NEW SCHEME
CHOICE BASED CREDIT SYSTEM

FOR

Ph.D. PHYSICS

JULY-2022

Department of Physics,
Sri Sai University
Palampur
Himachal Pradesh
176081

Course Structure

Course Code	Title of the Paper	Lectures /week	Contact Hours / Week	Credits
Semester-I ***Compulsory Courses***				
PHY-CC-611	Material Characterization and Instrumentation	4	4	4
RM-CC-023	Scientific Research Methodology	4	4	4
RPE-CC-021	Research and Publications Ethics	2	2	2
				10
(Elective) ***Any one from following related to Thesis work***				
PHY-EC-612	Nano Physics	4	4	4
PHY-EC-613	Radio Astronomy and Space Science	4	4	4
PHY-EC-614	Modern Electronics	4	4	4
PHY-EC-615	Polymer Electrolytes for Smart Materials	4	4	4
PHY-EC-616	Solar Energy and Photovoltaic's	4	4	4
PHY-EC-617	Plasma Physics	4	4	4
PHY-EC-618	Advanced Solid State Physics	4	4	4
				4
	Thesis work with assessment after every six month	Satisfactory/not satisfactory		

Compulsory core courses=03

Elective Course=01

Total credits=14

SEMESTER I

Compulsory Courses

PHY-CC-611: MATERIAL CHARACTERIZATION AND EXPERIMENTAL TECHNIQUES

Course Objectives	• The knowledge of synthesis and characterization techniques is very important • To prepare and specialize them in the relevant areas of research and development
Course Outcomes	The scholars must to know about all the methodologies theoretical as well as experimental.

Module I

Synthesis of materials: Bulk synthesis ;solid state route, Sol gel, co-precipitation ,combustion methods, Thin film fabrication :spin coating ,dip coating, spray and evaporation, Vacuum techniques. vacuum pumps(Rotary and diffusion pumps)and vacuum gauges.

Module II

Structural and composition characterization: Basics of X-ray diffraction (XRD),grazing incidence and powder XRD, scanning electron microscope, energy dispersive X-ray analysis, X-ray photoelectron spectroscopy, atomic force microscope (AFM),scanning tunneling microscopy(STM) and Transmission electron microscope.

Module III

Optical spectroscopy and Raman spectroscopy: review of molecular and vibrational spectroscopy, basic principle and instrumentation, advantages and limitation, fourier transform infrared spectroscopy (FTIR), UV-Vis spectroscopy and Raman spectroscopy, analysis of spectrum.

Module IV

Electric and thermal measurements:a.c.and d.c. electrical conductivity measurement as a function of temperature and frequencies. magnetoresistance measurements, specific heat measurements, impedence spectroscopy:A.C. impedence spectroscopy ,thermo gravimetric analysis (TGA),differential thermal analysis (DTA)and differential scanning calorimetric (DSC) analysis.

Module V

Magnetic characterization: Characterization of magnetic materials, ferromagnetic, multiferroic, spinglass materials and underlying principles, vibrating sample magnetometer (VSM), SQUID magnetometer, AC susceptibility and DC magnetization measurements.

Text books:

1. *Material science and engineering (John Wiley and Sons,Inc.) By William D.Callister,Jr.*
2. *Introduction to Ceramics,W.D.Kingery.*
3. *Introduction to Nanotechnology, K.K.Chattopadhaya and A.N.Banerjee.*

Reference books:

4. *Material Science of Thin film ,M.Ohring.*
5. *Handbook of Vacuum technology,KarlJousten.*

RM-CC-023: SCIENTIFIC RESEARCH METHODOLOGY

Course Objectives	• To familiarize the research students about the fundamentals aspects in the fields of research techniques • To prepare and specialize them in the relevant areas of research and development
Course Outcomes	The scholars will learn to write thesis by knowing the technical methods. IPR must to know.

Module I

Methodology and Literature: Meaning of research, purpose of research. Research methods; scientific methods, experimental methods, observational methods, survey and questionnaires methods, role of theory, characteristics of research. Criteria of good research. Need for research design. Types of research: fundamental or pure research, applied research, action research, experimental research. Review of work relevant to the chosen problems, Applied science and technology index,Classical and comprehensive works.

Module II

Abstracting and indexing Services (A&I): Current services : CA weekly issues, CA issue indexes-keyword index. General subject index, Chemical substance index, formula index, index of ring systems, author index and patent index.CA Collective indexes: Collective index (CI), volume index, quinquennial index, decennial index (DI). SCI indexing, Google indexing, ISI web of Knowledge, SCI impact factor and its importance worldwide.

Module III

Mathematical and computational Treatment: Data collection techniques, analysis and presentation and presentation of data. Statistical and Airthmetic mean, geometric mean treatments. Storage and retrival of data, Development of data based structure, data processing and basic operation, sorting Network protocol, Development of Web page, Plotting of Data using different software. Such as MATLAB, MATHCAD, MATHEMATICA, STATISTICA, SAS, CHEMWINDOW, CHEMSKETCH, LaTex

Module IV

Scientific technical writings: How to present the data in form dessertations / Thesis, lab report, manuals and research papers, the use quotation, footnotes in table and figures, referencing, appendices, editing and evaluation and the final report

Module V

Intellect Property Rights (IPR): General introduction to IPR. Approach to securing patent. Protection of IPR. Indian and other patents organisation. Meaning of Patents, uses, importance and asking for patent rights for industrial application and commercialization. Patent Acts and Treaties. World Trade Organisation (WTO). Trade –Related Aspects of Intellectual Property Rights (TRIPS)

Text books:

1. *Research Methodology by Dr.Baidyanath Mishra, Ashok Kumar Satapathy, Sujata Mishra*
2. *Consumer Protection Act.*
3. *Patents Act.*

Reference books:

4. *Thesis and Assignment Writing- J Anderson, B.H.Dursten and M.Poole, Wiley Eastern (1977)*
5. *Research Methodology (Second Revised Edition)-C.R.Kothari;New Age Publishers, 2004*

- **In case of those M.Phill Pass candidates who have passed M.Phill Degree with minimum B Grade as regular student and have studied paper on Scientific Research Methodology are exempted from this paper.**

RPE-CC-021: RESEARCH PUBLICATION AND ETHICS

RPE01: Philosophy And Ethics

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

RPE02: Scientific Conduct

1. Ethics with respect to science and research.
2. Intellectual honesty and research integrity.
3. Scientific misconducts: Falsification, fabrication, and plagiarism (FFP).
4. Redundant publications: duplicate and overlapping publication, salami slicing.
5. Selective reporting and misrepresentation of data.

RPE03: Publication Ethics

1. Publication ethics:definition,introduction and importance.
2. Best practices/standards setting initiatives and guidelines:COPE, WAME, etc.
3. Conflicts of interest.
4. Publication misconduct:definition, concept ,problems that lead to unethical behavior and vice versa, types.
5. Violation of publication ethics, authorship and contributorship.
6. Identification of publication misconduct, complaints and appeals.
7. Predatory publisher and journals.

PRACTICE

RPE04: Open Access Publishing

1. Open access publications and initiatives,
2. SHERPA/RoMEO online resource to check publisher copyright & self archiving policies.
3. Software tool to identify predatory publications development by SPPU.
4. Journal finder/journal suggestion tools viz.JANE, Elsevier journal finder, springer journal suggester, etc.

RPE05: Publication Misconduct

A. Group discussions

1. Subject specific ethical issues, FFP, authorship.
2. Conflicts of interest.
3. Complaints and appeals:example and fraud from india and abroad.

B. Software tool

Use of plagiarism software like turnitin, urkund and other open source software tools.

RPE06: Databases And Research Metrics

A. Databases

1. Indexing databases.
2. Citation databases:web of science ,scopus, etc.

B. Research metrics

1. Impact factor of journal as per journal citation report, SNIP,SJR,IPP,Cite,Score.
2. Metrics :h-index, g-index, i10index, altmetrics.

Text books:

1. Research and Publications Ethics by Santosh Kumar Yadav
2. A guide to research and Publications Ethics by Partha Pratim Ray

References books:

1. Research and Publications ethics by Dr. S.B. Kishor, Sr. Ajay S. Kushwaha, Dr. Gitanjali
2. Handbook of Research Ethics and scientific integrity, Springer, Ron Iphofen

Elective Courses

(Any one from following related to thesis work)

PHY-EC-612 NANO PHYSICS

Course Objectives	To familiarize the research students about the fundamentals quantum mechanics.
Course Outcomes	The scholars will learn the facts how where and when to go with synthesis and characterization process.

Module I

Quantum mechanics and quantum confinement: Introduction to quantum mechanics and quantum confinement and application with reference to quantum wells, quantum wires, quantum dots, nano clusters and nano crystal.

Module II

Introduction to synthesis of nanomaterials: Lower dimensional structures: 3D, 2D, 1D and 0D structure. Strategies of synthesis and technological applications of nanomaterials.

Module III

Characterization and characterization techniques of nanomaterials: Introduction, structural characterization of nanomaterials, operational principles of microscopic and spectroscopic studies: XRD, SAXS, SEM, TEM, EDAX, LEED, SPM, AFM, XPS, ESCA. Optical spectroscopy, luminescence spectroscopy, UV-Vis spectroscopy, infrared spectroscopy, Raman spectroscopy, Auger, thermal analysis methods.

Module IV

Semiconductor Electronics: Fundamental physics of semiconductor materials and its significance in nanotechnology.

Module V

Applications of nanotechnology in various fields:: Renewable energy, solar energy, fuel cells etc., Material manufacturing and automobile industry, Biomedical science, medicine ,diagnostics, etc, Computers, electronics and communication.

Text books:

1. Nanotechnology Fundamentals and applications: Manasi Karkee, I K International Publishing Learning Pvt. Ltd. 2009
2. Nanomaterials: B.Viswanathan- Narosa 2009

References books:

1. Solid State Physics: JP Srivastva-Prentice Hall 2007.
2. Introduction to nanotechnology: Charles P.Poole Jr. and Franks J.Qwens-John Wiley & sons 2003.

PHY-EC-613 RADIO ASTRONOMY AND SPACE SCIENCE

Course Objectives	• To familiarize the research students about the fundamentals aspects in the fields of Radio astronomy and space science. • To prepare and specialize them in the relevant areas of research and development
Course Outcomes	The scholars will learn to write thesis by knowing the radio astronomy techniques, Radar techniques and Dynamics of Stellar System.

Module I

Amplifiers and Oscillators: Classification of amplifiers – The concept of feedback. Positive and negative feedback. Advantages of negative feedback- emitter followers- RC coupled amplifiers. Phase shift, Wein Bridge, Hartley and Colpitts Oscillators, Crystal Oscillators. IC 555 Astable, Monostable and Bistable multivibrators**.**

Module II

Radio Astronomy Techniques: Electromagnetic spectrum. Radio window. Various types of radio telescope antennas. Design of construction of a simple radio telescope. Receivers system and their calibration. Design and construction of a simple radio interferometer. LB and VLBI system. GMRT at Pune. Aperture Synthesis.

Module III

Space Studies: Near earth environment. Earth's atmosphere. Various Ionosphere layers of the earth. Propagation of E.M. waves. Radio studies of Ionosphere. Observation of differential Doppler effect and Faraday effect. Measurement of total electron content of earth's ionosphere.

Module IV

Radar Techniques: Radar equations, pulse and continuous wave radar astronomy system. Radar studies of planets and meteors. Solar radiations. Solar radio telescope at JapalRangapur Observatory. Indian MST radar. MST radar for Ionosphere studies. Meteor Astronomy. Shower and non- shower meteors. MST radar studies of Meteors.

Module V

Dynamics of Stellar System: The N- body problem. Stellar system as N-body system. Dynamical evaluation of star clusters. Virial theorem. Jacobi's criterion of stability and virial theorem. Masses of stellar system and cluster of galaxies from virial theorem. Effect of stellar

encounters. The Relaxation time. Tidal effects of galaxies and interstellar clouds. The collisioless Boltzmann equation. The hydro-dynamical equations. Jean's theorem. Mathematical models of Galaxies- Sersic, Plummer and King's models**.**

Text Books

1. *The backyard astronomer's guide;fourth edition,Terence Dickinson and Alan Dyer.*
2. *A textbook of astronomy and astrophysics,Willey.*

References Books

1. *Radio Astronomy: J.V.Evans and T.Hagfers.*
2. *Solar Radio Astronomy – M.R.Kundu. Theory Paper*
3. *L.Spitze: Physical Processes in the Interstellar Medium. John Wiley 1978*

PHY-EC-614 MODERN ELECTRONICS

Course Objectives	• To familiarize the research students about the fundamentals aspects in the fields of Modern Electronics. • To prepare and specialize them in the relevant areas of research and development
Course Outcomes	The scholars will learn to write thesis by knowing microcontroller, embedded system and programming techniques.

Module I

Microcontroller. Introduction to microcontroller, 8051 microcontroller, MCS-51 Architecturel, Register,8051 pin description ,Connection, I/O ports, Memory organization, Addressing modes, Instruction set, Stack pointer, 8051 Assembly language programming, Development system and Tools, Software simulator of 805, Interrupts, Timer and counter, Serial communication, Atmel microcontrollers (89C51/ 89C2051), Architectural overview, Pin description (89C51/ 89C2051)

Module II

Applications of Microcontroller: MCS -51 and 89C51/ 89C2051, PIC microcontroller-overview, Memory organization and instructions, Addressing modes, I/Oports, Interrupts in PIC 16C61/71,PIC 16C61/71 timers, PIC16C61/71-ADC, PIC 16F8XX flash microcontroller, Interfacing and microcontroller applications, Industrial applications, Industrial applications of microcontroller.

Module III

VHDL: Basic terms in VHDL, Behavioral modelling, Types of delay, Sequential processing, Data types, Function and procedure, Attributes, Configuration.

Module IV

Embedded System: Introduction to embedded system, Design challenges, optimizing design metrics, Processor design and IC technology, Embedded system project management, Embedded system design and Codesign issues in system development process, Design cycle in the development phase for an embedded system, Use of software tool for development of embedded system.

Module V

PC interfacing study of PC parallel port: Essentials, Accessing ports, Programming issues, Programming tools, Experiments and interfacing, Study of PC serial port: Format and protocol, Sending serial Data , Transmitting a byte, Data Formats, Preventing missed data , Port architecture, Port resources, Configuring inside the UART.

Text books

1. *Modern electronics and integrated circuits;Stanier,BJ.*
2. *An introduction of modern electronics,Wiley.*

Reference Books

1. *Modern electronic circuits reference manual; John Markus.*
2. *Electronic devices and circuit ;eleventh edition,Pearson.*

PHY-EC-615: POLYMER ELECTROLYTES FOR SMART MATERIALS

Course Objectives	To familiarize the research students about the fundamentals aspects in the fields of polymer electrolytes, Nano- Composite Polymer Electrolytes.
Course Outcomes	On successful completion of this course, scholar should be conversant with the concepts of polymer electrolytes ,gel electrolytes and nano composite polymer electrolytes.

Module I

Introduction: General introduction to Solid State Ionic, Ionic Conduction and Defects, Transport Mechanism in Superionic Conductors, Superionic Conductors, Developments in Superionic conductors, Classification of Superionic Conductors -Depending on Defect concentration,- depending on the nature of Mobile Species,

Module II

Crystalline materials: Crystalline/Polycrystalline Solid Electrolytes, (a) Cationic conductor, (b) Anionic Conductors, Ion conducting Glasses, Composite Electrolytes, Different Mechanisms for Proton Conduction**.**

Module III

Polymer Electrolytes: General Introduction, Classification of Polymer Electrolytes, (a) Polyelectrolytes, (b) Polymer – Salt complex, (c) Polymer Gel Electrolytes, Unplasticized and Plasticized Polymer Electrolytes, Physical properties of Plasticizers, Lithium Ion Conducting Polymer Electrolytes, Magnesium Ion Conducting Polymer Electrolytes, Fluoride Ion Conducting Polymer Electrolytes, Proton Conducting Polymer Electrolytes.

Module IV

Polymer Gel Electrolytes: General Introduction, Types of Gel Electrolytes, Aqueous and Non aqueous Gel Electrolytes, Hydrogels, Lithium Ion Conducting Gel Electrolytes, Magnesium Ion Conducting Gel Electrolytes, Fluoride Ion Conducting Gel Electrolytes, Proton Conducting Gel Electrolytes, Breathing Polymeric Chain Model**.**

Module V

Nano- Composite Polymer Electrolytes: General Introduction, Developments in Composite Electrolytes, Plasticized Nano- composite Polymer Electrolytes, Composite Polymer Gel Electrolytes, Double Percolation Threshold Model, Inducting Effect, Application of Various nanocomposite in smart technology.

Text Books

1. *Polymer electrolytes;first edition,Elsevier.*
2. *Polymer materials with smart properties,Maria Bercea.*

References books

1. *Polymer Electrolytes; Fundamentals and application (Woodhead publishing Series in Electronic and optical Materials) 1st edition by Cesar Sequeira (Editor).*
2. *Composites and Nanocomposites by A.K.HaghiOluwatobi Samuel, Josmin P. Jose, Hanna J. Maria.*

PHY-EC-616: SOLAR ENERGY AND PHOTOVOLTAICS

Course Objectives	To familiarize the research students about the fundamentals aspects in the fields of solar energy and photovoltaics
Course Outcomes	The scholars will be benefitted to know some special topics on solar cell, nanomaterials in solar photovoltaic technology, and future scope and possibilities on photovoltaics issues

Module I

Energy Resources And Solar Spectrum: World energy resources- Indian energy scenario- Environmental aspects of energy utilization, Renewable energy resources and their importance- Global solar resources, Solar spectrum-Electromagnetic spectrum, basic laws of radiation, Physics of the Sun - Energy balance of the earth, energy flux, solar constant for earth, green house effect.

Module II

Solar Cell Fundamentals: Photovoltaic effect- Principles of direct solar energy conversion into electricity in a solar cell, semiconductor properties, energy levels, basic equations, solar cell, p-n junction, structure, I-V characteristics of a PV module, maximum power point, cell efficiency, fill factor, effect of irradiation and temperature

Module III

Solar Electrical Energy Conversion: Solar photovoltaic energy conversion- principles- physics and operation of solar cells, classification of solar PV systems, Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar isolation and temperature, losses, solar PV power plants.

Module IV

Nanomaterials for Solar Applications: First, second, third and fourth generation solar cells, photochemical solar cells, PV panels with nanostructures, phase compositions on nanoscale microstructures- role of nanostructures and materials- nanomaterials in solar photovoltaic technology- band gap engineering and optical engineering-tandem structures-quantum well and quantum dot solar cells- photo-thermal cells-organic solar cells, hybrid solar cell bulk heterojunctions and blends, performance and reliability of nanomaterials based solar cells, market and research trend for various types of solar cells.

Module V

Fabrication Routes for Photovoltaics Structures: PVD, CVD, spray pyrolysis, PLD, spin coating, vacuum coating techniques, sputtering, MBE, junctions fabrication, importance of glob box inert system, designs or solar cell layers, importance of various layers in junction system in single junction and multi junction solar panels, electrodes, anti reflection coating, hole and electron transport and blocking layers, latest efficiencies of various type of solar cells, market and research status for various types of solar cells, future scope and possibilities on photovoltaics issues.

Text books:

1) Garg H.P., Prakash J., Solar Energy Fundamentals and applications, Tata McGraw Hill, 2005.

Reference books:

2) John R. Balfour, Michael L. Shaw, Sharlave Jarosek, Introduction to Photovoltaics, Jones & Bartlett Publishers, Burlington, 2011.

PHY-EC-617: PLASMA PHYSICS

Course Objectives	To introduce the basic theoretical background of plasma physics
Course Outcomes	On successful completion of this course, scholar should be conversant with the concepts of Debye shielding, Fluid theory and the idea of Kinetic theory in plasma and various application of plasma physics

Module I

Introduction: Introduction to plasma, definition, concept of temperature- Debye shielding- The plasma parameters-Criteria for plasma, application of plasmas physics (basic ideas) Single particle motions; uniform E and B fields- Gravitational field- non uniform B fields and curve B- magnetic mirrors non uniform E field, Time –varying B field –Adiabatic invariants.

Module II

Fluid Models: Fluid theory in Plasma, Fluid equations of motion, Single fluid mangneto-hydrodynamics, magnetic Reynolds number, magnetic equilibrium-the concept of beta, diffusion, resistivity and collision in Plasma, Fokker plank equation
Waves in fluid plasma: Representation of waves- group velocity- plasma oscillations- waves in unmagnetized plasmas- electron plasma waves-Langmuir waves and oscillations-ion sound waves, high frequency electromagnetic waves in unmagnetized plasma.

Module III

Kinetic theory Kinetic theory: need for kinetic theory, f (υ) equations by kinetic theory, Vlaslov equations, Kinetic effects on plasma waves and in a magnetic field, Landaus treatment, BGK and Van Kampen modes- experimental verification

Module IV

Plasma instabilities: instability in plasma, streaming instability, ion drag force induced, drift wave instability and parametric instability, Chaos and time series analysis, Fourier theory, Liapunov exponent, Attraction, self–similarity, Hurst exponent and Fractal dimension

Module

Applications: Waves in space plasma, plasma turbulence and particle heating, Fundamentals of plasma processing, gas discharge processes, dc discharge, rf discharge, capacitive and inductively coupled plasma systems, theory and description of different plasma production systems, dusty plasma, introduction to controlled thermonuclear fusion, magnetic confinement: Tokamak, Spheromak and ITER

Text books:

1. Francis F Chen: *Introduction to plasma physics and controlled Fusion*, vol. I: plasma physics, 2nd edition, Springer, 1984.

Reference books:

1. Robert J Goldston and Paul H Rutherford: *Introduction to Plasma Physics*, Institute of Physics, London, 1995.
2. U. S. Unan and U Golkowsky: *Principles of Plasma Physics for Engineers and Scientist*, Cambridge University Press, 2011.

PHY-EC-618: ADVANCED SOLID STATE PHYSICS

Course Objectives	To provide the complete conceptual knowledge of solid state physics.
Course Outcomes	After understanding the basic concepts the student will be able to apply his/her theoretical knowledge to perform the synthesis and characterization work. Of various materials or even their nano forms.

Module I

Transport properties of metals and semiconductors: Boltzmann equation, electrical conductivity, calculation of relaxation time, impurity scattering, ideal resistance, general transport coefficients, thermal conductivity, thermoelectric effects, lattice conduction, phonon drag. Thermal conductivity, thermoelectric and magnetic effects, hot electron and energy relaxation times.

Module II

Dielectric properties of solids and ferro-electricity: Macroscopic description of static dielectric constant, electronic ionic and orientation polarization , Lorentz field, dielectric constant of solids, complex dielectric constant and dielectric losses, theory of electronic polarisation and optical absorption. General properties, classification, dipole theory and its drawbacks, thermodynamics of ferroelectric transitions, ferroelectric domains.

Module III

Magnetic properties of solids: Classification Langevin theory of diamagnetism, Quantum theory of paramagnetism, Ferromagnetism, concept of domains, thermodynamics, thickness of Bloch wall, Molecular field concept, Weiss theory, Heisenberg exchange interaction, Ising Model, concept of magnons and thermal excitation of magnons, Ferromagnetism and antiferromagnetism.

Module IV

Superconductivity: Review of basic properties, classification into type I and type II, energy gap and its temperature dependency, super currents and critical currents, London's phenomenological equations, penetration depth, cooper pairs, coherence length, instability, of Fermi surface and cooper pairs, BCS theory, ground state energy of superconductor, quantization fo magnetic flux, Josephson effects (AC & DC) and applications.

Module V

Glasses and Ceramics: Introduction to glass: definition, enthalpy/temperature diagram, principles of glass formation, kinetic theory of glass formation, determination of glass forming ability and glass stability, Glass melting, fining of melts, phase separation and mechanism, ceramic phase equilibrium diagrams, Gibb's phase rule, phase equilibrium diagrams for one and two components.

Text books:

1. Introduction to Solid State Physics, C.Kittel, Wiley eastern.
2. Solid State Physics, A J Dekkar, Premtice Hall.

Reference books:

1. The Physical Principles of solids, A.H. Morrish.
2. Principles of the theory of solids , J M Ziman, Cambridge University Press.
3. Introduction to superconductivity , M. Tinkham, McGraw- Hill, International Editions, VTU.

Format of Dissertation:

Title Page
TITLE OF THE THESIS
Supervised by:
Co-Supervised by: (If any case)
Submitted by:
Department of Physics
Sri Sai University, Palampur
Session
Month
Year
Page 2
(Preferably on (Guide's) letter head)
CERTIFICATE
This is to certify that the Thesis entitled "**Title**" aimed at "Research purpose" was worked upon by the following students under my supervision at Physics Laboratory in Department of Physics, Sri Sai University, Palampur.
signatures
It is certified that this work is original and has not been submitted for any degree.
Chairman Name of Guide
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ABBREVIATIONS USED
Page 7
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Page 8
LIST OF GRAPH AND FIGURES
Page 9
INTRODUCTION
Chapter 1
Chapter 2
Chapter 3
……..
Concluding remarks and future scopes for the applicability and betterment of humanity.
END OF REPORT
Appendices
Source code and other relevant appendices
Bibliography /References.

INSTRUCTIONS FOR THE FORMATTING AND PRESENTATION OF RESEARCH REPORT/ THESIS

The following instructions be strictly adhered to while formatting the Research work Report/Thesis.

Top margin = 2.54 cm
Bottom margin = 2.54 cm
Left margin = 3.17 cm
Header and Footer = 3.17 cm
Page Size = 1.25 cm (from edge)
Font = Times new Roman
- Body test size……. 12pt
- Chapter headings …… 18 pt Bold
- Section heading ……16 pt Bold
- Sub Section heading …….14 pt Bold

Header and footers
- Header …… Chapter Name
- Footer…….. Page number

Spacing before and after body text paragraph 6 pt uniform
Spacing before section headings Zero
Spacing after section headings 12
Line spacing 1.5 lines
Tables……Centered, captions must.
Diagrams……Centered, captions must, No text around Diagrams
Page Numbering scheme for entailing chapters…. Roman Numbers
Page Numbering scheme for entailing pages of chapters ….. Arabic
The pages starting from Certificate to list of graph and figures must be enlisted in chronological sequence using Roman Numbers.
Final Project report must be - Hard Bound
- Rexene Covered
- Golden text to be used on cover
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- Paper to be used Bond paper

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***The enrolled student for Ph.D must have to provide the six month research work report followed by the power point presentation in front of the expert panel decided by the concern department.**