FATIMA COLLEGE (AUTONOMOUS)

Re-Accredited with "A" Grade by NAAC (3rd Cycle)
94th Rank in India Ranking 2019 (NIRF) by MHRD
Maryland, Madurai- 625 018, Tamil Nadu, India

NAME OF THE DEPARTMENT	**:**	**PHYSICS**
NAME OF THE PROGRAMME	**:**	**Ph.D**
PROGRAMME CODE	**:**	**DSPH**
ACADEMIC YEAR	**:**	**21-22**

COLLEGE PROFILE

Fatima College (Autonomous), Mary Land, Madurai, is a Post Graduate and Research Institution for Women affiliated to Madurai Kamaraj University. It is a Catholic Minority institution established and run by St. Joseph's Society of Madurai (of the Congregation of the Sisters of St. Joseph of Lyons, France). This institution came into existence through the tireless efforts of the missionary sisters of St. Joseph of Lyons and the zeal and heroic sacrifice of Rev. Sr. Rose Benedicta, the Foundress of the College.

The College was started in St. Joseph's Campus Madurai as a Second Grade College with 63 students in 1953. It was upgraded into a Post Graduate College in 1964; Autonomous in 1990 and a Research Institute in 2004. The College now offers 21 Undergraduate Programmes, 13 Postgraduate Programmes, 2 Professional Programme, 5 M.Phil. Programmes and 6 Departments have become Research Centres. It has strength of 4134 Students, 206 Teaching Staff and 100 Non-Teaching Staff.

The comprehensive assessment by NAAC in 1999 placed Fatima College in Five Star Status of merit. The college strives to sustain excellence, quality and relevance while equipping the students to meet the demands of higher education in India. In 2004 UGC conferred on Fatima College the status of College with Potential for Excellence. In 2006 and 2013 NAAC Re-Accredited the College with 'A' Grade. The College was ranked 94th in the All India NIRF Ranking in 2019 by MHRD.

VISION

WOMEN'S EMPOWERMENT THROUGH EDUCATION

The vision of the college is to empower women by developing human capabilities through quality education based on Christian values, making them responsible citizens who can work for the advancement of the society and promote communal harmony in the multi-religious and multi-cultural reality of India eventually evolving into women of communion.

MISSION

- To enhance quality of life through the development of individuals.
- To enable women to become contributors in the economic, social and political development of India.
- To equip the students with 21st century skill-sets with a focus on problem-solving abilities
- To motivate them to work for social justice
- To give preference to the rural economically backward and first-generation learners
- To enable students to be employed in the technology oriented competitive market

VISION OF THE DEPARTMENT

Educate , Empower and Excel

MISSION OF THE DEPARTMENT

- To ignite the young minds and impart quality education in basic Physics
- To promote enthusiasm in the study of physics through innovative and dedicated teaching methodologies
- To discover the budding talents in theoretical and experimental physics and ensure their global competency
- To provide a stimulating environment and strengthen basic and application oriented research aptitude among the students.

FULL TIME DOCTOR OF PHILOSOPHY

PHYSICS - Year - I

For those who joined in 2020 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
DSPH	21PHDCWP01	SOLID STATE IONICS	Core	-	2

COURSE DESCRIPTION

This course emphasise the basic concepts of Solid State Ionics which involves its structure, properties and its applications in electrochemical devices.

COURSE OBJECTIVES

This course provides detailed information about the field of Ionics and its contribution in electrochemical devices.

UNITS

UNIT I: BASICS ON CRYSTAL STRUCTURE

Crystalline solids – space lattice – the basis and crystal structure ; crystal translational vectors, symmetry operation primitive lattice cell and unit cell symmetry elements, Fundamental type of lattice, atomic packing, atomic radius,

lattice constants and density, crystal structure other cubic structure- type of bonding – Ionic bonding – Energy of formation of NaCl Molecules, medelung constants – potential energy of diagram of ionic molecules – calculation of repulsive exponent – Born Haber cycle characteristics of ionic bond.

UNIT II: TRANSPORT PROPERTIES OF IONIC CONDUCTORS

Ionic conductivity – Normal and super ionic conductors – distinguision – Mass transport in crystals – Diffusion – Atomic diffusion theory – Experimental determination of the diffusion constant – Ionic conduction – Experimental results – for ionic conduction – The Einstein relation – Dielectric loss in ionic crystals – Electronic conduction in ionic crystals – Excess conductors – Deficit conductors – Amphoetric semiconductor

UNIT III: SUPER IONIC SOLIDS

Phenomenological Models – Huberman's Theory – Ries Strassler Toom's Theory – Weleh and Diene Theory – Lattice Gas theory – Free ion model – Domain Model – Rica and Roth Theory – The Path Probability Method – The static variables – the Path variables – The path Probability – Stationary state condition – Classification of Superionic solids – Crystalline and – Amorphous – Glasses – Dispersed solid Electrolytes - polymers – Ion exchange resins – biological basis resins - Classification over conducting ion species – mode and mechanism of conduction in each case and their corresponding criteria to be superionic conductors.

UNIT IV: EXPERIMENTAL TECHNIQUES AND METHODS

Structural characterization – XRD surface Analysis, EXAFS, IPS, and Quasi neutron scattering – Thermodynamical characterization – Differential scanning calorimetry, Differential Thermal Analysis, Thermo Gravimetric Analysis and Thermo electric power – Ion transport properties – Electrical conductivity – Two probe method – four probe method - Immitance spectroscopy – Dynamical conductivity – state conductivity – polarization characteristic – determination of small electronic transport numbers – The permeation Technique (Static) – The polarization cell (Static) – the polarized cell technique (Dynamic) – The permeation technique (Dynamic).

UNIT V: APPLICATIONS OF SUPER IONIC SOLIDS

Application of superionic solid – Battery and Non – Battery application – conventional cells – fuel cells – sensors and partial pressure – gauges – Oxygen and non Oxygen sensors – coulometers – timers – Diffusion coefficient measurement in solids and liquids – Electro chemic displays.

BOOKS FOR STUDY AND REFERENCES:

1. Superionic solid – Principles and applications (Ed . S. Chandra) North Holland 1981.
2. Solid state ionics . (Eds. T Kudo and Fueki) VCH Publishers, Kodansha 1990.

3. Lectures on solid state physics (Eds. G Bush and H Schade), international series on Natural Philosophy Vol. 79 Pergamon, press 1976.

4. "Solid Electrolyted" (Eds. S Geller) Springer Verlag New york 1977.

5. 'Importance Spectroscopy' (Eds. Joscher) Springer Verlag .
'Physics of Electrolytes – Transport Processes solid Electrolytes and in Electrodes (Eds. J Hladik) Academic press, New york 1972.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	understand the basic ideas on crystals	K1, K2	PSO1,PSO2
CO 2	understand and analyse the transport properties of ionic conductors	K1, K2, K3	PSO3,PSO4
CO 3	understand the concepts of super ionic solids	K1, K2	PSO1,PSO3
CO 4	discussion on various characterization techniques that can be used for the	K2, K2, K3& K4	PSO4, PSO5

	analysis of super ionic solids		
CO 5	Study that involves the application of solid state ionics in various electrochemical devices	K1, K2, K3 & k4	PSO3,PSO4& PSO5

COURSE DESIGNER: Dr. M. Ragam

A. Sheela Vimala R

Dr. A. SHEELA VIMALA RANI
HEAD & ASSOCIATE PROFESSOR
DEPARTMENT OF PHYSICS
FATIMA COLLEGE
MADURAI - 625 018

Forwarded By

Dr. A. Sheela Vimala Rani

HoD'S Signature & Name

FULL TIME DOCTOR OF PHILOSOPHY

PHYSICS - Year - I

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
DSPH	21PHDCPP02	MATERIALS SCIENCE	Ph.D Core	-	2

COURSE DESCRIPTION

This course aims at providing the theoretical aspects of materials science.

COURSE OBJECTIVES

This course provides the knowledge about phase diagrams, mechanical properties, ceramics, polymers, plastics and crystals.

UNITS

Unit –I: PHASE DIAGRAMS

Solid solutions and intermediate phases – Equilibrium phase diagrams, Cu-Ni, Pb-Sn, Al-Cu system phase diagrams – Free energy and equilibrium phase diagrams – Nucleation and growth – Martenstic transformation – Strengthening mehanisms – Iron Carbon system – Alloy steels – Aluminium-Copper system – Copper-Zinc system – Corrosion

Unit –II: MECHANICAL PROPERTIES

Stress- Strain curve – Elastic deformation: Characteristics, Atomic mechanism, Sheer stress, Bulk modulus, Strain energy,

Strain deformation – Viscous deformation: Spring-Dashpot models – Anelastic and Viscoelastic deformation: Viscoelastic models – Plastic deformation: Dislocations and Stress-strain curves, Plasticity theory – Fracture: Ideal fracture, Brittle fracture, Fracture mechanics, Cohesive models, Ductile fracture – Mechanical testing

Unit –III: CERAMICS

Structure of ceramics – Production of ceramics: Raw materials, Forming and Post-forming processes – Production of glass: Melting of glass, Glass forming and annealing – Mechanical properties of ceramics – Wear and erosion resistance – Thermal shock – Silica-Alumina system – Commercial systems: Zirconia, Sialones, Cement and Concrete

Unit – IV: Polymers and Plastics

Molecular structure: Monomers & Polymers, Synthesis, Molecular weight measurement, Branching & Tacticity, Copolymers and blend – Mechanics of polymer chain: Freely jointed chains, Entanglements, Rubber elasticity – Thermoplastic melts: Viscosity, Shear thinning, Processing, Extrusion – Amorphous polymers: Solidification, glass transition, Various models – Crystalline polymers – Crosslinked polymers: Elastromers, Thermosets – Liquid crystal polymers – Mechanical properties: Stress-Strain behavior – Chemical properties

Unit –V: CRYSTALS

Crystal growth from solution – Melt growth techniques: Bridgman method, Czochralski crystal pulling technique, Crystal growth

from Vapor phase – Crystal Imperfections – Point defects: Vacancies, interstitials, Impurities, electronic defects – Line defects: Edge dislocation, Screw dislocation – Surface defects: Grain boundaries, Tilt boundaries, Twin boundaries, Stacking faults, Ferromagnetic domain walls – Volume defects: Cracks, Voids

BOOKS FOR STUDY AND REFERENCES:

1. J.C.Anderson, K.D.Leaver, P. Leevers and R.D.Rowlings, Materials Science for Engineers, Nelson Thomas Ltd, First Indian reprint, 2010.
2. M.Arumugam, Materials Science, Anuradha Agencies, Publishers, Sechond Edition, Fifth Reprint, 2005.
3. R,Balasubramaniam, Materials Science and Engineering, Wiley India (P) Ltd, 2010.
4. V.Raghavan, Materials Science for Engineering, Prentice Hall of India Pvt Ltd, 2006.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	gain knowledge about the phase diagram	K1,K2	PSO1,PSO2

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 2	know about the basic ideas of mechanical properties of the materials	K1, K2	PSO1,PSO2
CO 3	understand the basic concepts of ceramics	K1 , K2, K3	PSO2, PSO3
CO 4	know about the polymers and plastics	K1, K2, K3& K4	PSO4,PSO5
CO 5	gain information about the crystals	K1, K2 , K3 & K4	PSO4,PSO5

COURSE DESIGNER: **Dr. M. Ragam**

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FULL TIME DOCTOR OF PHILOSOPHY

PHYSICS - Year - I

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
DSPH	21PHDRMP03	RESEARCH METHODOLOGY	Ph.D Core	-	2

COURSE DESCRIPTION

This is a cross-curricular subject, which may be of interest for those students who are considering undertake a research career, especially in the fields of physics and technologies in physics.

COURSE OBJECTIVES

This paper highlights the various postulates of research problems, research design, writing a thesis and modern statistical methods. This helps to carry out research problem individually in a perfect scientific method.

UNITS

UNIT I: INTRODUCTION TO RESEARCH

Meaning of Research-Objectives of Research-Motivation in Research-Types of Research-Research Approaches-Significance of Research-Research and Scientific Method-Importance of Knowing How Research is Done-Research Process-Criteria of Good Research-Problems Encountered by Research.

UNIT II: SOURCE MATERIAL AND REVEWING OF LITERATURE IN THE AREA OF STUDY

Preparing a list of reading material and reference in the concerning area of specialization and topic of research-Critical evaluation and review of research work carried out so for on the topic-Difficulties with reviews-Primary and secondary source of materials and methods and technique to be adopted in the collection of primary data.

UNIT III: DESIGN AND PLANNING OF EXPERIMENTS, TIME SCHEDULING

Aims and Objectives-Selecting the problem-Necessity of Defining the problem-Technique involved in Defining a problem-An illustration-Expected outcome-Methodology to be adapted-Planning of experiments for achieving the aims and objectives-Importance of reproducibility of research work.

UNIT IV: THE COMPUTER: IT'S ROLE IN RESEARCH

Introduction - The Computer and Computer Technology-The Computer System - Important Characteristics - Computer Applications - Computers and Researcher - Software Using Origin - Microsoft Office – Matlab - Mathematica etc.

UNIT V: INTERPRETATION AND REPORT WRITING

Meaning of Interpretation-Interpretation-Technique of Interpretation: Precaution in Interpretation-Significance of Report Writing-Different Steps in Writing Report-Layout of the Research Report-Types of Reports-Oral Presentation-Mechanics of Writing

Research Report-Precautions for Writing Research Reports-Conclusions.

TEXT BOOK

1. C.R. Kothari, Research Methodology Methods and Techniques, 2/e, Vishwa Prakashan, 2006 2. Donald H.McBurney, Research Methods, 5th Edition, Thomson Learning, ISBN:81-315-0047-0,2006.

BOOKS FOR REFERENCE

1. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006.
2. Fuzzy Logic with Engg Applications, Timothy J.Ross, Wiley Publications, 2nd Ed[d]
3. Simulated Annealing: Theory and Applications (Mathematics and Its Applications, by P.J. van Laarhoven& E.H. Aarts[e]
4. Genetic Algorithms in Search, Optimization, and Machine Learning by David E. Goldberg

COURSE OUTCOMES

On the successful completion of the course, students will be able to

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	understand the basics of research and its objectives	K1,K2	PSO1,PSO2

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 2	gain knowledge about the theoretical research involved	K1, K2	PSO1,PSO2
CO 3	get exposure to planning of experiments and the various methodologies involved	K1 , K2, K3	PSO2, PSO3
CO 4	apply the use software and other computational techniques for data presentation	K1, K2, K3& K4	PSO4,PSO5
CO 5	understand and analyse the techniques of interpretation involved in written and oral presentations	K1, K2 , K3& K4	PSO4,PSO5

COURSE DESIGNERDr. M. Ragam

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FULL TIME DOCTOR OF PHILOSOPHY

PHYSICS - Year - I

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
DSPH	21PHDREP04	RESEARCH AND PUBLICATION ETHICS	Ph.D Core	-	2

COURSE DESCRIPTION

This course emphasise the basic concepts of philosophy of science and ethics.

COURSE OBJECTIVES

This course provides detailed information about research integrity and publication ethics.

UNITS

UNIT I: PHILOSOPHY AND ETHICS

Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: definition, moral philosophy, nature of moral judgments and reactions.

UNIT 2: SCIENTIFIC CONDUCT

Ethics with respect to science and research. Intellectual honesty and research integrity. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP). Redundant publications:

duplicate and overlapping publications, salami slicing. Selective reporting and misrepresentation of data

UNIT 3: PUBLICATION ETHICS

Publication ethics: definition, introduction and importance Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types. Violation of publication ethics, authorship and contributor ship. Identification of publication misconduct, complaints and appeals. Predatory publishers and journals practice.

UNIT 4: PUBLICATION MISCONDUCT

Group Discussions: Subject specific ethical issues, FFP, authorship. Conflicts of interest. Complaints and appeals: examples and fraud from India and abroad.

Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools

UNIT 5: DATABASES AND RESEARCH METRICS

Databases: Indexing databases. Citation databases: Web of Science, Scopus, etc.

Research Metrics: Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score. Metrics: h-index, g index, i10 index, altmetrics.

BOOKS FOR REFERENCE

1. The Ethics of Teaching and Scientific Research By Miro Todorovich; Paul Kurtz; Sidney Hook.
2. Research Ethics: A Psychological Approach By Barbara H. Stanley; Joan E. Sieber; Gary B. Melton.
3. Research Methods in Applied Settings: An Integrated Approach to Design and Analysis By Jeffrey A. Gliner; George A. Morgan Lawrence Erlbaum Associates, 2000.
4. Ethics and Values in Industrial-Organizational Psychology By Joel LefkowitzLawrence Erlbaum Associates, 2003.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	understand the basics of philosophy and ethics of research	K1,K2	PSO1,PSO2
CO 2	Understand the scientific misconducts like falsification, fabrication and plagiarism	K1, K2	PSO1,PSO2
CO 3	gain knowledge about the publication misconducts related will authorship and contributorship	K1 , K2, K3	PSO2, PSO3
CO 4	Understanding of the publication misconducts	K1, K2, K3 & K4	PSO4,PSO5

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 5	Information about databases and research metrics	K1, K2 , K3 & K4	PSO4,PSO5

COURSE DESIGNER: Dr. M. Ragam

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NAME OF THE DEPARTMENT: PHYSICS

NAME OF THE PROGRAMME :Ph.D

PROGRAMME CODE :DSPH

ACADEMIC YEAR :21-22

COLLEGE PROFILE

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VISION OF THE DEPARTMENT

Educate , Empower and Excel

MISSION OF THE DEPARTMENT

- To ignite the young minds and impart quality education in basic Physics
- To promote enthusiasm in the study of physics through innovative and dedicated teaching methodologies
- To discover the budding talents in theoretical and experimental physics and ensure their global competency
- To provide a stimulating environment and strengthen basic and application oriented research aptitude among the students.

FULL TIME DOCTOR OF PHILOSOPHY

PHYSICS - Year - I

For those who joined in 2020 onwards

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
DSPH	21PHDCWP01	FERROMAGNETIC NANOSTRUCTURES FOR ENERGY STORAGE APPLICATIONS	Core	-	2

COURSE DESCRIPTION

This course emphasise the basic concepts of nanostructures and composites which involves its structure, properties and its applications in energy storage.

COURSE OBJECTIVES

This course provides detailed information about the magnetic nanostructures and its contribution in energy storage.

UNITS

UNIT I: PROPERTIES OF INDIVIDUAL NANOPARTICLES

Introduction - Metal Nanoclusters : Magic Numbers - Theoretical Modeling of Nanoparticles - Geometric Structure - Electronic Structure - Reactivity - Fluctuations - Magnetic Clusters - Bulk to Nanotransition

UNIT II: NANOSTRUCTURED FERROMAGNETISM

Techniques for ME effects in nanocomposites - Layered multiferroic composites: Ferromagnetic– ferroelectric composites-Direct

magnetoelectric effects - Converse ME effects - Conclusions - Epitaxial multiferroic heterostructures: Introduction - BiFeO3 systems-related multiferroics - Ferrite-related multiferroics

UNIT III: ELECTROCHEMICAL CELL, BATTERIES AND SUPERCAPACITORS

Electrochemical cell, charge transfer mechanism, batteries and supercapacitors, difference between a supercapacitor and a battery

UNIT IV: SUPERCAPACITORS: FUNDAMENTAL ASPECTS

Introduction ; Electrostatic Capacitor ; Electrolytic Capacitor ;Electrical Double-Layer Capacitor - Technological Aspects of Supercapacitors : Construction – Electrodes – Electrolyte – Separator- Charge Storage Mechanism : Helmholtz Model - Gouy–Chapman Theory - Stern Modification of the Diffuse Double Layer ; Equivalent Model of an EDLC ; Pseudocapacitance- Applications- Advantages and Disadvantages of Supercapacitors

UNIT V: CURRENT APPLICATIONS OF SUPERCAPACITOR

Memory backup - electric vehicle power quality - electromechanical actuators - Adjustable-Speed Drive Ride-Through

TEXT BOOKS:

1. INTRODUCTION TO NANOTECHNOLOGY, Charles P. Poole, Jr. ,Frank J. Owens
   Sec 4.1, 4.2, 4.5

2. COMPOSITE MAGNETOELECTRICS: Materials, Structure and Applications, Gopalan Srinivasan, Shanshank Priya, Nian X.sun
   Sec 3, Sec 5.1, 5.2, 5.4, 5.5

3. NANOSTRUCTURED CERAMIC OXIDES FOR SUPERCAPACITOR APPLICATIONS, edited by Avinash Balakrishnan and K. R. V. Subramanian
   Sec 3 Sec 6.

COURSE OUTCOMES

On the successful completion of the course, students will be able to:

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	understand the properties of nanoparticles	K1, K2	PSO1,PSO2
CO 2	understand and analyse the basics of ferromagnetism, multiferroic composites , multiferroic heterostructures and the magnetoelectric characterization techniques.	K1, K2, K3	PSO3,PSO4
CO 3	understand the difference between an electrochemical cell, battery and supercapacitors and its charge transfer mechanism	K1, K2	PSO1,PSO3
CO 4	comprehend the basics of supercapacitors, their technical aspects, storage mechanisms towards device fabrication	K2, K2, K3& K4	PSO4, PSO5
CO 5	gain information about some of the important supplications of supercapacitors	K1, K2, K3 & k4	PSO3,PSO4& PSO5

COURSE DESIGNER:Dr. M. Ragam

Forwarded By
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HoD'S Signature & Name

FULL TIME DOCTOR OF PHILOSOPHY

PHYSICS - Year - I

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
DSPH	21PHDCPP02	NANOSCIENCE AND APPLICATIONS	Ph.D Core	-	2

COURSE DESCRIPTION

This course emphasise the basic concepts of nanomaterials, their synthesis, characterization and applications.

COURSE OBJECTIVES

This course aims at providing a deep knowledge on nanomaterials and nanostructures, methods of preparation, characterization and their applications.

UNITS

Unit –I NANOMATERIALS

Introduction to nanomaterials - Properties of materials and nanomaterials - Role of size in nanomaterials – Nanoparticles – Semiconducting nanoparticles – Nanowires - Nanoclusters. Nanostructures: Zero, One, Two and Three - dimensional structure - Size control of metal Nanoparticles and their optical, electronic and magnetic properties - Surface plasmon resonance - Change of bandgap.

Unit –II SEMICONDUCTOR NANOSTRUCTURES AND NANO-PARTICLES

Semiconductor nanoparticles: Size dependant physical properties, Melting point - Solid-state phase transformations – Excitons - Band-gap variations -

Quantum confinement and effect of strain on band-gap in epitaxial quantum dots.

Optical luminescence and fluorescence from direct band gap semiconductor nanoparticles - LED and Solar cells – Electroluminescence - Barriers to nanoparticle lasers - Doping nanoparticles.

Unit –III SYNTHESIS OF NANO STRUCTURE

Chemical Routes for Synthesis of Nanomaterials: Chemical precipitation and co-precipitation: Metal nanocrystals by reduction - Sol-gel synthesis - Reverse micelles - Myle formation - Solvothermal synthesis - Thermolysis routes - Bio synthesis.

Fabrication of Nanomaterials by Physical Methods: Inert gas condensation - Arc discharge - Plasma arc technique - Laser abalation - Ball Milling - Molecular beam epitaxy- Chemical vapour deposition and Electro deposition methods.

Nanocomposites: An Introduction-Types of Nanocomposite (i.e. metal oxide, ceramic, glass and polymer based) - Core-Shell structured nanocomposites.

Unit – IV: CHARACTERIZATION OF NANOSTRUCTURES

X-ray diffraction - Small angle X-ray Scattering - Optical Microscope and their description – X-ray Photoelectron Spectroscopy(XPS) – Secondary Ion Mass Spectroscopy(SIMS), Scanning Probe Microscopy (SPM) - TEM and EDAX analysis - Atomic force microscopy (AFM).

Unit –V APPLICATIONS OF NANOMATERIALS

Solar Cells - Band Diagram and Operational principle of nanocrystalline solar cells - Principles of Operation, Energy Conversion and storage devices - Lithium Ion Batteries- Magnetic nanoparticles as contrast agents for medical diagnosis - Nanoparticles in medicine – Size dependent effects of magnetic particles- Energy storage.

BOOKS FOR REFERENCE

1. Nanochemistry: A chemical approach to nanomaterials, G. A. Ozin, A. C. Aresnault, L. Cadematriri, RSC Publishing, Cambridge UK, 2005.

2. Chemistry of nanomaterials: Synthesis, properties and applications, CNR Rao, Achim Muller, Anthony K.Cheetham, John Wiley & Sons, 2006.

3. Nanoparticles: From theory to applications, G. Schmidt, Wiley Weinheim, 2004. 17

4. Instrumentation, E L Principe, P Gnauck and P Hoffrogge, Microscopy and Microanalysis Cambridge University Press, 2005.

5. Nanocomposite science and technology, P.M. Ajayan, L.S. Schadler, P.V. Braun, Wiley, New York, 2003.

6. Nanostructures and Nanomaterials : Synthesis, Properties and Applications, Guozhong Cao, Ying Wang, World Scientific Publishing Co. Pte. Ltd, 2011.

7. Solar cells: Operating principles, technology and system applications, Martin A Green, Prentice Hall Inc, Englewood Cliffs, NJ, USA, 1981.

8. Semiconductor for solar cells, H.J Moller, Artech House Inc, MA, USA, 1993.

9. Hand book of Batteries and fuel cells, Linden, Mc Graw Hill, 1984.

10. Thermal Analysis of Materials, Robert F Speyer, New York, 1993.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	gain knowledge about the basics of nanomaterials, their structure and properties	K1,K2	PSO1,PSO2
CO 2	know about the semiconductor nanoparticles and their properties with few applications	K1, K2	PSO1,PSO2
CO 3	understand the various synthesis techniques used for the nanoparticle preparation	K1 , K2, K3	PSO2, PSO3
CO 4	know about the various characterization techniques employed to study the material	K1, K2, K3& K4	PSO4,PSO5
CO 5	gain information about the various fields of applications of nanomaterials	K1, K2 , K3 & K4	PSO4,PSO5

COURSE DESIGNER: Dr. M. Ragam

Forwarded By
Dr. A. Sheela Vimala Rani
HoD'S Signature & Name

FULL TIME DOCTOR OF PHILOSOPHY

PHYSICS - Year - I

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
DSPH	21PHDRMP03	RESEARCH	Ph.D	-	2

		METHODOLOGY	**Core**		

COURSE DESCRIPTION

This is a cross-curricular subject, which may be of interest for those students who are considering undertake a research career, especially in the fields of physics and technologies in physics.

COURSE OBJECTIVES

This paper highlights the various postulates of research problems, research design, writing a thesis and modern statistical methods. This helps to carry out research problem individually in a perfect scientific method.

UNITS

UNIT I: INTRODUCTION TO RESEARCH

Meaning of Research-Objectives of Research-Motivation in Research-Types of Research-Research Approaches-Significance of Research-Research and Scientific Method-Importance of Knowing How Research is Done-Research Process-Criteria of Good Research-Problems Encountered by Research.

UNIT II: SOURCE MATERIAL AND REVEWING OF LITERATURE IN THE AREA OF STUDY

Preparing a list of reading material and reference in the concerning area of specialization and topic of research-Critical evaluation and review of research work carried out so for on the topic-Difficulties with reviews-Primary and secondary source of materials and methods and technique to be adopted in the collection of primary data.

UNIT III: DESIGN AND PLANNING OF EXPERIMENTS, TIME SCHEDULING

Aims and Objectives-Selecting the problem-Necessity of Defining the problem-Technique involved in Defining a problem-An illustration-Expected outcome-Methodology to be adapted-Planning of experiments for achieving the aims and objectives- Importance of reproducibility of research work.

UNIT IV :THE COMPUTER: IT'S ROLE IN RESEARCH

Introduction-The Computer and Computer Technology-The Computer System-Important Characteristics-Computer Applications-Computers and Researcher-Software Using Origin-Microsoft Office-Matlab-Mathematica etc.

UNIT V :INTERPRETATION AND REPORT WRITING

Meaning of Interpretation-Interpretation-Technique of Interpretation: Precaution in Interpretation-Significance of Report Writing-Different Steps in Writing Report-Layout of the Research Report-Types of Reports-Oral Presentation-Mechanics of Writing Research Report-Precautions for Writing Research Reports-Conclusions.

TEXT BOOK

1. C.R. Kothari, Research Methodology Methods and Techniques, 2/e, Vishwa Prakashan, 2006 2. Donald H.McBurney, Research Methods, 5th Edition, Thomson Learning, ISBN:81-315-0047- 0,2006.

BOOKS FOR REFERENCE

1. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006.
2. Fuzzy Logic with Engg Applications, Timothy J.Ross, Wiley Publications, 2nd Ed[d]
3. Simulated Annealing: Theory and Applications (Mathematics and Its Applications, by P.J. van Laarhoven& E.H. Aarts[e]
4. Genetic Algorithms in Search, Optimization, and Machine Learning by David E. Goldberg

COURSE OUTCOMES

On the successful completion of the course, students will be able to

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	understand the basics of research and its objectives	K1,K2	PSO1,PSO2
CO 2	gain knowledge about the theoretical research involved	K1, K2	PSO1,PSO2
CO 3	get exposure to planning of experiments and the various methodologies involved	K1 , K2, K3	PSO2, PSO3
CO 4	apply the use software and other computational techniques for data presentation	K1, K2, K3& K4	PSO4,PSO5
CO 5	understand and analyse the techniques of interpretation involved in written and oral presentations	K1, K2 , K3& K4	PSO4,PSO5

COURSE DESIGNERDr. M. Ragam

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FULL TIME DOCTOR OF PHILOSOPHY

PHYSICS - Year - I

PROGRAMME CODE	COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
DSPH	**21PHDREP04**	**RESEARCH AND PUBLICATION ETHICS**	**Ph.D Core**	**-**	**2**

COURSE DESCRIPTION

This course emphasise the basic concepts of philosophy of science and ethics.

COURSE OBJECTIVES

This course provides detailed information about research integrity and publication ethics.

UNITS

UNIT I: PHILOSOPHY AND ETHICS

Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: definition, moral philosophy, nature of moral judgments and reactions.

UNIT 2: SCIENTIFIC CONDUCT

Ethics with respect to science and research. Intellectual honesty and research integrity. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP). Redundant publications: duplicate and overlapping publications, salami slicing. Selective reporting and misrepresentation of data

UNIT 3: PUBLICATION ETHICS

Publication ethics: definition, introduction and importance Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. Conflicts of interest. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types. Violation of publication ethics, authorship and contributor ship. Identification of publication misconduct, complaints and appeals. Predatory publishers and journals practice.

UNIT 4: PUBLICATION MISCONDUCT

Group Discussions: Subject specific ethical issues, FFP, authorship. Conflicts of interest. Complaints and appeals: examples and fraud from India and abroad.

Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools

UNIT 5: DATABASES AND RESEARCH METRICS

Databases: Indexing databases. Citation databases: Web of Science, Scopus, etc.

Research Metrics: Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score. Metrics: h-index, g index, i10 index, altmetrics.

BOOKS FOR REFERENCE

1. The Ethics of Teaching and Scientific Research By Miro Todorovich; Paul Kurtz; Sidney Hook.
2. Research Ethics: A Psychological Approach By Barbara H. Stanley; Joan E. Sieber; Gary B. Melton.
3. Research Methods in Applied Settings: An Integrated Approach to Design and Analysis By Jeffrey A. Gliner; George A. Morgan Lawrence Erlbaum Associates, 2000.
4. Ethics and Values in Industrial-Organizational Psychology By Joel LefkowitzLawrence Erlbaum Associates, 2003.

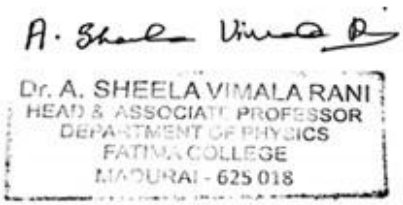
COURSE OUTCOMES

On the successful completion of the course, students will be able to

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 1	understand the basics of philosophy and ethics of research	K1,K2	PSO1,PSO2

NO.	COURSE OUTCOMES	KNOWLEDGE LEVEL (ACCORDING TO REVISED BLOOM'S TAXONOMY)	PSOs ADDRESSED
CO 2	Understand the scientific misconducts like falsification, fabrication and plagiarism	K1, K2	PSO1,PSO2
CO 3	gain knowledge about the publication misconducts related will authorship and contributorship	K1 , K2, K3	PSO2, PSO3
CO 4	Understanding of the publication misconducts	K1, K2, K3 & K4	PSO4,PSO5
CO 5	Information about databases and research metrics	K1, K2 , K3 & K4	PSO4,PSO5

COURSE DESIGNER Dr. M. Ragam



Forwarded By
Dr. A. Sheela Vimala Rani
HoD'S Signature & Name