

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
INSTRUCTION DIVISION
Course Handout (Part II)

03.08.2015

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : **BIO G525**
Course Title : **ENVIRONMENTAL BIOTECHNOLOGY AND WASTE MANAGEMENT**

Instructor-incharge : **Prof. S.K. VERMA**

Instructor : **B.Vani**

Course Description :

Application of biotechnology to the management of environmental problems. Biotechnology for enhanced plant and animal production through biological insecticides, herbicides resistance, mineral cycling, conservation of genetic resources and biological nitrogen fixation. Use of biotechnological processes for pollution control, bioremediation of toxicants and treatment of domestic and industrial wastes. Ethical issues related with the release of genetically modified organism.

Scope and Objectives:

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

Text Book: Environmental Biotechnology by Alan Scragg, Oxford University Press, UK.
2005

Reference Book

RB-1 : Biotechnology, a comprehensive treatise, ed by Rehm H J and Reed G, VCH Verlag, Germany, 1999

Course Plan

| Lecture No. | Learning Objectives | Topics to be covered | Reference Chap./Sec. (Book) |
|--------------------|---|---|------------------------------------|
| 1 | Introduction to environmental biotechnology | Basic concept of environment and its components. Biotechnology for environment; definitions and facts | Chap. 1, TB |
| 2-3 | Environmental pollution | Sources of various pollutions and their environmental impact. | Chap.1, TB |
| 4-6 | Environmental monitoring | Methods for the measurement of pollution. Air, water and soil sampling; Analyses of samples; physical, chemical and biological methods. Nucleic acid based techniques for analyses of diversity, structure and dynamics of microbial community in wastewater treatment, Concept of biomarkers | Chap.3, TB |
| 7-9 | Biotechnology of sewage | Basics of sewage treatment processes. | Chap.4 TB |

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| | treatment | Function of various treatment systems. Microbiology of sewage treatment | |
| 10-11 | Bioremediation of inorganic pollutants (nitrate and phosphate) | Nitrification and denitrification–microbial fundamentals and application. Biological phosphate removal | Chap. 5 TB RB 1 |
| 12-14 | Bioremediation of inorganic pollutants (heavy metals and radionuclides) | Microbial interaction with metallic elements. Metal Toxicity. Molecular mechanism of metal resistance. Biosorption and biotransformation of metals and radionuclides. Recent developments in metal bioremediation. | Chap.5, TB & RB 1, Class notes |
| 15-16 | 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. Recent developments in waste treatment. | Chap.5 TB RB 1, Class Notes |
| 17-18 | Phytoremediation | Use of plants for removal of organic and metallic pollutants | Chap. 5 TB RB 1, Class notes |
| 19-20 | 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 | Chap. 6 TB |
| 21-22 | Nano-biotechnology and Environment | Pros and cons of nano-biotechnology | Class notes |
| 23-25 | Bioresource technology development | Biotechnology for energy production; basic concept. Biological energy sources and bio-fuels. Biotechnology for enhanced oil recovery | Chap. 7 TB |
| 26-29 | Bio-mining of metals and radionuclides | Concepts of bioleaching, microbial aspects, regulatory factors and process application | Chap 8 TB Class Notes |
| 30-32 | Disposal and treatment of medical waste | Sources, health hazards, treatment and disposal technologies | Lecture Notes |
| 33-36 | Biological nitrogen fixation | Importance, mechanism, genetic regulation, organism involved, Application of BNF in agriculture | Lecture Notes |
| 36-38 | Biosensor technology | Principle, types and applications | Chap.3 TB, RB 1, Class Notes |
| 39-40 | Ethical issues in environmental biotechnology | Release of genetically modified organisms | Chap. 9 TB |
| 41-42 | Intellectual property rights and environmental biotechnology | IPR for microorganisms and for environmental biotechnology processes | Class Notes |

Examination Scheme :

| EC No. | Evaluation component | Duration | Date, time & venue | Weightage (%) | Nature of Component |
|---------------|-----------------------------|-----------------|-------------------------------|----------------------|----------------------------|
| 1 | Mid Sem | 90 min | 5/10 10:00 - 11:30 AM | 25 | CB |
| 2 | Assignment | Take Home | | 10 | |
| 3 | Quiz (several) | 20 Min | | 15 | CB |
| 4 | Seminar | -- | | 15 | |
| 5 | Comprehensive Examination | 3.0 hrs | 1/12 AN | 35 | CB + OB |

Chamber Consultation Hour : To be announced**Notices : Notices will be displayed on Biological Science Notice Board**

**Instructor-in-charge
BIO G525**