	On completion of the subject, the students will gain knowledge aboutirradiation and safety measures to be followed and its application in foodindustries.
CourseOutcome(s)	
CO1	Tostudytheimportanceofnon-thermalmethodslikeirradiationasanalternative tothe conventionalmethodsofprocessing.
CO2	Tostudytheimportanceand safetyissuesoftheirradiatedfoods
CO3	Tostudytheeffectofmicrowaveradiationasaprocessingandpreservationmethod
CO4	UnderstandtheinteractionofIRradiationwithfoodmaterials-itsmeritsand

	demerits
CO5	UnderstandtheimpactofradioandUVradiationonmicroorganismoffood

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			M									L		
CO2		H	M	M				M					L	M	
CO3		M	M		H			L					L	M	
CO4		M			H						L				L
CO5		M	M		H						M				M

CourseTopic(s)

Unit1:BASICS OFRADIATION CHEMISTRY 9Hou

Electromagnetic energy, ionizing radiation, Concept of radiation, dielectric properties, ionizationand excitation, Radiation chemistry basics –primarychemical effects and secondary effects onfood,Gvalue,irradiationparameters,instrumentsformeasuringradiation,effectoffoodirradiationandpotentialitiesforradiationprocessingoffoods.

Unit2: RADIATIONCHEMISTRYOFFOODCOMPONENTS 9Hou

Basics-carbohydrates,proteins,lipids,vitaminsetc.Radiationeffectoncontaminatingmicroorganisms like bacteria, viruses, yeasts and molds –Dosages of radiation for various plantfoodsandanimalfoods-meatandpoultry,
fruits, vegetables, spices, dairy products; Radiation equipment, salient features; Packaging ofirradiatedfoods andsafety issues.

Unit 3:MICROWAVES INFOODPROCESSING 9Hou

Microwave heating, nature of energy, batch and continuous ovens, microwave generators, waveguides, brief description of oven construction, application of microwave radiation and safetymeasures.

Unit 4:INFRARED RADIATION 9Hou

Absorption and scattering characteristics of various food materials, PolarizationcharacteristicsofIRradiation,PropagationofIRradiationin foodstuffs.IRgenerators,applications,Relativemerits anddemerits.

Unit5:RADIOFREQUENCYHEATINGPRINCIPLES 9Hou

RF heating equipment, Advantages of Radio frequency heating of foods - Ultra violet radiationanditseffectonmicroorganismsin foods -UVtreatmentapplicationand equipment.

TextBook(s):

1.J.F.Diehl: SafetyofRadiated FoodsMarcelDekkerInc.NY(1995)
2.GouldG.W.NewMethodsofFoodPreservation,AspenPublisheresInc.Maryland. 1999.

ReferenceBook(s):

1. Ohlsson and Bengtson: Microwave Processing TechnologiesWoodhead Publishing,Cambridge,UK(2002)
2. PhilipRichardson:ThermalTechnologiesforFoodProcessingWoodheadPublishingLimited,CRCPress.(2001)

FT18R206	FOODBIOTECHNOLOGY	L	T	P	Credit
		3	0	0	3

Prerequisite: NIL **CourseCategories:**OpenElective
CourseType: Theory

Course Objective(s)	Theobjectiveofthecourseistocreategeneralunderstandingaboutnewtechniquesusedinfoodbiotechnology
CourseOutcome(s)	
CO1	Understand aboutProspectusofBio-Technology
CO2	Understandaboutdifferentmicrobialproducts
CO3	Adaptenzymetechnology
CO4	Adaptbiotechnologicalaspectsinplanttissueculture
CO5	

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H					L					L	L	L		L
CO2		M	H			L		L			M		M		M
CO3	M					L					H		M		M
CO4			M		H						L	L	M		M
CO5		M	M			H	H				M		M		M

CourseTopic(s)

Unit1:BIOTECHNOLOGY 9 **Hours**
Definition,Scope,Application.Genecloning -Definition,Basicconcepts,Characteristicsofidealcloning vector,Plasmid,Bacteriophages,CosmidandPhasmidEg.PBR322.

Unit2:FERMENTATIONTECHNOLOGY **9Hours**
Definition, Steps in fermentation, Design of bio reactors, Medium &Micro organism. Microbialproducts-Primary,secondarymetabolites,VitB12,CitricAcid,Penicillin&alcohol.

Unit 3:ENZYMETECHNOLOGY **9Hours**
Productionofenzymes - Amylase, Protease,Lipase, Lactaseandpectinase, Useofenzymes infood&beverageindustry(egCheese,fruit,juice,Wine,Meattendarizing&dairy)

Unit 4:PLANTTISSUECULTURE **9 Hours**
BasicrequirementfortissuecultureLab,Media&Techniques(Basicsonly)Animalcellculture-Primaryculture cellline,media requirement&application(onlyoutline)

BIOTECHNOLOGY&HEALTHCAREVACCINES **9 Hours**

Types, Biogas&Bioethanolproduction,ConceptofBio- remediation,Hazardsofgeneticengineering.

TextBook(s):

1. Biotechnology,Kumar'sV.SarisPublications,Kanyakumari.
2. Biotechnology,SinghB.D.KalyaniPublications,NewDelhi.
3. AtextbookofBiotechnology,Dubey,R.C.SChand&Co,NewDelhi.

ReferenceBook(s):

1. GeneTechnology,Davson,M.T.,Powel,R,.andGannonF.BiosscientificpublishersLtdU.K.
2. BasicBiotechnology,Rev,Fr,Dr.Ignasimuthu,S.J.TataMcGrawHillPublicationCoLtd.,New Delhi.

FT18R207	**TECHNOLOGYOFCONVENIENTFOOD**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**3**

Prerequisite:NIL **CourseCategories:**OpenElective
CourseType: Theory

Course Objective(s)	Toenablethestudenttounderstandtraditionalpatternsoffood
CourseOutcome(s)	
CO1	Understandaboutculturalperspectivesand basicingredientforfoodpreparation
CO2	Tounderstandtraditionalmethodoffoodpreservation
CO3	To understandcommercialproductionoftraditionalfood andhealthaspectsoftraditionalfood
CO4	Understand the commercialmethodofproduction oftraditionalfoods
CO5	UnderstandthehealthaspectofTraditionalfoods

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M					H		L		L			L		
CO2			M		L	L					M		M		
CO3		M	M			H					M		M		
CO4			M			M					M		M		
CO5	M		M			H	M				H			H	

CourseTopic(s)
Unit1:HISTORICALANDCULTURALPERSPECTIVES **9 Hours** Importanceoffoodinunderstandinghumanculture-variability,diversity,frombasicingredientstofood preparation; impact of customs and traditions on food habits, festive occasions, specificreligiousfestivals,mourning;Kosher,Halalfoods. **Unit2:TRADITIONALMETHODSOFFOODPROCESSING** **9 Hours** Dairy Products- paneer, butter and ghee manufacture; commercial production and packaging oftraditionalbeveragessuchastendercoconutwater,neera,lassi,buttermilk,dahi. **Unit3:TRADITIONALFOODPATTERNS** **9 Hours** Typical breakfast, meal and snack foods of different regions of India, Traditional fermented foods,pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditionalfoods **Unit 4:COMMERCIALPRODUCTIONOFTRADITIONALFOODS** **9Hours** Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozenfoods, Commercial production of intermediate foods – ginger and garlic pastes, tamarind pastes,masalas(spicemixes),idlianddosabatters. **Unit5:HEALTHASPECTSOFTRADITIONALFOODS** **9 Hours** Comparison of traditional foods with typical fast foods / junk foods – cost, food safety, nutrientcomposition,bioactivecomponents;energyandenvironmentalcostsoftraditionalfoods;traditionalfoodsusedforspecific ailments /illnesses. **Text Book(s):** 1. Sen,ColleenTaylor–FoodCultureinIndia‖GreenwoodPress,2005. 2. Davidar,RuthN.–IndianFoodScience:AHealthandNutritionGuidetoTraditional Recipes:EastWestBooks,2001.

FT18R208	**FOUNDATIONOFFOODANDNUTRITION**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**3**
Prerequisite:NIL		**CourseCategories:**OpenElective **CourseType:**Theory			
Course Objective(s)	Studentswillbeabletoapplytheirknowledgeinnutritionindesigningnewrangeofproducts withimprovednutritionalcharacteristics				
CourseOutcome(s)					
CO1	Understandstudentsabouttheimportanceoffoodandnutrition				
CO2	Understandstudentsabouttheimportanceofnutritionandclassificationofnutrition				
CO3	Thestudentwillbeabletounderstandaboutbalanceddiet				
CO4	Enablethemto developdifferentmethodofcooking				
CO5	Enablethemtodevelop newproductsofhigh nutritive value				

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M			M							L		
CO2	M		M			M	L						L		
CO3	M		L			M		L			L		M	M	
CO4	M		L	L		L							M		
CO5	M	L	M	L		H		L			M		M	M	

CourseTopic(s)

Unit1:INTRODUCTIONTOFOODANDNUTRITION 9 Hours

Basictermsusedinstudyoffoodandnutrition,Understandingrelationshipbetweenfood,nutritionandhealth

Unit 2:BALANCEDDIET 9Hours

Functions of food-physiological, psychological and social.,Concept of Balanced Diet, Food Groups,FoodPyramid,FoodExchange List,PrinciplesofMealPlanning

Unit 3:NUTRIENTS 9 Hours

Classification, digestion, absorption, functions, dietary sources, RDA, clinical manifestations ofdeficiency and excess of the following in brief: Energy, Carbohydrates, lipids and proteins,Fatsoluble vitamins-A, D, E and K, Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine,folate,vitaminB12 and vitamin CMinerals– calcium,iron,iodine,fluorineand zinc

Unit4:METHODSOFCOOKING 9 Hours

Dry,moist,fryingand microwavecooking,Advantages,disadvantagesandtheeffectofvariousmethods ofcookingonfoods

Unit 5:NUTRITIONIMPROVEMENTOFFOODS 9 Hours

Nutrientlosses incookingandenhancingthenutritionalqualityoffoods, Fortificationoffoods,Probiotic andPrebioticfoods.

TextBook(s):

1. Bamji MS, Krishnaswamy K, Brahmam GNV (2009). Textbook of Human Nutrition, 3rdedition.OxfordandIBHPublishingCo.Pvt.Ltd.
2. Srilakshmi(2007). FoodScience,4thEdition.NewAgeInternationalLtd.

Referencebook(s):

1. Sizer,F& Whitney, E. (2008).Nutrition:conceptsandcontroversies. (11thed.).Belmont,CA:Wadsworth/Thompson.
2. Millsaps, E.M.(Ed.).(2009).WritingatCarson-Newmancollege. (5thed.). JeffersonCity,TN:Carson-Newman.

FT18R209	FOODPROCESSINGTECHNOLOGY	L	T	P	C
		3	0	0	3

Prerequisite:NIL **CourseCategories:**OpenElective
CourseType: Theory

Course Objective(s)	Tointroducestudentsaboutthemethodsofprocessingandpreservationtopreventfoodwastageandlosses
CourseOutcome(s)	
CO1	Explainthecurrentscenariooffooddemandin India&world.
CO2	Understandtheunitoperationstocontrolthefactorsaffectingfoods.
CO3	ApplyUnitOperationsandUnitProcessesinfoodprocessindustries.
CO4	Explainaboutthepackagingtechnologies for variouskindsoffoods
CO5	Applythemanufacturing techniquesintheproductionofvalueaddedfoodproductsunderaseptic conditionsinfoodprocessindustries.

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M		L		L		M				L	M	M	
CO2	M		L	M						L	L		M	L	
CO3	M		L		M	L					M		L		L
CO4	M		M		L	L					M		L		L
CO5	M	L	M		L	L	H	M			L		M		

CourseTopic(s)

Unit1:INTRODUCTION **9 Hours**
Generalaspectsoffood industry;Worldfoodneedand Indiansituation;Constituentsoffood;Qualityandnutritionaspects;Foodadditiveandstandards

Unit 2:DETERIORATIVEFACTORS **9 Hours**

Deteriorative factorandtheircontrol;Preliminaryprocessing methods;ConservationandPreservationOperations

Unit3:PRESERVATION METHODS **9 Hours**

Preservationbyheatandcold;Dehydration;Concentration;Frying;Drying;Irradiation;Microwaveheating.

Unit4:PACKINGMETHODS **9 Hours**

Sterilizationandpasteurization;Fermentation;Pickling;Packingmethods.Cereal,grains;pulses;Vegetables;Fruits;Spices;Fats andOils.

Unit5:PRODUCTIONANDUTILIZATIONOFFOODPRODUCTS **9 Hours**

Bakery, confectionery and chocolate products; Soft and alcoholic beverages; Dairy products; Meat;poultry and fish products: - Factory Hygiene -Wastewater disposal and pollution control in foodindustry.

TextBook(s):

1.P.J.Fellows.― FoodProcessingTechnology– PrinciplesandPractice‖.WoodheadPublication.3rdedition.2009.

ReferenceBook(s):

1. Toledo, R. T., Fundamentals of Food Process Engineering, Aspen Publishers, 2nd Edition,2002.
2. StephanieClark,StephaineJung,BuddhiLamsal.―FoodProcessing:PrinciplesandApplications‖.WileyBlackwell.2ndEdition.2014.

FT18R210	**COMPOSITION,QUALITY&SAFETYOFFOODS**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**3**

Prerequisite:NIL **CourseCategories:**OpenElective **CourseType:**Theory

Course Objective(s)	Toenablethestudenttounderstandinteractionbetweenconstituentsanditseffectsonfoodquality
CourseOutcome(s)	
CO1	Assesnutritionalqualityoffood andcomposition
CO2	Evaluatesensoryqualitytestwithinstruments
CO3	Setupqualitymanagementsysteminfoodindustry
CO4	Inspectfromraw materialtofinalproductinprocessingline
CO5	Analysisofundesirableconstituentsinfoodduringprocessing

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	H		L			L							M		
CO2		H	M	M	M						M				
CO3		M	H		L	M		M		M	H	M			
CO4		M	H		L	L			L	M	H		M		
CO5	L	M	H			M		M		L	M				

CourseTopic(s)

Unit1:INTRODUCTION **9 Hours**

Ways of describing food quality: Composition, appearance, kinesthetic and flavor attributes.Nutritionalqualityoffoodsanditsassessment(contentandqualityofnutrients). Microbiologicalqualityoffoods.

Unit2:SENSORY **9 Hours**

Sensoryqualityandits evaluation,instrumentalmeasurementofsensoryattributessuchascolor,viscosity,textureetc.

Unit3:QUALITYCONTROL **9Hours**

Qualitycontrol,qualityassuranceandtotalqualitymanagementinfoodindustry.

9Hours

Unit4:DEFECTSINFOODQUALITY

Defectsinfoodquality,itssources,classification,preventionandcontrol.Statisticalqualitycontrol.Qualitycosts.

Unit 5:ANTINUTRITIONALFACTORS **9Hours**

Anti nutritional factors in food. Undesirable constituents developing in Process and storage offood. Microbial contamination, pesticide residues, concept of HACCP, physical, chemical andmicrobiologicalsafetyoffood.

TextBook(s):

1. MarkClute,QualityControlforthefoodindustry,CRCpress,Nov2008.
2. VkJoshi,SensoryScience:PrinciplesAndApplicationInFoodEvaluation,AgrotechBooks,2ndedition,2006

ReferenceBook(s):

1. ElenaCastell-perez,LjubicaDokic,PetarDokic,P.W.Vowsy,RheologyApplicationsToFoodQualityAndProductDevelopment,BlackwellPubProfessional,2010
2. Fenemaowen,Foodchemistry.MarcelDekkerpublication,3rdedition,2005

		L	T	P	Credit

FT18R211	BAKERYANDCONFECTIONARY TECHNOLOGY	3	0	0	3

Prerequisite: NIL **CourseCategories:**OpenElective
CourseType: Theory

Course Objective(s)	Onsuccessfulcompletionofthe subject,studentswillgetexposure abouthowtoprocess bakeryandconfectionaryproducts

CourseOutcome(s)

CO1	Adaptthestandardsandregulations followedinBakeryandconfectionaryindustry
CO2	Utilizebakeryunitprocessingmachineryeffectively
CO3	adaptvariousprocessflowlineinconfectionaryand bakeryproducts
CO4	Handleconfectionaryproducts
CO5	Knowledgeaboutpreparationmethodandqualityaspectofcerealbasedproducts

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M			L		M			L		M		
CO2		M	M			L				M	L		M		
CO3	L	M	M			L				M	L		M		
CO4		H	M			L				M	L		M		
CO5		M	M			L				M	L		M		

CourseTopic(s)

Unit1:BAKERYINDUSTRY **9 Hours**
Currentstatus,growthrate,and economicimportanceofBakeryIndustryinIndia.Producttypes,nutritionalqualityand safetyofproducts,pertinentstandards&regulations.

9Hours
Unit2:BREAD,BUNSAND PIZZABASE
Ingredients&processesforbreads,buns, pizzabase,Equipmentsused,productqualitycharacteristics,faultsandcorrectivemeasures

Unit3:CAKES,BISCUITS,COOKIES&CRACKERS **9 Hours**
Ingredients&processesforcakes,Equipmentsused,productqualitycharacteristics,faultsandCorrectivem easures.Differenttypes oficings.

Unit4:CONFECTIONARYPRODUCTS **9 Hours**
Hard-boiled candies, toffees fruit drops, chocolates and other confectionaries:- ingredients,equipments&processes,productqualityparameters,faultsandcorrectivemeasures.

Unit 5:BREAKFASTCEREALS,MACARONIPRODUCTS ANDMALT **9Hours**

Production and quality of breakfast cereals, macaroni products and malt, Production &quality ofchewingand bubblegums,cocoaproducts,breakfast cereals,macaroniproducts,sproutedgrains.

TextBook(s):

1.Beckette,IndustrialChocolateManufacture,Wiley-blackwellpublisher,3rdedition,20092.FaridiFaubion,Doughrheologyand bakedproduct texture,CBSpublications,1997

RefernceBook(s):

FT18R311	**BEVERAGETECHNOLOGY**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**3**

Prerequisite:FT18R209 **CourseCategory:**OpenElective **CourseType:**Theory

Course Objective(s)	Thestudentsacquireknowledgeofvariousprocessingandpreservationtechniquesforbeverages.
CourseOutcome(s)	
CO1	Process fermentedbeverageswithandwithoutalcohol
CO2	Processfruitjuicesandconcentrateswithprocessequipments
CO3	Processinstant coffeepowderadaptingnewtechnologies
CO4	Adaptnewtechnologytoprocesstea
CO5	Adaptbrewingand fermentationforeffectiveproductionofbeverages

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		M			L		M					H	L	
CO2	M		M		L	L					L		H		
CO3	M		M		L	L					L		H		
CO4	M		M				L				L		M		
CO5	M										L		H		

CourseTopic(s)

Unit1:INTRODUCTION **9 Hours**

Classification,productionandconsumptionofbeverages-Alcoholicbeverages &non-alcoholicbeverages-carbonatedandnoncarbonated.-Conceptoffermentationforproductionofbeverages,legislationofbeverageproducts.

Unit2:FRUITJUICES **9Hours**

Fruit JuicesSquashes&Cordials:Equipment forfruit juices,doubleoperationsprocess-Pulpingequipment,flashpasteurization,fruitbeverage-preparation&preservation-Straining,filtration& clarification- Preservation of fruitjuices preservation by additionofsugar,freezing, bycarbonation&byfiltration.

Unit3:COFFEEANDTEAPROCESSING **9 Hours**

Coffee-Productionpractice,processingofcoffeebeansintopowder,instantcoffee,decaffeination-Tea-Leafprocessing,variousclassesoftea,changesduringprocessingoftealeaves,instanttea.

Unit4:CHEMISTRYOFFERMENTATION **9Hours**

compositionofwine-mold&yeastofgrape&wine-Productionofred&whitetablewine,productionofsherrysparklingwine,desertwinevermouthwine,flavoredwine,fruitwineetc-Nonbacterial&bacterialspoilageofwine-winerybyproducts.

Unit5:BREWING **9 Hours**

FermentedBeverages:Beer–Brewing,rawmaterial&manufacture,storagefinishing& packaging-Brandy&whiskyproduction- Definition,compounds &methodsformanufacturing

TextBook(s):

1. VarmanAlan,andSakesland,Technology,ChemistryandMicrobiologyoffood beverages,Springer(sie)Publisher,2nd edition,2009

Reference(s):

1. GirdharilalandSiddappa,PreservationofFruitsandVegetables,KalyaniPublishers,2001.
2. W.V.Cruees,CommercialfruitsandVegetableproducts,AgrobiosPublishers,2009.

FT18R312	**FERMENTEDFOODPRODUCTS**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**3**
Prerequisite:NIL		**CourseCategories:** OpenElective **CourseType:**Theory			
Objective(s)	Toprovidestudentswiththeskilltoproducesomefoodsanddrinksresultingfrom alcoholicoracidic fermentationprocess.				
CourseOutcome(s)					
CO1	Understandthebasicsoffermentationprocessandtheirbenefits.				
CO2	AdapttheImpactoffermentedproductsanditsbenefits				

CO3	PreservefermentedFoodsbyadaptingtechnologytomeetdemands.

MappingofCourse Objective(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M					L							L		
CO2	L	M						L					L		
CO3	M		M			L					M		M		
CO4			M			M					M		M		
CO5			M			M					M		M		

CourseTopic(s)

Unit 1:INTRODUCTIONTOFERMENTATION **9 Hours**
Definition-benefitoffermentation-nutritivevalueoffermentedfoods-microbialchangesinfermentedfoods-microorganism-proteolytic,liployticand fermentativebacteria.

Unit2:CULTUREMAINTENANCE **9 Hours**
PreparationandMaintenanceofBacterial,YeastandMoldculturesforfoodfermentations.Probiotics - Lactic acid bacteria-activities and health-promoting effects. Mushrooms: Cultivationandpreservation.

Unit3:FERMENTEDPRODUCTS **9 Hours**
Fermented Dairy Products: Cheeses, Curd and Yoghurt,Buttermilk and the fermented milks.Spoilages and effects of fermented dairy products and their control. Fermented meat and fishproducts,Orientalfermentedfoods

Unit4:FERMENTEDDRINKS **9 Hours**
Fermentative Production of Beer, Wines, Cider andVinegar,distilledspirits(eg.Rum,gin,whisky),FermentedVegetables(Pickles).

Unit5:MICROBIALPROTEINS **9Hours**
Production of Baker's Yeast, Microbial Proteins and fats,Foodenzymes(eg.Amylases,protease,lipases,pectinases,rennin),HFCS(HighFructoseCornSyrup)

TextBook(s):

1. SukumarDe,OutlinesofDairyTechnology,OxfordUniversityPressNDelhi,1991.
2. PrescottandDunn,IndustrialMicrobiology,Agrobios(India)publisher,2009

ReferenceBook(s):

1. L.E.Casida,IndustrialMicrobiology,NewAgeInternational(p)LtdNDelhi,2007
2. W.C.frazierandD.C.Westhoff,FoodMicrobiology,TataMcgrawHillpublisher, 3rd

edition,2008.

FT18R313	FOODLAWSANDSTANDARDS	L	T	P	Credit
		3	0	0	3

Prerequisite:FT18R210 **CourseCategories:**OpenElective
CourseType: Theory

Course Objective(s)	Toenablethestudentstounderstand thebasicsoffoodsafetyandregulationsgoverningthesame,the worldover.
CourseOutcome(s)	
CO1	StudentswillbeabletodevelopProtocolsbasedonGMPforFoodProcessingIndustries
CO2	DevelopnewinnovativenormsandEnsureimplementationofadequatesafetyregulations andcontrol.
CO3	Studentswillbeabletorunriskanalysisbasedupondataandstatisticsobtainedfromproduc tionlines.

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M			L		H	M	M	L	M	M	H	
CO2		H						H	M	M	L	M		H	
CO3		M	H					H	M	M	L	M		H	
CO4		M	M					H	M	M	L	M		H	
CO5		M	H				H	H	M	M	L	M		H	

CourseTopic(s)

Unit1:GENERALPRINCIPLESFORFOODSAFETYANDHYGIENE **9 Hours**
Principlesoffoodsafetyandquality-FoodSafetySystem-Qualityattributes-TotalQualityManagement.GoodHygienic Practices,GoodManufacturingPractices

Unit2:HACCP **9 Hours**
HACCP–Introduction,SevenPrinciples,–AOQL(AverageOutgoingQualityLimit)–HACCPplanchart.

Unit 3:INTERNATIONALBODIES **9Hours**
Structure,organizationand practicaloperationofInternationalStandardizationOrganization(ISO),

CodexAlimentarius, WorldTradeorder, WorldHealthOrganization

Unit 4:NATIONALSTANDARDS **9Hours**

FoodstandardsandSpecifications: FSSAI-Structure,Organizationand Functions,PFA,AGMARK,andBISStandards.

Unit5:FOODLABELLINGSTANDARDS **9Hours**

Foodlabelling–Standardsforprocessedfood,irradiated foods,Safetyaspectsofdrinkingwater andIndianregulationsforbottledwater.

Textbook(s):

1. NealD. Fortin. 2009. Foodregulation, WileyPublishers.
2. NaomiRees. DavidWatson.2000.Internationalstandardsforfoodsafety, AnAspenPublications.

ReferenceBook

1. O'Rourke.2005.EuropeanFoodlaw,3rdEdition,Thomson,SweetandMaxwell.

FT18R314	**PACKAGING TECHNOLOGYOF FOODS**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**3**

Prerequisite:NIL **CourseCategories:**OpenElective
CourseType: Theory

Objective(s)	Tostudyaboutthefunctionsofpackaging along withtheinfluenceofvariousfactorsonfood
CourseOutcome(s)	
CO1	UnderstandpackagingmaterialsanditsimportanceinfoodIndustry
CO2	AdaptandutilizepackagingmaterialsforrightapplicationinFoodIndustry
CO3	CheckBarrierpropertiesofPackagingmaterialstoavoidcrosscontaminationwithair ,waterandprintingink
CO4	Standardizetesting methodsforpackaging materialtoassurequality
CO5	Confirmpackaginglawsandregulations meetingstandards

Mapping ofCOsandPos

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M				L							L		
CO2		M	H		M		M						M		
CO3		M	M	L			L						M		

CO4	H		M			L					M		M		
CO5	M		H			H	H	L		L	L			H	

CourseTopic(s)

Unit 1:INTRODUCTIONTOFOODPACKAGING **9 Hours**

Packagingterminology–definition.FunctionsofFoodPackage,Packagingenvironment.Characteristicsoffoodstuffthatinfluencespackagingselection, ShelfLifeEstimation.

Unit2:PACKAGING METHODS **9 Hours**

Active packaging, CAP & MAP. Special packaging methods-vacuum and gaspackaging,shrinkpackage,retortpouches,Biodegradablepackages.

Unit 3:PACKAGINGMATERIALANDTHEIRPROPERTIES **9Hours**

ManufacturingofMetalcans,glasscontainers, plasticcontainersandpouches, paperandpaperboard.Propertiesofplastics,.Filling andsealing ofFlexibleplasticcontainers

Unit 4: PACAKGINGOFFRESHANDPROCESSED FOODS **9 Hours**

Packaging of Fruits and vegetables, Fats and Oils, Spices, meat, Poultry and sea foods, DairyProducts,Bakery,beverages,Dehydratedandfrozenfoods.Liquidandpowderfillingmachines–bottlingmachines,FormFillSeal(FFS)andmultilayerasepticpackagingmachines.

Unit5:ENVIRONMENTALISSUESINPACKAGING **9 Hours**

Packaging Laws and Regulations, Safety aspects of packaging materials; sources of toxicmaterials and migration of toxins into food materials, Environmental & Economic issues,recyclingandwaterdisposal.

TextBook(s):

1. Robertson,G.L.–Food Packaging:PrinciplesandPractice(2nd Edn).Taylor& Francis.2006.

ReferenceBook(s):

1. Han,J.H.—InnovationsinFoodPackaging‖.ElsevierAcademicPress,2005.
2. Ahvenainen,R.—NovelFoodPackagingTechniques‖.CRCPress.2003.

.Coles,R.,McDowell,D.andKirwan,M.J.—FoodPackagingTechnology‖.CRCPress.2003.

FT18R315	NUTRACEUTICALSANDFUNCTIONAL FOODS	L	T	P	C
		3	0	0	3

Prerequisite:FT18R208 **CourseCategories:**OpenElective
CourseType: Theory

Course Objective(s)	Describe the research on the health benefits of functional foods andnutraceuticalsidentifyingstrengths,limitationsandfuturedirections
CourseOutcome(s)	
CO1	Understandaboutfunctionalfoodsand itsproperties
CO2	UnderstandregardingMetabolicdisordersanditsrelation withfunctionalfoods
CO3	LearnthebenefitsoffortificationinFoodsupplements
CO4	Utilize foodwastefornutritionenrichment
CO5	UnderstandtheimportanceofPrebioticandprobioticfoods

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M		L		L							L		
CO2		M	H			M		H		M		L	L	L	
CO3	M	M				M		M			M	L		L	
CO4	L		M			M	L	L			L	L	L		
CO5	L		M			M	H	M			M	M	M		

CourseTopic(s)

Unit 1:NUTRACEUTICALS:HISTORICAL,TELEOLOGICALASPECTSANDCLASSIFICATION 9Hours

Introduction – Historical Reviews - Teleology of nutraceuticals - Organization models fornutraceuticals–Classification of Nutraceuticalsbasedon thesources–Animal,PlantandMicrobial–Nutraceuticalsinspecificfoods.

Unit2:FOODRECOMMENDEDFORMETABOLIC DISORDER 9 Hours

Food recommended and restricted in metabolic disorders and disturbances, gastrointestinaldisorders; fever and infection; liver, gall, bladder and pancreatic disturbances; blood, circulatoryandcardiacdiseases;urinaryandmusculoskeletaldiseases;allergies.

Unit 3:NUTRITIONALDEFICIENCIES 9 Hours

Nutritional deficiencies and its correction trough fortification and supplementation of foods.Beneficialeffectofspices,honey,spirulina etc.

Unit4:HEALTHBENEFITSOFMICRONUTRIENTS 9 Hours

Healthbenefits/mode ofactionofPUFA/gammalinolenicacids, antioxidants,dietaryfiber,oligosaccharides,sugaralcohols,peptidesandproteins,glycosides,alcohols,iso-prenoidesandvitamins,choline,LAB,phenolics,flavonols,minerals

Unit5:HERBSASFUNCTIONALFOODS 9 Hours

Herbal medicine – Herbs as ingredients in functional foods – actions of herbal and evidence ofefficacy, Cruciferous vegetables and cancer prevention, Evolution of marketing environmentforFunctionalfoodsandNutraceuticals,Potentialproductpositioning.

TextBook(s):
Robert E.C Wildman. Handbook of Nutraceuticals and Functional Foods, Ed., Robert E.C.Wildman,CRC PressLLC.ISBN–0849387345,2001.

FT18R410	**PROCESSINGOFMARINEPRODUCTS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Prerequisite:FT18R209 **CourseCategories:**OpenElective
CourseType: Theory

Course Objective(s)	To understand about the composition, nutritive value and processing technologyofmarineproducts
CourseOutcome(s)	
CO1	Thestudentwillbeabletounderstandabout thecompositionofmarineproducts
CO2	Thestudentwillhaveknowledgeontheprocessingof marine and theirbyproducts
CO3	Examinethequalityofmarineproductsandqualityissuesinpostproductionandfactors affectingthequality

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M												L		
CO2	M					L	H						M		L
CO3	M	M		L	L						L		L	L	
CO4	L		M								M		M		
CO5	L	M	M	L	L						L		M		

CourseTopic(s)

Unit1:INTRODUCTION **9 Hours**
Chemistryofseafoodcomponents- Proteins,Lipids.
Proteinhydrolysisinseafoods,oxidationoflipidsinseafoods.Flavoroffish-Tasteactivecomponent

PROCESSINGOFBY-PRODUCTS **9 Hours**
Fish By-products: Protein, Peptides, Collagen and Gelatin, Fish oil. Crustaceans By-products:ChitinandChitosan,Seaweedby-products andtheirapplications.

Unit 3:QUALITYOFSEAFOODS **9Hours**

Freshnessqualityofseafoods-Appearance, Color,Texture,OdorandFlavor,Destructiveslowanalyses,Alternativemethods.Factorsaffecting thelossofqualityinseafoods.

Unit 4:PRESERVATIONOFSEAFOOD **9Hours**

Chillingoffreshfish, Freezingandfrozenstorage,Dryingofseafoods,Smokingandothermethodsofpreservation

Unit5:CANNING OFSEAFOODS **9 Hours**

Introduction, Unit operations in the canning process- primary processing, heat treatment, packingand sealing, cooling. Production of canned sea foods – Mackerel, Salmon, Tuna, Shrimp andclams.

TextBook(s):

1. ShahidiandJ.R.Botta,-Seafoods:Chemistry,Processing,TechnologyandQuality‖, SpringerScienceBusinessmedia,1996.
2. 2.ZdzislawE.Sikorshi,—Seafoods:Resources,NutritionalComposition,andPreservation‖,CRC Press,2004.

FT18R411	**NANOTECHNOLOGYINFOOD PROCESSING**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**3**

Prerequisite:FT18R210 **CourseCategories:** Honours **CourseType:**Theory

Course Objective(s)	Thestudentwillbeableto workinnanotechnologyprinciplesandindustry applications
CourseOutcome(s)	
CO1	Understandingaboutbasicofnanotechnology
CO2	Understandaboutnanoparticlesstructures
CO3	Applykeyconceptsofnanotechnologyinfoodpackaging
CO4	UnderstandtheEthicalbehaviorstobefollowedinnanotechnology
CO5	Understand theregulationsofnanotechnologyin foods

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M	L	H	L							M		L
CO2	H		M	L	H	L					M	M			H
CO3		M	H	L	H	L					M	M			H

CO4	L		M	L	H	L		H				M		M	
CO5			H	L	H	L		M		L	M			M	

CourseTopic(s)

Unit 1:BASICSOFNANOTECHNOLOGYANDNANOSTRUCTURES INFOOD

9 Hours Background-Evolutionofnewtechnologiesinthefoodsector,Publicperceptionofnanotechnologyfood products, Nanomaterials for food applications-Nano-sized food ingredients and additives,Naturallyoccurringfoodnanosubstances andnanostructure

Unit2:NANOSENSORS 9Hours

Introduction-Sensors- Biosensors-Enzyme biosensors and diagnostics-DNA-based biosensors anddiagnostics-RFID- Integrated nano sensor networks, detection and response-Nano sensors for foodquality-Transductionprinciples.

Unit3:NANOTECHNOLOGY INFOODPACKAGING 9Hours

Introduction-Reasonstopackagefoodproducts-Physicalpropertiesofpackagingmaterials-Antimicrobialfunctionality-Visualindicators-Improvementofmechanicalpropertiesthroughnanocomposites,nano-structuredcoatings,Activepackagingmaterials-Intelligentpackagingconcepts.

Unit4:NANO-ETHICS 9 Hours

Nano-ethics-Historicalbackground-Identifyingandavoidingunethicalnanotechnologicalproducts-Ensuringethicalnanotechnologicalresearch, innovationandproduction-Nano-ethicsasthequestionofthegoodnanotechnologicalsociety

Unit5:APPLICATIONS 9 Hours

Current and projected applications of nanotechnology for the food sector-Potential health risks andgovernance ofrisks-Regulationspertainingtonanofoodsthe worldover

Text Book(s):

QasimChaudhry,LawrenceCastleand RichardWatkins,–NanotechnologiesinFood‖publishedby RoyalSocietyofChemistry,2010.

ReferenceBook(s):

Lynn J.Frewer,Willem,Norde,ArnoutFischer,andFrans Kampers,–NanotechnologyinAgri-FoodSector‖PublishedbyWiley-VCHVerlagGmbH&co.KGaAHoschstr,2011.

FT18R412	ENVIRONMENTAL POLLUTIONCONTROL	L	T	P	Credit
		3	0	0	3

Prerequisite:FT18R313 **CourseCategories:**OpenElective
CourseType: Theory

Course Objective(s)	Toenablethestudenttounderstandenvironmentalpollutioncontrolinfoodindustries
CourseOutcome(s)	
CO1	Utilize byproductsfromcereals,pulses,oilseeds,fruitsandvegetables
CO2	Manageindustrialwastefromfoodindustries
CO3	Use ofbiologicaloxidationsystem
CO4	Useadvanced wastewatersystembyusingphysicchemicalmethods
CO5	Analyzeenvironmentalissuesthatleadtoglobalwarming,acidrainandgreenhouseeffects

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M				H						M		
CO2		M	M			L	H	M		L				M	
CO3		M	M				H				M		L		
CO4	M		M	M			H	M			M		L		
CO5			M			L	H	H						M	

CourseTopic(s)

Unit 1:FOODWASTEFROMINDUSTRIES **9 Hours**

Characterization and utilization of by-products from cereals, pulses, oilseeds, fruits,Vegetables,plantation,dairy,eggs,meat,fishand poultryprocessing industries.Elementsofimportanceinefficientmanagementofwastesfromaforesaidfoodindustries.

Unit 2:POLLUTION ANDITS ABATEMENT **9 Hours**

Standardsforemissionor dischargeofenvironmentalpollutantsfromfoodprocessing Industriescoveredunder EPA. Characterizationoffoodindustrieseffluents, intermsofparametersofimportance.

Unit3:PRIMARYTREATMENTSOFEFFLUENT **9 Hours**

Screening,sedimentation,floatationasperandprimarytreatments,biologicaloxidations:– objectives,organisms,reactions,oxygenrequirements,aerationdevices.

Unit4:ADVANCEDWASTEWATERSYSTEMS **9 Hours**

Effect on characteristic parameters of effluents in treatments using lagoons, trickling filters,activated sludge process, oxidation ditches, rotating biological contracters and theirs variationsandadvancedmodifications.Coagulationandflocculation,disinfection,handlinganddisposa lofsludge andtreatedeffluents ConformingtoEPAprovisions.

Unit5:ENVIRONEMENTALETHICSFORSUSTAINABLEDEVELOPMENT9Hours
Environmentalethics-issuesandpossiblesolutions-populationexplosion,climaticchange, ozone layer depletion,globalwarming,acidrainand greenhouse effect. Sustainable development:definition, objectives and environmental dimensions of sustainable development-environmentalauditforsustainabledevelopment.

TextBook(s):

1. Foodprocessing wastemanagement AVI Publishers,West GreenJH,KramerA,
2. VassoOreopoulou,WinfriedRuss,(Eds.),Utilizationofby-productsandtreatmentofwasteinthefoodindustry,Springer,2007.

Reference(s):

1. NFGray,Watertechnology:AnintroductionforScientists,Elsevier,2005.
2. KCAgarwal,Environmentalpollution,VedamsBooks,2001.

FT18R413	TECHNOLOGYOFFOODEMULSIONS, FOAMS ANDGELS	L	T	P	Credit
		3	0	0	3

Prerequisite:FT18R272 **CourseCategories:**Honours
CourseType: Theory

Objective(s)	Toimpart basicknowledgeregardingfooddispersionsystems,their formation,behaviorandfactorsaffectingtheirstability.
CourseOutcome(s)	
CO1	Tounderstandaboutfooddispersions
CO2	Tounderstandaboutfoodemulsions
CO3	Tounderstand aboutfoamandstructure
CO4	Tounderstandaboutstructureofgel
CO5	Tounderstandabouttheoryofgelformation

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H												M		
CO2	H												M		
CO3	H										L		M		L
CO4	H										M		M		L
CO5	H										M		M		

CourseTopic(s)

Unit 1:FOODDISPERSIONS **9 Hours**
Fooddispersions,theircharacteristicsandfactorsaffectingfooddispersions.

Unit 2:FOODEMULSIONS **9 Hours**
Foodemulsions;emulsifiersandtheirfunctionsinfoods;theHLBconceptinfoodemulsifiers;emulsionformationandstability;polymers andsurfectants.

Unit 3:FOAMANDSTRUCTURES **9 Hours**
Milk foamsandtheirapplications,structureoffoams,egg foamsanduses,foamformationandstability.

Unit4:STRUCTUREOFGELS **9 Hours**
Structureofdairyfoodsrepresentingemulsions,foamsandgels;physicalstructureoffatrich,concentrated,fermented,coagulatedanddriedproducts.

Unit 5:THEORYOFGELFORMATION **9Hours**

Theoryofgelformation;pecticsubstancesandjellies;fruitpectingels;milkjellies.

TextBook(s):

1. StigE.Friberg.,KareLarssonandJohanSjoblom.–FoodEmulsions‖.CRC Press .2003.
2. DavidJulianMcClements.―FoodEmulsions‖.CRCPress.1998.

ReferenceBook(s):

1.BlanshardJMV&LillfordP.―FoodStructureandBehaviour‖.AcademicPress.1987

FT18R414	NANOTECHNOLOGYINFOOD PROCESSING	L	T	P	Credit
		3	0	0	3

Prerequisite:FT18R251 **Course Categories:**Honours
CourseType: Theory

Course Objective(s)	Thestudentwillbeableto workinnanotechnologyprinciplesandindustry applications
CourseOutcome(s)	
CO1	Understandingaboutbasicof nanotechnology
CO2	Understandaboutnanoparticlesstructures
CO3	Applykeyconceptsofnanotechnologyinfoodpackaging
CO4	UnderstandtheEthicalbehaviorstobefollowedinnanotechnology
CO5	Understand theregulationsofnanotechnologyin foods

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M	L	H	L							M		L
CO2	H		M	L	H	L					M	M			H
CO3		M	H	L	H	L					M	M			H
CO4	L		M	L	H	L		H				M		M	
CO5			H	L	H	L		M		L	M			M	

CourseTopic(s)

Unit 1:BASICS OFNANOTECHNOLOGYANDNANOSTRUCTURESINFOOD9 Hours
Background-Evolutionofnewtechnologiesinthefoodsector,Publicperceptionofnanotechnologyfood products, Nanomaterials for food applications-Nano-sized food ingredients and additives,Naturallyoccurringfoodnanosubstances andnanostructure

Unit2:NANOSENSORS 9 Hours
Introduction-Sensors- Biosensors-Enzyme biosensors and diagnostics-DNA-based biosensors anddiagnostics-RFID- Integrated nanosensor networks, detection and response-Nanosensors for foodquality-Transductionprinciples.

Unit3:NANOTECHNOLOGY INFOOD PACKAGING 9Hours
Introduction-Reasonstopackagefoodproducts-Physicalpropertiesofpackagingmaterials-Antimicrobialfunctionality-Visualindicators-Improvementofmechanicalpropertiesthroughnanocomposites,nano-structuredcoatings,Activepackagingmaterials-Intelligentpackagingconcepts.

Unit 4:NANO-ETHICS **9Hours**

Nano-ethics-Historical background-Identifying and avoiding unethical nanotechnologicalproducts-Ensuring ethical nanotechnologicalresearch,innovation and production-Nano-ethicsasthe questionofthegoodnanotechnologicalsociety

Unit5:APPLICATIONS **9Hours**

Currentand projectedapplicationsofnanotechnologyforthefood sector-Potentialhealthrisksandgovernance ofrisks-Regulationspertainingtonanofoodsthe worldover

TextBook(s):

QasimChaudhry,LawrenceCastleandRichardWatkins,–NanotechnologiesinFood‖publishedby RoyalSocietyofChemistry,2010.

ReferenceBook(s):

Lynn J.Frewer,Willem,Norde,ArnoutFischer,andFrans Kampers,–NanotechnologyinAgri-FoodSector‖PublishedbyWiley-VCHVerlagGmbH&co.KGaAHoschstr,2011.

FT18R415	**DRYINGTECHNOLOGY**	**L**	**T**	**P**	**Credit**
		3	**0**	**0**	**3**

Pre-requisite:FT18R372 **CourseCategories:**Honours **CourseType:**Theory

Course Objective(s)	Toenablethestudenttounderstandbasictheoryofdryinganditssignificanceinfoodsystems
CourseOutcome(s)	
CO1	Understandtheimportanceofdryingasamethodoffoodprocessing
CO2	Understandtheprincipleandworkingofvarioustypesofdryers.
CO3	Applytheknowledge ondrying technologyinvariousfoodindustries.
CO4	Understandand applytheprincipleoffreezedrying intheindustry
CO5	Understandandapplythefluidizedbeddryingtechnologyintheindustry

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M	H									M		L
CO2	M		H		M						M		M		L
CO3	M		M		M						M		M		L
CO4	M		M		M						M		M		L

CO5	M		M		M						M		M		L

CourseTopic(s)

Unit1:BASICSOFDEHYDRATION **9 Hours**

Principlesofdrying–Fundamentalsofair-water mixtures–psychrometricchart–Heatand mass transfer in ideal dryers – with and without recirculation. Theories of drying – constant andfalling rate period - diffusion theory, capillary theory, evaporation – condensation theory, Luikov,PhilipandDeVriestheoryWatercontentinfoodsanditsdetermination–Theoreticalandempiricalmodelsfordeterminingwateractivity

Unit 2:CABINET,VACUUMANDDRUMDRYINGOFFOODS **9 Hours**

Fundamentals of cabinet drying – Mass and Heat balances in dryers (batch and continuous)(simple problems only) – description of batch and continuous dryers – Application in Foodindustry–VacuumandDrumdriers

Unit3:SPRAY DRYINGOFFOOD **9 Hours**

Fundamentals–Nozzles,Rotaryatomizersandtwofluidfeeds-Interactionofdropletswithair-Drying of droplets with soluble and insoluble solids – Microstructure of spray driedproducts –Reconstitution–Foamspraydrying–ApplicationsintheFoodindustry

Unit4:FREEZEDRYINGOFFOODS **9 Hours**

Fundamentalsoffreezedrying–Freezinganddryingsteps–Combinedheatandmasstransfer(onlytheory)–Structuralchangesandvolatileretentionduringfreezedrying–Freezedehydrationrelatedprocesses :prefreezing, preconcentration, condensation, defrosting– Industrial freeze driers – Atmosphericfreeze drying-Applicationsinfoodindustry

Unit5:FLUIDISEDBEDDRYING, MICROWAVEDRYINGANDEXTRUSIONOFOODS **9 Hours**

Fluidised beddrying– BatchandContinuousdryers–Pneumaticdryer.Extrusioncooking–SingleandTwin-screwextruders Packagingofdehydratedproducts

TextBook(s):

1.Y.H.Hui:*Food DryingScienceand Technology,Microbiology,Chemistry,Application,* CHIPS(2008)

ReferenceBook(s):

1. ArunS.Mujumdar:*HandbookofIndustrialDrying*,3rdEdition,CHIPS(2006)

FT18R416	FOODTOXICOLOGY	L	T	P	Credit
		3	0	0	3

Pre-requisite:FT18R371 **CourseCategories:**Honours

CourseType: Theory

Course Objective(s)	Theobjectiveofthecourseistointroducefoodrelatedtoxicologicalcompounds
CourseOutcome(s)	
CO1	Understandaboutfoodtoxicologyanditshazards
CO2	Understandaboutfoodsensitivityandallergy
CO3	Analyzefoodtoxininfoodsamples
CO4	Adaptingtoxinformedduringprocessingandcontrolling

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		M			L	H						L	M	
CO2	M		M			L	M	L						M	
CO3		M	M	L			M							H	
CO4		M		M		L	H			L				H	
CO5			H	M			H	L		L		M		H	

CourseTopic(s)

Unit1:INTRODUCTION **9 Hours**

Definition and need for understanding food toxicology; Hazards - Microbiological, nutritionalandenvironmental.Basicsofimmuneresources- humoralandcellmediaresources. Allergenandmechanismofallergicresources.

Unit2:FOODALLERGYANDSENSITIVITY **9 Hours**

Chemistryoffoodallergens,celiacdisease,fooddisordersassociatedwithmetabolism,lactose intolerance,andasthma

Unit 3:PRINCIPLESOFTOXICOLOGY **9 Hours**

Natural food toxicants - toxicity of mushroom alkaloids, seafood, vegetables, fruits, pulses,andantinutritionalcompounds.Biologicalfactorsthatinfluencetoxicity,toxinabsorptionint heG.I.track,Industrialmicroflora,blood,brainbarrier,storageand excretionoftoxins

Unit4:DETERMINATION OFTOXICANTS INFOODSAMPLING **9Hours**

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

Unit5:TOXICANTSFORMEDDURINGFOODPROCESSING **9 Hours**

Intentional direct additives, preservatives, nitrate, nitrite, and N- nitroso compound flavourenhancers,foodcolours,indirect additives,residuesandcontaminants,heavymetals,other organicresiduesandpackagingmaterials.Toxicityofheatedandprocessedfoods,foodcarcinogensand mutagens – Polycyclicaromatic hydrocarbons, N - nitrosamines, Acrylamide and their mode ofaction

Textbook(s):

1. Shibamoto,TakayukiandLeonardF.Bjeldanzes–IntroductiontoFood Toxicology‖2nd Edition.AcademicPress,2009.
2. Alluwalia, Vikas–FoodHygieneandToxicology‖ParagonInternationalPublishers,2007

ReferneceBook(s):

1.Helferich,WilliamandCarlK.Winter–Food Toxicology‖CRC Press,2001.

FT17R417	**EXTRUSIONTECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
requisite:FT17R381		**CourseCategories:**Honour **CourseType:**Theory			
Objective(s)	Toenabletostudentstodevelop extrudedproductswithdifferentfoodingredients				
CourseOutcome(s)					
CO1	Studyabouttheprinciple,andmethodsofextrusiontechnologytoidentifytheproductspecificextruder				
CO2	Knowledgeaboutdesignextruders				
CO3	Knowledgeaboutimpact ofphysio-chemicalcharactersoffoodingredientsand Processparametersonqualityofextrudedproductstooptimize the processparametersforcostandqualityoptimization				
CO4	Understandtheimpact ofprocessparametersonNutritionalaspectextruded producttodesignthevalueaddedextruded products				
CO5	UnderstandtheApplicationsandAdvantagesofExtruders				

Mapping ofCOsandPos

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H	M	H								M		

CO2		M	M	M	H								M		
CO3	M		M	M	H								M		
CO4	H			M	H								M		
CO5	H		M	M	H		M				M	M	M		M

CourseTopic(s)

Unit 1:Introduction **9 Hours**

Definitionofextrusion,Principleofextrusion,functionsandadvantagesofextruders,Componenets of extruder, classification of extruders: single screw, twin screw, cold extruder,extrudercooker,pressureclassification

Unit2:BasicsofExtruderdesign **9 Hours**

Rheology of feeds, modeling of feed flow in extruder, Isothermal Newtonian flow, Correctedflow equation, Leakage flow, Isothermal Non Newtonian, Modelling of input power, Design ofDie:diecharacteristics andeffects

Unit3:Compositionandphysicalrequirementsofextruderfeeds **9Hours**

Preconditioningofextruderfeeds,benefits,typesofpreconditioners(atmosphericandpressurized,single/doubleshaft,DDDS,Effectsofextruderparametersandfeedcompositioncharacteristics of extruded products: gelatinization of starch feeds, denaturation of protein feeds**Unit 4:Changescausedbyextrusion** **9Hours**

Structural changes – expansion, texturization etc. and nutritional changes in carbohydrates,protein,lipid,vitamins,minerals,antinutritionalfactors

Unit 5:Applicationofextrusiontechnology: **9Hours**

Food–Proteinbased,sugarbasedandcerealbased(Ex.RTEBreakfastcereals,meatsubstitutes,texturedplantandmilkproteins,specialtyfoods,toffee,surimi,snacksetc.,)Precooked/thermally modified starch, flours and grain. Animal feed- pet foods, aquatic feed,cattlefeed.Qualityimprovement–Texturealteration,Enzymesinactivation,partialdehydration,Homogenization,Proteindenaturing,Gelatinization,destructionofmicrobesandtoxiccompounds.

TextBook(s):

1. MedeniMaskan, Aylin Altan**-** Advances in Food Extrusion Technology - CRC Press(2016)
2. N.D.Frame- TheTechnologyofExtrusionCooking- Springersciencebusiness media(2012)

Reference(s)

Jean-MarieBouvierandOsvaldoH.Campanella-ExtrusionProcessingTechnology:FoodandNon-FoodBiomaterials–Wiley–(2014).

FT18R418	REFRIGERATIONAND COLDSTORAGE	L	T	P	Credit
		3	0	0	3

Prerequisite:FT17R372 **CourseCategories:**Honours
CourseType: Theory

Objective(s)	1. Toenablethestudentstounderstandthevariousconceptsbehindrefrigerationandcoldstorageconstruction. 2. Oncompletionofthesubject,thestudentswill beableto applytheir knowledgeoncoldstorageofperishableproducts.

CourseOutcome(s)

CO1	Toenablethestudentstounderstandthevariousconceptsbehindrefrigerationandair conditioning.
CO2	Thestudentswillbeabletodesignrefrigerationandcoldstoragesystems
CO3	To studythevariousrefrigerationsystems
CO4	Thestudentswillbeabletounderstandfreezinganddifferenttypesoffreezerused
CO5	Toenablethestudentsto understandthevariousconceptsbehindcoldstorageconstruction,design,maintenance,andapplicationsin foodindustry.

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M			L		L							M		
CO2	M			M		L	M				M	M	M		
CO3	M			L		L		L			H		M		
CO4	M			L		L							M		
CO5			M			L		M			M	M	M		

CourseTopic(s)

Unit1:REFRIGERATOR **9 Hours**
Thermodynamic principles of refrigeration, Refrigeration cycles, Refrigerants and Equipments-COP-Atmospheric airanditsproperties,Psychometrics

Unit2:COLD STORAGE **9 Hours**
Cold Storage- construction, design, prefabricated systems. Freezer storage, pre-cooling and prefreezing. Cold storage practice, stacking and handling of materials, optimum temperatures forfoods.Storages-operationandmaintenance

Unit 3:CHILLING **9 Hours**

Chilledfoods-equipment,Secondary refrigerants,directexpansion,transportanddisplaycabinets - microbiology, packaging - Hygienic design considerations for chillers and chilledStorages-Evaporative coolingandits applications.

Unit4:FREEZING **9 Hours**

Freezing equipment, Freezing rates, ice crystals, quick freezing, cryogenic Freezing, freezing ofdifferentfoods.

Unit5:PRESERVATION **9 Hours**

Preservation of different products - dairy plant refrigeration system, meat and poultryrefrigerationsystem,seafoodrefrigerationsystem

TextBook(s):

1. Da-WenSun, HandbookofFrozenFoodProcessingandPackaging, SecondEdition,CRCPress,TaylorandFrancisGroup,2012.
2. C.P.Mallet,FrozenFoodTechnology,SpringerLondon,Limited,2012.

ReferenceBook(s):

1. William C. Whitman, William M. Johnson, John A. Tomczyk, and Eugene SilbersteinRefrigerationandAirConditioningTechnology,SixthEdition,Delmar,Cengage Learning,2009
2. JudithA.Evans,FrozenFoodScienceandTechnology,BlackwellPublishingLtd,2008.

FT18R419	POSTHARVESTPESTMANAGEMENTINFOOD SAFETY	L	T	P	C
		3	0	0	3

Prerequisite:FT18R371 **CourseCategories:**Honours

CourseType: Theory

Courseoutcomes:

OnSuccessfulcompletion,studentscanbeableto
CO1:describeand analyzepeststhatdamageagriculturalproduces.CO2: analyzemethodstocontrolpestsofcerealsandpulses
CO3: analyzemethodsto controlpestsofvegetables,oilcropsand spicesCO4: analyze methods to control pests of tropical and sup tropical fruitsCO5:describeintegratedandinnovativepestmanagementconcepts

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M		L		M	M	L			M	M	L	L	
CO2		M	M	L		M	M			L			L	L	
CO3		M	H	L		M	M			L			L	L	
CO4		M	H	L		M	M			L			L	L	
CO5		M	M	L		M	M			L	M		L	L	

Unit I Definition of pests, classification of insects, diagnostic characters of arachinda anddiploma. Some knowledge of phytophagous, mites, slugs and snails, crows, parrots, rats,miceandungulates.Pathwayofpestentry,riskanalysis,preventionofentry,pestfreeareas,A n introduction of acaricides, rodenticides, weedicides, fumigants etc. insect growthregulatorslikerepellents,attractants,inhibitorsetc.

Unit II Insect pests of cereals and pulses including nature of damage life history of importantpestsandphysical,mechanical&biologicalcontrol.

Unit III Insects pests of vegetables, oil crops and spices with nature of damage, physical,mechanical & biological control and life history of at least two important pests from eachcategory

Unit IV Insects pests of tropical and sub-tropical fruits including nature of damage. physical,mechanical & biological control and life history of at least two important pests from eachcategory

Unit V Components of Integrated pest management(IPM) -implementation of IPM, legalapproach- sanitary and phytosanitory measures (SPS) measures and quarantine concepts,health approach- pesticide residual effects, pest management informatics, Innovative pestmanagementconcepts–

TEXTBOOKS

1.L.R.VermaandV.K.Joshi,(Eds).,PostHarvestTechnologyofFruitsandvegetables,IndusPublishingcompany,NewDelhi,2000.

2. MirceaEnachescuDauthy,"FruitandVegetableProcessing"FAOAgriculturalServicesBulletinNo.119,1995

3. Pantastico,E.C.B.,Postharvestphysiology,handlingandutilizationoftropicalandsubtropicalfruitsandvegetables.AViPub.Co,1975.

4. Birch,G.andCampbell-Platt,G.(Eds.).,FoodSafety- theChallengeAhead. InterceptLtd.,Andover,England.,1993

REFERENCES

1.Hand bookofFooddehydrationand drying,NIIRboard,2000.

2.PHPandey,PostHarvestTechnologyofFruitsandVegetables(Principlesandpractices),KalyaniPublishers,NewDelhi,1998

FT18R420	FOODMATERIALSCIENCE	L	T	P	Credit
		3	0	0	3
Prerequisite:FT18R272		**CourseCategories:**Honours **CourseType:**Theory			
Course Objective(s)	Enablethestudentstounderstandfoodswithmodifiedtexturalproperties				
CourseOutcome(s)					
CO1	Describethestructuralpropertiesoffoodsmaterials				
CO2	Analyzeanddescribethestructuralrelationshipandemulsion				

CO3	Describethecompositepropertiesoffoods
CO4	Describethestructuralpropertiesofdifferentfoods
CO5	DescribeandAnalyzethekineticsofmaillardreaction

MappingofCourseOutcome(s):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		M	M									M		
CO2		M	M	M							L		M		
CO3	L		M	L									M		
CO4	L		M	L							L		M		
CO5	M			L						M	L		M		

CourseTopic(s)

Unit 1: Compositestructureofbiologicaltissueusedforfood,foodpolymers-fringedmicellestructural model, state diagram of food materials, concept of glass transition, crystallizationkinetics,dynamicmaps,interfacialproperties

Unit2: Structurepropertyrelationshipinfood,structureinwaterbygelation, bubblecontainingfood,emulsions,fatcrystalnetwork,processingoffoodpowder

Unit3: Foodstructuring-compositematerials,factorsaffectingcompositematerials,typesofcomposite-particulate,fibrous,laminate.Solid,foamandsponges.

Unit4: Structuringfoodproducts-dairyproducts,cereal, dairy,meat, chocolate.

Unit5: Maillardreaction,streckerdegradation,flavorformationviamaillardreaction,roleofkineticmodellinginmaillardreaction

TextBook(s):

1. Aguilera**,José Miguel,**Lillford**,PeterJ.(Eds.),** FoodMaterialsSciencePrinciplesandPractice,**(2008)**

2. Pieter Walstra ,Physical Chemistry of Foods (2002)

ReferenceBook(s):

Hans-DieterBelitz,WernerGrosch,PeterSchieberleandpublished,Springer,FoodChemistry(4threvisedand extendededition)2009.