DEPARTMENT OF NANOSCIENCE AND NANOTECHNOLOGY

UNIVERSITY OF KERALA

M.PHIL PROGRAMME IN NANOSCIENCE AND NANOTECHNOLOGY
SYLLABUS

Under Credit and Semester System w.e.f 2016 admissions

DEPARTMENT OF NANOSCIENCE AND NANOTECHNOLOGY
UNIVERSITY OF KERALA
M.PHIL PROGRAMME IN NANOSCIENCE AND NANOTECHNOLOGY

Programme Objectives

- To introduce students to areas of creative thinking and critical reasoning which are relevant to his/her research and to introduce the students to the current research issues and processes.
- The programme will consist of lectures and related activities that will help in developing good understanding of methods of research process and management.
- To provide students knowledge in the field of Nanoscience and Nanotechnology and Nanobiology.
- The programme will consist of lectures and related activities that will help the students to understand the characterization techniques to analyze the nanomaterials.
- To provide students knowledge in the field of Nanoscience and current trends in the field of Nanotechnology.
- The programme will consist of lectures and related activities that will help the students to understand emerging technologies in the field of Nanoscience and Nanotechnology.

Structure of the Programme

<table>
<thead>
<tr>
<th>Semester No.</th>
<th>Course Code</th>
<th>Name of the Course</th>
<th>No.of Credits</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>NST-711</td>
<td>Research Methodology</td>
<td>4</td>
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<tr>
<td></td>
<td>NST-712</td>
<td>Nanomaterials and Nanoscience</td>
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<tr>
<td></td>
<td>NST-713</td>
<td>Advance Nanomaterials and Nanotechnology</td>
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<td>II</td>
<td>NST-721</td>
<td>Dissertation</td>
<td>20</td>
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<td></td>
<td>Total Credits</td>
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<td>32</td>
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Semester : I  
Course Code : NST- 711  
Course title : RESEARCH METHODOLOGY  
Credits : 4

Aim : To introduce students to areas of creative thinking and critical reasoning which are relevant to his/her research and to introduce the students to the current research issues and processes.
**Objectives**: The course will consist of lectures and related activities that will help in developing good understanding of methods of research process and management.

**Module I : OBJECTIVES AND TYPES OF RESEARCH**


Research formulation

Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Formulation of a working hypothesis - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – Reviews, treatise, monographs-patents – web as a source – Searching the web and information mining - Critical literature review – Identifying gap areas from literature review.

**Module II : RESEARCH DESIGN, METHODS**

Research design – Basic Principles- Need of research design – Features of good design – Important concepts relating to research design – Observation and facts, laws and theories. Prediction and explanation, induction, deduction - Development of models - Developing a research plan - Exploration, Description, Diagnosis - Experimentation - Determining experimental and sample design.

Data collection and analysis

Execution of the research - Observation and Collection of experimental data. Methods of data collection - Sampling Methods - Sampling techniques, steps in sampling, sampling size, advantages and limitations of sampling - Data Processing and Analysis strategies - Data Analysis with Statistical Packages - Hypothesis-testing - Generalization and Interpretation.

**Module III : REPORTING AND THESIS WRITING**


**Module IV : RESEARCH ETHICS**
Module V: ERRORS AND UNCERTAINTIES IN MEASUREMENTS

Introduction to Errors and uncertainties in the measurement - Performance parameters of instrument - Propagation of uncertainties in compound quantities - curve fitting, regression and correlation.

REFERENCES


ADDITIONAL REFERENCES

1998.

- Carlos. C M, Intellectual property rights, the WTO and developing countries : the TRIPS
- Fink A, Conducting Research Literature Reviews: From the Internet to Paper. Sage 2009

- Inquiry, Allyn and Bacon, 2009.

Semester : I
Course Code : NST- 712
Course title : NANOMATERIALS AND NANOSCIENCE
Credits : 4

Aim : To provide students knowledge in the field of Nanoscience and nanotechnology.

Objectives : The course will consist of lectures and related activities that will help the students to understand the characterization techniques to analyze the nanomaterials.

Module I : INTRODUCTION TO NANOMATERIALS

Zero-dimensional, one-dimensional and two-dimensional nanostructures, size dependent properties – specific heat and melting point- mechanical properties – super plasticity - plastic deformation of ceramics - nanoceramics - catalytic properties.
Synthesis of nanomaterials - bottom-up and top-down approaches - nanoparticles - colloidal technique - homogeneous and heterogeneous nucleation - synthesis of metallic and semiconductor nanoparticles - stabilization of nanoparticles - sonochemical method - synthesis and properties of core-shell nanoparticles.


Nanobiology - Overview of cell structure and biomacromolecules - chemical building block of cells – Nanobiotechnology – Introduction - learning from nature - Engineered nanoparticles and biomedical applications.

Module II: EXPERIMENTAL TECHNIQUES


Module III: QUANTUM CONFINED SYSTEMS


Module IV: ELECTRICAL PROPERTIES


Spintronics - Diffuse spin dependent transport – spin dependent scattering – giant magneto resistance (GMR) and colossal magneto resistance (CMR) materials – ballistic spin transport.

Module V: MAGNETIC PROPERTIES

REFERENCES

- Challa Kumar (Ed) - Nanomaterials for Medical Diagnosis and Therapy, Wiley-VCH, 2006.
Semester : I
Course Code : NST- 713
Course title : ADVANCE NANOMATERIALS AND NANOTECHNOLOGY
Credits : 4

Aim : To provide students knowledge in the field of Nanoscience and nanotechnology and current trends in the field of nanotechnology.

Objectives : The course will consist of lectures and related activities that will help the students to understand emerging technologies in the field of nanotechnology.

Module I : NANOSTRUCTURED FILMS
Synthesis - physical vapour deposition (PVD) – molecular beam epitaxy (MBE) - DC/RF magnetron sputtering - chemical vapour deposition (CVD) – progress and challenges of photovoltaic applications of silicon nanocrystalline materials - sol-gel technique – sol-gel films – properties and applications of sol-gel derived nanostructured thin films.


Module II : NANOLITHOGRAPHY
Module III: PHOTOCHEMISTRY AND ELECTROCHEMISTRY OF NANO-ASSEMBLIES


Module IV: SPECIAL NANOMATERIALS


Module V: NANOCOMPOSITES

REFERENCES

Aim: The aim of this course is to enable students to develop an understanding and obtain practical experience of the research process and research skills required to undertake a supervised research project.

Students will be required to identify relevant information on a topic and critically review the research of others. A range of approaches should be used in the field of Nanoscience and Nanotechnology.

Objective: This course aims to develop an understanding of the processes and skills required to undertake a supervised research project at M.Phil level, and to write it up as dissertation.

The objectives are

- develop research skills commensurate with the accomplishment of a degree
- develop skills in independent inquiry
- produce a coherent and logically argued piece of writing that demonstrates competence in research and the ability to operate independently
- address issues of research design, methodology, ethics and theoretical arguments, and apply these to research