

**INTEGRAL UNIVERSITY  
LUCKNOW**

**SYLLABUS & EVALUATION  
SCHEME  
for**

**B.TECH.  
FOOD TECHNOLOGY**

**IV Year**

**VII Sem**

**(with effect from 2018-19)**

**Annexure BE02**

**B.Tech Food Technology**  
**(with effect from July 2018)**

**IV Year**

**VII Sem**

S. No.	Course Category	Subject Code	Name of Subject	Periods and Credits				Evaluation Scheme				Subject Total			
				L	T	P	C	Sessional (CA)			ESE				
								CT	TA	Total					
1	DC	BE-431	Edible Oil Processing Technology	2	1	0	3	25	15	40	60	100			
2	DC	BE-432	Food Regulation and Quality Control	2	1	0	3	25	15	40	60	100			
3	DC	BE-433	Plantation Products and Spices Technology	2	1	0	3	25	15	40	60	100			
4	DE		Departmental Elective 3	3	1	0	4	25	15	40	60	100			
5	DE		Departmental Elective 4	3	1	0	4	25	15	40	60	100			
6	DC	BE-434	Edible Oil Processing Technology Lab	0	0	4	2	30	30	60	40	100			
7	OE		Open Elective-I	-	-	-	4	25	15	40	60	100			
8	DC	*BE-300	Industrial Training	0	0	0	0	0	0	0	50*	S/U*			
<b>Total</b>				12				5	4	23	180	12	300	400	700

\* A zero-credit industrial training. Candidate has to score an S (satisfactory) grade.

L: Lecture T: Tutorial P: Practical C: Credit CA: Continuous Assessment

CT: Class Test TA: Teacher's Assessment ESE: End Semester Examination

DC: Departmental Core DE: Departmental Elective

**Departmental Elective 3**

1. Novel Food Processing Technologies (BE-435)

2. Analytical Techniques (BE-436)

**Departmental Elective 4**

1. Enzyme Technology (BE-437)

2. Nutraceuticals and Functional Foods (BE-438)

**BE-431**

**EDIBLE OIL PROCESSING TECHNOLOGY**

Pre-requisite	Co-requisite	L	T	P	C
None	None	2	1	0	3

**Objective:** To acquaint the students with production, unit operation, and causes of spoilages of edible oils.

<b>Unit I</b>	<b>Introduction</b>	<b>8</b>
	Introduction-Importance of oil seed processing industry in India, storage of oil seed grains. Composition of different oil seeds (sunflower, mustard, rapeseed, soybean, corn, palm oil, etc.).	
<b>Unit II</b>	<b>Types of Fats</b>	<b>8</b>
	Types of fats and their composition-Animal- Lard, margarine their technology and applications. Vegetable oils, Hydrogenated fats. Cocoa butter equivalents, shortenings, low fat spreads, peanut butter etc. Specialty fats and designer lipids for nutrition and dietetics, especially by biotechnology.	
<b>Unit III</b>	<b>Technologies for Extraction</b>	<b>8</b>
	Processing technologies for oil extraction-Traditional and Expellers Extraction methods, types of expellers and solvent extraction technology. Refining of oil seeds. Rendering of animal fats.	
<b>Unit IV</b>	<b>Processing of Vegetable Oils and Storage</b>	<b>8</b>
	Processing of vegetable oils. Hydrogenation of vegetable oils, shortenings and margarine. Fractionation, winterzation, inter-esterification etc. for obtaining tailor-made fats and oils. Rancidity and flavor reversion, mechanism and their control measures. Quality assessment tests of fats and oils, oil and fat adulterants, Packaging and storage of fats and oils.	

## References

### Books

1. Williams. P.N. & Devine. J. (1996). The Chemistry and Technology of Edible Oil and Fats.
2. Berk & Bhatia (2008). Handbook of Industrial Oil and Fat Products, Vol 1-4. CBS Publishers, New Delhi.
3. Meyer (1998). Food Chemistry. CBS Publishers, New Delhi.
4. Hamilton, R.J. and Bharti, A. Ed. 1980. Fats and Oils: Chemistry and Technology. Applied Science, London.
5. Salunkhe, O.K. Chavan, J.K, Adsule, R.N. and Kadam, S.S. 1992. World Oilseeds: chemistry, Technology and Utilization. VNR, New York.
6. Wolf, I.A. Ed. 1983. Handbook of Processing and Utilization in Agriculture. (2 vol. set). CRC Press, Florida

Pre-requisite	Co-requisite	L	T	P	C
None	None	2	1	0	3

**Objective:** To provide the students an opportunity to learn food safety and management systems and to learn international food laws and quality standards.

<b>Unit I</b>	<b>General Principles of Food Hygiene</b>	<b>8</b>
	General principles of food hygiene, relation to food preparation, personal hygiene. Introduction to food analysis, sampling techniques, storage and preservation of samples, expression of results.	
<b>Unit II</b>	<b>General Principles of Quality</b>	<b>8</b>
	General principles of quality control, quality attributes, colour, gloss, viscosity and consistency, size and shape, and texture, flavour, taste, sensory evolution techniques.	
<b>Unit III</b>	<b>Proximate Analysis and Food Quality</b>	<b>8</b>
	Proximate analysis of foods: Principles of estimation of moisture, fat, protein, carbohydrates, crude fibre, minerals and vitamins in foods. Principles of food quality assurance, objectives, raw material quality assurance, finished product quality assurance. Food laws and standards, national and international regulatory agencies, Concept of HACCP & ISO 9000 series. Food adulteration: methods of evaluation of different food adulterants.	
<b>Unit IV</b>	<b>Methods of Quality Assessment</b>	<b>8</b>
	Methods of quality assessment of food materials: Fruits, vegetables, cereals, dairy products, meat products and eggs. Food hazards and food handling habits. Sources of water, sanitary aspects of water supply, quality of water. Impurities in water supply and their treatment.	

#### References

##### Books

1. Krammar & Twigg (1996), Quality Control for Food Industry. CBS Publishers.
2. Pomerans, Y. & Meloan (1978). Food Analysis: Theory and Practice, Westport. Connecticut: AVI Publishers
3. Ronald, S. Kirk, & Ronald, Sawyer (1991). Pearson's Composition & Analysis of Foods, 9th Edition, Longman Scientific & Technical, U. K.

Pre-requisite	Co-requisite	L	T	P	C
None	None	2	1	0	3

**Objective:** To acquaint the students with the methods for processing of various spices, tea, coffee, and cocoa.

<b>Unit I</b>	<b>Production and Processing of Tea Leaves</b>	<b>8</b>
	Black tea, Green tea and Oolong tea. Chemistry of tea manufacturing and tea quality; tea aroma precursors; tea flavour; tea grades; storing of tea Instant tea, tea concentrates, decaffeinated tea, flavoured tea, herbal tea.	
<b>Unit-II</b>	<b>Coffee</b>	<b>8</b>
	Production and processing of coffee cherries by wet and dry methods to obtain coffee beans, grinding, storage and preparation of brew, Soluble/Instant coffee, Use of chicory in coffee, decaffeinated coffee. Production, processing and chemical composition of cocoa beans.	
<b>Unit-III</b>	<b>Cocoa Processing</b>	<b>8</b>
	Cleaning, roasting, alkalization, cracking and fanning, Nib grinding for cocoa liquor, cocoa butter and cocoa powder. Manufacturing process for chocolate: Ingredients, Mixing, Refining, Conching, Tempering, Moulding etc. to obtain chocolate slabs, chocolate bars. Enrobed and other confectionary products. Composition, Structure and characteristics of cashew nut and other dry fruits.	
<b>Unit-IV</b>	<b>Spices</b>	<b>8</b>
	Types, production, pre-harvest and post-harvest problems in processing, properties, drying, storage and packaging, health benefits; flavouring components. Spice powder and paste: their processing, quality, storage; spice based food additives; volatiles, essential oils and oleoresins: their characteristics, extraction procedure and utilization.	

### References

#### Books

1. Tea Production and Processing. B. Banerjee, Oxford & IBH Pub. Co., 1st Edition, 1993.
2. Coffee Technology. M. Sivetz, AVI publishing Co., 1st Edition, 1979.
3. Minor Spices and Condiments: Crop Management and Post Harvest Technology. J.S. Purthi, ICAR publication, 1st Edition, 2001.
4. Major Spices of India: Crop Management and Post Harvest Technology. J.S. Purthi, ICAR publication, 1st Edition, 2003.
5. Tree Nuts: Production, Processing, Products. J. G. Woodroof, AVI Pub. Co., 1<sup>st</sup> Edition, 1979.

Pre-requisite	Co-requisite	L	T	P	C
None	None	3	1	0	4

**Objective:** To acquaint the students with the scope of emerging food processing technologies and their limitations.

<b>Unit I</b>	<b>High Pressure Processing</b>	<b>8</b>
	High Pressure Processing: Principles of high pressure processing, Effects of high pressure on food quality: Pressure effects on microorganisms, texture and nutrients of food. Hurdle Technology Concept; effect on preservation of food.	
<b>Unit II</b>	<b>Pulsed Electric Field</b>	<b>8</b>
	Pulsed electric fields processing: PEF treatment systems, main processing parameters. Mechanisms of action: mechanisms of microbial inactivation.	
<b>Unit III</b>	<b>Osmotic Dehydration and Membrane Processing</b>	<b>8</b>
	Osmotic dehydration: mechanism of osmotic dehydration, application of osmotic dehydration. Membrane separation: Principle, different types of Membrane processing, Application in Food industry.	
<b>Unit IV</b>	<b>Ultrasound Processing</b>	<b>8</b>
	Ultrasound processing: fundamentals of ultrasound, ultrasound as a food preservation and processing aid, effects of ultrasound on food properties.	
<b>Unit V</b>	<b>Alternate Thermal Processing</b>	<b>8</b>
	Microwave heating, Radio-frequency processing: dielectric heating, radio-frequency heating; Ohmic heating, Freeze drying, freeze concentration, UV radiation towers.	

### References

#### Books

1. P. J. Fellows (2009). Food Processing Technology: Principles and Practice. Third edition. Wood Head Publishing in Food Science, Technology and Nutrition.
2. Howard Q. Zhang, Gustavo V. Barbosa-Cánovas, V. M. Bala Balasubramaniam, C. Patrick Dunne, Daniel F. Farkas, James T. C. Yuan (2011). Nonthermal Processing Technologies for Food. Wiley-Blackwell.
3. Ortega-Rivas, Enrique (2012). Non-thermal Food Engineering Operations. Springer.
4. N. S. Isaacs (1998). High pressure food science, bioscience and chemistry. Wood Head Publishing Limited.
5. H. L. M. Lelieveld, S. Notermans, and S. W. H. De Haan (2007). Food preservation by pulsed electric fields: From research to application. Wood Head Publishing Limited.

Pre-requisite	Co-requisite	L	T	P	C
None	None	3	1	0	4

**Objective:** Specific goal of this course is to acquaint the students with characteristics and working mechanisms of common analytical tools and the application of analytical methods to current scientific challenges.

<b>Unit I</b>	<b>Introduction</b>	<b>8</b>
	Introduction to Food Analysis: Safety in Laboratory. Sampling and sampling techniques, sample preparation for analysis. Basic principles of spectroscopy: UV-VIS molecular absorption spectrometry, atomic absorption & emission spectrometry, fluorescence spectrometry, Atomic mass spectrometry, IR spectrometry.	
<b>Unit II</b>	<b>Separation Science</b>	<b>8</b>
	Separation Science: Basic principles of chromatography, HPLC, GC, TLC, Super critical fluid extraction chromatography	
<b>Unit III</b>	<b>Electrophoresis</b>	<b>8</b>
	Electrophoresis methods, Immunoassays analysis, ELISA testes. Radiochemical Methods: Use of radioisotopes. Modern techniques used for proximate analysis.	
<b>Unit IV</b>	<b>Textural Analysis</b>	<b>8</b>
	Textural analysis-Instrumentation, measurement of textural property, types of probes, load cells, TPA, presentation of texture analysis graphs, suitability of food material for textural analysis, factors affecting the texture analysis	
<b>Unit V</b>	<b>Rheometry and Colour Analysis</b>	<b>8</b>
	Rheometry-Instrumentation. Viscometry-instrumentation, principle, measurement of parameter from viscometry. Food colour analysis	

### References

#### Books

1. S.S. Neilson, Food analysis, Springer.
2. AOAC methods for Food Analysis.
3. Y. Pomeranz and C. E Meloan, Food Analysis, Theory and practice; AVI Publishing Company, INC West Port, Connecticut, USA.
4. Fung, D.Y.C. and Matthews, R., Instrumental Methods for Quality Assurance in Foods; Marcel Dekker, Inc. New York.
5. Moskowitz, H. R., Food Texture: Instrumental and Sensory Measurement; Marcel Dekker, Inc. New York.

Pre-requisite	Co-requisite	L	T	P	C
None	None	3	1	0	4

**Objective:** This subject will cover aspects related to the types of enzymes, their mechanisms, kinetics of the reactions catalyzed and applications in different studies.

<b>Unit I</b>	<b>Enzymes</b>	
	Introduction, Allosteric enzymes, Ribozymes, Abzymes; Applications in industrial, medical, analytical, chemical, pharmaceutical and food sectors; Enzyme isolation and purification methods.	
<b>Unit II</b>	<b>Enzyme Kinetics of Free Enzymes</b>	
	Michaelis-Menten kinetics, kinetics for reversible reactions; Effect of various types of inhibition, evaluation of kinetic parameters; Multi-substrate reactions and their kinetics.	
<b>Unit III</b>	<b>Immobilized enzymes</b>	
	Methods of enzyme immobilization, factors affecting immobilized enzymes, kinetics of immobilized enzymes, internal and external mass transfer effects in immobilized-enzyme reactors, intra-particle diffusion, micro-environmental effects on enzyme kinetics, enzyme deactivation, operational stability and optimization, general design considerations for the immobilization process.	
<b>Unit IV</b>	<b>Design and Analysis of enzyme reactors</b>	
	Types of Reactors (Modes of operation), Basic design of enzyme reactors under Ideal conditions (Batch and continuous mixed reactors, continuous packed bed reactor under plug flow regime), Effect of Diffusional restrictions on Enzyme reactor design and performance in heterogeneous systems. Parameters affecting the performance of enzyme reactors.	
<b>Unit V</b>	<b>Enzyme reactions in organic media</b>	
	Study cases of Enzymatic Processes: (any one enzyme/biocatalyst like Proteases, Acylases, Lipases, Oxidoreductases, Aldolases, Amylases etc. to mention a few (Recommended topics to be covered-Applications of the biocatalyst, sources and production of biocatalyst, structure and mechanism, improvement of the biocatalysis reaction)	

### References

#### Books

1. Prescott & Dunn (1992), Industrial Microbiology, 4th Edition. CBS Publishers, New Delhi.
2. Ward, O. P. (1989). Fermentation Biotechnology- Principles, Process and Products. Prentice Hall Publishers, New Jersey.
3. Stansbury, P.F., Whitaker, A and Hall, S. J. (1995). Principles of Fermentation Technology, Pergamon Press, Oxford.
4. Young, M. Y. (1984). Comprehensive Biotechnology (Vol.1-4), Pergamon Press Oxford.





Pre-requisite	Co-requisite	L	T	P	C
None	None	3	1	0	4

**Objective:** To acquaint students with therapeutic properties of major fruits, vegetables, spices, and herbs.

<b>Unit I</b>	<b>Introduction to Nutraceuticals as Science</b>	<b>8</b>
	Historical perspective, classification, scope & future prospects. Applied aspects of the Nutraceutical Science. Sources of Nutraceuticals. Relation of Nutraceutical Science with other sciences: medicine, human physiology, genetics, food technology, chemistry and nutrition.	
<b>Unit II</b>	<b>Functions of Nutraceuticals</b>	<b>8</b>
	Properties, structure and functions of various Nutraceuticals: Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin and Ornithine alpha ketoglutarate. Use of proanthocyanidins, grape products, flaxseed oil as Nutraceuticals.	
<b>Unit III</b>	<b>Food as Remedies—I</b>	<b>8</b>
	Nutraceuticals bridging the gap between food and drug, Nutraceuticals in treatment for cognitive decline, Nutraceutical remedies for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia,	
<b>Unit IV</b>	<b>Food as Remedies—II</b>	<b>8</b>
	Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers etc. Brief idea about some Nutraceutical rich supplements, e.g., Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, Kelp and Spirulina etc.	
<b>Unit V</b>	<b>Anti-nutritional Factors Present in Foods</b>	<b>8</b>
	Types of inhibitors present in various foods and how they can be inactivated. General idea about role of Probiotics and Prebiotics as nutraceuticals. Recent advances in techniques & feeding of substrates. Assessment of nutritional status and Recommended Daily allowances.	

### References

#### Books

1. Handbook of Nutraceuticals and Functional Foods Edited by Robert E.C. Wildman, Routledge Publishers.
2. Nutraceuticals by L. Rapport and B. Lockwood, Pharmaceutical Press.
3. Methods of Analysis for Functional Foods and Nutraceuticals Edited by W. Jeffrey, Hursts, Routledge Publishers
4. Dietary Supplements and Functional Foods -Geoffrey P. Webb.

**BE -434 EDIBLE OIL PROCESSING TECHNOLOGY LAB**

<b>Pre-requisite</b>	<b>Co-requisite</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
None	BE-431	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

1. Determination of fat content of oil seeds.
2. Determination of acid value of the extracted oils.
3. Determination of free fatty acids of oil samples.
4. Determination of the iodine value of oil samples.
5. Visit to an oil extraction, refining and vanaspati unit.
6. Determination of the saponification value of different oils.
7. Determination of the smoke point of different oils.
8. Determination of the peroxide value of oil samples.

**References**

**Books**

1. Hamilton, R.J. and Bharti, A. Ed. 1980. Fats and Oils: Chemistry and Technology. Applied Science, London.
2. Salunkhe, O.K. Chavan, J.K, Adsule, R.N. and Kadam, S.S. 1992. World Oilseeds: chemistry, Technology and Utilization. VNR, New York.
3. Wolf, I.A. Ed. 1983. Handbook of Processing and Utilization in Agriculture. (2 vol. set). CRC Press, Florida.