Unit II: Mechanisms of immunity (8 hours)

Humoral and cell-mediated immunity, antigen and antibody interaction, antibody structure and classification, Ag-Ab complex and clearing

Unit III: Tools and Techniques related to Immunology (8 hours)

Western blotting, Immunoprecipitation, Immunolocalization, ELISA, Immunodiffusion, Rocket Electrophoresis, DOPE test, production and purification of monoclonal and polyclonal antibodies, applications.

Unit IV: Emerging pathogens and host-pathogen interactions (8 hours)

New pathogens and diseases, single chain antibody engineering, AIDS, cancer and other disease immunity

Practical components **(30 hours)**

1. Blood smear preparation and staining
2. Immunodiffusion demonstration
3. ELISA test
4. Western blotting
5. Immunoprecipitation
6. Pregnancy test (Simulation experiment)

Essential/recommended readings

1. *Kuby Immunology*, Owen and Punt, W. H. Freeman & Company, 7 edition, 2013.
2. *Microbiology: an introduction*, Tortora et al., Benjamin Cummings, 11 edition 2012.
3. *Immunology and Immunotechnology*, Ashim K Chakravarty, , O.U. P, 1 edition, 2006.
4. *The Biology of Cancer*, Robert Weinberg, Garland Science

Generic Elective: (GE)

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)	Department offering the course
		Lecture	Tutorial	Practical/ Practice			
Devices and Nanotechnology (GE)	**4**	**3**	**1**	**0**	**Class XII pass**	**Functional knowledge on electronics and**	**Physics/Electronics faculty of CIC**

						circuit analysis	

Course Objective

This module provides interactive learning of nano-science and its applications. It emphasizes learning in material science, medical, photonics, optical, electronic and magnetic devices at nanoscale. It intends to enlighten about identification, fabrication and characterization of nano based devices.

Course Learning Outcomes:

• For students, this course on devices and nanotechnology becomes very important, as this exposes them to the most versatile and interdisciplinary world of nanotechnology, which is emerging as a branch having its relevance in various fields like medical, biotechnological, industrial, forensic science, material science etc.

• Students would be exposed to the relevant concepts of nanomaterials, their identification and characterization along with studying their applications in optical, electronic and magnetic devices.

• Nano based devices and sensors are a major attraction for students, because this not only makes them understand about the basic principles related to them, but it also inculcates the skills among students, which are required to develop nano-based formulations or devices as a whole.

Keywords: Optical devices; Nanoscale photonic devices; Sensor Technology; Nanoscale CMOS design

Unit I: Optical devices, electronic devices, liquid crystal and magnetic devices and their functionalitySpintronic devices (including spin valves and MRAM devices) - Nanoscale semiconductor electronic devices - CMOS at sub-15nm gate length, Carbon nanotubes, III-V and wide-bandgap devices - Devices for quantum computing **(12 hours)**

Unit II: Nanoscale photonic devices - Basic properties of liquid crystals - Molecular properties of the organic materials and their use in current production and research level electronic devices - Thin Films Growth and Epitaxy, Characterization of Nanomaterials **(9 hours)**

Unit III: Introduction to Sensor Technology - CMOS scaling challenges at nanoscale regimes - Device technologies for sub 100nm CMOS - Device scaling and ballistic MOSFET **(12 hours)**

Unit IV: Nanoscale CMOS design, Nanoscale circuits - Non classical CMOS **(9 hours)**

References

1. Nanotechnology for Electronic Materials and Devices, Korkin, A.; Gusev, E.; Labanowski, J.K.; Luryi, S. Springer, 2007

2. Electronics Composite -Modeling, Characterization, Processing, and MEMS Applications-Minoru Taya, Cambridge University Press, 2008

3. Nanotechnologies for Future Mobile Devices - Tapani Ryhänen, Mikko A. Uusitalo, Olli Ikkala, Asta Kärkkäinen, Cambridge University press, 2010

4. High-Speed Heterostructure Devices From Device Concepts to Circuit Modeling - Patrick Roblin, Hans Rohdin, Cambridge University press, 2006