15P1WPH213 Semiconducting Luminescent Materials

Subject Code	**15P1WPH213**	
Subject Name	**Semiconducting Luminescent Materials**	
Credits	**3**	**Contact Hours: 03**

Module No.	**Subtitle of the Module**	**Topics**
1.	**Principles of Photoluminescence**	Introduction; Photoluminescent solid systems; classification of crystalline solids; density of one-electron states; intrinsic semiconductors; Doped semiconductors; Direct gap and indirect gap semiconductors; excitation in insulators and large band gap semiconductors; Radiative transition in pure semiconductors; optical behavior of doped semiconductors; Radative transitions across the band gap; Non radiative processes; p-n junctions.
2.	**Narrow-Gap semiconductors**	Introduction; Narrow gap semiconductor materials; Photoconductive detectors; Photovoltaic detectors; Focal plane arrays.
3.	**Solid state lighting**	Introduction; Low brightness applications; High brightness applications; lattice mismstched strain free materials; Physics of solid state light emiiting diodes; solid stste lamps; future outlook.
4.	**Fundamentals of the quantum confinement effect**	Introduction to quantum dots; Hierarchies of theory; Particle in a sphere; Multiband effective mass approximation approach; Atomistic approaches; Ptredeictions and limitations of the approaches; Dynamical and higher order processes: Hot Exciton relaxation dynamics; Multiple exciton structures, Recombination and generation.
5	**Selenide and sulfide quantum dots**	Optical properties: Introduction; Colloidal nanocrystals photoluminescence; Quenching by surface states; Ligand-nanocrystal binding constants; Nanocrystal photolouinescence quenching by charge and energy transfer; nanocrystals interband charge relaxation; nanocrystals photoluminescence intermittency.
6	**Photoluminescence spectroscopy of single semiconductor nanoparticle**	Introduction; Single molecule fluorescence spectroscopy; Photoluminescence of single semiconductor nanoparticles; Photoluminescence of doped semiconductor nanoparticles; Interfacial electron transfer of single semiconductor nanoparticle.
7.	**Biological applications of**	Introduction; Materials; Solubilization; Functionalization; Toxicity; Limitations ***Biological applications:*** Cellular labeling; Single

	photoluminescent semiconductor quantum dots	quantum dot tracking; Intracellular delivery and therapeutics; FRET based biosensing; In vivo deep tissue Imgaing.

Recommended Reading (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)	
1.	Fundamentals of semiconductors: Physics and Materials properties, Peter Y. Yu and Manuel Cardona, Springer
2.	Principles of fluorescence spectroscopy, Lakowicz, springer
3.	Learning Bio-Micro-nanotechnology, Mendelson, CRC Press
4.	Handbook of Luminescent semiconductor materials, Bergman and Mchale (EDs), CRC Press
5.	Nanomedicine, Kardan, Chen and Xie, Wiley