

**MASTER OF SCIENCE  
FOOD AND ENVIRONMENTAL TOXICOLOGY  
Program code: 1840**

**INTRODUCTION**

The Departments of Food Science & Nutrition and Environment Technology Management, College of Life sciences at the Kuwait University, are proposing a two-year Master of Science joint degree program in **Food and Environmental Toxicology**. The program is designed to prepare post-graduate students for a career with Food Control Department, Kuwait Municipality, Ministry of Commerce and Industries, Environmental Protection Authority, Food & Nutrition Administration, Ministry of Health, and other organizations dealing with food production, as well as food imports. The program offers both thesis and non-thesis options.

*According to the University Council decision dated 4/2/2007, Thesis students admitted with effect from September 2007 are exempted from the comprehensive examination.*

**PROGRAM REQUIREMENTS** (non-thesis option in parenthesis)**36 (36) TOTAL COURSE CREDITS****18 (21) COMPULSORY COURSES**

1840-510	Mammalian Toxicology	(3)
1840-511	Ecological Toxicology	(3)
1840-512	Risk Assessment	(3)
1840-513	Experimental Toxicology Lab	(3)
1840-514	Statistics for Toxicologists	(3)
1840-593	Project (non-thesis option only)	(3)
2000-501	Scientific Writing and Communication Skills	(3)

**9 (15) ELECTIVE COURSES**

1840-515	Research Methodologies in Food and Environmental Toxicology	(3)
1840-516	Food Toxicology	(3)
1840-517	Nutritional Toxicology	(3)
1840-518	Molecular Toxicology	(3)
1840-519	Fate of Environmental Toxicants	(3)
1840-520	Aquatic Toxicology	(3)
1840-521	Organ Toxicology	(3)
1840-522	Principles of Toxicological Pathology	(3)
1840-591	Special Topics in Food and Nutritional Toxicology	(3)
1840-592	Special Topics in Environmental Toxicology	(3)
2000-503	Ethics and Professionalism	(2)

**9 COMPULSORY COURSES**

1840-597	Thesis	(0)
1840-598	Thesis	(0)
2000-599	Thesis	(9)

***COURSE DESCRIPTION*****1840-510: MAMMALIAN TOXICOLOGY****CR: 3**

Course will discuss the history, and scope of toxicology, concept of toxicology/poisoning, etiology of poisoning, factors affecting toxicity, chemical structure and toxicity, mechanism of assimilation, distribution, biotransformation and excretion of these poisons in mammals (toxicokinetics), reaction of these poisons with biomolecules, interaction of toxic substances; molecular mechanisms of important toxic compounds in mammals.

**1840-511: ECOLOGICAL TOXICOLOGY****CR: 3**

This course will provide an advanced understanding of uptake and transport of environmental pollutants in the ecosystems, how these pollutants affect the ecological populations, bioaccumulation and bio-magnification of pollutants, effects in different marine species. Study of heavy metals, environmental contaminants, radioactive compounds, nano materials, etc. and the complex mixtures of pollutants in air, sea, soil and water samples.

**1840-512: RISK ASSESSMENT****CR: 3**

This course deals with the basic concepts, principles and components of health risk assessment of chemical substances on human and ecological health; changing disease patterns as affected by global climate changes and air, water and soil pollution; data search, selection, analysis and evaluation of studies on toxicity, dose-response relationship and exposure, and compilation and assessment of toxicity; factors affecting risk assessment in human and ecological systems; epidemiological and medical implications of environmental toxicants.

**1840-513: EXPERIMENTAL TOXICOLOGY****LAB****CR: 3**

A few lectures on: History, philosophy and basic requirements of toxicological evaluation;

limitations of currently accepted method; the rationale for acute, sub-acute and chronic toxicity testing; Lab: carcinogenicity/mutagenicity testing; cell culture studies, role of biochemical, metabolic and toxicokinetic testing of chemicals and drugs in mammalian and ecological systems. A critical laboratory approach to the conduct and interpretation of toxicity studies will be followed.

**1840-514: STATISTICS FOR TOXICOLOGISTS****CR: 3**

Sampling methods and experimental design, multivariate analysis, regression, analysis of matched data and nonparametric statistics, rank correlation, and use of SAS or SPSS software in analysis of research data in food, nutrition and environmental toxicology.

**1840-515: RESEARCH METHODOLOGIES IN FOOD AND ENVIRONMENTAL TOXICOLOGY****CR: 3 PR: 1840-510, 1840-511**

Students will be exposed to the procedure of developing a project/research proposal including study design, data collection, data analysis and interpretation of results. At the end, students will present a seminar on their project/research proposal in the area of food and environmental toxicology.

**1840-516: FOOD TOXICOLOGY****CR: 3 PR: 1840-510**

Introduction to food toxicology and regulation, dose-relationships, toxicodynamics, mechanisms of various toxins entering the food chain: microbial toxins, marine toxins, prions, lactose, phytanic acid, avidin, enzyme inhibitors, endogenous plant toxins, flatulence-causing carbohydrates, phytolectins, nitrosamines, toxic chemical elements (mercury, lead, arsenic, cadmium, copper, nickel, chromium, fluorine, selenium), agro-chemicals (pesticides, veterinary drugs and feed additives), pharmaceutical residues (vitamin intoxication), permissible and non-permissible food additives, flame retardants,

dioxins, toxicants unintentionally entering food during processing, packaging (migration of toxic monomers), storage and distribution.

**1840-517: NUTRITIONAL TOXICOLOGY**

**CR: 3 PR: 1840-510**

Effect of processing on the nutritional value and toxicity of foods (e.g., lipid and protein oxidation products, heterocyclic amines, acrylamide, trans-fats, polycyclic aromatic hydrocarbons in smoked meat/fish), epidemiological and medical impact of toxins in foods, nutritional factors (status of proteins, carbohydrates, lipids, vitamins and minerals) affecting xenobiotic action, diagnosis and therapy of vitamin intoxications, characteristics and mode of action of endocrine disrupters, examples of endocrine disruptors, hormonal cancers, esterogenicity testing, cellular regulation from nutritional perspective.

**1840-518: MOLECULAR TOXICOLOGY**

**CR: 3 PR: 1840-510**

This course deals with the molecular mechanisms of toxicity: variability and type of toxic response, disturbance of cell homeostasis, receptor-mediated mechanisms, toxic effects mediated by cellular membranes, alterations of cell energetics, covalent bonding with cellular macromolecules, mechanism of oxidative stress, inhibition of DNA repair process, multiple interorgan effects, use of biomarkers for the study of toxic effects and biomonitoring approaches to toxic exposure.

**1840-519: FATE OF ENVIRONMENTAL TOXICANTS**

**CR: 3 PR: 1840-513**

This course deals with the identification of toxicants and other persistent chemicals (mainly pesticides, herbicides, PAH, PCBs etc..) and their sources in the environment. Toxicants behavior in air, soil and groundwater, and their eventual fate. Physical and chemical parameters of toxicants and their control.

**1840-520: AQUATIC TOXICOLOGY**

**CR: 3 PR: 1840-511**

This course deals with the identification of petroleum origin toxicants, surface run-off water and sewage water pollutants (endocrine disrupters etc..), and their presence/accumulation in marine waters and on sea beds. Toxicants' behavior, metabolism, and their eventual fate in aquatic animals. Physical and chemical

parameters of these toxicants and their control in aquatic systems.

**1840-521: ORGAN TOXICOLOGY**

**CR: 3 PR: 1840-510, 1840-511**

Interpret, analyze and describe the signs of toxicity that toxic compounds (both organic and inorganic) cause and relate to the structure and function of the tissues, organs and organ systems; toxic effects and their underlying mechanisms, including genotoxicity and chemical carcinogenicity; changes in the normal anatomy, physiology of the liver, kidney, gastrointestinal tract, skin, central and peripheral nervous systems, endocrine system, musculoskeletal system, cardiorespiratory system, haematopoietic system and reproductive system; effect of toxins on spermatogenesis, oogenesis, male and female fertility and teratogenicity.

**1840-522: PRINCIPLES OF TOXICOLOGICAL PATHOLOGY**

**CR: 3 PR: 1840-510, 1840-511**

This course will cover general and specific pathological changes that are produced by toxic substances in organisms, basic tissue theory and causes of pathological changes, molecular toxicology and biochemistry for the detection of cellular damage; chemical mediators of inflammation; acute and chronic inflammation; disorders of the immune response and of tissue growth – hypertrophy, dysplasia and neoplasia; tissue restoration and repair; cell necrosis and degeneration; thrombosis and embolism – their origins and consequences; new techniques used in histology and electron microscopy; and cell organelles and their response to toxic agents.

**1840-591: SPECIAL TOPICS IN FOOD AND NUTRITIONAL TOXICOLOGY**

**CR: 3**

Selected topics in food and nutrition toxicology to cover current issues of interest will be covered. The emphasis will change as the need emerges with time.

**1840-592: SPECIAL TOPICS IN ENVIRONMENTAL TOXICOLOGY**

**CR: 3**

Selected topics in environmental toxicology to cover current issues of interest will be covered. The emphasis will change as the need emerges with time.

**1840-593: PROJECT**  
**CR: 3**

The student undertakes an independent project on a research topic of theoretical and/or experimental focus under the supervision of a faculty member listed in the supervisory list of the College of Graduate Studies. The objective is to provide the student with an opportunity to integrate and apply the knowledge gained throughout the course of study in a practical problem. The student must document the project in a scientific report following standard research writing guidelines and give a public presentation to the project examination committee.

**1840-597: THESIS**  
**CR: 0****1840-598: THESIS**  
**CR: 0****2000-599: THESIS**  
**CR: 9**