P.G. DEPARTMENT OF APPLIED PHYSICS AND BALLISTICS

SYLLABUS FOR THE COURSE IN M.PHIL IN PHYSICS (SFC MODE)

FOR THE SESSION2017-2018

F.M. UNIVERSITY, BALASORE

M.PHIL. PHYSICS
SYLLABUS 2017-2018

P.G. Department of Applied Physics and Ballistics

Approved by BOS on Dt. 20.09.2017

(SFC MODE)

M.Phil. in Physics		
Semester	Marks	Credit
1st semester	300	24
2nd semester	300	24
Total	600	48

M.Phil. in Physics			
First Semester			
Code	Name	Mark	Credit
PHY-501	Research Methodology	80+20=100	08
PHY-502	Advance Theoretical Physics	80+20=100	08
PHY-503	Computer Application (Theory) Advance Practical	20+5=25 75 (Total=100)	08
	Total	300	24

Second Semester			
Code	Name	Mark	Credit
PHY-601	Pre presentation/Proposal for Project	100	08
PHY-602	Project & Grand viva	200	16
	Total	300	24

(1ST SEMESTER)

Phy-501 Research Methodology & Computer Application **Marks: 80**
Internal:20
Total Marks:100 (8 Credits)

Research Methodology

Unit I: Research methods – Identification of the Problem – Determining the mode of attack -Literature survey – Mode of approach of actual investigation – Abstraction of a research paper – Drawing inferences from data - Qualitative and Quantitative analysis

Unit II: Writing a thesis or paper - General formation - page and chapter formation. The use of quotation - footnotes - tables and figures - referencing - appendixes - revising the paper or thesis - editing and evaluating and the final product - proof reading - the final types copy.

Unit III: FORTRAN Programming: Introduction, I/O Statement, Control Statements, DO Loops, Arrays and Subscripted variables, Sub programs, Data files, C Programming: Constants, variables, data types, Operators and Expressions, I/O Operations, Decision making and Branching, Decision making and Looping, Arrays.

Unit IV: Approximations and errors in Computing, Introduction to Numerical Methods, Matrix and linear equations, Roots of nonlinear equations, Numerical Differentiation and Integration, Curve fitting: Interpolation and regression, Numerical solution of Ordinary Differential Equations

References:

1. Numerical Methods for Physicists, Anthony O'Hare, 2005
2. Numerical Analysis, S. S. Sastry, Prentice Hall of India Pvt. Ltd., New Delhi.
3. Thesis and Assignment Writing – J Anderson, B.H. Burston and M. Poole, Wiley Eastern (1977).
4. A Hand Book of Methodology of Research – P. Rajammal and P. Devadoss, R.M.M Vidya Press (1976).
5. Computer Oriented Numerical Methods – V. Rajaraman, Prentice Hall of India.
6. Numerical Methods for Scientific and Engineering Computation – MK Jain, SRK Iyengar and RK Jain, Wiley Eastern publn.
7. Numerical methods, E. Balagurusamy, Tata McGraw-Hill
8. Elementary Numerical analysis-an algorithmic approach- S.D. Conte and C.de Boor, 1981, 3rd Edition, McGraw Hill.
9. Applied Numerical analysis, B.F. Gerald, and P.O. Wheatley, 1994,5th Edition, Addison-Wesley, M.A.
10. Applied Numerical Methods, B. Carnagan, H.A. Luther and J.O. Wilkes, 1969, Wiley, New York.
11. Numerical Methods, and Computer, S.S. Kuo, 1996, Addison-Wesley.
12. Numerical Recipes in FORTRAN, W.H. Press, 1992, 2nd Edition, Cambridge University press
13. FPRTRAN 77 and Numerical Methods by C. Xavier.

PHY 502 Advance Theoretical Physics **Marks: 80**

Internal:20

Total Marks:100 (8 Credits)

Materials Physics

Unit I: X-ray diffraction Methods

X-ray diffraction and Neutron diffraction basic theory and instrumentation, interpretation of diffraction patterns - indexing, systematic absences – space group determination - use of powder diffraction files - identification of phases - particles size and structure determination of poly-crystalline and amorphous materials.

Unit II: Spectroscopic Methods

X-Ray Absorption Spectroscopy, Principles, and its applications in Materials science, Introduction to FTIR spectroscopy, basic principle and applications of FTIR spectroscopy & TGA

Microscopic Methods

Introduction, basic theory and application of Scanning Electron Microscopy (SEM) and Energy Dispersive x-ray analysis, Transmission Electron Microscopy (TEM), and Atomic Force Microscopy (AFM).

Nuclear Reactions

Unit-III: The Phenomenological Optical Potential

Rationale for the optical potential, Partial wave expansion, the radial wave function, Its asymptotic behavior, Elastic scattering amplitude, Coulomb and Nuclear potential, Parameterization of Optical potential, Elastic scattering of alpha particles, spin-orbit interaction and nucleon elastic scattering, elastic scattering of heavy-ions, the imaginary potential and mean free path, systematic of parameters

Unit-IV: Distorted Born Approximation

Integral equations and scattering amplitude, the first Bohr Approximation, Distorted-Wave Green's Functions, the Gell-Mann Goldberger Transformation, two potential formula, The DWBA transition amplitude, Antisymmetrization

Reference Books:

1. Crystallography Applied to Applied to Solid State Physics, A.R. Verma & O.N. Srivastava, New Age International Publishers, 2nd Edition, New Delhi
2. Instrumental Methods of Analysis, Willard Merritt, CBS publishers, 2005
3. Electron Microscopy & Microanalysis of Crystalline Materials J A Belk, Appl. Sci. Publishers, 1979.
4. Instumental Methods of Analysis, Hobart H. Willard, Lynne L. Merritt, Jr., John A. Dean, Frank A. Settle, Jr. CBS Publishers and Distributers, New Delhi
5. Material Science & Engineering: An Introduction by William D. Callister, JWS, Newyork.
6. Solid State Physics, C. Kittel, Wiley- Eastern.
7. The Crystalline State, Vols I and III W.L. Bragg (Ed.), P.T. Bell &Sons London (1952).
8. Crystal Structure Analysis By X-ray Diffraction, H.J. Stout and F. Jensen, Van Nostran (1968).
9. Fundamentals of Crystallography,C. Giacovazzo (Ed.), International Union of Crystallograph} .3nd Oxford University Press (1992).
10. Electron Microscopy in the Study of Materials', Arnold M Prutton, 'Surface Physics', 2nd Ed., Clarendon
11. X-ray Diffraction, B.E. Warren, Addison-Wesley Publishing Co. Reading, MA, 1969
12. EXAFS: Basic rinciples and Data Analysis, B.K. Teo, Springer-Verlag, Berlin, 1986.
13. Introduction to Nuclear Reaction by G. R. Satchler (Macmillan Pub.).
14. Introduction to Nuclear Reaction by C. A. Bertulani, P. Danielewicz (I.O.P. Pub.).
15. The Optical Model of Elastic Scattering by P. E. Hodgson (Oxford Pub.)

PHY 503 Computer Applications And Advance Practical **20+5 (Internal)=25 (Theory) 75-Marks 8 credits Total=100**

Part - I

Computer Applications (Theory) **(20+5)**

Basic architecture of modern computer systems for scientific computing, Basics of programming languages, tools used in scientific computing, MS- Word, MS- EXCEL, MS-Powerpoint, Computer network and Internet.

Part - II

Advance Practical **(75)**

A. Research Methodology Lab Practice:
Programming techniques like FORTRAN, C, C++, Mathematica, Matlab – packages like LaTeX, Word, Power Point, Excel. Application of above for real physics problems. Basic idea about Internet, e-journal, article search.

B. Material Science Lab:
1. Sample studies by using FTIR.
2. Sample studies by using SEM
3. Stress & strain measurement by using UTM.

C. Nuclear Reaction Computation Lab:
4. 1d, 2d and 3d tunneling problems with different potentials then calculation of reaction cross section for different systems (by using MATLAB or FORTRAN 77 or C or C++)
5. Model available code run, developing a new code for calculation. (FORTRAN 77 or C)

2ND SEMESTER

PAPER-PHY-601 **100 Marks------8 credits**
Pre presentation/ proposal for project
PAPER-PHY-602
Project and grand viva **200 Marks------16 credits**