**Department of Food Science & Technology**

 **University of Kashmir, Hazratbal Srinagar-190 006.**

***(NAAC Accredited Grade – A+)***

 **Programme Objectives:**

* To enable the students to identify researchable issues in food and agro-processed industry.
* To formulate, monitor and undertake research projects independently
* To generate reproducible meaningful data and interpret the same in the form of scientific

The pre-Ph.D course work is part of integrated Ph.D programme in Food Technology. It comprises of three papers (courses) each having weightage of 100 marks. Paper I (Advance in Food Science) and Paper II (Research Methodology) are compulsory to all the students admitted to the programme. In addition to these two papers student have to take Paper III which is based on the area of research of the student.

**Paper I: Advances in Food Science and Technology Marks: 100**

**UNIT I: Advances in Food Processing and Evaluation**

* Pulse Electric Field: Principle, Mechanism, Application and safety aspects of PEF.
* Cold plasma technology: Recent developments, principle and applications in food safety and preservation.
* Supercritical fluid extraction: Principle and Application of SCFE in food processing.
* Supercritical fluid chromatography: Principle and application of SCFC in food analysis.
* Encapsulation: Method of encapsulation, applications in neutraceuticals, packaging, probiotics, and advances in this field.

**UNIT II: Food Biotechnology**

* Neutrigenomics: Definitions, significance in health and disease, advances in the science and future perspectives.
* Genetically modified foods, their safety concerns: (Allergenicity, toxicity and genetic hazards).
* Food allergy: Main sources of food allergens, Diagnosis and management of nut allergy.

**UNIT III: Food Packaging**

* Edible and biodegradable films: Mechanical properties, chemical resistance, and chemistry of degradation, structures, active functions, and trends in the use of edible films and coatings.
* Biodegradable materials: Polyesters, aliphatic co-polymers, poly lacide, polyhydroxy alkanoates, starch, chitosan, alginate, microbial origin.
* Active Packaging: Antioxidant packaging applications, Antimicrobial agents (essential oils, plant extracts, enzymes, chitosan, bacteriocin, inorganic nanoparticles), effect on mechanical and barrier properties of packaging.

**UNIT IV: Advances in Food Safety**

* Metabolomics: Interventions for developing functional foods and neutraceuticals.
* Novel food authentication techniques: Application of nucleic acid based techniques in food authentication. Trends and emerging approaches.
* Non-destructive assessment of food quality: Ultrasound as food processing and preservation technique and impact of food properties.

**Suggested Readings:**

1. Rehman, S. (2007). Handbook of Food Preservation. Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300 Boca Raton, FL 33487-2742.
2. Arya, P.P. and Pal , Y. (2001).Research Methodology in Management: Theory and Case
3. Chap T. Le., (2003).Introductory Biostatistics. A John Wiley & Sons Publication.
4. Aggarwal BL. 2003. *Basic Statistics*. New Age.
5. Introductory statistics by Prem S. Mann
6. Food Analysis by Pomernz.
7. The chemical Analysis of Food and Food Products by Jacobs.

**PAPER II: Research Methodology**  **Marks: 100**

**Unit I**

**Methods of Data Collection:**

Primary data and secondary data, methods of primary data collection, classification and organisation of data.

**Sampling Methods :**

Sampling, Need for sampling, unit, population, sample, sampling error, sampling methods; Simple, Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling and Multistage Sampling. Sample size, Standard Error.

**Normal Distribution:**

Measures of Central Tendency (Mean, Median and Mode). Measures of dispersion (Range, Standard Deviation, Standard Error, Coefficient of Variation).

**UNIT II: Statistical Analysis of Experimental Data**

* Correlation Analysis: concept and significance Karl Pearson’s coefficient correlation.
* Regression analysis: Lines of regression and regression equation
* Analysis of Variation (ANOVA)
* Testing of Hypothesis; (Tests of significance, ‘t’ Test,)

**Unit III.**

* Principles and applications of atomic absorption spectroscopy- components of atomic absorption spectroscopy.
* X-ray analysis of foods – Properties, Production and Detection, X ray tubes, Detectors, Sources, Applications in food industry.
* FTIR spectroscopy- Principles and application

**Unit IV**

* Electrophoresis- Applications, Principles of separation of neutral molecules, Capillary zone electrophoresis.
* Immunoassays- applications in food with special reference to ELISA
* Differential scanning calorimetry.

 **Suggested Readings:**

1. Kothari C.R., (1985) Research Methodology Methods and Techniques by New Age International Publishers, 2nd Edition.
2. Arya, P.P. and Pal , Y. (2001).Research Methodology in Management: Theory and Case
3. Chap T. Le., (2003).Introductory Biostatistics. A John Wiley & Sons Publication.
4. Aggarwal BL. 2003. *Basic Statistics*. New Age.
5. Introductory statistics by Prem S. Mann
6. Food Analysis by Pomernz.
7. The chemical Analysis of Food and Food Products by Jacobs.

**PAPER-III (Rice Science and Technology) for Nafiya Qadir Marks: 100**

**Unit I: Introduction to rice**

* Structure and composition of rice grain. Physical and chemical methods of rice quality evaluation.
* Rice milling-Stages of milling process.
* Table rice substitutes & products from whole grain rice - retort rice, frozen rice, quick cooking rice, flaked rice, puffed rice and popped rice.

**Unit II: Starch Chemistry**

* Composition and structure of starch. Other components of starch granules.
* Resistant starch- Definition, types, methods of determination and health benefits.
* Physical and chemical modification of starch.
* Gel permeation chromatography: Principle, working and applications.

**Unit III: Protein Chemistry**

* Rice protein fractions. Extraction of rice proteins-alkaline, enzymatic and physical methods.
* Functional properties of rice proteins. Applications of rice proteins in food industry.
* Allergenicity, off flavours and antinutritional factors associated with rice.
* Biotech rice: Current developments, and future detection challenges in food and feed chain.

**Unit IV: Glycemic index and diet**

* Rice consumption in relation to development of type II diabetes and hyperlipidemia.
* Glycemic index: Overview, factors affecting glycemic index of rice.
* Composition, properties and health benefits of indigestible carbohydrate polymers as dietary fiber.
* Kinetics of starch digestibility. Effect of processing, modification, food proteins, food lipids,dietary fiber, α-amylase inhibitors and antinutrients on starch digestibility.

**REFERENCES**

1. Amagliani, L., Regan, J. O., Kelly, A. L., & Mahony, J. A. (2016). Chemistry, structure, functionality and applications of rice starch. *Journal of Cereal Science,* **70**: 291-300.
2. Amagliani, L., Regan, J. O., Kelly, A. L., & Mahony, J. A. (2017). The composition, extraction, functionality and applications of rice proteins: A review. *Trends in Food Science & Technology*, **64**: 1-12.
3. Bhattacharya, K. R., & Ali, S. Z. (2015). An introduction to rice-grain technology*.Woodhead Publishing***.**New Delhi.
4. Champagne, E. T. (2004). Rice: Chemistry and technology**.** *American Association of Cereal Chemists,* Inc. U.S.A.
5. Marie-Alice, F., Nancy, H. C., Isabel, T., Marc, L., Dieter, D., Philippe, H. (2016). Biotech rice: Current developments and future detection challenges in food and feed chain. Trends in Food Science & Technology, **52**: 66-79
6. Mudgil, D., & Barak, S. (2013) .Composition, properties and health benefits of indigestible carbohydrate polymers as dietary fiber. *International Journal of Biological Macromolecules,* **61**: 1– 6
7. Watson, R. R., Preedy, V. R., & Zibadi, S. (2014). Wheat and rice in disease prevention and health**.** *Academic Press*. London.

**PAPER-III (Tea) for Sadaf Pervaiz Marks: 100**

**Unit 1**

* Tea: Botanical aspects and its production.
* Types of tea, Quality standards of tea.
* Statistics of tea production in India and abroad.
* Green Tea: The plants, Processing, Manufacturing and Production.
* Black Tea: The plants, Processing, Manufacturing and Production
* White Tea: The plants, Processing, Manufacturing and Production
* Instant tea, Decaffinated tea and Herbal teas

**Unit II**

* Chemical composition of tea leaves.
* Chemical composition of tea flush: polyphenols, proteins, minerals and CHO.
* Anti-oxidant compounds of tea and their estimation.

**Unit III**

* Health benefits associated with green tea consumption.
* Adverse effects of tea on health- Hepato-toxicity, Neurotoxicity, caffenism, Interaction with proteins and their impact on food quality.
* Reactions of caffeine under alkaline conditions.

**Unit IV**

* Efficient extraction stratigies of tea: Conventional solvent extraction technique for tea, Environmental friendly green technologies for tea.
* High impact value-added products of tea: Tea bags, Iced tea, Tea concentrate, Tea cider and carbonated bottled tea.
* Nitrosamine formation in tea. Chemistry of formation and their harmful effects.

**REFERENCES**

1. Varnam, A. H. and Sutherland, J. P. (2009). Beverages Technology, Chemistry and Microbiology. Aspen pPublishers.
2. Tariq, M., Naveed, A., & Barkat, A. K. (2010). The morphology, characteristics, and medicinal properties of Camellia sinensis tea. *Journal of Medicinal Plants Research*, *4*(19), 2028–2033.
3. Sur, S., & Panda, C. K. (2017). Molecular aspects of cancer chemopreventive and therapeutic efficacies of tea and tea polyphenols. *Nutrition*, *43*–*44*, 8–15.
4. Food Analysis by Pomernz.
5. Preedy, V. R. Tea in Health and Disease Prevention. Academic Press Publications.

**PAPER-III (Tree nut allergy and Management) for Gazalla MARKS: 100**

**UNIT 1**

* Tree nut allergy and prevalence in south Asia
* Tree nut allergens, epidemiology and nomenclature
* Major tree nuts involved in development of allergy
* Mechanism of development of allergy and anaphylaxis

**UNIT II**

* Walnuts: Composition ( Fatty acids, allergens)
* Health benefits of walnuts (Hypolipdemic properties, anticancer properties)
* Walnut allergy and major walnut allergens,
* Characteristics and effect of walnut allergens on immune system

**UNIT III**

* Management of tree nut allergy
* Effect of thermal treatments (roasting, boiling and high pressure) on tree nut allergens
* Allergen immunotherapy and dietary avoidance
* Symptoms of allergy (response of body’s immune system)

**UNIT IV**

* The Walnut Industry in India, current status and future outlook
* Diagnosis of walnut allergy
* Pathogenesis and prevention of walnut allergy

**REFERENCES:**

1. Alsavar. C & Shahidi. F (2008).Tree nuts, Compostion, Phytochemicals and Health effects, CRC Press.
2. Fernández Rivas. M. & Asero. R. (2014). Risk Management for Food Allergy, Academic Press

## [Fernández- Rivas](https://www.sciencedirect.com/science/article/pii/B9781845690281500010#!). M & [Ballmer](https://www.sciencedirect.com/science/article/pii/B9781845690281500010#!). B (2007). Food allergy current diagnosis and management. [Managing Allergens in Food](https://www.sciencedirect.com/science/book/9781845690281),Wood Head Publishing series.

**PAPER-III (Olive oil and Oil Processing) Marks: 100**

**UNIT- I: Olive Oil and Health Benefits**

* Origin, history and global scenario of olive production
* Fatty acid and phenolic composition of olive oil
* Role of olive oil in prevention and treatment of cardiovascular diseases
* Role of olive oil in prevention and treatment of cancer
* Role of olive oil in prevention and treatment of diabetes

**UNIT- II: Oil processing and olive byproducts**

* Refining of oil – Detailed account of oil refining
* Hydrogenation of oil – Process of hydrogenation, need and importance
* Olive leaves – Phenolic composition, extraction of phenols, health benefits
* Olive pomace – Extraction of fatty acid and phenols, applications

**UNIT- III: Procedures of oil extraction**

* Solvent extraction – Basis of extraction, applications, advantages and disadvantages
* Subcritical extraction – extraction procedures, applications
* Supercritical fluid extraction – Equipment, extraction process, applications
* Extraction of oil from oilseeds – General process of seed oil extraction

**UNIT- IV: Introduction to Hydroxytyrosol**

* Principal sources of Hydroxytyrosol available in nature. Chemistry and natural process of production of Hydroxytyrosol in olives
* Toxicity and nutraceutical applications of Hydroxytyrosol, Tyrosol and oleuropein
* Bioavailability and excretion of Hydroxytyrosol with respect to human body
* Methods for enhancement of Hydroxytyrosol Residence Time in the human body

**REFERENCES**

1. Carrera–González, M. P., Ramírez–Expósito, M. J., Mayas, M. D., Martínez–Martos, J. M. (2013). Protective role of oleuropein and its metabolite hydroxytyrosol on cancer. Trends in Food Science & Technology, 31, 92–99.
2. Casaburi, I., Puoci, F., Chimento, A., Sirianni, R., Ruggiero, C., Avena, P., Pezzi, V. (2013). Potential of olive oil phenols as chemopreventive and therapeutic agents against cancer: A review of in vitro studies. Molecular Nutrition & Food Research, 57, 71–83.
3. Casimir C. Akoh, David B. Min. Food Lipids: Chemistry, Nutrition, and Biotechnology, Third Edition. CRC Press, Talyor and Francis Group
4. da Silva, R. P. F. F., Rocha-Santos, T. A. P., Duarte, A. C. (2016). Supercritical fluid extraction of bioactive compounds. Trends in Analytical Chemistry, 76, 40–51.
5. Rahmanian, N., Jafari, S. M., Wani, T. A. (2015). Bioactive profile, dehydration, extraction and application of the bioactive components of olive leaves. Trends in Food Science & Technology, 42(2), 150-172.
6. Robert E.C. Wildman. Handbook of Nutraceuticals and Functional Foods, Second Edition CRC Press, Talyor and Francis Group
7. Robles-Almazan, M., Pulido-Moran, M., Moreno-Fernandez, J., Ramirez-Tortosa, C., Rodriguez-Garcia, C., Quiles, J. L., Ramirez-Tortosa, M. (2018). Hydroxytyrosol: Bioavailability, toxicity, and clinical applications. Food Research International, 105, 654–667.
8. Wani, T. A., Masoodi, F. A., Gani, A., Baba, W. N., Rahmanian, N., Akhter, R., Wani, I. A., Ahmad, M. (2018). Olive oil and its principal bioactive compound: Hydroxytyrosol – A review of the recent literature. Trends in Food Science & Technology, 77, 77–90.
9. Xu, L., Li, Y., Dai, Y., Peng, J. (2018). Natural products for the treatment of type 2 diabetes mellitus: Pharmacology and mechanisms. Pharmacological Research, 130, 451–465