

Credit: 3-0-0-3Approval: Approved in 8th Senate**Prerequisites:** - IC 136 - Understanding Biotechnology & its Applications or Consent of Faculty member**Students intended for:** 3rd and 4th year UG and PG**Elective or Compulsory:** Elective**Semester:** Odd/Even

Course Preamble: This course deals with a relatively newer field of research, which has been growing exponentially since the start of the twenty first century. The field focuses primarily on the programming and engineering of DNA secondary structures at the nanometer scale which could have several chemical, biological, computational and electronic applications. The course will consist of a series of lectures in conjunction with a series of presentations of recent papers in the field.

Course Outline:**Module 1 [6 Lectures]**

DNA: Brief history about the discovery of the structure of DNA, Concept of DNA helix, Structural features of DNA and its distinction with RNA, Basic concept of gel electrophoresis, DNA amplification and ligation.

Module 2 [6 Lectures]

Structural DNA nanotechnology: Four arm junction, double crossovers, DNA arrays and Lattices, 3D structure- cube, tetrahedron, dodecahedron octahedron, pyramid, DNA origami.

Module 3 [10 Lectures]

Dynamic DNA nanotechnology: Reconfigurable DNA based structures, DNA nanomechanical devices, DNA nanomotors, DNA aptamers, DNA walker, DNA Tweezer, DNAzyme – structure function and applications, DNA nanotransport device, molecular cages

Module 4 [10 Lectures]

DNA based logic gates: AND, OR, NOT, XOR, NAND gates, Single and multiple input DNA logic gates, Circular logic gates, DNA Circuits, DNA computing.

Module 5 [10 Lectures]

DNA directed Assembly of metal, semiconductor nanoparticles and nanoclusters. DNA Scaffolding, DNA nanorobot, Application of DNA assembled structure in chemical, biological and molecular sensing, DNA-based drug and gene delivery, Future Applications.

Text & Reference Books:

A nascent textbook mentioned below will be used as appropriate and several recent articles from peer reviewed journals like *Nature*, *Science*, *Nature Nanotechnology*, *ACS Nano*, *Nanoletters* etc. in the field of DNA nanotechnology will be discussed. The course material will be provided.

1. DNA Nanotechnology – From Structure to Function, Edited by *Chunhai Fan*, Springer-Verlag Berlin Heidelberg, 2013, ISBN 978-3-642-36076-3.
2. DNA Nanotechnology: Methods and Protocols, Edited by *Giampaolo Zuccheri* and *Bruno Samorì*, Humana Press, Springer Science+Business Media, LLC, 2011, ISBN 978-1-61779-142-0.