



INSTRUCTION DIVISION, FIRST SEMESTER 2016 – 2017

COURSE HANDOUT (PART II)

Date: 01.08.2016

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 G525**

Course Title : **ENVIRONMENTAL BIOTECHNOLOGY AND WASTE MANAGEMENT**

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

Instructor : **P. Sankar Ganesh & B. Siva Prasad**

Course Description :

This course gives overall information on the application of biotechnology to the management of environmental problems and for enhanced plant & animal production through biological insecticides, herbicides resistance, mineral cycling, conservation of genetic resources and biological nitrogen fixation. The waste management portion focuses on the use of biotechnological processes for pollution control, bioremediation of toxicants and treatment of domestic and industrial wastes. Ethical issues related to the release of genetically modified organism and the intellectual property rights are also discussed.

Scope and Objectives :

The major objective of this course is to impart knowledge on application of biotechnological processes for the betterment of environment as a whole. This course is designed to make the student understand various biological phenomena, which can be exploited to save environment from eventual deterioration, mainly in terms of waste management.

Text Book :

T: Alan Scragg, ***Environmental Biotechnology***, Oxford University Press, 2009 reprint.

Reference Books :

R1: Rehm H J and Reed G, ***Biotechnology, a comprehensive treatise***, VCH Verlag, Germany, 1999.

R2: A K Chatterjee, ***Introduction to Environmental Biotechnology***, PHI, India, 2000.

R3: Andrew D Eaton, Lenore S Clesceri, Eugene W Rice and Arnold E Greenberg, ***Standard Methods*** – For the Examination of Water and Wastewater, American Public Health Association, 2005.

R4: Raina M Maier, Ian L Pepper and Charles P Gerba, ***Environmental Microbiology***, 2nd Ed., Academic Press, 2009.

R5: Bimal C. Bhattacharyya and Rintu Banerjee, ***Environmental Biotechnology***, Oxford Higher Education, 2007.

R6: Godfrey Boyle, ***Renewable Energy*** – Power for a sustainable future, 2nd Ed, Oxford, Indian Edition, 2011 reprint.

R7: Anjaneyulu Y, ***Introduction to Environmental Science***, BS Publications, 2004.

R8: Laxmi Lal and DK Gupta, ***Composting Technology***, Agrotech Publishing Academy, 2008.

R9: Howard S Peavy, Donald R Rowe, George Tchobanoglous, ***Environmental Engineering***, Mc Graw-Hill International Editions, Civil Engineering Series, 1985.

R10: LL Somani, ***Vermicomposting and Vermiwash***, Agrotech Publishing Academy, 2008.

Course Plan :

Lecture Number	Learning Objectives	Topics to be covered	Reference Chap (Book)
1	Introduction to environmental biotechnology	Basic concept of environment and its components. Biotechnology for environment; definitions and facts.	1(T); 1(R2); 1(R7); 1(R5)
2-3	Environmental pollution	Sources of various pollutions and their environmental impact.	1(T); 12, 13, 14, 15, 16, 17(R7)
4-5	Environmental monitoring	Methods for the measurement of pollution. Physical, chemical and biological methods. Nucleic acid based techniques for analyses of diversity, Concept of biomarkers.	3(T); 5(R2); 4(R5); 8,9,10,11,12, 13(R4)
6-7	Biosensor technology	Principle, types and applications.	3(T); R1
8-9	Basics of microbiology in relation to environment	Microbial groups, characteristics; Microbial metabolism in relation to waste treatment.	2 (T); 3(R2); 2(R4); 3(R5)
10-12	Biotechnology of sewage treatment	Basics of sewage treatment processes. Function of various treatment systems. Microbiology of sewage treatment.	4(T); 4(R2); 24(R4); 5(R9)
13-14	Bioremediation of inorganic pollutants (nitrate and phosphate)	Biological removal of nitrogen and phosphate.	5(T)
15-16	Bioremediation of inorganic pollutants (heavy metals and radionuclides)	Microbial interactions. Metal Toxicity. Molecular mechanism of metal resistance. Biosorption and biotransformation of metals and radionuclides. Recent developments in metal bioremediation.	5(T); 6(R2); 21(R4); R1
17-18	Biomining of metals and radionuclides	Concepts of bioleaching, microbial aspects, regulatory factors and process application.	8(T); 8(R2)
19-22	Bioremediation of organic pollutants	Aerobic and anaerobic degradation of organic pollutants. Principles, biochemical pathways and genetic regulation. Degradation of aliphatic, aromatic, polyaromatic and chlorinated compounds.	5(T); 7(R2); 20(R4); R1
23-25	Phytoremediation	Use of plants for removal of organic & metallic pollutants.	5(T); R1
26-28	Bioreactors	Reactor configuration. Processing and operation. Comparison of different bioreactors.	R1; 6(R5); Class Notes
29-30	Development of clean technology (minimization of waste generation)	Fundamentals of clean technology. Integrated pest management and bio-control of plant diseases. Microbial polymer production and bio-plastic technology.	4(T); Class Notes
31-34	Bioresource technology development	Biotechnology for energy production – basic concept. Biological energy sources and bio-fuels. Biotechnology for enhanced oil recovery.	7(T); 10(R2); 4(R6); 3(R5)
35-37	Bioprocessing of solid waste	Composting, vermicomposting and role of termites in waste processing, Recent developments in waste treatment.	4(T); 10(R2); R8; R10
38-40	Agriculture biotechnology for safe environment	Methods and application for plant and animal improvement. Biotechnology of nitrogen fixation.	9(T)
41-42	Ethical issues in environmental biotechnology	Release of genetically modified organisms	9(T)

Evaluation Scheme :

Theory Portion				
Evaluation component	Duration	Weightage, %	Date and Time	Nature of the Component*
Test 1	1 Hr.	10% (30)	13.09.2016 1:00 to 2:00 PM	CB
Test 2	1 Hr.	15% (45)	21.10.2016 1:00 to 2:00 PM	OB
Research oriented activities/ Class work[#]	Diverse	25% (75)	Continuous Evaluation	OB
Comprehensive Examination	3 Hrs.	30% (90)	08.12.2016 9:00 AM to 12:00 PM	CB
Practical Portion				
Practical/ Record	-	15% (45)	Continuous Evaluation	OB
Comprehensive Examination	1 Hr.	5% (15)	To be announced	OB

* OB: Open book (60%), CB: Closed book (40%)

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

Prof. P. Sankar Ganesh
Instructor In-charge
BIO G525