



INSTRUCTION DIVISION, FIRST SEMESTER 2014 – 2015

COURSE HANDOUT (PART II)

Date: 01.08.2014

In addition to Part – I (General Handout for all courses) printed on Page 1 of the timetable book; this portion gives further specific details regarding the course.

Course Number : **BIO G661**

Course Title : **GENE TOXICOLOGY**

Instructor In-charge : **P. SANKAR GANESH**

Instructor : **P. Sankar Ganesh**

Course Description :

Gene toxicology course is aimed at imparting basic understanding of deleterious action of toxicants affecting the integrity of genetic material in cells. It provides fundamentals of evaluating toxicity of various genotoxic substances (radiations, pesticides, combustion of hydrocarbons and antineoplastic drugs) which are capable of causing genetic mutations in living systems. This course is encompassed to deliver fundamental and advanced aspects of gene toxicology to uncover the impact of xenobiotics, drugs and pollutants on environmental health.

Scope and Objectives :

Gene Toxicology course covers three basic areas: scientific basis of the discipline, methodologies of genotoxicity assays, and their application to evaluate genotoxic potential of both natural and synthetic chemicals. It is designed for graduate and advanced undergraduate students in Environmental Science & Engineering, Toxicology, and related disciplines. Therefore, it is aimed at disseminating knowledge on basics of toxicology, mechanisms and effects of toxicants, biotransformation of toxicants, fundamental aspects of genetic toxicology, screening of genotoxic substances, genetic risk estimation, various assays in genetic toxicology, application of genetic toxicology as well as techniques that are available for their laboratory research. The overall emphasis will be made on cellular and molecular actions of toxicants and their genotoxicity assessment. Students are expected to develop a comprehensive understanding of biochemical and molecular changes caused by environmental chemicals and toxicants.

Text Book :

T: Lesley A. Stanley. (2014). Molecular and Cellular Toxicology: An Introduction. Wiley Blackwell Publishers, New York

Reference Books :

R1: Duffus, J.H. & Worth H.G.J. (Ed.) (2006). Fundamental Toxicology. RSC publishing.

R2: David Brusick. (1980). Principles of genetic toxicology. Plenum Press, New York.

R3: Parry, James M., Parry, Elizabeth M. (Eds.). (2012). Genetic Toxicology: Principles and Methods. Humana Press, New York

R4: Hodgson, E. and Smart, R.C. (2001). Introduction to Biochemical Toxicology, 3rd Ed. Wiley and Sons, New York.

R5: Andor Kocsis and Hajna Molnar (Eds.) (2009). Genotoxicity: Evaluation, Testing and Prediction, Nova Science Publishers, New York

R6: Darrell R., Boverhof and B., Bhaskar Gollapudi (Eds). 2011. Applications of Toxicogenomics in Safety Evaluation and Risk Assessment

Course Plan :

Lecture	Learning objective(s)	Topic(s) to be covered	Book (Chapter)
1-3	Introduction	Exposure to potentially toxic substances/xenobiotics, toxicity testing and dose response	T(1), R1(1), R5(1-2)
4-5	Susceptibility to toxic chemicals/	Xenobiotic biotransformation and metabolism	T(2), R1(2-3), R4 (9-11) R6(1-2)
6-7	In vitro methods to understand xenobiotic metabolism	<i>In vitro</i> methods for Adsorption, Distribution, Metabolism and Excretion (ADME)	T(5), R2 (2-3)
8-9	Genetic toxicology-Introduction	Scope and importance of genetic toxicology and toxicogenetics and toxicogenomics	T(2), R2(1), R5 (1-2) R6(1)
10-11	Fundamentals of genetic toxicology	Basic genetics, cell cycle and chromosome mechanics, DNA alterations and resulting genotoxic effects	T(2), R2(2), R4 (22), R5 (1-2)
12-14	Consequences of genotoxic effects	Gene pool consequences, direct effect of mutagens	T(2), R2(3), R5 (3, 7)
15-18	Screening chemicals/xenobiotics for genotoxic properties	Definition of screening, hazard assessment and risk analysis. Characteristics of adequate screening methods, building test batteries and data analysis & interpretation	T(8), R2(4), R5 (3-4) R(3-4)
19-23	Genetic risk estimation	Factors influencing risk analysis-(genotype, DNA repair capacity, cell type and diet), risk estimation methods for somatic and germ cells and dosimetry issues in risk assessment.	T(8), R2(5), R3 (10-13), R4(23), R5 (10) R6(3-4)
24-27	Gene toxicology lab	Regulatory requirements affecting lab operations, hazardous waste disposal, lab design and containment, personal protection and waste disposal	R2(7), R5 (2) R6(12-14)
28-32	Description of genetic toxicity assays	Common assays for gene mutation, tests for chromosomal aberrations and tests for DNA damage	T(8), R2(8), R3 (2-8), R5 (10)
33-36	Applications of genetic toxicology	Environmental monitoring, occupational monitoring approaches, cytogenetic techniques, immune assays and DNA probes in human health monitoring	T(8-9), R2(6), R3(10, 14,15), R5 (8) R6(5-10)
37-39	Biotechnology research and genetic toxicology	Impact of genetic toxicity testing on biotech products, advanced techniques in genetic toxicology and associated implications in biotech	T(3-4, 6-7), R2(9), R5 (4-5) R6(17)
40-42	Review on application of genetic toxicology in environmental health	Discussion on advances in genetic toxicology for environmental health monitoring	T(10), R2(5), R3 (1), R5 (5,9,11)

Evaluation Scheme :

Evaluation component	Duration	Weightage, %	Date and Time	Nature of the Component*
Test 1	1 Hr.	10%	15.09.2014, 4:00pm	CB
Test 2	1 Hr.	10%	01.11.2014, 4:00pm	OB
Research oriented activities/ Class work[#]	Diverse	25%	Continuous Evaluation	OB
Practical work^{\$}	Diverse	15%	Continuous Evaluation	OB
Comprehensive Examination	3 Hrs.	40%	10.12.2014, 2:00pm	CB

* OB: Open book (50%), CB: Closed book (50%)

This component includes one or more of the following: Literature Survey, Seminars/Presentations, Research Summaries, etc.

\$ This component includes one or more of the following: Design/Development of processes/products/artifacts, Experimental or Quantitative Analysis of processes/products/phenomena, Design of Experiments, etc.

Chamber consultation hour: To be announced in the class.

Grading policy: Award of grades will be guided in general by the histogram of marks. Decision on border line cases will be taken based on individual's sincerity, student's regularity in attending classes, and the instructor's assessment of the student.

Make-up policy: Make-up for Test 1 or 2 will be given only in genuine (medical emergency) cases of absence. If the absence is anticipated, before the examination, prior permission of the Instructor-in-charge is necessary. The request for make-up should reach the Instructor-in-charge at the earliest. Make-ups for class tests/ quizzes and assignments are not given. Also refer to Clause 4.07 of BITS *Academic Regulations* for more details.

Notices: All notices/ announcements regarding this course shall be displayed only in the Course Management System (CMS).

Dr. P. Sankar Ganesh
Instructor In-charge
BIO G661