

III. DEPARTMENT OF FOOD CHEMISTRY AND NUTRITION



Sr. No.	Course No.	Course title	Credits	Semester
1	FCN-111	Environmental Science and Disaster Management	2 (1+1)	I
2	FCN-112	Biochemistry	2 (1+1)	I
3	FCN-123	Human Nutrition	3 (2+1)	II
4	FCN-124	Food Chemistry of Macronutrients	3 (2+1)	II
5	FCN-235	Food Chemistry and Micronutrients	3 (2+1)	III
6	FCN-246	Food Additives and Preservatives	2 (1+1)	IV
7	FCN-357	Instrumental Techniques in Food Analysis	2 (0+2)	V
8	FCN-368	Enzymes in Food Industry	2 (1+1)	VI
		Total Credits	19 (10+9)	

Theory

Environment, Ecology and Ecosystems: Introduction, Definition, Inter-relationship amongst and between them, components of environment, relationship between different environment components, Man-environment relationship, Impact of Technology of the Environment, Environmental Degradation. Ecology and Ecosystems: Introduction, ecology, objectives and classification of iconology, concepts of an ecosystem structure and functions of ecosystem, components of ecosystem. Energy Flow: Introduction, Food Chain – grazing, detritus, Food Web, Ecological Pyramids – Pyramid of numbers, pyramids of biomass, pyramid of energy or productivity Bio-geo-chemical cycles: Introduction, Hydrological cycle, Carbon Cycle, Oxygen cycle, Nitrogen Cycle, Sulfur cycle Energy Flow in Ecosystem: Introduction, Renewable resources, Non-renewable resources, Destruction versus conservation. Major Ecosystems: Introduction, Forest ecosystem, Grassland Ecosystem, Desert Ecosystem, Aquatic Ecosystem, Estuarine ecosystem. Population and Natural Resources: Introduction, development of habitation pattern, environmental factors governing human settlement, population and pollution, reasons for overpopulation, aquatic population growth, demographic projections and population structures, production of food Forest Resource: Introduction, Indian scenario, Importance of Forests – Ecology and economically, uses of forest products, forest types, deforestation – causes, effects, forest degradation in India Energy Resources: Introduction; Indian Scenario; Conventional energy sources and its problems; Non-conventional energy sources – advantages and limitations; Problems due to extraexploitation of energy resources. Environmental pollution: Water pollution – Introduction, water quality standards, sources of water pollution, classification of water pollutants, effect of water pollutants; Air Pollution – Introduction, composition of air, structure of atmosphere, ambient air quality standards, classifications of air pollutants, sources of common air pollutants, effects of common air pollutants; Land Pollution – Introduction, lithosphere, land uses, causes of land degradation; Noise pollution – introduction, sources of noise pollution, effect of noise pollution; Radioactive pollution, Eutrophication; Control of environmental pollution through Law Food Processing Waste and its management: Introduction, management of urban waste water, recycling of organic waste, recycling of factory effluent. Current Environmental Global Issues: Introduction, global warming, green house effect, acid rain, depletion of ozone layer, etc.

Practical

Environment and its Analysis; Water quality parameters; Determination of pH, Acidity and Alkalinity of water; Estimation of dissolved oxygen; Estimation of Biological Oxygen Demand; Estimation of Chemical Oxygen Demand; Estimation of Nitrates; Estimation of Phosphates; Estimation of pollutant Elements; Estimation of Heady Toxic elements; Estimation of Lead/Mercury; Visit to Industrial Sewage Disposal Unit

Teaching Schedule - Theory with Weightages (%)

No. of Units	TOPICS	Weightage (%)
1 – 2	Environment, Ecology and Ecosystems: Introduction, Definition, Inter-relationship amongst and between them, components of environment, relationship between different environment components, Man-environment relationship, Impact of Technology of the Environment, Environmental Degradation.	12
3	Ecology and Ecosystems: Introduction, ecology, objectives and classification of iconology, concepts of an ecosystem structure and functions of ecosystem, components of ecosystem.	7
4	Energy Flow: Introduction, Food Chain – grazing, detritus, Food Web, Ecological Pyramids – Pyramid of numbers, pyramids of biomass, pyramid of energy or productivity.	6
5	Bio-geo-chemical cycles: Introduction, Hydrological cycle, Carbon Cycle, Oxygen cycle, Nitrogen Cycle, Sulfur cycle	7
6	Energy Flow in Ecosystem: Introduction, Renewable resources, Non-renewable resources, Destruction versus conservation.	6
7	Major Ecosystems: Introduction, Forest ecosystem, Grassland Ecosystem, Desert Ecosystem, Aquatic Ecosystem, Estuarine ecosystem.	7
8	Population and Natural Resources: Introduction, development of habitation pattern, environmental factors governing human settlement, population and pollution, reasons for overpopulation, aquatic population growth, demographic projections and population structures, production of food	6
9	Forest Resource: Introduction, Indian scenario, Importance of Forests – Ecology and economically, uses of forest products, forest types, deforestation – causes, effects, forest degradation in India	6
10	Energy Resources: Introduction; Indian Scenario; Conventional energy sources and its problems; Non-conventional energy sources – advantages and limitations; Problems due to extraexploitation of energy resources.	7
11 – 14	Environmental pollution: Water pollution – Introduction, water quality standards, sources of water pollution, classification of water pollutants, effect of water pollutants; Air Pollution – Introduction, composition of air, structure of atmosphere, ambient air quality standards, classifications of air pollutants, sources of common air pollutants, effects of common air pollutants; Land Pollution – Introduction, lithosphere, land uses, causes of land degradation; Noise pollution – introduction, sources of noise pollution, effect of noise pollution; Radioactive pollution, Eutrophication; Control of environmental pollution through Law	24
15	Food Processing Waste and its management: Introduction, management of urban waste water, recycling of organic waste, recycling of factory effluent.	6
16	Current Environmental Global Issues: Introduction, global warming, green house effect, acid rain, depletion of ozone layer, etc.	6
	Total	100

Practical Exercises

No. of Units	Topics	No. of Experiments
1	Environment and its analysis	1
2	Water quality parameters	1
3	Determination of pH of water samples	1
4	Determination of acidity of water	1
5	Determination of Alkalinity of water sample	1
6	Measurement of turbidity of water samples	1
7	Determination of conductivity of water sample	1
8	Estimation of dissolved Oxygen (DO) in water sample	1
9	Estimation of Biological Oxygen Demand (BOD) of water	1
10	Estimation of Chemical Oxygen Demand (COD) of water	1
11	Determination of chloride in water	1
12	Determination of calcium hardness of water	1
13	Determination of total hardness of water	1
14	Determination of minerals in water	2
15	Visit to Industrial Sewage Disposal Unit	1
	Total	16

TEXT BOOK

Sr. No.	Name of Book	Author	Publisher
1	Principles of Environmental Studies	Chary Manohar and Jaya Ram Reddy	BS Publishers, Hyderabad. 2004
2	Water and Waste Water Analysis	Kaul S N, Ashuthosh Gautam	Days Publishing House, Delhi. 2002
3	Fundamentals of Environmental Biology	Agrawal KC	Nidhi Publishers (India), Bikaner. 2001

REFERENCE BOOKS

Sr. No.	Name of Book	Author	Publisher
1	Text Book of Environmental Studies for Undergraduate Courses	Bharucha Erach	University Grants Commission, University Press, Hyderabad. 2005
2	Introduction to Environment Science	Sharma J P	Lakshmi Publications. 2003
3	Methods in Environmental Analysis – Water	Gupta P K	Soil and Air. Agro bios, Jodhpur. 2004
4	Natural Disaster	Sharma, R.K. & Sharma, G	APH Publishing Corporation, New Delhi. 2005
5	Environment and Ecology: Biodiversity, Climate Change and Disaster Management	Husain Majid	Online book. 2013

Theory

Introduction: Biochemistry & its scope; Cellular Biochemistry - Cell-structure – plant and animal, composition and function of cell organelle Carbohydrates: Occurrence, Classification & Structures; Physicochemical and Metabolic functions; Biological role of carbohydrates; Metabolism of carbohydrates - glycolysis and respiration, production of ATP, brief description of electron transport chain, oxidative and substrate phosphorylation Proteins: Occurrence, Classification & Structures; Physicochemical & Metabolic functions; Metabolism of proteins - Breakdown of proteins, transamination, deamination, decarboxylation, nitrogen fixation, urea cycle; Lipids: Occurrence, Classification & Structure; Physicochemical and metabolic functions; Biological role of lipids; classification and biosynthesis; Biological role of lipids; breakdown of triglycerides and phospholipids; β -oxidation of long chain fatty acids, ketosis, biosynthesis of fatty acids, triglycerides and phospholipids; Nucleic Acids: Classification, structure & biosynthesis of nucleic acid; Metabolism RNA and DNA metabolism. Vitamins; Sources and classification, Chemistry and Metabolic functions, deficiency syndromes, Minerals; Sources and classification, Chemistry and Metabolic functions, deficiency syndromes.

Practical

Safety measures in the Laboratory; Preparation of various solutions and buffers; Qualitative and quantitative determination of carbohydrates; Qualitative and quantitative determination of amino acids; Qualitative and quantitative determination of proteins; Qualitative and quantitative determination of Lipids; Qualitative and quantitative determination of Vitamins and minerals

Teaching Schedule - Theory with Weightages (%)

No. of Units	TOPICS	Weightage (%)
1 – 2	Introduction: Biochemistry & its scope; Cellular Biochemistry - Cell-structure – plant and animal, composition and function of cell organelle	14
3 – 6	Carbohydrates: Occurrence, Classification & Structures; Physicochemical and Metabolic functions; Biological role of carbohydrates; Metabolism of carbohydrates - glycolysis and respiration, production of ATP, brief description of electron transport chain, oxidative and substrate phosphorylation	20
7 – 10	Proteins: Occurrence, Classification & Structures; Physicochemical & Metabolic functions; Metabolism of proteins - Breakdown of proteins, transamination, deamination, decarboxylation, nitrogen fixation, urea cycle	20
11 – 13	Lipids: Occurrence, Classification & Structure; Physicochemical and metabolic functions; Biological role of lipids; classification and biosynthesis; Biological role of lipids; breakdown of triglycerides and phospholipids; β -oxidation of long chain fatty acids, ketosis, biosynthesis of fatty acids, triglycerides and phospholipids	16
14	Nucleic Acids: Classification, structure & biosynthesis of nucleic acid; Metabolism RNA and DNA metabolism	10
15	Vitamins; Sources and classification, Chemistry and Metabolic functions, deficiency syndromes	10
16	Minerals; Sources and classification, Chemistry and Metabolic functions, deficiency syndromes	10
	Total	100

Practical Exercises

No. of Units	Topics	No. of Experiments
1.	Safety measures in the Laboratory	1
2.	Use of different equipments/ glasswares/ utensils in laboratory	1
3.	Preparation of different solutions based on molarity, concentration and normality, etc	1
4.	Preparation of buffer solutions	1
5.	Qualitative Tests of Carbohydrate (Molisch's Test, Fehling's Test, Benedict Test, Iodine Test, etc.)	1
6.	Quantitative Determination of Carbohydrate by Phenol Sulphuric acid method	1
7.	Determination of reducing sugar by Nelson-Somogyi method	1
8.	Qualitative test for Amino acids and proteins (Biuret Test, Xanthoproteic Test, Ninhydrin Test, Millon's Test, Nitroprusside Test, etc)	1
9.	Estimation of protein content by Micro-Kjeldahl Method	1
10.	Determination of protein by Lowry Method	1
11.	Determination of protein content by beuret method	1
12.	Qualitative tests for lipids (saponification test, unsaturated fatty acid test, etc)	1
13.	Determination of total fat by acid hydrolysis method	1
14.	Determination of crude fat by Soxhlet Method	1
15.	Determination of ash content of given sample	1
16.	Determination of crude fibre content of given sample	1
	Total	16

TEXT BOOK

Sr. No.	Name of Book	Author	Publisher
1	Fundamentals of Biochemistry	Jain JL, Jain S and Jain N	S. Chand Publication, India 2016
2	Biochemistry	Satyanarayana	Elsevier, 2013
3	Lehninger Principles of Biochemistry	David L. Nelson and Michael M. Cox	6th Ed. Macmillan Learning, NY, USA. 2012
4	Outlines of Biochemistry	Conn EE and Stumpf PK	4 th Edition Wiley Eastern Ltd, Pune (India)

REFERENCE BOOKS

Sr. No.	Name of Book	Author	Publisher
1	Wardlaw's Perspectives in Nutrition: A Functional Approach	Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner	McGraw-Hill, Inc., NY, USA. 2013
2	Biochemistry	Donald Voet and Judith G. Voet	4th Ed. John Wiley and Sons, Inc., NY, USA. 2011
3	Handbook of Nutrition and Food	Carolyn D. Berdanier, Elaine B. Feldman and Johanna Dwyer	2nd Ed. CRC Press, Boca Raton, FL, USA. 2008
4	Biochemistry & Molecular Biology of Plants	Bob B. Buchanan, Wilhelm Gruissem and Russell L. Jones	John Wiley and Sons, Inc., NY, USA. 2002

Theory

Concepts and content of nutrition: Nutrition agencies; Nutrition of community; Nutritional policies and their implementation; Metabolic function of nutrients Nutrients: Sources, functions, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats in human beings; Water and energy balance: Water intake and losses; Basal metabolism- BMR; Body surface area and factors affecting BMR Formulation of diets: Classification of balanced diet; Preparation of balanced diet for various groups; Diets and disorders Recommended dietary allowances; For various age group; According physiological status; Athletic and sports man; Geriatric persons Malnutrition: Type of Malnutrition; Multi-factorial causes; Epidemiology of under nutrition and over nutrition; Nutrition infection and immunity; Nutrition education Assessment of nutritional status: Diet surveys; Anthropometry; Clinical examination; Biochemical assessment; Additional medical information In-born error of metabolism: Blood constituents; Nutrients; Hormones and enzymes; Miscellaneous disorders Food fad and faddism Potentially toxic substance in human food.

Practical

Role of various national and international agencies in field of human nutrition; Calculation of BMR and body surface area; Preparation of balance diets, evaluation of energy value and techno economical feasibility; Anthropometric measurements; Techniques in animal feeding experiments; Biochemical analysis of urine and blood; Nutritional survey; Determination of energy value; Bomb Calorimeter On basis of composition; Computation of Energy requirements; On the basis of Physical activity ACU unit

Teaching Schedule - Theory with Weightages (%)

No. of Units	TOPICS	Weightage (%)
1 – 4	Concepts and content of nutrition: Nutrition agencies; Nutrition of community; Nutritional policies and their implementation; Metabolic function of nutrients	12
5 – 8	Nutrients: Sources, functions, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats in human beings;	12
9 – 12	Water and energy balance: Water intake and losses; Basal metabolism- BMR; Body surface area and factors affecting BMR	12
13 – 16	Formulation of diets: Classification of balanced diet; Preparation of balanced diet for various groups; Diets and disorders	12
17 – 20	Recommended dietary allowances; For various age group; According physiological status; Athletic and sports man; Geriatric persons	12
21 – 24	Malnutrition: Type of Malnutrition; Multi-factorial causes; Epidemiology of under nutrition and over nutrition; Nutrition infection and immunity; Nutrition education	12

25 – 26	Assessment of nutritional status: Diet surveys; Anthropometry; Clinical examination; Biochemical assessment; Additional medical information	7
27 – 28	In-born error of metabolism: Blood constituents; Nutrients; Hormones and enzymes; Miscellaneous disorders	7
29 – 30	Food fad and faddism	7
31 – 32	Potentially toxic substance in human food	7
	Total	

Practical Exercises

No. of Units	Topics	No. of Experiments
1	Role of various national and international agencies in field of human nutrition	1
2	Nutritive value of different food groups	1
3	Nutritional labeling of food products	1
	Calculation of BMR	1
5	Calculation of BMI	1
6	Anthropometric measurements	1
7	Preparation of balance diet and RDA of nutrients	1
8	Techniques in animal feeding experiments	1
9	Computation of energy requirements	1
10	Determination of energy value of food by bomb calorimeter	1
11	Clinical methods of assessing nutritional status (for calorific requirement)	1
12	Clinical methods of assessing nutritional status (for vitamin deficiency)	1
13	Clinical methods of assessing nutritional status (for mineral deficiency)	1
14	Diet for specific health condition (diabetic patient)	1
15	Diet for specific health condition (Obesity)	1
16	Visit to Pathological laboratory	1
	Total	16

TEXT BOOK

Sr. No.	Name of Book	Author	Publisher
1	Advanced Text Book on Food & Nutrition (Volume I and II)	Swaminathan M	The Bangalore Printing and Publishing Co.Ltd, Bangalore. 2006
2	ABC of Nutrition (4 th edition)	Stewart Truswell	BMJ Publishing Group 2003 ISBN 0727916645
3	Encyclopedia of Human Nutrition	Benjamin C., Lindsay A., Andrew P.	Elsevier Academic Press, 2005 ISBN 0121501108
4	Barasi's Human Nutrition – A Health Perspective	Mike Lean and E. Combet	Second Edition CRC Press, London
5	Principles of Human Nutrition	Martin Eastwood	Blackwell Publishing, Boca Rotan
6	Encyclopedia of Foods – A Guide to Healthy Nutrition	Mayo Clinic and Dole Food Company Inc.	Academic Press – An Imprint of Elsevier, San Diego, California

REFERENCE BOOK

Sr. No.	Name of Book	Author	Publisher
1	Essentials of Human Nutrition	Jim M. and Stewart T.	Oxford University Press, 2002 ISBN 019850861
2	Introduction to Human Nutrition	Micheal J. G., Susan A.L. Aedin C. and Hester H.V.	Wiley-Blackwell Publication, UK 2009 ISBN 9781405168076
3	Nutrition and Health	Gerald W.	Taylor and Francis, London 2002 ISBN 0415278740
4	Handbook of Nutrition and Food	Carolyn D. Berdanier, Elaine B. Feldman and Johanna Dwyer	2nd Ed. CRC Press, Boca Raton, FL, USA. 2008
5	Nutrition and Physical Fitness	Bogert L.J., Goerge M.B, Doris H.C.	W.B. Saunders Company, Toronto, Canada

Theory

Introduction: Nature Scope and development of food chemistry, role of food chemist. **Moisture in foods:** Role and type of water in foods; Functional properties of water; role of water in food spoilage; Water activity and sorption isotherm; Molecular mobility and foods stability. **Dispersed systems of foods:** Physicochemical aspects of food dispersion system (sol, gel, foam, emulsions, etc); Rheology of diphase systems **Carbohydrates:** Changes of carbohydrates on cooking, modification of carbohydrates, dietary fibres and carbohydrates digestibility; Enzymatic and chemical reactions of carbohydrates; **Proteins in foods:** Processing induced, physical, chemical and nutritional changes in protein, chemical and enzymatic modification of protein **Lipids in foods:** Role and use of lipids/fat, crystallization and consistency, chemical aspects of lipids, lipolysis, auto-oxidation, thermal decomposition, chemistry of frying technology of fat and oil; **Oil processing:** Refining, hydrogenations, inter esterification, safety use of oils and fats in food formulation; Enzymatic and chemical reactions of fats; Rancidity and its types, detection techniques chemical aspects of lipids, antioxidants

Practical

Determination of moisture content of foods using different methods; Studies of absorption isotherms; Swelling and solubility characteristics of starches; Rheological properties of diphase systems; Determination of crude proteins by microkjaldhal method; Determination of essential amino acids methionine etc.; Isolation of protein from different sources and preparation of protein isolates and concentrates; Determination of acid value, saponification value and iodine number of fat/ oil

Teaching Schedule - Theory with Weightages (%)

No. of Units	TOPICS	Weightage (%)
1 – 3	Introduction: Nature Scope and development of food chemistry, role of food chemist.	12
4 – 8	Moisture in foods: Role and type of water in foods; Functional properties of water; role of water in food spoilage; Water activity and sorption isotherm; Molecular mobility and foods stability	16
9 – 13	Dispersed systems of foods: Physicochemical aspects of food dispersion system (sol, gel, foam, emulsions, etc); Rheology of diphase systems	16
14 – 19	Carbohydrates: Changes of carbohydrates on cooking, modification of carbohydrates, dietary fibres and carbohydrates digestibility; Enzymatic and chemical reactions of carbohydrates;	18
20 – 25	Proteins in foods: Processing induced, physical, chemical and nutritional changes in protein, chemical and enzymatic modification of protein	18
26 – 32	Lipids in foods: Role and use of lipids/fat, crystallization and consistency, chemical aspects of lipids, lipolysis, auto-oxidation, thermal decomposition, chemistry of frying technology of fat and oil; Oil processing: Refining, hydrogenations, inter esterification, safety use of oils and fats in food formulation; Enzymatic and chemical reactions of fats; Rancidity and its types, detection techniques chemical aspects of lipids, antioxidants;.	20
	Total	100

Practical Exercises

No. of Units	Topics	No. of Experiments
1	Determination of moisture content by hot air oven method	1
2	Determination of moisture content of liquid foods by Karl Fischer method	1
3	Studies on sorption isotherm	1
4	Preparation of different gel system	1
5	Preparation of emulsion and determination of emulsion stability	1
6	Isolation of protein from different food sources	1
7	Preparation of protein isolate/concentrate	1
8	Isolation of starch of given sample	1
9	Studies on different properties of starches	1
10	Determination of total sugar in food	1
11	Estimation of reducing sugar in food	1
12	Determination of Physical properties of fat	1
13	Determination of acid value of oil	1
14	Determination of iodine value of oil	1
15	Determination of saponification value	1
16	Test for detection of different oils (Baudouin test, Halphens test, hexabromide test)	1
	Total	16

TEXT BOOK

Sr. No.	Name of Book	Author	Publisher
1	Food Chemistry	Owen R, Fennema	3rd Ed. Marcel Dekker, Inc., New York, USA. 1996
2	Food Chemistry	Lillian Hoagland Meyer	The AVI Publishing Co Inc., Connecticut, MA, USA. 1974
3	Principles of Food Chemistry	DeMan JM	AVI Publishing Co Inc., 1976
4	Essentials of Food and Nutrition	Swaminathan M.	Vol. II, Ganesh & Co., 1974

REFERENCE BOOKS

Sr. No.	Name of Book	Author	Publisher
1	Introductory Food Chemistry. Comstock Publishing Associates	John W. Brady	Cornell University Press, Ithaca, USA. 2013
2	Food Chemistry	H.-D. Belitz, W. Grosch and P. Schieberle	4th Ed. Springer-Verlag Berlin Heidelberg. 2009
3	Biochemistry of Foods	Eskin NAM, Henderson HM and Townsed RJ	Academic Press, New York 1971
4	Food Biochemistry and Food Processing	Benjamin K. S.	Wiley-Blackwell, London ISBN: 978081380874
5	Food Chemistry	David Newton	Facts on File, Inc. New York ISBN: 0816052778

Theory

Chemistry of food flavour; Philosophy and definitions of flavour, flavourmatics/flavouring compounds, sensory assessment of flavour, technology for flavour retention; Pigments in animal and plants kingdoms: Heme pigments, chlorophyll, carotenoids, phenolic and flavonoids, betalins, effect of processing on pigment behaviour; Technology for retention of natural colours of food stuffs Food colorants; Regulatory use of regulatory dyes; Colour losses during thermal processing; Vitamins and minerals: Requirements, allowances, enrichment, restorations, fortifications, losses of vitamins and minerals, optimization and retention of vitamins and minerals; Chemistry of anti-nutritional factors. Food toxicology: Inherent toxicants – antinutritional factors their occurrence, effects and methods of elimination or inactivation- protease inhibitions, lectins, lathyrogens, phytates and flatulence factors; Terms in toxicology; Safety evaluation using traditional and modern approach; Food Contaminants; Pesticidal residues – permitted limits; Toxicology and public health

Practical

Preparation of mineral solution by using ash and tri acid method (dry and wet oxidations); Estimation of calcium; Determination of phosphorus; Determination of iron; Estimation of magnesium; Estimation of tannins and phytic acid from food; Determination of vit. A (Total carotenoids); Determination of ascorbic acid by dye method; Determination of niacine and pyridoxine; Determination of food colors; Assessment of hydrocolloids as food additives

Teaching Schedule - Theory with Weightages (%)

No. of Units	TOPICS	Weightage (%)
1 – 6	Chemistry of food flavour; Philosophy and definitions of flavour, flavourmatics/flavouring compounds, sensory assessment of flavour, technology for flavour retention;	22
7 – 11	Pigments in animal and plants kingdoms: Heme pigments, chlorophyll, carotenoids, phenolic and flavonoids, betalins, effect of processing on pigment behaviour; Technology for retention of natural colours of food stuffs;	18
12 – 15	Food colorants; Regulatory use of regulatory dyes; Colour losses during thermal processing;	16
16 – 20	Vitamins and minerals: Requirements, allowances, enrichment, restorations, fortifications, losses of vitamins and minerals, optimization and retention of vitamins and minerals; Chemistry of anti-nutritional factors.	18
21	Nutraceuticals in food: major nutraceuticals viz. antioxidants, phenols, tannins, etc	3
22 – 32	Food toxicology: Inherent toxicants – antinutritional factors their occurrence, effects and methods of elimination or inactivation- protease inhibitions, lectins, lathyrogens, phytates and flatulence factors; Terms in toxicology; Safety evaluation using traditional and modern approach; Food Contaminants; Pesticidal residues – permitted limits; Toxicology and public health	23
	Total	100

Practical Exercises

No. of Units	Topics	No. of Lectures
1.	Preparation of mineral solution by using ash and tri acid method (dry and wet oxidations)	1
2.	Estimation of calcium	1
3.	Determination of phosphorus	1
4.	Determination of iron	1
5.	Estimation of magnesium	1
6.	Estimation of tannins from food	1
7.	Estimation of oxalic acid in tomatoes	1
8.	Estimation of phytic acid from food	1
9.	Determination of total carotenoids	1
10.	Determination of ascorbic acid by dye method	1
11.	Determination of niacin/ pyridoxine	1
12.	Estimation of lysine content	1
13.	Determination of food colors	1
14.	Qualitative tests for identification of phytochemical in food	1
15.	Determination of chlorophyll content of given sample	1
16.	Determination of in-vitro digestibility of protein	1
17.	Estimation of total phenol content	1
	Total	16

TEXT BOOK

Sr. No.	Name of Book	Author	Publisher
1	Food Chemistry	Owen R, Fennema	3rd Ed. Marcel Dekker, Inc., New York, USA. 1996
2	Food Chemistry	Meyer L.H.	CBS Publishers & Distributors, New Delhi (India) 2004
3	Food Chemistry	Lillian Hoagland Meyer	The AVI Publishing Co Inc., Connecticut, MA, USA. 1974
4	Introductory Food Chemistry.	John W. Brady	Cornell University Press, Ithaca, USA. 2013
5	Food Chemistry	H.-D. Belitz, W. Grosch and P. Schieberle	4th Ed. Springer-Verlag Berlin Heidelberg. 2009
6	Biochemistry of Foods	Eskin NAM, Henderson HM and Townsed RJ	Academic Press, New York 1971

REFERENCE BOOKS

Sr. No.	Name of Book	Author	Publisher
1	Food Biochemistry and Food Processing	Benjamin K. S.	Wiley-Blackwell, London, 1983
2	Food Chemistry	David Newton	Facts on File, Inc. New York 2004
3	Principles of Food Chemistry	DeMan JM	AVI Publishing Co Inc., 1976
4	Essentials of Food and Nutrition	Swaminathan M.	Vol. II, Ganesh & Co., 1974

Theory

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 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. Pigments: Importance; Classification: Utilization as food colour Food Preservatives : Introduction; Classification- Natural & chemical preservatives; Mode of action; Role in Food processing 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 agents Stabilizers, thickeners and Emulsifiers: Introduction; Types; Applications in food processing; Sweeteners: Introduction; Classification- Artificial sweeteners & Non-nutritive sweeteners; Health implications; Role in food processing. Bleaching & maturing agents: Introduction; Different bleaching & maturing agents; Role in food processing Taste and Flavoring agents: Introduction; Classification of flavors- natural & synthetic; Flavor enhancer/ Potentiator; Importance of taste and flavours; Role of flavoring agents in food processing. Anti-caking agents and Humectants: Introduction; Different Anti-caking agents and Humectants; Role in food processing Starch modifiers: Introduction; Chemical nature; Role in food processing. Antimicrobial agents, Clarifying agents, antifoaming agents, Fat mimetics and replacers: Introductions; Role in food processing;

Practical

Evaluation of GRAS aspects of Food Additives; Qualitative Tests for Presence of Benzoic acid in foods; Quantitative Determination of Benzoic acid; Determination of Nitrates and Nitrites in Foods; Qualitative and Quantitative Test for presence of non-nutritive sweeteners; Identification of Natural Colors; Determination of Synthetic colorants in food; Extraction and identification of food pigments; Determination of total chlorophyll by Spectrophotometric method; Detection of chemical preservatives in foods; Study of effect of acidulants in fruit juices; Study of effect of stabilizers/thickeners on quality of foods; Study of effect of clarifying agents on the fruit juices; Role of emulsifiers in foods; Role of leaving agent in baked food product; Role and mode of action of antioxidant in food products

Teaching Schedule - Theory with Weightages (%)

No. of Units	TOPICS	Weightage (%)
1 – 3	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	19
4 – 6	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.	19
7	Pigments: Importance; Classification: Utilization as food colour	6
8 – 10	Food Preservatives : Introduction; Classification- Natural & chemical preservatives; Mode of action; Role in Food processing 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 agents	19
11	Stabilizers, thickeners and Emulsifiers: Introduction; Types; Applications in food processing;	6
12	Sweeteners: Introduction; Classification- Artificial sweeteners & Non-nutritive sweeteners; Health implications; Role in food processing.	6
13	Bleaching & maturing agents: Introduction; Different bleaching & maturing agents; Role in food processing.	6
14	Taste and Flavoring agents: Introduction; Classification of flavors- natural & synthetic; Flavor enhancer/ Potentiator; Importance of taste and flavours; Role of flavoring agents in food processing.	6
15 – 16	Anti-caking agents and Humectants: Introduction; Different Anti-caking agents and Humectants; Role in food processing Starch modifiers: Introduction; Chemical nature; Role in food processing. Antimicrobial agents, Clarifying agents, antifoaming agents, Fat mimetics and replacers: Introductions; Role in food processing;	13
	Total	100

Practical Exercises

No. of Units	Topics	No. of Experiments
1.	Evaluation of GRAS aspects of Food Additives	1
2.	E numbers for different food additives	1
3.	Qualitative Tests for presence of benzoic acid in foods	1
4.	Qualitative Tests for presence of sulphurous acid in foods	1
5.	Quantitative determination of benzoic acid	1
6.	Determination of nitrates and nitrites in Foods	1
7.	Qualitative for presence of non-nutritive sweeteners	1
8.	Identification of colors in food by TLC	1
9.	Determination of diacetyl content in dairy products	1
10.	Determination of total chlorophyll by Spectrophotometric method	1
11.	Detection of chemical preservatives in foods	1
12.	Study of effect of acidulants in fruit juices	1
13.	Study of effect of stabilizers/thickeners on quality of foods	1
14.	Study of effect of clarifying agents on the fruit juices	1
15.	Role of emulsifiers in foods	1
16.	Role of leavening agent in baked food product	1
17.	Role and mode of action of antioxidant in food products	1
18.		
	Total	16

TEXT BOOK

Sr. No.	Name of Book	Author	Publisher
1	Food Additives	A Larry Branen, P Michael Davidson and Seppo Salminen	CRC Book Press. USA.
2	Food Additives	S.N. Mahindru	APH Publishing Corporation, Drya Ganj, New Delhi.
3	Food colours, Flavours and Additives Technology Handbook	NIIR Board of Consultants and Engineers	National Institute of Industrial Research, Kamla Nagar, Delhi

REFERENCE BOOKS

Sr. No.	Name of Book	Author	Publisher
1	Food chemistry	H.D. Belitz, W. Grosh and P. Schieberle	4 th Revised & Extended Edition, Springer. 2009
2	Food chemistry	Owen R Fennema	Marcel Dekker, Inc. New York. 1996
3	Food chemistry	Lillian Hogland Meyer	Avi Pub Co .1974
4	Handbook of Food Toxicology	S.S Deshpande	Marcel Dekker 2002

Practical

Sampling plan; Sample collection and preparation for analysis; Sensory evaluation of products; Quality evaluation of raw materials: Fruits, vegetables, cereals, dairy products, meat, poultry products; Quality evaluation of food products for color and taste of marketed products; Analysis of heavy metals using atomic absorption spectrophotometer; Estimation of phytic acid using spectrophotometer; Separation of amino acids by two-dimensional paper chromatography; Identification of sugars in fruit juice using TLC; Separation of pralines by ion-exchange chromatography; Molecular weight determination using sephadox-gel; Identification of organic acids by paper electrophoresis; Gel-electrophoresis for analytic techniques; Quantitative determination of sugars and fatty acid profile by GLC; Quantitative make-up of water and fat soluble vitamins using HPLC; Separation of sugars by paper chromatography; Analysis of wheat flour; Analysis of foods for pesticide and drug residues; Study of colorimetry and spectrophotometry; Spectrophotometric method of total chlorophyll (A & B).

Practical Exercises

No. of Units	Topics	No. of Experiments
1.	Sampling plan; Sample collection and preparation for analysis	2
2.	Study of different chromatographic techniques	1
3.	Identification of sugars in fruit juice using TLC	1
4.	Separation of amino acids by two-dimensional paper chromatography	1
5.	Determination of carotenoids by HPLC	2
6.	Analysis of heavy metals	2
7.	Quantitative determination of sugars and fatty acid profile by GLC	2
8.	Identification of organic acids by paper electrophoresis	1
9.	Gel-electrophoresis for analytic techniques	1
10.	Near-Infrared Spectroscopy	1
11.	Estimation of phytic acid using spectrophotometer	1
12.	Quantitative make-up of water soluble vitamins	2
13.	Quantitative make-up of fat soluble vitamins	2
14.	Estimation of chlorophyll content by different methods	1
15.	Analysis of minor constituents of foods	2
16.	Determination of molecular weight of pectin	1
17.	Quality evaluation of raw materials: Fruits, vegetables, cereals, dairy products, meat, poultry products	6
18.	Quality evaluation of food products for color and taste of marketed products	4
	Total	32

TEXT BOOK

Sr. No.	Name of Book	Author	Publisher
1	Handbook of Food Analysis Instruments	Semih Ötles	CRC Press, Boca Raton, FL, USA. 2009
2	Food Analysis	S. Suzanne Nielsen	3rd Ed. Kluwer Academic, New York, USA. 2003
3	Official methods of analysis of AOAC International	AOAC	17th Ed. Gaithersburg, MD, USA, Association of Analytical Communities, 2003
4	Instrumental Methods of Food Analysis	Macleod AJ	Elek Sci. Marcel Dekker. 1973
5	Food Analysis - Theory and Practice	Pomrenz Y & Meloan CE	3rd Ed. CBS. 1996
6	Handbook of Analysis and Quality Control for Fruit and Vegetable Products	Ranganna S.	2nd Ed. Tata-McGraw-Hill. 2001

REFERENCE BOOKS

Sr. No.	Name of Book	Author	Publisher
1	Food Analysis Laboratory Manual	S. Suzanne Nielsen	2nd Ed. Springer, NY, USA. 2010
2	Modern Techniques for Food Authentication	Da-Wen Sun	Elsevier Inc., Burlington, MA, USA. 2008
3	Pearson's Chemical Analysis of Foods	Kirk RS & Sawyer R	9th Ed. Longman Scientific & Technical. 1991

Theory

Introduction: classification and nomenclature, mechanism of enzyme action, enzyme kinetics, factors affecting the rate of enzymic reactions, sources of enzymes Enzyme Kinetics: enzyme concentration, substrate concentration, environmental conditions, inhibitors, activators and cofactors Undesirable and desirable enzymic reactions in foods Sources of enzymes: different sources, extraction of enzymes and purification, enzyme technology and application Enzymes in milk and cheese industries: enzymes in milk processing and cheese production Enzymes in Meat industry: enzymes in tenderization of meat Enzymes in baking industry Enzymes in production of beverages and fruit juices: enzymes in tea, cocoa, wine, beer, whiskey, cider, etc Enzymes in sugar industries: Types of enzymes in sugar industry; isolation, purification and assay of enzymes, Enzymes in fats, oil, flavour and fragrances Immobilized enzymes in food processing

Practical

Effects of different enzymatic reactions on foods; Effect of enzymes on meat; Effects of enzymes on bakery products; Effect of enzymes on fruit juices and beverages; Improving different properties of foods by application of enzymes; Enzymes

Teaching Schedule - Theory with Weightages (%)

No. of Units	TOPICS	Weightage (%)
1 – 3	Introduction: classification and nomenclature, mechanism of enzyme action, enzyme kinetics, factors affecting the rate of enzymic reactions, sources of enzymes	19
4 – 5	Enzyme Kinetics: enzyme concentration, substrate concentration, environmental conditions, inhibitors, activators and cofactors	13
6 – 7	Undesirable and desirable enzymic reactions in foods	13
8 – 9	Sources of enzymes: different sources, extraction of enzymes and purification, enzyme technology and application	13
10	Enzymes in milk and cheese industries: enzymes in milk processing and cheese production	6
11	Enzymes in Meat industry: enzymes in tenderization of meat	6
12	Enzymes in baking industry	6
13	Enzymes in production of beverages and fruit juices: enzymes in tea, cocoa, wine, beer, whiskey, cider, etc	6
14	Enzymes in sugar industries: Types of enzymes in sugar industry; isolation, purification and assay of enzymes,	6
15	Enzymes in fats, oil, flavour and fragrances	6
16	Immobilized enzymes in food processing	6
	Total	

Practical Exercises

No. of Units	TOPICS	No. of Lectures
1	Classification of enzymes	1
2	Isolation and purification of enzymes	1
3	Activation of polyphenol oxidase from food sample	1
4	Separation of casein from milk using rennin	1
5	Effect of xylanase enzyme on water absorption capacity of bread	1
6	Measurement of amylase content of wheat flour	1
7	Application of pectinase in fruit juices	1
8	Inactivation of phosphatase enzyme	1
9	Effect of papain on meat tenderness	1
10	Application of lipase in enhancing emulsifying capacity	1
11	Application of lipase in noodles	1
12	Detection of phosphatase enzyme in milk	1
13	Use of glucose oxidase in egg powder manufacture	1
14	Use of invertase enzyme in confectionary	1
15	Use of lactase enzyme in dairy industry	1
16	Effect of cellulose on fruit juice yield	1
	Total	16

TEXT BOOK

Sr. No.	Name of Book	Author	Publisher
1	Enzymes in Food Processing	G.A. Tucker and L.F.J. Woods	Springer 2009
2	Enzymes in Food and Beverage Processing	Muthuswamy C.	CRC Press, London 2015
3	Enzymes in Food Processing – Fundamentals and potential application	Panesar P.S., Marwaha S.S. and Kumar H.	IK International Publishing House, 2010 ISBN: 9380026331

REFERENCE BOOKS

Sr. No.	Name of Book	Author	Publisher
1	Enzymes in Industry: production and applications	Aehle W	Wiley- VCH Verlag GmbH & Co.
2	Principles of Enzyme Technology	Khan M.Y. and Khan F.	PHI Publication, New Delhi 2015 ISBN 8120350413
3	Microbial Enzyme Technology in Food Applications	Ray R.C. and Rosell C.M.	CRC Press, London 2017 ISBN: 1498749844