

**Shree Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
(Autonomous)**

Affiliated to Saurashtra University, Rajkot

**Department of Biotechnology
B. Sc. BIOTECHNOLOGY**

GENERIC ELECTIVE – I

16UBTGE01	Generic Elective I: Green Biotechnology	2hrs/wk	2 Credits
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Objectives:

Upon completion of the course the student will be able to

1. Understand different green alternative offered by biotechnology against toxic chemicals and polluting processes
2. Describe the role of biotechnology in agriculture, environment protection, energy production and biodegradable materials.
3. Discuss the advantages of green biotechnology vs conventional technology
4. List of microorganism involved providing green alternatives

Unit: 1 Introduction to green biotechnology

(4 hrs)

- Introduction to biotechnology
- Introduction to green biotechnology
- Introduction to the use of microbes and GMOs in green biotechnology
- Applications of green biotechnology.
- Biosafety of genetically modified organisms.

Unit: 2 Green agricultural biotechnology

(5 hrs)

- Introduction to bio-fertilizers, bio-fertilizers vs chemical fertilizers
- Mechanisms of action of bio-fertilizers, microbes used as bio-fertilizers

- Introduction to bio-pesticides, bio-pesticides vs chemical pesticides
- Mode of action of bio-pesticides and examples of bio-pesticides
- Genetically modified bio-fertilizers and bio-pesticides

Unit: 3 Green energy using biotechnology

(5 hrs)

- Renewable and non- renewable energy resources.
- Conventional fuel and their impact on environment.
- Solar energy converters and useful features of Biofuels
- Modes of utilization of biomass
- Bioethanol, biogas and bio hydrogen
- Biodiesel microbial recovery of petroleum.

Unit: 4 Green environmental biotechnology

(5 hrs)

- Bio-indicators and biosensors for detection of pollution.
- Introduction to bioremediation - Bioremediation of heavy metal contaminated sites
- Bioremediation of oil and pesticides.
- Biodegradation of xenobiotic compounds
- Bio-mining and bio-leaching of heavy metals: Cadmium, Lead, Mercury, Metal binding targets and organisms, Metal microbial interaction, Biomethylation of elements (Methylation of mercury and arsenic), advantages and disadvantages of bioleaching.

Unit 5: Bio-plastics and bio-materials

(5 hrs)

- Introduction to Bioplastics – Synthetic vs bioplastics
- Types bioplastics
- Microbes used in biodegradable plastics
- GMO's for Biodegradable plastics
- Application of Biodegradable plastics

Reference Books:

1. Alexander N Glazer, Hiroshi Nikaido, W.H.Freeman and Company (1995) Microbial Biotechnology: Fundamental of Applied Microbiology, CambridgeUniversity Press.
2. Bernaral R. Glick and Jack J. Pastemak (1994) Molecular biotechnogy: Principles a nd Applications of Recombinant DNA, ASM Press. Washington, D.C
3. Glick and Jack J. Pastemak (2010) Molecular Biotechnology: Principle and Application of recombinant DNA , ASM Press. Washington, D.C
4. Rehacek Z and Mehta P. (1993) Fungal Ecology and Biotechnogy, Rastogi Publicaions, Meerut, India.
5. Martin Alexander (1999) Biodegradation and Bioremediation, Academic Press, California.
6. Dr. Ajay Singh and Dr. Owen P. Ward (2004) Applied Bioremediation and Phytoremediation, Springer-Verlag Berlin Heidelberg, New york.
7. E.S.Stevens (2001) Green Plastics: An introduction to the new Science of Biodegradable Plastics, Princeton University Press.

GENERIC ELECTIVE - II

16UBTGE02	Generic Elective II: Genetically Modified Organisms	2hrs/wk	2 Credits
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Objectives:

After completion of this course, student will be able to:

1. Describe what GMOs are
2. List out different genetically modified bacteria, fungi, plants and animals
3. Describe the method of gene transfer in organisms
4. Understand the applications and advantages of GMOs
5. Discusses various issues associated with use of GMOs

Unit 1: Introduction to GMOs

(4 hrs)

- What are genetically modified organisms?
- Common vectors used for cloning genes in bacteria, fungi, animals and plants
- Methods of gene transfer in bacteria, fungi, animals and plants
- Screening of transgenics
- Examples of GM bacteria and Fungi and their applications

Unit 2: GMOs in agriculture

(5 hrs)

- History of GM crops
- Traits introduced in plants: Pest resistance, herbicide resistance, nutritional enrichment, stress tolerance and examples of genetically modified plants: BT cotton, BT-Brinjal, Flavr Savr tomato, glyphosate-tolerant soybeans, Golden rice, GM white button mushroom
- Molecular farming
- Advantages and issues associated with use of GM crops
- Status of genetically modified crops in India

Unit 3: Genetically modified animals

(5 hrs)

- History of GM animals

- Examples of GM animals: GM insects, GM frogs, GM fish, GM mammals
- Application of GM animals
- Controversies associated with use of GM animals

Unit 4: GMO in environment

(5 hrs)

- GMOs for bioremediation of contaminated sites
- GMOs for leaching and recovery of metals and oil
- GMOs for biofuel and bioplastics
- GMOs as fertilizers and pesticides

Unit 5: Genetic Technology: Social, Legal and Ethical issues

(5 hrs)

- Pros and Cons of genetic technologies: Genetic screening for any predisposition symptoms, cancer screening, gene therapy, cloning, DNA fingerprinting (paternity and forensics), in vitro fertilization. Misuse of technology
- Social issues: Public opinions against the molecular technologies
- Legal issues: Legal issues associated in use of genetic technologies in some countries
- Ethical issues: Necessity of ethics in use of molecular technologies, overview of ethical committees

References:

1. Parekh, S.R. (2004). The GMO Handbook: Genetically Modified Animals, Microbes, and Plants in Biotechnology. Humana Press. N.Y. USA. ISBN 978-1-61737-482-1
2. Nelson, G.C. (2001). Genetically Modified Organisms in Agriculture: Economics and Politics. Academic Press, USA. ISBN 0-12-515422-4.
3. Thomson, J.A. (2006). GM Crops: The Impact and the Potential. CSIRO Publishing, Australia. ISBN 978 0 64309 160 3
4. Houdebine, L.M. (1997). Transgenic Animals: Generation and use. Harwood Academic Publisher. Netherlands. ISBN 90-5702-068-8
5. Carpi, E. (2011). Progress in Molecular and Environmental Bioengineering - From Analysis and Modeling to Technology Applications. InTech Publication. ISBN 978-953-307-268-5.

6. Tzotzos, G.T. (1995). Genetically modified organisms: a guide to biosafety. International Centre for Genetic Engineering and Biotechnology, C.A.B. International CAB International, U.K.