CENTRAL UNIVERSITY OF GUJARAT
SCHOOL OF NANO SCIENCES
SYLLABUS for Ph.D (Nanosciences) course work – 36 credits

Course Code	Course Title	Credits
	Semester I (Total Credits -9)	
NSC 615	**Research methodology and writing**	3
NSC 618	**Computer: basic functions and use for research purpose**	2
NSC 619	**Statistics and data analysis**	2
NSC 643	**Seminar III**	2
	Semester II (Total Credits -7)	
NSC 654	**Applied Nanochemistry**	3
NSC 655	**Bio-Nanotechnology**	2
NSC 662	**Instrumentation**	2
	M.Sc Semester III (Total Credits -20)	
	Dissertation	20

SEMESTER I

Course NSC 618: Research methodology and writing - 3C

Unit 1: Introduction to research
Meaning and nature of research, types of research, research theories, scientific and experimental methods in research, interdisciplinary and multidisciplinary research, inductive, deductive and intuitive sources of knowledge, qualities of a researcher

Unit 2: The research process
Research design, Definition and identification of research problems, Aims and objectives of research, Hypothesis: meaning, types and significance, Survey and review of literature, Methods of data collection, Validity of data

Unit 3: Research writing
Writing research report and research proposals, structure and content of reports, styles of referencing and citations, bibliography, use of endnote, publication styles of journals, ethics in research, forma of plagiarism, copyright regulations
Text/References:

1.Introduction to educational research by Charlse C.M and Martler C.A, Pearson boston publishing, Boston, 2002.
2.Social research methods by Oxford University Press, Oxford, USA, 2002.

Course NSC 618: Computer: basic functions and use for research purpose - 2C

Unit 1: Introduction to computers
Fundamentals of computers and their components, Hardware and software, Operating systems, Word processing programme: basics, editing, referencing, Spread sheet programme: application, features and functions, formulas, statistics, graphs, presentation programme: application, features and functions, creating presentations, Database management systems: Creation, updating, indexing and searching of data.

Unit 2: ICT for research purpose
Use of ICT: Web based resources, search engines and techniques, Web as a tool for scientific literature survey, archive browsing, Research purpose softwares: Origin and MS Excel, Graph plotting and its types, Curve fitting, and data management. Chemdraw: Use of ChemDraw, The Basics, Drawing Resonance Structures, Drawing Reactions, Drawing Schematics.

Text/References:
1. Introduction to Computing Explorations in Language, Logic, and Machines by David Evans, University of Virginia, 2011
2. Computer Networks 5th By Andrew S. Tanenbaum , 2010, Pearson publications

Course NSC 619: Statistics and data analysis - 2C

Unit 1: Measurement scales, normal distribution, Correlation and Regression analysis: Types of scales, Establishing reliability of scale and other instruments of evaluation, Normal distribution: Introduction and importance, Properties of normal probability distribution, Divergence from normal distribution, Application of normal probability curve. Null hypothesis and its importance. Correlation: introduction, linear and curvilinear correlation, calculation methods. Regression: Introduction, equations, Multiple correlation and partial regression.

Unit 2: Inferential and non-parametric statistics. Inferential: Difference between percentages, means, Student t-test, Analysis of variance and co-variance. Non-parametric: Chi-square test, Sign test, Man-Whitney U test.

Text/References:

Fundamental statistics in psychology and education by Gulford J.P and Fruchter B, McGraw Hill Kogokusha LTD, New Delhi, 1978

Course 4: NSC 643 Seminar - 2C

SEMESTER II

Course NSC 654 : Applied Nanochemistry - 3C

Unit 1: Basic approaches for the synthesis of nanoparticles, surfactants, self-assembly, phase rule in oil and water system, self-assembled mono layers, LB Films. Applications of zero-dimensional Nanoparticles, applications of one-dimensional nanotubes and nanowires, application of nanoporous materials.

Unit 2: Preparation and characterization of diblock copolymer-based nanocomposites, application of nanopolymers: application of nanocomposites: metal-metal nanocomposites, polymer-metal nanocomposites, ceramic nanocomposites. Application of organic nanoparticles. Applications of nanocomposites in catalysis.

Unit 3: Dielectrics, ferroelectrics, magneto ceramics, and multiferroics Magnetism, Dia-, Para-, Ferro-, Antiferro, Ferri-magnetism, Magnetic properties, Superconducting nanomaterials & their properties and applications. Application of Thermo Electric Materials (TEM): Concept of phonon, Thermal conductivity, Specific heat; application of Carbon Nano Structures: DLCs, C60, C80 SWNT and MWNT.

Text/References:

1. Nanochemistry: A Chemical Approach to Nanomaterials by G. A. Ozin, A.C. Arsenault, and L. Cademartiri, The Royal Society of Chemistry, Cambridge, 2nd Ed., 2009.
2. Nanostructures & Nanomaterials: Synthesis, Properties, and Applications by Guozhong Cao, Imperial College Press, London, 2004.
3. Nanoscale Science and Technology, edited by R. W. Kelsall, I. W. Hamley, and M. Geoghegan, Wiley,West Sussex, 2005.

4. Novel Nanocrystalline Alloys and Magnetic Nanomaterials by Brian Cantor. Polymer nanocomposites, edited by Yiu-Wing Mai and Zhong-Zhen Yu, First published 2006, Woodhead Publishing Limited and CRC Press LLC, USA.

Course NSC 655: Bio-Nanotechnology - 2C

Unit 1: Bio-nanotechnology Concept Structural Principle of Bio-nanotechnology, Function of Biological molecules, Molecular motors, force, elasticity, Biofilm inhibition by nanoparticles, DNA computers and DNA microprocessors, Biotechnology based genetic engineering.

Unit 2: Nanotechnology in Drug Delivery Nanoparticle in Drug delivery: Types of Nanoparticles/Nano carrier, Different methods for synthesis of polymeric nano-carrier. Targeted drug delivery, Nanoparticle delivery for Cancer and other disease Treatment.

Text/ References:

1. Nanotechnology in Biology and Medicine: Methods, Devices and Application by Tuan Vo-Dinh .CRC press, 2007.

2. Nanosystem characterization tools in the life sciences by Challa Kumar. WileyVCH, 2006.

Course NSC 662: Instrumentation - 2C

Unit 1: Basic concept of Instrumentation Spectroscopy: UV-VIS-NIR, FT-IR, NMR, Fluorescence Spectroscopy, Chromatography: GC, HPLC, GC-MS, HPTLC, PCR, Electrophoresis.
Microscopy: Scanning Electron Microscopy, Transmission Electron Microscopy, High Resolution Transmission Electron Microscopy, Field Emission Scanning Electron Microscopy, Atomic Force Microscopy.

Unit 2: Advance Instrumentation Techniques Principle, Theory, Working and Application: X-Ray Diffraction, X-Ray Reflectivity, Differential thermal and Gravimetric Analysis, Vibrating sample Magnetometer, Brunauer-Emmett Teller surface areas, Zeta sizer.
Scanning Tunneling Spectroscopy, Atomic Absorption Spectrophotometer, Photoluminescence Spectroscopy, Electrochemical Impedance.

Text/ References:

1) Nanostructures and Nanomaterials, synthesis, properties and applications by Guozhong Cao, Imperial College Press, 2004.
2) Nanomaterials – Handbook by Yury Gogotsi, CRC Press, Taylor & Francis group, 2006.
3) Nanomaterials: synthesis, Properties and Applications by Edelstein A S and Cammarata R C,Taylor and Francis, 2012.

SEMESTER III

Course: Dissertation- 20C