

Annixure - C
DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR M.P.
(A CENTRAL UNIVERSITY)
DEPARTMENT OF PHYSICS

DEPARTMENT OF PHYSICS

Ph.D. PROGRAMME in PHYSICS

(One semester Course work)
(Courses effective from Academic Session 2019-2020)



SYLLABI OF COURSES TO BE OFFERED (As per Ordinance 23 (A), and UGC Guidelines -2016)

SCHOOL OF MATHEMATICAL AND PHYSICAL SCIENCES
DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR (M.P.) 470003
(A CENTRAL UNIVERSITY)

Dshukla

Page 1 of 10

[Signature]
24.7.19
[Signature]
24.7.19

[Signature]
24/7/19

[Signature]
24/7

[Signature]
24/7/19

[Signature]
24/7/19

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR M.P.
(A CENTRAL UNIVERSITY)
DEPARTMENT OF PHYSICS

Course work for Ph.D. in Physics

Session 2019-20

Course Structure

I Semester

Core Courses:

		L	T	P	C
PHY CC 141	Research Methodology	3	1	0	4
PHY CC 142	Advances in Physics	3	1	0	4
PHY CC 143	Review of Literature (Dissertation)	Self Study			4

Elective Course (any one of the following)

PHY EC 141	Advanced Theoretical Methods	3	1	0	4
PHY EC 142	Advanced Experimental Methods	3	0	1	4
PHY EC 143	Advanced Electronic Systems	3	0	1	4

Core credits	=	8
Elective Credits	=	4
Review of Literature (Dissertation)	=	4
Total Credits	=	16

The detailed syllabi of each course follow on pages 3 to 9.

[Signature]
24.7.19

[Signature]
24/7/19

[Signature]
24.7.19

[Signature]
24/7/19

[Signature]
24/7/19

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR M.P.
(A CENTRAL UNIVERSITY)
DEPARTMENT OF PHYSICS

Ph.D. (Physics): I Semester
Session: 2019-2020
Core Course

PHY CC 141	Research Methodology	3	1	0	4
------------	----------------------	---	---	---	---

Objective:- This paper is designed to teach research scholars about meaning and importance of research. Research methodology also give information about basic research needs like problem detection and hypothesis and is solution by data collection and analysis.

Mode of study includes assigning the topic to students based on their basic background and presentation in the form of seminar which will be followed by discussion and submission of the write-up. There may not be any formal classroom teaching.

Unit I

Principles of Scientific Research:

Definition – History – Evolution of Scientific Inquiry

Meaning and importance of research – Types of Research, Research Design – Need – Features – Inductive, Deductive and Development models

Analysis of Literature Review – Primary and Secondary Sources, Web sources –critical Literature Review

Hypothesis – Different Types – Significance – Development of Working Hypothesis

Research Methods: Scientific method vs. Arbitrary Method, Logical Scientific Methods

(Lectures –12)

Unit II

Data Collection and Analysis:

Sources of data: Primary, Secondary and Tertiary.

Methods of collecting data: Observation, field investigations, direct studies – Reports, Records of Experimental observations.

Sampling methods: Data Processing and Analysis strategies, Graphical representation – Descriptive Analysis – Inferential Analysis- Correlation analysis – Least square method - Data Analysis using statistical package – Hypothesis – testing – Generalization and Interpretation – Modeling.

(Lectures –12)

Unit III

Scientific Writing:

Structure and components of Scientific Reports, types of report: Technical Reports and Thesis.

Different steps in the preparation: Layout, structure and language of typical reports, illustrations and tables; Bibliography, referencing and foot notes.

Oral presentation: Planning, preparation and practice, making presentation; use of visual aids; importance of effective communication.

Preparing Research papers for journals, seminars and conferences; design of paper using TEMPLATE; Impact factor of a journal, citation index, ISBN & ISSN.

Preparation of Project Proposal: Title, Abstract, Introduction – Rationale, Objectives, Methodology; Time frame and work plan; Budget and Justification

(Lectures –12)

DShukla
24.7.19
24/7/19
24/7/19
24/7/19
Indirani
24.7.19

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR M.P.
(A CENTRAL UNIVERSITY)
DEPARTMENT OF PHYSICS

Unit IV

IPR and Ethical Issues:

Intellectual Property rights and patent law; copy right – royalty related aspects of intellectual property rights, commercialization; Ethical Issues, Ethical Committees. Reproduction of published material: plagiarism, citation and acknowledgement; reproducibility and accountability.
(Lectures –12)

Unit V

Application of Computer in Research:

MS office and its application in Research: MS Word, MS Power point and MS Excel; statistical computation using SPSS.

Use of Internet in Research – Websites, searches engines, E-journal and E-Library, INFLIBNET.
(Lectures –12)

Expected Outcomes:- research scholars will know about research and how to define research problem. They also learn about various parts of research paper and scientific writing.

Essential Readings:

1. An introduction to Research Methodology., Garg.B.L. Karadia, R., Agarwal,F. and Agarwal, RBSA Publishers U.K., 2002
2. Research Methodology: Methods and Techniques. Kothari, C.R.Second Edition. New Age International Publishers, New Delhi.2008
3. Research Methodology, Sinha, S.C. and Dhiman, A.K.Ess Ess Publications, 2002
4. How to write and publish a scientific paper. Day, R.A. Cambridge University Press. London, 1992
5. Philosophy of Natural science Englewood Cliffs, Hempel,C. N.J: Prentice Hall, 1966.
6. The Metaphysical Foundations of Modern Science. Burt, E.A, .London, 2003.
7. Laboratory Life. The construction of scientific facts. Latour, B. & Woolgar. 3, 2nd Edition. Princeton: Princeton University Press.1986
8. Statistical Methods. 37th ed. (Rev) Gupta S.P., Sultan Chand and Sons. New Delhi,2008
9. Indian Philosophy and Philosophy of Science, Sundar Sarukkai Motilal Banarsidass Publishers Pvt.Ltd. New Delhi. 2008

Suggested Readings:

10. Introductory probability and Statistics; Applications for forestry and Natural sciences.CAB International,Kozak A, Kozak R.A., Staudhammer C.L., and Watts S.B., UK.408p,2008
11. Internet for Everyone, Vikas Publishing House. Leon & Leon (2202).
12. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing. Wadehra, B.L., 2000.
13. Metropolitan Book Comp. Ltd. Chandra A. and Sexena T.P.) Style Manual, New Delhi, 2000
14. Computer Fundamentals, Sinha P.K. BPB Publications, New Delhi. 1992.
15. Advanced Engineering Mathematics – Erwin Kreyszig, Wiley International 9th Ed.

Sharma
24.7.19

Approved
24/7/19

Sharma
24.7.19

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR M.P.
(A CENTRAL UNIVERSITY)
DEPARTMENT OF PHYSICS

Ph.D. (Physics): I Semester
Session: 2019-2020
Core Course

PHY CC 142	Advances in Physics	3	1	0	4
------------	---------------------	---	---	---	---

Objective:- The main objective of this paper is to give information to scholars' about physics theories behind origin of the universe, black holes, dark matter etc.

UNIT I

History of Science: Emergence of science, dark ages, beginning of modern science, the renaissance: the "Golden Age" of science, the era of Newton, industrial revolution, the remaining part of 19th century, modern science.

The Origin of the Universe: theories of the origin of the universe by ancient Greeks, the birth and growth of the universe, the Big Bang theory, Quantum Cosmological Theory, Milky Way and external galaxies, galaxies and their classification, the solar system and planet earth. (Lectures -12)

UNIT II

Brief History of Physics: Definition and origin of physics, stages in the history of physics: antiquity, middle ages, renaissance, modern age.

Early atomic and molecular theories, the breakdown of classical physics, quantization of electromagnetic radiation, the era of modern physics; structure of atom, the nucleus, elementary particles; the truth about space and time: Einstein's special theory of relativity, space and time in Einstein's general relativity. (Lectures - 12)

UNIT III

Fundamental Forces: The Four Fundamental Forces, Strong Force, the Electromagnetic Force, the Weak Force, Gravity; Unification of forces: the grand unification theory.

Elementary Particles: The Elementary Particles, matter and antimatter, pair production and annihilation, antimatter in the universe; the Standard Model, the Higgs particle, the Large Hadron Collider. (Lectures - 12)

UNIT IV

Black Holes: History, discovery of black holes, formation and characteristics of black holes, birth of a black hole, evidence of black holes, behavior of light with respect to gravity, white dwarf, neutron stars.

Dark Matter: Hidden Mass in the universe, theories of dark matter, massive astrophysical compact halo objects (MACHOs), dark matter and the big bang theory, fate of the universe, theory of dark energy; Cosmic hide and seek: the search for the missing mass, determining the mass of galaxies. (Lectures - 12)

UNIT V

Technology and Society: Impact of science and technology, differences between science and technology, impact of science and technology on various aspects of people's lives, concept of intermediate or appropriate technology, challenges of science and technology.

Man and his Energy Resources: Energy resources, energy generation and the environment, energy in the atmosphere: wind and solar energy. (Lectures - 12)

Outcomes:- Research scholars will know physics behind various phenomena universe and learn physics theories about these phenomena. Student also get familiar with elementary particles and fundamental forces.

Dr. Shukla
24.7.19

Dr. Shukla
24.7.19

Dr. Shukla
24.7.19

Dr. Shukla
24.7.19

Dr. Shukla
24.7.19

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR M.P.
(A CENTRAL UNIVERSITY)
DEPARTMENT OF PHYSICS

Essential Readings:

1. The Evolution of Physics- Einstein and L. Infeld, Toughstone 1967.
2. The Ascent of Man- J. Bronowski, Liffle and Brown Company, 1976.
3. Cosmos- Carl Sagan, McDonald and Company, 2003.
4. In search of Schrodinger's Cat- John Gribbin, Random House, 2012

Suggested Readings:

5. Chaos- James Gleick, Viking Penguin, 1987
6. Doubt And Certainty – Tony Rothman and George Sudarshan (Helix books, Cambridge, 1998
7. Toa of Physics – Fritjof Capra, Shambhala Publication 3rd Edition. 1975.

Dhruv
24/7/19

hul
24/7/19

R
24/7/19

Narain
24.7.19

R
24/7/19

Apurva
24/7/19

Mahar
24.7.19

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR M.P.
(A CENTRAL UNIVERSITY)
DEPARTMENT OF PHYSICS

Ph.D. Physics: I Semester
SESSION: 2019-2020
Elective Course

		L	T	P	C
PHY EC 141	Advanced Plasma Physics	3	1	0	4

Objective:- The advanced concepts and included in the syllabus according to present needs and deeds in laboratory and space plasma research. This syllabus provides the background for space plasmas, astrophysical plasmas and cosmology. This paper will also enhance the concepts related to earth and atmospheric physics.

UNIT - I

Characteristic Properties of Plasma:

The occurrence and importance of plasma in nature, Plasma approximation, Concept of Debye length, Plasma parameter, Plasma frequency, Classification of plasma, Some basic plasma phenomena, Controlled thermonuclear fusion.

(Lectures -12)

UNIT - II

Dynamics of charged particles:

General law for motion of charged particles in electric field, Motion in an alternating electric field, Particle motion in presence of magnetic field, Time varying magnetic field and space varying electric field equation of motion, Curvature and gradient drift, Adiabatic invariance of magnetic moment. Pondermotive force.

(Lectures -12)

UNIT - III

Introduction to Kinetic Theory:

The meaning of $f(v)$, Equation of Kinetic Theory, Derivation of the Fluid Equations, Plasma Oscillation and Landau Damping, A Physical derivation of Landau Damping, BGK and Van Kampen Modes, Experimental verification, Ion Landau Damping.

(Lectures -12)

UNIT - IV

Waves in Plasma:

Electromagnetic waves in free space (wave equation, solution in plane wave, harmonic waves, energy flow, wave packet and group velocity), Magneto hydrodynamic waves (Alfven waves, Magneto-sonic waves),

(Lectures -12)

UNIT - V

Waves in cold plasma (basic equation of magneto-sonic theory, plane wave solution and linearization), Waves in warm plasma (waves in a fully ionized isotropic warm plasma, derivation of the equations for the electron and ion velocities, longitudinal waves, transverse waves).

(Lectures -12)

Outcomes: The research scholar will be able to develop and use the appropriate concepts for applications in various branches of plasma physics.

Essential Readings:

1. Fundamental of Plasma Physics by J.A. Bittencourt (IIIrd edition), Springer., 2004
2. Introduction to Unmagnetized Plasma by C. Uberoi, Prentice Hall of India. 1990

Suggested Readings:

3. Introduction to Plasma Physics by F.F. Chen, Springer.1974

Suggested e-books :

Introduction to Plasma theory by D.R. Nicholson, Wiley Publication.
Fundamentals of Plasma Physics by P.M. Bellan.

D. Sharma
Mohini
24.7.19

4802086
24.7.19

12
24/7/19

24/7/19
24/7/19

Approved
24/7/19

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR M.P.
(A CENTRAL UNIVERSITY)
DEPARTMENT OF PHYSICS

Ph.D. Physics: I Semester

SESSION: 2018-19

Elective Course

PHY EC 142	Advanced Experimental Methods	3	0	1	4
------------	-------------------------------	---	---	---	---

Objective: the course of advanced Experimental methods designed to teach students about preparation of nano- materials, fabrication of this titan by various techniques .it also provide knowledge about characterization techniques'.

Unit – I

Synthesis Techniques: Crystal Growth and Wafer Preparation, Thin Film Evaporation Process, Physics of Sputtering and Ion beam processing of thin films, Chemical Vapor Deposition, Substrate surface and thin film Nucleation, Epitaxy, Oxidation, Lithography, Ion implantation, Etching and Cleaning.

(Lectures – 12)

Unit –II

Structure and Microstructure: Structural and Micro-structural Techniques: X-ray diffraction, Energy Dispersive X-ray analysis, SEM, TEM, AFM, STM. Magnetic Force Microscopy (MFM), Ellipsometry, Spectroscopic techniques: Spectrophotometry, FTIR spectroscopy, Raman spectroscopy, Photoluminescence, Nuclear Magnetic Resonance (NMR) spectroscopy.

(Lectures – 12)

Unit –III

Physical Properties: Physical Properties Measurement Techniques: Electrical Characterizations: Measurement of resistivity by four-probe method, Dielectric, Impedance and Ferroelectric hysteresis measurements. Vibrating Sample Magnetometer (VSM),

(Lectures – 12)

Unit - IV

Superconducting Quantum Interference Device (SQUID). Heat capacity measurements, Thermal characterization techniques: Differential Scanning Calorimeter (DSC), Thermo-Gravimetric and Differential Thermal Analyzer (TG-DTA).

(Lectures – 12)

Unit - V

Spectroscopic Characterization : Double Beam IR Spectrometers, Basic Concepts of Raman Spectroscopy in Solids, Sensitive Detectors such as PMT CCD Camera, characterization of solid thin films through ellipsometry, Identification and Analysis of Optic and Acoustic, Modes in Solids, Electronics Absorption Study for Band Gap Determination.

(Lectures – 12)

Outcomes:- the research scholar will know about the multiple characterization techniques .

Essential Readings:

1. W. Demtroder, *Laser Spectroscopy Basic Concepts and Instruments*, third edition, Springer 2004.
2. x-ray Diffraction, B. D. Cullity, Addison-Wesley Publishing Company, Inc., 2013
3. Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AFM by Ray F. Egerton, Springer, 2005
4. Transmission Electron Microscopy, D. B. Williams and C. B. Carter, Springer.,2009
5. Principles of Fluorescence Spectroscopy by Lakowicz publisher Kulwer Academic/Plenum.,1999

Suggested Readings:

6. Thermal Characterization of Polymeric materials by E. Turi, Elsevier 1981.
7. Broadband Dielectric Spectroscopy by Kremer, Friedrich, Schonhals & Andreas, Springer 2003.
8. Physical Properties of Crystals by J.F. Nye, Oxford University Press., 1985
9. Dielectric Relaxation in Solids by A.K. Johnscher, Chelsea Dielectric press, 2006
10. Physical principles Electron Microscopy by – R.F. Egerton, Springer 2005
11. Instrumental Methods of Analysis Willard, H.H., Merit L.L., Dean J.A Seattl e F.L., CBS publishing and Distribution, 1995

Dshunda

Indranil 24.7.19

24.7.19

24/7/19

24/7/19

24/7/19

24/7/19

Page 9 of 10

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR M.P.
(A CENTRAL UNIVERSITY)
DEPARTMENT OF PHYSICS

Ph.D. (Physics): I Semester
SESSION: 2019-20
Core Course

PHY CC 143	Review of Literature (dissertation)	L	T	P	C
		Self Study			4

Each Research Scholar will be assigned a (departmental) faculty member as Supervisor on the topic of his/her interest.

The students are required to submit a dissertation on the topic/area of research assigned to him/her under the Supervisor allocated to him/her advisor the Department.

The evaluation of the dissertation and viva on it shall be on the lines as mentioned in the ordinance for the purpose.

D. Shukla

RP
24/7/19

Prof. Dr. J. K. Singh
24/7/19

M. K. Singh
24.7.19

R
24/7/19

Dr. Anurag
24.7.19