

Scheme & Syllabus of **Ph.D. - Food Science & Technology**

Batch 2020 onwards



By

Board of Study (Food Science & Engineering)
Department of Food Science & Technology (Main Campus)
IK Gujral Punjab Technical University

Program Outcomes

- PO1 Learning to conduct innovative and high quality research to solve emerging problems in Food Science and Technology through applying the fundamental scientific knowledge and designing and conducting research experiments and analysing the findings.
- PO2 Conceptualizing and solving scientific and technological problems through lateral and original thinking and evaluating a wide range of potential solutions for those problems to arrive at feasible and optimal solutions after considering public health, food safety, food preservation, novel value-added product development, nutritional enhancement and food security as core areas of expertise.
- PO3 Doctoral students will attain professional and leadership skills for professional positions in food and allied industries, government, or research institutes.
- PO4 Communication skills and professional approach to convey technical information and defend scientific findings within the scientific community by presenting research to local, regional, and national audiences through publications, report writings and presentations will be enhanced.
- PO5 Developing skills and competencies in budding researchers and inculcating the requisite aptitude in them to conduct advanced research in the emerging areas of food science and technology with a rigorous and scientific approach.

IK Gujral Punjab Technical University
Ph.D. : Food Science & Technology (Batch 2020 onward)

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total	Credits
			L	T	P	Internal	External		
PHDFT-101-20	Compulsory Course	Research Methodology	3	1	0	40	60	100	4
PHDFT-101-20		Research and Publication Ethics	2	0	0	20	30	50	2
PHDFT-201-20	Core Theory Course (Any one)	Advances in Food Processing Technology	3	1	0	40	60	100	4
PHDFT-202-20		Advances in Food Analysis	3	1	0	40	60	100	
PHDFT-203-20		Advances in Food Packaging	3	1	0	40	60	100	
PHDFT-204-20		Processing Technology for Bioactive Compounds	3	1	0	40	60	100	
PHDFT-301-20	Interdisciplinary Course (Any One)	Intellectual Property Rights	3	1	0	40	60	100	4
PHDFT-302-20		Product Design & Development	3	1	0	40	60	100	
PHDFT-303-20		Project Planning & Implementation	3	1	0	40	60	100	
PHDFT-304-20		Food Supply Chain Management	3	1	0	40	60	100	
PHDFT-401-20	Core Presentation	*Presentation	0	0	6	75	-	75	3
		Total	11	3	6	215	200	425	17

*Minimum two presentation related to proposed research area of the candidate

*Non-University Exam

COMPULSORY

COURSE

PHDFT-101-20: Research Methodology

Total Marks: 100

L	T	P
3	1	0

Objectives:

1. To acquire the knowledge of fundamental of research.
2. To develop understanding about planning and designing a research problem.
3. To understand various statistical tools for data analysis.
4. To develop the skills related to research publication and thesis writing.

Course outcome:

1. The students would be acquainted with knowledge related to concept, types and objective of research.
2. Knowledge of fundamentals of planning and hypothesising a research problem and designing the experiments would be helpful in effective pursuance of the research objectives.
3. The students would be acquainted with the effective means of writing, compiling, presenting and discussing the findings of the experiments and their further publications in the reputed journals.
4. Knowledge of statistical tools would be instrumental in drawing inferences and conclusive reports from the laboratory experiment results.

Course Content:

Unit I

Introduction: Definition, general and specific characteristics of research, classification, types and objective of research, steps in research process, criteria of good research, basic concept of experiments and research, significance of research.

Planning and designing a research study: choosing a research topic, literature review, research problem formulation, articulating hypothesis, selection of variables, formulation of objectives, research participants.

Unit II

Research methodology and experimental design: Materials and methods, Meaning, nature and types of data: primary and secondary; observational; experimental. Data Collection: types of sampling design and sampling techniques, characteristics of a good sample, sampling and non sampling errors, preparation of samples, Principles of research design and methodology, general types of research designs and approaches, compilation and documentation of data.

Unit III

Statistical applications and data analysis: An overview of application of central tendency and dispersion, standard deviation, standard error of mean, coefficient of variation, variance, population null hypothesis, level of significance and confidence, power of test, one tail and two tail test, parametric tests: definitions and applications of t-test for one and two sample

means, F test for two variances, analysis of variance (ANOVA) (One way and two way), Basic of correlation and regression analysis.

Unit IV

Thesis writing/ research papers/ review articles: significance of writing of thesis/ research papers/ review articles and presentation, Format of the research report, style of writing the report, references and bibliography, effective presentation and discussion of results/findings, intellectual property rights and plagiarism.

Books Recommended

- 1 Basotia, G.R. and Sharma, K.K. 2009. *Research methodology*
- 2 Chaudhary, C.M. 2009. *Research methodology*, RBSA Publications
- 3 Kothari, C.R. 2004. *Research methodology: Methods and Techniques*
- 4 Gupta, S. P. 2008. *Statistical Methods*, Sultan Chand and Sons, New Delhi.
- 5 Gupta, S.C. & Kapoor, V.K. 2003. *Fundamentals of Mathematical Statistics*. S. Chand & sons.

Mapping of course “Research Methodology – PHDFT-101-20” outcomes and Program outcomes:

Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)						
	Program Outcome (PO)					
		PO1	PO2	PO3	PO4	PO5
Course Outcome (CO)	CO 1	3	3	3	2	3
	CO 2	3	3	3	3	3
	CO 3	2	2	3	3	1
	CO 4	3	3	3	3	2

PHDFT-102-20: Research and Publication Ethics

Total Marks: 50

L	T	P
2	0	0

Objective:

1. Awareness of students about philosophy and ethics about publication.
2. Introduce students to the Intellectual honest and research integrity.
3. To impart knowledge of various tools for plagiarism checking.
4. To know about the databases and research metrics.

Course Outcome: After the completion of the course, the students will be able to:

1. Learn the best practices for publication ethics
2. Understand the Ethics with respect to science and research.
3. To know about the various databases sources.
4. Learn about the various tools for plagiarism checking.

Course Content:

Unit I

PHILOSOPHY AND ETHICS: Introduction to philosophy: definition, nature and scope, concept, branches; Ethics: definition, moral philosophy, nature of moral judgments and reactions

SCIENTIFIC CONDUCT: Ethics with respect to science and research, Intellectual honest and research integrity, Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP), Redundant publication: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data

Unit II

PUBLICATION ETHICS : Publications ethics: definition, introduction and importance, Best practices/standard setting initiative and guideline: COPE, WAME, etc., Conflicts of interest, Publication misconduct: definition, concepts, problems that lead to unethical behavior and vice versa, types, Violation of publication ethics, authorship and contributorship, Identification of publication misconduct, complaints and appeals, Predatory publisher and journals

Unit III

OPEN ACCESS PUBLISHING : Open access publications and initiatives, SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies, Software tool to identify predatory publication developed by SPPU, Journal finder/ journal suggestion tools viz. JANE, Elsevier journal finder, Springer Journal suggester, etc.

PUBLICATION MISCONDUCT: Subject specific ethical issues, FFP, authorship, Conflicts of interest, Complaints and appeals: examples and fraud from india and abroad

Unit IV

SOFTWARE TOOLS: Use of plagiarism software like Turnitin, Urkund and other open source software tools

DATABASES AND RESEARCH METRICS : Databases : Indexing databases ,Citation databases: Web of Science, Scopus etc.

RESEARCH METRIC: Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score, Metrics: h-Index, g index, i10 index, altmetrics

Mapping of course “PHDFT-102-20: Research and Publication Ethics ”outcomes and Program outcomes:

Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)						
	Program Outcome (PO)					
		PO1	PO2	PO3	PO4	PO5
Course Outcome (CO)	CO 1	3	3	3	2	3
	CO 2	3	3	3	2	3
	CO 3	3	3	3	2	3
	CO 4	3	3	3	3	3

CORE THEORY

COURSE

PHDFT-201-20: Advances in Food Processing Technology

Total Marks: 100

L	T	P
3	1	0

Objectives:

1. To acquire knowledge of emerging / alternative technologies applied to food processing.
2. To enable a student to know the relative advantages / disadvantages over existing technologies.
3. To understand the economics and commercialization of newer technologies.
4. To study about microbial safety of foods by emerging methods.

Course Outcome: On completion of the subject, the students will be able to:

1. Develop an appreciation about need of different emerging techniques used in food processing and preservation.
2. Apply their knowledge on high pressure processing, pulsed electric processing, and hurdle technology in various food industries.
3. Understand the concepts related to membrane technology, supercritical fluid extraction and quality assessment of food using ultrasonic techniques.
4. Get an overview on principles, mechanism and application of nanotechnology in food.

Course Content:

Unit I

Membrane technology: Introduction to membrane processes: micro- filtration, UF, NF and RO and their industrial application.

Supercritical fluid extraction: Concept, extraction methods and its application.

Unit II

Microwave and radio frequency processing: Definition, Advantages, mechanism of heat generation, application in food processing: microwave blanching, sterilization and finish drying.

Hurdle technology: Types of preservation techniques and their principles, concept of hurdle technology and its application.

Unit III

High Pressure processing: Concept, equipment's for HPP treatment, mechanism of microbial inactivation and its application in food processing.

Ultrasonic processing: Properties of ultrasonic, application of ultrasonic as processing techniques.

Unit IV

Newer techniques in food processing: Application of technologies of high intensity light, pulse electric field, ohmic heating, IR heating, inductive heating and pulsed X-rays in food processing and preservation.

Nanotechnology: Principles and applications in foods.

Suggested Readings

- Barbosa-Canovas 2002. *Novel Food Processing Technologies*. CRC.
- Dutta AK & Anantheswaran RC.1999. *Hand Book of Microwave Technology for Food Applications*.
- Frame ND. (Ed.). 1994. *The Technology of Extrusion Cooking*. Blackie.
- Gould GW. 2000. *New Methods of Food Preservation*. CRC.
- Shi J. (Ed.). 2006. *Functional Food Ingredients and Nutraceuticals: Processing Technologies*. CRC.

Mapping of course “Advanced Food Process Technology- PHDFT-201-20” outcomes and Program outcomes:

Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)						
	Program Outcome (PO)					
		PO1	PO2	PO3	PO4	PO5
Course Outcome (CO)	CO 1	3	3	2	2	3
	CO 2	3	3	2	2	3
	CO 3	3	3	2	2	3
	CO 4	3	3	2	2	3

PHDFT-202-20: Advances in Food Analysis

Total Marks: 100

L	T	P
3	1	0

Objectives:

1. To develop an understanding about the advanced analytical and instrumental techniques.
2. To illustrate the principle and mechanism of analytical instruments.
3. To describe bio-chemical analysis of food components.

Course Outcomes: After the completion of the course, the students will be able to:

1. Have a thorough knowledge about the applications various analytical and instrumental techniques.
2. Understand the mechanisms and principle behind various analytical techniques.
3. Acquaint with the spectroscopic, chromatographic and microscopic techniques
4. Comprehend the field of electrophoresis and textural properties.

Course Content:

Unit I

Spectroscopy: UV-Visible spectroscopy, Atomic absorption spectroscopy, Flame photometry, Fluorescence spectroscopy, Emission spectroscopy, Mass-spectroscopy, Fourier Transform Infra-Red.

Unit II

Methods of separation and analysis of biochemical compounds and macromolecules: Principles and applications of Gas Chromatography, High Performance Liquid Chromatography, Thin layer chromatography.

Unit III

Microscopic techniques: Light microscopy, Scanning electron microscopy, Transmission electron microscopy, particle size analysis, Thermal techniques in food analysis: Differential scanning calorimetry and Thermo gravimetric analysis.

Unit IV

Electrophoresis: Different kinds of electrophoresis, western blotting, gel documentation, Concept of rheology, Textural properties: Classification, objective methods of texture evaluation, Measurement of texture, structural aspects of food texture, engineering approach and techniques for evaluation of food texture.

Recommended Readings:

1. Pare, J. R. J. and Bélanger, J. M. R. (2015). *Instrumental Methods of Food Analysis*: Elsevier
2. Pomeranz, Y. and Meloan, C. E. (1996). *Food Analysis: Theory and Practice* (3 ed.): CBS Publications, New Delhi.
3. Winton, A. L. (2001). *Techniques of Food Analysis*: Agrobios, Jodhpur.
4. Sharma, B. K. (1994). *Instrumental Methods of Chemical Analysis*: Krishna, Meerut.
5. Skoog, D. A., Holler, F. J. and Nieman, T. A. (1998). *Principles of Instrumental Analysis* (5 ed.): Harcourt, Singapore.

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6. Gopalan, R., Subramanian, P. S. and Rangarajan, K. (2008). *Elements of Analytical Chemistry*: Sultan Chand & Sons. Food Texture and Viscosity; Concept and Measurement; Malcolm C. Bourne; An Elsevier Science Imprint.
7. *Rheological Methods in Food Process Engineering*; James F. Steffe; Freeman Press.

Mapping of course “PHDFT-202-20: Advances in Food Analysis” outcomes and Program outcomes:

Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)						
	Program Outcome (PO)					
		PO1	PO2	PO3	PO4	PO5
Course Outcome (CO)	CO 1	3	2	3	2	3
	CO 2	3	2	3	2	3
	CO 3	3	2	3	2	3
	CO 4	3	2	3	2	3

PHDFT-203-20: Advances in Food Packaging

Total Marks: 100

L	T	P
3	1	0

Objective:

1. The purpose of this course is to explain the various recent techniques of food packaging, applications, principles and requirements of these techniques.
2. Identify the purpose, principle and advance knowledge related to the various packaging technology systems.
3. Awareness of students about the recycling of packaging materials, biodegradable packaging materials and safety and legislative aspects.

Course Outcome: On successful completion of the subject, the students will be able to:

1. Comprehend advance knowledge on the properties and production of various packaging materials and effect of various indicators used in supply chain management to indicate the food quality
2. Understand various types of scavengers and emitters for improving the food shelf life.
3. Learn about consumer response about new packaging systems and safety and legislative requirements
4. Acquaint about food-package interaction between package-flavour, gas storage systems for food storage, recycling and use of green plastics for reducing the pollution and their effect on food quality.

Course Content:

Unit I

Active and intelligent packaging techniques, oxygen, ethylene and other scavengers: Oxygen scavenging technology, selection of right type of oxygen scavengers, ethylene scavenging technology, carbon dioxide and other scavengers, antimicrobial food packaging, antimicrobial packaging system, effectiveness of antimicrobial packaging.

Unit II

Advantages of non-migratory bioactive polymers, Inherently bioactive synthetic polymers: types and application, Polymers with immobilized bioactive compounds, defining and classifying time temperature indicators (TTIs), requirements for TTIs, development of TTIs, maximizing the effectiveness of TTIs to monitor shelf-life during distribution, use of freshness indicator in packaging: Compounds indicating the quality of packaged food products, pathogen indicators, moisture regulation: Silica gel, clay, molecular sieve, humectants, irreversible adsorption.

Unit III

Developments in modified atmosphere packaging (MAP): Novel MAP applications for fresh-prepared produce, novel MAP gases, testing novel MAP applications, Applying high O₂ MAP. Combining MAP with other preservation techniques, packaging-flavor interactions:

Factors affecting flavor absorption, role of the food matrix, role of differing packaging materials.

Unit IV

Modern packaging systems: Green plastics for food packaging, problem of plastic packaging waste, range of biopolymers, developing novel biodegradable materials, Integrating intelligent packaging: role of packaging in the supply chain, creating integrated packaging, storage and distribution: alarm systems and time temperature indicators, traceability: radio frequency identification, recycling packaging materials: recyclability of packaging plastics, improving the recyclability of plastics packaging, Testing the safety and quality of recycled material, using recycled plastics in packaging, methods for testing consumer responses to new packaging concepts.

Recommended Readings:

1. Jung, H. H. (2014). *Innovations in Food Packaging*: Oxford, London.
2. Ahvenainen. R. (2003). *Novel Food Packaging Techniques*: CRC Publications.
3. Robertson, G. L. (2010). *Food Packaging and Shelf Life*: CRC Publications, New York.
4. Robertson, G. L. (2006). *Food Packaging: Principles and Practice* (2 ed.): CRC Publications, Boca Raton.

Mapping of course “PHDFT-203-20: Advances in Food Packaging” outcomes and Program outcomes:

Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)						
	Program Outcome (PO)					
		PO1	PO2	PO3	PO4	PO5
Course Outcome (CO)	CO 1	3	1	3	3	3
	CO 2	1	2	1	2	1
	CO 3	1	1	2	1	2
	CO 4	2	3	1	3	2

PHDFT-204-20: Processing Technology for Bioactive Compounds

Total Marks: 100

L	T	P
3	1	0

Objective:

Objectives:

1. To know the structural properties, sources and importance of bioactive compounds.
2. To impart knowledge of different extraction methods of bioactive compounds
3. To impart knowledge of different analysis methods of bioactive compounds
4. To impart knowledge of encapsulation methods of bioactive compounds

Course Outcome: On successful completion of the subject, the students will be able to:

1. Comprehend advance knowledge on the properties and extraction of various bioactive compounds
2. Understand various types of free radicals and bioactive compounds.
3. Learn about different analysis methods of bioactive compounds
4. Acquaint about interaction between encapsulation materials and bioactive compounds.

Course Content:

Unit I

Bioactive compounds: Introduction, Definition, Classification of bioactive compounds and Functional foods, Health benefits. Selection and Preparation of Plant and Plant Parts for Phytochemical Analysis: Introduction, collection and Selection of Plant and Plant Parts, Pre-preparation Technique (Cleaning, Drying, Packaging of Dried Plants, grinding, peeling etc.);

Methods of Extraction: Introduction, Organic Solvent Extraction, Extraction with Supercritical Gases, Steam Distillation, Extraction of Essential Oil, Soxhlet Extractor, Accelerated Solvent Extractor, Purification and Concentration of Miscella, Schemes of procedure for extracting Plant Tissues, Other Minor Extraction Methods, Advances in extraction techniques (Ultrasound extraction, microwave extraction etc).

Unit II

Antioxidants: Concept of free radicals and antioxidants; antioxidants role as nutraceuticals and functional foods. In vitro study of antioxidant activities and polyphenols.

Qualitative and Quantitative Estimation of Bioactive compounds: Introduction, Gas Chromatography, Liquid Chromatography, High Performance Liquid Chromatography: Introduction, Theoretical Principles, overview of instrument, sample handling, interpretation of the produced data.

Introduction, Theoretical Principles, overview of instrument, sample handling, interpretation of the produced data – Spectroscopy; Ultraviolet Spectroscopy; Infrared Absorption Spectroscopy; Near- Infrared Absorption Spectroscopy; Mass Spectroscopy.

Unit III

Properties and functions of various bioactive compounds/functional food ingredients: Sources and role of phenolic acids, flavonoids, carotenoids, lycopene, anthocyanin, tocotrienols, chlorophyll, polyunsaturated fatty acids, terpenoids. Protein, complex carbohydrates like dietary fibers as functional food ingredients; probiotic, prebiotics and symbiotic foods, and their functional role.

Different foods as functional food: cereal products (oats, wheat bran, rice bran, etc.), fruits and vegetables, milk and milk products, legumes, nuts, oil seeds and sea foods, herbs, spices and medicinal plants. Beverages (tea, coffee, cocoa, wine, beer) as functional foods/drinks and their protective effects.

Unit IV

Encapsulation and delivery of bioactive compounds: Introduction, Designing of delivery systems incorporated with food bioactive components encapsulation and delivery systems – Emulsion, spray drying, freeze drying, co-extrusion, microencapsulation and Nano-laminated Biopolymer Structures in Foods;

Reference Books

1. *Functional Foods: Biochemical and Processing Aspects*, Volume 1. Giuseppe Mazza. CRC Press.
2. *Handbook of Nutraceuticals and Functional Foods*, Second Edition. Robert E.C. Wildman. CRC Press.
3. *Dietary Supplements of Plant Origin*. Massimo Maffei. CRC Press.
4. *Nutraceutical beverages Chemistry, Nutrition and health Effects*. Fereidoon Sahidi, Deepthi K. Weerasinghe. American Chemical Society.
5. *Vegetables, fruits, and herbs in health promotion*. Ronald R. Watson. CRC Press.
6. *Fruit and Cereal Bioactives: Sources, Chemistry, and Applications*. Özlem Tokusoglu; Clifford Hall III. CRC Press.
7. *Natural Products from Plants*. Leland J. Cseke; Ara Kirakosyan Peter B. Kaufman; Sara L. Warber James A. Duke; Harry L. Brielmann. CRC Press

**Mapping of course “PHDFT-204-20: Processing Technology for Bioactive Compounds”
outcomes and Program outcomes:**

Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)						
	Program Outcome (PO)					
		PO1	PO2	PO3	PO4	PO5
Course Outcome (CO)	CO 1	3	3	2	1	3
	CO 2	3	3	2	1	3
	CO 3	3	3	2	2	3
	CO 4	3	3	2	1	3

INTERDISCIPLINARY

COURSE

PHDFT-301-20: Intellectual Property Rights

Total Marks: 100

L	T	P
3	1	0

Objective:

1. To sensitize the students regarding the essentials of Intellectual Property Rights,
2. To describe the fundamentals of Intellectual Property Rights,
3. legislations and significance to it in the development of agriculture, food and nutritional security.
4. To describe the procedure of commercial transfer and acquisition of technology.

Course Outcome: After the completion of the course, the students will be able to:

1. Acquaint the students with different IPR and its their importance in protecting individual rights.
2. Understand the Indian Legislations for the protection of various types of Intellectual Properties.
3. Understand the relation between WTO and IPR with Economic Development.
4. Have knowledge regarding licensing and the technology transfer to industry.

Course Content:

Unit I

Need for the introduction of Intellectual Property Right regime; GATT and WTO, WTO and Economic Development, IPR Protection and Economic Development, TRIPs and various provisions in TRIPs Agreement.

Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties.

Unit II

Fundamentals of patents, copyrights, geographical indications, designs and layout, trademarks: Introduction, Procedure, Infringement

Unit III

Protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection. Introduction of WIPO.

Unit IV

International Treaty on Plant Genetic; Licensing and the Transfer of Technology: Introduction, The Commercial Transfer and Acquisition of Technology, Negotiation of Licensing Agreements, Remuneration, Material transfer agreements, Research collaboration Agreement.

Recommended Readings:

1. Rashmi Aggarwal and Rajinder Kaur, *Patent Law and Intellectual Property in the Medical Field*, IGI Global
2. Arthur Miller and Michael Davis, *Intellectual Property, Patents, Trademarks, and Copyright in a Nutshell (Nutshells)*, West Academic Publishing
3. Silke von Lewinski (Edited), *Indigenous Heritage and Intellectual Property*, Genetic Resources, Traditional Knowledge and Folklore, 2nd Edition, (2008), Wolters Kluwer.
4. Paul L.C. Torremans (edited), *Intellectual Property and Human Rights*, Enhanced edition of Copyright and Human Rights, (2008), Wolters Kluwer.
5. Dr. T. Ramakrishan (Edited), *Biotechnology and Intellectual Property Rights* (2003), CIPRA, NLSIU, Bangalore.
6. Pat Roy Mooney, *The Law of the Seed: Another Development and Plant Genetic Resources*, Development Dialogue, 1983
7. Daniel Gervais (edited), *Intellectual Property, Trade and Development* (2007), Oxford University Press.
8. Peter – Tobias Stoll, Jan Busche and Katrin Arend (Edited), *WTO-Trade related Aspects of Intellectual Property Rights* (2009) (Vol. 7), Martinus Nijhoff Publishers.
9. A.H. Qureshi, *Interpreting WTO Agreements*, Cambridge.

Mapping of course “PHDFT-301-20: Intellectual Property Rights” outcomes and Program outcomes:

Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)						
	Program Outcome (PO)					
		PO1	PO2	PO3	PO4	PO5
Course Outcome (CO)	CO 1	1	2	3	3	2
	CO 2	1	1	3	3	2
	CO 3	1	1	3	3	2
	CO 4	1	2	3	3	2

PHDFT-302-20: Product Design & Development

Total Marks: 100

L	T	P
3	1	0

Objective:

1. To understand the fundamental of product design and development.
2. To understand the consumer role in product development.
3. To acquire the knowledge about the various steps involved in product development process.
4. To understand the legal aspects of new product launch.

Course Outcome: After the completion of the course, the students will be able to:

1. Understand the concept of product design and development.
2. Grasp the role of consumers in product development.
3. Learn about product development technology and technological knowledge about marketing and distribution.
4. Understand the various product development process.

Course Content:

Unit I

Concept of product development - product success and failure, factors for success, process of product development, managing for product's success.

Innovation strategy - possibilities for innovation, building up strategy, product development programme.

Unit II

The product development process - product strategy, product design and process development, product commercialization, product launch and evaluation.

Role of consumers in product development - consumer behaviour, food preferences, avoiding acceptance, integration of consumer needs in product development and sensory needs.

Unit III

The knowledge base for product development technology - knowledge and the food system, knowledge management, knowledge for conversion of product concept to new product, technological knowledge (product qualities, raw material properties, processing, packaging requirement, distribution and marketing).

Unit IV

Managing the product development process, - principles of product development management, people in product development management, designing the product

development process, key decision points, establishing outcomes, budgets and constraints, managing and organizing product development process.

Improving the product development process - key message, evaluating product development, innovative matrices, striving for continuous improvement, Improving success potential of new products, market exploration and acquisition, Legal aspects of new product launch.

Suggested Readings

1. Clarke & Wright W. 1999. *Managing New Product and Process Development*. Free Press.
2. Earle and Earle 2001. *Creating New Foods*. Chadwick House Group.
3. Earle R, Earle R & Anderson A. 2001. *Food Product Development*. Woodhead Publ.
4. Fuller 2004. *New Food Product Development - from Concept to Market Place*. CRC.

Mapping of course “PHDFT-302-20: Product Design & Development ”outcomes and Program outcomes:

Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)						
	Program Outcome (PO)					
		PO1	PO2	PO3	PO4	PO5
Course Outcome (CO)	CO 1	3	1	1	1	2
	CO 2	1	2	2	3	1
	CO 3	2	3	1	2	2
	CO 4	1	2	2	1	1

PHDFT-303-20: Project Planning & Implementation

Total Marks: 100

L	T	P
3	1	0

Objective:

5. Awareness of students about fundamentals of project management.
6. Introduce students to the methodology of project formulations and the implementation procedures and strategic planning of new projects.
7. To impart knowledge of project deliverables
8. To know the execution of the project plan and evaluating project progress.

Course Outcome: After the completion of the course, the students will be able to:

5. Learn the strategies of project management
6. Understand the resources planning, cost and budget management.
7. Execute the project plan and evaluation of project progress.
8. Learn about the project quality standards and measurement of performance of those standards.

Course Content:

Unit I

An introduction to project management: An overview of project management. The differences between Product, Project and Program management, Industrial, R&D and social security projects.

Successful Initialization and Project Planning: Defining the project scope. Establishing the project scope and defining project deliverables. Defining and Sequencing of Project Deliverables. Project scheduling techniques, Market research and forecasting. GMP and HACCP.

Unit II

Resource Planning: Determining resource requirements and acquiring those resources, Source of finance, Debt-equity ratio, Debt service coverage ratio, ROI, RONW, Process of soliciting and selecting vendors for material and services for the project. Cost Management. Establishing the project budget and analyzing budget variances, techno-economic feasibility analysis.

Unit III

Execution of the Project Plan and Evaluating Project Progress: Execution of the project plan and activities required to create the project team, monitor progress against the plan, and keep the project on track. Capacity utilization, Breakeven point.

Unit IV

Risk Identification and Analysis: Identify risky events, measure the element of risk, and develop responses to high-risk events. Establishing the Project Management Team Identifying project team members, and structuring a successful project team. Keeping the Project on Track The quality process, Project's quality standards and how performance to those standards will be measured. Managing Project Change Handling formal and informal change, how to identify and evaluate change, and incorporate change into the project plan.

Suggested Readings

Pavlyak MM.2000. *Systems Survival Guide*. Ruby Moon Press.

Thomsett TC.1990. *The Little Book of Project Management*. American Management Association.

Mapping of course “PHDFT-303-20: Product Design & Development” outcomes and Program outcomes:

Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)						
	Program Outcome (PO)					
		PO1	PO2	PO3	PO4	PO5
Course Outcome (CO)	CO 1	3	3	3	2	3
	CO 2	3	3	3	2	3
	CO 3	3	3	3	2	3
	CO 4	3	3	3	3	3

PHDFT-304-20: Food Supply Chain Management

Total Marks: 100

L	T	P
3	1	0

Objective:

1. Study the concept, applications, systems and practices of food supply chain management in food industry.
2. Understanding the primary difference between logistic and supply chain management.
3. Understanding of the management components of supply chain management.
4. Knowledge about the professional opportunities in supply chain management.

Course Outcome: After the completion of the course, the students will be able to:

1. Learn the individual process of supply chain management and their interrelationship within individual companies and across the supply chain.
2. Grasp the supply chain information system and integrating the supply chain
3. Understand the concept of supply chain inventory management.
4. An understanding of tools and techniques useful in implementing the supply chain management.

Course Content:

Unit I

Building blocks of supply chain network, performance measures, decisions in supply world and models.

Unit II

Supply chain inventory management, economic order quantity models, recorder point models, multi echelon inventory systems.

Unit III

Use of stochastic models and combinatorial optimization in SC planning, layout, capacity planning, inventory optimization, dynamic routing and scheduling.

Unit IV

Internet technologies and electronic commerce in SCM related to ERP, Q procurement, e-logistics, internet auctions, e-market, electronic, business process optimization.

Suggested Readings

1. Chopra S & Meindel P. 2002. *Supply Chain Management: Strategy, Planning and Operation*. Prentice Hall.

2. Handfield RB & Nochols EL.1999. *Introduction to Supply Chain Management*. Prentice Hall.
3. Hopp WJ & Spearman ML. 1996. *Factory Physics: Foundations of Manufacturing Management*. McGraw Hill.
4. Levi DS, Kaminsky P & Levi ES. 2000. *Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies*. Mc Graw Hill.
5. Shapiro JF. 2001. *Modeling the Supply Chain*. Duxbury Thomson Learning.
6. Tayur S, Ganeshan R & Magazine M.1999. *Quantitative Models for Supply Chain Management*. Kluwer Academic Publ.
7. Viswanadham N. 2000. *Analysis of Manufacturing Enterprises*. Kluwer.
8. Viswanadham N & Narahari Y. 1998. *Performance Modeling of Automated Manufacturing Systems*. Prentice Hall.

Mapping of course “PHDFT-304-20: Food Supply Chain Management” outcomes and Program outcomes:

Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)						
	Program Outcome (PO)					
		PO1	PO2	PO3	PO4	PO5
Course Outcome (CO)	CO 1	1	2	2	1	2
	CO 2	2	2	2	1	2
	CO 3	1	2	2	1	2
	CO 4	2	2	2	1	2