1.2.1

List of New Courses Introduced 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 : *M.Sc. (Physics)*

Academic Year : 2021-22

List of New Courses

Sr. No.	Course Code	Name of the Course
01.	PPPALT2	Quantum Mechanics Lab
02.	PPPALT3	Electronic and Experimental Methods Lab
03.	OPNPPT1	Nanomaterials and its Applications
04.	OPNPPL1	Nanomaterials and its Applications Lab
05.	PPPBLT2	Advanced Quantum Mechanics Lab
06.	PPPBTD1	Computational Physics and Programming Lab

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.)

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

Academic Year : 2021-22

School : *School of Physical Sciences*

Department : *Pure and Applied Physics*

Date and Time : *March 10, 2022 – 02:00 PM*

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. M. N. Tripathi
2. Prof. P. K. Bajpai
3. Prof. D. C. Gupta, External Member (Professor & Head, School of Studies in Physics, Jiwaji University, Gwalior)
4. Dr. A. K. Singh
5. Mr. P. Rambabu
6. Dr. R. P. Patel
7. Dr. M. P. Sharma

The committee discussed and approved the scheme and syllabi. The following courses were revised in the M. Sc. (Physics):

- Classical Mechanics
- Electronic and Experimental Methods
- Statistical Mechanics

The following new courses were introduced in the M. Sc. (Physics):

- Quantum Mechanics Lab (PPPALT2)
- Electronic and Experimental Methods Lab (PPPALT3)
- Nanomaterials and its Applications (OPNPPT1)
- Nanomaterials and its Applications Lab (OPNPPL1)
- Advanced Quantum Mechanics Lab (PPPBLT2)
- Computational Physics and Programming Lab (PPPBTD1)

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Signature & Seal of HoD

Scheme and Syllabus

Course Structure
M.Sc. Physics Syllabus 2021-22

Sem	Course Opted	Course Code	Name of the course	Credit	L:T:P	Internal	External	Total
I	Core-1	PPPATT1	Classical Mechanics	5	4+1+0	30	70	100
	Core -2	PPPATT2	Quantum Mechanics	4	3+1+0	30	70	100
		PPPALT2	Quantum Mechanics Lab	1	0+0+1	30	70	100
	Core -3	PPPATT3	Electronic and Experimental Methods	3	3+0+0	30	70	100
		PPPALT3	Electronic and Experimental Methods Lab	2	0+0+2	30	70	100
	Open Elective		Opted from the pool and offered by other departments	5		30	70	100
	Other if any							
			TOTAL	**20**				**500**
			Open Elective offered by department					
	Open Elective	OPNPPT1	Nanomaterials and its Applications	3	3+0+0	30	70	100
		OPNPPL1	Nanomaterials and its Applications Lab	2	0+0+2	30	70	100
	Open Elective	OPNPPT2	Advanced characterization and computational techniques in Physics	3	3+0+0	30	70	100
		OPNPPL2	Advanced Characterization and Computational Techniques in Physics Lab	2	0+0+2	30	70	100
II	Core-4	PPPBTT1	Concepts of Mathematical Physics	5	4+1+0	30	70	100
	Core -5	PPPBTT2	Advanced Quantum Mechanics	4	3+1+0	30	70	100
		PPPBLT2	Advanced Quantum Mechanics Lab	1	0+0+1	30	70	100
	Core -6	PPPBTT3	Statistical Mechanics	5	4+1+0	30	70	100
	Discipline Specific elective 1	PPPBTD1	Computational Physics and Programming	3	3+0+0	30	70	100
		PPPBLD1	Computational Physics and Programming Lab	2	0+0+2	30	70	100
	Other if any							
			TOTAL	**20**				**1000**
III	Core-7	PPPCTT1	Nuclear and Particle Physics	5	4+1+0	30	70	100
	Core-8	PPPCTT2	Condensed Matter Physics	3	3+0+0	30	70	100
		PPPCLT2	Condensed Matter Physics Lab	2	0+0+2	30	70	100
	Research Methodology	PPPCTR1#	Research Methodology in Physics	2	2+0+0	30	70	100
	Discipline Specific elective 2	PPPCTD1	Molecular Physics and Group Theory	5	4+1+0	30	70	100
	Discipline Specific elective - 3	PPPCTD2	i. Advanced Condensed Matter Physics-I	3	3+0+0	30	70	100
			ii. Advanced Nuclear Physics –I		3+0+0	30	70	100
			iii. Astronomy and Astrophysics-I		3+0+0	30	70	100
			iv. Molecular Spectroscopy-I		3+0+0	30	70	100
			v. Material Science –I		3+0+0	30	70	100
			vi. Accelerator Physics-I		3+0+0	30	70	100
		PPPCLD2	Respective Discipline Specific elective Lab - 3	2	0+0+2	30	70	100
	*Certificate/ FC/UEC			2		30	70	100
	Other if any							
			TOTAL	**22+2 ***				**1300**

Core –2: Quantum Mechanics Lab
Course Code: PPPALT2 **Credits = 1 (0+0+1)**

1. To determine the Planck Constant and work function
2. Measurement of wavelength of He-Ne LASER (Grating)
3. To determine the wavelengths of Hydrogen spectrum and determine the value of Rydberg's constant.

Core –3: Electronics and Experimental Methods Lab
Course Code: PPPALT3 **Credits = 2 (0+0+2)**

1. Study the operational Amplifier as inverting and non-inverting amplifier
2. Study the operational Amplifier as a summing amplifier (Voltage adder and voltage subtraction).
3. Study the operational Amplifier as a differentiator and integrator.
4. A study of V-I characteristics of light emitting diode (LED).
5. A study of V-I characteristics of Tunnel diode.
6. Study of Solar Cell characteristics
7. Photoconductivity (Photocurrent as a function of irradiance at constant voltage)
8. Design of regulated Power Supply
9. Verification of De Morgan's Theorem
10. To design a digital to analog converter (DAC) of given specifications

Open Elective: Nanomaterials and Its Applications
Course Code: OPNPPT1 **Credits = 3**
(3+0+0)

Course Objectives:
The objective of the subject is that the student acquires knowledge
- To foundational knowledge of the Nanomaterials and related fields.
- To understand the influence of dimensionality of the object at nanoscale on their properties
- To make the students acquire an understanding the basic Nanoscience/Nanotechnology and their Applications .
- Students gain knowledge about the principles of various synthesis techniques**.**

Learning Outcomes:
After completing this course students will be able to:
- Learn about the background on Nanoscience
- Understand the various synthesis methods of Nanomaterials and their application and the impact of Nanomaterials on environment
- Apply their learned knowledge to develop new Nanomaterial's.

Unit – I: History of nano- materials, Ancient Indian Culture and Nanotechnology, Role of Feynman in development of Present Nano-sciences, what are Nanoscience and Nanotechnology?Atomic structure and atom size and their effects, Types of 1D, 2D, 3D Nano-structured materials, Influence of nano over micro/macro.

Unit – II: Properties of Nano materials: Physical, Magnetic, Optical, Thermal, Mechanical, Electrical for nano materials and Chemical Properties, Size effects, Surface Effects and Surface to Volume ratio.

Unit – III : Type of Nanomaterials: different type of nano materials,Carbon nanotube, Fullerene, Type of CNT: SWNT (Single wall nano tube), Multi wall nano tubes. 2D nano material, Graphite and

Graphene, metal nano particle silver and gold, ZnO and TiO_2 metal oxides, Semiconductors, Nano-composites,Creating nanoparticles by using software.

Unit – IV: Synthesis of nano materials**:** Top- down or bottom up approach, Physical Methods, PLD, Sputtering, Thermal evaporation, Chemical Methods – CVD, Sol-gel, Hydrothermal, Biological Methods – Green Synthesis, mechanical milling, sputtering and microwave plasma, chemical reduction and oxidation, hydrothermal, micelles, sol-gel processes, photolysis, and metal organic chemical vapor deposition

Reference Books:

1. Introduction to Nano Science and Nano Technology – K.K. Chattopadhyay & A. N. Banerjee PHI Pvt. Ltd., 2009.
2. Nano technology: Principles and practices - Sulabha K. Kulkarni, Capital Publisher Co., 2015.
3. Introduction to nano technology: Charles P. Poole, Jr. Frank J. Owen, Wiley, Interscience Pub., May, 2003.
4. Nanostructures & Nanomaterials Synthesis Properties & Applications. Guozhong Cao, Imperials College Press London. 2004
5. Textbook of Nanoscience and Nanotechnology-B.S.Murty, P.Shankar, BaldevRaj, B.B. Rath and James Murday Universities press, IIM, Metallurgy and Materials Science
6. Principles of Nanoscience & amp; Nanotechnology M.A. Shah, Tokeer Ahmad, Narosa Publishing House
7. Nanocrystals: Synthesis, Properties and Applications C.N. Rao, P.J. Thomas, G.U. Kulkarni
8. Nano materials Handbook – Yury Gogotsi
9. Introduction to Nano science and Nano technology – K K Chatopadhayya & Banerjee, PHI
10. Introduction of Nano Technology - Cahrles P. Poole Jr and Franks J. Qwens
11. Nano: The Essentials. T. Pradeep, McGraw Hill Education.20/01/2007
12. Handbook of Nanostructures: Materials and nanotechnology, H.S. Nalwa, Vol 1-5, Academic Press, Bostan. I Ed.,Oct., 1999.

Open Elective: Nanomaterials and Its Applications Lab

Course Code: OPNPPL1 **Credits = 2 (0+2+0)**

1. To determine the crystallite size of given sample and observe the influence of do-pants through given XRD data.
2. To analyze the particle size Scanning Electron Microscopy and Transmission Electron Microscopy images of given samples.
3. To determine the crystallinity and phase composition of the given sample through selective area electron diffraction.
4. To determine the electronic band-gap of given sample through Tauc plots derived from UV-Vis diffused reflectance spectroscopy.
5. To identify Hydrogen bond through FTIR spectroscopy.
6. To analyze the elemental species present in the given sample through X-ray Photoelectron Spectroscopy.

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7.

Core –5: Advanced Quantum Mechanics Lab **Credit: 1 (0+0+1)**

Course Code: PPPBLT2

1. By analyse the Zeeman Effect in mercury vapour, determine the fine structure constant by Fabry-Perot Interferometry. (Experiment)
2. Calculate the energy difference between the singlet and triplet state of He Atom. (Mathematical solutions only)
3. Two identical particles of spin 1/2 are enclosed in a one-dimensional box potential of length L with walls at x=0 and x=L. Find the Ground state energy. (You can use any programming language)

Reference Books:

1. Modern*Quantum Mechanics*, by J. J. *Sakurai*&Jim Napolitano, 2nd Edition. Addison-Wesley.
2. *Quantum Mechanics*. Concepts and Applications. Second Edition. Nouredine *Zettili*.

DSE – 1: Computational Physics and Programming Lab **Credit: 2 (0+0+2)**

Course Code: PPPBLD1

Name of the experiments

1. Implementation of solving the non-algebraic equation using Fortran 90
2. Implementation of Numerical Integration using Fortran 90
3. Implementation of Solving Differential equation using Fortran 90
4. Implementation of Solving linear equations using Fortran 90

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