BTC DSC 453(A)T
MEDICAL BIOTECHNOLOGY

Contact Hours: 45
Full Marks = 100 [ESE (70) CCA (30)]

Course Objectives: This course aims to provide students with a comprehensive understanding of medical biotechnology, including gene editing techniques, vaccine development, biopharmaceuticals, and diagnostic methods. It also explores emerging technologies like nanomedicine and AI in healthcare. By the end of this course, students should have a solid grasp of the role of biotechnology in healthcare, ethical considerations, and how it impacts personalized medicine.

UNIT 1 *(8 Lectures)*

Introduction to medical biotechnology: role of biotechnology in healthcare; ethical, legal, and social considerations in medical biotechnology. **Gene editing in medicine:** gene therapy and its applications; CRISPR-Cas9 and genome editing; genetic counselling.

UNIT 2 *(9 Lectures)*

Introduction to vaccines: history of vaccines; basic concept of immunity and immunization; types of vaccines (live attenuated, inactivated, subunit, mRNA and DNA vaccines); mechanisms of vaccine action. **Vaccine development:** preclinical testing and animal models; clinical trials (phase I, II and III).

UNIT 3 *(10 Lectures)*

Biopharmaceuticals and therapeutic proteins: monoclonal antibodies and their applications; therapeutic proteins and their role in medicine; challenges in biopharmaceutical development. **Diagnostic techniques in medical biotechnology:** Single Nucleotide Polymorphism (SNP) genotyping techniques; serological tests and immunoassays; point-of-care diagnostics; role of biotechnology in early disease detection.

UNIT 4 *(8 Lectures)*

Stem cell therapy and regenerative medicine: types of stem cells and their properties; applications of stem cell therapy in medicine; ethical and safety considerations in stem cell research; regenerative medicine and tissue engineering.

UNIT 5 *(10 Lectures)*

Pharmacogenomics and personalized medicine: pharmacogenomics and its significance in drug development; tailoring drug therapies based on genetic information; challenges and ethical considerations in personalized medicine. **Emerging technologies in medical biotechnology:** nanomedicine and its applications; artificial intelligence and machine learning in healthcare; 3D printing and biofabrication.

Course Outcomes: *Upon completion, students will be able to analyze the ethical, legal, and social aspects of medical biotechnology. They will understand gene editing methods such as CRISPR-Cas9, the history of vaccines, and vaccine development stages. Students will also comprehend the role of monoclonal antibodies, diagnostic techniques, and the potential of stem cell therapy. They'll explore the ethical dimensions of stem cell research and appreciate emerging technologies in healthcare, including nanomedicine, artificial intelligence, and 3D printing.*

SUGGESTED READING

1. Glick, B. R. (2020). Medical Biotechnology. United States: Wiley.
2. Khan, F. A. (2014). Biotechnology in Medical Sciences. United Kingdom: Taylor & Francis.
3. Nag, M., Joshi, S., Mukherjee, S. (2022). Contemporary Medical Biotechnology Research for Human Health. Netherlands: Elsevier Science.
4. Godbey, W. (2014). An Introduction to Biotechnology: The Science, Technology and Medical Applications. Netherlands: Elsevier Science.
5. Ahmed Hotiana, M. (2018). The Future of Medical Biotechnology: Use of Techniques Like Stem Cell Therapy and Monoclonal Antibodies for Medical Purposes. Germany: GRIN Verlag.