DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

P.G Diploma Food Safety and Quality Assurance in Food Industry

REGULATIONS

Background: Food Safety Regulations in India has reached global standards with the introduction of Food Safety and Standards Act 2006 in the year 2011. With this, requirement of adequately trained manpower to be a part of Food Safety Quality Assurance and Regulatory Systems has increased immensely. With the enormous expansion of food sector (Manufacturing, retail distribution and hospitality sector) and customer awareness, safety and quality assurance has become a very vital hitch to be addressed in the current decade. This has opened an enormous job opportunities for adequately trained human resource in the area.

In view of this, for the first time in India, Post Graduate Diploma course (One year – Full time) on Food Safety and Quality Assurance in Food Industry will be offered by Pondicherry University, Puducherry, sponsored by University Grants Commission under the innovative programmes scheme. The post M.Sc. P.G Diploma programme is intended to prepare food scientists, food engineers, microbiologists and others with appropriate scientific backgrounds for active job opportunities in food safety and quality assurance, monitoring and certification process in the food industry and in the Government.

The course provides an outline of State-Of-Art theoretical information and practical experience, directly and indirectly related to a better understanding of food safety problems, their origin and solutions. The program is framed for transmission of both knowledge and know-how of local importance and global significance to the students.

Admission requirements
M.Sc. in Food Science and Nutrition/ Food Science and Technology/ Biotechnology/ Biochemistry/ Microbiology or M. Tech. in Food Technology/ Biotechnology with minimum of 55% marks or B.Sc. with 55% marks in any area of life sciences with at least 3 years of experience in the food industry / B. Tech. in Food Technology/ Biotechnology with at least 2 years of experience in the food industry/B. Tech in Food technology with two year P.G. Diploma in Food Technology.
## CURRICULUM - OVERVIEW

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Code</th>
<th>Title of the Course</th>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>DFSQ601</td>
<td>Food Safety Basics</td>
<td>HC</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>DFSQ602</td>
<td>Microbiological Safety of Foods</td>
<td>HC</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>DFSQ603</td>
<td>Analytical Quality Assurance in Food Laboratories</td>
<td>HC</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>DFSQ604</td>
<td>Chemical Safety of Foods</td>
<td>HC</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>DFSQ605</td>
<td>Food Standards And Quality Control</td>
<td>HC</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>DFSQ615</td>
<td>Food Toxicology</td>
<td>SC</td>
<td>3</td>
</tr>
</tbody>
</table>

### LAB

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title of the Course</th>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFSQ651</td>
<td>Food Standards And Quality Control Lab</td>
<td>HC</td>
<td>1</td>
</tr>
<tr>
<td>DFSQ652</td>
<td>Analytical Quality Assurance in Food Laboratories Lab</td>
<td>HC</td>
<td>1</td>
</tr>
<tr>
<td>DFSQ653</td>
<td>Microbiological Safety of Foods Lab</td>
<td>SC</td>
<td>1</td>
</tr>
<tr>
<td>DFSQ654</td>
<td>Chemical Safety of Foods Lab</td>
<td>SC</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>DFSQ621</td>
<td>Food Safety And Standards Act 2006</td>
<td>HC</td>
</tr>
<tr>
<td>DFSQ622</td>
<td>Industry Project Programme (Any One Area):</td>
<td>HC</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>1. Food Safety Regulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Food Safety in Manufacturing Sector</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Food Safety in Retail Sector</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Food Safety in Catering Sector</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Food Safety Auditing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DFSQ632</td>
<td>Food Safety Auditing</td>
<td>SC</td>
<td>4</td>
</tr>
</tbody>
</table>

### LAB

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title of the Course</th>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFSQ655</td>
<td>Food Safety Auditing Lab</td>
<td>SC</td>
<td>1</td>
</tr>
</tbody>
</table>
### Semester I

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title of the Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFSQ601</td>
<td>Food Safety Basics</td>
<td>3</td>
</tr>
<tr>
<td>DFSQ602</td>
<td>Microbiological Safety of Foods</td>
<td>3</td>
</tr>
<tr>
<td>DFSQ603</td>
<td>Analytical Quality Assurance in Food Laboratories</td>
<td>3</td>
</tr>
<tr>
<td>DFSQ604</td>
<td>Chemical Safety of Foods</td>
<td>3</td>
</tr>
<tr>
<td>DFSQ605</td>
<td>Food Standards And Quality Control</td>
<td>3</td>
</tr>
<tr>
<td>DFSQ651</td>
<td>Food Standards And Quality Control Lab</td>
<td>1</td>
</tr>
<tr>
<td>DFSQ652</td>
<td>Analytical Quality Assurance in Food Laboratories Lab</td>
<td>1</td>
</tr>
<tr>
<td>DFSQ615</td>
<td>Food Toxicology</td>
<td>3</td>
</tr>
<tr>
<td>DFSQ653</td>
<td>Microbiological Safety of Foods Lab</td>
<td>1</td>
</tr>
<tr>
<td>DFSQ654</td>
<td>Chemical Safety of Foods Lab</td>
<td>1</td>
</tr>
</tbody>
</table>

**Hard core**

**Soft Core**

UNIT II

Food Sanitation and safety: Factors contributing to physical, chemical and biological contamination in food chain, prevention and control of food borne hazards, definition and regulation of food sanitation, sources of contamination, personal hygiene-food handlers, cleaning compounds, sanitation methods, waste disposal strategy (solid and liquid waste) and pest control

UNIT III

Food adulteration: common adulterants, simple tests for detection of adulteration. Food additives-classification, functional role and safety issues, types of adulteration and recent trends in food adulteration.

UNIT IV


UNIT V

Food Quality Indices: Meat and meat products, fish and fish products, milk and dairy products, vegetables, fruits and their products, grain, pulses and oil seeds, coffee, tea and spices.

Text books

Importance and significance of microorganisms in food safety, intrinsic and extrinsic factors affecting the growth of microorganisms in food.

Protection and preservation of foods: Hurdle technology, chemical, modified atmosphere, irradiation, thermal and non-thermal techniques.

Foodborne diseases: characteristics and incidence - global and Indian scenario, food poisoning and food intoxications of microbial origin, bacterial foodborne diseases; viral foodborne diseases; protozoa animal parasite foodborne diseases; mycotoxicoses; mushroom poisoning; investigation and management of foodborne diseases.

Food spoilage: characteristic features, dynamics and significance of spoilage of different groups of foods - cereal and cereal products, vegetables and fruits, meat poultry and sea foods, milk and milk products, packed and canned foods.

Determination of microorganisms and their products in food: sampling, sample collection, transport and storage, sample preparation for analysis, microscopic and culture-dependent methods - direct microscopic observation, culture enumeration and isolation methods; culture-independent techniques - PCR Based, DGGE, metagenomics, etc.; chemical, physical, immunological methods for microbial metabolites - microbial metabolites.

Text books

UNIT I  9 hours
Food laboratories: need for food analysis, accreditation of food laboratory, referral laboratories, functions of food analysts, hierarchy of food safety authorities, analysis of food samples and reports, other regulatory provisions pertaining to analysis of food.

UNIT II  10 hours
Validation of analytical methods: Good Laboratory Practices (GLP)- history of GLP, areas of application, facilities, test systems, test and reference items, Standard Operating Procedure (SOP), study performance and reporting.

UNIT III  9 hours
Analytical method used for quality determination: chemical and physical, microbiological, biochemical and sensory analysis.

UNIT IV  10 hours
Analytical methods of determination of basic food components: protein, saccharides, lipids, vitamins, water, minerals and trace elements, sensory active compounds, anti-nutritive and natural toxic compounds, food additives and food contaminants.

UNIT V  10 hours
Advanced laboratory techniques: principle, working and application of GC, HPLC, HPTLC, LC/MS, inductively coupled Plasma Mass Spectroscopy and PCR, real time PCR, ELISA, Triple Quadrupole system.

Text Books

UNIT I
9 hours
Pesticides and veterinary drugs: Detection and quantification of carbamates, organochlorine and organosulfur, organohalogens, nitrites, herbicides, hormones, antibiotics, steroids, environmental chemicals - heavy metals, toxic residues, radioactive isotopes.

UNIT II
10 hours
Processing contaminants: Detection, quantification and health hazards of direct contaminants – acrylamide, PAHs, oxyhalides, and haloacetic acids, preservatives, flavor enhancers, color additives. Indirect contaminants- boiler water additives, peeling aids, defoaming agents, building and equipment contaminates: lubricants, paint and coatings, contaminants during packaging, storage and transport: cleaners, sanitizers and cross contaminates.

UNIT III
10 hours
Food additives: Detection, quantification and health hazards of hydrogenated or partially hydrogenated oils, high-fructose corn syrup, artificial colorants, artificial sweeteners such as aspartame, sucralose and saccharin, BHA or BHT, monosodium glutamate, hydrolyzed vegetable protein or autolyzed yeast extract, potassium bromate, propyl gallate, sulfites, sodium nitrate, sodium benzoate.

UNIT IV
10 hours
Food colorants and sweeteners: Detection, quantification and health hazards of brilliant blue, Indigo, carmine, citrus red, fast green, erythrosine, allura red, tartrazine, sunset yellow, lake pigments and non certified colorants, food sweeteners- neotame, sorbitol and non certified sweeteners.

UNIT V
9 hours
Emulsifiers, stabilizers, thickening and gelling agents: tara gum, soyabean hemicelulose, sucroglycerides, stearyl tartarate, talc, gluconic acid, candelilla wax, carbamide, argon, salt of aspartame and other non certified agents- detection, quantification and health hazards.

Text Books
UNIT I
Principal aspects of sampling of food: Importance of sample collection, sampling tools and containers, sample collection techniques, sampling for microbiological analysis of food, routine versus investigational sampling, quantity of sample to be collected, packaging and sealing of sample, dispatch of sample, documentation and commodity specific sampling procedure.

UNIT II
Codex Alimentarius Commission (CODEX): Introduction, standards, codex of practice, guidelines and recommendations, applying codex standards, Codex India, core functions of National Codex Contact Point, National Codex Committee of India

UNIT III

UNIT IV
Hazard Analysis Critical Control Point (HACCP): History, structure, pre- requisites and principles, HACCP applications, HACCP based SOPs.

UNIT V
Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Agricultural Practice(GAP), Good Veterinary Practice (GVP), Storage and distribution of food, sanitation and safety in food services.

Text Books
UNIT - I 11 hours

Principles of Toxicology: classification of toxic agents; characteristics of exposure; spectrum of undesirable effects; interaction and tolerance; biotransformation and mechanisms of toxicity. Evaluation of toxicity: risk vs. benefit: experimental design and evaluation: prospective and retrospective studies: Controls: Statistics (descriptive, inferential): animal models as predictors of human toxicity: Legal requirements and specific screening methods: LD$_{50}$ and TD$_{50}$: in vitro and in vivo studies; clinical trials.

UNIT – II 9 hours

Natural toxins in food: natural toxins of importance in food- toxins of plant and animal origin; microbial toxins (e.g., bacterial toxins, fungal toxins and Algal toxins), natural occurrence, toxicity and significance, determination of toxicants in foods and their management.

UNIT – III 10 hours

Food allergies and sensitivities: natural sources and chemistry of food allergens; true/untrue food allergies; handling of food allergies; food sensitivities (anaphylactoid reactions, metabolic food disorders and idiosyncratic reactions); Safety of genetically modified food: potential toxicity and allergenicity of GM foods. Safety of children consumables.

UNIT – IV 9 hours

Environmental contaminants and drug residues in food: fungicide and pesticide residues in foods; heavy metal and their health impacts; use of veterinary drugs (e.g. Malachite green in fish and β-agonists in pork); other contaminants in food, radioactive contamination of food, Food adulteration and potential toxicity of food adulterants.

UNIT – V 9 hours

Food additives and toxicants added or formed during food processing: safety of food additives; toxicological evaluation of food additives; food processing generated toxicants: nitroso-compounds, heterocyclic amines, dietary Supplements and toxicity related to dose: common dietary supplements; relevance of the dose; possible toxic effects.

Text Books

PG DIPLOMA IN FOOD SAFETY AND QUALITY ASSURANCE IN FOOD INDUSTRY
1. Sampling Quantity, packaging and sealing of sample, dispatch of sample, documentation and commodity specific sampling procedure for microbiological analysis of food
2. Sampling Quantity, packaging and sealing of sample, dispatch of sample, documentation and commodity specific sampling procedure for chemical analysis of foods
3. Hazard Analysis and Critical Control Point (HACCP) of Milk and milk products
4. Hazard Analysis and Critical Control Point (HACCP) of Cereals and cereal products
5. Hazard Analysis and Critical Control Point (HACCP) of Meat and meat products
6. Hazard Analysis and Critical Control Point (HACCP) of Fish
7. Hazard Analysis and Critical Control Point (HACCP) of Bakery products
8. Hazard Analysis and Critical Control Point (HACCP) of Fruits and vegetables
1. Calibration of pipettes, scales and dispensers
2. Calibration of selected equipments
3. Equipment Maintenance, record keeping and reporting of results
4. Estimation of proximates from food samples
5. Estimation of vitamins from food samples
6. Estimation of minerals from food samples
7. Estimation of trace elements from food samples
8. Estimation of mycotoxins from food samples
1. Collection of food samples – sampling, collection, transport and storage

2. Enumeration of microorganisms:
   a. Direct count
   b. Total aerobic count
   c. Selective media

3. Identification of pathogenic microorganisms
   a. Selective media
   b. PCR based identification
   c. ELISA

4. Detection of microbial metabolites: HPTLC, HPLC, ELISA
   a. Bacterial toxins: Ceralides, *E Coli* Toxins
   b. Mycotoxins: Aflatoxins, Trichotheenes
   c. Histamine

5. Isolation and identification of virulent *E. Coli* from foods

6. Investigation of suspected food borne disease outbreak
1. Detection and quantification of pesticides
2. Detection and quantification of hormones
3. Detection and quantification of antibiotics and steroids
4. Detection and quantification of environmental chemicals - heavy metals, toxic residues, radioactive isotopes.
5. Detection and quantification of processing contaminates.
6. Detection and quantification of food additives.
7. Detection and quantification of food colorants and sweeteners.
8. Detection and quantification of emulsifiers and stabilizers
9. Detection and quantification of thickening and gelling agents
PONDICHERRY UNIVERSITY

Department of Food Science and Technology

**P.G Diploma Food Safety and Quality Assurance in Food Industry**

**Semester II**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title of the Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFSQ621</td>
<td>Food Safety And Standards Act 2006</td>
<td>4</td>
</tr>
<tr>
<td>DFSQ622</td>
<td>Industry Project Programme (Any One Area):</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>1. Food Safety Regulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Food Safety in Manufacturing Sector</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Food Safety in Retail Sector</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Food Safety in Catering Sector</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Food Safety Auditing</td>
<td></td>
</tr>
<tr>
<td>DFSQ632</td>
<td>Food Safety Auditing</td>
<td>4</td>
</tr>
<tr>
<td>DFSQ655</td>
<td>Food Safety Auditing Lab</td>
<td>1</td>
</tr>
</tbody>
</table>
## DFSQ621  FOOD SAFETY AND STANDARDS ACT 2006  CREDIT  4

### UNIT I  12 hours

Food Safety and Standards Act: Salient features of food safety and standards Act, 2006, administration at central and state level, functions, duties and responsibilities of food safety regulators, implementation of food regulation – FSS act, 2006 including licensing and registration, inspection and reports, improvement notices and prohibition Orders.

### UNIT II  14 hours

Food safety standards of licensing and registration of food Business regulations, 2011: short title, commencement, definitions, licensing and registration of food business, schedule I, II, III, IV. general requirements of hygienic and sanitary practices to be followed by all food business operators applying license, specific hygienic and sanitary practices to be followed by food business operator engaged in manufacturing, processing, storage and selling of milk and milk products, meat and meat products, specific hygienic and sanitary practices to be followed by food business operators engaged in catering/ food service management.

### UNIT III  12 hours

Food safety standards of packaging and labeling regulations, 2011- Short title and commencement, definition, registration, packaging - general requirements, product specific requirements. labeling - manner of declaration, specific requirements and restriction on manner of labeling, restriction on advertisement, exemption from labeling requirement, notice of addition, admixture or deficiency in food.

### UNIT IV  14 hours

Food safety standards of food product standards and food additives regulations 2011- Short title, commencement, definition and regulation of dairy products and analogues, fats, oils and fat emulsions, fruits and vegetable products, nuts and raisins, cereal and cereal products, bakery products, meat and meat products, fish and fish products, sweet and confectionery, sweetening agents, salt, spices, condiments and related products, common salt, beverages- alcoholic and non alcoholic, irradiation of foods, food additives and other food products.

### UNIT V  12 hours

Food safety standards of prohibition and restriction sales regulations 2011- title, commencement, definitions, prohibition and restriction of sales – sale of certain admixtures prohibited, restriction on the use of certain ingredients, prohibition and restriction on sale of certain products.
Food safety and standards of contaminants, toxins and residues regulation 2011-short title, commencement and definition of metal contaminants, crop contaminates and naturally occurring toxic substances, residues, antibiotic another pharmacologically active substances.

Food safety standards of laboratory and sample analysis, 2011- short title, commencement and definition of notified laboratories to import, referral laboratories, procedure for sampling.

**Text Book**


Project work in a food industry with following specializations:

1. Food safety regulation, working with the enforcement agency.
2. Food safety in manufacturing sector, in a food processing industry.
3. Food safety in retail sector, in a food retailing company.
4. Food safety in catering sector, in a catering organization.
5. Food safety auditing- working with a food safety auditing company.

Candidates will be trained in the selected topics in any of the four areas in an industry or a company and will submit a project at the end and will be evaluated through viva voce.
UNIT I
12 hours


UNIT II
12 hours

Export and import of food in India: Introduction, import and export policies, FDA import policy, export-import policy, export control systems. Import intelligence and alert systems, packaging and labeling, specifications and certifications. case studies and judicial pronouncements, procedure for investigations and filing of cases by food safety regulator as per FSS act.

UNIT III
14 hours

Inspection of food establishments, manufacturing units: Food regulatory enforcement and compliance through inspection. Inspectional requirements for food business operators: general inspection procedures, biological inspection of establishments.

UNIT IV
12 hours

Special establishment inspection part I: Processing of fruits and vegetables, bakery products, milk and milk products, meat and meat products, fish and fish products and chocolate and cocoa.

UNIT V
12 hours

Special establishment inspection part II: Candy and chocolate processing units, fats and oil processing units, frozen food establishments, food canning plants, beverage industry, retail meat shops, food ware houses and food service distribution

Text Books


Auditing of a selected food industry / establishment and submission of report

1. Data collection on the quality of raw materials
2. Date collection on the processing parameters and documentation
3. Data processing
4. Preparation of model
5. Validation of model
6. Making recommendation to the Industry
7. Comparative analysis of similar establishments
8. Submission of report