

Nanomedicine (MMD-895)

Credit Hours 3 (3-0)

Course Description

Nanomedicine is the application of nanotechnology to medicine. It is a rapidly expanding interdisciplinary field that seeks to develop new and improved techniques for the screening, diagnosis, treatment, and prevention of disease. Today, nanomedicines are used globally for patients suffering from a range of disorders including ovarian and breast cancer, kidney disease, fungal infections, elevated cholesterol, menopausal symptoms, multiple sclerosis, chronic pain, asthma and emphysema.

This introductory course provides an overview of the distinctive features of nanotechnology and its applications in medicine. Cutting-edge research in disease screening, diagnosis, treatment, and prevention will be discussed. Students will be exposed to clinical technologies, as well as those still under development.

Educational Objective

- The potential benefits and challenges of nanomedicine
- How is nanomedicine currently being used to treat patients?
- What are the building blocks of nanomedicine?
- How do they provide unique & distinctive functions in the body?
- How can we customize nanomedicine solutions for specific diseases?
- How do we demonstrate that nanomedicine is both safe and effective?

Course Outcomes

- Identify and articulate examples of medical problems amenable to nanomedicine solutions
- Compare and contrast existing nanomaterial designs and their ability to perform specific functions
- Analyze how cellular and physiological phenomena will impact nanomaterial success
- Recognize that meeting the challenges of nanomedicine requires the coordinated efforts of interdisciplinary teams

Course Contents

1. Nanomedicine and personalized nanomedicine
2. Nanoscale
 - Nanotechnologies
 - Role of Nanotechnology in Medicine
3. Nanopharmaceuticals
4. Designing Nanocarriers for Drug Delivery
 - Introduction
 - Sizes, Shapes and Advantages of Nanomaterials
 - Bioconjugation Strategies
 - Carbon Nanotubes
 - Drug Targeting
 - Future Perspectives
5. Nanoparticles-Based Carriers for Gene Therapy and Drug Delivery
 - Introduction
 - Targeted Delivery
 - Conclusion
6. Organic Nanoparticles
 - Polymeric Nanoparticles: Synthetic Polymer-Drug Conjugates
 - Dendrimer-Based Nanomaterials
 - Combinatorial Polymer and Lipidoid Libraries for Nanomedicine
 - Lipid-Based and Other Organic Structures: Liposomal Nanomedicines
7. Inorganic Nanoparticles
 - Metal and Metal Oxides Based Nanoparticles
 - Cyclodextrin-Based Nanoengineered Drug Delivery System
8. Nanomedicinal approaches for Diabetes Management
 - Treatments for Diabetes
 - Why the Interest in Nanomedicine Research?
 - The Vision of Nanotechnology and its Clinical Applications for Diabetes
9. Nanomedicine as a Business Venture
10. The Impact of Nanopharmaceuticals on Healthcare and Regulation
11. Challenges to Nanomedicine

Recommended Books

1. Mishra, A. K. (Ed.). (2013). *Nanomedicine for drug delivery and therapeutics*. John Wiley & Sons.

2. Ge, Y., Li, S., Wang, S., & Moore, R. (Eds.). (2014). *Nanomedicine: Principles and perspectives*. Springer.
3. Kohonen, T., Schroeder, M. R., Huang, T. S., & Maps, S. O. (2001). Springer-Verlag New York. *Inc., Secaucus, NJ, 43(2)*.