

Programme Name	Ph.D.	Programme Code	
Course Code	DSE704	Credit	4
Year/Sem	1/1	L-T-P	4-0-0
Course Name	Bio-Analytical & Microbial Techniques		
Objectives of the Course:			
<ol style="list-style-type: none"> 1. To provide scientific and computational knowledge related to various techniques associated with biotechnology. 2. To impart laboratory skills for handling analytical tools in industry and research institution. 3. To give the scientific knowledge regarding safety regulations for handling of instruments in the laboratory and industry. 4. To demonstrate the operating procedures associated with upstream and downstream process like chromatography, electrophoresis, centrifugation, etc. 			
UNIT I CHROMATOGRAPHY & CENTRIFUGATION ((Total Topics -10 and Hrs-10)			
General principle and application chromatography, Gas chromatography, Paper chromatography, Thin layer chromatography, HPLC (High Performance/Pressure Liquid chromatography). Centrifugation: Principle and application. Common centrifuges used in laboratory Types of rotors (fixed angle, swing bucket), Types of Centrifugation: Preparative, differential & density gradient.			
UNIT-II SPECTROSCOPY & MICROSCOPY (Total Topics -9 and Hrs-10)			
Spectroscopic methods: principle and applications of UV-visible, FTIR. Principle & application of X-ray crystallography. Basic knowledge of the principles and applications of Microscopy: Light, phase contrast, Fluorescence and Transmission Electron microscopy			
UNIT- III MICROBIOLOGICAL TECHNIQUES (Total Topics -8 and Hrs-10)			
Media preparation (Selective and differential), Sterilization techniques, isolation and maintenance of bacterial and fungi cultures, staining techniques, biochemical characterization, antimicrobial assay along with determination of MIC.			
UNIT-IV MOLECULAR TECHNIQUES (Total Topics -8 and Hrs-10)			
Electrophoresis- General principle and application electrophoresis, Agarose gel electrophoresis, SDS- PAGE, Blotting techniques. Working & application of RT-PCR, Gel DOC.			
Course Outcomes (COs):			
CO1. Development of scientific, computational and analytical knowledge regarding principle and application of advanced analytical techniques in the field of biotechnology and microbiology.			
CO2. Comprehension of microbial techniques and processes for isolation and screening of microbes isolated from different environment and sources.			
CO3. Exhibit skills to pertaining to analytical characterization of biological samples.			
CO4. Apply modern techniques and their statistical knowledge for solving various scientific problems in industry and research institution.			
References Books :			
<ol style="list-style-type: none"> 1. Sharma, V.K., <i>Techniques in Microscopy and Cell Biology</i>, Tata McGraw Hill, 1991. 2. Alberts, B., <i>Molecular Biology of the cell</i>, Garland, 1989, 2nd edition. 3. Robyt, J.F. and White B.J., <i>Biochemical Technique: Theory & Practical</i>, Waveland Press, Inc. 4. Wilson, K. and Walker, J., <i>Practical Biochemistry</i>, University of Hertfordshire Cambridge University Press, 4th edition. 			



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Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun, Uttarakhand

Programme Name	Pre-Ph.D. Course Work	Programme Code	23-
Course Code	DSE704	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Advanced Research & Instrumentation Techniques		

Objectives of the Course:

1. To learn & apply concept of Thermogravimetric techniques in research.
2. To provide knowledge about spectroscopic techniques for research.

UNIT I (Total Topics-12 and Hrs-12)

UV-Visible spectroscopy

Basic principle, Various electronic transitions Beer-Lambert law, effect of solvent on electronic transitions, molar extinction coefficient, concept of chromophores and auxochromes, bathochromic, hypsochromic, hyperchromic and hypochromic, UV spectra of conjugated enes and enones, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Woodward-Fiesher rules for conjugate dienes and carbonyl compounds.

Infrared spectroscopy

Infra-red spectroscopy: Basic principle, Instrumentation Selection rules, fundamental modes of vibration, overtones, combination bands, Fermi resonance, Factors affecting IR spectra. Effect of hydrogen bonding, solvent effect on IR of gaseous, solids and polymeric Interactions with molecules: absorption and scattering. Means of excitation (light sources), detection of the signal (heat differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR). Interpretation of IR spectra of aliphatic, aromatic hydrocarbons, amines, amides, carbonyl compounds etc

UNIT- II(Total Topics- 12 and Hrs-12)

NMR spectroscopy

Principle, Instrumentation, Factors affecting chemical shift, Uses of TMS equivalent and non-equivalent protons, chemical shifts, factors affecting chemical shifts, shielding of magnetic nuclei, deshielding, anisotropic effects in alkene, alkyne, aldehydes and aromatics, spin-spin coupling, coupling constant, chemical exchange, Simple applications, Interpretation of NMR spectra of aliphatic, aromatic hydrocarbons, carbonyl compounds etc.

Thermal methods of analysis:

Thermal methods: Principle & application of Thermogravimetric analysis; TGA, DTA & DSC , DSC : Principle instrumentation and applications.

UNIT-III (Total Topics- 12 and Hrs- 12)

Microscopic Techniques: Preparation of Thin-films, Physical vapor deposition, Evaporation Techniques-Sputtering (RF & DC), Spin Coating, Pulsed Laser deposition, Working Principle of X-ray Diffractometer, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning tunneling microscopy (STM), Introduction & application of Bio analytical techniques



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UNIT-IV (Total Topics- 12 and Hrs-12)

Physical instrumentation techniques: Physical Properties: Introduction, & applications of different physical Characteristics: Viscosity, optical activity & conductivity, Instrumentation: Viscometer, pH meter, Refractometer, Polarimeter.

CO-1: Inculcate knowledge about advanced techniques for physical parameters of materials.

CO-2: Apprise UV visible & Spectroscopic techniques.

CO-3: Learn interpretation of data used in spectroscopy analysis.

CO-4: Learn principle and method of microscopic & thermogravimetric techniques for characterisation of material for research.

Reference Books:

1. Spectroscopy of Organic Compounds, New Age International Publishers; PS Kalsi
2. Spectrometric Identification of Organic Compounds, John Wiley; Silverstein, Robert M.; Webster, Francis X.; Kiemle
3. Practical NMR Spectroscopy, ML Martin, JJ Delpach and GJ Martin, Heyden.
4. Fundamentals of Molecular Spectroscopy Colin N. Banwell and Elaine M. Mc Cash Tata McGraw Hill.
5. Introduction to NMR Spectroscopy: RJ Abraham, J Fischer and P Loftus, Wiley.
6. Spectroscopic Method in Organic Chemistry: DH Williams, I Fleming, Tata MacGraw Hill.
7. Instrumental Method of Analysis: Seventh Edition, Willard Merritt, Dean, Settle. CBS



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Programme Name	Pre-Ph.D. Course Work	Programme Code	23-
Course Code	DSE704 (i)	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Food Science & Nutrition		

Objectives of the Course:

1. To understand the importance and principle of food science and nutrition
2. To develop specific knowledge in advance food science
3. To learn various aspects of fundamental and therapeutic nutrition.
4. To create advance knowledge for development of food product

UNIT I (Total Topics- 10 and Hrs-7)

Fundamental of Food Science

Introduction Food science and nutrition, Properties of food – physical and chemical properties, Effects of cooking and processing techniques on nutritional components and other physical parameters, Food pigments and additives.

UNIT II (Total Topics- 16 and Hrs- 12)

Food Nutrition

Food groups – balanced diet, food pyramid, macro and micro nutrition, Nutrients-role of nutrients in the body, nutrient deficiencies and requirements for Indians. Dietary guidelines and Meal planning, Basic Principles of Meal Planning, Meal Planning Through Lifecycle: Nutritional needs of pre-school children, adolescence, adult, old Age, Nutraceuticals, Classification of nutraceuticals, Health benefits of functional ingredients, Biological effects of functional foods, Prebiotics, Probiotic.

UNIT- III (Total Topics- 20 and Hrs-15)

Therapeutic and Community Nutrition

Diet therapy, Special feeding methods, Role of Dietitian, Nutrition counseling, Dietary diagnosis, Diet in infections and fevers, Diet in Allergy, Diet in deficiency diseases: Diet in Obesity, underweight, lung diseases, GI tract diseases, Diseases of the liver and gall bladder Diseases of the cardio vascular system, Diabetes, Diseases of the kidney and urinary, Public health nutrition, Community nutrition, sports nutrition, nutrition in emergencies and disasters, Nutritional assessment-methods and techniques, Nutritional intervention-national nutrition policies and programs, food and nutrition security.



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UNIT-IV (Total Topics- 15 and Hrs-12)

Food Quality, Sensory Evaluation and Instrumentation

Definition of Food quality, Role of food quality in Food Industry. Quality evaluation of foods- objectives and subjective, Quality attributes; Classification of quality attributes. Quality Measurements: Laboratory measurement: types of tests, panel selection and testing environment, serving procedures, instruction to judges, Difference tests, directional difference tests, classification of difference tests, two sample tests, three sample tests, multisampling tests, comparison of procedures, ranking, scoring, hedonic scaling, dilution procedures, descriptive sensory analysis, contour method, other procedures.

Food Preservation

Food preservation, Basic Concepts in Food Preservation, Preservation using technology, Food Adulteration, Health hazards of food adulterants, Effect of food adulteration- food quality and nutritive value of foods, Food additives, Food Laws and standards.

Course outcome

CO-1:Construct relationship between food Chemistry and Food Technology for application in industry

CO-2:Constructing new fundamental phenomenon with their team about anthropometric assessment associated with sources, function and deficiency of different nutrient.

CO-3:Compare acute and chronic diseases and differentiate their treatments.

CO-4:Get familiarized with the general parameters and factors affecting involved in sensory evaluation of food.

CO-5: Understanding the concept of food preservation and factors affecting the food quality.

Reference Books

1. Roday, S. *Food Science*, Oxford publication, 2011.
2. Meyer, *Food Chemistry*, New Age, 2004
3. B. Srilakshmi, *Food science*, New Age Publishers, 2002
4. Prescott, L.M., Harley, J.P. and Klein, D.A. *Microbiology*. 4th edition McGraw-Hill, New York. 1999
5. Frazier, W.C. *Food Microbiology*. 4th edition. Mc Graw Hill. New York, 2008
6. waminathan M. 1974. *Essentials of Foods and Nutrition*. Vol. II. Ganesh&Co. London.
7. De Sukumar., *Outlines of Dairy Technology*, Oxford University Press, 2007
8. Meilgard (1999). *Sensory Evaluation Techniques*, 3rd ed. CRC Press LLC, 1999
9. Pieterneel A, Luning, Willem J. Marcelis, *Food Quality Management Technological and Managerial principles and practices*, Wageningen, 2009.

Programme Name	Pre-Ph.D. Course Work	Programme Code	23-
Course Code	DSE704 (ii)	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Food Quality System Management and Sensory Evaluation		
Objectives of the Course:			
<ol style="list-style-type: none"> 1. To understand the quality principles, attributes and sensory evaluation with various food laws 2. To know about quality management system, sanitary and hygienic practices 3. To gain knowledge about patent methodology for research output 4. To get familiarized with all requirements in sensory analysis 5. To study the mechanism and different techniques involved in sensory perception 			
UNIT I (Total Topics- 10 and Hrs-10)			
Concept of quality: Quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation; Sensory <i>vis-à-vis</i> instrumental methods for testing quality.			
UNIT II (Total Topics-20 and Hrs- 10)			
Concepts of quality management: Objectives, importance and functions of quality control; Quality management systems in India; Sampling procedures and plans; Food Safety and Standards Act, 2006; Domestic regulations; Global Food safety Initiative; Various organizations dealing with inspection, traceability and authentication, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS); Labeling issues; International scenario, International food standards.			
UNIT- III (Total Topics- 22 and Hrs-10)			
Quality assurance, Total Quality Management; GMP/GHP; GLP, GAP; Sanitary and hygienic practices; HACCP; Quality manuals, documentation and audits; Indian & International quality systems and standards like ISO and Food Codex; Export import policy, export documentation; Laboratory quality procedures and assessment of laboratory performance; Applications in different food industries; Food adulteration and food safety.			
UNIT-IV (Total Topics- 12 and Hrs-10)			
IPR and Patent- Patent- Introduction, Filling of patent, agencies of patent, National and international Patents, Concept of six sigma, concept of 5S and housekeeping, importance of 5S. Concept of solid waste management, method for solid waste management and treatments, latest global trends of waste management.			
UNIT-V (Total Topics-20 and Hrs-12)			
Introduction to sensory analysis; general testing conditions, Requirements of sensory laboratory; organizing sensory evaluation programme. Selection of sensory panelists; Factors influencing sensory measurements; Sensory quality parameters -Size and shape, texture, aroma, taste, color and gloss; Detection, threshold and dilution tests. Taste measurement, Measurement of color; Munsellcolour system, CIE color system, Hunter color system, spectrophotometer and colorimetric etc. Odour measurement using different techniques –			

primitive to recent techniques. Merits and demerits of each method. Different tests for sensory evaluation– discrimination, descriptive, affective; Flavor profile and tests; Ranking tests; Methods of sensory evaluation of different food products. Computer-aided sensory evaluation of food & beverage, statistical analysis of sensory data.

Course outcome

CO-1: Get familiarized with all requirements involved in training of sensory panel during sensory analysis.

CO2. Assess different tests and methods involved used in sensory evaluation of different food products.

CO3: Understanding TQM by National and international Lab

CO 4: Understand IPR, Sigma rule and waste management

CO5 Learn to demonstrate the color estimation technique

Reference Books

1. *Raju N.V.S. (2014). Total Quality Management, first edition, Cenange Learning, first edition.*
2. *Pieterneel A, Luning, Willem J. Marcelis, (2009). Food Quality Management Technological and Managerial principles and practices, Wageningen.*
3. Rao E. S. (2013). Food Quality Evaluation, Variety Books.
4. Amerine, Pangborn&Roessler (1965). Principles of Sensory Evaluation of food, Academic Press, London.
5. Meilgard (1999). Sensory Evaluation Techniques, 3rd ed. CRC Press LLC, 1999
6. deMan J. (2007). Principles of Food Chemistry, 3rd ed., Springer.
7. Brannen and et al.,(1990)Food Additives, Marcel Dekker,New York,1990