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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 Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Pure and applied physics

Programme Name : Master of Science in Physics

Academic Year : 2018-19

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	PT-104	Basic Electronic Devices
02.	PT-302	Introductory to Computational Physics
03.	PT-401	Experimental Technique in Physics
04.	PT-402	Accelerator Physics
05.	PT_304	Materials science

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

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गुरु घासीदास विश्वविद्यालय
(केंद्रीय विश्वविद्यालय अधिनियम 2009 डा. 25 के अंतर्गत स्थापित केंद्रीय विश्वविद्यालय)
कोनी, बिलासपुर - 495009 (छ.ग.)



Guru Ghasidas Vishwavidyalaya
(A Central University Established by the Central Universities Act 2009 No. 25 of 2009)
Koni, Bilaspur - 495009 (C.G.)



PT-401 Experimental Techniques in Physics

Objective- The course mainly focuses on developing the experimental and instrumentation skills of the students. It is an advanced level experimental techniques course which is useful for those who opt research in experimental research of Physics.

Unit – I

Signal processing techniques: pre-amplifiers, filters; Measurement techniques: sensors and transducers, general instrumentation, measurement of voltage, current, charge, frequency etc.

Unit – II

Vacuum: Rotary vane pump, Roots blower pump, Diffusion pump, Ionization pump, Diaphragm pump, Adsorption pump, Turbo molecular pump; Measurement of Vacuum: Pirani/Thermocouple gauge, Penning/Ionization Gauge (hot cathode and cold cathode), Leak detection.

Unit – III

Production, properties and applications of x-rays, x-ray absorption and its role in structure evaluation, x-ray detectors, structure factor, form factor, Small Angle X-ray Scattering (SAXS), x-ray fluorescence (XRF), energy dispersive x-ray (EDX), particle induced x-ray emission (PIXE).

Unit – IV

Surface morphology using Transmission electron microscopy (TEM), Scanning Electron Microscopy (SEM), Scanning Tunneling Microscopy (STM) and Atomic Force Microscopy (AFM). Depth profiling by ion beam sputtering and secondary ion mass spectrometry (SIMS), Low energy ion scattering (LEIS), Rutherford Back Scattering Spectrometry (RBS), Nuclear reaction analysis (NRA).

Outcomes- Understanding of sensors and transducers for temperature, pressure, optical and vibration measurements

- A detailed understanding of vacuum technology involving generation and measurement of vacuum, Principles of rotary pump, diffusion pump, turbomolecular pump and ion pump, Measurement of vacuum using pirani, penning and ion gauges

References:

1. Analog and Digital Electronics for Scientists (2nd Ed.) (Wiley – Inter-science, New York).
2. Surface Analysis Methods in Materials Science : D. J. O. Conner (Springer Verlag).
3. Characterization of Solid Surface: P.F. Kane (Plenum).
4. R. Sahu, Physics of solid, nuclei and particle, Narosa publishing house, 2006.
5. K. L. Chopra, Thin film phenomena , Mcgraw- Hill book company latest Edition.
6. C. C Julian, Introduction of electron Scanning Tunneling Microscopy, Columbia university press, 2006
7. V. V. Rao, T. B. Ghosh and K. L. Chopra, Vacuum Science and Technology, Allied Publishers – 1998.
8. N. Harris, Modern Vacuum Practice [Freely available on net] (www.modernvacuumpractice.com/editor/user_DocView.asp?DocumentID=18)
9. D. M. Hoffman, B. Singh & J. H. Thomas, Handbook of Vacuum Science and technology, Academic press: 2005.
10. J. M. Lafferty, Foundations of Vacuum science and Technology, John Wiley and Sons, New York, 1998.
11. A. Chambers, R. K. Fitch & B. S. Halliday, Basic Vacuum technology, 2nd Ed, Overseas press, New Delhi -2005 or CRC press – 1998.
12. J. A. Nielson and D. Mc Morrow, Elements of Modern X-ray physics, John Wiley & sons, 2001.
13. G. V. Pavlinsky, Fundamentals of x-ray physics, Cambridge International sci Pub, 2008.



14. A. K. Singh, Advanced X-ray Techniques in Research and Industry, Capital Publishing Company, 2006.
15. N. Kasai, M. Kakudo, X-ray diffraction by macromolecules, Springer, 2005

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(vi) Special Paper : Material Science -I

Unit-I: Laws of Thermodynamic functions, Concept of free energy, stability and metastability, Relative stability of phases and phase rule and phase diagrams solid solutions, limited and unlimited solid solubility, interstitial and substitutional solid solutions, Hume Rothery rules, Unary and Binary phase diagrams (Lead-tin and Iron-carbon phase diagram), Lever rule, homogeneous and heterogeneous nucleation, growth and transformation kinetics, microstructural changes during cooling and heating.

Unit-II: Preparation of bulk, thin film and nano-materials: solid state reactions method, sol-gel method, precipitation method, nanomaterials: Bottom up method, cluster beam evaporation, ion beam deposition, chemical bath deposition, Top down method, ball milling, lithography, advantages and disadvantages of various synthesis methods.

Unit-III: Polymers, mechanism of polymerization, Molecular weight distribution in linear polymers, condensation. polymers, size distribution in polymer molecules, Effect of polymer structure on properties conducting polymer, introduction to liquid crystalline materials, mechanism of liquid crystal display devices.

Unit-IV: Introduction to Dielectrics, magnetic and multiferroic materials: Dielectric materials, linear and non-linear dielectrics, Ferroelectric materials, important characteristics and applications of ferro-electric materials, para, ferro, anti-ferro magnetic properties of materials, hysteresis losses, hard and soft magnetic materials, structure and properties of spinels, garnets and hexagonal ferrites and their uses, magnetic bubbles.

References:

1. Materials Science & Engineering : V. Raghavan
2. Elements of materials science & Engineering : L.H. Van
3. The Structure and properties of materials : R.M. Rose & J. Wulff
4. KP Jain, Physics of semiconductor nanostructures, Narosa Publishing House.

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