PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
*Autonomous*
Siddhartha Nagar, Vijayawada–520010
*Re-accredited at 'A+' by the NAAC*

# INTRODUCTION TO NANOMATERIALS (Openelective)

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| Offered to : M.Sc.(PHYSICS) | Course Code : 22OE3PH2 |
| Course Type : openelective (OE) | Course : Introduction to Nanomaterials |
| Year of Introduction : 2021 | Year of offering : 2022 |
| Year of Revision : 2021 | Percentage of Revision : Nil |
| Semester : III | Credits : 4 |
| Hours Taught: 60 hrs. per Semester | Max.Time : 3 Hours |

**Course Description:**

Introduction to Nanomaterials course is a broad and interdisciplinary one, which describes the different physical and chemical methods for synthesis of different nanostructures and their characterization through various tools and their applications in diverse fields.

## Course Objectives:

1. To understand the structure of nanomaterials.
2. To understand the chemical synthesis of nanomaterials
3. To learn the physical methods of preparation of nanomaterials.
4. To Understand the applications of nano carbons.
5. To learn the thenano device fabrication.

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**CourseOutcomes:**Attheendofthiscourse,studentsshouldbeableto:

CO1: Explain the size and shape dependent properties of nano particles and change in their functional properties.
CO2:Synthesizenano particles by some physical methods
CO3:Synthesizenano particles by some chemical methods
CO4:Fabricate the nanodevice structures using nanocarbon and use them for different applications
CO5: Fabricate the device structures using lithographic techniques

| CO-POMATRIX | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **CO-PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
| 22OE3PH2 | **CO1** | H | | | | | M | L |
| | **CO2** | H | | | | | M | L |
| | **CO3** | H | | | | | M | L |
| | **CO4** | H | | | | | H | L |
| | **CO5** | H | | | | | H | L |

| Syllabus | | |
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| **Unit** | **LearningUnits** | **Lecture Hours** |
| I | **IntroductiontoNanomaterials**<br>Introduction and origin of Nanomaterials –Zero, One and Twodimensional NanomaterialsQuantum confinement, Density of states, Dependence of dimensionality - Physical and chemicalproperties. | 8 |
| II | **SynthesisofNanomaterials-ChemicalMethods**<br>IntroductiontoBottom-upandTop-downapproachesSol-GelProcess–Self-assembly–Electrodeposition–SprayPyrolysis–FlamePyrolysis–MetalNanocrystalsbyReduction–SolvothermalSynthesis–PhotochemicalSynthesis–CombustionMethod–ChemicalVaporDeposition(CVD) | 8 |
| III | **SynthesisofNanomaterials-PhysicalMethods**<br>Ball Milling – Inert Gas Condensation Technique (IGCT)–Thermal evaporation–Pulsed LaserDeposition(PLD)–Sputtering– MolecularBeamEpitaxy(MBE)–Microlithography–Etching. | 8 |
| IV | **Nano-Carbon**<br>Carbonmoleculesandcarbonbond-C60:Discovery,SynthesisandstructureofC60-Superconductivity in C60 - Carbon nanotubes: Fabrication – Structure – Electrical properties – Vibrational properties–Mechanical properties–Applications (fuel cells,chemical sensors,catalysts). | 8 |
| V | **NanoDevices**<br>Introduction – Nanofabrication – Photo-Lithography – Pattern transfer –Introduction to MEMS -Single Electron Transistor – Solar Cells –Dye sensitized solar cells - Light Emitting diodes – GasSensors –Microbatteries-Fieldemissiondisplaydevices–FuelCells. | 8 |

**ReferenceBooks:**


1. Nanomaterials:Synthesis,Propertiesand Applications–EditedbyA.S.EdelsteinandR.C.Cammarata,InstituteofPhysics Publishing,2002.
2. IntroudctiontoNanotechnology–CharlesP.PooleJrandFrantJ.Owens,WileyInterscience,2003.
3. NanopracticlesfromTheoryto Applicationsedited byGunterSchmid,WileyVCH,2004.
4. NanoelectronicsandNanosystemsbyK.Goser,P.GlosekotterandJ.Dienstuhl.(Springer).
5. NanoscienceandNanotechnology(TataMcGrawHill, NewDelhi, 2012)T.Pradeepetal.,.
6. NanoscaleScienceandNanotechnology(John-Wiley&Sons,Chichester,2005)byR.W.Kelsall,I.W.HamleyandM.Geoghegan,
7. NanostructuresandNanomaterials(ImperialCollegePress,London, 2004) byG. Cao,. M.Wilson,K.Kannangara,G.Smith,M.Simmons,B.Raguse,Nanotechnology:BasicScienceandEmergingTechnologies(OverseasPress,New Delhi,2005).