1.1.2

List of Employability/ Entrepreneurship/ Skill Development Courses with Course Contents

Colour Codes		
Employability Contents	**Green**	
Entrepreneurship Contents	**Light Blue**	
Skill Development Contents	**Pink**	
Name of the Subjects/Related to all three Components (Employability/ Entrepreneurship/ Skill Development)	**Yellow**	

List of New Courses

Department : *Pure and Applied Physics*

Program Name : *Pre Ph.d.. (Physics)*

Academic Year : 2016-17

List of Revised Courses

Sr. No.	Course Code	Name of the Course
01.	PRE-Ph.D./Phy/p-3	III A: Advanced Materials
02.	PRE-Ph.D./Phy/p-3	III B: Spectroscopic Techniques
03.	PRE-Ph.D./Phy/p-3	III C: Advances in Plasma Physics
04.	PRE-Ph.D./Phy/p-3	III D: Advance Nuclear Physics
05.	PRE-Ph.D./Phy/p-3	III E: Advanced Astronomy and Astrophysics

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शुद्ध एवं अनुप्रयुक्त भौतिकी विभाग
Dept. of Pure & Applied Physics
गुरु घासीदास विश्वविद्यालय
Guru Ghasidas Vishwavidyalaya
बिलासपुर (छ.ग.)/Bilaspur (C.G.)

Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2016-17

School : *School of Physical Sciences*

Department : *Pure and Applied Physics*

Date and Time : *December 12, 2016 – 11:30 AM*

Venue : *Smart Class Room*

The scheduled meeting of member of Board of Studies (BoS) of Department of Pure and Applied Physics, School of Studies of Physical Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, was held to design and discuss the M. Sc. (Physics), scheme and syllabi.

The following members were present in the meeting:

1. Dr. R. P. Prajapati
2. Dr. M. N. Tripathi
3. Dr. R. K. Pandey
4. Dr. Parijat Thakur
5. Dr. H. S. Tewari
6. Prof. D. P. Ojha
7. Prof. P. K. Bajpai

The committee discussed and approved the scheme and syllabi.

The following new courses were introduced in the Pre Ph.D. (Physics):

III A: Advanced Materials
III B: Spectroscopic Techniques
III C: Advances in Plasma Physics
III D: Advance Nuclear Physics
III E: Advanced Astronomy and Astrophysics

Signature & Seal of HoD
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Scheme and Syllabus

Course Structure
Pre Ph.D.-Physics Syllabus 2016-17

Pre-PhD Course Work (Physics)

Examination Scheme

Course Code	level	Course name	Credit	Remarks
	School level	Research Methodology& Computer Applications	04	Common to all
	Department level	Experimental, Theoretical techniques & Instrumentation in Physics Research	04	Common to Physics Candidates
	Paper –III (Optional) Any one of the followings	III A: Advanced Materials III B Spectroscopic Techniques III C Advances in Plasma Physics III D: Advance Nuclear Physics III E: Advanced Astronomy and Astrophysics	04	Any course

Paper III A: Advanced Materials

Objective - This course aimed at students who have a strong materials background wish to gain more specialised knowledge of the principles, structure, processing and design of advanced engineering materials. However, it is suitable also for graduates from other engineering and science backgrounds who wish to specialise in materials engineering.

Unit I

Linear and non linear dielectric materials, Ferroelectric, piezoelectric and electro-optic materials,composite materials, Liquid crystals, Materials for solar cells and Fuel cells.

Unit II

Colossal magnetoresistance materials, magneto caloric materials, Multifunctional materials, magneticfield induced polarization and electric field induced magnetization.

Unit III

Properties of Individual Nano-particles, metal nano clusters, magnetic clusters, semiconductor nanoparticles, optical properties, methods of synthesis of nano particles,

Unit IV

Carbon allotropes, fullerene, carbon nano tubes, graphene, graphite oxide and applications, Applicationsof carbon materials, Functionalization of graphene and carbon nanotubes

Unit V

Low dimensional systems, preparation, size & dimensionality effects, excitons, single electron tunneling,applications of quantum nanostructures, self assembly, process of self assembly

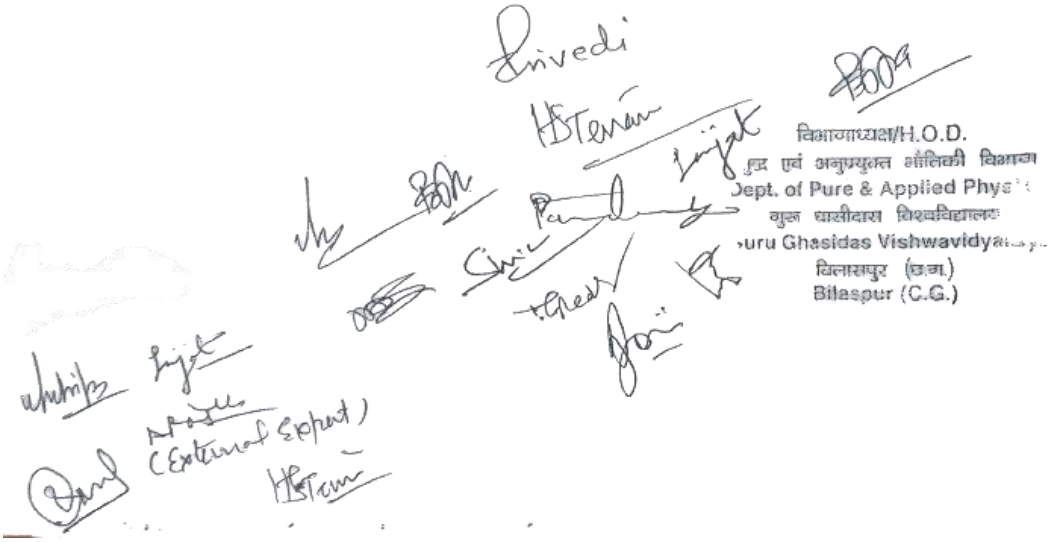
Computational Techniques: Basics of ab-initio calculations, basic principles of density functional theory(DFT), exchange correlation energy functional, applications of DFT

Outcomes –students will be able to Identify and describe different types of material processing techniques for advanced materials and Ability to select suitable material for specific applications.

Reference Books

1. Colossal magnetoresistance charge ordering and related properties of manganese oxides, C.N. R.Rao and B. Raveau
2. Dielectric relaxation in solids, A.K.Jonscher
3. Dielectrics and Waves, R. Von Hippel

4. Physics of Low dimensional semiconductors, J.H.Davies
5. Carbon Nanotubes, Dresselhaus M.S., Dresselhaus G. and Avouris P.
6. Carbon Nanomaterails, YuryGogotsi
7. Computational Chemisty, Lewars
8. Density Functional Theory: A practical approach, David S. Sholl, Janice A. Steckel



Paper III B Spectroscopic Techniques

Objective - This course will give an introduction to modern spectroscopic techniques including time-resolved laser methods.

Unit-I Raman Spectroscopy- Instrumentation , Basic Components of Raman system, Spectrometer and Detectors, Raman Spectroscopy of Solid and Liquids, Raman spectroscopy of Materials, Qualitative versus Quantitative Raman, Vibrational Analysis, Spectral Analysis by Group Theory, Character Table

Unit –II IR-Spectroscopy

Instrumentation, Basic Components, IR-sources, Spectrometer and Detectors, Infrared absorptionspectroscopy, Fourier transformed infrared spectroscopy attenuated total Reflectance(ATR) spectroscopy, diffuse reflectance spectroscopy.

Unit-III Electronic Spectroscopy Techniques

Instrumentation, Basic Components, UV-Visible sources, spectrometer and detectors, UV-Vis spectroscopy, Absorption., Transmission, Reflection, Photoluminescence, spectroscopy, florescence and phosphorescence, circular dichroism

Unit-IV Advance Spectroscopy Techniques

Surface Enhanced Raman Spectroscopy, UV Resonance Raman Spectroscopy, Tera hertz Spectroscopy,Laser Induced Breakdown Spectroscopy (LIBS)

Unit –V Other Techniques

Particle Induced X-ray emission, Nuclear Magnetic Resonance(NMR) spectroscopy, Electron Spin Resonance (ESR) Spectroscopy

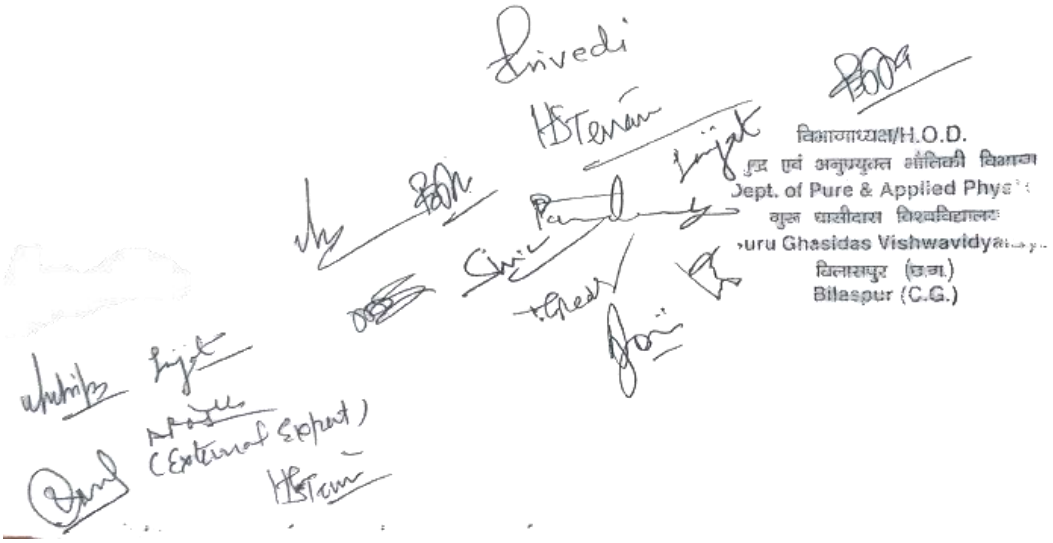
Outcomes -Recognize spectroscopy in microwave, Rotational spectra of rigid diatomic molecules, selection rules, interaction of spectral lines . Study of Vibrating diatomic molecule, energy levels of a diatomic molecule, simple harmonic and anharmonic oscillator, Scattering of light and Raman Spectrum. rotational and vibrational Raman Spectra .Learn Electronic spectra of diatomic molecules Born-oppenheimer approximation . Make Students aware of the fine structure of ESR absorption, Hyperfine structure, Double resonance in ESR, Techniques of ESR spectroscopy.

Text and Reference Books

1. Modern Spectroscopy, 4th Edition , J.Michael Hollas , Wiley
2. Chemical Application of Group Theory , 3rd Edition By F.Albert Cotton , Willey
3. Introduction to Molecular Spectroscopy : By Goron M.Barrow , Mc Grraw Hill New York
4. Handbook of Vibrational Spectroscopy , Vol0-I & II: By John M.Chalmers and Peter R.Griffiths,

Wiley

5. Condensed Matter Optical Spectroscopy : An illustrated Introduction by Luhan Ionita , CRC Press
6. Handbook of Raman Spectroscopy : From the Research laboratory to the process line : By Lan R. Lewis , Howell Edwards .CRC Press
7. Infrared and Raman Spectroscopy of Biological Materials : By Hans Ulklrich Grelich , Bing Yan CRC Press
8. Terahertz Spectroscopy : Principles and Applications , By Susan L.Dexheimer , CRC Press
9. NMR and Chemistry : An Introduction to modern NMR Spectroscopy , Fourth Edition By J.W. Akitt , B.E Mann , CRC Press
10. Laser Spectroscopy : Basic Concepts and Instrumentation 2nd Edition By Wolfgang Demtroder Springs



Paper III C (Optional)
Advances in Plasma Physics

Unit-I: Fluid theorem in Plasmas:

Single fluid and two fluid theorems', Mangnetohydrodynamics(MHD) fluid theory, fast slow and intermediate MHD wave, Dissipation in MHD Fluid, collisonless anistropic plasma, chew Goldberger and low theory

Unit-II: Nonlinear Phenomenon:

Concept of Sheath, wave particle interaction, Nonlinear landau damping, Wave kinetic equation, KDV Equations, Reductive perturbation analysis.**Unit-III: Instabilities in Plasma**

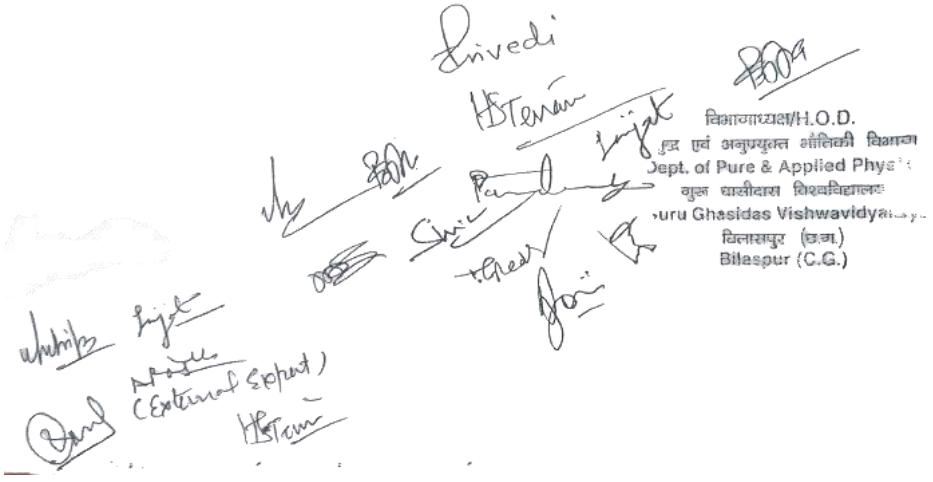
Stable neutral and unstable systems, Analysis of stability and non-stability, kinetic theory, macro stabilities, self-gravitational stability, Rayleigh- Taylor (R-T) instability, Kelvin– Helmholtz (k-h) instability, structure formation, Micro stabilities, Electron cyclotron instability.

Unit-IV: Basin of Dusty (Complex) Plasmas:

Dusty plasma and parameters, Characteristics of complex plasma, Application, dust charging process, Dynamics of dust grain, strong coupling phenomenon, Complex plasma crystal formation.

Text and Reference Books:

[1] J.A Bittencourt, Fundamental of Plasma Physics, Pergamon press
[2] N A Krall and A W Trivelpiece, Principle of Plasma Physics, McGraw Hills
[3] F F Chen, Introduction to Plasma Physics and controlled Fusion, Plenum press
[4] P M Bellan, Fundamental of Plasma Physics, Cambridge University press
[5] P K Shukla and A A Mamun, Introduction to Dusty Plasma Physics, IOP
[6] I P Goedbloed and S Poedts, Principle of Magnetohydrodynamics, Cambridge press
[7] I D Landan and F M Lifshiz, Statistical Physics
[8] S Chandrashekhar, Hydrodynamics and Hydromagnetic stability, Claredon Press



Paper III D(Optional)

III D: Advance Nuclear Physics

Objective -To impart knowledge about nuclear deformations, properties and nuclear models for understanding of related reaction dynamics. Beside this, students will be exposed to heavy ion physics and nuclear astrophysics.

Advance Nuclear Models: Single particle motion, Shell model with configuration mixing. Nilsson model. Strutinsky and shell corrections. Liquid drop model and collective motion. Rotation and vibration with particle coupling, Cranking models, Hartree-Fock model. quasipanicles and pairing

Experimental Techniques for Nuclear Structure Studies: Production of nuclei at extreme of spin. isospin and excitation energies. Nuclear reactions for production of various isotopes. Gamma ray spectroscopy for the study of discrete states of nuclei. Electromagnetic properties. Lifetime measurement: RDM. DSAM and Introduction to High-spin phenomena

Signal Processing: Pre-amplifiers. amplifiers. polezero cancellation. Base line restoration, Pile up rejection, Function generator. NIM & CAMAC Standards

Detectors: Energy loss of charged particles in matter, range & straggling. energy. position & time detection for charged particles with solid state detectors, ionization chamber. Multi wire proportional counter, semiconductor gamma detector, scintillation detectors,

Outcomes- Students will have achieved the ability to: 1. explain nuclear deformation and related orientation effects 2. collective description of nuclear behavior. 3. to examine dynamics of heavy-ion reactions 4. basic aspects of astrophysics

Reference Books:

1. Nuclear Structure from a Simple Perspective, R. F. Casten
2. Basic Ideas and Concepts in Nuclear Physics, K Heyde
3. Introductory Nuclear Physics, S.M. Wong
4. In Beam Gamma ray Spectroscopy, H. Morinaga
5. Advance in Nuclear Physics – Vol 10, Baranger, Michel, Vogt, Erich
6. Techniques for Nuclear and Particle Physics Experiments, William R. Leo
7. Radiation Detection and Measurement, G.F.Knol

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Paper III E (Optional)

Advanced Astronomy and Astrophysics

Objective - The coursework may be tailored to a student's needs, and can include astrophysical techniques, astrophysical computing, planetary science, stellar astrophysics, galaxies, cosmology, and courses from cognate disciplines. Many courses contain research or hands-on components that develop skills and knowledge in the latest advances in astronomy and astrophysics. They also offer training in areas highly relevant outside of academia, e.g. project management, computer programing, and problem solving skills. Some of the courses may include the acquisition and analysis of telescope data, the development of theoretical models, or the development and testing of new astronomical instrumentation.

Unit-I

Introduction to Astronomy and Astrophysics

Stellar structure and evolution - The HR diagram - Colors, magnitudes, Spectral classification - White dwarfs, neutron stars, black holes – Binary Stars – Binary X-ray Sources & Accretion discs – Extra-solar planetary Systems - ISM - Structure of Milky Way - Stellar population and galactic structure.

Unit-II

Galaxies: Structure, Dynamics and Evolution

Galaxies as self gravitating objects, virial equilibrium - Estimates of collision times - Collisionless Boltzmann equation and some steady state solutions - Globular clusters - stability - Spiral structure, bars and disc dynamics - Ellipticals - Galaxy morphology - Chemical evolution -Galaxy formation and evolution.

Unit-III

Extragalactic Astronomy

Phenomenology of AGNs (Seyferts, Quasars, Radio Galaxies, LINERS, BL Lacs) with a survey of continuum, emission and absorption features of spectra - Black hole and accretion disc models for AGNs - Emission line regions (BLR, NLR) - Physics of jets and hot spots.

Unit-IV

Telescope: Ground Telescopes and Space based Telescopes

Photometry: Instrumental magnitudes and colors, seeing and atmospheric effects, extinction correction. Standard photometric systems: UBV and other systems, transformation to a standard photometric systems, Absolute and differential photometry

Unit-V

Basics of CCD data reduction: Plate scale, readout noise and gain, signal-to-noise ratio, correction for bias, dark and flat fielding, fringing and cosmetic effects.

Basic understanding of X-ray Astronomy: X-ray Optics – Detectors - X-ray Data Reduction andAnalysis - Spectral & Timing Analysis

Learning Outcomes

1. Demonstrate high level knowledge in Astronomy & Astrophysics and relate it to a range of disciplinary and interdisciplinary contexts;
2. Apply their knowledge in the discipline to new problems;
3. Interpret, synthesise and critically analyse new published literature of relevance to Astronomy & Astrophysics;

Recommended Text and Reference Books:

1. The physical universe, Shu F., (University of California).
2. Astrophysics for Physicists, Choudhuri, A.R. (Cambridge University Press).
3. An introduction to Modern Astrophysics, Bradley W. Carroll & Dale A. Ostlie. (PearsonInternational Edition).
4. Astronomical Photometry: Henden A. A. and Kaitchuck R H (Willmann-Bell).
5. Galactic Astronomy, Mihalas, D. and Binney, J. (W.H. Freeman & Co).
6. Galactic Dynamics, Binney, J. and Tremaine, S. (Princeton University Press).
7. An Introduction to Active Galactic Nuclei, Peterson B.M. (Cambridge University Press).
8. Handbook of CCD Astronomy, Howell S.B. (Cambridge University Press).
9. Handbook of X-ray Astronomy, K. Arnaud, R. Smith & A. Siemiginowska (CambridgeUniversity Press).
10. High Energy Astrophysics, M.S. Longair Cambridge University Press).

Radiative Processes in Astrophysics, G.B. Rybicki & A.P. Lightman (Wiley-VCH)

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(External Expert)