



**UTTARANCHAL
UNIVERSITY**

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ArcadiaGrant,P.O.Chandanwari, Premnagar,Dehradun, Uttarakhand-
248007,INDIA

Detailed Course Structure & Syllabus of Pre Ph.D. (Food Technology) Course Work (As per CBCS system) W.E.F Session 2022-23



**Course Structure of the Pre-Ph.D (Food Technology) Course Work:
Applicable for Batch: 2022-23**

SCHEME OF EXAMINATION

**Ph.D(Food Technology)
(Effective from Academic Year 2022-23)**

Under Choice Based Credit System (CBCS)

**Course Structure of the Pre-Ph.D (Food Technology) Course Work:
Applicable for Batch: 2022-23**

Scheme of Pre-Ph.D. Course Work

S.No	Course Code	Subject	Credits	Evaluation - Scheme							
				Period			Sessional			Examination	
				L	T	P	CT- I	CT- II	Total	ESE	Sub. Total
Courses											
1.	RM-101	Research Methodology	4	4	0	0	20	20	40	60	100
2.	RM-102	Computer & Stats Application in Research	2	2	0	0	20	20	40	60	100
3.	RPE-103	Research & Publication Ethics	2	2	0	0	20	20	40	60	100
4.	DSE-104	Discipline Specific Electives	3	3	0	0	20	20	40	60	100
5.	RS-105	Seminar Presentation	2	0	0	4	20	20	40	60	100
		Total	13	11	0	4	100	100	200	300	500

List of Electives

S. No.	Course Code	Course Name
1	AR-104	Advanced Research & Instrumentation Techniques
2	FT-104 (1)	Advance food technology and quality management
3	FT-104 (2)	Advanced food chemistry and analytical techniques



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SYLLABUS

of

Ph.D(Food Technology)



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Programme Name	Pre-Ph.D. Course Work	Programme Code	23-
Course Code	RM-101	Credit	4
Year/Sem	1/1	L-T-P	4-0-0
Course Name	Research Methodology		

Objectives of the Course:

1. To Equip the Students with the Concept and Methodology of Research.
2. To provide knowledge about type of research, preparation of reports and thesis, designing of Research using Scientific Methods.

UNIT I (Total Topics- 7 and Hrs-12)

Introduction to Research: Definition, Nature and significance, Role and Objectives; Types of Research: exploratory, descriptive, experimental and diagnostic research, social and legal research and traditional, analytical, empirical & fundamental research, Doctrinal and non-doctrinal research methods; Various Research Designs; Scientific Research Process: Overview, Problem identification and formulation of research statement.

UNIT II (Total Topics- 7 and Hrs- 12)

Data Collection: sources, primary and secondary methods, significance of Primary and Secondary Data, questionnaire Vs. schedules; Data Processing: Editing, Coding Organization and Presentation; Attitude Measurement and scaling: Measurement Scales, Sources of Errors in Measurement, Techniques of Developing Measurement Tools, Classification and Testing (Reliability, Verification and Validity) Scales, Designing Questionnaires and Interviews.

UNIT- III (Total Topics- 5 and Hrs- 10)

Sampling, Sampling Methods, Sampling Plans, Sampling Error, Sampling Distributions: Theory and Design of Sample Survey, Census Vs Sample Enumerations, Objectives and Principles of Sampling, Types of Sampling, Sampling and Non-Sampling Errors, Concept of Permutation, Combination & Probability for research analysis.

UNIT-IV (Total Topics- 5 and Hrs- 10)

Interpretations and Report Writing: Meaning of Interpretation, Techniques of Interpretation, Precautions in Interpretation, Significance of Report Writing, Steps in Report Writing, Layout of Report and Precautions in Writing Research Reports. Limitations of RM: Ethics in Research, Philosophical Issues in Research.

CO1. Acquire in-depth knowledge of various fundamentals, theories and principles related to the research and apply the acquired knowledge in carrying out research studies in the area of interest.

CO2. Identify, formulate and critically investigate research problems by applying research-oriented knowledge and analyze relevant data to reach certain conclusions in the form of alternative solutions to these problems.

CO3. Apply the acquired knowledge and skills to develop minds to think out of the box while carrying out research operations to conclude something.

CO4. Apply parametric and non-parametric statistical tests to verify the developed hypothesis to suggest innovative solutions to the problem being investigated.



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Reference Books

1. William G. Zikmund, "Business Research Methods", Orlando: Dryden Press.
2. C. William Emory and Cooper R. Donald, "Business Research Methods", Boston, Irwin.
3. Fred N Kerlinger, "Foundations of Behavioural Research", New Delhi: Surjeet Publications.
4. Naresh Malhotra, Marketing Research : An Applied Orientation, Pearson publication David Nachmias and ChavaNachmias, "Research Methods in the Social Sciences", New York: St.Marlia's Press.
5. Bhattacharya, D. K. (2004) Research Methodology, New Delhi, Excel Books.



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Programme Name	Pre-Ph.D. Course Work	Programme Code	23-
Course Code	RM-102	Credit	2
Year/Sem	1/1	L-T-P	2-0-0
Course Name	Computer & Stats Application in Research		

Objectives of the Course:

1. To appraise computational skills for research application.
2. To assess statistical method for research analysis.

UNIT I

Characteristics of Computers, Evolution of computers, computer memory, computer generations, Basic computer organization; System software, Application software, introduction to operating system, single user, multi-user, multi-tasking single tasking, application of computer for business and research, MS-windows, Linux .Application of Internet in research : INFLIBNET, Use of Internet, sights (DOAJ), Use of E Journals, Use of E library, use of EBSCO HOST online database of Academic Libraries. Subject/field specific tools on www.freeware.com

UNIT II

Computer Application in Research,. Basic concept of Computer, Use of Internet for Research Purpose: E-mail, WWW, Web browsing, technical skills, drawing inferences from data, Research publishing tools-MS Word, Adobe acrobat, Graphics tool-MS Excel, Presentation tool-MS Power, Data Analysis Software and Analysis Techniques point. Creating presentation and adding effects, Introduction to Data analysis software-SPSS: Definition, objectives and features, data analysis using SPSS.

UNIT- III

Statistical methods for research application in analysis of data, Measurement in Research , data interpretation, Measures of Central Tendency, Measures of Dispersion, Measures of Asymmetry (Skewness), std deviation, Measures of Relationship, Simple Regression Analysis, Correlation and Regression, Partial Correlation.

UNIT-IV

Statistical Tools-Hypothesis and Hypothesis Testing: Parametric & Non-Parametric Tests, Important Parametric Tests ,Hypothesis Testing of Correlation Coefficients ,U Test, Chi Square Test, ,T-Test.Analysis of Variance (ANOVA) , The Basic Principle of ANOVA ,ANOVA Technique, Setting up Analysis of Variance Table, Short-cut Method for One-way ANOVA, Coding Method, Two-way ANOVA .

Course Outcomes:

- CO1.** Acquire knowledge of concept of computer with application in Research.
- CO2.** Apply acquired knowledge of computer for presentation skills.
- CO3.** Acquire knowledge of statistical methods for Research.
- CO4.** Apply acquired knowledge to describe the inductive nature of quantitative data analysis.



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Reference Books

1. C. R. Kothari, "Research Methodology: Methods and techniques", New Delhi: Vishwa Prakashan.
2. Brymann, Alan and Carmer, D. (1995) Qualitative data analysis for social scientist, New York, Routledge Publication.
3. Jain, Satish: "Introduction to Computer Science and basic Programming." BPB Publications, New Delhi, 1990. •
Rajaraman, V., "Fundamental of Computers", Prentice Hall of India, New Delhi, 1996.



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Programme Name	Pre-Ph.D. Course Work	Programme Code	23-
Course Code	RPE-103	Credit	2
Year/Sem	1/1	L-T-P	2-0-0
Course Name	Research & Publication Ethics		

Objectives of the Course:

Its objectives to provide knowledge about ethics and code of research publication with concept of plagiarism.

UNIT I (Total Topics- 2 and Hrs-8)

1. Introduction to philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgments and reactions

UNIT II (Total Topics- 5 and Hrs- 5)

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data

UNIT- III (Total Topics-7 and Hrs-7)

1. Publication ethics: definition, introduction and importance
2. Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types
5. Violation of publication ethics, authorship and contributorship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

UNIT- IV (Total Topics-4 and Hrs-4)

Practice

Open Access Publishing

1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder/ Journal suggestion tools viz. JANE, Elsevier Journal finder, Springer Journal Suggester, etc.

CO1. Recognize the basics of philosophy of science & ethics, research integrity, publication ethics and theories of research ethics.

CO2. Familiarize with important issues in research ethics, research integrity, scientific misconduct and misinterpretation of data.

CO3. Analyze the best practices for publications, publication ethics and identify the predatory publishers & journals.

CO4. Demonstrate & use plagiarism software tools, open-source software tools, citation databases and



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research metrics.

CO5. Publish credible & scholarly publications in reputed peer-reviewed journals.

References-

Research and Publication Ethics, Dr Sumanta Dutta, Bharti Publications, 2021

Research and Publication Ethics, Dr Santosh kumar Yadav, Anne Publications, 2020



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Programme Name	Pre-Ph.D. Course Work	Programme Code	23-
Course Code	RS- 105	Credit	2
Year/Sem	1/1	L-T-P	0-0-4
Course Name	Seminar Presentation		

Objectives of the Course:

Main objective of this course is to develop presentation skills in the scholars and knowledge about review of literature so that they can review properly for utilisation in their research work.

Seminar Presentation-Candidate/Research Scholar has to go through the review of literature in the concerned field of research. Review of literature guidelines will be given by the concerned faculty/Dean of Department/School/College. Research Scholar has to prepare presentation on review of literature in the concerned field/ topic assigned by the department (DRC) periodically during course work. There will be minimum 3 presentations of review of literature during pre-Ph.D. course work.

- First presentation will be required in DRC/FRC for review of literature with concerned Department focus on area of research. It will be evaluated and assessment sheet will be sent from Department to Dean Research & Studies office.
- Similarly second presentation will be required by research scholar with extension of first presentation and more number of references would be added.

Internal & end term examination marks will be as per scheme. Each presentation is to be assessed by the department as per instructions from Dean-Research & Studies.

Final presentation would be required at the time of end term/sem. examination on proposed synopsis. General guidelines would be issued by Dean-Research for seminar presentation.

Course outcomes

CO1. Research Scholar would be able to develop & explore the review of literature in concerned area.

CO2. Analyze review of literature critically for finding the research gap.

CO3. Apply acquired knowledge in making systematic seminar presentations.

CO4. Apply acquired knowledge for improving development of all-round research.



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Programme Name	Pre-Ph.D. Course Work	Programme Code	23-
Course Code	AR-104	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	FT-104 (1)	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Advance food technology and quality management		

Objectives of the Course:

1. To understand basic concept of advance Food Technology and quality management
2. To aware about advances in food technology
3. To learn food engineering and processing
4. To create concept of food quality control. And quality systems

UNIT I (Total Topics- 20 and Hrs-5)

Food Engineering and Processing

Methods of food preservation such as heat processing, pasteurization, canning, dehydration, freezing, freeze drying, fermentation, microwave, irradiation and chemical additives. Aseptic preservation, hurdle technology, hydrostatic pressure technology and microwave processing. Use of non-thermal technologies (microfiltration, bacteriofugation, ultra high voltage electric fields, pulse electric fields, high pressure processing, irradiation, thermosonication), alternate-thermal technologies (ohmic heating, dielectric heating, infrared and induction heating)

UNIT II (Total Topics-15 and Hrs- 3)

Technology of Food Products of Plant Origin

Post-harvest management of fruits and vegetables, Biochemical and physical changes during ripening of fruits & vegetables, respiration and factors affecting it, role of ethylene in accelerated ripening, post-harvest treatments for extension of shelf-life of fresh produce, Strategic interventions to minimize postharvest losses including vapour heat treatment, wax coating, chemicals, etc. Biochemical changes during germination, development and maturation of cereals, oilseeds and pulses, Chemical composition and nutritive values of cereals (rice, wheat, maize, sorghum and bajra), oilseeds (groundnut, cotton seed, castor, sesamum rape and mustard) and pulses crop (bengal gram, pigeonpea) Basic principles involved in fermentation, Technological aspects of pickled vegetables like sauerkraut, cucumbers, Technology of wine, beer and distilled alcoholic beverages, defects in alcoholic beverages. Advances in milling of rice and Turbo milling of wheat. Bakery products; role of ingredients, Developments in manufacturing processes for bakery products such as breads; biscuits; pizza bases, cake etc; changes during processing of bakery products. Utilization and importance of dairy ingredients in bakery products. Important group of enzymes involved in food processing; Application of enzymes in food processes like enzymes juice extraction, juice clarification, in bread manufacture, meat tenderization, ice cream manufacture, de- sugaring of egg. Basic principles involved in fermentation, Technological aspects of pickled vegetables like sauerkraut, cucumbers, Technology of wine, beer and distilled alcoholic beverages, defects in alcoholic beverages. Newer concepts in food processing including organic foods, processing of organic raw material, genetically modified foods.

UNIT- III (Total Topics- 15 and Hrs-3)

Technology of Food products of Animal origin

Dairy plant operations viz. receiving, separation, clarification, pasteurization, standardization, homogenization, sterilization, storage, transport and distribution of milk. Milk products processing viz. cream, butter, ghee, cheese, condensed milk, evaporated milk, whole and skimmed milk powder, ice-cream, butter oil, khoa, channa, paneer and similar products. Scope of meat, fish and poultry processing industry in India. Slaughter and dressing of various animals and poultry birds. Post mortem examination. Rigor mortis. Retail and wholesale cuts. Factors affecting meat quality. Curing, smoking, freezing, canning and dehydration of meat, poultry and their products. Sausage making. Microbial factors influencing keeping quality of meat. Processing and preservation of fish and its products. Meat tenderization and role of enzymes in meat processing. Utilization of by-products.

UNIT-IV (Total Topics- 15 and Hrs-3)

Food Quality

Food Quality Management Objectives, importance and functions of quality control. Quality systems and tools used for quality assurance including control charts, acceptance and auditing inspections, critical control points, reliability, safety. Total quality management, good management practices, HACCP and codex in food. International and National food laws. FSSAI. Food adulteration, food safety. Sensory evaluation, panel screening, selection methods. Sensory and instrumental analysis quality control.

UNIT-V (Total Topics-12 and Hrs-8)

Fermentation technology, fermented food products (animal and plant based), microbial spoilage of foods. Use of biotechnology in production of food additives viz. preservatives, colorants, flavours. Use of biotechnologically improved enzymes in food processing industry, biomass production using industrial wastes. Single cell proteins, Food contaminants viz. aflatoxins. Food intoxication and infection. Consumer concerns about risks and values, Biotechnology and food safety.

Course outcome

CO1: Familiarize with the instruments used in food analysis.

CO2: Construct relationship between farm to various methods of processing, production and utilization in the cereals, fruits and vegetable and beverage industry

CO3: Analyse the quality attributes, their measurement principle in the dairy and meat industry

CO4: Apply the food laws with their amendments and regulation guidelines

CO5: Understanding the concept of food biotechnological aspects and functional foods

Reference Books

1. *B. Srilakshmi, Food science, New Age Publishers, 2002*
2. *Roday, S. Food Science, Oxford publication, 2011.*
3. *Unit operations of Agricultural processing K.M Sahay & K.K Singh*



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4. . *Introduction to Food Process Engineering Ramco.T. Toledero*
5. *Chakraborty., Post Harvest Technology of Cereals, Pulses and Oilseeds, revised ed., Oxford & IBH Publishing Co. Pvt Ltd, 1988*
6. *Cereals Technology by Samuel A.Matz. CBS Publications.*
7. *Food Facts and Principles by Mannay;New age International (P) Ltd.*
8. .*Biochemistry by LubertStryer. Publisher:WH Freeman; Edition VI.*
9. *2.Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen M. Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. Publisher: McGraw Hill; Edition 28.*
10. *De Sukumar, Outlines of Dairy Technology, Oxford University Press, Oxford.2007*
11. *Hall GM, Fish Processing Technology, VCH Publishers Inc., NY, 1992*
12. *Fermentation Biotechnology: Principles, Processes and Products, Ward OP, 1989, Prentice-Hall.*
13. . *Frazier, W.C. Food Microbiology. 4th edition. Mc Graw Hill. New York, 2008*
14. *Meilgard (1999). Sensory Evaluation Techniques, 3rd ed. CRC Press LLC, 1999*
15. *Pieterneel A, Luning, Willem J. Marcelis, Food Quality Management Technological and Managerial principles and practices, Wageningen,2009.*



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Programme Name	Pre-Ph.D. Course Work	Programme Code	23-
Course Code	FT-104 (2)	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Advanced food chemistry and analytical techniques		

Objectives of the Course:

1. To understand the importance of food Science and food chemistry.
2. To develop basic concept about applied nutrition.
3. To acquire basic knowledge of preparation and standardization of solutions
4. To have sound knowledge of operation of sophisticated instruments
5. To impart knowledge about newer techniques such as immunoassay and thermal analysis

UNIT I (Total Topics- 8 and Hrs- 8)

Definition and importance; major food constituents and their physicochemical properties; role of water in food. Carbohydrates, proteins and lipids: classification, physical, chemical, nutritional, and functional properties and their structural correlations; auto-oxidation of lipids and rancidity.

UNIT II (Total Topics- 10 and Hrs-8)

Properties of minerals, vitamins, pigments, anti-oxidants, flavour components, allergens, toxins and anti-nutritional factors in foods; Interaction of constituents in food systems; Changes during storage and processing; Browning reactions in foods. Preparation of Chemical solutions: Preparation of solutions and their types. pH and Buffers: Importance and measurement of pH.

UNIT- III (Total Topics -10 and Hrs-8)

Food groups and their typical composition; essential nutrients- sources, functions, deficiency diseases; requirements and recommended dietary allowances; digestion, absorption, transport and metabolism of nutrients in human system; protein quality evaluation. Water activity: its measurements and significance in food quality, calibration and standardization of different instruments. Definition of sample and sampling equipments.

UNIT-IV (Total Topics 10 and Hrs-8)

Chromatographic Techniques: General principles. Classification of Chromatographic techniques Partition and adsorption chromatography. Paper, thin layer, gas liquid, ion exchange and affinity chromatography. Gel filtration. Introduction to High Pressure Liquid Chromatography. Electrophoresis and Microscopic Techniques: General principles. Paper electrophoresis, Types of gel electrophoresis, SEM, TEM, Compound microscope, Light

microscope.

UNIT-V(Total Topics -10 and Hrs-10)

Spectroscopy: Beers and Lambert's law. Extinction coefficient. General principles of colorimeters and spectrophotometers, Atomic spectroscopy, Emission spectroscopy, IR spectroscopy. Flame photometer, FTIR. Special techniques: Immunoassay techniques: Isotopic, non – isotopic and enzyme immunoassays: surface tension: Enzymatic methods of food analysis: thermal methods in food analysis (Differential scanning calorimetric and others)

Course Outcome

CO 1: Create a depth of knowledge about compositional, nutritional technological aspect of plant and animal food.

CO 2: Identify different type of browning in food which help in estimating quality of food both at industrial and domestic purpose

CO 3: Analyse different type of food groups their RDA and standardization of instruments

CO-4: Apply and Understand the basic steps in thermal processing and their working principles

CO-5: Adapt different techniques used during preparation and preservation of foods.

Reference Books

1. *Roday, S. Food Science and Nutrition*, Oxford publication, 2011, 2nd Edition
2. *Srilakshmi, B. Food science*, New Age Publishers, 2016, 6th Edition.
3. *Manay, N.S. and Shadaksharaswamy, M. Foods Facts and Principles*, New Age Publishers, 2020, 10th edition.
4. *Bamji MS, Rao NP & Reddy V. Textbook of Human Nutrition*. Oxford & IBH.2003.
5. *Joshi SA.. Nutrition and Dietetics*. Tata McGraw Hill. 1999
6. *Khanna K, Gupta S ,Passi SJ, Seth R & Mahna R.. Nutrition and Dietetics*. Phoenix Publ. 1997
7. *Swaminathan M. Essentials of Foods and Nutrition*. Vol. II. Ganesh & Co. London. 1974.
8. *Advances in Food and Nutrition Research*. Elsevier Book Series.
9. *Aurand LW, Woods A & Wells MR. Food Composition and Analysis*. AVI Publ. 1987
10. *B. Food Science*, New Age International Private Limited.
11. *Raju N.V.S., Total Quality Management*, Cengage Learning India Private Limited; 1 edition
12. *Walt Boyeses, Instrumentation reference Book*, Elsevier Inc. 2010.
13. *B C Nakra, K K Chaudhry. Instrumentation Measurements and Analysis*, Tata McGraw-Hill Publishing Company Limited. 2004
14. *Jack Cazes, Ewing's analytical Instrumentation Hnadbook*, CRC Press Taylor & Francis Group. 2004.
15. *Bela G. Liptak, Analytical Intrumentation*, Chilton Book Company. 1994.



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16. *Wilson K. and Walker J., Principle and techniques of Biochemistry and Molecular Biology, Cambridge University Press.*
Keith Wilson and John Walker, Biophysical chemistry principle and techniques. Himalayan Publishing House.