

AWADHESH PRATAP SINGH UNIVERSITY,
REWA (M.P.)



Ph. D. COURSE WORK STRUCTURE

Physics

2018-19

AWADHESH PRATAP SINGH UNIVERSITY, REWA

STRUCTURE OF SYLLABUS FOR Ph.D. COURSE WORK (PHYSICS) 2018-19 ONWARDS
(AS PER ORDINANCE NO. 11 DOCTOR OF PHILOSOPHY)

Paper Code	Name of Theory Papers	Credits	Maximum Marks (Theory+ Internal Assessment)	Minimum Passing Marks
Ph.D. 101	RESEARCH METHODOLOGY	4	100 (80+20)	55
Ph.D. 102	REVIEW OF PUBLISHED RESEARCH IN THE RELEVANT FIELD	3	100	55
Ph.D. 103	COMPUTER APPLICATIONS	3	100 (80+20)	55
Ph.D. 104	SPECIALIZATION SUBJECTS (ANY ONE OF THE FOLLOWING):MP104 (a) (Group-A): Astrophysics MP104 (b) (Group-B): Materials Science	3	100 (80+20)	55
Ph.D. 105	COMPREHENSIVE VIVA-VOCE	3	100	55
TOTAL CREDITS		16		

Handwritten signature and date: 27/01/19

Handwritten signature

Ph.D. (PHYSICS)

Ph. D. 101 : RESEARCH METHODOLOGY

Time: 03 Hours

Theory Paper: Max. Marks-80

Internal Assessment : Max. Marks-20

Minimum Pass Marks-55

The paper setter is required to set in all **Eight questions**, out of which only **four** questions are to be attempted by the students. All questions will be of equal marks. Two questions are to be set from each unit. The students are required to attempt at least one question from each unit.

Unit - I

Concepts in Research: Definition and Objective, Research Approach & Types of Research, Criteria of Good Research, Defining Research Problems. Research Design: Features of Good Research Design, Research Design With Reference to Physics, Basic Principles of Experimental Research Designs, Report, Paper & Dissertation Writing Concept.

Unit - II

Nature and Purpose of Mathematical Statistics, Tabulation and Statistical Inference, Tabular and Graphical Representation of Data, Bar, Pie & Radar Diagrams, Mean, Median, Mode & Variance, Co-relation and Co-efficient, Random Sampling, χ^2 - Test, Method of Least squares curve Fitting of Straight Lines & Polynomials Data Fourier Techniques and applications.

Unit - III

Theoretical Modelling Methods: Bisection Method, General Idea of Mathematical Modelling and Simulation - Monte Carlo Technique, Random Walk Problem, Newton Raphson Method, Least Square Fitting of Linear and Exponential Functions, Numerical Differentiations & Integration. Simpson's Rule, Runge Kutta Method.

Unit - IV

General Idea of Preparation of Materials: Solid State Reaction Method and Wet Chemical Method, Electro-Deposition Methods: (Basics only), Elementary Idea of Vacuum Coating Methods, Basic Principles & Applications of XRD, SEM, And FTIR. Methodology of Space Research - Ground Based & Satellite Observations, Cosmic Ray Detectors, Methods of Extracting Scientific Information from Space Data.

Reference Books:

1. Research Methodology: Methods & Techniques: C.R. Kothari, New Age International Publisher, N. Delhi (2009).
2. How to Write and Publish: R.A. Dayand, B. Gastel, Cambridge University Press.
3. How to Research: L. Blaxter, C. Hughes and M. Tight Viva Books.
4. A Student Guide to Methodology: P. Clough &, C. Mutbrown, Sage Publications.
5. Fundamentals to Computers: V. Rajaraman (PHI)
6. Probability & Statistical For Engineers & Scientists: Shelder Ren Elsevier Academic Press.
7. Principles of Instrumental Analysis: Skoog & Leary.
8. Astronomy: Baker
9. Solar Terrestrial Physics: Akasofu & Chapman.
10. Experimental Methods in Modern Physics: A.P. Mellissinos.

Shilpa

Shilpa

Ph.D. 102

REVIEW OF PUBLISHED RESEARCH IN THE RELEVANT FIELD

~~Wally~~
5/10/15

[Handwritten signature]

the meeting held on 07/08/19

The paper setter is required to set in all **Eight questions**, out of which only **four** questions are to be attempted by the students. All questions will be of equal marks. Two questions are to be set from each unit. The students are required to attempt at least one question from each unit.

Unit - I :

Anatomy of computers and their classification: Input and output devices. Concepts of computer ware, language processors and computer languages. Basics of operating system: with emphasis on windows operating system. Concept of OLE. Basics of MS-Office: MS Word, MS Excel, MS Power Point, Internet and E-mail basics web search engines. Types of search engines.

Unit - II : Conceptual framework of computer languages (Algorithm, Flow charts). Need of structured programming, Top-down, bottom-up and modular programming design. Introduction to C and C++ languages. basic structure of C++ program. Character set, keyword and identifiers C++ data types, variable and data type declaration. Arithmetic, relational, logical, assignment, conditional, increment and decrement operations, input and output statements.

Unit - III : Control statements: Branching, Looping and Jumping: If, If-else, if nested, if-else statements, switch, while, Do....While and For statements. Simple C++ programs (search of prime number between given range of numbers, finding the smallest and largest of given numbers, sum of algebraic series, factorial of given number, roots of a quadratic equation, binary to decimal and decimal to binary convertor etc). Functions: need of functions, calling the function by value and reference. Category of functions, no argument no return, argument but no return, argument with return, Recursion: One and Two dimensional arrays. String and string handling functions like `sprint()`, `strcpy()`, `scanf()`, `strlen()`, `sizeof()`, `strcmp()`, arrays and string functions.

Unit - IV : Computer network : LAN, MAN, WAN, client server. Network topologies: Bus, Ring, Star, Mesh. Internet : History of internet, Service provider (ISP), Types of internet account-shell/ Address, TCP / IP Address. Types of connectivity-Dial up, Leased lines, Satellite. IP Address- Class A, Class B, Class C, Domain Name Address, URL(absolute and relative). Web Technology: Web Browser: Internet Explorer, Netscape Navigator, Static and dynamic web page. Introduction to HTML: HTML tags, `<HTML>`, `<TITLS>`, `<HEAD>`, `<BODY>`, `<P>`, `
`, `<ALIGN>`, `<I>`, ``, `<DIV>`, `<PRE>`, and their attributes. ``, `<a>` and their attributes.

Statistical packages: MS-Excel, Statistical functions, SPSS package: structure and characteristics, use of SPSS in data analysis in Physics. Origin software: Need, characteristics and application in Physics.

Reference Books:

1. Let us c: Yashwat Kanetkar
2. Programming with C++: Balaguruswami
3. Internet and Web Page : VK Jain
4. Internet and Web page design : Dr. PD Murarka
5. C# 2008 in simple step Dreamtech Press

Shankar
25/10/15

[Signature]

Ph.D. (PHYSICS)

Ph. D. 104 (I) : Astrophysics

Time: 03 Hours

Theory Paper : Max. Marks-80

Internal Assessment : Max. Marks-20

Minimum Pass Marks-55

The paper setter is required to set in all **Eight questions**, out of which only **four** questions are to be attempted by the students. All questions will be of equal marks. Two questions are to be set from each unit. The students are required to attempt at least one question from each unit.

Unit - I: Solar output and Cosmic Ray Modulation:

Physical Characteristics of Sun, Solar Structure, Development of Centre of Activity, Sunspots, Prominences and Flares, The Sun and Interplanetary Space, the Solar Atmosphere (Photosphere, Chromosphere and Corona), Solar Wind and concept of heliosphere, Solar Wind Observation, Solar and Interplanetary Magnetic Fields, Interplanetary Sector Structure, Theory of Solar Cycle Evolution, Solar Flares and Coronal Mass Ejections, Variational Characteristic of different types of Solar Modulation, Long and Short Term Cosmic Ray Variation, Forbush Decreases, Ground level Enhancement, Cosmic Ray Propagation Models (Diffusion, Convection and Drift Model).

Unit - II Magnetospheric Processes

Structure of Geomagnetosphere, Different Regions of Magnetosphere and Associated Phenomena, Magnetospheric Models, the Concept of Closed and Open Magnetosphere, Interplanetary and Geomagnetic Disturbances, Shock-Wave in Interplanetary Space, Magnetospheric Storms, Interaction of Solar plasma with Magnetosphere, Collision of the Interplanetary Shock Wave with the Magnetosphere, Storms Sudden Commencement (SSC), Interaction of Solar Plasma with Magnetosphere, Morphology of Geomagnetic Storms, Polar Sub Storms and Auroral Phenomena, Association of geomagnetic Storms with Solar and Interplanetary Parameters. Near Earth Space Weather.

Unit - III : Radio Astronomy

Telescopes, Reflection and Refraction Telescope, Ground Based Optical Telescope (Visible And Infra-Red), Space Telescope (From Ultraviolet to Sub Millimetre), Radio Single Dishes and Aperture Synthesis, Radio Telescope (Beyond the Sub Millimetre Range), Large Telescope of the future. Radio Astronomy, Quasars and Molecules in Space, Infra-Red and X-Ray Astronomy, Neutrino Astronomy, Neutron Detector.

Unit - IV Stars and Galaxies

Formation of Stars, Evolution of Stars, Stellar Spectra and the Hertzsprung-Russell Diagram, Explanation of the Main- Sequence (the Mass-Luminosity Relation), Variable Stars, the Pulsation Theory of Variable Stars, Neutron stars, The Classification and Morphology of Galaxies, Formation and Evolution of Galaxies; Rotation of the Galaxy (Differential Rotation) the General Structure of Galaxy (the Central Region, the Galactic Disk and the Galactic Halo), the Mass of The Galaxy, the Cause of Spiral Structure, Luminosity Distribution in a Galaxy, Distances of Galaxies, Radio Galaxies, Seyfert Galaxies, Nebulae, Novae, Super Nova, Chandrasekhar Limit and Black Holes,

Reference Books:

1. Discovering Astronomy, R. Robert Robbins and William, H. Jefferys (John Wiley).
2. Observational Astrophysics: P. Lena, F. Labrun and F. Mignard (Springer).
3. Astronomy and Astrophysics with elements of Cosmology: V. B. Bhatia (Narosa)
4. Advanced Stellar Astrophysics: William K. Rose.
5. Galaxies and Cosmology: F. Combes, P. Boisse, A. Mazure, A. Blanchard
6. An Introduction to Astrophysics: Baidyanath Basu.
7. Physics and The physical Universe: Jerry B. Marmon.
8. Principles of Astronomy: P. Stanley Wyatt, James B. Kaler.
9. The State Of Universe - Ed. By G. Bath.
10. Astronomy - D.H. Menzel
11. Source Book of Space Physics. - Glasstone,
12. Space Science & Earth Environment - S.S. Degaonkar
13. Star & Planet - Abbeti.
14. The Sun - Abbeti.
15. Solar & Terrestrial Phys. - Akasafu & Chapman.
16. Cosmic Rays: Donnan
17. Cosmic Rays: Sandstrom
18. Progress in STP(V Int. Symposium): J. Roederer

Ph.D. (PHYSICS)

Ph. D. 104 (II): Materials Science

Time: 03 Hours

Theory Paper : Max. Marks-80
Internal Assessment : Max. Marks-20
Minimum Pass Marks-55

The paper setter is required to set in all **Eight questions**, out of which only **four** questions are to be attempted by the students. All questions will be of equal marks. Two questions are to be set from each unit. The students are required to attempt at least one question from each unit.

Unit - I: Crystal Graph and Nanomaterials Basics

Nucleation & Growth: Concept of Nucleation and their Types - Homogeneous & Heterogeneous Nucleation Processes, Growth and Overall Transformation Kinetics. Micro to Nano: Properties of Nano-particles, Nature of Carbon Bonds and Carbon Allotropes, Structure and Properties of C₆₀, Graphene and Carbon Nanotubes, Synthesis of Nanomaterials - Top Down and Bottom Up Approach, Chemical Route of Synthesis of Magnetic Nanoparticles: Sol-Gel Synthesis methods, Nano materials in Energy application (solid state Batteries, smart window and solar cells basics only).

Unit - II

Solid State Ionics: Super Ionic Solids- Definition and Characteristic Features, General Classification of Superionic Solids, Basic Idea of Ion Transport in Solids, Polymer Electrolytes and their Types. Mechanism of Ion Transport in Polymer Electrolyte-Macroscopic Approach: VTF and WLF Forms, Configurational Entropy Models, Application of Superionic Solids with emphasis to Electrochromic Display Devices, Sensors and Solid State Batteries (Without Theory).

Unit - III

Solar Cells: Sun's Spectrum, Solar Constant, Air Mass, Method of Measuring Solar Radiation (Out line only) Direct and Indirect Band Gap Materials, P-N Junction Diode, Photovoltaic Effect, Solar Cell Parameters and I-V Characteristics, Design Consideration for Solar Cell Fabrication, Type of Solar Cells. Metal Semiconductor Contacts and Photoelectrochemical Solar Cells (Basic Concept Only), Organic Solar Cells, Basic principles and types, Photovoltaic modules and arrays.

Unit - IV

Superconductors: Comparison Between Superconductor & Ideal Conductor, High Tc Cuprate (HTSC) Families, Structure of Y₁Ba₂Cu₃O_{7-x} and Variation of Tc with X, General Characteristics of Cuprate Superconductors, Methods of Preparation of High Tc Superconductors in Bulk and Thin Film Forms. Type II Superconductivity, Phase Diagram of La_{2-x}Sr_xCuO₄, Electronic Structure of Cuprates, Two Band Model & Hubbard Model, Normal State Properties, Critical Current of Pure Elements, Critical Current in Mixed State, Role of Inhomogeneities in Flux Pinning Depinning, Anisotropies in HTSC, Limitations of BCS Theory, RVB Theory of High Tc Superconductivity,

Reference Books:

1. S. Chandra: Superionic Solids & Applications.
2. F M Gray: Solid Polymer Electrolytes-Fundamentals &.. Technological Applications
3. Fonash: Solar Cell.
4. Fa hrenbruch and Bube: Fundamentals of Solar Cells.
5. R.:K. Kotnala, N.P. Singh: Essentials of Solar Cells.
6. S.M. Sze: Physics & Technology of Semiconductor Devices.
7. S.Chandra: Photoelectrochemical Solar Cells.
8. A. K. Saxena High Temperature Superconductor
9. T.V. Ramakrishna & C.N.R. Rao: Superconductivity Today.
10. S.V. Subramaniam & E.S.R. Gopal: High Temperature Superconductors.
11. A_S. Edelstein and R.C. Cammarata: Nanomaterials- Synthesis, Properties, Characterization and Applications
12. H.S. Nalwa :Encyclopedia of Nanotechnology
13. Handbook of Nanotechnology: Bhushan (Ed), Springer Verlag, New York (2004).
14. CNR Rao and Govindaraj: Nanotubes And Nanowires.
15. Handbook of Analytical Instruments, R.S. Khandpur
16. Thermal Methods of Analysis: W.W. Wendlandt
17. Elements of X-Ray Diffraction, B.D. Cullity -
18. Tuan Vo-Dinh: Nanotechnology In B: 'logy and Medicine: Methods, Devices and Application
19. Mao Hong Fan, Chin-Pao Huang, Alan E Bland, Z Honglin Wang, Rachid Sliman, Ian Write: Environanotechnology.