PERIYARUNIVERSITY

PERIYARPALKALAINAGARSALEM
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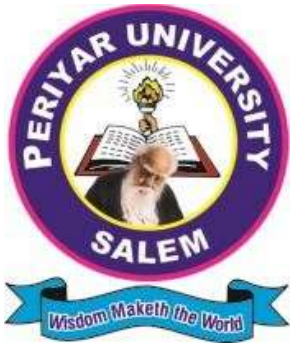

SYLLABUSFOR

B.Sc.FoodTechnology

CHOICEBASEDCREDITSYSTEMOUTCOMEBASEDEDUCATION

(ForCandidatesadmittedintheCollegesaffiliatedtoPeriyarUniversityfrom2021-2022onwards)

CONTENTS

		MicrobiologyPractical	
NON-MAJORELECTIVECOURSES(ForOtherMajor)			
III		***NMECI***FoodPreservation	
IV		***NMECII*** FoodSafetyInitiatives	

REGULATIONS

1. Preamble:

B.Sc. Food Technology curriculum has been structured in compliance withUGC Model curriculum and TANSCHE guidelines. Core courses addressesthe science of food, food chemistry, food engineering, food processing andfood preservation, food safety and quality assurance, food innovation, foodpackaging, technology of cereals, pulses, oilseeds, fruits, vegetables, egg,milk, fleshy foods, spices and condiments and food entrepreneurship.

Theprogrammeempowersthecapacityofthestudentsasperthejobrolespecific requirementsoffoodindustries.

2. EligibilityforAdmission

CandidatesforadmissiontothefirstyearoftheDegreeofB.Sc.FoodTechnologys hallberequiredtohavepassedtheHigherSecondaryExaminations conducted by the Government of Tamil Nadu or any otherequivalentexamination.

AsperGovernmentOrder(2020-2021)G.O.(1D)No.110,HigherEducation(G1)Department,dated18.07.2020.

- **General Stream:** ChemistrywithSciencesubjectslikeBiology/Home Science/Botany and Zoology/ComputerScience/Computer Applications/Microbiology/Food ServiceManagement/NutritionandDietetics
- **VocationalStream:**Agriculture/HomeScience/EngineeringandTechnology

3. EligibilityfortheAwardoftheDegree

A candidate shall be eligible for the award of the Degree only if she hasundergone the prescribed course of study for a period of not less thanthreeacademicyears,passedtheexaminationsofallthesixsemesterspresc ribed.

4. CourseofStudy

ThemainstreamsofstudyforB.Sc.FoodTechnologyshallconsistofthefollowing :

PART-I:

Tamil/OtherlanguagesP

ART-II: English

PART-III: CoreCourses,ElectiveCoursesandAlliedCourses
PART-IV: SBEC*/NMEC**/Add-oncourse/EVS***/ValueEducationPART-V:
ExtensionActivities:NSS/NCC/Sports/YRCandother Extracurricularactivitiesofferedunderpart Vofthe programmes

*SkilledBasedElectiveCourse
**NonMajorElectiveCourse
***EnvironmentalScience

Nonmajorelectivecoursemaybechosenbyotherstreamstudentsoftherespectivecollegesandthesamemustbecommunicatedtothe University.

5. Examinations

Semester pattern is adopted for examinations. Candidates failing in anycourse will be permitted to appear for such failed course at subsequentexaminations.ExaminationsforI,IIIandVsemesterswillbeheldinNovember/ December and for II, IV and VI semesters will be held in April /Maymonthofeveryyear.

RequirementtoappearfortheexaminationA candidateshall bepermittedtoappearfortheuniversityexaminationsforanysemester(practical/ theory) if he / she secure not less than 75% of attendance in thenumberofworkingdaysduringthesemester.

6. PassingMinimum

Acandidatewhosecuresnotlessthan40%intheEndSemesterExamination (ESE) and 40% marks in the ESE and Continuous InternalAssessment (CIA) put together in any course of Part I, II, III& IV shall bedeclaredtohavepassedtheexaminationinthecourse(TheoryorPractical).

7. ClassificationofSuccessfulCandidates

Candidates who secure not less than 60% of the aggregate marks in thewhole examination shall be declared to have passed the examination inFirstClass.Allothersuccessfulcandidatesshallbedeclared to havepassedintheSecondClass.Candidateswhoobtain75%ofthemarksinthe aggregate shall be declared to have passed the examination in FirstClass with Distinction provided they pass all the examinations prescribedforthecourseatthefirstappearance.Candidateswhopassalltheexaminations (Part I, II, III & IV) prescribed for the course in the **FIRSTAPPEARANCEITSELFALONE**iseligibleforranking.

8. Maximum Duration for the completion of the programme:

Themaximumdurationforcompletionofthe UG Programme shall notexceedtwelvesemesters(6years).

9. CommencementofthisRegulation:

These regulations shall take effect from the academic year 2022-2023, i.e.forstudentswhoaretobeadmittedtothefirstyearoftheB.Sc.FoodTechnology programmeduringtheacademicyear2022-2023andthereafter.

10. PatternofQuestionPaper(AllCourses)

Time:3Hours

Maximum:75Marks

PartA :15 x1 =15(Multiple Choice)(Threequestions from each unit)Part B:2x5=10(AnyTwoquestions)(Onequestionfromeachunit)PartC:5x10=50 (Onequestionfromeachunitwithinternalchoice)

11. Evaluation Pattern for Continuous Internal Assessment(CIA)

11A.THEORYCOURSES

Component	Time	Appearing marks	CIAmarks	MinimumPass
TestI	2hours	50	5	40%
TestII	2hours	50	5	40%
Assignment(minimum2)Assignment 1-ProblemBasedActivities Assignment2-Field/IndustrialVisitReports		10	10	40%
StudentSeminarwithpowerpointpresentation		5	5	40%
TotalMarksforCIA		115	25	10
TotalMarksforESE		75	75	30
Minimumattendanceforeachtheorycoursetoappear forESE				75%

11B.PRACTICALS

Component	Appearing marks(Average)	CIAmarks	MinimumPass
Performance ineachexperiment	10x5=50	20	40%
InternalPracticalTest1	60	10	40%

InternalPracticalTest2	60	10	40%
TotalMarksforCIA	170	40	16
TotalMarksforESE	60	60	24
Minimumattendanceforeachpracticalcoursetoappear forESE			75%

ProgrammeSpecificOutcomes

PO1.KNOWLEDGE

Studentswillbeableto

- define and disseminate the updated food technology relatedinformationtothesociety
- recognizethetraditionalpractices,culturalbeliefsandethosinfoodproduction,processingandsupplytothemarket

PO2.SKILLS

Studentswillbeableto

- addresstheskillgapin the divisions of food industrial sector andfoodbusinessoperations
- applythescientificmethodsandtechniques,aswellasqualitymanagementprocessesrelatedtofoodtechnology.
- Innovateuniquesolutiontosolvetheproblemsinthe foodindustriesandfoodsupplychainmanagement
- administertheSDGsandfoodrelatedsocietalissuesusingsustainablemodels
- naturalizesthefoodplantlayoutanddesign,manufacturingprotocol, HACCP implementation and complete quality assurance offoodbusinessoperation

PO3.COMPETENCIES

Studentswillbeableto

- guide and supervise effectively the entire process of foodmanufacturingunitwithcoordination
- trainandempowerthefoodhandlerswithgoodattitudeandethos
- applytechnicalknowledgeacquiredinthefieldoffoodtechnologyinhiscareerplatformsconfidentlywithprofessionalethics.

SEMESTERWISECURRICULUMFRAMEWORKANDSCHEMEOFEXAMINATION

SemesterI								
Part	Course Type	CourseTitle	TL Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
I	Language	TamilIorOther language	6	3	25	75	100	3
II	Language(English)	EnglishI-Communicative English	6	3	25	75	100	3
III	CoreI	Fundamentals of FoodScienceand Chemistry	6	3	25	75	100	5
	CorePracticalI	Fundamentals of FoodScienceand ChemistryPractical	3	-	-	-	-	-
	AlliedI	ChemistryI	4	3	25	75	100	4
	Allied PracticalI	ChemistryIPractical	3	-	-	-	-	-
IV	Add-on Course	ProfessionalEnglishI	6	3	25	75	100	4
	Value Education	Value Education	2	3	25	75	100	2
	Total		36	18	150	450	600	21

SemesterII								
Part	Course Type	CourseTitle	Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
I	Language	TamilIIorother language	6	3	25	75	100	3
II	Language	EnglishII-Communicative English	6	3	25	75	100	3
III	CoreII	PrinciplesofFoodProcessingand Preservation	4	3	25	75	100	5
	CorePracticalII	PrinciplesofFoodProcessingandPreservationPractical	3	6	40	60	100	3
	AlliedI	ChemistryII	4	3	25	75	100	4
	AlliedPracticalI	ChemistryIand IIPractical	3	3	40	60	100	2
	CorePracticalI	Fundamentals of FoodScience and ChemistryPractical	-	6	40	60	100	3
IV	Add-on course	ProfessionalEnglishII	6	3	25	75	100	4
		Environmental Studies	2	3	25	75	100	
	Total		30	30	245	555	800	28

SemesterIII								
Part	Course Type	CourseTitle	Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
I	Language	TamilIIIlorother language	6	3	25	75	100	3
II	Language	EnglishIII-Communicative English	6	3	25	75	100	3
III	CoreIII	Fundamentals of FoodEngineering	4	3	25	75	100	5
	CorePractical III	FundamentalsofFoodEngineeringPractical	3	-	-	-	-	-
	AlliedII	FoodSafetyandMicrobiologyI	4	3	25	75	100	4
	AlliedPracticalII	FoodSafety andMicrobiologyPractical I	3	-	-	-	-	-
IV	SBECI	FoodProduct Innovation	2	3	25	75	100	3
	NMECI	FoodPreservation(offered by other major course)	2	3	25	75	100	3
IV	NMSDC	Digital Skill for Employability- Microsoft Office Essentials	2	3	25	75	100	2
	Total		30	18	150	450	600	20

SemesterIV								
Part	Course Type	CourseTitle	Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
I	Language	TamilIVorother language	6	3	25	75	100	3
II	Language	EnglishIV-Communicative English	6	3	25	75	100	3
III	CoreIV	TechnologyofCereals, PulsesandOilseeds	4	3	25	75	100	5
	Core Practical III	FundamentalsofFoodEngineeringPractical	-	3	40	60	100	3
	CorePractical IV	TechnologyofCereals, PulsesandOilseeds Practical	3	6	40	60	100	3
	AlliedII	FoodSafetyand MicrobiologyII	4	3	25	75	100	4
	AlliedPracticalII	FoodSafety andMicrobiologyPracticalIandII	3	3	40	60	100	2
IV	NMSDC	Employability Skills-Microsoft	2	2	25	75	100	2
IV	SBECII	FoodAdditives	2	3	25	75	100	3
	NMECII	FoodSafetyInitiatives(offered by other major course)	2	3	25	75	100	3
	Total		30	30	270	630	900	29

SemesterV								
Part	Course Type	CourseTitle	Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
III	CoreV	TechnologyofFruits, VegetablesandPlantationCrops	5	3	25	75	100	5
	CoreVI	TechnologyofSugar, SaltandBeverages	5	3	25	75	100	5
	CorePracticalV	Technology of Fruits,Vegetablesand PlantationCrops Practical	6	-	-	-	-	-
	ElectiveI	FoodQualityControl	4	3	25	75	100	4
	ElectiveII	Food Storage andPackaging	4	3	25	75	100	4
IV	**NMSDC**	**Advanced Technology for Employability – Food Analysis Food Processing & Preservation**	**2**	**3**	**25**	**75**	**100**	**2**
	SBECIV	FoodPlantHygiene andSanitation	4	3	25	75	100	2
	Total		30	18	165	435	600	23

SemesterVI								
Part	Course Type	CourseTitle	Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
III	CoreVII	Food and Nutrition	6	3	40	60	100	4
	CoreVIII	TechnologyofEggand Dairy	4	3	25	75	100	4
	CoreIX	Technologyof FleshyFoods,Spicesand Condiments	4	3	25	75	100	4
	CorePracticalV	Technology of Fruits,Vegetablesand PlantationCrops Practical	-	3	40	60	100	3
	CorePracticalVI	TechnologyofEgg,Dairy andFleshyFoodsPractical	6	3	40	60	100	3
	ElectiveIII	Food Product Development	4	3	25	75	100	4
IV	SBECV	Bakery	3	3	40	60	100	2
	SBECVI	Entrepreneurship Development	3	3	40	60	100	2
V	Extension Activities	NSS/NCC/YRC/ExtracurricularActivities						
	Total		30	30	275	525	800	26

OVERALLPROGRAMMEGRADEANDCREDITS

Semester	Hrs./Week	TotalMarks	Credits
SemesterI	30	600	21
SemesterII	30	800	28
SemesterIII	30	600	20
SemesterIV	30	900	29
SemesterV	30	600	23
SemesterVI	30	800	26
Total	**30**	**4300**	**147**

SyllabusforB.Sc.FoodTechnologyS
EMESTERI
PartIII:COREI–FundamentalsofFoodScienceandChemistry

CourseName	FundamentalsofFoodScienceandChemistry	**ProgrammeName**	B.Sc. FoodTechnology
CourseCode	2022BFTC01	**Academic YearIntroduced**	2022 -23
Type ofCourse	Theory	**Semester**	I

COURSEOUTCOMES

On completionofthecourse,thestudents will beable to	
CO1	Definethechemicalconstituentsand colloidalnatureoffood
CO2	Explain the natureofwaterand carbohydrates in food
CO3	Enshrinethescientificprinciplesoffood proteinsandlipids
CO4	Appraisethenatureofvitaminsandpseudovitaminsinfood
CO5	Enumeratethechemistryandtypesofmacroandmicromineralsin food

COURSEOBJECTIVESANDHOURSOFINSTRUCTION

Unit/Module	Objectives	Hours ofInstruction TL+A+As=To
Colloidal Nature of Food	Toimpartlearningontypesandapplicationofcolloidalsystemandmethods ofcooking	12+3+2=17
Water and Carbohydrates	Toillustrate thetypesandchemicalnatureofwaterandcarbohydratesin food	12+3+2=17
ProteinsandLipids	Todifferentiatethechemicalnatureandtypesofproteinsandlipidsinfood	13+4+2=19
VitaminsandPseudo Vitamins	Topicturizethechemistryandretentionofvitaminsandmineralsinfood	14+3+2=19
Minerals and Phytonutrients	Toexhibit the types, nature and role of functional components (colours/pigments,flavours,enzymesandphytochemicals)infood	13+3+2=18
TotalHoursofInstruction		90(18x5)

TL-TeachingandLearning,A-Activities,As-Assessment,To-TotalHours

COURSEPLAN

Unit/Module	IntendedLearningChapters	CO(s)Mapped
I	a. Conceptoffood and nutrients *b.* ColloidalSysteminfoods-*Types&Properties,Sols,Gels,EmulsionandFoams – nature and factors influencing its formation and stability, application ofcolloidalchemistrytofoodpreparation* *c.* Cooking of food - *cooking methods and principles and effect of cooking onconstituentsof food*	CO1
II	*a.* Water – *chemistry, physical properties, free, bound and entrapped water, wateractivity in food, moisture sorption isotherm of a food, water quality for foodprocessing-drinkingwater, mineralwaterandpotable water* *b.* Carbohydrates – *types of carbohydrates in food, chemical structure, physio-chemical and functional properties, types of starch, resistant starch; role of foodcarbohydrate/starch incookery*	CO2
III	*a.* Proteins – *classification/types, chemistry and nature of proteins in food, physio-chemical and functional properties of food proteins, role of food proteins incookery* *b.* Lipids – *classification/types of lipids, types of fats and oils in food, chemistryand nature of fats and oils in food, physio-chemical and functional properties offatsandoilsinfood,role offats andoilsincookery*	CO3

IV	*a.* Vitamins-*classification/types,chemistryandnatureofvitaminsinfood,physio-chemical and functional properties of vitamins in food, effect of cookingon vitamins,pseudovitaminsinfood* *b.* Minerals-*classification/types,chemistryandnatureofmineralsinfood,physio-chemicalandfunctionalpropertiesofmineralsinfood,effectofcooking onmineralsin food*	CO4

V	*a.* Colours/Pigments-*classification/types,chemistryandnatureofcolours/pigmentsinfood, effectofcookingon colours/pigments infood* *b.* Flavours - *classification/types, chemistry and nature of flavours in food, effect ofcooking onflavoursinfood* *c.* Enzymes - *classification/types, chemistry and nature of enzymes in food,effectof cooking on enzymes in food, enzymatic and non-enzymatic browning reactionin food* *d.* Phytochemicals-*classification/types,chemistryand nature of phytochemicalsin food,effect ofcookingonphytochemicalsinfood*	CO5

REFERENCES

TEXTBOOKS	
1	JohnM.deMan.,JohnW.Finley.,W.JeffreyHurst.,ChangYongLee.,(auth.) (2018),PrinciplesofFoodChemistry, 4thEd., ANASPENPublications,Maryland,Springer
2	Fennema,OwenR.(1996),FoodChemistry,3rd Ed.,MarcelDekker,NewYork
3	NormanN.Potterand JosephH.Hotchkiss,(1998),FoodScience,5thEd.,Springer
4	H.-D.Belitz.,W.Grosch.,P.Schieberle.,(2009),FoodChemistry,4thandrevisedEd.,Springer-VerlagBerlin Heidelberg
5	JanVelisek,(2014),TheChemistryofFood,WileyBlackwell
REFERENCEBOOKS	
1	JosephJ.Provost.,KeriL. Colabroy.,BrendaS. Kelly., MarkA.Wallert.(2016),TheScienceofCooking: UnderstandingtheBiologyandChemistrybehind FoodandCooking,WileyBlackwell
4	PeterChiKeungCheung&BhavbhutiM.Mehta(eds.).(2015),HandbookofFoodChemistry,SpringerReference
5	B.Sunithaand R.Aruna, FoodChemistryofMacronutrients,DepartmentofFood Chemistryand NutritionStudy Material,AcharyaNGRanga AgriculturalUniversityCollegeofFoodScience& Technology,Bapatla
6	Y.H.Huiand AssociateEditors,(2006),HandbookofFood Science,Technologyand Engineering,Vol.ItoIV, Taylorand Francis(CRC)
JOURNALSANDDOCUMENTS	
1	FoodChemistry,Springer
2	CerealChemistry,Springer
3	TheJournalofFood ScienceandTechnology,Springer

PartIII:COREI PRACTICAL –Fundamentalsof FoodScienceandChemistryPractical

CourseName	Fundamentals of Food Science and ChemistryPractical	**ProgrammeName**	B.Sc. FoodTechnology
CourseCode	2022BFTC01	**Academic YearIntroduced**	2022 -23
Type ofCourse	Theory	**Semester**	I

COURSEOUTCOMES

On completionofthecourse,thestudents will beable to	
CO1	Differentiatedifferenttypesofsolution andmethodsofcookingfood
CO2	Analysethe roleofwaterand carbohydratesincookingandprocessingoffood
CO3	Determinethetypeand roleofprotein and lipid in rawandcookedfood
CO4	Evaluatethenatureofvitaminsandpseudovitaminsin rawand cookedfood
CO5	Cataloguethechemistryand typesofmacroandmicro mineralsin rawand cookedfood

COURSEOBJECTIVESANDHOURSOFINSTRUCTION

Unit/Module	Objectives	Hoursof InstructionTL+A+As=To
ColloidalNature ofFood	Toimpartpracticallearningontypesandapplicationofcolloidalsystemand methodsofcooking	2+10+3=15
Water and Carbohydrates	Toillustratetheroleofwaterandcarbohydratesincookingandprocessingof food	2+10+3=15

Proteins and Lipids	Todeterminethechemicalnatureandroleofproteinsandlipidsincookedand processed food	2+22+6=30
Vitamins and PseudoVitamins	Tostudythetypesandlevelofretentionofvitaminsandmineralsinfoodoncooking/processing	2+16+6= 24

Minerals and Phytonutrients	Tocharacterisethe nature of functional components (colours/pigments, flavours,enzymesandphytochemicals)infoodoncooking/ripening/processing	2+16+6= 24
TotalHoursofInstruction		108(18x6)

TL-TeachingandLearning,A-Activities,As-Assessment,To-TotalHours

COURSEPLAN

Unit/Module	IntendedLearningExercises	CO(s) Mapped
I	1. Identifythetypeofcolloidal solution anddescribeonit 2. TabulatetheSOPfordifferentcookingmethodsbyintegratingnatureofingredients,techniquean dmethod	CO1
II	1. Differentiatethetypeofwater as perqualityparameter 2. Identify the type of starch and sugar through qualitative tests and microscopic examinationin various food	CO2
III	1. Tabulatethename,typeandbiologicalvalueofproteinintenfoodsthroughevidencebased database 2. Determinetheproteincontentoffoodbymicrokjeldahlmethod 3. Experimentthenatureofproteindenaturationoncookingandprocessingofmilkand egg 4. Tabulatethename,typeandnatureoffattyacidsintenfoodsthroughevidencebaseddatabase 5. Determinethetotalfatcontentoffood suingsoxhletapparatus 6. DeterminetheFFA,Iodinenumberandsaponificationvalueoffreshfatsandoilsand RUCO	CO3
IV	1. Tabulatethename,typeandchemicalnatureofvitaminsintenfoodsthroughevidencebased database 2. DeterminetheBetaCaroteneandvitaminCcontentofthefreshandprocessedfruitsandvegetables 3. Tabulatethename,typeandchemicalnatureofmineralsintenfoodsthroughevidencebased database 4. Determinethecalciumand ironcontentofthefreshandprocessedfruitsand vegetables	CO4
V	1. Demonstratethe effectofcookingoncolours/pigmentsinfood 2. Determinethesensoryqualitychangesoncookingoffoodintermsofdescriptivesensoryprofile 3. Determinethebrowningindexoffruitsand vegetablesand defineitnatureofbrowning 4. Identifythepresenceorabsenceofphytochemicalsin food oncooking/processing	CO5

REFERENCES

TEXTBOOKS	
1	ConnieM.WeaverandJamesR.Daniel,(2003),TheFoodChemistryLaboratory:AManualforExperimentalFoods, Dietetics,and Food Scientists,SecondEdition (ContemporaryFood Science),SecondEdition,CRCPress.
2	ShaliniSehgal,(2016),ALaboratoryManualofFoodAnalysis,ikbooks.com.
3	MohiniSethiandEramS.Rao,(2020),e-bookedition,Food Science:ExperimentsandApplications,CBSPublishers and DistributorsPvt. Ltd.
REFERENCEBOOKS	
1	JosephJ.Provost.,KeriL.Colabroy.,BrendaS. Kelly.,MarkA.Wallert.(2016),TheScienceofCooking:UnderstandingtheBiologyandChemistrybehindFood andCooking,WileyBlackwell.
2	M.S.Swaminathan, (1987),FoodScience,ChemistryandExperimentalFoods,Secondedition, BangalorePrint.& Pub.Co.,Bangalore.
3	MississippiStateUniversityExtension,(2019),RevisedbyCourtneyCrist, M.W. Schilling,ViodeldaJackson,and J.B.Williams,Experimentsin FoodScience LaboratoryManual.
JOURNALSANDDOCUMENTS	
1	FoodChemistry,Springer
2	CerealChemistry,Springer
3	TheJournalofFood ScienceandTechnology,Springer

SEMESTERII

PartIII:COREII – PrinciplesofFoodProcessingandPreservation

CourseName	PrinciplesofFoodProcessingandPreservation	**ProgrammeName**	B.Sc. FoodTechnology
CourseCode		**Academic YearIntroduced**	2022 -23
Type ofCourse	Theory	**Semester**	II

COURSEOUTCOMES

On completionofthecourse,thestudents will beable to	
CO1	Comprehendthescope,principlesand methodsoffood processingand preservation
CO2	Definetheroleofpackagingin preservationand applythemethod ofhightemperatureprocessing
CO3	Specifythesuitablelowtemperatureprocessingand preservationmethod to storethefood
CO4	Applythesuitabledryingand dehydration techniquetopreservethefood
CO5	Explicatethemembranetechnology,useofpreservativesandhurdletechnologyinfood preservation

COURSEOBJECTIVESANDHOURSOFINSTRUCTION

Unit/Module	Objectives	Hours ofInstruction TL+A+As=To
Introductiontofoodprocessing andpreservation	Toimpartknowledgeonscope,principlesandmethodsoffood processingandpreservation	14+3+2=19
PackagingandHightemperature processing	Toenlighten theprinciplesand methodsof packagingthe preservedfoodsandhightemperature processingandpreservation	14+3+2=19
Lowtemperatureprocessing	Toeducatetheprinciplesandmethodsoflowtemperature processingandpreservation	12+3+2=17
DryingandDehydration	Toimparttechnicalknowledgeon dryinganddehydrationoffoods	13+3+2=18
Othermethodsofpreservation	Toillustratetheprinciplesandtechnologybehindthemembrane filtration,applicationoffoodpreservativesandhurdletechnology	12+3+2=17
TotalHoursofInstruction		90 (18x5)

TL-Teachingand Learning,A-Activities,As-Assessment,To-TotalHours

COURSEPLAN

Unit/Module	IntendedLearningChapters	CO(s) Mapped
I	*a.* Food Processing*: Introduction, Scope and Importance, Goals and Objectives of foodprocessing,Historicaldevelopmentsinfoodprocessing,Principlesoffoodprocessing, merits and demerits - minimal processing - removal of moisture, removalof air, low temperature, high temperature, milling, fermentation andirradiationprocessing; advanced processing - extrusion cooking, hydrostatic pressure cooking,dielectricheating,microwaveandultrasound processing* *b.* FoodPreservation*:Principles,methodsandimportanceoffoodpreservation*	CO1
II	*a.* PackagingandBottling-*metalcontainers,glasscontainers,plasticcontainers,retortable Pouches, artificial and intelligent packages and methods of packaging – ordinary,controlledandmodifiedatmosphere, vacuumpackaging* *b.* PasteurizationandSterilization-*Definition,time-temperaturecombinationandequipments* *c.* Blanching and Canning - *Definition, time-temperature combination and equipments,adequacyinblanchingandcanning*	CO2
III	*a.* Coldstorage– *Refrigeration,coldstoragemethods,advantagesanddisadvantages* *b.* Freezing - *direct and indirect, freezing curve, freezer selection - still air sharpfreezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenicfreezing,advantagesanddisadvantagesoffreezing, changesinfoodduringfreezing andstoragein frozencondition*	CO3

IV	*a.* Drying:*Utilitiesofdrying,thermalproperties,EquilibriumMoistureContent(EMC), drying theories, drying rate, methods of drying - contact drying, convectivedrying, freeze drying, radiation drying, superheated steam drying, types of dryers - Deepbed,Flatbed,Continuous,Recirculating,LSU,Fluidizedbed,Rotary,Tray, TunnelandSolar* *b.* Dehydration:*Wateractivity,moisturesorptionisotherm,osmoticdehydrationusing*	CO4

	saltandsugar	
V	*a.* Membrane Technology - *Introduction to pressure activated membrane processes-Microfiltration,ultra-filtration,nanofiltrationandReverseOsmosisanditsindustrialapplication,membraneperformance,andlimitationofmembraneprocesses* *b.* Preservation by using preservatives - *Food additives - Definition, types, Class I andClassII preservatives* *c.* HurdleTechnology-*conceptanditsapplication*	CO5

REFERENCES

TEXTBOOKS	
1	GSubbulakshmi,ShobhaAUdipi,PadminiSGhurge(2021),FoodProcessingandPreservation,SecondEdition, NewAgeInternationalPublishers,NewDelhi
2	P.Fellows,(2000),FoodProcessingTechnology,PrinciplesandPractice,2nd Edition,WoodheadPublishingLimited andCRCPressLLCinNorth andSouthAmerica
3	PaineFA andPaineHY,(1992),HandbookofFoodPackaging,SecondEdition,Published undertheauthorityofThe InstituteofPackaging,Springer-Science+BusinessMedia,BV
4	KhetarpalNeelam, (2005),FoodProcessingandPreservation,DayaPublishingHouse,NewDelhi
5	BSivasankar(2002),FoodProcessingandPreservation, PHILearningPvt. Ltd.,NewDelhi
REFERENCEBOOKS	
1	J.ScottSmith,Y.H.Hui,(2004),FoodProcessing,PrinciplesandApplications,1st Edition,BlackwellPublishingLtd, UK
2	M.ShafiurRahman, (2007),HandbookofFoodPreservation,2nd Edition,CRCPress,Taylor&Francisgroup, London,NewYork
3	TheodorosVarzakas,ConstantinaTzia,(2016),Handbook ofFoodProcessing,Food Preservation,CRCPress,Taylor &Francisgroup,London,NewYork
4	Stephanie Clark, Stephanie Jung and BuddhiLamsal, (2014), Food Processing Principles and Application, 2nd Edition,JohnWiley&Sons, Ltd.,UK
5	GeoffreyCampbell-Platt,(2009),Food ScienceandTechnology,BlackwellPublishingLtd,UK
6	Karnal,MarcusandD.B.Lund,(2003),PhysicalPrinciplesofFoodPreservation,MarcelDekker,Inc.USA
JOURNALSANDDOCUMENTS	
1	JournalofFoodProcessingandPreservation,WileyPeriodicalsInc.
2	FoodProduction,ProcessingandNutrition,Springer
3	FoodPackagingandShelfLife,Springer

Part III: CORE II PRACTICAL – Principles of Food Processing and PreservationPractical

CourseName	Principles of Food Processing and PreservationPractical	**ProgrammeName**	B.Sc. FoodTechnology
CourseCode		**Academic YearIntroduced**	2022 -23
Type ofCourse	Practical	**Semester**	II

COURSEOUTCOMES

On completionofthecourse,thestudents will beable to	
CO1	PracticetheGFLPandpreservethefoodusingsuitablepackaging
CO2	Sterilize/pasteurize/bottle/canthefoodandpreserveusinghightemperature
CO3	Storethefoodin effectivecoldtemperatureandpreserveitsquality
CO4	Dryand dehydratethefoodtoimproveitsshelflife
CO5	Preservethefoodusingsuggestedfoodpreservative,hurdletechnologyand definethewaterqualityusing TDS

COURSEOBJECTIVESANDHOURSOFINSTRUCTION

Unit/Module	Objectives	Hours ofInstruction TL+A+As=To
GFLPandFood packaging	ToillustratetheGFLPandimpactofpackagingonpreservingthesensory qualityoffoods	3+3+3=9

Hightemperature preservation	To educateonmethodofsterilization/pasteurization/bottling/canningoffood	3+9+3=15

Lowtemperature preservation	Toanalyze the role of refrigeration and freezing in preserving the fruits/vegetablesand fleshyfoods	3+15+6=24
Drying and Dehydration	Tounderstandthedryingoffoodsbyusingdifferenttypesofdryersand osmoticdehydration technique	3+15+6=24
Hurdletech nology preservation	Topreparepickles,jamandjellyandmarmaladesusingpreservatives,hurdletechnolo gyandmembranefiltration	6+24+6=36
TotalHoursofInstruction		108(18x6)

TL-TeachingandLearning,A-Activities,As-Assessment,To-TotalHours

COURSEPLAN

Unit/Module	IntendedLearningExercises	CO(s) Mapped
I	*a. GoodFoodLaboratoryPracticedefinedbyFSSAI* *b. Comparethesensoryqualityofanyonefoodpackedbydifferentmethodsofpackaging*	CO1
II	*a. Experimentthesterilizationorpasteurizationoffoods(laboratoryoratIndustry)* *b. Experimentthebottling/canningoffoods (laboratoryoratIndustry)*	CO2
III	*a. Refrigeratefruitsand vegetablesandevaluate its sensoryquality* *b. Deepfreezethe non-vegetarianfoodand evaluate itssensoryquality* *c. Visitcoldstorageand freezingfacilityexisting in theindustryandreport*	CO3
IV	*a. Drythefoodusingtraydrierorhotairdrierandobservethedrying characteristics* *b. Applytheosmoticdehydrationtoanyonefruitorvegetableandobserveitscharacteristicchange s* *c. Drythefoodusingsun drierorhotairdrierandobservethedrying characteristics*	CO4
V	*a. Preparethepickle using rawmango,garlic&lemonand evaluateitssensoryprofile* *b. Preparethejam&jellyusinganyfivepectin richfruitsand evaluateitssensoryprofile* *c. Preparethemarmalade usingorange andevaluateitssensoryprofile* *d. Check the TDS of the water filtered by different methods and report its suitability forconsumption*	CO5

REFERENCES

TEXTBOOKS	
1	https://fssai.gov.in/upload/uploadfiles/files/Manual_GFLP_06_09_2018.pdf
2	https://www.studocu.com/my/document/universiti-teknologi-mara/food-analysis/fst528-lab-manual/10347126
3	https://egyankosh.ac.in/handle/123456789/1166
4	https://www.scribd.com/document/556561814/3-3-PFPP-Lab-Manual-converted
5	http://14.139.185.57:8080/jspui/bitstream/123456789/10752/1/810084-practical%20manual.pdf
6	https://www.doctorfresh.in/blog/11/how-to-check-tds-of-water
REFERENCEBOOKS	
1	https://www.nios.ac.in/media/documents/srsec321newE/pracmanual321.pdf
2	https://iastate.pressbooks.pub/foodproductdevelopment/open/download?type=pdf
3	http://www.rpaulsingh.com/learning/virtual/virtual.html
JOURNALSANDDOCUMENTS	
1	JournalofFoodProcessingandPreservation,Hindawi
2	FoodProduction,ProcessingandNutrition,Springer
3	FoodPackagingandShelfLife,Springer

SEMESTERIII

CorePaperIII FundamentalsofFoodEngineering4hrs/week

UNITI
Units and dimensions, basic principles of mass and energy balances, classifications of processes andunitoperations,SignificanceofEngineering,propertiesoffoodmaterials: physical,thermal,aerodynamic,mechanical,opticalandelectromagneticproperties.

UNITII
Food processing as a manufacturing process, status of food processing industries in India andabroad: sector wise food processing, import and export of food commodities/processed foods,Underutilized food commodities. Food material transportation, supply (value addition) chain,scale-upandplantlayout(equipmentand utilities).

UNITIII
Foodmaterialsscienceandengineering- Anoverview:Introduction:Molecularbasis offoodmaterials,Benefits,classification,determinationanddesignationofthefineness ofgroundmaterial,sieve/screenanalysis,principle and mechanisms,observationofmaterials atvarioussizerangesandsize-propertyrelationship,amorphousandcrystallinestructuresofmaterials, interfacial properties of the food materials, applicationof materials science in fooddesignanddevelopmentofengineeredfoodmaterials.

UNITIV
Food manufacturing as industrial practice: Food processing as a manufacturing process, statusoffoodprocessingindustries inIndiaandabroad:sectorwise food processing,importandexportoffoodcommodities/processedfoods,Underutilizedfoodcommodities.Fo odmaterialtransportation,supply(valueaddition)chain,scale-upand plantlayout(equipmentand utilities).

UNITV
Sustainablefoodprocessingsystems:Wateractivityoffoodanditssignificanceinfoodpreservation;dehydrati onand dryingoffooditems;IMF;Lowtemperature
preservation: cold storage, cold chain, freezing Environmental impact of food processing, packagingandhandling.

REFERENCS

1. R.L.Earle,.UnitOperationsinFoodProcessing,NZIFST(Inc.)
2. ZekiBerk,FoodProcessEngineeringandTechnology,ELSEVIER
3. J.G.Brennan,.FoodProcessingHandbook, WILEY-VCHVerlagGmbH&Co.
4. FarrallA.W,Engineeringfor dairyandfoodproduct,JohnWileyandSons
5. 5.Fellows,P.J.(2009).FoodProcessingTechnology:PrinciplesandPractice.3rdEdition,Woo dhead Publishing,Oxford.
6. Potter,N.N.andHotchkiss,J.H.(2007).FoodScience.CBSPublishers&Distributors,NewDelhi.
7. R.L.Earle.2004.UnitOperationsinFoodProcessing.TheNewZealandIntituteofFoodScience& Technology, Nz.Warren L.McCabe,JulianSmith, Peter Harriott.2004.
8. UnitOperationsofChemicalEngineering,7thEd.McGraw-Hill,Inc.,NY,USA.ChristieJohnGeankoplis.2003.
9. TransportProcessesandSeparationProcessPrinciples(IncludesUnitOperations),4thEd.Prentice-Hall,NY,USA.
10. GeorgeD.SaravacosandAthanasiosE.Kostaropoulos.2002.HandbookofFoodProcessingEq uipment.Springer Science+BusinessMedia,NewYork,USA.
11. J.F.Richardson,J.H.HarkerandJ.R.Backhurst.2002.Coulson&Richardson'sChemicalEngin eering, Vol.2, ParticleTechnologyand SeparationProcesses,5thEd.

CorePracticalIII FundamentalsofFoodEngineering 3hrs/week

1. Comparisonofconventionaland microwaveprocessingoffood.
2. DeterminationofpHofdifferentfoodsusingpHmeter.
3. Studyqualitycharacteristicsoffoodspreservedbydrying/dehydration/freezing.
4. DryingoffoodusingTraydryer/otherdryers
5. Preservationoffoodbycanning(Fruit/Vegetable/meat).
6. Toperformblanchingofdifferentplantfoods.
7. Osmoticdehydration.
8. Tostudygelatinizationbehavior ofvariousstarches.
9. Conceptofshelf lifeofdifferentfoods.
10. Tostudytheconceptofglutenformationofvariousflours.
11. Plantlayoutdesign.
12. Determinationofviscosity

AlliedPaperIIFoodSafetyandMicrobiologyI **4hrs/week**

UNITI

Standardization of Foods; Definition, Standards of Quality, for cereals, starchy foods, spices andcondiments,sweeteningagents,meatandmeatproducts,vinegar,sugarand confectionary,beverages-alcoholic and non alcoholic , carbonated water etc., Milk and milk products , oils andfats ,Cannedfoods,fruitsandvegetablesproducts.

UNITII

Food laws and regulation: Mandatory and voluntary food laws, International quality systems andstandards like ISO and Food Codex, BRC; International trades & federal agencies, Indian act-FoodSafetyand Standards Act,2006.

UNITIII

Various food acts- PFA, FPO, AGMARK, MMPO, MFPO, edible oil acts, standard weight acts.HACCPANDWTO(briefly)

UNIT-IV

Microorganisms important in food microbiology – Mold, Fungi, Algae, Bacteria and Virus – generalcharacteristics. Contamination of foods – green plants and fruits, animals, sewage, soil, water, airduring handling and processing. Spoilage – cause, classification, factors affecting kinds and numbersofmicroorganismsinfood.

UNIT-V

Spoilageofdifferentgroupsoffoods– cerealandcerealproducts,vegetablesandfruits,meatsandmeatproducts,fishandotherseafoods,eggs,poultry, milkandmilkproductsand cannedfoods..

REFERENCS

1. Siddappaa,G.S.,GirdhariLalandTandon,G.L.1998..PreservationofFruitsandVegetables.ICAR,NewDelhi
2. Sivasankar,B.2002.FoodProcessingandPreservation.PHILearningPvt.Ltd.Delhi
3. Srilakshmi.2010.FoodScience.NewageInternational978-81-224-2724-0.
4. Srivastava,R.P.&SanjeevKumar.2002.FruitsandvegetablePreservation–Principlesand Practice.InternationalBookDistributingCo.,Lucknow.
5. Swaminathan,M.1988.HandbookofFoodScience&ExperimentalFoods.Bappcopublishers,Bangalore
6. U.D.ChavanandJ.V.Patil.2013.IndustrialProcessingoffruitsandvegetables.AstralInternationalPvt Ltd.NewDelhi.
7. Vijay,K.2001.Text BookofFoodSciencesandTechnology.ICAR, NewDelhi.
8. AdamsM.R.,MossM.O.,FoodMicrobiology,Newageinternationalpublishers,NewDelhi,2015.
9. WilliamCFrazier.,DennisCWesthoff.,FoodMicrobiology,McGrawHilleducationprivatelimited, Newdelhi,2014.
10. Sivasankar.,FoodProcessingandPreservation,PHILearningprivatelimitedNewdelhi,2015.
11. BranenA.L.andDavidson,P.M..AntimicrobialsinFoods.MarcelDekker,NewDelhi,1983.
12. JayJ.M.,ModernFoodMicrobiology.3rdEdn.VNR,NewYork.utta.19809thEdition,PrismBooksPvt. Ltd.,1986

AlliedPracticalII **FoodSafetyandMicrobiologyI** **3hrs/week**

1. IntroductiontotheBasicMicrobiologyLaboratoryPracticesandEquipments
2. Functioninganduseofcompoundmicroscope
3. Cleaningandsterilizationofglassware
4. Preparationandsterilizationofnutrientbroth
5. Cultivationandsub-culturingofmicrobes
6. Preparationofslant,stabandplatesusingnutrientagar
7. Morphologicalstudyofbacteriaandfungiusingpermanentslides
8. Simplestaining
9. Gram'sstaining
10. StandardPlateCountMethod
11. IdentificationofMoldsbylactophenolbluestaining
12. NegativeStaining
13. MicrobiologicalExaminationoffood
14. BacteriologicalAnalysisofWater byMPNmethod
15. Assessmentofsurfacesanitationbyswabandrinsemethod
16. Assessmentofpersonalhygiene

SBECI FoodProductInnovation 2hrs/week

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UNIT-I

Food product development tool: Organoleptic testing panels- export profile panels, primarysensory panels and secondary sensory panels;Research guidance panels- purpose, panelorganization,utilityof results.Interlockingactivities ofpeopleandorganization.

UNITII

Basic principles & concept of food product development. Cultural approach to development of dietarypatternofvariousgroups-linguistic,regional,religious(ethic).

Factorsinvolvedinfoodhabitalteration, availability, importance & role of different research & development departments in foodproductionindustry.

UNIT-III

Types of new products: Completely new product; new product for company existingcompetitorproduct-ideasources, "musthave"- "wouldlike"specifications; someminor new technology forexisting factory; new entry using existing technology in existing factory; steps in the development ofnewproduct-concepttesting,prototypeproduct,processdevelopment,publichealthclearance,packaged product storage studies, finalize specifications, develop advertising claims, pre productionruns,marketresearch,timing.

UNITIV

Steps in product development –material resources based on market demand, standardization methodsinvolved in product development.Portion size & portion control, Calculation of nutritive value & costofproduction, Shelflife &storage stabilityevaluationprocedureofdevelopedfoodproducts.

UNITIII

Formulation of new food products for infants, preschool children, adolescents, pregnant & nursingmothers, old age, sports persons. Selection & training of judges, Development of score card analysisofdata. Roleofadvertisement&technologiesinpromotionofnewproducts.

REFERENCES:

1. Sivaramaprasad.A,1985,AgriculturalMarketinginIndia-MittalPublications,NewDelhi.
2. Acharya.S.S,andN.L.Agarwal,1992,AgriculturalMarketinginIndia-OxfordandIBHPublishingPvt.,Ltd.,NewDelhi.
3. DevelopingNewFoodProductsForaChangingMarketPlace,2ndEdition,2005,Aaron,L. Brody,JohnB.Lord.
4. NewFoodProductDevelopment,2004,GordonW.Fuller.5.JohnKao,Creativity&Entrepreneurship packageCompatibility,toxicity,taintingandcorrosion.Packagingandenvironment.

NMECI FoodPreservation 2hrs/week

(offeredto other major course)

UNITI
FundamentalsofFoodPreservation-Concept-Importanceoffoodpreservation-Principlesoffoodpreservation-Techniquesoffood preservation.

UNITIIMicroorganismsinfood -Introduction-TypesofMicroorganisms-Conditionsforgrowth.
-Foodspoilage &theircontrol.

UNITIIIPreservationbypreservatives-Conceptanddefinition-Types-Naturalpreservatives -Syntheticpreservatives

UNITIV
Irradiation-Concept,definition-Principlesofirradiation.-Types-Application.Preservationbydrying-Concept,history-Typesof dryingand dryers.-Treatmentspriorto drying.

UNITV
Preservationbyuseofhightemperature.-Conceptandimportance-Variousmethodsused-pasteurization, Boiling, Canning -Effect of high temperature on food. Unit III - Preservation byLow Temperature - Concept, History -Types of Preservation methods bylow temperature - Differentequipmentsusedforpreservationbylowtemperature-TreatmentsPriortofreezing

REFERENCES:

1 PrakashTriveni:FoodPreservation,Aadipublication,Delhi.
2 M.ShafiurRahman:HardBook OfFoodPreservation,MarcelDekkerInc,NewYork. 3McWillims and Paine: ModernFoodPreservation,SurjeetPublication.
4 Fellows,PandEllisH.1990FoodProcessingTechnology:PrincipalandPracticals,NewYork.
5 NPCSBoard,ModernTechnologyonFoodPreservation6)B.Sivasankar;FoodProcessingandPreservation.

SEMESTER IV

Core paper IV Technology of cereals, Pulses and oilseeds 4/week

Objectives

- To teach technology of milling of various cereals
- To impart technical knowhow of pulses and oilseeds refining

UNIT:I

Paddy processing and rice milling: Conventional milling, modern milling, milling operations, milling machines, milling efficiency; Quality characteristics influencing final milled product; parboiling, ageing of rice, utilization of by products.

UNIT:II

Wheat milling: Break system, purification system and reduction system; extraction rate and its effect on flour composition; quality characteristics of flour and their suitability for baking; Corn milling: Dry and wet milling of corn, starch and gluten separation, milling fractions and modified starches.

UNIT:III

Barley: Malting and milling; Oat/Rye: Processing, milling; Sorghum: Milling, malting, pearling; Millets (Pearl millets, finger millets): Processing of millets for food uses; Secondary and tertiary products processing of cereals and millets; By-products processing of cereals and millets; Processing of infant foods from cereals and millets; Breakfast cereal foods: Flaked, puffed, expanded, extruded and shredded.

UNIT:IV

Pulse milling: home scale, cottage scale and modern milling methods, machines, milling quality, milling efficiency, factors affecting milling quality and quantity; Problems in dhal milling industry; Nutritional changes during soaking and sprouting of pulses; Cooking quality of dhal, methods, factors affecting cooking of dhal; Quick cooking dhal, instant dhal; Soybean milk processing and value addition.

UNIT:V

Problems in oil milling industry; Desolventization; Refining of oils: Degumming, neutralization, bleaching, filtration, deodorization, their principles and process controls.

Hydrogenation of oils; New technologies in oilseed processing; Utilization of oil seed meals for different food uses: High protein products like protein concentrates and isolates; By-products of pulse and oil milling and their value addition.

REFERENCES:

1. Kent,N.L.2003.TechnologyofCereal,5thEd.Pergamon Press.
2. Chakraverty.1988.PostHarvestTechnologyofCereals,PulsesandOilseeds,revisedEd., Oxford & IBH Publishing Co. Pvt Ltd.
3. Marshall,RiceScienceandTechnology.1994.WadsworthEd.,MarcelDekker,New York.
4. Manay,S. and Sharaswamy,M. 1987. Food FactsandPriniciples.Wiley Eastern Limited.
5. AmalenduChakraverty and R. Paul Singh. 2014. Post Harvest Technology and Food Process Engineering. CRC Press, Boca Raton, FL, USA.
6. Elaine T. Champagne. 2004. Rice: Chemistry and Technology, 3rd Ed.,

AACCInternational, Inc., St. Paul, MN, USA.
7. AmalenduChakraverty, Arun S. Mujumdar, G.S. VijayaRaghavan and Hosahalli S. Ramaswamy. 2003. Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., NY, USA.

Core practical IV Technology of cereals, Pulses and oilseeds 3hrs/week

1. Observations of morphological characteristics of cereals
2. Determination of physical properties of cereals
3. Determination of chemical properties of cereals
4. Determination of cooking quality characteristics of rice
5. Experiment on productionof puffed rice,
6. Experiment on production of popcorns
7. Experiment on production of noodles
8. Determination of gelatinization temperature by amylograph
9. Experiment on preparationof value added products from millets
10. Determinationofphysicalpropertiesoflegumes andoilseeds
11. Determinationofproximatecompositionofselectedpulses and oil seed
12. Removal of anti-nutritional compounds from selected pulses and oilseeds
13. Experimentstudyofcookingqualityofdhal
14. Experimentonpreparationofvalueaddedproductslegumeproducts

AlliedPaper II FoodSafetyandMicrobiologyII 4hrs/week

Objectives

1. Togainan understandingon the foodsafety/qualityaspectsfor foodindustries.
2. Toapplythe principles of safetyand qualitysystems to control foodrisks/hazards And assurethe qualityof foodproducts.

UNIT I

Foodsafety-DefinitionandtermsSafetyinfoodprocurement,handling, preparationstorageanddistribution.
Food Adulteration- IPC provisions onfoodadulteration.Foodallergensanditsmanagement.FoodBiosecurity,Fooddefense,Foodbio terrorismandprotectionmeasures.

UNIT II

Scopeoffoodqualityandfoodsafetyactivities-Foodsafetyaspartoffoodquality.
Foodqualityattributes-Qualityassessment of food materials during andafterprocessing.
RoleofQualityControlandQualityassuranceinthefoodindustries.Qualityplan, Qualitymanuals.
Qualityimprovement-TotalQualityManagement-Principleandimplementation,Qualityimprovementtools,customerfocus,costimplicationsofqu alitysystems.

UNIT III

FactorsAffecting FoodSafety

Physical Hazards, Biological, Hazards, Chemical Hazards, Microorganisms in Foods, Bacteria,Fungi, Yeasts, Moulds, Viruses, Parasites, Recent Concerns of Food Safety Prions, Concern ofGenetically Modified Foods. Concern of Dioxin-Contaminated Foods.HACCP system and foodsafetyusedincontrolling microbiological hazards.

UNIT IV

Food Fermentations
Fermentation–definition and types
Microorganismsused infood fermentations
Dairy Fermentations-starter culturesandtheir types , concept of probiotics,
FermentatedFoods-types,methodsofmanufactureforvinegar,sauerkraut,tempeh, miso , soya sauce ,beer,wine and traditional indian foods

UNIT V

SanitationandFoodindustry

Sanitation guidelines-Definition and regulationoffood sanitation.
Cleaning and sanitation of food establishment,equipment,cleaningcompoundsandsanitizers,safetylimitsofsanitizers.FoodFilt ration,Chlorination,Ozonation,Disinfection,CIP and COP.
Importanceofpersonalhygieneof foodhandlers.
Planning and implementationofTrainingprogramme.
Relationship of microorganisms to sanitationSewageandwasteproducthandlingandtreatment.

Control ofinfestation, IntegratedPestmanagement

Foodsanitationcontrolandinspection.

REFERENCE:

1. Atlas, M.Ronald (1995) Principles of Microbiology, 1st Edition, Mosby-Year Book, inco,Missouri,U.S.A.
2. Frazier,W.C. (1998)FoodMicrobiology,McGrawHillInc,4thEdition.
3. Roday. S. (1999) Food Hygiene and Sanitation, 1st Edition, Tata McGraw Hill, New Delhi.
4. 4.Joshua A.K.2000Microbiology.Popular BookDepot,Madras.
5.Adams& Moss 2000, Food Microbiology, Panima Publishing corporation, New Delhi.6.Anandhanarayan. R & C.K.J. Panicker, 2003, Textbook of Microbiology, Orient longmanpublications,Chennai.

AlliedPracticalII FoodSafetyandMicrobiologyII 3hrs/week

1. PFA, FPO, Agmark, BIS and HACCP for common foods: Cereals and flours, Pulses, nuts and oilseeds, Fruits and vegetables, Oil, butter, ghee, vanaspati and other fats, Milk and milk products, Sugar, jaggery and miscellaneous foods, Meat, fish and poultry, Eggs
2. Physical and chemical methods/techniques for assessment of food quality
3. Quality evaluation of processed foods with cereal, pulse, vegetable, fruit, milk, milk products, meat, fish and poultry as main component by chemical and sensory methods.
4. Market survey of processed foods with reference to food labeling.
5. Visit to Consumer Forum/Food Quality Laboratory .
6. Food adulteration tests for different foods.

SBECII Food Additives 2hrs/week

Objectives

- To teach various types of food additives
- To recognize the type of additive added to a food by reading the label on the packaging of the food.

UNIT I

Introduction: Introduction to Food Additives; Scope of food additives; Functions and uses of Food Additives; Classification- Intentional & Unintentional Food additives; Types of food additives Toxicology and Safety Evaluation of Food Additives: Effects of Food Additives; Food Additives generally recognized as safe (GRAS); Tolerance levels & Toxic levels in Foods; Legal safeguard; Risks of food additives.

UNIT II

Naturally occurring food additives: Classification; Health Implications; Role in Foods Acidulants: Introduction; Different acidulants; Role in food processing Food colorants: Introduction; Natural & Synthetic food colorants; Classification of Food colorants; Chemical nature; Impact on health.

UNIT III

Pigments: Importance; Classification: Utilization as food colour.Food Preservatives : Introduction; Classification- Natural & chemical preservatives, Mode of action.

UNIT IV

Antioxidants & chelating agents: Introduction; Role in foods; Types of antioxidants -natural & synthetic; Mode of action of antioxidants in foods; Chelating agents- Naturally & synthetic; Mode of action of chelating agents; Applications of antioxidants and chelating .

UNIT V

Sweeteners: Introduction; Classification- Artificial sweeteners & Nonnutritive sweeteners.Classification of flavors- natural & synthetic; Flavor enhancer/ Potentatior; Importance of taste and flavours; Role of flavoring agents in food processing.

REFERENCES:

1. Food Additives A Larry Branen, P Michael Davidson and SeppoSalminen CRC Book Press. USA.
2. Food Additives S.N. Mahindru APH Publishing Corporation, DryaGanj, New Delhi.
3. Food colours, Flavours and Additives Technology Handbook NIIR Board of Consultants and Engineers Natonal Institute of Industrial Research, Kamla Nagar, Delhi
4. Food chemistry H.D. Belitz, W. Grosh and P. Schieberle 4 th Revised &Extemded Edition, Springer.

NMEC II Food Safety Initiatives 2hrs/week

(Offeredto other major course)

Objectives

- To understand the safetyandhygiene
- To learn thetypesof hazards associated with food

UNITI

IntroductiontoFoodSafety, Definition, Types ofhazards,biological,chemical,physical hazards, Factors affecting Food Safety, ImportanceofSafe Foods, Impactonhealth,Controlmeasures.

UNIT II

Management ofhazards-Need, Control of parameters, Temperature control, Food Storage,HygieneandSanitationinFoodServiceEstablishments- Introduction, Sources of Contamination, controlmethodsusingphysicalandchemicalagents

UNIT III

FoodSafetyManagementTools- Basic concept, Prerequisites- GHPs ,GMPs, HACCP, ISO series, TQM-conceptandneedforquality,componentsofTQM,Kaizen.Risk Analysis, Accreditation and Auditing.

UNIT IV

Microbiologicalcriteria- Microbiologicalstandardsandlimits, Sampling Basicsteps in detectionoffoodbornepathogens, WaterAnalysis.

UNIT V

FoodlawsandStandards, IndianFoodRegulatoryRegime, Global Scenario, Otherlawsandstandardsrelatedtofood.

REFERENCES

1. Lawley,R.,CurtisL.andDavis,J.TheFoodSafetyHazardGuidebook,RSC publishing, 2004
2. DeVries.FoodSafetyandToxicity,CRC,NewYork,1997
3. Marriott,NormanG.PrinciplesofFoodSanitation,AVI,NewYork,1985
4. Forsythe,SJ.MicrobiologyofSafeFood,BlackwellScience,Oxford,2000
5. Forsythe,S.J.TheMicrobiologyofSafeFood,secondedition,Willey-Blackwell,U.K.,2010
6. MortimoreS.andWallaceC.HACCP,Apracticalapproach,ChapmanandHil l,London,1995
7. BlackburnCDWandMcClureP.J.Foodbornepathogens.Hazards,riskanalysis&contr ol.CRCPress,Washington,U.S.A, 2005

SEMESTER V

Part	Course Type	CourseTitle	Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
III	CoreV	TechnologyofFruits, VegetablesandPlantationCrops	5	3	25	75	100	5
	CoreVI	TechnologyofSugar, SaltandBeverages	5	3	25	75	100	5
	CorePracticalV	Technology of Fruits,Vegetablesand PlantationCrops Practical	6	-	-	-	-	-
	ElectiveI	FoodQualityControl	4	3	25	75	100	4
	ElectiveII	Food Storage andPackaging	4	3	25	75	100	4
IV	SBECIII	Food PlantLayout	3	3	25	75	100	2
	SBECIV	FoodPlantHygiene andSanitation	3	3	25	75	100	2
	Total		30	18	165	435	600	23

Core V	TECHNOLOGY OF FRUITS, VEGETABLES AND PLANTATION	5Hrs	5Credits

	CROPS		

Objectives

1. Toimpart knowledge of different methodsof fruits and vegetable processing.
2. To learnabout processing of variousspices,tea,coffeeandcocoa.

UNITI

Introduction

Importance of fruits and vegetable, history and need of preservation, reasons of spoilage, methodofpreservation (short&long term).

CanningandBottlingofFruitsandVegetables

Selection of fruits and vegetables, process of canning, factors affecting the process- time andtemperature, containers of packing, lacquering, syrups and brines for canning,spoilage in cannedfoods**.**

UNITII

FruitsBeverages

Introduction, Processing of fruit juices (selection, juice extraction, deaeration, straining, filtrationand clarification), preservation of fruit juices (pasteurization, chemically preserved with sugars,freezing, drying, tetra-packing, carbonation), processing of squashes, cordials, nectars,concentrates and powder.

UNITIII

Jams,JelliesandMarmalades

Introduction**,** Jam: Constituents, selection of fruits, processing & technology**,** Jelly: Essentialconstituents(Role of pectin, ratio), Theory of jelly formation, Processing & technology, defectsinjelly**,** Marmalade: Types,processing & technology,defects.

Pickles,ChutneysandSauces

Processing,Types,Causesofspoilageinpickling.

UNITIV

TomatoProducts

Selection of tomatoes, pulping& processing of tomato juice, tomato puree, paste, ketchup, sauceandsoup**.**

DehydrationofFoodsandVegetables

Sun drying & mechanical dehydration, process variation for fruits and vegetables, packing andstorage**.**

UNITV

Spices

Processingandpropertiesof majorandminor spices,essentialoils&oleoresins, adulteration

Tea,CoffeeAndCocoa

Processing,VarietyandProducts

REFERENCES

1. Girdharilal, Siddappaa, G.S and Tandon, G.L.1998. Preservation of fruits & Vegetables,ICAR,NewDelhi

2. W B Crusess.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition,Pub:AgrobiosIndia

3. Manay,S.&Shadaksharaswami,M.2004.Foods:FactsandPrinciples,NewAgePublishers

4. Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products,TataMcGraw-Hill publishing company limited, Second edition.

5. Srivastava, R.P. and Kumar, S. 2006 . Fruits and Vegetables Preservation- Principles andPractices.3rd Ed. InternationalBookDistributingCo.

Objectives

1.Toimpart knowledge of different methodsof sugar, salt and beverages.

2.To understand the processing of sugar and beverages.

UNIT-I

Sugar

Introduction, properties, type of plants-sugar cane, sugar beet, composition of sugar cane and sugar beet,Processing method for sugar, and by products.

UNIT-II

Confectionery Technology:

Different stages of sugar cookery and preparation of indigenous products based on the stages. Preparation of sugar solutions and evaluation using Refractometry and Brix

Preparation and quality evaluation of non-crystalline candies: NonCrystalline candies; Hard candies caramels, toffees and nougats

Preparation and quality evaluation of Crystalline candies: Fondant, fudge and Marshmallow

Preparation of Cocoa, Chocolate and related products

UNIT-III

Salt-Production, properties, processing, types and uses in food processing industry.

UNIT-IV

Processing of beverages: Packaged drinking water, juice based beverages, synthetic beverages, still, carbonated

Low-calorie and dry beverages, isotonic and sports drinks

Dairy based beverages

Alcoholic beverages, fruit beverages, specialty beverages

UNIT-V

FSSAI specifications for beverages

Ingredients, manufacturing and packaging processes and equipment for different Beverages

Sweeteners, colorants, acidulants,

Clouding and clarifying and flavouring agents for beverages

REFERENCES:

1. Lees and Jackson **(1994)** Sugar Confectionery and Chocolate Manufacture by, 1st Ed. London: Chapman & Hall,1973, Reprinted
2. Justin J. Alikonis. Candy Technology **(1979)** AVI publishing company, Inc., Westport, Connecticut
3. Philip R. Ashurt, (2005). Chemistry and technology of Soft drinks and fruit juices, 2nd edition

   Blackwell Publishing Ltd. E book
4. Tammy Foster and Purnendu, C. Vasavada, (2003) Beverage Quality and safety, 2nd edition. CRC Press - E book.

5. Principles of Sugar Technology, Vol 1-3 by Peter Honig, ElsaevierPoh, Co., Newyork
6. Training manual for sugar mills by Mangal Singh, Somaiya Pvt. Ltd. Mumbai.

Core Practical V	TECHNOLOGY OF FRUITS, VEGETABLES AND CROPS PRACTICAL	6Hrs*	3Credits

*(SemVI Practical)

1. Estimationof totalsoluble solids (TSS).
2. Estimationof pH and acidityofproducts.
3. Estimationofbrix:acidityratio
4. Estimationofascorbicacidandeffectofheattreatmentonit.
5. Tostudythestepsofcanmakingprocess.
6. Preparationand evaluationofpectinproducts.
7. Adulterationofspices.
8. Dehydration of fruits and vegetables.
9. Rehydration of fruits and vegetables.

REFERENCES

1. Girdharilal, Siddappaa, G.S and Tandon, G.L.1998. Preservation of fruits & Vegetables,ICAR,NewDelhi

2. W B Crusess.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition,Pub:AgrobiosIndia

3. Manay,S.&Shadaksharaswami,M.2004.Foods:FactsandPrinciples,NewAgePublishers

4. Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products,TataMcGraw-Hill publishing company limited, Second edition.

5. Srivastava, R.P. and Kumar, S. 2006 . Fruits and Vegetables Preservation- Principles andPractices.3rd Ed. InternationalBookDistributingCo.

Elective I	FOOD QUALITY CONTROL	4Hrs	4Credits

Objectives:

To enable the students

1. To gain knowledge about food laws and standards for food quality
2. To know about food additives and quality control of foods.

UNIT-I

Principles of Quality control of foods –Raw material control, processed food control and finished product inspection. Leavening agents- classification, uses and optimum levels.Food additives - Preservatives, colouring, flavouring, sequestering agents, emulsifiers, antioxidants.

UNIT-II

Standardisation systems for quality control of foods:-National and International standardization system, GMP, GHP. Different types of food grade materials. Food adulteration - Common adulterants in foods and tests to detect common adulterants.

UNIT-III

Standards for foods: Cereals and pulses, milk and milk products, Coffee, tea, sugar and sugar products.

UNIT-IV

Methods for determining quality - Subjective and objective methods.Sensory assessment of food quality-appearance, color, flavour, texture and taste, different methods of sensory analysis, preparation of score card, panel criteria, sensory evaluation room.

UNIT-V

Food safety, Risks and hazards: Food related hazards, Microbial consideration in food safety, HACCP-principles and structured approach. FSSAI

REFERENCES

1.Food science-Norman potter
2.Food Technology-Presscott.S.C.and Procter
3.Food chemistry-Meyer
4.Foodscience,Chemistry and experimental foods-M.Swaminathan
5.Food chemistry-Lee
6.Food science-Srilakshmi(2001)2nd edition, New age international publishers-(2001)
7.Rerfus.K.Guthrie-Food sanitation –3rd edition –Van Nostrand Reinhold Newyork 1988.
8.Mahirdra-S.N.-Food safety –A techno-legal analysis-Tata McGrawhill publishers 2000.
9.ManoranjanKalia-Food processing and preservation.
10.Roday-Food hygiene and sanitation.
11.Indian Food industry,2000,Vol19:2

Objectives:

- Toimpart comprehensive overviewof the scientificandtechnicalaspectsoffoodpackaging.
- Toinstillknowledgeonpackagingmachinery,systems,testingandregulationsofpackaging.

Unit1:

Food storage

Introduction classification of food based on perish ability, definition of food storage, types of storage, essential features of food storage areas, basic guidelines for food storage, care and maintenance of storage equipment.

Unit2:

IntroductiontoFoodPackaging

PackagingFunctionsandRequirements,,Printingofpackages.Barcodes&othermarking,Labeling Laws

Unit 3:

Food Packaging Materials

Paperandpaper-basedmaterials,corrugatedfiberboard(CFB).

Plastics,formation-Injectionmolding,Blowmolding,Typesofplastics,Lamination,Biodegradableplastics,EdiblepackagingandBio-composites.EnvironmentalConcerns-recycling and disposal ofplastic waste

Metalpackaging- Metals: Tinplate, tinning process, components of tinplate, tin free can (TFC)typesof can, metallic films, lacquers

Glass:Composition, Properties,Methodsofbottlemaking,Typesofclosures.

Unit4:

Package Designing for Foods

Package design for fresh horticultural produce and animal foods, dry and moisture sensitivefoods,frozenfoods,fatsandoils,thermally processed foods and beverages.

Unit 5:

Testing and Regulatory Aspects of Food Packaging(Chapter 22 Robertson, 2012)TestingProceduresforPackagingMaterials-thickness,tensilestrength,punctureresistance,burstingstrength,sealstrength,watervaporpermeability,CO2permeability,oxygenpermeability,greaseresistance,

TestingProceduresforPackagedFoods-
Compatibilityandshelflifestudies,evaluationoftransportworthiness offilled packages.
FoodPackaging Laws and Regulations.

REFERENCES

1. RobertsonGL,FoodPackaging–PrinciplesandPractice,CRCPressTaylorandFrancisGroup, 2012
2. PaineFAandPaineHY,AHandbookofFoodPackaging,BlackieAcademicandProfessional, 1992
3. ColesR,McDowellD,KirwanMJFood Packaging Technology.Blackwell, 2003
4. Mudambi, Sumathi V. and Rajagopal, M.V. 2001. Fundamentals of Foods & Nutrition. New Age International (P) Ltd. Publishers, New Delhi. 405p.
5. Sethi, M. 2008. Institutional Food Management. New Age International (P) Ltd. Publishers, New Delhi. 450p.
6. Sethi, M. and Malhan, S. 1989. Catering Management: An Integrated Approach. New Age International (P) Ltd. Publishers, New Delhi. 450

SBEC III	FOOD PLANT LAYOUT	3Hrs	2Credits

Objective:

1. Toimpart comprehensive overviewof the scientificandtechnicalaspectsoffood plan layout.

Unit I

Plant Layout-

Introduction Design considerations of processing agricultural and food products. Plant design concepts and general design considerations: Plant layout, plant location, location factors and their interaction with plant location, location theory models, and computer aided selection of the location. Human factors in design, selection of materials of construction and standard component, design standards and testing standards.

Unit II

Process Economics of Plant Layout

Feasibility analysis and preparation of feasibility report: plant size, factors affecting plant size and their interactions, estimation of break-even and economic plant size; Product and process design, process selection, process flow charts, Plant utilities, electricity, water, steam, air, raw material requirements and computer aided development of flow charts.

Unit III

Food Processing Plant & Equipment Layout

Plant layout and design of bakery and biscuit industries; fruits and vegetables processing industries including beverages Equipment layout in fruits and vegetables processing industries including beverages food Industries : Basic understanding of equipment layout and. Preparation of flow sheets for material movement and utility consumption in food plants.

Unit IV

Food Processing Plant & Equipment Layout

Plant layout and design of milk and milk products; meat, poultry and fish processing industries. Equipment layout in milk and milk products; meat, poultry and fish processing industries: Basic understanding of equipment layout and. Preparation of flow sheets for material movement and utility consumption in food plants.

Unit V

Project Evaluation and Cost Estimation

Preparation of flow sheets for material movement and utility consumption in food plants; Application of Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) in project planning and monitoring; Cost estimation for a Food Plant; Scale-up. Case Study: Preparation of plant layout and cost estimation for a food processing plant

REFERENCES

1. Maroulis, Z.B. and Saravacos, G.D. . Food Process Design. Marcel Dekker Inc,. 2003.
2. Antonio Lopez-Gomez, Gustavo V. Barbosa-Canovas,"Food Plant Design (Food Science and Technology)", CRC Press, 2005.
3. Towler, G. and Sinnott, R.K. Chemical Engineering design principles, practice and Economics of Plant and Procese. 2nd Edition. Elsevier.2012.
4. Theunis C. Robberts . Food plant engineering system. II Edition, CRC Press, Washington, 2013.
5. M Moore, Mac Millan, Plant Layout & Design. Lames, New York, 1971.

6. Langley and C. Billy, Refrigeration and Air conditioning, Ed. 3, Engle wood Cliffs (NJ), Prentice

SBEC IV	FOOD PLANT HYGIENE AND SANITATION	3Hrs	2Credits

Objectives:

- Introduction to Food Hygiene and Sanitation and its significance in Food industries.
- Understanding general principles of Food Hygiene in relation to food preparation.

UNIT I

General principle of food hygiene

Hygiene in rural and urban areas in relation to food preparation, personal hygiene and food handling habits.Sanitary aspects of building and processing equipment. Establishing and maintaining sanitary practices in food plants.

UNIT II

Physical and chemical control, Food contamination by microorganisms, effective control of micro-organisms, importance in food sanitation, micro-organisms as indicator of sanitary quality.

UNIT III

Sanitary aspects of water supply:

Source of water, quality of water, water supply and its uses in food industries. Purification and disinfection of water preventing contamination of potable water supply.

UNIT IV

Effective detergency and cleaning practices: Importance of cleaning technology, physical and chemical factors in cleaning, classification and formulation of detergents and sanitizers, cleaning practices. Role of sanitation, general sanitary consideration and sanitary evaluation of food plants.

UNIT V

Food Plant Hygiene and Sanitation

WastedisposalControlmethodsusingPhysicalandChemicalAgents,PestandRodentControl, ETP Design and Layout. Food storage sanitation, transport sanitation and watersanitation.

By-products utilisation obtained from dairy plant, egg& poultry processing industry and meatindustry.

Wastewater and solid waste treatment: - Waste-types-solid and liquid waste characterization,physical, chemical, biological, aerobic, anaerobic, primary, secondary and tertiary (advanced)treatments.

REFERENCES

1. Principles of Food Sanitation by Marriott and Norman, G.
2. Hygiene and Sanitation in Food Industry by S. Roday, TMH
3. Guide to Improve Food Hygiene by Gaston and Tiffney, TMH.
4. Practical Food Microbiology & Technology by Harry H. Weiser, Mountney, J. and Gord, W.W.
5. Food Poisoning and Food Hygiene by Betty C. Hobbs, London publication.

6. NormanG.MarriottandRobertB.Gravani.(2006).PrinciplesofFoodSanitation, 5th edition

SEMESTER VI

Part	Course Type	CourseTitle	Hrs. /week	Examination				Credits
				Hrs.	CIA marks	ESE marks	Total marks	
III	CoreVII	Food and Nutrition	6	3	40	60	100	4
	CoreVIII	TechnologyofEggand Dairy	4	3	25	75	100	4
	CoreIX	Technologyof FleshyFoods,Spicesand Condiments	4	3	25	75	100	4
	CorePracticalV	Technology of Fruits,Vegetablesand PlantationCrops Practical	-	3	40	60	100	3
	CorePracticalVI	TechnologyofEgg,Dairy andFleshyFoodsPractical	6	3	40	60	100	3
	ElectiveIII	FoodProduct Development	4	3	25	75	100	4
IV	SBECV	Bakery	3	3	40	60	100	2
	SBECVI	EntrepreneurshipDeveopment	3	3	40	60	100	2
V	Extension Activities	NSS/NCC/YRC/ExtracurricularActivities						
	Total		30	30	275	525	800	26

CoreVII	FOOD AND NUTRITION	6Hrs	4Credits

Objectives

- Learnthemetabolicpathwaysofnutritionalsignificance
- Getacquaintedwiththe roleofenzymesandcoenzymesin metabolism

UNIT-I

Concepts of Food and Nutrition

Functions of food; Basic food groups; nutrients supplied by food; Water and energy balance, water intake and losses, basal metabolism, acid base balance

UNIT-II

Balanced diet

Formulation of diets, classification of balanced diet, preparation of balanced dietfor various groups; Recommended dietary allowances for various age groups;Malnutrition; Assessment of nutritional status; Food fad and faddism; Potentiallytoxic substance in human food

UNIT-III

Mechanism of Enzyme action

Introduction to enzyme and characteristics, coenzymes, kinetics and mechanismof enzyme action.

Minerals

Functions, sources, absorption, deficiency of macro minerals
Functions, sources, absorption, deficiency of micro minerals

UNIT-IV

Nutrients

Functions, sources, digestion, absorption, assimilation, transport of carbohydrates
Functions, sources, digestion, absorption, assimilation, transport of proteins
Functions, sources, digestion, absorption, assimilation, transport of fats

UNIT-V

Vitamins Functions, sources, absorption, deficiency of Vitamins A &D
Functions, sources, absorption, deficiency of Vitamins E & K
Functions, sources, absorption, deficiency of water soluble vitamins.

REFERENCES

1. Albanese,A.(Ed.).(2012).NewermethodsofnutritionalbiochemistryV3:Witha pplicationsandinterpretations.Elsevier.
2. Bettelheim,F.A.,Brown,W.H.,Campbell,M.K.,&Farrell,S.O.(2009).General, Organic&Biochemistry.Brooks/ColeCengageLearning.
3. Champe, P. C., Harvey, R. A., & Ferrier, D. R. (2005). Biochemistry.LippincottWilliams&Wilkins,6th Edition,WoltersKluwer,Lond on.
4. Chatterjea M.N. and Shinde R.,2016 -Textbook of Medical Biochemistry, 8th edition –Jaypee Brothers MedicalPublishers (P)Ltd.NewDelhi.
5. David L.N. and Cox M.M., 2017 – Lehninger Principles of Biochemistry, 7th edition - W. H.Freeman &CoLtd.
6. HarbansLal, 2017 - Essentials of Biochemistry for BSc Nursing Students – CBS Publishers&Distributors Pvt.Ltd.,New Delhi.
7. Murray,R.K.,Granner,D.K.,Mayes,P.A.andRodwell,V.W.(2000):25thEd.HarpersB iochemistry.Macmillanworthpublishers.
8. Sathyanarayana U and Chakrapani U, 2016 – Biochemistry, 4th Revised Edition

– Elsevier(NewDelhi) andBooks and Allied(p) Ltd.,Kolkata.
9. ShanmughamAmbika (1985) Fundamentals of bio-chemistry tomedicalstudents.NVABharatPrinters,and traders56,PetersRoad,Madras-86.

CoreVIII	TECHNOLOGY OF EGG AND DAIRY	4Hrs	4Credits

Objectives

- To know the need and importanceofdairyand eggindustry
- Toknowthe compositionalandtechnological aspectsofmilk and egg.
- Tostudyprocessedmilkand egg products.

UNIT-I

Cream: Basic aspect, Classification, manufacture of different types of cream, processing of cream; Classification of dairy products;

Butter: Definition, composition; processing and production steps, overrun, butter making machines, quality testing of table butter, butter- defects, causes and their prevention, packaging and storage

UNIT-II

Paneer and Cheese: Definition, composition, types, processing steps, process flow diagram, equipment, quality defects, causes and prevention, packaging and storage.

UNIT-III

Ice cream and frozen desserts: Definition, composition, types, Processing steps and flow diagram, equipment, quality testing, defects causes and prevention, packaging and storage.

UNIT-IV

Condensed and Dried milk: Definition, composition, role of milk constituents
in condensed milk, manufacture of condensed milk, types of standards for dried milk

UNIT-V

Eggs: Structure, composition, quality characteristics, processing, preservation of eggs. Factorsaffecting egg quality andmeasuresofeggquality.
By-products of eggs and their utilization

REFERENCES

1. DeSukumar,OutlinesofDairyTechnology,OxfordUniversityPress,Oxford.2007.
2. HallGM,FishProcessingTechnology,VCHPublishersInc.,NY,1992
3. SenDP,AdvancesinFishProcessingTechnology,AlliedPublishersPvt. Limited2005
4. ShahidiFandBottaJR,Seafoods:Chemistry,Processing,TechnologyandQuality,BlackieAcademic & Professional,London,1994
5. Y.H. Hui. 1993. Dairy Science and Technology Handbook, Vol. I, II and III. Wiley-VCH, USA
6. WebbandJohnson, Fundamentalsof DairyChemistry
7. Vikas Nanda. 2014. Meat, Egg and Poultry Science & Technology. I.K. International Publishing HousePvt. Ltd., New Delhi.

CoreIX	TECHNOLOGY OF FLESHY FOODS, SPICES AND CONDIMENTS	4Hrs	4Credits

Objectives

- Tounderstandneedandimportanceof fleshy food and spices and condimentsindustries
- Tostudyprocessingandpreservationof fleshy foods.

UNIT-I

Structure and composition of muscle, types, classification and composition of fish

Pre-slaughter operations and slaughtering operations for animals and poultry.

Dressing and evaluation of animal carcasses; Factors affecting post-mortemchanges, properties and shelf life of meat;

Mechanical deboning, grading and aging; Eating and cooking quality of meat.

UNIT-II

Meat cutting and handling; Preparation, preservation and equipment for manufacture of smoked meat and its quality evaluation

Preparation, packaging and equipment for manufacture of dehydrated meat products and their quality evaluation;

Preparation, preservation and equipment for manufacture of meat sausages andtheir quality evaluation.

UNIT-III

Production and processing scenario of spice, flavour and plantation crops andits scope.

Major spices: Post harvest technology, composition

Processed products of spices: Ginger, chilli, turmeric, onion and garlic, pepper,Cardamom

UNIT-IV

Minor spices: Herbs, leaves and spartan seasonings and their processing andutilization;

All spice, Annie seed, sweet basil; Caraway seed, cassia, cinnamon Clove, coriander, cumin, dill seed; Fennel seed, nutmeg, mace, mint marjoram. Rosemary, saffron, sage; Savory, thyme, ajowan; Asafetida, curry leaves

UNIT-V

Flavours of minor spices; Flavour of major spices and condiments

Spice oil and oleoresins: Extraction techniques; Super critical fluid extraction ofSpices.

Functional packaging of spices and condiments products

By-products of plantation crops and spices and condiments.

REFERENCES

1. K.G. Shanmugavelu. Spices and Plantation Crops. Oxford & IBH Publishing Co., New Delhi
2. J.W. Purseglave, E.G. Brown, C.L. Green and Robins. Spices, Vol. I and II. SRJ Academic Press,New Delhi.
3. H. Panda. Handbook on Spices and Condiments (Cultivation, Processing and Extraction). AsiaPacific Business Press Inc., New Delhi.
4. S. Gupta. Handbook of Spices and Packaging with Formulae. Engineers India Research Institute,
5. Vikas Nanda. 2014. Meat, Egg and Poultry Science & Technology. I.K. International Publishing HousePvt. Ltd., New Delhi.
6. B.D. Sharma and Kinshuki Sharma. 2011. Outlines of Meat Science and Technology. JaypeeBrothersMedical Publishers Pvt. Ltd., New Delhi.
7. Fidel Toldrá, Y. H. Hui, IciarAstiasarán, Wai-Kit Nip, Joseph G. Sebranek, Expedito-Tadeu F. Silveira,
8. Louise H. Stahnke, Régine Talon. 2007. Handbook of Fermented Meat and Poultry. BlackwellPublishing Professional, Ames, Iowa, USA.
9. Joseph Kerry, John Kerry and David Ledward. 2005. Meat Processing-Improving Quality. WoodheadPublishing Ltd., Cambridge, England.
10. B.D. Sharma. 1999. Meat and Meat Products Technology Including Poultry Products Technology. JaypeeBrothers Medical Publishers Pvt. Ltd, New Delhi.
11. Alan H. Varnam and Jane P. Sutherland. 1995. Meat and Meat Products: Technology, Chemistry andMicrobiology. Chapman & Hall, London.
12. William J. Stadelman and Owen J. Cotterill. 1995. Egg Science and Technology, 4th Ed. Food ProductsPress, NY, USA.
13. R.A. Lawrie. 1985. Meat Science, 4th Ed. Pergamon Press, Oxford, UK.

Core Practical VI	TECHNOLOGY OF EGG, DAIRY AND FLESHY FOODS PRACTICAL	6Hrs	3Credits

Objectives

- To acquire practical skills in techniques used for processing of meat and dairy product

- To formulate and develop novel products with meat and dairy and understand their marketability in the food industry.

1. Preparation of ghee
2. Preparation of paneer
3. Preparation of ice-cream
4. Preparation of khoa
5. Preparation of whey drink
6. Preparation of halwa/ kheer etc.
7. Determination of selected quality parameters of selected dairy products.
8. Preservation of meat/ fish by curing and pickling
9. Preservation of meat by dehydration
10. Evaluation of quality and grading of raw and boiled eggs
11. Preparation of value added dairy/meat/ egg

REFERENCES

1. Das H. (2005). Food Processing Operations Analysis, Asian Books.
2. De Sukumar, (2007) Outlines of Dairy Technology, Oxford University Press.
3. Ramesh C. Chandan, ArunKilaraNagendra Shah (Editors) 2008 Dairy Processing and Quality Assurance Hardcover, Wiley Blackwell Publisher
4. Spreer, Edgar, (2005). Milk and Dairy Product Technology, Marcel Dekker.
5. 3.Y.H. Hui (2012)- Handbook of meat and Meat processing, CRC Press

Elective III	FOOD P RODUCT DEVELOPMENT	4Hrs	4Credits

Learning Objectives

To enable the students to:

- Understandtheconceptofdevelopment ofa newproduct
- Discussthepreparationofnewproductsbasedonspecialdietaryrequirements,function ality,convenience
- EmploynovelmethodstoenhancetraditionalIndian foods.

UNIT-I

IntroductiontoNewfoodproducts&foodproductdevelopment

Concepts,definitions&characteristics.Factorstoconsiderforfoodproductdevelopment (externalandinternalfactors)

Typesofnewfoodproducts-Lineextensions,new-to-worldproducts,innovative/creativeproducts,existingproducts-repositioned,reformulated, newform,newsize, andnewpackage.

UNIT-II

Stagesinfoodproduct developmentIdeageneration

Internal&externalsources;Screening-CourseObjectivesandcriterion; Development of product prototype- market research, concepttestingapproaches,productformulationandspecification,productoptimization, process development & optimization, product attributes,scale up requirements; Product prototype testing - consumer testing,packaging testing, shelf life testing, product integrity and conformanceto standards; Marketing plans - price structure, place & distributionsystem,promotionalprogram,marketpositioning,testmarketing,resultsevaluation

UNIT-III

Conceptsinsensory evaluationoffoods

Sensoryattributesoffoods:Chemical senses(olfactoryandgustatory);physical, kinesthetic and tactile senses (appearance, color, texture, &overalltaste).

Score card development. Role of sensory analysis in product development&qualitycontrol.

UNIT-IV

Subjectiveevaluationmethods

Definition, advantages, and disadvantages. Subjective tests: Analytical tests(sensitivitytests,differencetests,rankingtests),descriptivetests,andconsumer/ preference tests.

UNIT-V

Objectiveandinstrumental evaluationmethods

Objectivemethodsforappearance,size,shape,volume,specificgravity,refractiveindex, moisture, fat, and others.Instrumentalmethodsforevaluationofcolor,viscosity,texture&aroma.

TEXT BOOKS

1. Carpenter Lyon &Hasdell, “Guidelines for Sensory Analysis in Food Product Development and Quality Control”, Springer, 2000
2. Earle, M. D., Earle, R. L., & Anderson, A. M. (2001). Food product development. Boca Raton, Fla: CRC Press.
3. Gordon L Robertson. 2006. Food Packaging: Principles and Practice. 2nd Ed. CRC Press
4. Harper J.M. Extrusion of Foods. Vol. 1 & 2 (1991) CRC Press, Inc.) Boca Raton, Aorida
5. Naik, H.R., & Amin, T. (2021). Food Processing and Preservation (1st ed.). CRC Press. https://doi.org/10.1201/9781003243250
6. V.K. Joshi (2006) Sensory science- Principles and Applications in Food Evaluation,Agrotech Publishing Academy, Udaipur.

SBEC V	BAKERY	3Hrs	2Credits

Learning Objectives:

To enable student to

1. Understand the technique of baking.
2. Know the equipments and ingredients used in baking.
3. Understand the production of baked products.

UNIT I: BAKING

a. History of baking, definition, principle, changes that take place during baking, advantages and disadvantages, classification of baked foods.
b. Factors to be considered for setting up a bakery unit.

UNIT II: EQUIPMENTS

a. Major equipment's – description, types, materials and usage.
b. Minor equipment's - description, types, materials and usage.

UNIT III: INGREDIENTS

a. Major ingredients – types, role and usage.
b. Minor ingredients - types, role and usage.
c. Batter and Dough – definition, types, methods of making batter and dough.

UNIT IV: CAKES

a. Cake preparation – ingredients, methods, types.
b. Faults and remedies.
c. Icing – Definition, types.

UNIT V: BISCUITS

a. Biscuit preparation – ingredients, methods, types.
b. Faults and remedies.

TEXT BOOKS

1. YogambalAshokkumar, (2012), Textbook of Bakery and Confectionery, 2nd edition, PHI, New Delhi.
2. Sivasankar, D., (2007), Food Processing and Preservation, Prentice Hall of India, New Delhi.
3. Dubey, S.C., (2012), Basic Baking, 4th Edition, The Society of Indian Bakers, New Delhi.
4. Bakers, (2008), Handbook on Practical Baking, US Wheat Associates, New Delhi.

SBEC VI	ENTREPRENEURSHIP DEVELOPMENT	3Hrs	2Credits

Objectives

- Initiate entrepreneurial motive and impart skills and capabilities for entrepreneurship
- Comprehend nuances of entrepreneurship
- Gain knowledge on Governmental plans and programs

UNIT-I

Entrepreneurship: Importance and growth, characteristics and qualities of entrepreneur

Role of entrepreneurship, ethics and social responsibilities

Entrepreneurship development: Assessing overall business environment in the Indian economy

Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs

UNIT-II

Globalization and the emerging business/entrepreneurial environment

Concept of entrepreneurship

Entrepreneurial and managerial characteristics, managing an enterprise

Motivation and entrepreneurship development, importance of planning, monitoring, evaluation and follow up, managing competition, entrepreneurship development programs

SWOT analysis

Generation, incubation and commercialization of ideas and innovations

UNIT-III

Women entrepreneurship: Role and importance, problems

Planning and evaluation of projects: Growth of firm, project identification and selection, factors inducing growth

UNIT-IV

Project feasibility study: Post planning of project, project planning and control; New venture management; Creativity

Government schemes and incentives for promotion of entrepreneurship; Government policy on small and medium enterprises (SMEs)/SSIs

UNIT-V

Export and import policies relevant to food processing sector; Venture capital; Contract farming and joint ventures, public-private partnerships

Overview of food industry inputs; Characteristics of Indian food processing industries and export

REFERENCES

1. B. Jankiraman,P.V. Raveendra, V.K. Srirama(2010). Role and Challenges ofEntrepreneurshipDevelopment, Excel Books Publishers
2. Dr.JayshreeSuresh(2012)EntrepreneurialDevelopment,MarghamPublications

3. SSKhanka(2011)Entrepreneurial development,S Chand,and company
4. SunilGupta,(2018),Small-Scale Industries andEntrepreneurship,ABD Publishers
5. TNChhabra(2019),EntrepreneurshipDevelopment, SunIndiaPublications
6. Taneja,S.andGupta,S.L.(1992).EntrepreneurshipDevelopment,New VentureCreation,GalgotiaPublishingCompany, New Delhi.