List of Revised Courses

Department : *Pure and Applied Physics*

Program Name : *B.Sc. (Physics)*

Academic Year : 2021-22

List of Revised Courses

Sr. No.	Course Code	Name of the Course
01.	PPUATT1	Mathematical Physics-I
02.	PPUBTT2	Waves and Optics

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 B. 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 B. Sc. (Physics):

- Mathematical Physics-I
- Waves and Optics

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

- **Indian Contribution to Physics (AECPP01)**
- **Analytical Techniques in Physics (SECPP01)**
- **Analytical Techniques in Physics Lab (SECPP01)**
- **Physics for Sustainable Future (AECPP02)**
- **Renewable Energy and Energy Harvesting (SECPP02)**

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.)

Signature & Seal of HoD

Scheme and Syllabus

Course Structure
B.Sc. Physics Syllabus 2021-22

Sem.	Course	Course Code	Course Name	Credits	Credits (L+T+P)	Internal Marks/	ESE Max. Marks	Total Marks
I	Core 1	PPUATT1	Mathematical Physics-I	5	4+1+0	30	70	100
	Core 2	PPUATT2	Mechanics	3	3+0+0	30	70	100
		PPUALT2	Mechanics Lab	2	0+0+2	30	70	100
	GE-1		Opted from the pool Course and offered by Sister Departments	5		30	70	100
	AEC-1		Opted from the Pool Course offered by University	2		30	70	100
	SEC-1		Opted from the Pool Course offered by University	2		30	70	100
			Total	**19**				**600**
II	Core 3	PPUBTT1	Electricity and Magnetism	3	3+0+0	30	70	100
		PPUBLT1	Electricity and Magnetism Lab	2	0+0+2	30	70	100
	Core 4	PPUBTT2	Waves and Optics	3	3+0+0	30	70	100
		PPUBLT2	Waves and Optics Lab	2	0+0+2	30	70	100
	GE-2		Opted from the pool Course and offered by Sister Departments	5		30	70	100
	AEC-2		Opted from the Pool Course offered by University	2		30	70	100
	SEC 2		Opted from the Pool Course offered by University	2		30	70	100
			Total	**19**				**600**
III	Core 5	PPUCTT1	Mathematical Physics-II	5	4+1+0	30	70	100
	Core 6	PPUCTT2	Thermal Physics	3	3+0+0	30	70	100
		PPUCLT2	Thermal Physics Lab	2	0+0+2	30	70	100
	Core 7	PPUCTT3	Analog Systems and Applications	3	3+0+0	30	70	100
		PPUCLT3	Analog Systems & Applications Lab	2	0+0+2	30	70	100
	GE-3		Opted from the pool Course and offered by Sister Departments	5		30	70	100
	AEC-3		Opted from the Pool Course offered by University	2		30	70	100
	Additional Credit Courses					30	70	100
			Total	**22**				**800**
IV	Core 8	PPUDTT1	Mathematical Physics-III	5	4+1+0	30	70	100
	Core 9	PPUDTT2	Elements of Modern Physics	3	3+0+0	30	70	100
		PPUDLT2	Elements of Modern Physics Lab	2	0+0+2	30	70	100
	Core 10	PPUDTT3	Digital Systems and Applications	3	3+0+0	30	70	100
		PPUDLT3	Digital Systems and Applications Lab	2	0+0+2	30	70	100
	GE 4		Opted from the pool Course and offered by Sister Departments	5		30	70	100
	AEC -4		Opted from the Pool Course offered by University	2		30	70	100

	Internship*			6**		30	70	100
	Additional Credit Course					30	70	100
			Total	**22+6****				**900**
V	Core 11	PPUETT1	Quantum Mechanics & Applications	5	4+1+0	30	70	100
	Core 12	PPUETT2	Statistical Mechanics	5	4+1+0	30	70	100
	DSE - 1	PPUETD1	Fundamentals of Nano Materials	3	3+0+0	30	70	100
		PPUELD1	Basic Nano Materials Lab	2	0+0+2	30	70	100
	DSE - 2	PPUETD2	Experimental Techniques	3	3+0+0	30	70	100
		PPUELD3	Experimental Techniques Lab	2	0+0+2	30	70	100
	AEC-5		Opted from the Pool Course offered by University	2		30	70	100
	Additional Credit Courses					30	70	100
			Total	**22**				**800**
VI	Core 13	PPUFTT1	Electromagnetic Theory	5	4+1+0	30	70	100
	Core 14	PPUFTT2	Solid State Physics	3	3+0+0	30	70	100
		PPUFLT2	Solid State Physics Lab	2	0+0+2	30	70	100
	DSE 3	PPUFTD1	Basics Nuclear Physics	3	3+0+0	30	70	100
		PPUFLD2	Basics Nuclear Physics Lab	2	0+0+2	30	70	100
	Seminar	PPUFS01#	Seminar	2		30	70	100
	Dissertation	PPUFD01#	Dissertation/ project work followed by seminar	7		30	70	100
			Total	**23**				**600**
Ability Enhancement Course (AEC) offered by Department								
1	AEC	AECPP01	Indian Contribution to Physics	2	2+0+0	30	70	100
2	AEC	AECPP02	Physics for Sustainable Future	2	2+0+0	30	70	100
Skill Enhancement Course offered by Department								
1	SEC	SECPP01	Analytical Techniques in Physics	2	1+0+1	30	70	100
2	SEC	SECPP02	Renewable Energy and Energy harvesting	2	1+0+1	30	70	100
Generic Elective offered by Department								
1	GE	PPUATG1	Mechanics	3	3+0+0	30	70	100
		PPUALG1	Mechanics Lab	2	0+0+2	30	70	100
2	GE	PPUBTG2	Electricity and Magnetism	3	3+0+0	30	70	100
		PPUBLG2	Electricity and Magnetism Lab	2	0+0+2	30	70	100
3	GE	PPUCTG3	Thermal Physics	3	3+0+0	30	70	100
		PPUCLG3	Thermal Physics Lab	2	0+0+2	30	70	100
4	GE	PPUDTG4	Elements of Modern Physics	3	03+0+0	30	70	100
		PPUDLG4	Elements of Modern Physics Lab	2	0+0+2	30	70	100

Semester - I

Core - 1: Mathematical Physics-I
Course Code: PPUATT1 **Credits = 5**
(4+1+0)
Course Objectives

- The emphasis of course is on applications in solving problems of interest to physicists. The students are to be examined entirely on the basis of problems, seen and unseen.

Unit – I: Calculus: First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients.Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problems. Particular Integral.

Unit – II: Calculus of functions of more than one variable: Partial derivatives, exact and inexact
differentials. Integrating factor, with simple illustration.Constrained Maximization using Lagrange Multipliers. **Vector Calculus**: Vector Differentiation: Directional derivatives and normal derivative.Gradient of a scalar field and its geometrical interpretation.Divergence and curl of a vector field.Del and Laplacian operators.Vector identities.

Unit – III: Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian.Notion of infinitesimal line, surface and volume elements.Line, surface and volume integrals of Vector
fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs).

Unit – IV: Orthogonal Curvilinear Coordinates: Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.
Dirac Delta function and its properties: Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function.

Reference Books:

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn.,
   Elsevier.
2. An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning
3. Differential Equations, George F. Simmons, 2007, McGraw Hill.
4. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
5. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book
6. Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning
7. Mathematical Physics, Goswami, 1st edition, Cengage Learning
8. Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford University Press
9. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
10. Essential Mathematical Methods, K.F.Riley&M.P.Hobson, 2011, Cambridge Univ. Press.
11. Mathematical Physics, H.K. Dass and R. Verma, S. Chand & Company.

Core - 4: Waves and Optics **Credits = 3 (3+0+0)**

Course Code: PPUBTT2

Course Objectives:
The course aims to develop an understanding of:
- The type of waves and various phenomenon of optics.
- The superposition of waves, progressive and stationary waves, optical phenomenon based on superposition of waves such as Interference and Diffraction.

Learning Outcomes:
Upon successful completion of this course, students will be able to address following points:
- The physics behind various phenomenon in wave and optics.
- The significance of superposition of waves and optical phenomenon based on principle of superposition of waves.

Unit – I: Superposition of Harmonic oscillations:
Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences.
Superposition of two perpendicular Harmonic Oscillations, Graphical and Analytical Methods of Lissajous Figures with equal and unequal frequency and their uses.

Unit – II: Wave Motion and Velocity:
Plane Wave. Longitudinal and Transverse Waves. Plane Progressive (Traveling) Waves. Wave Equation. Particle and Wave Velocities. Group Velocity, Graphical Relation between Wave and Group Velocity, Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave.
Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction.

Unit – III: Interference:
Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index. (9 Lectures)

Unit – IV: Fraunhofer and Fresnel Diffraction:
Fraunhofer Diffraction: Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating.
Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire.

Reference Books:
1. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
2. Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
3. Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
4. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
5. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
6. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.