Swami RamanandTeerthMarathwada University, Nanded

Choice Base Credit System (CBCS) Course Structure (New Scheme)

Faculty of Science

B.Sc First Year

First Semester Food Science Syllabus

Semester Pattern effective from June 2016

Course No.	Course title	Periods/ Week	Total Period	Internal Evaluation	External Evaluation	Total Marks	Credits
CCFS-IA	English & Science communication Skills-I	03	45	10	40	50	2
CCFS-IIA	Principles of food processing	03	45	10	40	50	2
CCFS-IIIA	Food Production Trends and Programmes	03	45	10	40	50	2
CCFS-IVA	Food Chemistry	03	45	10	40	50	2
CCFS-VA	Fundamentals of Microbiology	03	45	10	40	50	2
CCFS-VIA	Human Nutrition	03	45	10	40	50	2
CCFS-VIIA	Fluid Mechanics & Hydraulics	03	45	10	40	50	2
CCFSP-1A	Practicals based on CCFS-II & IV A	03+03	20	20	80	100	4
CCFSP-2A	Practicals based on CCFS-V, VI &VII A	03+03	20	20	80	100	4
						550	**22**

Swami RamanandTeerthMarathwada University, Nanded

Choice Base Credit System (CBCS) Course Structure (New Scheme)

Faculty of Science

B.Sc First Year

Second Semester Food Science Syllabus

Semester Pattern effective from June 2016

Course No.	Course Title	Periods/ Week	Total Period	Internal Evaluation	External Evaluation	Total Marks	Credits
CCFS-IB	English & Science communication Skills-II	03	45	10	40	50	2
CCFS-IIB	Biochemistry	03	45	10	40	50	2
CCFS-IIIB	Post- Harvest Management of fruit and vegetable	03	45	10	40	50	2
CCFS-IVB	Cereal Processing	03	45	10	40	50	2
CCFS-VB	Food Microbiology	03	45	10	40	50	2
CCFS-VIB	Energy generation and Conservation	03	45	10	40	50	2
CCFS-VIIB	Heat and Mass Transfer	03	45	10	40	50	2
CCFSP-1B	Practicals based on CCFS-II,III & IVB	03+03	20	20	80	100	4
CCFSP -2B	Practicals based on CCFS-V,VI & VIIB	03+03	20	20	80	100	4
						550	**22**

Swami RamanandTeerthMarathwada University, Nanded

Choice Based Credit System(CBCS) Course Structure (New Scheme)

Faculty of Science

B.Sc. Second Year

Third Semester Food Science Syllabus

Semester pattern effective from June 2017

Sr. No.	Paper No.	Name of the course	Instruction Hrs/week	Total Period	Internal Evaluation	External Evaluation	Total Marks	Credits
1	CCFS-IC	English & Science Communication Skill	03	45	10	40	50	02
2	CCFS-IIC	Legume and Oil Seed technology	03	45	10	40	50	02
3	CCFS-IIIC	Meat, Poultry and Fish Technology	03	45	10	40	50	02
4	CCFS-IVC	Wheat Milling and Baking Technology	03	45	10	40	50	02
5	CCFS-VC	Milk &Confectionery Technology	03	45	10	40	50	02
6	CCFS-VIC	Techniques in Food Analysis	03	45	10	40	50	02
7	CCFS-VIIC	Food Processing Equipments	03	45	10	40	50	02
8	CCFSP-IC	Practicals based on CCFS-II-C, III-C,IV-C	03+03		20	80	100	04
9	CCFSP-IIC	Practicals based on CCFS-V-C VI-C,VII-C	03+03		20	80	100	04
10	SEC-I	Spice & Condiments Processing Or Bakery Technology I	03	45	25	25	50	02
							600	**24**

Swami RamanandTeerthMarathwada University, Nanded

Choice Based Credit System(CBCS) Course Structure (New Scheme)

Faculty of Science

B.Sc. Second Year

Fourth Semester Food Science Syllabus

Semester pattern effective from June 2017

Paper No.	Name of the course	Instruction Hrs/week	Total Period	Internal Evaluation	External Evaluation	Total Marks	Credits
CCFS-ID	English & Science Communication Skill	03	45	10	40	50	02
CCFS-IID	Fruits and Vegetable Processing	03	45	10	40	50	02
CCFS-IIID	Fermentation and Industrial Microbiology	03	45	10	40	50	02
CCFS-IVD	Spice and Flavour Technology	03	45	10	40	50	02
CCFS-VD	Food Additives	03	45	10	40	50	02
CCFS-VID	Food packaging	03	45	10	40	50	02
CCFS-VIID	Computer Fundamental	03	45	10	40	50	02
CCFSP-ID	Practicals based on CCFS-II-D, III-D,IV-D	03+03	-	20	80	100	04
CCFSP-IID	Practicals based on CCFS-V-D, VI-D,VII-D	03+03	-	20	80	100	04
SEC-II	Dairy Products Development **Or** Bakery Technology II	03	45	25	25	50	02
						600	**24**

Swami RamanandTeerthMarathwada University, Nanded

Choice Base Credit System (CBCS) Course Structure (New Scheme)

Faculty of Science

B.Sc Third Year

Fifth Semester Food Science Syllabus

Semester Pattern effective from June 2016

Paper No.	Name of the Course	Periods / Week	Total Period	Internal Evaluation	External Evaluation	Total Marks	Credits
CCFS-IE	Environmental Studies	03	45	10	40	50	***
CCFS –IIE	Food Biotechnology	03	45	10	40	50	2
CCFS –IIIE	Product Development &Formulation	03	45	10	40	50	2
CCFS –IVE	Food Industrial Byproducts And Industrial Waste Management	03	45	10	40	50	2
CCFS –VE	Carbonated and Beverage Technology	03	45	10	40	50	2
CCFS –VIE	Biochemical Engineering	03	45	10	40	50	2
CCFS –VIIE	Instrumentation and Process Control	03	45	10	40	50	2
CCFSP-1	Practical's based on DSEPFS II,III & IV E	03+03	20	20	80	100	4
CCFSP-2	Practical's based on DSEPFS V, VI & VII E	03+03	20	20	80	100	4
SEC-III	Earning& Learning programme (ELP)ORDevelopment of fortified food products	03	45	25	25	50	2
Total						**600**	**22**

Swami RamanandTeerthMarathwada University, Nanded

Choice Base Credit System (CBCS) Course Structure (New Scheme)

Faculty of Science

B.Sc Third Year

Sixth Semester Food Science Syllabus

Semester Pattern effective from June 2016

Paper No.	Name of the Course	Period /Week	Total Period	Internal Evaluation	External Evaluation	Total Marks	Credits
CCFS-IF	Specialty Foods	03	45	10	40	50	2
CCFS –IIF	Extrusion Technology	03	45	10	40	50	2
CCFS –IIIF	*Food Hygiene and Microbiological Standards	03	45	10	40	50	2
CCFS –IVF	Entrepreneurship Development & Communication skill	03	45	10	40	50	2
CCFS –VF	Food Plant Design & Layout	03	45	10	40	50	2
CCFS –VIF	Food Laws and Regulation	03	45	10	40	50	2
CCFS-VIIF	Food Quality Assurance and certification	03	45	10	40	50	2
CCFSP-1	Practicals based on CCFS-IF, IIF& IIIF	03+03	20	20	80	100	4
CCFSP-2	Practicals based on CCFS-IV, V & VI F	03+03	20	20	80	100	4
DSEFSP-3	Dissertation	04	20	10	40	50	2
SEC-IV	Food Processing **OR**Fermented food products	03	45	25	25	50	2
						650	**26**
Total Marks and credits of B.Sc. I, II and III year	Total Marks of B.Sc.Food Science Degree (Three years of course with dissertation, CBCS Pattern)						**44+ 48+ 48= 140.**

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

I year I semester

Subject:Principle of Food Processing Code: CCFS II A

Credits: 02 Marks: 50 (External 40, Internal 10)

1. Food Processing:-a) Introduction, scope.b) Sources of food.c) Perishable &non perishable food. d) Causes of food spoilage
2. Preservation by Salt & Sugar:-a) Principle.b) Methods.c) Equipments used
d) Effect on food quality.
3. Preservation by thermal Processing:-a) Principle.b) Equipments used.
C) Methods- Canning, blanching, sterilization, evaporation, pasteurization
4. Preservation by drying, dehydration and concentration:-a) Principle
b) Equipments and machineries used.c) Methods of drying, dehaydration
d) Methods of concentration- Thermal, freeze, membrane
e) Changes in food quality by drying dehydration & concentration
5. Preservation by radiation, chemicals & preservatives:-a) Principle
b) Methods of radiations) Effect on microorganisms) Physical, chemical & biological effects on quality of food
6. Use of low temperature:-a) Principle) Equipments' used
c) Methods - chilling. freezing, cold storage.d) Effect on food quality

Praticals:-

1) Study of various machineries used in processing.
2) Demonstration of effect of blanching on quality of foods.
3) Study of preservation of foods by heat treatment canning-Canning of fruits and vegetables.
4) Preservation of food by high concentration of sugar i.e., preparation of jam
5) Preservation of food by using slat-pickle.
6) Preservation of food by using chemicals
7) Preservation of bread, cake using mold inhibitors.
8) Drying of Mango/other pulp.

Reference Books:

1) Technology of Food preservation N.W. Dersoir and N.W. Dersoir
2) Introduction to Food Science and Technology. G.P. Stewart and M.A. Amerine

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

I year I semester

Subject: Food Production Trends and ProgramsCode: CCFS III A

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit 1: Food demand and supply- Qualitative and quantitative requirements

Unit 2: Expected technological advances to meet the needs

Unit 3: Future priorities in food production needs status of food industry in India and abroad

Unit 4: Magnitude and interdependence of food production and processing agencies

Unit 5: Food availability production – Types of foods like processed semi processed, ready to eat foods, fast foods, pet foods

Unit 6: Food characteristics and nutritional significance of major food groups

Unit 7: Present trends of consumption and further requirements

Unit 8: Consumers change of aptitude in food products consumption

Unit 9: New food products developed programs aimed for making more food availability to increasing population and their prospects merits and drawbacks, prospects for future growth in India

Unit 10: National and international trends and programs in food handing, processing and marketing

Unit 11: Potentials and prospects of developing food industry in India

Unit 12: Food losses-factors affecting- programs and strategies to eliminate the losses and meet the required demand.

Unit 13: Global demand of food

Unit 14: World food day – importance and action plans

Reference books:

1. Food Science 3rd Edition: N.N. Potter, AVI Publishing Co Lns west post. USA.
2. Caned Foods Thermal Processing and Microbiology: AC Herson& A.D. Null and J.A. Churchill Ltd.
3. Agricultural administration in India. K. Vijayaraghavan
4. Modern techniques field crops of raising :Chidda Singh, Oxford & IBH Pub co.
5. Agriculture Research systems &21st : K.V. Raman, M.M. Anwer and R.D. Gaddagimeth, Management in the a NAARAM Alumni Association National Academy of Agril, Research management, Rajendranagar Hyderabad.
6. Food processing industries: B.M. Desai, V.K. Gupta, N.V. Namboodri. Oxford & IBH Publishing Company, PVT.Ltd. 66 Janpath, New Delhi.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

I year I semester

Subject: Food Chemistry Code: CCFS IV A

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit 1: Nature Scope and development of food chemistry. Role of food chemist

Unit 2: Moisture in Foods

i) Role and type of water in foods, ii) Functional properties of water, role of water in food spoilage iii) Water activity and sorption isotherm iv) Molecular mobility and foods stability

Unit 3: Dispersed systems of foods

(i) Physicochemical aspects of food dispersion system a) Sol b) Gel c) Foam d) Emulations (ii) Rhology of diphase systems

Unit 4: Carbohydrates

(i) Functional characteristics of different carbohydrates (Sugar-water relationship and sweetness) (ii) Maillard reactions, caramelization, methods to control non enzymatic reactions. (iii) Modification of carbohydrates – unmodified and modified starches, Modified celluloses (iv) Dietary fibres – NDF, ADF, cellulose, hemicelluloses, pectin and carbohydrates digestibility – sugars and starch and their values (v) Functional properties of polysaccharides, natural vegetable gums, carbohydrate composition of various natural foods.

Unit 5: Proteins in foods

(i) Physicochemical properties – ionic properties, denaturation, gelation and hydrolysis (ii) Protein content and composition in various foods- cereal grains, legumes and oilseed proteins, protein of meat, milk, egg and fish. (iii) Functional properties of proteins in foods- water and oil binding, foaming and gelation, emulsification (iv) Effects of processing on functional properties of proteins-heat processing on functional properties of proteins-heat processing, alkali treatments, chilling, freezing, dehydration & radiations. (v) Unconventional sources of proteins- SCP, Fish protein concentrates, leaf proteins.

Unit 6: Lipids of Foods

(i) Role and Use of lipid/fat: Occurance, fat group classification (ii) Physicochemical aspects of fatty acids in polymorphisms & its application. (iii) Chemical aspects of lipolysis, autooxidation, antioxidants (iv) Technology of fat

and oil processing-a) Refining b) Hydrogenation c) Interesterification d) Safety use of oils and fats in food formulation

Unit 7: Enzymes in food industry

Carbohydrases (amylases, cellulases, pectinases, invertases) Proteases, lipases & oxidases in food processing.Role of endogenous enzymes in maturation and ripening, Enzymatic browning- mechanism, methods of regulation control.

Practicals:

1. Determination of moisture content of foods using different methods
2. Studies of sorption isotherm of different foods
3. Study of swelling and solubility characteristics of starches
4. Study of rheological properties of diphase system
5. Determination of crude protein by microkjeldhal method
6. Preparation of mineral solutions by using ash and tri acid methods (Dry and wet oxidations)
7. Estimation of calcium
8.Determination of iron
9. Estimation of magnesium
10. Study of estimation of trypsin inhibitor activity
11. Study of tannins and phytic acid from foods
12. Determination of vitamin A (Total Carotenoids)
13. Determination of food colors
14.Assessments of various pectinases from fruits

Reference books:

1. Food chemistry: Vol I Fennama O.R.
2. Food chemistry : Mayer L.H.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

I year I semester

Subject: Fundamental of Food Microbiology Code: CCFS V A

Credits: 02 Marks: 50 (External 40, Internal 10)

1. Microbiology -

a) Evolution & scope of microbiology

b) Need & Importance

c) General morphological, cultural characteristics

d) Reproduction of bacteria, yeasts, moulds, actionomycetes, algae, protooa.

2. Nutrient transport phenomenon & physiology of micro-organisms

3. Genctic recombination, transduction, transformation & bacterial conjugation, mutation& mutagenesis

4. Growth curve: Physical & chemical factors influencing growth & destruction of microorganisms including thermal death time, Z,F, & D values.

5. Viruses : Structure & replication with perticular reference to food borne viruses

6. Control of microorganisms by physical & chemicals, antibiotics & other chemotherapeutic agents

Practicals:

1) Microscopy
2) Micrometry.
3) Cleaning and sterilization of Glassware
4) Preparation of nutrient agar media and techniques of inoculation
5) Staining methods : Monochrome staining, Negative staining, Gram staining, endospore staining.
6) Pure culture techniques (Streak plate / pour plate)
7) Introduction to identification procedures (morphology and cultural characteristics)

8) Study of growth characteristics of bacteria
9) Study of anaerobic culture methods.

Reference books:

1) Biology of Microrganisms T.D. Brock
2) Microbiology Fundamentals and Applications Purohit SS
3) Microbiology

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

I year I semester

Subject: Human NutritionCode: CCFS VI A

Credits: 02 Marks: 50 (External 40, Internal 10)

1. Concepts & content of nutrition -
a) Nutrition agencies
b) Nutrition of community
c) Nutritional policies & their implementation
d) Metabolic function of nutrients
2. Water & energy balance
a) Water intake & losses
b) Basal metabolism-BMR Body surface area & factors affecting BMR
3. Formulation of diets
a) Classification of balanced diet
b) Preparation of balanced diet for various groups Diets & disorders
4. Recommended dietary allowances For various age groups
a) According physiological status, Athletic & sports man
b) Geriatric persons
5. Malnutrition
a) Type of Malnutrition
b) Multi-factorial causes
c) Epidemiology of under nutrition & over nutrition
d) Nutrition infection & immunity
e) Nutrition education
6. Assessment of nutritional status based on Diet surveys
a) Anthropometry
b) Clinical examination
c) Biochemical assessment
d) Additional medical information
7. In-born errors of metabolism related to Blood constituents
a) Nutrients
b) Hormones & enzymes
c) Miscellaneous disorders

8. Food fad & faddism
9. Potentially toxic substance in human food

Practicals:

1) Role of various national and International Agencies in the field of human nutrition
2) Study of calculation of BMR & body surface area
3) Anthropometric measurements
4) Preparation of balance diets for adolescent girl and pregnant woman- calculate energy value, Protein, iron, calcium and vitamin (A,B,C)
5) Biochemical analysis of urine and blood
6) Nutritional survey

Reference books:

1. Community Nutrition Mc. Laren
2. ICMR Publications ICMR
3. Food & Nutrition M. Swaminathan
4. Assessment of Nutritional status of community D.B. Jelliffee

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

I year I semester

Subject: Fluid Mechanics & HydraulicsCode: CCFS VII A

Credits: 02 Marks: 50 (External 40, Internal 10)

1	Properties of fluids and Static pressure of liquids : Hydraulic pressure, absolute and gauge pressure, pressure head of a liquid. Pressure on vertical rectangular surfaces. Compressible and non-compressible fluids. Surface tension
2	**Pressure measuring devices:** Simple, differential, micro, inclined manometer, mechanical gauges,
3	**Floating bodies :**Archimede's principle, stability of floating bodies. Equilibrium of floating bodies
4	**Fluid flow :**Classification, steady, uniform and non-uniform, laminar and turbulent, Bernoulli's theorem and its applications, Flow through pipes: Loss of headFlow through orifices, discharge losses. Time for emptying a tank. Venturi meter, pitot tube, Rota meter. Water level point gauge, hook gauge. Reynold's number
5	**Pumps :** Classification, reciprocating, centrifugal pump. Pressure variation, work efficiency. Types of chambers, selection and sizing

Practicals

1 Study of different tools and fittings

2 To plot flow rate versus pressure drop with U-tube manometer

3 Verification of Bernoulli's theorem

4 Determination of discharge co-efficient for venturi,
Orifice, V-Notch

5 Verification of emptying time formula for a tank

6 Determination of critical Reynold's number by Reynold' apparatus

7 Study of reciprocating, centrifugal and gear pump

8 Calibration of Rotameter

9 Study of different types of valves

REFERENCE BOOKS

1 Fluid Mechanics V.L. Streeter (1983), McGraw Hill, New York

2 Fluid Mechanics R.S. Khurmi (1994), Sultan Chand Publishers, Delhi.

3 Hydraulics JagdishLal (1987), Metropolitan Publishers, New Delhi.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

I year II semester

Subject: BiochemistryCode: CCFS II B

Credits: 02 Marks: 50 (External 40, Internal 10)

1. **Biochemistry**-a) Introduction.b) Nature and scope

2. Cellular Biochemistry-a) Composition and function of cell organelle
b) Cell structure - plant and animal) Carbohydrates - occurrence, classification, structures,physiochemical and metabolic functions
d) Metabolism of carbohydrates - glycolysis, TCA cycle, HMP pathway, oxidative phosphorylation and Gluconeogenesis

3. Proteins-a) Occurrence.b) Classification and structures
c) physicochemical and metabolic functions

4. Lipids -a) Occurrence .b) Classification and structures) Physicochemical and metabolic function.d) Metabolism - degradation of fats, B-oxidation

5. Nucleic Acids-a) Classification and structure's) Biosynthesis of Nucleic Acid - RNA and DNA metabolism.

6. Vitamins-a) Classification and sources.b) Chemistry and metabolic functions
c) Efficiency diseases syndromes

7. Enzymes-a)Chemical nature and nomenclature.b) Classification) Solutes and properties. d) Mechanism of action.e) Coenzyme and prosthetic groups

Practicals:-

1) Safety measures in the laboratory.
2) Preparation of various solutions and buffers
3) Qualitative and quantitative estimation of carbohydrates.
4) Qualitative and quantitative estimation of amino acids.
5) Qualitative and quantitative estimation of proteins.
6) Qualitative and quantitative estimation of Lipids.

Reference books:

1) Osner hawk's Practical Physiological Chemistry Hawk
2) Principles of biochemistry Lehninger
3) Principles of Biochemistry Voet
4) Practical Biochemistry Thamiah

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

I year II semester

Subject:Post Harvest Management of Fruits and VegetablesCode: CCFS III B

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit 1: Post harvest technology of fruits and vegetables: an overview concept and science, importance of loss reduction, role in export, economy and employment generation
Unit 2: Morphology, structures and composition of fruit and vegetable – Physical, textural characteristics, structure and composition
Unit 3: Maturity standards: Importance, methods of maturity determinations, maturity indices for selected fruits and vegetables
Unit 4: Harvesting of important fruits and vegetable
Unit 5: Fruits ripening – Chemical changes, regulations, methods
Unit 6: Storage practices: controlled atmospheric, Bead atmosphere, hypobaric storage, cool store, zero energy, cool chamber
Unit 7: Commodity pretreatments – chemicals, wax coating, prepacking
Unit 8: Physiological post harvest diseases, chilling injury and diseases
Unit 9: Handling and packaging of fruits and vegetables: Post harvest handling system of citrus, mango, banana, pomegranate, tomato, papaya and carrot packaging house operations
Unit 10: Principles of transport and commercial transport operations

Practicals:

1. Studies on morphological features of some selected fruits and vegetables
2. Studies on maturity indices
3. Studies of harvesting of fruits and vegetables
4. Determination of RQ
5. Studies on pre-cooling and storage of fruits and vegetables
6. Studies on wax coating on apples, Papaya, citrus, mango, aonla

7. Studies on use of chemical for ripening and enhancing shelf life of fruits and vegetables
8. Studies on regulation of ripening of banana, mango, papaya
9. Studies on various storage systems and structures
10. Studies on prepacking of fruits
11. Studies on physiological disorders- Chilling injury of banana and custard apple
12. Visit to commercial packing house- grape/mango/pomegranate/banana
13. Visit to commercial storage structures onion, garlic, potato

Reference books:

1. B. Pantastico. Post harvest physiology, handling and utilization of tropical and subtropical fruits and vegetables.
2. R.B. Wills. T.L. Lee and E.G. Hall, L.R. Verma and V.K. Joshi.
Post harvests: An introduction to be physiology and handling of fruits and vegetables
Post harvest technology of fruits and vegetables Vol I.
3. D.K. Singh Hi-tech horticulture
4. Eskin. Biochemistry of foods
5. Townsend Duckworth. Fruit and vegetable technology

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

I year II semester

Subject: Cereal Processing Code: CCFS IV B

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit 1: Present status and future prospects of cereals (Rice, wheat, /corn, sorghum, Rye)
Morphology of Rice: Physical properties: Density bulk density, Angle of response-hardness, asperity, porosity, stack of milling and moisture of physical properties. Chemical composition- Distribution of nutrients and Aroma of rice. Drying of paddy- General principles and methods of drying, batch type, continuous type driers.
Unit 2: Parboiling of rice: Milling of rice: Conventional milling, modern milling, advantages and disadvantages of milling machineries, By products of rice milling, Aging of rice, Enrichment-need of enrichment methods of enrichment, Enrichment levels of fortification of amino acids, processed foods from rice- breakfast cereals, flakes, puffing, canning and instance rice.
Unit 3: Corn morphology, Physicochemical properties, corn milling fractions and preparations of modified starches. Barley-morphology-physicochemical properties and processing (malting)
Unit 4: Sorghum-morphology Physicochemical properties Milling, Malting, Pearling and industrial utilization
Unit 5: Millets-Oat/Rye- Importance of Millet Composition, Processing of millets for food uses.

Practicals:

1. Study of morphological characteristics of cereals
2. Study of physical properties of cereals
3. Study of chemical properties of cereals
4. Study of determination of colour of cereals
5. Study of parboiling of paddy

6. Study of cooking quality of rice
7. Study of milling of rice
8. Study of conditioning of wheat
9. Study of production of sorghum flakes
10. Production of popcorns
11. Study of preparation of sorghum malt
12. Determination of gelatinization temperature by amylograph
13. Study of extraction of oil from rice bran
14. Visit to cereal processing unit

Reference books:

1. Technology of cereals: Kent
2. Post harvest technology of cereals, pulses and oil seeds: A. Chakrawarthy
3. Modern cereal science and technology: Y. Pomeranz
4. Utilization of rice: Luh
5. Post harvest biotechnology of cereals: D.K. Salunkhe
6. Handbook of cereal science and technology: O.R. Fennema, Markus, Karel

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

I year II semester

Subject:Food Microbiology Code: CCFS V B

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit 1: Microbial spoilage of foods
Unit 2: Chemical changes caused by microorganisms
Unit 3: Principles of food preservation
Unit 4: Control of microorganism by use of low and half temperatures
Unit 5: Asepsis, water activity, drying, preservatives, radiations and pressure for control of microorganisms
Unit 6: Microbiology of milk and milk products
Unit 7: Microbiology of fruits and vegetables, Sources of contamination, spoilage and prevention
Unit 8: Microbiology of cereals and cereal products. Sources of contamination, spoilage and prevention
Unit 9: Microbiology of meat and meat products. Sources of contamination, spoilage and prevention
Unit 10: Microbiology of fish and other sea foods. Sources of contamination, spoilage and prevention
Unit 11: Microbiology of poultry and eggs
Unit 12: Microbiology of sugar and sugar products. Sources of contamination, spoilage and prevention
Unit 13: Microbiology of salts and spices products. Sources of contamination, spoilage and prevention
Unit 14: Microbiology of canned foods. Sources of contamination, spoilage and prevention

Practicals:

1. Study of isolation of molds from foods
2. Microbial examination of cereal and cereal products. Identification, isolation and confirmation of *R. nigricans*

3. Study of microbial examination of Vegetables and fruits. Identification, isolation and confirmation of *R. nigricans/ Erwiniacarotovora.*
4. Microbial examination of meat and meat products. Identification, isolation and confirmation of coliform bacteria/*P. fluorescens*
5. Microbial examination of fish and other sea foods. Identification, isolation and confirmation of *Proteus*
6. Study of microbial examination of eggs and poultry identification, isolation and confirmation of *Pseudomonas fluorescens*
7. Study of microbial examination of milk and milk products. Identification, isolation and confirmation of *S. thermophilus*
8. Study of microbial examination of sugar, salt and spices. Identification, isolation and confirmation of *L. measenteroides/ L. dextranicum*
9. Study of thermal death time determination

Reference books:

1. Modern food microbiology. James M. Jay
2. Basic food microbiology G.J. Banwart
3. Applied Microbiology-Singh B.D., Nallariu P., Kavikishore P.B. and Singh R.P.
4. Food microbiology and Lab practice-Bell

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

I year II semester

Subject:Energy generation and conservationCode: CCFS VI B

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit 1: Units and dimension, Basic concept: System, processes, cycles, energy, Thezeroth law of thermodynamics
Unit 2: Ideal gases: Equation of state, Compression and expansion of gases
Unit 3: The first law of thermodynamics, internal energy, enthalpy
Unit 4: Renewable energy sources like solar, wind and biogas and their utilization in food processing
Unit 5: Related equipments and their machinaries for Renewable energy sources
Unit 6: Fuels; Chemical properties, air for combustion, calorific value and its determination, Burners, firing of fuels
Unit 7: Properties of steam: Wet, dry, saturated, superheated steam, use of steam tables
Unit 8: Steam generators: Fire tube boilers, Water tube boilers
Unit 9: Boiler mounting and boiler accessories.
Unit 10: Measurement of height of boiler chimney
Unit 11: Condensers- Principle and types
Unit 12: Layout of pipeline and expansion joints
Unit 13: Boiler trial: Codes, Indian boiler regulation acts, Air stage, Air compressors.

Practicals:

1. Application of thermodynamics in engineering problems
2. Determination of dryness fraction of steam
3. To study the boiler installed in modern plant water softening, plant backcock and steam line layouts and steam traps
4. Visit to sugar Mill or Rice Mill plant with steam utilization
5. Study of solar water heater and biogas plants and appliances

Reference books:

1. Engineering thermodynamics – C.P. Gupta RajendraPrakash (1991) Nemi Chand and Sons Roorkee
2. Elements of Heat engines- N.C. Pandya. C.S. Shah (1990) Charotar Publishing house Anand
3. Indian boiler regulation codes (1991)
4. Dairy Plant Engg. And management: Tufail Ahmed (196). Kitabmahal New Delhi.
5. Thermal engineering: Mathur and Mehta

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

I year II semester

Subject:Heat and Mass Transfer CCFS VII B

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit 1: Basic heat transfer process, Thermal conductivity, Overall heat transfer co-efficient, Physical properties related to heat transfer
Unit 2: One dimensional steady state conduction: Theory of heat conduction, Fourier's law, Derivation of Fourier's equation in Cartesian coordinates, heat flow through slab, cylinder and sphere with non uniform thermal conductivity
Unit 3: Heat transfer through composite walls and insulated pipelines
Unit 4: Steady state heat conduction with heat dissipation to environment: introduction to extended surfaces of uniform area of cross section. Education of temperature distribution with different boundry conditions. Introduction to unsteady state heat conduction
Unit 5: Convection: Forced and free convection, Use of dimensional analysis for correlating variables affecting convection heat transfer, Concept of Nossolt number, Prandtl number, Reynolds number
Unit 6: Radiation: Emissivity, absorptivity, transmissivity, Radiation through black and grey surfaces, Determination of shape factors
Unit 7: Heat exchangers: General discussion, fouling factors, Jacketed kettles, LMTD, Parallel and plate heat exchangers
Unit 8: Applications of different types of heat exchangers in dairy and food industries
Unit 9: Mass transfer: Fick's Law of Diffusion, steady state diffusion of gases and liquids through solids, isothermal evaporation of water into air, mass transfer coefficient, Applications in dairy and food industry.

Practicals:

1. To study different types of heat exchangers used in dairy and food industries
2. Preparation and calibration of thermocouples
3. Determination of thermal conductivity: Milk, solid dairy food products

4. Determination of overall heat transfer coefficient of : Shell and tube, Plate heat exchangers, Jacketed kettles used in dairy and food industries
5. Studies on heat transfer through extended surfaces
6. Studies on temperature distribution and heat transfer in HTST pasteurizer
7. Design problems on heat exchangers

Reference books:

1. A course in Heat Mass Transfer- S. Domkondwar (1993) DanpatRai and Sons New Delhi
2. Heat transfer- C.P. Gupta (1964) Prentice Hall of India New Delhi
3. Principles of Heat transfer- F. Kretiths and M.S. Bohn (1986) Harper and Row Publishers, New York.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

II year III semester

Subject: Legume and Oil Seed technology Code: CCFS IIC

Credits: 02Marks: 50 (External 40, Internal 10)

Unit I : Importance of legumes, pulses & oil seeds 08

Presents status, morphology, chemical composition, anti- nutritional factors, classification and types.

Unit II :Milling 08

Principles, methods and equipment's used for milling, fermented products of legumes.

Unit III : Removal of anti-nutritional factors 08

Soaking- Principles and their methods, Cooking quality of dal

Unit IV : Oil extraction and refining of oil 08

Oil extraction- Traditional method- ghani, modern methods-expellers- Principle and structure, solvent extraction- principles, pre treatment, factors affecting on extraction process, refing- degumming, neutralization, bleaching ,filtration and deodorization.

Unit V : New technology in oil seed processing 08

Utilization of oil seed, meals for different food uses, high protein products, protein concentrates and protein isolates.

Practical:

1) Physical properties of legumes and oil seeds
2) Estimation of protein
3) Estimation of fat
4) Study of methods and principles of dehuling
   A) Application of oil
   B) Applications of red earth slurry
5) Anti-nutritional factors and methods of illumination
6) Study of soaking, sprouting legume and cooking quality of dal
7) Fermented products of legume –Dosa , idli, wada&dhokla
8) Production of protein rich products
9) Visit to dal mill and oil extraction plant

Reference book:

1) Post-harvest biotechnology of legumes D. K. Solunke et al
2) Post-harvest biotechnology of oil seed D. K. Solunke et al
3) Processed food stuffs A. M. Alschule
4) The chemistry and technology of edible oil and fats A. E. Baily
5) Post- harvest technology of cereals, pulses and oil seeds Chakraborthy A
6) Oil seed processing technology B. D. Shukla

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

II year III semester

Subject: Meat, Poultry and Fish Technology Code: CCFS IIIC

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit I : Importance, development and composition of meat, poultry and fish 08

sources, physio-chemical properties , muscle structure, pre slaughter transport, care anti- mortem inspection, abattoir design and layout.

Unit II:Slaughtering of animals and poultry. 08

Postmortem inspection, grading of meat , factors affecting post mortem changes and shelf life of meat

Unit III: Processing and preservation of meat 08

Mechanical deboning , aging or chilling, frezzing pickling curing ,cooking , smoking of meat, principles and methods of meat tenderization, meat emulsion and manufacture of meat and poultry products.

Unit IV : Egg 08

Structure, composition, quality characteristics processing and preservation of egg.

Unit V : Meat plant 08

Sanitization, safety and by product utilization

Practical

1) Pre slaughtering operations of meat animals and poultry birds
2) Study of slaughtering and dressing of meat animals
3) Study of post mortem changes
4) Study of meat cutting and handling
5) Study of evaluation of meat quality
6) Study of preservation of meat by different methods and preparation of meat and poultry products
7) Evaluation of quality and grading of eggs
8) Study of preservation of shell eggs
9) Study of by products utilization

Reference book

Principles of Meat science	F.J. Forrest
Meat handbook	Albert Levie
Developments in Meat Science Vol I & II	Ralston Lawrie
Poultry production	R. A Singh
Meat Technology	Gerard F

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

II year III semester

Subject: Wheat Milling and Baking Technology Code: CCFS IVC

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit I : Wheat 08

Importance, production, varieties, types grading, quality, structure, physiochemical, rheological properties and enzymes in wheat.

Unit II : Conditioning and milling of wheat 08

Principles, methods of conditioning roller flour milling process , break rolls, reduction rolls, design and operation

Unit III : Flour 08

Types, grades, supplementations, fortifications, additives, improvers, bleaching and oxidizing agents

Unit IV : Bakery Products 08

Roll of bakery ingredients(Major &minor), products from hard and soft wheat, bread processing (straight and sponge dough method), quality

control, testing of raw material, bakery products faults and its shelf-life, nutritional improvements of bakery products.

Unit V: Bakery unit **08**

Setting, bakery norms, specifications for a raw materials, packing, marketing of products, project report preparation.

Practical

1) Classification of wheat based on physio-chemical properties
2) Study of quality testing of flour and yeast.
   a)falling numbers and a amylase activities
   b) sedimentation value
   c) pelshenk value
   d) rheological value
3) Study of manufacturing of bread with different types and their types
4) Test baking- biscuits, cookies, crackers, buns
5) Preparation of cakes, pastry and pizza
6) Visit to wheat milling industry and bakery unit

Reference book

1) Bakery science and cereal technology khetarpaout
2) Technology of cereals Kent
3) Bread Spensor
4) Flour milling process Scott

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

II year III semester

Subject: Milk &Confectionery Technology Code: CCFS VC

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit I : Introduction to confectionery and Role of ingredients

History, traditional confectionery good, types of confectionery, classification, basic technical consideration (TS, TSS, Ph, invert sugar, ERH, Glucose syrup, RH,),Types of ingredients used- sugar, milk and milk products, whipping agent, release agent, thickeners, acidulents, flavours, emulsifiers, additives, starch derivatives and colours.

Unit II :Coca and chocolate processing Coca bean processing- roasting, fermentation, production of coco butter, powder and its quality, Chocolate processing- ingredients, mixing, refining, conching, tempering, molding, cooling, coating, fat bloom

Unit III : Confectionery Processing (High boiled sweets, caramel and toffee,Fondant, Tablet, marshmallow, panning)
Definition, composition, ingredients, methods of preparation, recipes, faults, factors affecting on quality, definition, methods of preparation, composition, faults and factors affecting on quality of products, packaging and marketing.

Unit IV : Introduction to Milk and Processing of Milk Definition, composition of milk from different species, colostrum, physio-chemical properties of milk, nutritive value of milk and milk products, classification of milk products, Pasteurization by LTHT and HTST and UHT- filtration, UF and RO, clarification, cream separation, standardization, homogenization, heat processing, boiling, sterilization.

Unit V :Manufacturing of different milk products

Butter, butter oil (ghee), yoghurt, cheese, ice cream types, roll of ingredients, various methods of preparations and fermented milk and milk products

Unit IV :Manufacturing of Indigenous milk products, Indian Milk confectionery, By products and packaging of milk products

Ghee, Khoa, Chenna, paneer, dahi, shrikhand, Khoa and Chenna based sweets, Types of by- products of dairy industry and theirutilization, packaging and storage of milk and milk products

Practicals

1) Sampling and analysis of milk- physio-chemical properties and composition, DMC and DYC reduction tests, presence of adulterants and preservation
2) Study of clarification and separation of milk
3) Study of heat processing of milk- pasteurization
4) Preparation of butter, ghee,dahi, shrikhand, lassi, khoa and its sweets
5) Preparation of chenna, paneer and chenna based sweets

6)Preparation of high boiled sweets

7)Preparation of toffee and candy

8) Preparation of chocolate

9) Preparation of flour based sweets

10) Preparation of petha

11) Visit to confectionery industry and dairy plant

Reference book

1) Outlines of dairy technology----- Sukmar De,
2) The fluid milk industry--- J. L. publishing company USA
3) Principles of dairy processing---- J . N. warner, wiley Eastern ltd, new delhi
4) Indian dairy products ----- k. s. Rangappa and k. L. Acharya
5) Sugar confectionery and chocolate manufacture R. Less
6) Industrial chocolate manufactory and use S. T. Beeketi
7) Basic baking S. C. Dubey
8) Judging of dairy products ---- J. A. Nelson and traout
9) Milk processing and dairy products industry ----EIRI Board of consultants Engineers Indian Research Institute, Delhi
10) Technology of milk processing ---- Q. A khan, Padamanabhan

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

II year III semester

Subject: Techniques in Food Analysis Code: CCFS VIC

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit I : Nature and concepts of food analysis 08

Rules and regulations of food analysis, safety laboratory,

sampling techniques.

Unit II : Principles and methodology involved in analytical techniques 08

pH meter and use of ion selective electrodes, spectroscopy, UV visible, florescence, infrared spectrophotometer , Atomic absorption and emission spectroscopy, mass spectroscopy, nuclear magnetic resonance and electron spin resonance, chromatography, Asorption, column, partition, gel-filtration, affinity, ion- exchange, Size-exclusion method, gas liquid chromatography.

Separation techniques- Dialysis, electrophoresis (Paper, SDS gel electrophoresis, immune electrophoresis), sedimentation ultra-filtration, ultra centrifugation, Iso electric focusing, isotopic techniques, monomeric techniques.

Unit III :Immuno assay techniques in food analysis 08

Isotopic and non -isotopicimmune assay, Enzyme immune assay.

Unit IV : Principle and methodology involved in analysis and evaluation of analytical data **08**

Rheological analysis, textural profile.
Evaluation of data- accuracy and precision, statistical significance, co relations regression, computers for data analysis and result interpretation.

Unit V : Sensory analysis of food **08**

Objective and Subjective method

Practical

1) Analysis of heavy metal using atomic absorption spectrophotometer
2) Estimation of phytic acid trypsin inhibitor activity using spectrophotometer
3) Separation of amino acids by two dimensional paper chromatography
4) Identification of fruit juice sugar using TLC
5) Separation of praline by ion exchange
6) Molecular weight determination using sephadox-gel
7) Identification of organic acids by paper chromatography
8) Gel-electrophoresis for analytic techniques
9) Quantitative determination of sugars and fatty acid profile by GLC
10) Study of Quantitative make up of water and fat soluble vitamins using HPLC
11) Study of determination of rheological characteristics of food sol / gel and sensory evaluation of foods.

Reference Book:

1) Food Analysis- Theory and practical Pomeranze&Melson
2) Methods in food analysis Mayananrd
3) Introduction to practical Biochemistry Plume Thamiah
4) Practical biochemistry

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

II year III semester

Subject: Food Processing Equipments Code: CCFS VIIC

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit I :Material Handling 08

Material handling machines, conveyors, pre-treatment unit operation (cleaning, dehulling, dehusking, sorting, grading, peeling and forming), size reduction, separation, agitation and mixing.

Unit II :Engineering Properties of Food material 08

Introduction, significance in equipment design, processing and handling of food products, hygienic design of food processing equipment's, sanitary requirements, sanitary pipes and fittings, rheology texture of food material, elastic, plastic and viscous behavior, methods of texture evaluation, subjective, objective measurements.

Unit III : Evaporation, Drying and Thermal Processing 08

Principles, types, classification, methods and equipments, mass and energy balance

Unit IV : Mechanical separations, Filtration, expression and Irradiation Process 08

Principles, types, classification, and equipments used

Unit V :Equipments used in various food processing 08

Baking, roasting, frying, blending, pulverization.

Practical

1) Study of centrifugal separators
2) Study of ultra- filtration equipments
3) Study of microwave oven, infrared moisture meter and universal moisture meter
4) Study of Instron and working
5) Study on the sorting and grading of materials
6) Study of evaporator, dryer, sterilizer with their design problem
7) Determine flow parameters of Newtonian, non- Newtonian food products by- capillary tube viscometer, Hokke's viscometer

Reference Book

1) Unit operation of chemical engineering-

   McCobe Smith Harriott
2) Food Engineering Operation-
   Brennan, Butters, Cowell and Lilly
3) Process Heat transfer- Kern
4) Introduction to food engineering- Heldman D. R. & Singh R. P.
5) Fundamental of food engineering- Charm S. E.

SEC I-A

B. Sc Food Science II year III semester

Spice & Condiments Processing.

Credits: 02 **Marks: 50 (External 25, Internal 25)**

1) Preparation of Various spice powder

- Preparation of read chilly powder
- Preparation of Turmeric powder
- Preparation of coriander powder
- Preparation of cumin seed powder
- Preparation of pepper powder
- Preparation of Dry ginger powder
- Preparation of Amchur powder

2) Preparation of Various masalas:-

1) Curry Masala
2) Garam Masala
3) Chat Masala
4) Mutton Masala
5) Chicken Masala
6) Fish Masala
7) Chole Masala
8)Samber Masala
9)PaniPuri Masala
10) PavBhaji Masala
11) Tea Masala
12) Milk Masala
13)Pulav Masala
14)Biryani Masala

3) Preparation of various Pickles Masala :-

1) Mango pickle Masala
2) Gava pickle Masala
3) Green chilli lemon pickle masala
4) Mix vegetable pickle masala
5) Lemon crush pickle masala

SEC I-B

B. Sc Food Science II year III semester

Bakery Technology I

Credits: 02 **Marks: 50 (External 25, Internal 25)**

- Preparation of basic bakery products
- Basic sponge cakes (Vanilla, Chocolate, Plain Butterscotch, fruit)
- Breads (Plain bread, milk, fruits, wheat)
- Buns
- Cup cakes
- Basic cookies

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

II year IV semester

Subject: Fruits and Vegetable Processing Code: CCFS II D

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit I : Introduction to fruits and vegetable processing and preservation 08

Production and processing scenario of fruits and vegetable in India and world, scope, importance, present constraints, prospects, principles and methods of preservation of fruits and vegetable.

Unit II : Commercial processing technology of fruits (I) 08

Mango (Pulp, RTS, squash, canned pulp, toffee, amchur, pickle, powder), **Banana** (wafers, puree, powder, banana fig), **Papaya** (jam, candy, RTS, nector, squash, papian), **Pomegranate** (Juice, squash, syrup, anardana, anargoli), **Guava** (jelly, juice, canned guava, squash, toffee), **Jamun** (RTS, jelly, syrup, wine, flakes, bar, powder).

Unit III :Commercial processing technology of fruits (II) 08

Grape (Rasins, juice,wine), **Fig**(Pulp, dried fig, toffee, powder, bar), **Citrus fruits** (jelly, marmalades, RTS, squash, candy), **Amala**(jam, candy, juice, squash, powder, dried shreds, chavanprash, pickle, chutney, sauce, muranba), **Tamarind** (Pulp, powder, toffee, bar, RTS), **Wood apple** (Jelly, Marmalades).

Unit IV :Commercial processing technology of vegetables(I) 08

Tomato (ketchup, sauce, puree, soup, chutney, pickle), **Ginger** (Candy, dried, pickle, RTS, Syrup) **Onion** (Dried onion, powder), **Garlic** (Dried onion, powder, pickle), **Potato** (Wafers, starch, papad),

Unit V :Commercial processing technology of vegetables(II) 08

Carrot (candy, pickle, jam), **Cauliflower and cabbage** (Dried, pickles), **Leafy Vegetables** (Dried- Spinach, fenugreek, coriander leaves, curry leaves), **Bitter guard** (Pickle, dried bitter guard).

Practical

1) Study of canning of mango/ Guava/ Papaya
2) Preparation fruit jam –Apple/mango/guava
3) Preparation of frit jelly- wood apple/ sweet orange/guava/ tamarind.
4) Preparation of fruits marmalades
5) Preparation of fruits preserve and candy
6) Preparation of fruits RTS
7) Preparation of fruits Squash
8) Preparation of fruits syrup
9) Study of preparation of grape raisin, dried flg and banana flg
10) Preparation of Pickle, mixed pickle
11) Preparation of dried Ginger
12) Preparation of amchur
13) Preparation of dried onion and garlic

14) Preparation of banana and potato wafers
15) Preparation of dehydrated leafy vegetables

Reference Book :

1) Fruits and vegetable preservation principles and practice— SrivastavaR. P.
2) Post- Harvest Technology of fruits and vegetables---- Sanjeev Kumar
3) Hi tech Horticulture----- Singh D. K.
4) Preservation of Fruits and vegetable------ Khader
5) Fruits and vegetable preservation------ Bhutani R. C.
6) Principle of Fruits Preservation----- Morris, Thomas Normon
7) Preparation of fruits and Vegetables ----- Gridharilal G. S. Siddappa and G. L. Tandon

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

II year IV semester

Subject: Fermentation and Industrial Microbiology
Code: CCFS III D

Credits: 02 **Marks: 50 (External 40, Internal 10)**

Unit I : Microorganism in industries, Fermentation: 08

Beneficial microorganism, screening, types of screening & isolation.
Definition of fermentation, types, design of fermenter, accessories with function.

Unit II : Metabolites: 08

Definition, types of metabolite, Industrially important secondary metabolite- organic acid, antibiotic, probiotic.
Advances in strain improvement for high yields of metabolite.Bacteriocins, biocolour, carotenoids, β-carotene, lycopene.

Unit II : production and purification of microbial compound: 08
Production and purification of microbial enzymes, polysaccharides, amino acids, vitamins and bioinsecticides.

Unit IV : Plant cell culture: 08
Definition, requirments, media,types of media, callus, subculture.

Production of secondary metabolite, continuous and batch culture.

Unit V : Fermented foods: 08

Fermented dairy products, alcoholic bevarages, roll of baker's yeast,

Angkak production and purification.

Practicals:

1)Study of production and assay of citric acid.

2) Study of production and assay of β-carotene.

3) Study of production and assay ofantibiotic penicillin/tetracycline.

4)Study of production of Angkak (Red rice)

5)Study of production, purification and assay of fungal amylase/protease.

6)Study of production of Xanthan/ Pollulan.

7) Study of production and assay of amino acid.

8) Study of single cell protein.

9)Study of mushroom production

10) Study of preparation of food based fermented product like Miso/

Idli/ Dhokla.

Reference book

11) Microbial Technology Vol-I ----- H.J.Peppler& D. Perlman

12) Microbial Technology Vol-II ----- H.J.Peppler& D. Perlman

13) Industrial microbiology ---- Prescott &Dunns.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

II year IV semester

Subject: Spice and Flavor Technology Code: CCFS IV D

Credits: 02 Marks: 50 (External 40, Internal)

Unit I : Introduction and post harvest technology of major spices 08

Production and processing scenario of spices, flavor and plantation crops and its scope, post-harvest technology, processed products and its utilization of various major spices (Ginger, turmeric, chilly, onion, garlic, pepper, cardamom, cashunuts and cocont)

Unit II : Processing and utilization minor spices, herbs and leafy vegetables 08

Annie, caraway seeds, cassia, cinnamon, clove, coriander, cumin, dill seed, fern seed, nutmeg, saffron, asafetida, sweet basil, marjoram, mint, sage, savory, thyme, ajawan, curry leaves.

Unit III : Tea, coffee, Coca, Vanilla Processing 08

Introduction, post harvest technology, utilization

Unit IV : Spice oli and oleoresins 08

Introduction, definition, processing and utilization

Unit V :Flavours and packaging of spices and its products08

Flavouring compounds in food, separation, purification and identification of natural flavouring materials, synthetic flavouring agents and their stability, standard specifications of spices and flavours, packaging of spice and its products

Practical

1) Study of identification and characterization of flavouring compounds of spices
2) Study of oil determination of spices
3) Study of extraction of oil from clove, pepper cardamom, chilly
4) Study of extraction of oleoresins- turmeric, ginger, pepper, clove
5) Study of piperine estimation in pepper oleoresins
6) Study of steam distillation of spices
7) Study of determination curcumin content in turmeric
8) Study of chemical analysis of spices, moisture, volatile oil specific gravity, refractive index, acid value
9) Study of standard specification of spice
10) Preparation of curry powder
11) Preparation of Indian masala for different food
12) Visit to spice industry

Reference book

1) Spices Vol II---- Parry J. W.
2) Spice and condiments--- Pruthy J. S.
3) Herbs and spices---- Rosemeryhemphill
4) The book of spices---- Rosen Gartan, F. and Living ton

5) Spices and herbs for the food industry ---- Lewies Y. S

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

II year IV semester

Subject: Food Additives **Code: CCFS V D**

Credits: 02 **Marks: 50 (External 40, Internal)**

Unit I : Intentional and unintentional food additives, their toxicology and safety evaluation 08

Unit II : naturally occurring food additives and food color (natural and artificial), pigments, importance and utilization of color 08

Unit III : Food preservatives and their chemical action 08

Unit IV : Taste and flavor inducer, potentiater 08

Unit V : Role and mode of action of salt, chelating agents, stabilizers and thickeners, polyhydric alcohol, anti-caking agent, firming and coloring agent, flour anti caking agent, anti-oxidants, non – nutritional sweetness and anti- microbial agents, spices, condiments 08

Practical

1) Study of evaluation GRAS aspects of food additives
2) Study of identification of food color by TLC

3) Study of isolation and identification of naturally occurring food pigment by paper and TLC
4) Study of spectrometric method of total chlorophyll (A & B)
5) Study of determination of diacetyl content of butter
6) Study of role and mode of action of chelating agents in fruit juice
7) Study of role and mode of action of stabilizer and thickeners in frozen dairy products (ice cream)
8) Study of role and mode of anti-oxidant in frozen fish
9) Study of role of leaving agent in baked food products

Reference books

1) Food chemistry Vol I------- Fennama O. R.
2) Food chemistry ------- Mayer L. H

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

II year IV semester

Subject: Food Packaging Code: CCFS VI D

Credits: 02 (Marks: 50 (External 40, Internal 10)

Unit I : Introduction to subject, Packaging situations in World, India, need of packaging, plastic consumption/use in World, India etc. Package requirements, package functions, Hazards acting on package during transportation, Storage and atmospheric package, labeling laws

Unit II : Package Materials: classification packages, paper as package material its manufacture, types, advantages corrugated and paper board boxes etc. Glass as package material, Manufacture, Advantages, disadvantages. Metal as package material-manufacture, Advantages, disadvantages, Aluminum as package material,. Its advantages and disadvantages, plastic as package material classification of polymers, properties of each plastics, uses of each plastics, chemistry of each plastic such as polyethylene, Polypropylene, polystyrene, polycarbonate, PVC, PVDC, Cellulose acetate, Nylon etc.

Unit III : Lamination Coating and Aseptic packaging

Lamination, need of lamination, types, properties, advantages & disadvantages of each type

Coating on paper & films, types of coatings. Need of coating, methods of coatings. Aseptic packaging-Need, Advantaged, process, comparison of conventional

&aseptic packaging, system of aseptic packaging and materials used in aseptic packaging. Machineries used in Packing foods

Unit IV : Packaging of Specific Foods

Packaging of specific foods with its properties, Like bread, Biscuits, Coffee, Milk powder, egg powder, carbonated beverages. Snack foods etc.

Unit V : Mechanical and functional tests on Package

Various mechanical and functional testes perform in laboratories on package boxes and package materials

Practicals:

1) Classification of various packages bared on material and rigidity
2) Measurement of thickness of paper, paper boards
3) Measurement of tensile strength of paper of paper boards
4) Determination of gas transmission rate of package films
5) Determination of WVTR of films
6) Determination of coating on package materials
7) Identification of plastic films
8) Prepackaging practices followed for packing fruits and vegetables

REFERENCE BOOKS

1	Handbook of Package Engineering	Joseph F. Hanlon
2	Fundamentals of Packaging	F.A. Paine
3	Food Packaging	Sacharow and Griffin
4	Principles of Food Packaging	R. Heiss
5	Flexible Packaging of Foods	A.L. Brody
6	Food Packaging and Preservation	M. Mathouthi

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based credit System (CBCS)

B.Sc. Food Science

II year IV semester

Subject: Computer Fundamental Code: CCFS VII D

Credits: 02 Marks: 50 (External 40, Internal 10)

Unit 1:- Computer Fundamentals 08

Features of computer System, Block Diagram, Hardware & software, Operating System (Overview = WINDOWS), Application Software, Viruses and Their Types, Precautions to take – e.g. Trojans, Worms, (Names of anti-virus software) etc., Networking Concept- Advantages, Topologies, Types

Unit 2:- WINDOWS AND MS-WORD 08

Features, Terminologies – Desktop, Windows, Icons, etc, Explorer – (Assignment with files, folders), Accessories- paint, notepad,

MS –WORD- File commands, print, page setup, Editing – cut, copy, paste, find, replace etc, Formatting commands, Spell check, Table, columns, drawing options, Hyperlinks, templates

Unit 3:- MS- EXCEL AND MS- POWER POINT 08

Features, rows, columns, sheets, auto fill etc, Formulae, function (Math / stat, if) Charts Data bases (create, sort, auto filter, subtotal)

MS-POWER POINT-Layouts, templates, clipart, custom animations, transitions etc

Unit 4:- DBMS-(Data Base Management System) and MS-ACCESS 08

Data, data types, tables, records, field, creating table, working with the table, adding, editing, deleting, recalling records,

MS-ACCESS-Table creation, Editing, deleting the records, Forms

Unit 5:- INTERNET / E-MAIL AND E-COMMERCE 08

History, Dial up, Domains, Browsers etc, Services, E-Mail, Outlook Express Hours Surfing By Students, Introduction of E-commerce, Electronic Commerce over the internet, Introduction to EDI (Electronic Data Interchange), Electronic Payment System, payment gateway, Internet banking, Concept of B to B & B to C

SUGGESTED PRACTICLE ASSIGNMENTS

1. Create folders, change date/time, change the desktop settings (Windows)
2. Kot, Logo, Students Resumes (Word)
3. Kot, Report Cards, Pass/Fail Results, Charts,
   Database of employees (Excel)

4 To download information from the internet as a topic (Internet)
5 To present the above information as a presentation (Power Point)
6 Create a form where all records can be displayed/ edited (Access)

RECOMMENDED BOOKS:-

1. Computer Fundamentals – P.K. Sinha
2. A first course in Computers- Sanjay Saxena
3. Mastering In MS- Office- Lonnie E. Moseley & Davis M Boodey(BPB Publication

SEC II-A

B. Sc Food Science II year IV semester

Bakery Technology II

Credits: 02 **Marks: 50 (External 25, Internal 25)**

- **Preparation of advance bakery products.**
- **Advance cakes with Icing**
- **Advance Cookies**
- **Muffins**
- **Khari& toast**
- **Advance Icing techniques**

SEC II-A

B. Sc Food Science II year IV semester

Dairy Products Development

Credits: 02 **Marks: 50 (External 25, Internal 25)**

1) Fermented milk products:-

- Curd, Shrikhand, lassi& their types, paneer

2) Chenna Based:-

- Rasgulla, sandesh, Kalakand, Rasmalai

3) Khoa Based:-

-Gulabjamun, Peda. Various types of burfi

4) Whole milk products:-

- Rabri, Various kheers, milk shakes, Ice cream, kulfi