Shivaji University, Kolhapur.

Revised Syllabus For

M. Sc. I of B. Sc. – M. Sc.Nanoscience and Technology(5 year integrated), Part IV, Semester VII & VIII

to be implemented from the academic year 2018-19

(June 2018) onwards.

SHIVAJIUNIVERSITY,KOLHAPUR

SNST–701T

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VII

Titleofthepaper:SemiconductorPhysics

UnitNumber	**Totalcredit:3**	**No.oflectures**
I)	**EnergyBandsandChargeCarriersinSemiconductors:** Bondingforcesandenergybandsinsolids,DirectandIndirectsemiconductors,variationofenergybandswithalloycomposition,Chargecarriersinsemiconductors:electronsandholes,effectivemass,intrinsicandextrinsicmaterials,electronsandholesinquantumwells,TheFermilevel,carrierconcentrationatequilibrium,temperaturedependence,spacechargeneutrality,conductivityandmobility,Driftandresistance,effectsoftemperatureanddopingonmobility,Highfieldeffects.	**12**
II)	**ExcessCarriersinSemiconductors:** Opticalabsorption,Luminescence,Directrecombinationofelectronsandholes,Indirectrecombinationandtrapping,steadystatecarriergenerationandQuasiFermilevels,Diffusionprocesses,DiffusionandDriftofcarriers,built-infields,Thecontinuityequation,steadystatecarrierinjection,diffusionlength,TheHaynes-Shockleyexperiment.	**13**
III)	**Junctions-I:** Fabricationofp-njunctions;Thermaloxidation,diffusion,Rapidthermalprocessing,Ionimplantation,CVD,Photolithography,etching,metallization,Thecontactpotential,Spacechargeatajunction,qualitativedescriptionofcurrentflowatajunction,Carrierinjection,reverse-biasbreakdown,ZenerandAvalanchebreakdown	**10**
IV)	**Junctions-II:** Capacitanceofp-njunctions,theVaractordiode,effectsofcontactpotentialoncarrierinjection,recombinationandgenerationinthetransitionregion,ohmiclosses,gradedjunctions,shottkybarriers,rectifyingcontacts,ohmiccontacts,heterojunctions,AlGaAs-GaAsheterojuction.	**10**

ReferenceBooks:

1.SolidstateelectronicdevicesbyB.G.Streetman.2.Phy
sicsofsemiconductordevicesbyS.M.Sze.
3.SolidStateandSemiconductorPhysicsbyMcKelvey.
4.PrinciplesofElecronicMaterialsandDevicesbyS.O.Kasap

SHIVAJIUNIVERSITY,KOLHAPUR

SNST–702T

School of Nanoscience and Technology,

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I, Semester – VII

Title of the paper:Carbonaceous materials

Unit Number	Total credit: 3	No. of lectures
I)	**Graphene:** Introduction of graphene: Definition and structure of graphene, Types of graphene: stacking AA, BB, AB dispersion relation, Single layer, Bi-layer, Few layer graphene; Properties of graphene; Optical: thickness dependency, optical conductivity, electric filed tunable transparency, plasmons and polaritons, carrier multiplication; Electrical: Boltzmann equation, ambipolar conduction, density of states and doping (electrostatic and chemical), quantum hall effect, Klein tunneling, diamagnetism, magnetoresistance and spin current; thermal conductivity; Mechanical; Surface phenomenon. **Characterization of graphene:** Transmission electron microscopy (TEM), Scanning tunneling microscopy (STM), Raman Spectroscopy, Electrical measurements: electric field effect, temperature dependent resistivity measurement.	12
II)	**Synthesis Methods of graphene:** Epitaxial growth of graphene on Silicon carbide, Chemical vapour deposition (CVD) growth of graphene films, Chemically derived graphene, Synthesis of graphene oxide: Hummer's method, Modified Hummer's method, Reduction of graphene oxide: Chemical methods and Physical methods, Electrochemical exfoliation, Nanotube slicing from solid state carbon sources. **Applications of graphene:** Graphene in the energy application: Li-ion batteries, Supercapacitors, Photovoltaic, Radio-frequency transistor, Photodetector, Modulator, Mode locked lasers; Other applications of graphene: Anti-corrosion coating, Anti-bacterial coating, catalyst, Sensors, Transparent Conductors.	13
III)	**Carbon Nanotubes:** Introduction of Carbon Nanotube (CNT): Definition of CNT, Bonding of carbon atoms, SP^3, SP^2, Deformed SP^2, Structure of Carbon Nanotubes, Chiral Vector; Types of Carbon nanotubes: Armchair, Zig-Zag and Chiral; Properties of Carbon Nanotubes: Electronic, Optical and Optoelectronic, Mechanical, Chemical and Electrochemical, Thermal and Thermoelectric; Opening, wetting and filling, doping, intercalation.	10
IV)	**Synthesis Methods and Growth Mechanisms of Carbon Nanotubes:** High temperature methods: Arc discharge, General technical features of the production process, Growth Mechanism, Laser Ablation of Graphite; Low temperature method: Chemical Vapour deposition (CVD) process, Vapour liquid solid model, Catalytic role. **Purification and functionalization:** Methods of Purification, Methods of	10

	Functionalization (Chemical and Physical), Advantage of purification and functionalization, Separation of carbon nanotubes based on chirality: semiconducting, metallic; **Applications of Carbon nanotubes:** Field emission, Li-ion battery, Supercapacitor, Sensors, Solar cell, CNT-polymer composite and avionics EM shielding.	

ReferenceBooks:

1)Graphene:CarboninTwoDimensions,byMikhailI.Katsnelson(http://www.amazon.com/Graphene-Dimensions-Mikhail-I-Katsnelson/dp/0521195403)

2)PhysicsofGraphene,Editors:**Aoki**,Hideo,**S.Dresselhaus**,Mildred(Eds.)http://www.springer.com/in/book/9783319026329

3)Graphene:Synthesis,Properties,andPhenomena,byC.N.R.Rao(Editor),AjayK.Sood(Editor),
http://www.amazon.com/Graphene-Synthesis-Properties-Phenomena-Rao/dp/3527332588/ref=pd_sim_b_2?ie=UTF8&refRID=1BE9W35KXA6TXMMMXVEP

4)GrapheneNanoelectronics,Metrology,Synthesis,PropertiesandApplications,Editors:**Raza**,Hassan(Ed.)
http://www.springer.com/in/book/9783642204678

5)GrapheneNanoelectronics:FromMaterialstoCircuits,Editors:**Murali**,Raghu(Ed.)http://www.springer.com/in/book/9781461405474

6)CarbonNanotubeandGrapheneDevicePhysics,byH.-S.PhilipWong(Author),DejiAkinwande(Author)
http://www.amazon.com/Carbon-Nanotube-Graphene-Device-Physics/dp/0521519055%3FSubscriptionId%3D1VXT0MZ5J2QQ5RY3VV02%26tag%3Dgrapheneinfo-20%26linkCode%3Dxm2%26camp%3D2025%26creative%3D165953%26creativeASIN%3D0521519055

7)CarbonNanotubeElectronics(IntegratedCircuitsandSystems)byAliJavey(Editor),JingKong(Editor),
http://www.amazon.com/Nanotube-Electronics-Integrated-Circuits-Systems/dp/0387368337%3FSubscriptionId%3D1VXT0MZ5J2QQ5RY3VV02%26tag%3Dgrapheneinfo-20%26linkCode%3Dxm2%26camp%3D2025%26creative%3D165953%26creativeASIN%3D0387368337

8)Polymer-GrapheneNanocomposites,**Editor(s):**VikasMittalhttp://pubs.rsc.org/en/content/ebook/978-1-84973-567-4#!divbookcontent

9)**PhysicsandChemistryofGraphene:GraphenetoNanographene,**ToshiakiEnoki,TsuneyaAndo.
http://www.crcpress.com/product/isbn/9789814241489

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VIII

Titleofthepaper:FunctionalNanomaterials

UnitNumber	**Totalcredit:3**	**No.oflectures**
I	**Semiconductorquantumdots:**Growthmechanism,shapeandcompositioncontrolofsemiconductornanocrystals,Synthesisofsemiconductornanocrystalsinorganicsolvents,Aqueoussynthesisofsemiconductornanocrystals,Multishellsemiconductornanocrystals,Layer-by-layer(LBL)assemblywithsemiconductornanoparticlesandNanowires,FluorescencespectroscopyofsingleCdSenanocrystals,Applicationsofquantumdotsinbiomedicine	**12**
II	**Nanotubesandnanowires:**Fabrication of TiO_2 NanotubeArraysbyElectrochemicalAnodization:FourSynthesisGenerations,MaterialPropertiesof TiO_2 NanotubeArrays:Structural,Elemental,Mechanical,Optical,andElectrical,Applications,BoronNitrideNanotubes:SynthesisandStructure,One-DimensionalSemiconductorandOxideNanostructures,Inorganicnanowires	**10**
III	**NanofibersandMetalOxideFrameworks**:Introduction,TheElectrospinningProcess,KeyProcessingParameters,NanofiberYarnsandFabricsFormation,PotentialApplicationsofElectrospunFibers,NanofibersforTissueEngineeringScaffolds,NanofibersforChemical/BioProtectiveMembranes,NanocompositeFibersforStructuralApplications.MetalOxideFrameworks,definitions,advantages,disadvantages,methodsofsynthesis,StructuraloriginalityofMOFs,properties,Applications	**10**
IV	**Polymernanocomposites:**IntroductionandreviewofPolymer,IntroductiontoBlockcopolymers,Propertiesofpolymers;solid,glasstransitiontemperature,crystalline-meltingtemperature,thermaltransitions,viscoelasticityandrubberelasticity.Polymeradditives:plasticizers,fillersandreinforcement:Polymerblends,toughenplasticsandphaseseparatedblends.Polymercomposites:mechanicalpropertiesandcompositefabrication. Introductiontopolymernanocomposites:Basicmaterialsforpolymernanocompositetechnology.Fabricationtechniques:Solutionintercalation,meltintercalation,rollmilling,emulsionpolymerization,in-situpolymerizationandhigh-shearmixing. Characterizationofpolymernanocomposites,	**13**

	Propertiesofpolymernanocomposites:Thermoplasticnocomposites,ThermosetNanocomposites,ElastomerNanocomposites. Applicationsofpolymernanocompositesin:hightemperature,paintformulation,Automobiles,Aerospace,InjectionMoldedProducts,Coatings, Adhesives, Fire-retardants, Packaging Materials,Microelectronic Packaging, Optical Integrated Circuits,	

ReferenceBooks:

1)TiO_2 NanotubeArrays:Synthesis,Properties,andApplicationsbyCraigA.GrimesandGopal K.Mor,SpringerPublisher

2)NanotubesandNanofibers;AdvancedMaterialsSeries,SeriesEditor:YuryGogotsi,Drexel University,Philadelphia,Pennsylvania,USA,NanotubesandNanofibersbyYuryGogotsi

3)Hybridporoussolids:past,present,futurebyGerardFerey,ChemicalSocietyReviews,37(2008)191-214.DOI:10.1039/b618320b

4)SemiconductorNanocrystal,QuantumDots:Synthesis,Assembly,SpectroscopyandApplicationsbyAndreyL.Rogach(Ed.),SpringerPublisher

5)NanotubesandNanowires,CNRRaoandGovindraj,RSCPublishers6)Quantumwell,wiresanddots,PaulHarison,WileyPublisher

7)JoelR.Fried;PolymersScienceandTechnology,Prentice-HallofIndiaPvt.Ltd.New Delhi,2002.

8)VasantR.Gowariker,N.V.Viswanathan,JayadevSreedhar;PolymerScience,NewAgeInternationalPvt.Ltd.,NewDelhi,Reprint2005.

9)JosephH.Koo,PolymerNanocomposites:Processing,Characterization,and Applications,McGraw-Hill,NewDelhi,2006.

10) SuprakasSinhaRayandMostoBousmina,PolymerNanocompositesandTheir Applications,AmericanScientificPublishers,2006.

11)S.C.TjongandY.-W.Mai,PhysicalPropertiesandapplicationofpolymer nanocomposites,AvolumeinWoodheadPublishingSeriesinCompositesScience andEngineering,2010.

12)F.Gao,AdvancesinPolymerNanocomposites,AvolumeinWoodheadPublishing SeriesinCompositesScienceandEngineering,2010.

SHIVAJIUNIVERSITY,KOLHAPUR

SNST-704T

SchoolofNanoscienceandtechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VII

Titleofthepaper:Nanocoatingsand A**pplications**

UnitNo.	Credits-3	No.OfLectures
I	**IntroductiontoNanocoatings:**WhyGoNano?OrNeedofNano,AGreatFuturefor Nanocoatings,FindingthePerfectSolvent,ApplicationsofNanocoatings. **Anti-fingerprintNanocoatings:**Introduction,TypesofAnti-fingerprintNanocoatings,Applicationsofanti-fingerprintcoatings. **Anti-corrosionNanocoatings:**Introduction,Principleofprevention&protectionof Corrosion,AdvantagesanddisadvantagesofAnti-corrosionNanocoatings,Advancedprotectivecoatingsforaeronauticalapplications	10
II	**Self-cleaningSol-GelNanocoatings:**Introduction,lotuseffect,Self-CleaningGlasses,Self-cleaningsmartnanocoatings,ApplicationsofSelf-cleaning(bionic&photocatalytic)Sol-GelNanocoatings. **Anti-fouling&easytocleanNanocoatings:**Introduction,ApplicationsofAnti-fouling&easytocleanNanocoatings. **Abrasion&wearresistantNanocoatings:**Introduction,Necessityofabrasion&wearresistantnanocoatings,ApplicationsofAbrasion&wearresistantNanocoatings.	10
III	**Anti-icingNanocoatings:**Introduction,Needofanti-icingnanocoatings,ApplicationsofAnti-icingNanocoatings. **ThermalbarrierandflameretardantNanocoatings:**Introduction,ApplicationsofThermalbarrierandflameretardantNanocoatings. **Anti-microbialNanocoatings:**Introduction,Nano-CoatingUseAgainstSARSVirus,ApplicationofAgNanoparticlesasAntibacterialCoating,UsingTiO_2Nano-ParticlestoDecreaseEnvironmentalContaminations,	12
IV	**UV-resistantNanocoatings:**Introduction,NecessityofUV-resistantnanocoatings,TypesofUV-resistanceNanocoatings,Applicationsofhydrophobicnanocoatings. **ConductiveNanocoatings:**Introduction,NecessityofConductiveNanocoatings,Conductivityfundamentals,CoatingBuild-Up,Controlofoptoelectronicproperties,MethodsofCoatingsCharacterization, PropertiesofCoatings,Applicationsofconductivenanocoatings. **SuperhydrophobicNanocoatings:**Introduction,BiomimicSuperhydrophobicSurface,Applicationsofhydrophobicnanocoatings.	13

ReferenceBooks:

1. **Nanocoatings:Principlesandpractice**Byst evenabbottandNigelHolmes
2. **NanocoatingsandUltraThinFilms** ByAbdelsalamHamdyMakhloufandIonTiginyanu**3.Na nocoatingsSizeEffectinNanostructuredFilms** MahmoodAliofkhazraei
4. **TheScienceandEngineeringofThermalSprayCoatings**LechP awlowski
5. **TheHandbookofNanomedicine**Kew alK.Jain
6. **Opticalthinfilmsandcoatings**Angela PiegariandFrançoisFlory
7. **BioinspiredIntelligentNanostructuredInterfacialMaterials**LeiJi angandLinFeng

SHIVAJIUNIVERSITY,KOLHAPUR

SNST–705T

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VII

Titleofthepaper:Nanobiotechnology

UnitNumber	Totalcredit:3	No.oflectures
I	**Biological synthesis of nanomaterials and their applications:** Biological synthesis of nanoparticles using bacteria, fungi, plants, purified enzymes, biological templates and S layer. Silver nanoparticles, gold nanoparticles, cerium oxide nanoparticles, titanium oxide and zinc oxide nanoparticles. Biological applications of inorganic nanoparticles. Introduction to biological nanoparticles and their applications: Exosomes, lipoproteins, ferritin, magnetite viruses. Biological nanomotors and Machines, mechanisms of biological machines, protein assemblies: muscle myosin, kinesin, nerve, ATPase, bacteriorhopsin, Hemoglobin dynein, cilia. Bacterial flagella: structure and function; nanomotor. Ion channels: nanopores of high specificity. Bioinspired nanomaterials: DNA and peptide based. Interaction between biomolecules and nanoparticle surfaces.	**13**
II	**Nanomaterial-Biomolecule interactions and Biosensors:** Protein-lipids-RNA and DNA, protein targeting, Small molecule/nanomaterial-protein interactions, Nanomaterial–cell interactions, Manifestations of surface modification (Polyvalency). Surface modified nanoparticles, MEMS/NEMS based on nanomaterials, Peptide/DNA coupled nanomaterial, Metal/metal oxide nanoparticles (antibacterial/antifungal/antiviral), Anisotropic and magnetic nanoparticles(Hyperthermia) Nanonephrology, Nanosystems in Inflammation, Targeting Macrophages to Control Inflammation, Tissue Regeneration, Growth And Repair, Tissue Bioengineering; Future Understanding for Treatment Biosensor and nanobiosensor, basic concepts, characterization, perception, Enzyme–metal NP hybrids for biosensing and for the generation of nanostructures, Biomolecule–semiconductor NPs for biosensing, Different types of nanobiosensors; CNT biosensor, DNA nanosensor, Nanowire biosensor, application of nanodiagnostics.Nanobiosensors for medical diagnostics. Nanoprobes for analytical applications.	**12**
III	**Fundamentals of Animal tissue culture:** Introduction to animal tissue/cell culture and lab facility, Definition, principle and significance of tissue culture. Maintenance of sterility, use of antibiotics, Logic of formulation of tissue culture media: natural, synthetic media, and sera. Sterilization of cell culture media and reagents. Introduction to the balance salt solutions and simple growth medium. Role of carbon dioxide in animal cell culture. Primary culture: Behavior of cells, properties, utility with different examples ii. Explant culture. iii. Suspension culture. Concept of Cell lines, Normal and established cell lines: Their characteristic features and utility, Characteristics of cells in culture. Contact inhibition, anchorage (in) dependence, cell-cell communication, Cell senescence.	**10**
IV	**Nanotechnology and its application in food industry:** Nanotechnology and food packaging, natural biopolymers, advantages of nanomaterials in food packaging applications, outstanding issues, risks and regulations, public perception. Nanotechnology in Agriculture, Precision farming, Smart delivery system, Insecticides using nanotechnology, Potential of nanofertilizers.	**10**

ReferenceBooks:

1. Principles and techniques of Biochemistry and Molecular biology, 7 th Edition, Keith Wilson and John Walker. Cambridge University Press, 2010
2. Analytical Techniques in Biochemistry and Molecular Biology, RajanKatoch, Springer, 2011
3. Basic Cell Culture Protocols, Editors: Helgason, Cheryl D., Miller, Cindy L, Springer 2005
4. Proteomic and Metabolomic Approaches to Biomarker Discovery, Haleem J Issaq, Academic press. 2013
5. Challa Kumar- Biological and pharmaceutical Nanomaterials, Wiley-VCH Verlag GmbH & Co. KGaA.
6. Cato T. Laurencin and Lakshmi S. Nair, Nanotechnology and Tissue Engineering The Scaffold, CRC Press taylor& Francis Group.
7. Peter X Ma, Scaffolds for tissue fabrication, materials today Volume 7, Issue 5, May 2004, Pages 30–40
8. K.K.Jain, Nano Biotechnology,Horizions Biosciences, 2006
9. Martin C. Woodle , Patrick Y. LuNanoparticles deliver RNAi therapy,materialstoday,Volume 8, Issue 8, Supplement, August 2005, Pages 34–41
10. C. Kumar, Nanomaterials for medical diagnosis and therapy, Wiley –VCH, 2007, USA
11. Chemical Sensors and Biosensors; Brian, R Eggins; Wiley; New York, Chichester; 2002.
12. Biosensors and modern biospecific analytical techniques, Wilson & Wilson's Comprehensive Analytical Chemistry; Ed. L Gorton; Elsevier, Amsterdam, London; 2005.
13. The Immunoassay Handbook; Ed. David Wild; 3rd ed.; Amsterdam: Elsevier; 2005.
14. Electrochemical Methods: Fundamentals and Applications; Allen J Bard and Larry R Faulkner; Wiley, New York, Chichester : 2nd ed.; 2001.
15. Ultrathin Electrochemical Chemo- and Biosensors: Technology and Performance in Springer Series on Chemical Sensors and Biosensors; Volume Two; Ed. Vladimir M. Mirsky; Springer, Berlin; 2004
16. Biosensors: A Practical Approach, J. Cooper & C. Tass, Oxford University Press, 2004.
17. Nanomaterials for Biosensors, Cs. Kumar, Wiley – VCH, 2007.
18. Smart Biosensor Technology, G.K. Knoff, A.S. Bassi, CRC Press, 2006.
19. Bernard R. Glick and Jack J. Pasternak (2002). Molecular Biotechnology, Panima Publishing House, New Delhi. PG & Research Department of Biotechnology, National College (Autonomous), Tiruchirappalli – 620 001. 18
20. Garrison C, Fathman F and Fitch W. (1982). Isolation- Characterization and utilization of T – Lymphocyte clones, Academic Press
21. Goldsby R. A. Kindt T.J, Osborne B. A and Kuby J. (2003). Immunology, W.H. Freeman and company.
22. Griffiths A. J, Miller J.H, Suzuki D.T, Lewontin R.C and Gelbart W.M. (2000). An introduction to Genetic analysis, W. H.Freeman and Company.
23. Masters J.R.W. (2000), Animal Cell culture, Oxford University Press.
24. Puher A. (1993). Genetic Engineering of animals (Ed.), VCH Publishers-WeinheimFRG.
25. Ranga M.M. (2003). Animal Biotechnology.
26. Springer T. A. (1985), Hybridoma Technology in Biosciences and Medicine, Plenum Press, New York.
27. Watson J.D, Gilman M, Witknowski J and Zoller M. (1992). Recombinant DNA, Scientific American Books, New York.
28. .Watson J.D, Hopkins N.H, Roberts J.W. Steitz J. A and Weiner A.M. (2002). Molecular Biology of gene, Benjamin / Cummings.

SHIVAJIUNIVERSITY,KOLHAPUR

SNST–706T

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VII

Titleofthepaper:ComputationalNanoscience

UnitNumber	Noncreditcourse	No.oflectures
I	**ComputationaltoolsforNanoscience** Programmingfundamentals,designanalgorithm,flowchartandpseudocode,ProgrammingwithMatlab,Introductiontoopensourcetoolsfor Nanoscience(Nanohub,MolecularWorkbench,Ninithi,Scilab,Octave,Avogadro), Introductiontoproprietarysoftware:MATLAB,Mathematica,COMSOL Multiphysics,VirtualNanolab&AtomistixToolKit(ATK),AdvantagedisadvantagesofOpensourceandProprietarysoftware's,Highperformancecomputingstructure(HPC)andIntroductiontoparallelcomputing.	**10**

ReferenceBooks:

1.JerryBanks,JohnS.Carson,BarryLNelson,DavidM.Nicol,Discrete EventSystemSimulation,PrenticeHallPublishers.
2.R.H.Landau,M.J.Jose,C.R.Bordeianu,ASurveyofComputationalPhysics(2008),Princeton UniversityPress.
3.Musa,S.M.(Ed.).(2011).ComputationalNanotechnology:ModelingandApplicationswith MATLAB®.CRCPress.
4.Xie,C.,&Lee,H.S.(2012).Avisualapproachtonanotechnologyeducation.InternationalJournalofEngineeringEducation,28(5),1006.
5.N.J.GiordanoandH.Nakanishi,ComputationalPhysics,PearsonPrenticeHall.
6.Network for Computational Nanotechnology, Available at:http://ncn.purdue.edu/wps/portal/pagr/o/
7.Gould,Tobochniketal,IntroductiontoComputersimulationmethods.(Additionweekly 2006)
8.M.RiethandW.Schommers,HandbookofTheoreticalandComputationalNanotechnology.

SHIVAJIUNIVERSITY,KOLHAPUR

SNST–711P

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VII

Titleofthepaper:LaboratoryCourse-I

TotalCredit:2

1	Resistivityofthinfilmbytwopointprobemethod
2	TEPofasemiconductor-I
3	Estimationofbandgapofsemiconductor
4	ResistivitybyVanderPauwmethod
5	StudiesonPNjunctionSi-solarcell
5	Studiessolarsimulator
6	StudiesonBJTdevice
7	StudiesonFETdevice
8	StudiesonMOSFETdevice
9	Magneticsusceptibility
10	Haynes-Shockleyexperiment

SHIVAJIUNIVERSITY,KOLHAPUR

SNST–712P

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VII

Titleofthepaper:LaboratoryCourse-II

TotalCredit:2

1	FunctionalizedCNTandidentificationofgroups		
2	FunctionalizedGrapheneandidentificationofgroups		
3	SynthesisofGrapheneOxidebymodifiedHummer'smethod		
4	ModelingandsimulationofCNT		
5	SimulationofballistictransportinCNT-FET		
6	EffectofSeriesresistanceandtemperatureonsolarcell-(Simulation)		
7	MeasurementofsurfaceareaofnanomaterialusingmultipointBET		
8	ComparisonofsurfaceareaofactivatedcarbonandCNTs		
9	HallmobilityofCNTandGraphene		

SHIVAJIUNIVERSITY,KOLHAPUR

SNST–713P

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VII

Titleofthepaper:LaboratoryCourse-III

TotalCredit:2

1	SynthesisofCdSe-ZnOcoreshellQDbyhotinjectionmethod
2	SynthesisofCdSe-CdScoreshellQDbyhotinjectionmethod
3	ElectrochemicalanodizationofTiO$_2$ nanotubes
4	Preparationofanodosedaluminiumoxide(AAO)
5	B-Hhysteresisloopstudy
6	ElectrodepositionofMnO$_2$bypotentiodynamicmethod
7	ElectrochemicalQuartzCrystalMicrobalancestudyofMnO$_2$
8	MnO$_2$-PEDOTnanocomposites
9	Metaloxideframeworks
10	NanocoatingsbyDCsputtering
11	NanocoatingsbyRFsputtering

SHIVAJIUNIVERSITY,KOLHAPUR

SNST–714P

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VII

Titleofthepaper:LaboratoryCourse-IV(Nano-Bio-I)

Totalcredit:2
1.Preparationofnanoparticlesusingbiologicalsource 2.Preparationofnanoparticlesusingbacterialcells,itsextracellularproteinsandcharacterization 3.Preparationofnanoparticlesusingfungi, itsextracellularproteinsandcharacterization 4.Preparationofnanoparticlesusingplantextractanditscharacterization 5.Preparationofvariousmetalnanoparticlesforthestudyoftheirbiologicalactivity6.Estimationofantibacterialactivityofmetalnanoparticles 7.Estimationofantifungalactivityofmetalnanoparticles 8.Preparationofglasswares,plasticwares,mediaandfinechemicalsforanimalcellcultures. 9.Culturing,maintenanceandpassagingofstockofanimalcellcultures 10.Synthesisofgoldnanoparticlesanditsassembly/Conjugationwithbiomoleculesi.e.BSA 11.SDSPAGEgelshiftassayforstudyofnanoparticle-biomoleculeassembly

References

1. Charles P. Poole Jr. and Franks. J. Qwens (2003) Introduction to Nanotechnology,Wiley
2. Ehud Gazit (2007) Plenty of Room for Biology at the Bottom: An Introduction to Bionanotechnology. Imperial college Press
3. Bharat Bhushan (2007) Springer Handbook of Nanotechnology. Springer Verlag.
4. Challa S., S. R. Kumar, J. H. Carola (2006) Nanofabrication towards biomedical application: Techniques, tools, Application and impact. John Wiley and sons.
5. Robert A. Freitas Jr (2003) Nanomedicine, Vol. I: Basic Capabilities.
6. Neelina H. Malsch (2005) Biomedical Nanotechnology. Taylor and Francis. CRC press.
7. Patrick Boisseau, Marcel Lahmani (2009) Nanoscience: Nanobiotechnology and
8. Ralph S. Greco, Fritz B. Prinz, R. Lane Smith (Editors) (2004) Nanoscale Technology in Biological Systems. CRC Press
9. Harry F. Tibbals (2010) Medical Nanotechnology and Nanomedicine. CRC Press
10. Research articles from various journals and databases

SHIVAJIUNIVERSITY,KOLHAPUR

SNST–801T

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VIII

Titleofthepaper:SolidStateElectronicDevices

UnitNumber	**Totalcredit:3**	**No.oflectures**
I)	**TransistorsandMicrowaveDevices:** BipolarjunctiontransistorBJT),frequencyresponseandswitchingofBJT, Singleelectrontransistor,Fieldeffecttransistor(JFET),MOSFETandMESFETdevices:structureanditsoperation,Tunneldiode,ResonanttunnelingandNDReffectsinnanostructures,Transferredelectrondevices-Gunndiode,Nano-CMOStechnology,	**13**
II)	**PhotonicDevices:** Radiativetransitionsandopticalabsorption,LightemittingDiodes,OLED, InfraredLED,Photodetector,Photoconductor,Photodiode,SemiconductorLasers,Laseroperation,populationinversion,carrierandopticalconfinement,opticalcavity	**12**
III)	**Nanopiezotronicsandnano-generators:** Piezoelectric,Electrostrictiveandmagnetostrictiveeffects,importantmaterialsexhibitingthesepropertiesandtheirapplicationsinsensorsandactuatordevices,PiezoelectricityofZnOnanowires,combinationof piezoelectric and semiconducting properties, PiezotronicnanodevicesusingZnOnanowires,chemical/humiditynanosensors,ZnOnanowiresnano-generator,Flexiblenano-generatorandpowerfiber,	**10**
IV)	**Micro-Electro-Mechanical-Systems(MEMS):** WhatisMEMS,MEMStechnology,AbriefhistoryofMEMS,IntroductiontoMEMSsensors,physical/chemical/biologicalMEMSsensors,Resonentmechanicalsensors,accelerometers,gasflowsensors,sensingprinciple,MEMSdesign,MEMSinautomobiles	**10**

ReferenceBooks:

1.Semiconductordevices:PhysicsandTechnology2ndEdition,S.M.Sze2.ModernDigitalElectronics,R.P.Jain
3.IntroductiontoSemiconductordevicesbyM.S.Tyagi
4.OpticalelectronicsbyAjoyGhatakandK.Thyagrajan,CambridgeUniversityPress.
5.Microsystemsandnanotechnology,Springer,byZ.Zhou,Z.L.WangandL.Lin

SHIVAJIUNIVERSITY,KOLHAPUR

SNST–802T

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VIII

Titleofthepaper:EnergyConversionandStorageDevices

UnitNumber	**Totalcredit:3**	**No.oflectures**
I)	**SolarPhotovoltaics:** P-Njunctionunderillumination,Lightgeneratedcurrent,I-Vequation,Characteristics,Upperlimitsofcellparameters,lossesinsolarcells,equivalentcircuit,effectsofvariousparametersonefficiency,Solarcelldesign,DesignforhighIsc,Antireflectivecoating(ARC),DesignforhighVocandfillfactor,Analyticaltechniques;solarsimulator,Quantumefficiency,Minoritycarrierlifetimeanddiffusionlengthmeasurement.Thinfilmsolarcells:Advantages,materials,a-Si,CdTe,CIGS	**12**
II)	**SensitizedandPolymerPhotovoltaics:** Dyesensitizedsolarcells,advantagesanddisadvantages,Quantumdotsensitizedsolarcells,Perovskitesensitizedsolarcells,Planarandbulkheterojunction polymer solar cells, Exciton generation anddissociation,Advantages,disadvantagesandtypesofmaterials	**13**
III)	**BatteriesandFuelcells:** Introduction to battery; Types of batteries: Primary batteries and Rechargeable batteries; Electrochemical cell and cell reactions; Parameters that influence cell reaction: thermodynamic parameters and kinetic parameters; Heat effects; Charging methods and techniques, Characteristic curves; Lead-acid battery; Ni/Cd battery; Ni/metal hybrid battery; Lithium ion batteries: Chemistry and Physics of lithium ion batteries, anode and cathode materials, applications; Introduction to fuel cells.	**10**
IV)	**Supercapacitors:** Introduction to supercapacitors; Differences between supercapacitors and batteries; Energy density and power density; Ragone plot; Electrochemical double layer capacitor: Electrode and electrolyte interfaces and their capacitances, Factors affecting double-layer capacitance; Pseudocapacitor: Electrochemical pseudocapacitance of electrode–electrolyte interface; Impedance of a pseudocapacitance, Technology development of various oxides as pseudocapacitors; RuO2 as a material for electrochemical capacitors.	**10**

ReferenceBooks:

1.Solarphotovoltaics,Fundamentals,TechnologiesandApplicationsbyChetanSinghSolanki, PHILearningPrivateLimited,Delhi-110092.

2.Polymerphotovoltaics,apracticalapproachbyFredrikC.Krebs,SpiePress,Bellingham,WashingtonUSA.

3.OrganicSolarCells,Theory,Experiment,andDeviceSimulationbyWolfgangTress,Springer.

4.DyeSensitizedSolarCellsbyK.Kalyansundaram,EPFLPress,ASwissacademicpublisherdistributedbyCRCpress.

5.Solarcells-Dye-sensitizedDevicesbyLeonidA.Kosyachenko,PublishedbyIntech,JanezaTrdine9,51000Rijeka,Croatia.

6.BatteryTechnologyHandbookbyH.A.Kiehne,MarcelDekker,Inc.,NewYork,Basel.

7.Electrochemical Supercapacitors, Scientific fundamentals and TechnologicalApplicationsbyB.E.Conway,KluwerAcademic/PlenumPublishers,NewYork,Boston,Dordrencht,London,Moscow.

SNST–

803T**SchoolofNanoscienceandTechnology**

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VIII

Titleofthepaper:Nanocatalysis

Unit No.	**Total Credits: 3**	**No. of Lectures**
I	Introductiontocatalysis,classifications,heterogeneouscatalysis,reaction onthesolidsurfaces,adsorptionisotherms,physisorptionand chemisorptions.,reactionmechanismandkineticsoftheheterogeneous catalyticreactions,activationenergy(Arrheniusequation,Eyringequation).	15
II	Catalyticactivity(bulkandnanoscale),catalyticactivitydeterminationfor metal/metaloxidenanostructures.Langmuir-Hinshelwoodmechanismfor nanocatalyst,Masstransport,diffusioncontrolledprocess,catalytic efficiencyandturnoverfrequency,inhibition.Applicationofmetal nanoparticlesinorganicreactions(HeckandSuzuki-Mauryareactions), environmentalremediation.	10
III	Introductionofphotocatalysis,Basicsofelectrochemistryand photochemistry,Electronicsstructureandphotoabsorption,Kineticsand photocatalyticactivity,Jablonskiidiagram,Structureofphotocatalystsand solarspectrumanalysis.Fundamentalunderstandingofsemiconductor interfaces,Principlesandrelevancetophotoelectrochemicaland photocatalysismechanism,Propertiesofgoodphotocatalysts,Advantages ofphotocatalysts,typesofphotocatalysts,Homogeneous,heterogeneous, carbonaceousandplasmonicphotocatalysts.	10
IV	Photocatalystsdesignandsynthesis,Applicationofphotocatalysis,Self cleaning,purificationofwaterandair,PhotoreductionofCO_2andfuelproductio n,antimicrobialuse.Characterizationandperformanceofphotocatalysts,Fabri cationofwaterpurificationreactor,Industrialdevelopmentofphotocatalysts,E nvironmentalremediation,Futurepossibilities	10

References

(1)J.P.Simons,PhotochemistryandSpectroscopy,Wiley,1971.

(2)J.G.Calvert,J.N.Pitts,Photochemistry,Wiley&Sons,NewYork,1966.

(3)N.Serpone,E.Pelizzetti(Eds.),Photocatalysis.FundamentalsandApplications, Wiley,NewYork,1989.

(4)K.K.Rohatgi-Mukherjee,FundamentalsofPhotochemistry,Wiley,NewYork, 3rdEdition,2002.

(5)NickSerponeandEzioPelizzetti,Photocatalysis:FundamentalsandApplication,WileyInterscience,1st Edition,1989

(6)Photoelectrochemistry,PhotocatalysisandPhotoreactorsFundamentalsand Developments,Schiavello,Mario(Ed.)Springer,1985.

(7)Photoelectrochemicalsolarcells,SureshChandra,GordonandBreachScience Publishers,1985.

(8)PhysicalChemistryofSurfaces,W.Adamson,WileyIntersciences,(5thedition) 1990.

(9)Physicalchemistry-PeterAtkins,JuliodePaula,7thEdition OxfordUniversityPress.

(10)CatalyticChemistry,B.C.Gates,JohnWileyandSonsInc.(1992)

(11)NanoparticlesandCatalysis;D.Astruc,Wiley-VCH,2008

(12)HeterogeneousCatalysis,D.K.ChakrabartyandB.Viswanathan,NewAge Publishers

SHIVAJIUNIVERSITY,KOLHAPUR

SNST–804T

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VIII

Titleofthepaper:NanomagnetismandSpintronics

UnitNumber	**Totalcredit:3**	**No.oflectures**
I	**Magnetismbasicsand**N**anomagnetism** Magneticquantitiesandunits,magnetismoffreeatomsandions,Hund'srulesandtheLandéfactor,localizedelectronmagnetisminsolids,itinerantelectronmagnetisminmetals,bandtheoryofmagnetism,indirectexchangeinteraction,magneticanisotropy,magnetizationandmagneticmaterials,domains,magneticenergies(magnetostaticenergy,magnetocrystallineenergy,magnetostrictiveenergy),domainwalls,demagnetizingfield,magnetizationprocess. **Magnetisminsmallstructures** Singledomainparticles,superparamagnetism, blockingtemperature,magneticultrathinfilms,magneticsurfaceandinterfaceanisotropies.	**13**
II	**Introductiontospinelectronics,GiantMagnetoresistance(GMR):**mechanismofGMR,spindependentscatteringofelectrons,interlayerexchangecoupling(RKKYcoupling),exchangebiasing,spinvalves,quantumtunneling,tunnelingmagnetoresistance(TMR),magneticoxidesandphasetransformations:colossalmagnetoresistance(CMR),magneticsemiconductors,multiferroics.	**12**
III	**Magneticdatastorage**:Magneticrecordingoverview,recordingmedium,particulaterecordingmedia,thinfilmrecordingmaterials, longitudinal versusperpendicularrecording,writeheads,readheads,magneticrandomaccessmemory(MRAM),outlookandfundamentallimitstorecording,patternedmedia	**10**
IV	**Nanobiomagnetism:** Materialsforbiomagnetism,targeting,functionalizationofmagneticnanoparticles,magneticseparation,manipulationofmagneticparticlesinfluidsmagnetictwizzers,drugandgenedelivery,magneticresonanceimaging,hyperthermia,magneticbiosensors,biologicalassaysystem,lab-on-a-chipconcept.	**10**

ReferenceBooks:

1)Modernmagneticmaterials,RobertC.O'Handley,JohnWiley&SonsInc.,2000.

2)Introductiontomagneticmaterials,CullityandGraham,JohnWiley&SonsInc.,2009.

3)Introductiontomagnetismandmagneticmaterials,D.Jiles,ChapmanandHallPub.,1991.

4)FundamentalsofMagnetism,MathiasGetzlaff,Springer,2008.

5)SpinElectronics,M.ZieseandM.Thornton(Eds.),Springer,2001.

6)AdvancedMagneticNanostructures,SellmyerandSkomski(Eds.),Springer,2006.

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SNST–805T

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VIII

Titleofthepaper:Biomedical applications of Nanobiotechnology

UnitNumber	**Totalcredit:3**	**No.oflectures**
I	**Cancer as a disease**: Malignant and benign growth in Cancers, difference between normal cell function and malignant cells, Types of cancer, causative agents of cancer, concept of oncogenes, proto-oncogenes, Gross tissue level changes in cancer, cellular events, molecular pathology, Early detection of cancers using nanotechnology, Biomarker development by nanoprobes, Conventional chemotherapy drugs their mechanism and limitations, Nanodrugs in cancer chemotherapy in details (synthesis, action, advantages, examples), Potential of nanotech application in cancer surgery. Introduction to genome /proteome analysis for cancer Nanobiotechnology for drug discovery, protein and peptide based compounds for cancer and diabetes, drug delivery, nanoparticle based drug delivery, lipid nanoparticles, vaccination, cell therapy, Gene therapy.	**13**
II	**Nanoparticles in Biological systems and Nanodiagnostics::** bone substitutes and dentistry, Implants and Prosthesis, Reconstructive Intervention and Surgery, Nanorobotics in Surgery, Photodynamic Therapy, Neuro-electronic Interfaces – Protein Engineering, Drug delivery, Therapeutic applications. Nano diagnostics, Nanoarrays for diagnostics, detection of single DNA, self assembled protein nanoarrays, protein nanobiochip, nanoparticles for molecular diagnostics, DNA nanomachines.	**12**
III	**Nanodrug delivery/administration:**Nanodrug delivery/administration, Polymer nanoparticles for drug and small silencing RNA delivery to treat cancers of different phenotypes. polymer NPs for miRNA delivery, polymer NPs for antisense miRNA, (antagomir) delivery, polymer NPs for siRNA delivery, polymer NPs for shRNA delivery, advantages and disadvantages associated with the use, of polymer NPs for drug, delivery, mechanism of drugs deliver to tumors by Polymer nanoparticles. Nanodevices for drug delivery and theranostics. Introduction to the potentials applications and challenges of nanomedicine. Nanomedicine and tissue engineering, nanobiomachines and nanorobots	**10**
IV	**Biological Interactions with nanomaterials and Nanotoxicology:** Introduction to Biocompatibility, Toxicity, Cytotoxicity, Hypersensitivity, Carcinogenicity, Fate of nanomaterials in the body: short term and long term effects. Interaction of Materials with Soft Tissues, Inflammation, Granulation Tissue Formation, Foreign Body Reaction, Fibrosis, Modification of Blood-Biomaterial Interactions, Interaction with Blood by Heparin, Interactions with Proteins, Cell Adhesion, Interactions with Hard Tissues, The Vroman Effect, Adhesion of Osteoblasts, Osseointegration, Fibrous Capsule Formation, Safety Testing of Biomaterials. Introduction, Toxicity of nanoparticles, Types of Nanoparticles causing Toxicity, Target organ toxicity, Exposure, Uptake, and Barriers, Experimental Models in Nanotoxicology - In vitro Models, In Vivo Models, Predicting Penetration and Fate of Nanoparticles in the Body, Toxicity Mechanisms - Mechanisms for Radical Species Production, General Genotoxicity Mechanisms, Detection and Characterization of Genotoxicity	**10**

ReferenceBooks:

1. Challa Kumar- Biological and pharmaceutical Nanomaterials, Wiley-VCH Verlag GmbH & Co. KGaA.
2. Cato T. Laurencin and Lakshmi S. Nair, Nanotechnology and Tissue Engineering The Scaffold, CRC Press taylor& Francis Group.
3. Peter X Ma, Scaffolds for tissue fabrication, materials today Volume 7, Issue 5, May 2004, Pages 30–40
4. K.K.Jain, Nano Biotechnology,Horizions Biosciences, 2006
5. Martin C. Woodle , Patrick Y. LuNanoparticles deliver RNAi therapy,materialstoday,Volume 8, Issue 8, Supplement, August 2005, Pages 34–41
6. C. Kumar, Nanomaterials for medical diagnosis and therapy, Wiley –VCH, 2007, USA
7. Harry F. Tibbals (2010) Medical Nanotechnology and Nanomedicine. CRC Press
8. Assessing Nanoparticle Risks to Human Health, Gurumurthy Ramachandran, Elesvier, 2011
9. Nanotechnology: Environmental Health and safety, Risks, Regulation and Management, Matthew Hull and Diana Bowman, Elsevier, 2010
10. Nanotechnology: Health and Environmental Risks, Jo Anne Shatkin, CRC Press, 2013
11. Principles and Methods of Toxicology, A.W. Hayes, Informa Health care, 2008

SHIVAJIUNIVERSITY,KOLHAPUR

SNST–806T

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VIII

Titleofthepaper:Quantumcomputation

UnitNumber	**Totalcredit:Noncreditcourse**	**No.oflectures**
I)	**Quantuminformationandquantumcomputers:** Howisaquantumcomputerdifferenttoaclassicalcomputer?,Howdoesaquantumcomputerwork?,Writingtoanidealisedatomic-quantumcomputer,Read-out from an idealised atomic-quantum computer, Quantumcomputation,Decoherence—theenemyofquantumcomputation,Thepowerofquantumcomputation,Powerofaclassicalcomputer,Powerofaquantumcomputer.ExperimentalImplementations	**10**

ReferenceBooks:

1.MassimilianoDiVentra,StephaneEvoy,JamesR.Heflin,IntroductiontoNanoscaleSciencea ndTechnology,Springer-2004.

2.MarcBaldo,IntroductiontoNanoelectronics,MITOpenCourseWarePublicationMay2011.

3.MichaelWilson,K.Smith,MichelleSimmons,BurkhardRaguse,Nanotechnology-BasicScienceandEmergingTechnologies,CRCPress,2012.

4.YoshioNishi,AdvancesinNon-volatileMemoryandStorageTechnology,WoodheadPublishingSeriesinElectronicandOpticalMaterials(Elsevier),2014.

5.MojtabaJoodaki,SelectedAdvancesinNanoelectronicDevices:Logic,MemoryandRF,Spri nger,2010.

6.IntroductiontoMEMS/NEMS,WolfsonSchoolofMechanicalandManufacturingEngineerin gLoughboroughUniversity,Loughborough

SHIVAJIUNIVERSITY,KOLHAPURS

choolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)M.S

c.-I,Semester–VIII

Titleofthepaper:LaboratoryCourse–I

TotalCredit:2

SNST–811P

1	ModelingandsimulationofFinFET		
2	ModelingandsimulationofMESFET		
3	Modelingof1Dresonanttunnelingdevice		
4	Simulationofharvestedelectricalpowerfrommechanicalvibrationusingapiezo electriccantileverbeam		
5	StudiesonDSCbasedonTiO_2andRudye		
6	StudiesonQuantumdotsensitizedsolarcells		
7	Studiesonperovskitesolarcell		
8	StudiesonPolymersolarcells		
9	StudiesonLi-ionbattery		
10	StudiesonMnO_2supercapacitor		

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SNST–812P

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VIII

Titleofthepaper:LaboratoryCourse-II

TotalCredit:2

1	Synthesisofaerogel		
2	SynthesisofNanophosphorpowder		
3	ElectrodepositionofelectrochromicWO_3		
4	Electrodepositionofelectrochromicnanoparticleof PB		
5	SynthesisofTransparentConductingOxidecoatingbyspraypyrolysistechnique		
6	Synthesisofbinarychalcogenidethinfilmsusing SILAR		
7	Synthesisofbinarychalcogenidesusing CBD		
8	Synthesisofelectrospinning-nanofiberofTiO_2		
9	SynthesisofCuObyhydrothermalmethod		
10	SynthesisofPANInanofiberforammoniagassensor		
11	Synthesisofnewnanoparticlebyusingmicrowavereactor		

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SNST–813P

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VIII

Titleofthepaper:LaboratoryCourse-III

TotalCredit:2

1	Photocatalysis-I		
2	Photocatalysis-II		
3	Catalysis-I		
4	ElectrodepositionofCo-AgGMRmaterial		
5	Sol-geldepositionofFe_2O_3 nanoparticle		
6	Spin-coatingofnanomaterials		
7	GMRmeasurementofCo-Agthingranularfilms		
8	SynthesisofDilutemagneticsemiconductors		
9	Measurementofresolvingpowerofhumaneye,opticalmicroscopeandelectronmicroscope		
10	StudiesonLEDandOLED,		
11	StudiesonAMOLED		

SHIVAJIUNIVERSITY,KOLHAPUR **SNST–814P**

SchoolofNanoscienceandTechnology

(5yearintegratedmultidisciplinary10semestercourse)

M.Sc.-I,Semester–VIII

Titleofthepaper:LaboratoryCourse-IV(Nano-Bio-II)

Totalcredit:2
1. Conjugation of nanoparticles with nucleic acids, DNA/RNA, Amino acids 2. Conjugation between PGLA and tetracycline 3. Preparation of PGLA-tetracycline functional nanoparticles using emulsion diffusion method/ nano-precipitation/dialysis method 4. Characterization of tetracycline modified nanoparticles 5. Synthesis and characterization of CdS quantum dots by reverse micellesmethod 6. Synthesis of oil based nanoemulsion drug delivery system 7. Testing the cell viability of metal oxide nanoparticles using tissue culture technique 8. In vitro study of the effect of nanoparticles on mammalian cells and tissues 9. MTT Assay for cell viability and growth, 10. Cell counting and Cell staining using PI-DAPI

References

1. K. Youell and Firman, Nanotechnology perception 3 (2007) 75,96. Comprehensive overview of motors in biology
2. Jeremy Ramsden, Essentials of nanotechnology
3. RammohanDevulapally and RamasamyPaulmurugan Polymer nanoparticles for drug and small silencing RNA delivery to treat cancers of different phenotypes *WIREs NanomedNanobiotechnol* 2014, 6:40–60. doi: 10.1002/wnan.
4. ItamarWillner, Bernhard Basnar and BilhaWillner Nanoparticle–enzyme hybrid systems for nanobiotechnology FEBS Journal 274 (2007) 302–309.
5. Nanotechnology :Technology Revolution of 21st Century by Rakesh Rathi, published by S. Chand.
6. Introduction to Nanoscience, by Stuart Lindsay.
7. Introduction to Nanomaterials and nanotechnology by Vladimir Pokropivny, RynnoLohmus, Irina Hussainova, Alex Pokropivny and Sergey Vlassov.
8. Nanomaterials by A.K. Bandyopadhyay; New Age International Publishers.
9. Nanotechnology by Mark Ratner and Daniel Ratner, Pearson Education.
10. Nano Essentials, T.Pradeep/TMH
11. Bharat Bhusan, “Springer Handbook of Nanotechnology”, springer, Newyork, 2007.
12. Hari Singh Nalwa, “Encyclopedia of Nanotechnology”, USA 2011.
13. James A. Schwarz, Cristian I. Contescu, Karol Putyera, “Dekker encyclopedia of nanoscience and nanotechnology” CRC Press, 2004.
14. Charles P. Poole Jr. and Franks. J. Qwens (2003) Introduction to Nanotechnology. John

15. Wiley and Sons.
16. Ehud Gazit (2007) Plenty of Room for Biology at the Bottom: An Introduction to
17. Bionanotechnology. Imperial college Press
18. Bharat Bhushan (2007) Springer Handbook of Nanotechnology. Springer Verlag.
19. Challa S., S. R. Kumar, J. H. Carola (2006) Nanofabrication towards biomedical
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21. Robert A. Freitas Jr (2003) Nanomedicine, Vol. I: Basic Capabilities.
22. Neelina H. Malsch (2005) Biomedical Nanotechnology. Taylor and Francis. CRC press.
23. Patrick Boisseau, Marcel Lahmani (2009) Nanoscience: Nanobiotechnology and
24. Nanobiology. Springer Publishers.
25. Ralph S. Greco, Fritz B. Prinz, R. Lane Smith (Editors) (2004) Nanoscale Technology in Biological Systems. CRC Press
26. Harry F. Tibbals (2010) Medical Nanotechnology and Nanomedicine. CRC Press
Assessing Nanoparticle Risks to Human Health, Gurumurthy Ramachandran, Elesvier, 2011
27. Nanotechnology: Environmental Health and safety, Risks, Regulation and Management, Matthew Hull and Diana Bowman, Elsevier, 2010
28. Nanotechnology: Health and Environmental Risks, Jo Anne Shatkin, CRC Press, 2013
29. Principles and Methods of Toxicology, A.W. Hayes, Informa Health care, 2008