Program Structure

CERTIFICATE

IN

BASIC PHYSICS & SEMICONDUCTOR DEVICES,

DIPLOMA

IN

APPLIED PHYSICS WITH ELECTRONICS

And

DEGREE IN BACHELOR OF SCIENCE

Department of Physics

School of Basic Sciences and Research

Sharda University

1. Standard Structure of the Program at University Level

1.1 Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship

Mission of the University

1. **Transformative educational experience**
2. **Enrichment by educational initiatives that encourage global outlook**
3. **Develop research, support disruptive innovations and accelerate entrepreneurship**
4. **Seeking beyond boundaries**

Core Values

- **Integrity**
- **Leadership**
- **Diversity**
- **Community**

1.2 Vision and Mission of the School

School of Basic Sciences and Research

Vision of the School

Achieving excellence in the realm of basic and applied sciences to address the global challenges of evolving society

Mission of the School

1. **To equip the students with knowledge and skills in basic and applied sciences**
2. **Capacity building through advanced training and academic flexibility.**
3. **To establish center of excellence for ecologically and socially innovative research.**
4. **To strengthen interinstitutional and industrial collaboration for skill development and global employability.**

1.3 Vision and Mission of the Department

Department of Physics

Vision of Department of Physics

To be recognized for quality education, innovation and socially relevant research by nurturing students and faculty to be good citizens to address the challenges faced by society through critical thinking and innovations anchored in physical sciences.

Mission of Department of Physics

1. **To provide education of global standards and nurturing young minds for fulfilling career and entrepreneurship in scientific research, applied fields, and advancing technologies.**
2. **To encourage faculty and students for research in core and interdisciplinary fields.**
3. **To establish collaborations with national and international centres of excellence in physical sciences and interdisciplinary fields.**

1.4 Programme Educational Objectives (PEO)

PEO1: To foster a strong foundation in theoretical and applied physics principles and theories to make students become globally competitive physicists.

PEO2: To develop strong interest in physics by cultivating critical thinking and problem-solving skills in students so that they are motivated to pursue research and higher education in physics.

PEO3: To emphasize on the interdisciplinary nature of physics and to integrate knowledge of other relevant disciplines to address a wide variety of problems through physics.

PEO4: To train the students to design, execute record and analyse the results of physics experiments in line with physics principles and theories.

PEO5: To create a sense of ethical responsibility among students towards the use of scientific knowledge for the benefit of humanity.

Methods of Forming PEO's

STEP 1 : The needs of the Nation and society are identified through scientific publications, industry interaction and media.

STEP 2. Taking the above into consideration, the PEOs are established by the Coordination Committee of the department.

STEP 3. The PEOs are communicated to the alumni and their suggestions are obtained.

STEP 4. The PEOs are communicated to all the faculty members of the department and their feedback is obtained.

STEP 5. The PEOs are then put to the Board of Studies of the department for final approval.

Proposed syllabus

Department of Physics

School of Basic Sciences and Research, Sharda University

SUBJECT PREREQUISITES

To undertake this program, a student must have had studied **Physics and Mathematics** of intermediate level.

1.5 Programme Outcomes (Pos)

The practical value of science for productivity, for raising the standard of living of the people is surely recognized. Science as a power, which provides tools for effective action for the benefit of mankind or for conquering the forces of Nature or for developing resources, is surely highlighted everywhere. Besides the utilitarian aspect, the value of Science, lies in the fun called intellectual enjoyment. Science teaches the value of rational thought as well as importance of freedom of thought.

Our teaching so far has been aimed more at formal knowledge and understanding instead of training and application oriented. Presently, the emphasis is more on training, application and to some extent on appreciation, the fostering in the pupils of independent thinking and creativity. Surely, teaching has to be more objective based. The process of application based training, whether we call it a thrill or ability, is to be emphasized as much as the content.

Physics is a basic science; it attempts to explain the natural phenomenon in as simple a manner as possible. It is an intellectual activity aimed at interpreting the Multiverse. The starting point of all physics lies in experience.

Experiment, whether done outside or in the laboratory, is an important ingredient of learning physics and hence the present program integrates six experimental physics papers focusing on various aspects of modern technology based equipment's. With all the limitations imposed (even the list of experiments as given in the syllabus) if the spirit of discovery by investigation is kept in mind, much of the thrill can be experienced.

1.5.1 Programme Outcomes (POs)

PO1. The main aim of this program is to help cultivate the love for Nature and its manifestations, to transmit the methods of science (the contents are only the means) to observe things around, to generalize, to do intelligent guessing, to formulate a theory & model, and at the same time, to hold an element of doubt and thereby to hope to modify it in terms of future experience and thus to practice a pragmatic outlook.

PO2. The program intends to nurture the proficiency in functional areas of Physics, which is in line with the international standards, aimed at realizing the goals towards skilled India.

PO3. Keeping the application-oriented training in mind; this program aims to give students the competence in the methods and techniques of theoretical, experimental and computational aspects of Physics so as to achieve an overall understanding of the subject for holistic development. This will cultivate in specific application-oriented training leading to their goals of employment.

PO4. The Bachelor's Project (Industrial Training / Survey / Dissertation) is intended to give an essence of research work for excellence in explicit areas. It integrates with specific job requirements / opportunities and provides a foundation for Bachelor (Research) Programs.

1.5.2 Programme Specific Outcomes (PSOs)

CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES

FIRST YEAR

PSO 1: This program aims to give students the competence in the methods and techniques of calculations using Newtonian Mechanics and Thermodynamics. At the end of the course the students are expected to have hands on experience in modeling, implementation and calculation of physical quantities of relevance.

An introduction to the field of Circuit Fundamentals and Basic Electronics which deals with the physics and technology of semiconductor devices is practically useful and gives the students an insight in handling electrical and electronic instruments.

Experimental physics has the most striking impact on the industry wherever the instruments are used. The industries of electronics, telecommunication and instrumentation will specially recognize this course.

DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS

SECOND YEAR

PSO 2: This program aims to introduce the students with Electromagnetic Theory, Modern Optics and Relativistic Mechanics. Electromagnetic Wave Propagation serves as a basis for all communication systems and deals with the physics and technology of semiconductor optoelectronic devices. A deeper insight in Electronics is provided to address the important components in consumer Optoelectronics, IT and Communication devices, and in industrial instrumentation.

The need of Optical instruments and Lasers is surely highlighted everywhere and at the end of the course the students are expected to get acquaint with applications of Lasers in technology. Companies and R&D Laboratories working on Electromagnetic properties, Laser Applications, Optoelectronics and Communication Systems are expected to value this course.

DEGREE IN BACHELOR OF SCIENCE

THIRD YEAR

PSO 3: This program contains very important aspects of modern day course curriculum, namely, Classical, Quantum and Statistical computational tools required in the calculation of physical quantities of relevance in interacting many body problems in physics. It introduces the branches of Solid State Physics and Nuclear Physics that are going to be of utmost importance at both undergraduate and graduate level. Proficiency in this area will attract demand in research and industrial establishments engaged in activities involving applications of these fields.

This course amalgamates the comprehensive knowledge of Analog & Digital Principles and Applications. It presents an integrated approach to analog electronic circuitry and digital electronics.

Present course will attract immense recognition in R&D sectors and in the entire cutting edge technology based industry.

Programme Structure
Department of Physics
School of Basic Sciences and Research, Sharda University

		Subject 1	Subject 2	Subject 3	Subject 4	Vocational	Compulsory Co-curricular	Training/ Survey/ Project	Credits	(Total Credits) After completion {Minimum Credits} [Max Duration in years]
		Major (PHYSICS)	Major (PHYSICS)	Major (MATHS)	Minor/ Elective (Chemistry/ Elective)	Minor	Minor	Major		
		Credits 4+2	Credits 4+2	Credits 4+2	Credits 4	Credits 3	Credits 2	Credits 3/6/8		
Year	Sem.	Own Faculty	Own Faculty	Any Faculty	Other Department/ Faculty	Vocational Faculty	Co- Curricular Course	Related to main Subject		
1	I	Mathematical Physics & Newtonian Mechanics + **LAB**: Mechanical Properties of Matter	General Properties of matter + **LAB**	Differential Calculus & Integral Calculus + **LAB**		Vocational course in Electronics	Food, Nutrition and Hygiene		23	(50) {46} {4} CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES
	II	Thermal Physics & Semiconductor Devices + **LAB**: Thermal Properties of Matter & Electronic Circuits	Renewable energy resources + **LAB**	Matrices and Differential Equations & Geometry (6)	Fundamental of Physical Chemistry/ Elective	Fundamentals of Physical and geometrical optics for eye and vision	First Aid and Health		27	
2	III	Electromagnetic Theory & Modern Optics + **LAB:** Demonstrative Aspects of Electricity & Magnetism	Oscillation and waves + **LAB**	Mathematical methods and differential equations (6)	Fundamental of Physical Chemistry/ Elective	Nano-materials Technology and Hands on Training	Human Values and Environment studies		27	(100) {96} [4] DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS
	IV	Perspectives of Modern Physics & Basic Electronics + **LAB:** Basic Electronics Instrumentation	Laser and applications + **LAB**	Advanced Mathematical Physics (6)		Vocational course in Computation physics using Sci Lab	Physical Education and Yoga		23	
3	V	Classical & Statistical Mechanics + Quantum Mechanics & Spectroscopy + **LAB:** Demonstrative Aspects of Optics & Lasers	Atmospheric and Astrophysics + Plasma Physics + **LAB**				Analytic Ability and Digital Awareness	Community connect (2) + Summer internship of term IV (1) (Will be done after 4th Sem)	25	(150) {146} {4} BACHELOR IN APPLIED PHYSICS WITH ELECTRONICS
	VI	Solid State & Nuclear Physics + Analog & Digital Principles & Applications + **LAB:** Analog & Digital Circuits	(Instrumentation) + (Nanomaterials) + **LAB**				Communication Skills and Personality Development	Research Project (3)	25	

Teaching Schemes

Program Structure Template
School of Basic Sciences & Research

CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES

Batch: 2021-2022
SEMESTER: I

S.No.	SU Subject Code	UPHE Subject Code	Subjects	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course: 1. Major 2. Minor/ Elective 3. Vocational 4. Compulsory Co-curricular 5. Training/ Survey/ Project
				L	T	P			
		THEORY SUBJECTS							
1.	BPH101	B010101T	Mathematical Physics & Newtonian Mechanics	4	0	0	4	Pre-Requisite Intermediate Physics	Major 1
2.	BPH102	B010102T	General Properties of matter	4	0	0	4	Pre-Requisite Intermediate Physics	Major 2
3.	BHM101	B030101T	Differential Calculus & Integral Calculus	4	0	0	4	Pre-Requisite Intermediate Mathematics	Major 3
4.	COC101	Z010101T	Food, Nutrition and Hygiene	2	0	0	2	Pre-Requisite High School Science	Compulsory Co-curricular
		Practical							
5.	BPP153	B010103P	Vocational course in Electronics	0	0	5	3		Vocational
6.	BPP151	B010104P	Physics Lab-1	0	0	4	2		Major Lab 1
7.	BPP152	B010105P	Physics Lab-2	0	0	4	2		Major Lab 2
8.	BHM151	B030102P	Mathematics Lab-1	0	0	4	2		Major Lab 3
TOTAL CREDITS							**23**		

Program Structure Template

School of Basic Sciences & Research

CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES

Batch: 2021-2022
SEMESTER: II

S.No.	SU Subject	UPHE Subject Code	Subjects		Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course: 1. Major 2. Minor/ Elective 3. Vocational 4. Compulsory Co-curricular 5. Training/ Survey/ Project
					L	T	P			
		THEORY SUBJECTS								
1.	BPH201	B010201T	Thermal Physics & Semiconductor Devices		4	0	0	4	Pre-Requisite Intermediate Physics	Major 4
2.	BPH202	B010202T	Renewable energy resources		4	0	0	4	Pre-Requisite Intermediate Physics	Major 5
3.		B030201T	Matrices and Differential Equations & Geometry		6	0	0	6	Pre-Requisite Intermediate Mathematics	Major 6
4.	BCY102	B020103T	Principles of Physical Chemistry/ Elective		4	0	4	4	Pre-Requisite Intermediate Chemistry	Minor/Elective
5.	COC201	Z020201	First Aid and Health		2	0	0	2	Pre-Requisite High School Science	Compulsory Co-curricular
		Practical								
6.	BPP253	B010203P	Fundamentals of Physical and geometrical optics for eye and vision		0	0	5	3		Vocational
7.	BPP251	B010204P	Physics Lab-3		0	0	4	2		Major Lab 4
8.	BPP252	B010205P	Physics Lab-4		0	0	4	2		Major Lab 5
	TOTAL CREDITS							**27**		

MAXIMUM CREDIT: 50
MINIMUM CREDIT REQUIRED: 46

Program Structure Template
School of Basic Sciences & Research

DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS

Batch: 2022-2023
SEMESTER: III

S.No.	SU Subject Code	UPHE Subject Code	Subjects	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course: 1. Major 2. Minor/ Elective 3. Vocational 4. Compulsory Co-curricular 5. Training/ Survey/ Project
				L	T	P			
		THEORY SUBJECTS							
1.	BPH301	B010301T	Electromagnetic Theory & Modern Optics	4	0	0	4	Pre-Requisite Intermediate Physics, Vectors	Major 7
2.	BPH302	B010302T	Oscillation and waves	4	0	0	4	Pre-Requisite Intermediate Physics, Mechanics	Major 8
3.	BPH303	B010303T	Mathematical methods and differential equations	6	0	0	6	Pre-Requisite Intermediate Mathematics	Major 9
4.	BCY102	B020103T	Principle of Physical Chemistry/ Elective	4	0	0	4	Pre-Requisite Intermediate Chemistry	Minor/Elective
5.	COC301	Z030301	Human Values and Environment	2	0	0	2	Pre-Requisite High School Science	Compulsory Co-curricular
		Practical							
6.	BPP353	B010304P	Nano-materials Technology and Hands on Training	0	0	5	3		Vocational
7.	BPP351	B010305P	Physics Lab-5	0	0	4	2		Major Lab 6
8.	BPP352	B010306P	Physics Lab-6	0	0	4	2		Major Lab 7
TOTAL CREDITS							**27**		

Program Structure Template
School of Basic Sciences & Research

DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS

Batch: 2022-2023
SEMESTER: IV

S.No.	SU Subject Code	UPHE Subject Code	Subjects	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course: 1. Major 2. Minor/ Elective 3. Vocational 4. Compulsory Co-curricular 5. Training/ Survey/ Project
				L	T	P			
		THEORY SUBJECTS							
1.	BPH401	B010401T	Perspectives of Modern Physics & Basic Electronics	4	0	0	4	Pre-Requisite Intermediate Physics	Major 10
2.	BPH402	B010402T	Laser and applications	4	0	0	4	Pre-Requisite Modern Optics, Waves and Oscilaltions	Major 11
3.	BPH403	B010403T	Advanced Mathematical Physics	6	0	0	6	Pre-Requisite Differentail and Integral Calculus	Major 12
4.	COC401	Z040401	Physical Education and Yoga	2	0	0	2	Pre-Requisite	Compulsory Co-curricular
		Practical							
5.	BPP453	B010404P	Vocational course in Computation physics using Sci Lab	0	0	5	3		Vocational
6.	BPP451	B010405P	Physics Lab-7	0	0	4	2		Major Lab 8
7.	BPP452	B010406P	Physics Lab-8	0	0	4	2		Major Lab 9
TOTAL CREDITS							**23**		

MAXIMUM CREDIT: 100
MINIMUM CREDIT REQUIRED: 96

Program Structure Template
School of Basic Sciences & Research

BACHELOR IN APPLIED PHYSICS WITH ELECTRONICS

Batch: 2021-2024
SEMESTER: V

S.No.	SU Subject Code	UPHE Subject Code	Subjects	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course: 1. Major 2. Minor/ Elective 3. Vocational 4. Compulsory Co-curricular 5. Training/ Survey/ Project
				L	T	P			
		THEORY SUBJECTS							
1.	BPH501	B010501T	Classical & Statistical Mechanics	4	0	0	4	Pre-Requisite Mechanics	Major 13
2.	BPH502	B010502T	Quantum Mechanics and Spectroscopy	4	0	0	4	Pre-Requisite Modern Physics	Major 14
3.	BPH503	B010503T	Atmospheric and Astrophysics	4	0	0	4	Pre-Requisite Basic Science	Major 15
4.	BPH504	B010504T	Plasma Physics	4	0	0	4	Pre-Requisite Properties of Matter	Major 16
5.	COC501	Z050501	Analytic Ability and Digital Awareness	2	0	0	2	Pre-Requisite Basic Knowledge of Computers	Compulsory Co-curricular
		Practical							
6.	BPP553	B010505T	Community connect (2) + Summer internship of term IV (1) (Will be done after 4th Sem)	0	0	6	3		Training/Survey/ Project
7.	BPP551	B010506P	Physics Lab-9 Demonstrative Aspects of Optics & Lasers	0	0	4	2		Major Lab 10
8.	BPP552	B010507P	Physics Lab-10	0	0	4	2		Major Lab 11
TOTAL CREDITS							**25**		

School of Basic Sciences & Research
BACHELOR IN APPLIED PHYSICS WITH ELECTRONICS

Batch: 2021-24
SEMESTER: VI

S.No.	SU Subject Code	UPHE Subject Code	Subjects	Teaching Load			Credits	Pre-Requisite/Co Requisite	Type of Course: 1. Major 2. Minor/ Elective 3. Vocational 4. Compulsory Co-curricular 5. Training/ Survey/ Project
				L	T	P			
		THEORY SUBJECTS							
1.	BPH601	B010601T	Solid State & Nuclear Physics	4	0	0	4	Pre-Requisite General properties of matter, Quantum Mechanics	Major 17
2.	BPH602	B010602T	Analog & Digital Principles & Applications	4	0	0	4	Pre-Requisite Electronics	Major 18
3.	BPH603	B010603T	Instrumentation	4	0	0	4	Pre-Requisite Exposure to Physics Labs	Major 19
4.	BPH604	B010604T	Nanomaterials	4	0	0	4	Co-requisite Solid State Physics	Major 20
5.	COC601	Z060601	Communication Skills and Personality Development	2	0	0	2	Pre-Requisite	Compulsory Co-curricular
		Practical							
6.	BPP653	B010605T	Research Project	0	0	6	3		Training/Survey /Project
7.	BPP651	B010606P	Physics Lab -11: Analog & Digital Circuits	0	0	4	2		Major Lab 12
8.	BPP652	B010607P	Physics Lab-12	0	0	4	2		Major Lab 13
TOTAL CREDITS							**25**		

MAXIMUM CREDIT: 150
MINIMUM CREDIT REQUIRED: 146

FIRST YEAR

DETAILED SYLLABUS FOR

CERTIFICATE

IN

BASIC PHYSICS & SEMICONDUCTOR DEVICES

SEMESTER I

BPH101 Mathematical Physics & Newtonian Mechanics

School: SBSR		**Batch: 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**SEMESTER: I**
1	Course Code	**BPH101**
2	Course Title	**Mathematical Physics & Newtonian Mechanics**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 1
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	This course provides an opportunity to develop knowledge and understanding of the key principles and applications of Mathematical Physics and Newtonian Mechanics
9	Course Outcomes	CO1: Recognize the difference between scalars, vectors, pseudo-scalars and pseudo-vectors, Understand the physical interpretation of gradient, divergence and curl. CO2: Comprehend the difference and connection between Cartesian, spherical and cylindrical coordinate systems, CO3: Know the meaning of 4-vectors, Kronecker delta and Epsilon (Levi Civita) tensors CO4:Study the origin of pseudo forces in rotating frame, Study the response of the classical systems to external forces and their elastic deformation CO5: Understand the dynamics of planetary motion and the working of Global Positioning System (GPS), Comprehend the different features of Simple Harmonic Motion (SHM) and wave propagation CO6: Understanding the concept of mathematical physics and Newtonian Mechanics on practical problems of Physics.

10	Course Description	This course provides students a full exposure to the basic principles and essential concepts of Mathematical Physics and Newtonian Mechanics including description of scalars, vectors, pseudo-scalars and pseudo-vectors, physical interpretation of gradient, divergence and curl, different coordinate systems, tensors, rotating frame, GPS, SHM etc. ***Introduction to Indian ancient Physics and contribution of Indian Physicists, in context with the holistic development of modern science and technology, should be included under Continuous Internal Evaluation (CIE).***
11	Outline syllabus	
		Part A: Mathematical Physics
	Unit 1	**Vector Algebra and Vector Calculus**
	A	Coordinate rotation, reflection and inversion as the basis for defining scalars, vectors, pseudoscalars and pseudo-vectors (include physical examples). Component form in 2D and 3D
	B	Geometrical and physical interpretation of addition, subtraction, dot product, wedge product, cross product and triple product of vectors. Position, separation and displacement vectors, Geometrical and physical interpretation of vector differentiation, Gradient, Divergence and Curl and their significance
	C	Vector integration, Line, Surface (flux) and Volume integrals of vector fields. Gradient theorem, Gauss-divergence theorem, Stoke-curl theorem, Greens theorem and Helmholtz theorem (statement only). Introduction to Dirac delta function.
	Unit 2	**Coordinate Systems**
	A	2D & 3D Cartesian, Spherical and Cylindrical coordinate systems, basis vectors, transformation equations.
	B	Expressions for displacement vector, arc length, area element, volume element, gradient, divergence and curl in different coordinate systems.
	C	Components of velocity and acceleration in different coordinate systems. Examples of non-inertial coordinate system and pseudo-acceleration
	Unit 3	**Introduction to Tensors**
	A	Principle of invariance of physical laws w.r.t. different coordinate systems as the basis for defining tensors
	B	Coordinate transformations for general spaces of nD, contravariant, covariant & mixed tensors and their ranks, 4-vectors
	C	Index notation and summation convention. Symmetric and skewsymmetric tensors. Invariant tensors, Kronecker delta and Epsilon (Levi Civita) tensors. Examples of tensors in physics.
		Part B: Newtonian Mechanics & Wave Motion
	Unit 4	**Dynamics of a System of Particles and Rigid Body**

	A	Review of historical development of mechanics up to Newton. Background, statement and critical analysis of Newton's axioms of motion. Dynamics of a system of particles, centre of mass motion, and conservation laws & their deductions.		
	B	Rotating frames of reference, general derivation of origin of pseudo forces (Euler, Coriolis & centrifugal) in rotating frame, and effects of Coriolis force. Angular momentum, Torque, Rotational energy and the inertia tensor. Rotational inertia for simple bodies (ring, disk, rod, solid and hollow sphere, solid and hollow cylinder, rectangular lamina).		
	C	The combined translational and rotational motion of a rigid body on horizontal and inclined planes. Precessional motion and its applications.		
	Unit 5	**Motion of Planets & Satellites and Wave Motion**		
	A	Two particle central force problem, reduced mass, relative and centre of mass motion. Newton's law of gravitation, gravitational field and gravitational potential. Kepler's laws of planetary motion and their deductions. Motions of geo-synchronous & geo-stationary satellites and basic idea of Global Positioning System (GPS).		
	B	Differential equation of simple harmonic motion and its solution, use of complex notation, damped and forced oscillations, Quality factor. Composition of simple harmonic motion, Lissajous figures		
	C	Differential equation of wave motion. Plane progressive waves in fluid media, reflection of waves and phase change, pressure and energy distribution. Principle of superposition of waves, stationary waves, phase and group velocity.		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**PART A** 1. Murray Spiegel, Seymour Lipschutz, Dennis Spellman, "Schaum's Outline Series: Vector Analysis", McGraw Hill, 2017, 2e 2. A.W. Joshi, "Matrices and Tensors in Physics", New Age International Private Limited, 1995, 3e **PART B** 1. Charles Kittel, Walter D. Knight, Malvin A. Ruderman, Carl A. Helmholz, Burton J. Moyer, "Mechanics (In SI Units): Berkeley Physics Course Vol 1", McGraw Hill, 2017, 2e 2. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 1", Pearson Education Limited, 2012 3. Hugh D. Young and Roger A. Freedman, "Sears & Zemansky's University Physics with Modern Physics",		

		Pearson Education Limited, 2017, 14e 4. D.S. Mathur, P.S. Hemne, "Mechanics", S. Chand Publishing, 1981, 3e B
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8
	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/

BPH102 General Properties of Matter

School: SBSR		**Batch: 2021-24**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**SEMESTER: I**
1	Course Code	**BPH102**
2	Course Title	**General Properties of Matter**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 2
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	1. To make the students familiar with use of vector algebra to study mechanics. 2. To understand and appreciate the rotational and harmonic motion. 3. To know the elasticity of matter and bending of beams in different situation. 4. To understand the concept surface tension and viscosity.
9	Course Outcomes	After the completion of this course, the student will be able to CO1: use of moment of force and properties of matter to describe the elasticity and beam bending. CO2: understand the cause of capillarity, and surface tension and explain the of real life observations based on it CO3: understand the cause of viscosity and explain the real-life observations based on it CO4: realize electrical and dielectric properties of materials. CO5: realize magnetic properties of materials. CO6: appreciate various properties of materials and will be able to relate it with real life problems.
10	Course Description	This course is designed to make students proficient in mechanics, especially rotational mechanics with vector treatment. They also learn about certain properties of matter like elasticity, surface tension and viscosity.
11	Outline syllabus	
	Unit 1	**Motion, Work, Energy and Momentum**
	A	Hooke's Law, Stress - Strain Diagram - Elastic moduli - Relation between elastic constants
	B	Poisson's Ratio – Determination of Poisson's ratio; Work done per unit volume in a strain

	C	Bending of beam; Bending moment, Flexural rigidity, Cantilever and depression of its loaded end
	Unit 2	**Surface Tension**
	A	Surface Tension: Definition and dimensions of surface tension; Applications, Surface Energy, Excess of pressure over curved surfaces
	B	Shape of liquid meniscus, Application to spherical and cylindrical drops and bubbles
	C	Capillarity, Variation of Surface tension with temperature, Jaegar's method
	Unit 3	**Viscosity**
	A	Streamline Flow; Newton's law of viscous flow, Bernoulli's Theorem; Co-efficient of viscosity and its dimensions
	B	Applications of Bernoulli's theorem in Venturi meter, Sprayers, movement of balls etc.
	C	Rate of flow of liquid in a capillary tube - Poiseuilles' formula, Variation of viscosity of a liquid with temperature
	Unit 4	**Dielectric Properties**
	A	Dielectric polarization, polar and non-polar dielectric molecules, polarizability
	B	The local field, Clausius-Mossotti equation, static dielectric constant, dipolar relaxation
	C	Internal fields in solids and liquids, frequency dependence of permittivity, dielectric loss, dielectric breakdown
	Unit 5	**Magnetic Properties**
	A	Introduction, Intensity of magnetization, magnetic susceptibility, Magnetic permeability and relative permeability
	B	Para-, dia- and ferromagnetic materians, Langevin's theory of diamagnetism, Quincke's method
	C	Hysteresis, hysteresis loss, application of hysteresis curve,
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction
	Weightage Distribution	CA | MTE+ETE 25% | 75%
	Text book/s*	1. Mechanics, D.S.Mathur, S.Chand & Co. (Text Book) 2. Properties of matter, D.S.Mathur, S.Chand & Co.
	Other References	3. Berkeley Physics Course, Volume I, Mechanics,C. Kittel, W. D. Knight, M. A. Rudderman, A. C. Helmhotz and B. J. Moye; McGraw-Hill 4. Mechanics , H.S.Hans and S.P.Puri, Tata McGraw-Hill (2003) 5. Physics (5th Edn.) - Principles with applications, Douglas C. Giancoli, Prentice Hall. 6. Physics (5th Edn.), John D. Cutnell & Kenneth W. Johnson, John Willey & Sons, Inc.

BHM101 Differential Calculus & Integral Calculus

School: SBSR		**Batch: 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**SEMESTER: I**
1	Course Code	**BHM101**
2	Course Title	**Differential Calculus & Integral Calculus**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
4	Course Status	Major 3
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	1.To familiarize the students with basic concepts of differential calculus and their applications. 2.To understand the basic concept of Integral calculus and their applications.
8	Course Outcomes	CO1: The programme outcome is to give foundation knowledge for the students to understand basics of mathematics including applied aspect for developing enhanced quantitative skills and pursuing higher mathematics and research as well. (K1, K2, K3). CO2: By the time students complete the course they will have wide ranging application of the subject and have the knowledge of real valued functions such as sequence and series. They will also be able to know about convergence of sequence and series. Also, they have knowledge about curvature, envelope and evolutes and trace curve in polar, Cartesian as well as parametric curves. (K1,K2, K3). CO3: The main objective of the course is to equip the student with necessary analytic and technical skills. By applying the principles of integral he learns to solve a variety of practical problems in science and engineering. (K2,K3, K4.) CO4: The student is equipped with standard concepts and tools at an intermediate to advance level that will serve him well towards taking more advance level course in mathematics. (K2,K3, K4). CO5: Describe and use the concepts of Improper integrals, their classification and convergence, Comparison tests. (K3,K4,K5).

		CO6: Explain the basic concepts of Vector Differentiation, Gradient, Divergence and Curl, Normal on a surface and find out Directional Derivative, Vector Integration, Theorems of Gauss, Green, Stokes and related problems. (K4,K5,K6).
9	Course Description	This course is an introduction to the fundamental of Mathematics. The primary objective of the course is to develop the basic understanding of convergence of sequence and series, curvature, envelope and evolutes and trace curve in polar, Cartesian as well as parametric curves, Vector Differentiation, Gradient, Divergence and Curl.
10	Outline syllabus	
		Part- A : Differential Calculus
	Unit 1	
	A	**Introduction to Indian ancient Mathematics and Mathematicians should be included under Continuous Internal Evaluation (CIE).** Definition of a sequence, theorems on limits of sequences, bounded and monotonic sequences, Cauchy's convergence criterion, Cauchy sequence, limit superior and limit inferior of a sequence, su-bsequence, Series of non-negative terms, convergence and divergence.
	B	Comparison tests, Cauchy's integral test, Ratio tests, Root test, Raabe's logarithmic test, de Morgan and Bertrand's tests, alternating series, Leibnitz's theorem, absolute and conditional convergence.
	C	Limit, continuity and differentiability of function of single variable, Cauchy's definition, Heine's definition ,equivalence of definition of Cauchy and Heine, Uniform continuity, Borel's theorem, boundedness theorem, Bolzano's theorem, Intermediate value theorem, extreme value theorem, Darboux's intermediate value theorem for derivatives, Chain rule, indeterminate forms.
	Unit 2	
	A	Rolle's theorem, Lagrange and Cauchy Mean value theorems, mean value theorems of higher order, Taylor's theorem with various forms of remainders.
	B	Successive differentiation, Leibnitz theorem, Maclaurin's and Taylor's series, Partial differentiation, Euler's theorem on homogeneous function.
	C	Tangent and normals, Asymptotes, Curvature, Envelops and evolutes, Tests for concavity and convexity, Points of inflexion, Multiple points, Parametric representation of curves and tracing of parametric curves, Tracing of curves in Cartesian and Polar forms.
	Unit 3	**Part B: Integral Calculus**
	A	Definite integrals as limit of the sum, Riemann integral, Integrability of continuous and monotonic functions, Fundamental theorem of integral calculus.
	B	Mean value theorems of integral calculus, Differentiation under the sign of Integration.

	C	Improper integrals, their classification and convergence, Comparison test, μ-test, Abel's test, Dirichlet's test, quotient test. Beta and Gamma functions.		
	Unit 4			
	A	Rectification, Volumes and Surfaces of Solid of revolution, Pappus theorem.		
	B	Multiple integrals, change of order of double integration.		
	C	Dirichlet's theorem, Liouville's theorem for multiple integrals.		
	Unit 5			
	A	Vector Differentiation, Gradient, Divergence and Curl.		
	B	Normal on a surface, Directional Derivative.		
	C	Vector Integration, Theorems of Gauss, Green, Stokes and related problems		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**PART A** 1. R.G. Bartle & D.R. Sherbert, Introduction to Real Analysis, John Wiley & Sons 2. T.M. Apostal, Calculus Vol. I, John Wiley & Sons Inc. 3. S. Balachandra Rao & C. K. Shantha, Differential Calculus, New Age Publication. 4. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002. 5. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007. 6. Suggestive digital platforms web links: NPTEL/SWAYAM/MOOCS 7. Course Books published in Hindi may be prescribed by the Universities. **PART B** 1. T.M. Apostal, Calculus Vol. II, John Wiley Publication 2. Shanti Narayan & Dr. P.K. Mittal, Integral Calculus, S.Chand 3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons. 4. Suggestive digital platforms web links: NPTEL/SWAYAM/MOOCS		

COC101 Food, Nutrition and Hygiene

School: SBSR		**Batch : 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**SEMESTER: I**
1	Course Code	**COC101**
2	Course Title	**Food, Nutrition and Hygiene**
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
4	Course Status	Co-Curricular Compulsory
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	This course provides an opportunity to develop knowledge and understanding of the basic concepts of Food, Nutrition and Hygiene
8	Course Outcomes	CO1: To learn the basic concept of the Food and Nutrition. CO2: To study the nutritive requirement during special conditions like pregnancy and lactation. CO3: To learn meal planning. CO4: To learn 100 days Nutrition Concept. CO5: To study common health issues in the society. CO6: To learn the special requirement of food during common illness.
9	Course Description	This course provides students a full exposure to the basic principles and essential concepts of food and nutrition, meal planning, health issues in the society and understanding of the food requirement during common illness.
10	Outline syllabus	
	Unit 1	

	A	Concept of Food and Nutrition (a) Definition of Food, Nutrients, Nutrition, Health, balanced Diet (b) Types of Nutrition- Optimum Nutrition, under Nutrition, Over Nutrition
	B	(c) Meal planning- Concept and factors affecting Meal Planning
	C	(d) Food groups and functions of food
	Unit 2	
	A	Nutrients: Macro and Micro (c) Protein (d) Minerals
	B	RDA, Sources, Functions, Deficiency and excess of (a) Carbohydrate (b) Fats (f) Water (g) Dietary Fibre
	C	RDA, Sources, Functions, Deficiency and excess of (c) Protein (d) Minerals Major: Calcium, Phosphorus, Sodium, Potassium Trace: Iron, Iodine, Fluorine, Zinc
	Unit 3	
	A	RDA, Sources, Functions, Deficiency and excess of (e) Vitamins Water soluble vitamins: Vitamin B, C Fat soluble vitamins: Vitamin A, D, E, K
	B	(f) Water
	C	(g) Dietary Fibre
	Unit 4	
	A	1000 days Nutrition (a) Concept, Requirement, Factors affecting growth of child
	B	b) Prenatal Nutrition (0 - 280 days): Additional Nutrients' (Requirement and risk factors during pregnancy)
	C	(c) Breast / Formula Feeding (Birth – 6 months of age) Complementary and Early Diet (6 months – 2 years of age)
	Unit 5	
	A	Community Health Concept (a) Causes of common diseases prevalent in the society and Nutrition requirement in the following: Diabetes

		Hypertension (High Blood Pressure) Obesity Constipation Diarrhea Typhoid Nutrition		
	B	(b) National and International Program and Policies for improving Dietary		
	C	(c) Immunity Boosting Food		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**1.** Singh, Anita, "Food and Nutrition", Star Publication, Agra, India, 2018. **2.** 1000Days-Nutrition_Brief_Brain-Think_Babies_FINAL.pdf **3.** https://pediatrics.aappublications.org/content/141/2/e20173716 **4.** https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5750909/ 5.ડડ વદં ા સ હૂં "आहार ડડડડડડડ ડડડ ડડડડ" ડડડડડડ ડડડડડડડ ડડડડડ 2015, तहे रवाृं ડડડડડડડ 6.Sheel Sharma,Nutrition and Diet Therapy,Peepee Publishers Delhi,2014,First Edition.		

BPP153 Vocational Course in Electronics

School: School of Basic Sciences and Research		**Batch: 2021-2024**
Program: Certificate in Basic Physics & Semiconductor Devices		**Current Academic Year: 2021-2022**
Branch: All		**Semester: I**
1	Course Code	**BPP153**
2	Course Title	**Vocational course in Electronics**
3	Credits	3
4	Contact Hours (L-T-P)	0-0-5
5	Course Status	Vocational
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	**1.** Acquainting Students with the technical skills of Electronics. **2.** To know about some Electrical Power Supply Devices. **3.** To study about the basic Communication techniques. **4.** To study about the Solar Power.
9	Course Outcomes	After successful completion of this course the students will/will be able to: **CO1:** Students will be having the knowledge of basic concepts of Electronics. **CO2:** Students will be having the knowledge of advance concepts of Electronics. **CO3:** Student will be able to maintain SMPS, UPS and various analogue and digital circuits. **CO4:** Student will able to get the knowledge about various electronics communication techniques, equipments and fibre optics and various transducers. **CO5:** Students will able to understand the fundamental of Renewable Energy System as well as method of installation of solar module. **CO6:** Students will be having basic technical skills of Electronics and also the knowledge to understand the concept and application of various electronics components and their application, Electrical Power Supply Devices, Fibre optic communication and Solar Power.
10	Course Description	This course is designed to provide students training on practical knowledge of Electronics, Electrical Power Supply Devices, Communication techniques and Basics of Solar cell.
11	Outline syllabus	
	Unit 1	
	A	

	B	Basics of AC and Electrical Cables, Passive Components
	C	Soldering & De-soldering and switches Practical knowledge of Electronics
	Unit 2	
	A	p-n junction diode, Zener diode and LED
	B	
	C	Transistors Introduction to Digital Electronics, Some Projects of Electronics
	Unit 3	
	A	Protection devices
	B	
	C	SMPS UPS
	Unit 4	
	A	Transducers
	B	
	C	Communication electronics Fibre optic communication
	Unit 5	
	A	Solar Power
	B	
	C	Basics of Solar cell Components of Solar unit
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction
	Weightage Distribution	CA | | ETE 25% | | 75%
	Text book/s*	Principles of Electronics by V. K. Mehta
	Other References	Electronics engineering by B.L theraja. Electronics devices and circuit theory by R. L. Boylestad

BPP151 Physics Lab 1 Mechanical Properties of Matter

School: SBSR		**Batch : 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**SEMESTER: I**
1	Course Code	**BPP151**
2	Course Title	**Physics Lab 1 (Mechanical Properties of Matter)**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
4	Course Status	Major Lab 1
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	This course provides an opportunity to develop knowledge and understanding of the basic working of experiments used to determine various mechanical properties of matter.
8	Course Outcomes	CO1: Understanding of experimental method to determine the moment of inertia. CO2: Understanding of experimental method to determine the modulus of rigidity. CO3: Understanding of experimental method to determine the Young Modulus. CO4: Understanding of experimental method to determine the Surface Tension. CO5: Understanding of experimental method to determine the viscosity and acceleration due to gravity. CO6: Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the mechanical properties.
9	Course Description	This course provides students a full exposure to the basic principles and essential concepts of performing experiments and calculating mechanical parameters.
10	Outline syllabus	

	Unit 1			
	A	Moment of inertia of a flywheel		
	B and C	Moment of inertia of an irregular body by inertia table		
	Unit 2			
	A	Modulus of rigidity by statistical method (Barton's apparatus)		
	B and C	Modulus of rigidity by dynamical method (sphere / disc / Maxwell's needle)		
	Unit 3			
	A	Young's modulus by bending of beam		
	B and C	Young's modulus and Poisson's ratio by Searle's method		
	Unit 4			
	A	Surface tension of water by capillary rise method		
	B and C	Surface tension of water by Jaeger's method		
	Unit 5			
	A	Coefficient of viscosity of water by Poiseuille's method		
	B and C	Acceleration due to gravity by bar pendulum		
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction		
	Weightage Distribution	CA		ETE
		25%		75%
	Text book/s*	1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e		

		2. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015, 1e 3. R.K. Agrawal, G. Jain, R. Sharma, “Practical Physics”, Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019 4. S.L. Gupta, V. Kumar, “Practical Physics”, Pragati Prakashan, Meerut, 2014, 2e Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=74 1. Torque and angular acceleration of a fly wheel 2. Torsional oscillations in different liquids 3. Moment of inertia of flywheel 4. Newton's second law of motion 5. Ballistic pendulum 6. Collision balls 7. Projectile motion 8. Elastic and inelastic collision

BPP152 Physics Lab 2

School: SBSR		**Batch: 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**SEMESTER: I**
1	Course Code	**BPP152**
2	Course Title	**Physics Lab 2**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
4	Course Status	Major Lab 2
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	This course provides an opportunity to develop knowledge and understanding of the basic working of experiments used to determine various mechanical properties of matter.
8	Course Outcomes	CO1: Understanding of experimental method to determine the height of building and MOI of flywheel. CO2: Understanding of experimental method to determine the Planck's Constant and B-H curve of magnetic material using CRO CO3: Understanding of experimental method to determine the acceperation due to gravity using simple pendulum.. CO4: Understanding of experimental method to determine the Surface Tension. CO5: Understanding of experimental method to determine the Hall effect parameters and band gap using four probe method CO6: Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the mechanical, electrical, magnetic properties.
9	Course Description	This course provides students a full exposure to the basic principles and essential concepts of performing experiments and calculating mechanical, electrical, magnetic parameters.

10	Outline syllabus	
	Unit 1	
	A	To determine the height of a building by the help of a Sextant.
	B and C	To determine the moment of inertia of Flywheel about its axis of rotation
	Unit 2	
	A	To determine the Planck's constant by measuring radiation in a fixed spectral range.
	B and C	To draw hysteresis curve (B-H curve) of a specimen in the form of a transformer on a C.R.O. and to determine its hysteresis loss.
	Unit 3	
	A B and C	To convert a galvanometer into a voltmeter reading up to V volts and calibrate it. To convert a galvanometer into an ammeter reading up to I amperes and calibrate it
	Unit 4	
	A	Calculate wavelength of laser light using Photo Cell.
	B and C	To verify the relation of time period using simple pendulum
	Unit 5	
	A	To study Hall effect and determine the Hall coefficient, carrier density and the mobility of a semiconductor material
	B and C	To determine Energy band gap of a semiconductor using Four Probe method.
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction

	Weightage Distribution	CA		ETE
		25%		75%
	Text book/s*	1. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962, 9e 2. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015, 1e 3. R.K. Agrawal, G. Jain, R. Sharma, “Practical Physics”, Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019 4. S.L. Gupta, V. Kumar, “Practical Physics”, Pragati Prakashan, Meerut, 2014, 2e		

BHM151 Mathematics Lab 1

School: SBSR		**Batch : 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**SEMESTER: I**
1	Course Code	**BHM151**
2	Course Title	**Mathematics Lab 1**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
4	Course Status	Major Lab 3
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	This course provides an opportunity to develop knowledge and understanding of the basic of different computer software and apply it on various problems of mathematics.
8	Course Outcomes	CO1: The main objective of the course is to equip the student to plot the different graph and solve the different types of equations by plotting the graph using different computer software such as Mathematica /MATLAB /Maple /Scilab/Maxima etc.. CO2: Student would be able to know the convergence of sequences through plotting, verify Bolzano-Weierstrass theorem through plotting the sequence, Cauchy's root test by plotting nth roots and Ratio test by plotting the ratio of nth and (n + 1)th term. CO3: Student would be able to plot Complex numbers and their representations, Operations like addition, substraction, Multiplication, Division, Modulus and Graphical representation of polar form. CO4: Student would be able to perform following task of matrix as Addition, Multiplication, Inverse, Transpose, Determinant, Rank, Eigenvectors, Eigenvalues,

		CO5: Student would be able to perform following task of matrix as Characteristic equation and verification of the Cayley-Hamilton theorem, Solving the systems of linear equations. CO6: Students would be able to apply the understanding of softwares such as Mathematica /MATLAB /Maple /Scilab/Maxima etc and applying the knowledge of certain plotting softwares on various problems of mathematics and apply it on various real life problems. CO6: Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the mechanical properties.
9	Course Description	This course provides students a full exposure to the basic principles and essential concepts of computer software's and their applications in understanding of various topics of mathematics
10	Outline syllabus	
	Unit 1	
	A	**Practical / Lab work to be performed in Computer Lab.** List of the practical's to be done using Mathematica /MATLAB /Maple /Scilab/Maxima etc. 1. Plotting the graphs of the following functions: (i) ax (ii) [x] (greatest integer function) (iii) x^{2n} ; n ∈ N (iv) x^{2n-1} ; n ∈ N
	B	(v) $\frac{1}{x^{2n-1}}$;n ∈ N (vi) $\frac{1}{x^{2n}}$;n ∈ N (vii) $\sqrt{ax+b}$, $\lvert ax+b\rvert$, $c \pm \lvert ax+b\rvert$
	C	(ix) $\frac{\lvert x\rvert}{x}$, $\sin\left(\frac{1}{x}\right)$, $x\sin\left(\frac{1}{x}\right)$, e^{x}, e^{-x} for $x \neq 0$. (x) $e^{ax+b}, \log(ax+b), \frac{1}{ax+b}, \sin(ax+b), \cos(ax+b), \lvert\sin(ax+b)\rvert, \lvert\cos(ax+b)\rvert$. Observe and discuss the effect of changes in the real constants a and b on the graphs.
	Unit 2	
	A	(2) By plotting the graph find the solution of the equation $x = e^{x}, x^2 + 1 = e^{x}, 1 - x^2 = e^{x}, x = \log_{10}(x), \cos(x) = x, \sin(x) = x, \cos(y) = \cos(x), \sin(y) = \sin(x)$ etc
	B	Plotting the graphs of polynomial of degree 2,3, 4 and 5, and their first and second derivatives.

		Sketching parametric curves, e.g., Trochoid, Cycloid, Epicycloid and Hypocycloid etc.		
	C	Study the convergence of sequences through plotting. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.		
	Unit 3			
	A	Tracing of conic in Cartesian coordinates.		
	B	Graph of circular and hyperbolic functions.		
	C	Obtaining surface of revolution of curves.		
	Unit 4			
	A	Complex numbers and their representations, Operations like addition, Multiplication, Division, Modulus. Graphical representation of polar form.		
	B and C	Matrix Operations: Addition, Multiplication, Inverse, Transpose, Determinant, Rank, Eigenvectors, Eigenvalues,		
	Unit 5			
	A, B and C	Characteristic equation and verification of the Cayley-Hamilton theorem, Solving the systems of linear equations.		
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction		
	Weightage Distribution	CA		ETE
		25%		75%

SEMESTER II

BPH201 Thermal Physics & Semiconductor Devices

School: SBSR		**Batch : 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**SEMESTER: II**
1	Course Code	**BPH201**
2	Course Title	**Thermal Physics & Semiconductor Devices**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 4
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	This course provides an opportunity to develop knowledge and understanding of the key principles and applications of Thermal Physics and Semiconductor Devices.
9	Course Outcomes	CO1: Recognize the difference between reversible and irreversible processes, Understand the physical significance of thermodynamical potentials. CO2: Comprehend the kinetic model of gases w.r.t. various gas laws, Study the implementations and limitations of fundamental radiation laws. CO3: Utility of AC bridges CO4:, Recognize the basic components of electronic devices. CO5: Design simple electronic circuits. CO6: Understand the applications of various electronic instruments.
10	Course Description	This course provides students a full exposure to the basic principles and essential concepts of Thermal Physics and Semiconductor Devices including description of reverdible and irreversible process, thermodynamical potentials, kinetic model of gases, fundamental radiation laws, basic

		components of electronic devices, design of electronic devices and their applications etc. ***Introduction to Indian ancient Physics and contribution of Indian Physicists, in context with the holistic development of modern science and technology, should be included under Continuous Internal Evaluation (CIE).***
11	Outline syllabus	
		PART A: Thermodynamics & Kinetic Theory of Gases
	Unit 1	**0th & 1st , 2nd & 3rd Law of Thermodynamics**
	A	State functions and terminology of thermodynamics. Zeroth law and temperature. First law, internal energy, heat and work done. Work done in various thermodynamical processes. Enthalpy, relation between CP and CV. Carnot's engine, efficiency and Carnot's theorem. Efficiency of internal combustion engines (Otto and diesel).
	B	Different statements of second law, Clausius inequality, entropy and its physical significance. Entropy changes in various thermodynamical processes. Third law of thermodynamics and unattainability of absolute zero.
	C	Thermodynamical potentials, Maxwell's relations, conditions for feasibility of a process and equilibrium of a system. Clausius- Clapeyron equation, Joule-Thompson effect.
	Unit 2	**Kinetic Theory of Gases and Theory of Radiation**
	A	Kinetic model and deduction of gas laws. Derivation of Maxwell's law of distribution of velocities and its experimental verification.
	B	Degrees of freedom, law of equipartition of energy (no derivation) and its application to specific heat of gases (mono, di and poly atomic).
	C	Blackbody radiation, spectral distribution, concept of energy density and pressure of radiation. Derivation of Planck's law, deduction of Wien's distribution law, Rayleigh-Jeans law, Stefan- Boltzmann law and Wien's displacement law from Planck's law.
		PART B: Circuit Fundamentals & Semiconductor Devices
	Unit 3	**DC & AC Circuits and Semiconductor**
	A	Growth and decay of currents in RL circuit. Charging and discharging of capacitor in RC, LC and RCL circuits. Network Analysis -
	B	Superposition, Reciprocity, Thevenin's and Norton's theorems. AC Bridges - measurement of inductance (Maxwell's, Owen's and Anderson's bridges) and measurement of capacitance (Schering's, Wein's and de Sauty's bridges).
	C	P and N type semiconductors, qualitative idea of Fermi level. Formation of depletion layer in PN junction diode, field & potential at the depletion layer. Qualitative idea of current flow mechanism in forward & reverse biased diode.

	Unit 4	**Diodes and Transistor**		
	A	Diode fabrication. PN junction diode and its characteristics, static and dynamic resistance. Principle, structure, characteristics and applications of Zener, Tunnel, Light Emitting, Point Contact and Photo diodes. Half and Full wave rectifiers, calculation of ripple factor, rectification efficiency and voltage regulation. Basic idea about filter circuits and voltage regulated power supply.		
	B	Bipolar Junction PNP and NPN transistors. Study of CB, CE & CC configurations w.r.t. active, cutoff & saturation regions; characteristics; current, voltage & power gains; transistor currents & relations between them. Idea of base width modulation, base spreading resistance & transition time.		
	C	DC Load Line analysis and Q-point stabilisation. Voltage Divider Bias circuit for CE amplifier. Qualitative discussion of RC coupled amplifier (frequency response not included).		
	Unit 5	**Electronic Instrumentation**		
	A	Multimeter: Principles of measurement of dc voltage, dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.		
	B	Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, electron gun, electrostatic focusing and acceleration (no mathematical treatment). Front panel controls, special features of dual trace CRO, specifications of a CRO and their significance		
	C	Applications of CRO to study the waveform and measurement of voltage, current, frequency & phase difference.		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**PART A** 1. M.W. Zemansky, R. Dittman, “Heat and Thermodynamics”, McGraw Hill, 1997, 7e 2. F.W. Sears, G.L. Salinger, “Thermodynamics, Kinetic theory & Statistical thermodynamics”, Narosa Publishing House, 1998 3. Enrico Fermi, “Thermodynamics”, Dover Publications, 1956 4. S. Garg, R. Bansal, C. Ghosh, “Thermal Physics”, McGraw Hill, 2012, 2e 5. Meghnad Saha, B.N. Srivastava, “A Treatise on Heat”, Indian Press, 1973, 5e **PART B** 1. R.L. Boylestad, L. Nashelsky, “Electronic Devices and Circuit Theory”, Prentice-Hall of India Pvt. Ltd., 2015, 11e		

		2. J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e 3. B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e 4. J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e 5. A. Sudhakar, S.S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 2015, 5e 6. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8
	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/

BPH202 Renewable Energy Resources

School: SBSR		**Batch : 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**SEMESTER: II**
1	Course Code	**BPH202**
2	Course Title	**Renewable energy resources**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 5
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	1. To know the importance of Physics and Materials Science. 2. To utilize the various synthesis procedure to develop materials. 3. To explain the practical application of materials in various area.
9	Course Outcomes	CO1: Learn the basics of Energy/Technology CO2: Understand the correlation between Applied science and Technology CO3: Apply the concept of Renewable energy and technology at certain levels. CO4: Develop renewable devices. CO5: Create the path to handle materials and devices. CO6: Expertise in various tools will make a bridge between industry and students and Find out the platform for employment in high tech industries
10	Course Description	Renewable energy power generation has grown as a result of clean energy policies in many countries. The fastest growing of these green energy sources is solar power and wind power. Hydro power is the largest alternative energy source but geothermal power, biomass power and tidal power are starting to make strides in the market.

		Introduction to Indian ancient Physics and contribution of Indian Physicists, in context with the holistic development of modern science and technology, should be included under Continuous Internal Evaluation (CIE).		
11	Outline syllabus			
	Unit 1	**Fossil fuels and Alternate Sources of Energy**		
	A	Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources		
	B	An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation		
	C	Geothermal energy tidal energy, Hydroelectricity. Environmental issues and Renewable sources of energy, sustainability		
	Unit 2	**Solar Energy**		
	A	Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy		
	B	Solar water heater,flat plate collector, solar distillation, solar cooker, solar green houses, solar cell		
	C	Need and characteristics of photovoltaic (PV) systems, PVmodels and equivalent circuits, and sun tracking systems		
	Unit 3	**Wind and Ocean Energy**		
	A	Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines		
	B	Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices		
	C	Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy,Osmotic Power, Ocean Bio-mass		
	Unit 4	**Geothermal and Hydro energy**		
	A	Geothermal Energy: Geothermal Resources, Geothermal Technologies		
	B	Hydro-Energy: Hydropower resources, hydropower technologies		
	C	Environmental impact of hydro power sources.		
	Unit 5	**Piezoelectric Energy harvesting**		
	A	Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity		
	B	Piezoelectric parameters and modelling piezoelectric generators		
	C	Piezoelectric energy harvesting applications		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%

	Text book/s*	1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi 2. Solar energy - M P Agarwal - S Chand and Co. Ltd. 3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd. 4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, 5. Oxford University Press, in association with The Open University. 6. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009 7. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA). 8. http://en.wikipedia.org/wiki/Renewable_energy
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8
	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/

COC201 First Aid and Health

School: SBSR		**Batch : 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**SEMESTER: II**
1	Course Code	**COC201**
2	Course Title	**First Aid and Health**
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
5	Course Status	Co-curricular Compulsory
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	The course objective is to learn the skill needed to assess the ill or injured, infants, children and adults, it also give basic sex and metal health education.
9	Course Outcomes	CO1: Learn the skill needed to assess the ill or injured person CO2: Learn the skills to provide CPR to infants, children and adults. CO3: Learn the skills to handle emergency child birth CO4: Learn the Basic sex education help young people navigate thorny questions responsibly and with confidence. Learn the Basic sex education help youth to understand Sex is normal. It's a deep, powerful instinct at the core of our survival as a species. Sexual desire is a healthy drive. CO5: Help to understand natural changes of adolescence Learn the skill to identify Mental Health status and Psychological First Aid CO6: This course will help in overall social and health development.
10	Course Description	This course will help students to learn skill for basic assess to treat the injured person, also learn about skills to handling child birth, basic sex education and mental health status.

11	Outline syllabus	
	Unit 1	
	A	***Basic First Aid*** □ Aims of first aid & First aid and the law. □ Dealing with an emergency, Resuscitation (basic CPR). □ Recovery position, Initial top to toe assessment. □ Hand washing and Hygiene □ Types and Content of a First aid Kit
	B	***First AID Technique*** □ Dressings and Bandages. □ Fast evacuation techniques (single rescuer). □ Transport techniques.
	C	***First aid related with respiratory system*** □ Basics of Respiration. □ No breathing or difficult breathing, Drowning, Choking, Strangulation and hanging, □ Swelling within the throat, Suffocation by smoke or gases and Asthma. ***First aid related with Heart, Blood and Circulation*** □ Basics of The heart and the blood circulation. □ Chest discomfort, bleeding.
	Unit 2	
	A	***First aid related with Wounds and Injuries*** □ Type of wounds, Small cuts and abrasions □ Head, Chest, Abdominal injuries □ Amputation, Crush injuries, Shock ***First aid related with Bones, Joints Muscle related injuries*** □ Basics of The skeleton, Joints and Muscles. □ Fractures (injuries to bones).
	B	***First aid related with Nervous system and Unconsciousness*** □ Basics of the nervous system. □ Unconsciousness, Stroke, Fits – convulsions – seizures, Epilepsy. ***First aid related with Gastrointestinal Tract*** □ Basics of The gastrointestinal system. □ Diarrhea, Food poisoning.
	C	***First aid related with Skin, Burns*** □ Basics of The skin. □ Burn wounds, Dry burns and scalds (burns from fire, heat and steam). □ Electrical and Chemical burns, Sun burns, heat exhaustion and heatstroke. □ Frost bites (cold burns), Prevention of burns, Fever and Hypothermia.
	Unit 3	
	A	***First aid related with Poisoning*** □ Poisoning by swallowing, Gases, Injection, Skin ***First aid related with Bites and Stings*** □ Animal bites, Snake bites, Insect stings and bites

	B	***First aid related with Sense organs*** □ Basic of Sense organ. □ Foreign objects in the eye, ear, nose or skin. □ Swallowed foreign objects.		
	C	***Specific emergency satiation and disaster management*** □ Emergencies at educational institutes and work □ Road and traffic accidents. □ Emergencies in rural areas. □ Disasters and multiple casualty accidents. □ Triage. ***Emergency Child birth***		
	Unit 4			
	A	***Basic Sex Education*** □ Overview, ground rules, and a pre-test □ Basics of Urinary system and Reproductive system. □ Male puberty — physical and emotional changes □ Facts, attitudes, and myths about LGBTQ+ issues and identities		
	B	□ Female puberty — physical and emotional changes □ Male-female similarities and differences □ Sexual intercourse, pregnancy, and childbirth		
	C	□ Birth control and abortion □ Sex without love — harassment, sexual abuse, and rape □ Prevention of sexually transmitted diseases.		
	Unit 5			
	A	Mental Health and Psychological First Aid □ What is Mental Health First Aid? □ Mental Health Problems in the India □ The Mental Health First Aid Action Plan		
	B	□ Understanding Depression and Anxiety Disorders □ Crisis First Aid for Suicidal Behavior & Depressive symptoms □ What is Non-Suicidal Self-Injury? □ Non-crisis First Aid for Depression and Anxiety □ Crisis First Aid for Panic Attacks, Traumatic events		
	C	□ Understanding Disorders in Which Psychosis may Occur □ Crisis First Aid for Acute Psychosis □ Understanding Substance Use Disorder □ Crisis First Aid for Overdose, Withdrawal □ Using Mental Health First Aid		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
		CA		MTE+ETE

	Weightage Distribution	25%		75%
	Text book/s/ Suggestive reading materials	Indian First Aid Mannual-https://www.indianredcross.org/publications/FA-manual.pdf Red Cross First Aid/CPR/AED Instructor Manual • https://mhfa.com.au/courses/public/types/youthedition4 • Finkelhor, D. (2009). The prevention of childhood sexual abuse. Durham, NH: Crimes Against Children Research Center. www.unh.edu/ccrc/pdf/CV192. pdf • Kantor L. & Levitz N. (2017). Parents' views on sex education in schools: How much do Democrats and Republicans agree? PLoS ONE, 12 (7): e0180250. • Orenstein, P. (2016). Girls and sex: Navigating the complicated new landscape. New York, NY: Harper. • Schwiegershausen, E. (2015, May 28). The Cut. www.thecut.com/2015/05/most-women-are-catcalled-before-they-turn-17.html • Wiggins, G. & McTighe, J. (2008). Understanding by design. Alexandra, VA: ASCD. • https://marshallmemo.com/marshall-publications.php#8	
	Suggestive Digital Platforms / Web Links	https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online https://www.firstaidforfree.com/ https://www.coursera.org/learn/psychological-first-aid https://www.coursera.org/learn/mental-health		

BPP253 Fundamentals of Physical and geometrical optics for eye and vision

School: SBSR		**Batch : 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**Semester: II**
1	Course Code	**BPP253**
2	Course Title	**Fundamentals of Physical and geometrical optics for eye and vision**
3	Credits	3
4	Contact Hours (L-T-P)	0-0-5
4	Course Status	Vocational
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	This course provides an opportunity to develop knowledge and understanding fundamental concepts of geometrical optics and optics of eye.
8	Course Outcomes	**CO1:** Understand concepts of reflection, refraction and geometry of lens. **CO2:** Understand concepts of refractive power of lenses and analyse the focal power and surface power of a lens. **CO3:** Understand the theory of Cylindrical lenses and Toric lenses. **CO4:** Understand the fundamental optics of eye. **CO5:** Understand the concept how an Ophthalmic lens is used to compensate the refractive error of the eye. **CO6:** Apply conceptual understanding and mathematical methods to solve the problems.
9	Course Description	This course provides students with an understanding of Opticianry skills and knowledge of physical, geometrical and visual optics as they relate to the eye and vision.

		Introduction to Indian ancient Physics and contribution of Indian Physicists, in context with the holistic development of modern science and technology, should be included under Continuous Internal Evaluation (CIE).
10	Outline syllabus	
	Unit 1	**Introduction**
	A	Basics of reflection and refraction
	B	Basics of reflection and refraction
	C	Basics of lens.
	Unit 2	**Refractive power and lenses**
	A	Curved refracting surfaces
	B	Optical axis and thin lens power
	C	Back vertex power and front vertex power.
	Unit 3	**Sphero-cylindrical lenses**
	A	Cylindrical lenses
	B	Toric lenses
	C	Spherical equivalent
	Unit 4	**The eye and refractive errors**
	A	Optics of eye
	B	Refractive errors
	C	Refractive errors
	Unit 5	**Accommodation and correcting lenses**
	A	Far point accommodation
	B	Near point accommodation
	C	correcting lenses
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction
		CA | | MTE+ETE

	Weightage Distribution	25%		75%
	Text book/s*	1. Optics by Brijlal and Subrahmanyam 2. Introduction of Ophthalmic Optics by Darryl Meister 3. Ophthalmic Prescription work: 2nd Edition, A.G. Bennett Simon J. L. Blumlein		
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8		
	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/		

BPP251 Physics Lab 3: Thermal Properties of Matter & Electronics Circuits

School: SBSR		**Batch : 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**SEMESTER: II**
1	Course Code	**BPP251**
2	Course Title	**Physics Lab 3**: **Thermal Properties of Matter & Electronic Circuits**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
4	Course Status	Major Lab 4
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the thermal and electronic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.
8	Course Outcomes	CO1: Understanding of experimental method to determine the co-efficient of rubber and copper CO2: Understanding of experimental method to verify Stefan's law and study thermocouple application. CO3: Understanding of experimental method to study charging and discharging in RL and RLC circuits. CO4: Understanding of experimental method to study the characteristics of various diodes. CO5: Understanding of various measurements with CRO CO6: Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the thermal and electronic properties.
9	Course Description	This course provides students a full exposure to the basic principles and essential concepts of performing experiments and calculating mechanical parameters.

10	Outline syllabus			
	Unit 1			
	A	Coefficient of thermal conductivity of copper by Searle's apparatus		
	B	Coefficient of thermal conductivity of rubber		
		Coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method		
	Unit 2			
	A	Verification of Stefan's law		
	B and C	Variation of thermo-emf across two junctions of a thermocouple with temperature		
	Unit 3			
	A	Charging and discharging in RC and RCL circuits		
	B and C	Resonance in series and parallel RCL circuit		
	Unit 4			
	A	Characteristics of PN Junction, Zener, Tunnel, Light Emitting and Photo diode		
	B and C	Characteristics of a transistor (PNP and NPN) in CE, CB and CC configurations		
	Unit 5			
	A	Half wave & full wave rectifiers and Filter circuits		
	B and C	Various measurements with Cathode Ray Oscilloscope (CRO)		
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction		
	Weightage Distribution	CA		ETE
		25%		75%

	Text book/s*/Virtual modes and links	1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e 3. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e 4. A. Sudhakar, S.S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 2015, 5e **Thermal Properties of Matter:** Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=194 1. Heat transfer by radiation 2. Heat transfer by conduction 3. Heat transfer by natural convection 4. The study of phase change 5. Black body radiation: Determination of Stefan's constant 6. Newton's law of cooling 7. Lee's disc apparatus 8. Thermo-couple: Seebeck effects **Semiconductor Devices:** Virtual Labs an initiative of MHRD Govt. of India http://vlabs.iitkgp.ac.in/be/# 9. Familiarisation with resistor 10. Familiarisation with capacitor 11. Familiarisation with inductor 12. Ohm's Law 13. RC Differentiator and integrator 14. VI characteristics of a diode 15. Half & Full wave rectification 16. Capacitative rectification 17. Zener Diode voltage regulator 18. BJT common emitter characteristics 19. BJT common base characteristics 20. Studies on BJT CE amplifier 1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=194 2. Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in/be/# 3. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities

BPP252 Physics Lab 4

School: SBSR		**Batch : 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2021-2022**
Branch: Physics		**SEMESTER: II**
1	Course Code	**BPP252**
2	Course Title	**Physics Lab 4**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
4	Course Status	Major Lab 5
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	**1.** To provide students an understanding of discrete nature of radiation by Planck's constant and Frank-Hertz experiment. **2.** To provide students an understanding of silicon solar cell. **3.** To study speed of ultrasonic waves in kerosene oil.
8	Course Outcomes	CO1: Students will show that they have learned fundamentals of mercury vapor filled tubes and discrete energy levels. CO2: Students will understand basics of solar cell and their characteristics. . CO3: Students will be able to correlate theory and practical together and get the clear understanding of waves and oscillations, Students will also gain knowledge of longitudinal and transverse mode of vibrations by tuning fork CO4: Students will understand basics of ultrasonic waves and its applications, CO5: To determine unknown frequency or to compare the frequencies of two unknown signals CO6: Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the semiconducting properties and wave oscillations.

9	Course Description	This course will help students to have basic understanding of quantum mechanics and wave and oscillations and also provides students a full exposure to the basic principles and essential concepts of performing experiments and calculating semiconducting parameters and wave oscillations concepts.
10	Outline syllabus	
	Unit 1	
	A, B and C	To determine the Planck's constant by measuring radiation in a fixed spectral range. To measure the excitation potential of mercury using the Franck-Hertz method.
	Unit 2	
	A, B and C	To determine the value of the ratio of charge to mass (e/m) of an electron by Thomson's method using a cathode-ray tube. To study Solar cell characteristics.
	Unit 3	
	A B and C	Study of damping a bar pendulum and determination of coefficient of damping, relaxation time, and quality factor of a damped simple harmonic motion. To determine the frequency of an electrically maintained tuning fork using Melde's Apparatus. (i). Transverse mode of vibration (ii). Longitudinal mode of vibratio
	Unit 4	
	A	
	B and C	Calculate the speed of ultrasonic waves in kerosene oil. To determine the velocity of sound using resonance tube.

	Unit 5			
	A B and C	To determine unknown frequency or to compare the frequencies of two unknown signals with the method of Lissajous figures by using C.R.O.		
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction		
	Weightage Distribution	CA		ETE
		25%		75%
	Text book/s*			

SECOND YEAR

DETAILED SYLLABUS FOR

DIPLOMA

IN

APPLIED PHYSICS WITH ELECTRONICS

SEMESTER III

BPH301 Electromagnetic Theory and Modern Optics

School: SBSR		**Batch: 2021-2024**
Program: Diploma in Advanced Physics with Electronics		**Current Academic Year: 2022-2023**
Branch: Physics		**SEMESTER: III**
1	Course Code	**BPH301**
2	Course Title	**Electromagnetic Theory & Modern Optics**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 7
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	This course provides an opportunity to develop knowledge and understanding of the key principles and applications of **Electromagnetic Theory & Modern Optics**
9	Course Outcomes	CO1: Better understanding of electrical and magnetic phenomenon in daily life. CO2: Study the fundamental physics behind reflection and refraction of light (electromagnetic waves). CO3: Study the working and applications of Interference and diffraction. CO4: To study the principle and use of polarimeters. CO5: Study the characteristics and uses of lasers. CO6: To study the basics of applied and modern Physics.
10	Course Description	This course provides students a full exposure to the basic principles and essential concepts of electrostatics, Magnetostatics, Time varying fields, Electromagnetic Waves, Interference, Diffraction, Polarisation and different types of lasers. ***Introduction to Indian ancient Physics and contribution of Indian Physicists, in context with the holistic development of modern science and technology, should be included under Continuous Internal Evaluation (CIE).***
11	Outline syllabus	
		Part A Electromagnetic Theory
	Unit 1	**Electrostatics**
	A	Electric charge & charge densities, electric force between two charges. General expression for Electric field in terms of volume charge density (divergence & curl of Electric field)
	B	General expression for Electric potential in terms of volume charge density and Gauss law (applicationsvincluded). Study of electric dipole.
	C	Electric fields in matter, polarization, auxiliary field **D** (Electric displacement), electric susceptibility and permittivity.
	Unit 2	**Magnetostatics**

	A	Electric current & current densities, magnetic force between two current elements.
	B	General expression for Magnetic field in terms of volume current density (divergence and curl of Magnetic field), General expression for Magnetic potential in terms of volume current density and Ampere's circuital law (applications included).
	C	Study of magnetic dipole (Gilbert & Ampere model). Magnetic fields in matter, magnetisation, auxiliary field **H**, magnetic susceptibility and permeability.
	Unit 3	**Time Varying Electromagnetic Fields and Electromagnetic Waves**
	A	Faraday's laws of electromagnetic induction and Lenz's law, Displacement current, equation of continuity and Maxwell-Ampere's circuital law. Self and mutual induction (applications included).
	B	Derivation and physical significance of Maxwell's equations. Theory and working of moving coil ballistic galvanometer (applications included). Electromagnetic energy density and Poynting vector. Plane electromagnetic waves in linear infinite dielectrics.
	C	Homogeneous & inhomogeneous plane waves and dispersive & non-dispersive media. Reflection and refraction of homogeneous plane electromagnetic waves, law of reflection, Snell's law, Fresnel's formulae (only for normal incidence & optical frequencies) and Stoke's law. **Part B: Modern Optics**
	Unit 4	**Interference and Diffraction**
	A	Conditions for interference and spatial & temporal coherence. Division of Wavefront - Fresnel's Biprism and Lloyd's Mirror. Division of Amplitude - Parallel thin film.
	B	Edge shaped film and Newton's Ring experiment. Interferometer - Michelson and Fabry-Perot, Distinction between interference and diffraction. Fresnel's and Fraunhofer's class of diffraction.
	C	Fresnel's Half Period Zones and Zone plate. Fraunhofer diffraction at a single slit, n slits and Diffracting Grating. Resolving Power of Optical Instruments - Rayleigh's criterion and resolving power of telescope, microscope & grating.
	Unit 5	**Polarisation and lasers**
	A	Polarisation by dichronic crystals, birefringence, Nicol prism, retardation plates and Babinet's compensator.
	B	Analysis of polarized light. Optical Rotation - Fresnel's explanation of optical rotation and Half Shade & Biquartz polarimeters, Characteristics and uses of Lasers.

	C	Quantitative analysis of Spatial and Temporal coherence, Conditions for Laser action and Einstein's coefficients. Three and four level laser systems (qualitative discussion).		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**PART A** 1. D.J. Griffiths, "Introduction to Electrodynamics", Prentice-Hall of India Private Limited, 2002, 3e 2. E.M. Purcell, "Electricity and Magnetism (In SI Units): Berkeley Physics Course Vol 2", McGraw Hill, 2017, 2e 3. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 2", Pearson Education Limited, 2012. 4. D.C. Tayal, "Electricity and Magnetism", Himalaya Publishing House Pvt. Ltd., 2019, 4e **PART B** 1. Francis A. Jenkins, Harvey E. White, "Fundamentals of Optics", McGraw Hill, 2017, 4e. 2. Samuel Tolansky, "An Introduction to Interferometry", John Wiley & Sons Inc., 1973, 2e. 3. A. Ghatak, "Optics", McGraw Hill, 2017, 6e		
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8		
	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/		

BPH302 Oscillations and Waves

School: SBSR		**Batch : 2021-2024**
Program: Diploma in Advanced Physics with Electronics		**Current Academic Year: 2022-2023**
Branch: Physics		**SEMESTER: III**
1	Course Code	**BPH302**
2	Course Title	**Oscillations and Waves**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 8
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	1. To develop an idea of superposition of waves and nature of oscillation 2. To know the brief detail of damping of oscillation and energy related to the system. 3. To know about the forced damping of waves and resonance of waves and to know about the wave motion and also about the coupled oscillation. 4. Deduce the classical, differential equations of waves and to learn about the modulation, propagation and dispersion of waves.
9	Course Outcomes	CO1: Learn the basics of waves and oscillation. CO2: learn about free damping of waves. CO3: learn about the forced damping of waves and resonance phenomenon. CO4: learn about coupled oscillation and idea of classical wave equation. CO5: learn about the motion of waves and acoustics. CO6: able to apply course knowledge on mechanical and electrical systems.
10	Course Description	This course is designed for B.Sc. third year students. This course deals the basics of different types of oscillations and waves. It also describes the basic knowledge of the subject to electrical and mechanical systems. ***Introduction to Indian ancient Physics and contribution of Indian Physicists, in context with the holistic development of modern science and technology, should be included under Continuous Internal Evaluation (CIE).***
11	Outline syllabus	
		Part A: Oscillation
	Unit 1	**Superposition of Harmonic Oscillations**
	A	The superposition principle and linearity, Superposition of Two Collinear Harmonic Oscillations
	B	Superposition of Two Collinear Harmonic Oscillations: Oscillations having equal and different frequencies: Beats, Application of Beats,
	C	Superposition of two perpendicular harmonic oscillations: Oscillations having equal frequencies and different frequencies, Lissajous Figures.
	Unit 2	**Free Damped Oscillations (One degree of freedom)**
	A	Damping forces, Oscillation of systems with one degree of freedom,

	B	Energy of a weakly damped oscillator, Logarithmic Decrement, Relaxation time, Quality factor,		
	C	Damped Oscillations of Mechanical and Electrical impedances (Series and parallel resonance circuit).		
	Unit 3	**Forced Oscillations and Resonance**		
	A	Forced Oscillations, Forced Oscillations of one dimensional harmonic oscillator: Steady State -		
	B	Amplitude, Phase, Resonance, Sharpness of Resonance, Power Dissipation and Quality Factor,		
	C	Helmholtz Resonator, Forced Oscillations of Mechanical and Electrical impedances (Series and parallel resonance circuit)		
	Unit 4	**Coupled Oscillations (Two degree of freedom)**		
	A	Coupled Oscillations, Two coupled pendulums,		
	B	Normal Coordinates and Normal Modes,		
	C	Transverse vibration of a string, Classical wave equation		
		Part B: Waves		
	Unit 5	**Wave Motion and Acoustics**		
	A	Differential equation of Wave motion, Wave velocities in continuous systems: Newton's Formula for velocity of sound,		
	B	Modulations, Wave Groups and Pulses, Particle and Wave Velocities, Normal and Anomalous dispersion, Doppler effect; Acoustics of building,		
	C	Condition for a good hall, Reverberation time, Sabine's Reverberation formula, Absorption Coefficient measurement.		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**PART A** 1. The Physics of Waves and Oscillations by N.K. Bajaj (Tata McGraw-Hill, 1988. **PART B** 1. Vibrations and Waves by A. P. French. (CBS Pub. & Dist., 1987) 2. Fundamentals of Waves & Oscillations by K. Uno Ingard (Cambridge University Press, 1988) 3. An Introduction to Mechanics by Daniel Kleppner, Robert J. Kolenkow (McGraw-Hill, 1973) 4. Waves: Berkeley Physics Course (SIE) by Franks Crawford.		
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx		

		4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8
	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/

BPH303 Mathematical Methods and Differential Equations

School: SBSR		**Batch : 2021-2024**
Program: Diploma in Advanced Physics with Electronics		**Current Academic Year: 2022-2023**
Branch: Physics		**SEMESTER: III**
1	Course Code	**BPH303**
2	Course Title	**Mathematical Methods and Differential Equations**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 9
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	This course provides an opportunity to develop knowledge and understanding of the key principles and applications of **Mathematical Methods and Differential Equations**
9	Course Outcomes	CO1: The course gives emphasis to enhance students' knowledge of functions of two variables, Laplace Transforms, CO2: Describe the Fourier Series, Fourier integral and evaluate the expansion of functions in terms of Fourier series, Fourier integral. CO3:. The objective of this course is to familiarize the students with various methods of solving differential equations, partial differential equations of first order and second order and to have qualitative applications. CO4: On successful completion of the course students should have knowledge about higher different mathematical methods and will help him in going for higher studies and research A student doing this course is able to solve differential equations and is able to model problems in nature using ordinary differential equations. CO5: After completing this course, a student will be able to take more courses on wave equation, heat equation, diffusion equation, gas dynamics, non linear evolution equation etc. These entire courses are important in engineering and industrial applications for solving boundary value problem. CO6: Describe and analyze the basic concepts of Mathematical methods and Differential equation.
10	Course Description	This course provides students a full exposure to the basic principles and essential concepts of different mathematical methods, Laplace transformation,

		Fourier analysis, Special functions, ordinary differential equations and partial differential equations.
11	Outline syllabus	
		Part A Mathematical Methods
	Unit 1	**Functions and Laplace Transformation**
	A	Limit and Continuity of functions of two variables, Differentiation of function of two variables, Necessary and sufficient condition for differentiability of functions two variables, Schwarz's and Young theorem.
	B	Taylor's theorem for functions of two variables with examples, Maxima and minima for functions of two variables, Lagrange multiplier method, Jacobians.
	C	Existence theorems for Laplace transforms, Linearity of Laplace transform and their properties, Laplace transform of the derivatives and integrals of a function, Convolution theorem, inverse Laplace transforms, Solution of the differential equations using Laplace transforms.
	Unit 2	**Fourier Series and calculus**
	A	Fourier series, Fourier expansion of piecewise monotonic functions, Half and full range expansions, Fourier transforms (finite and infinite), Fourier integral.
	B	Calculus of variations-Variational problems with fixed boundaries- Euler's equation for functionals containing first order derivative and one independent variable.
	C	Extremals, Functionals dependent on higher order derivatives, Functionals dependent on more than one independent variable, Variational problems in parametric form.
		Part B: Differential Equations
	Unit 3	**Differential Equations and special functions**
	A	Second order linear differential equations with variable coefficients: Use of a known solution to find another, normal form, method of undetermined coefficient, variation of parameters, Series solutions of differential equations, Power series method.
	B	Method of undetermined coefficient, variation of parameters, Series solutions of differential equations, Power series method.
	C	Bessel, Legendre and Hypergeometric functions and their properties, recurrence and generating relations.
	Unit 4	**Partial Differential Equation**
	A	Origin of first order partial differential equations. Partial differential equations of the first order and degree one,.
	B	Lagrange's solution, Partial differential equation of first order and degree greater than one

	C	Charpit's method of solution, Surfaces Orthogonal to the given system of surfaces.		
	Unit 5	**Second order differential Equations**		
	A	Origin of second order PDE, Solution of partial differential equations of the second and higher order with constant coefficients.		
	B	Classification of linear partial differential equations of second order.		
	C	Solution of second order partial differential equations with variable coefficients, Monge's method of solution		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**PART A** 1. T.M. Apostal, Mathematical Analysis, Person. 2. G.F. Simmons, Differential Equations with Application and Historical Notes, Tata –McGrawHill. 3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons. **PART B** 1. G.F. Simmons, Differential Equations with Application and Historical Notes, Tata –McGrawHill. 2. B. Rai, D.P. Choudhary & H. J. Freedman, A Course of Ordinary Differential Equations, Narosa. 3. Ian N. Snedden, Elements of Partial Differential Equations, Dover Publication. 4. L.E. Elsgolts, Differential Equation and Calculus of variations, University Press of the Pacific.		
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8		

	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/

COC301 Human Values and Environmental Studies

School: SBSR		**Batch : 2021-2024**
Program: Diploma in Advanced Physics with Electronics		**Current Academic Year: 2022-2023**
Branch: Physics		**SEMESTER: III**
1	Course Code	**COC301**
2	Course Title	**Human Values and Environmental Studies**
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
5	Course Status	Compulsory
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	The mission of the course on Human Values and Environmental Studies is to create morally articulate solutions to be truthful and just and to become responsible towards humanity.
9	Course Outcomes	CO1: Building fundamental knowledge of the interplay of markets, ethics, and law. CO2: To understand the core concepts for business ethics. CO3: To study the core concepts for a morally articulate solution evolver to management issues in general. CO4: To know how environmental degradation has taken place. CO5: To study the environmental laws and environmental management system. CO6: To understand the basic concepts of human ethics and conservation of ecosystem.
10	Course Description	The course seeks to establish a continuous interest in the learners to improve their thought process with intent to develop a new generation of responsible citizens capable of addressing complex challenges faced by the society due to disruptions in human interactions effecting human values.

11	Outline syllabus	
	Part A Human Values	
	Unit 1	**Human Values and present Practices**
	A	Introduction- Values, Characteristics, Types, Developing Value, system in Indian Organisation , Values in Business Management , value based Organisation , Trans –cultural Human values in Management. Swami Vivekananda's philosophy of Character Building, Gandhi's concept of Seven Sins, APJ Abdul Kalam, view on role of parents and Teachers.
	B	Human Values and Present Practices – Issues : Corruption and Bribe , Privacy Policy in Web and Social Media, Cyber threats ,Online Shopping etc. Remedies UK.
	C	Bribery Act, Introduction to sustainable policies and practices in Indian Economy.
	Unit 2	**Principles of Ethics**
	A	**Secular and Spiritual Values in Management- Introduction-** Secular and Spiritual values, features.
	B	Levels of value Implementation. Features of spiritual Values
	C	**Corporate Social Responsibility-** Nature, Levels, Phases and Models of CSR, Corporate Governance. CSR and Modern Business Tycoons Ratan Tata, Azim Premji, and Bill Gates.
	Unit 3	**Holistic Approach in Decision making**
	A	Decision making**,** the decision making process , The Bhagavad Gita: Techniques in Management , Dharma and Holistic Management.
	B	Discussion through Dilemmas – Dilemmas in Marketing and Pharma Organisations, moving from Public to Private – monopoly context , Dilemma of privatisation,
	C	Dilemma on liberalization, Dilemma on social media and cyber security , Dilemma on Organic food , Dilemma on standardization, Dilemma on Quality standards, Case Studies

	Part B: Environmental Studies			
	Unit 4	**Ecosystem:**		
	A	Concept, structure & functions of ecosystem : producer, consumer, decomposer, foodweb, food chain, energy flow.		
	B	Ecological pyramids Conservation of Biodiversity- In-situ & Ex- situ conservation of biodiversity, Role of individual in Pollution control, Human Population & Environment.		
	C	Sustainable Development, India and UN Sustainable Development Goals, Concept of circular economy and entrepreneurship		
	Unit 5	**Environmental Laws**		
	A	International Advancements in Environmental Conservation, Role of National Green Tribunal.		
	B	Air Quality Index, Importance of Indian Traditional knowledge on environment.		
	C	Bio assessment of Environmental Quality, Environmental Management System, Environmental Impact Assessment and Environmental Audit.		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**PART A** 1. A foundation course in Human Values and Professional Ethics by RR. Gaur, R. Sangal et.al 2. JUSTICE: What's the Right Thing to Do? Michael J. Sandel. 3. Human Values by A. N. Tripathi New Age International 4. Environmental Management by N.K. Uberoi 5. https://www.un.org/sustainabledevelopment/sustainable-development-goals/ 6. https://www.india.gov.in/my-government/schemes 7. https://www.legislation.gov.uk/ukpga/2010/23/contents		

		8. Daniel Kahneman, Thinking, Fast and Slow; Allen Lane Nov 2011 ISBN: 9780141918921
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8
	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/

BPP353 Nano-materials Technology and Hands on Training

School: School of Basic Sciences and Research		**Batch: 2021-2023**
Program: DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS		**Current Academic Year: 2022-2023**
Branch: All		**Semester: III**
1	Course Code	**BPP353**
2	Course Title	**Nano-materials Technology and Hands on Training**
3	Credits	3
4	Contact Hours (L-T-P)	0-0-5
5	Course Status	Vocational
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	**1.** To know about basic requirement of materials for applications in Solar cell and Photocatalytic activity. **2.** To know about synthesis of nanomaterials for their applications in Solar cell and Photocatalytic activity. **3.** To know how to characterize the prepared materials using different characterization techniques. **4.** To know how to study the various parameters of solar cell and photocatalytic activity to identify the best materials for the same.
9	Course Outcomes	After successful completion of this course the students will/will be able to: CO1: Students will be having the knowledge of basics about nanomaterials. CO2: Students will be having the knowledge of how to synthesis nanomaterials by various methods. CO3: Student will be having the knowledge to how to prepare electrolyte and electrode material. CO4: Student will able to get the knowledge ensemble the electrode and electrolyte to prepare a solar cell. CO5: Student will able to get the knowledge to characterize the nanoparticles. CO6: Students will be having the understanding of measuring various physical parameters of solar cell and photocatalytic activity and finding the best suitable material for solar cell and water purification from chemical dyes.
10	Course Description	This course is designed to provide students training on practical knowledge of synthesis the nanoparticles, characterization and measuring the physical and chemical properties required to get the best possible solar cell device and photocatalytic activity.
11	Outline syllabus	
	Unit 1	

	A	Introduction to nanostructured materials,
	B	
	C	Type of nanostructured materials, Lab facility demonstration
	Unit 2	
	A	Synthesis of different nanostructured materials by Sol-gel
	B	
	C	Synthesis of different nanostructured materials by Co-Precipitate method Synthesis of different nanostructured materials by solid state method
	Unit 3	
	A	Preparation of electrolyte material
	B	
	C	Preparation of electrode material Preparation of polymer electrolyte films using solution cast technique
	Unit 4	
	A	Preparation of Solar cells
	B	
	C	Characterization of all synthesized materials using various techniques such as XRD, UV spectrometer, Optical microscopy etc
	Unit 5	
	A	Measurement of various physical parameters of Solar cell.
	B	
	C	Measurement of photocatalytic activity of synthesized nanoparticels.
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction
	Weightage Distribution	CA: 25% | ETE: 75%
	Text book/s*	1. Nanostructures and Nanomaterials: Synthesis, Properties and Applications (World Scientific Series in Nanoscience and Nanotechnology). 2. Electrical Properties of Polymers by Tony Blythe and David Bloor, Cambridge University Press, Second Edition, 2005.
	Other References	References 1. Gong, J., Sumathy, K., Qiao, Q., & Zhou, Z. (2017). Review on dye-sensitized solar cells (DSSCs): Advanced techniques and research trends. Renewable and Sustainable Energy Reviews, 68, 234–246. doi:10.1016/j.rser.2016.09.097.

		2. Xu, C., Ravi Anusuyadevi, P., Aymonier, C., Luque, R., & Marre, S. (2019). Nanostructured materials for photocatalysis. Chemical Society Reviews, 48(14), 3868–3902. doi:10.1039/c9cs00102f. 3. Electrochemical Supercapacitors by B. E. Conway, Kluwer Academic/Plenum Publisher, New York, Boston, London, 1999

BPP351 Physics Lab 5: Demonstrative Aspects of Electricity & Magnetism

School: SBSR		**Batch : 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2022-2023**
Branch: Physics		**SEMESTER: III**
1	Course Code	**BPP351**
2	Course Title	**Physics Lab 5: Demonstrative Aspects of Electricity & Magnetism**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
4	Course Status	Major Lab 6
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine band gap, laser properties, study of interference and diffraction phenomena, Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.
8	Course Outcomes	CO1: Knowledge and study of basic physics experiments based on Semiconductors, energy band gap, planck constant etc. CO2: Use the concept of electricity and magnetism to find out variation of magnetic field through a current carrying coil and hall effect CO3: Understand and learn how to determine specific resistance CO4: Understand and perform laser-based experiments. CO5: Knowledge and study of various optical experiments. CO6:Apply the mathematical concepts/equations to obtain quantitative results and ability to conduct, analyze and interpret experiments.
9	Course Description	This course provides students a full exposure to the basic principles and essential concepts of performing experiments and calculating mechanical parameters.
10	Outline syllabus	
		Part A: Electromagnetic Theory
	Unit 1	
	A	To determine Energy band gap of a semiconductor using Four Probe method.
	B	To determine the variation of magnetic field along the axis of a current carrying coil and estimate the radius of the coil.

	C	To study Hall effect and determine the Hall coefficient, carrier density and the mobility of a semiconductor material
	Unit 2	
	A	To draw hysteresis curve (B-H curve) of a specimen in the form of a transformer on a C.R.O. And to determine its hysteresis loss
	B and C	To determine the Planck's constant by measuring radiation in a fixed spectral range. To determine the specific resistance of the material of a given wire using Carey Foster's bridge.
	Unit 3	
	A	To determine the diameter of thin wire by diffraction using laser.
	B and C	To determine the wavelength of laser light by diffraction at a single slit. To determine slit width of single and double slit by using Laser.
	Unit 4	
	A	To detrmine the wavelength of laser light by diffraction at a single slit
	B and C	To determine the wavelength of monochromatic light by Newton's Ring method
	Unit 5	
	A	To determine the focal length of the combination of two lenses separated by a distance with the help of a nodal slide and to verify the formula.
	B and C	To verify Stefan's Law.
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction
	Weightage Distribution	CA | | ETE 25% | | 75%
	Text book/s*/Virtual modes and links	1. B.Sc. Practical Physics- Harnam Singh, S. Chand Publishing. 2. B.Sc. Practical Physics- C L Arora, S. Chand Publishing. 3. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e 1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=194 2. Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in/be/# 3. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities

BPP352 Physics Lab 6: Oscillation and Waves LAB

School: SBSR		**Batch : 2021-2024**
Program: CERTIFICATE IN BASIC PHYSICS & SEMICONDUCTOR DEVICES		**Current Academic Year: 2022-2023**
Branch: Physics		**SEMESTER: III**
1	Course Code	**BPP352**
2	Course Title	**Physics Lab 6: Oscillation and Waves LAB**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
4	Course Status	Major Lab 7
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	Experimental physics has the most striking impact on the industry wherever the instruments are used to study harmonic motion, simple pendulum, compound pendulum, and Melde's experiment. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.
8	Course Outcomes	CO1:Knowledge and study of basic physics experiments based on simple harmonic motion CO2: Use the concept of stress, strain to calculate modulus of rigidity, Young's modulus. CO3: Understand how to determine moment of inertia of different bodies. CO4: Understand how to calculate frequency using Melde's Experiment CO5: To understand the basic and operation of Cathode Ray Oscilloscope. CO6:Apply the mathematical concepts/equations to obtain quantitative results and ability to conduct, analyze and interpret experiments.
9	Course Description	This course provides students a full exposure to the basic principles and essential concepts of performing experiments and calculating mechanical parameters.
10	Outline syllabus	

	Unit 1	
	A	1. To verify the relation of time period using simple pendulum. 2. To determine the acceleration due to gravity and radius of Gyration of compound pendulum and compare with theoretical value.
	B	
	C	
	Unit 2	
	A	3. To measure the moment of inertia of a flywheel. **4.** To determine the Young's modulus of a beam using cantilever beam experiment apparatus.
	B	
	C	
	Unit 3	
	A	5. To determine the modulus of rigidity of a material of a given wire with an inertia table (torsion pendulum) by dynamical method. 6. To calculate Moment of inertia of different irregular shapes.
	B	
	C	
	Unit 4	
	A	7. To determine the frequency of an electrically maintained tuning fork using Melde's Apparatus. (i) Transverse mode of vibration (ii) Longitudinal mode of vibration.
	B	
	C	
	Unit 5	
	A	8. To study the Cathode Ray Oscilloscope (i) Familiarisation with Oscilloscope (ii) Voltage and Frequency Measurement (iii)Lissajous Figures
	B	
	C	
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction
	Weightage Distribution	CA | | ETE
		25% | | 75%
	Text book/s*/Virtual modes and links	4. B.Sc. Practical Physics- Harnam Singh, S. Chand Publishing. 5. B.Sc. Practical Physics- C L Arora, S. Chand Publishing. 6. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e 1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=194 2. Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in/be/# 3. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities

SEMESTER IV

BPH401 Perspective of Modern Physics and Basic Electronics

School: SBSR		**Batch: 2021-2024**
Program: DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS		**Current Academic Year: 2022-2023**
Branch: Physics		**Semester: IV**
1	Course Code	**BPH401**
2	Course Title	**Perspectives of Modern Physics & Basic Electronics**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
4	Course Status	Major 10
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	This course provides an opportunity to develop knowledge and understanding of the key principles and applications of Modern Physics & Basic Electronics.
8	Course Outcomes	CO1. Recognize the difference between the structure of space & time in Newtonian & Relativistic mechanics.. CO2. Understand the physical significance of consequences of Lorentz transformation equations. CO3. Develop an understanding of the foundational aspects of Quantum Mechanics and comprehend the wave-particle duality. CO4. Study the comparison between various biasing techniques.. CO5. Study the classification of amplifiers and comprehend the use of feedback and oscillators. CO6. Comprehend the theory and working of optical fibers along with its applications.
9	Course Description	This course provides students a full exposure to the basic principles and essential concepts of of modern physics such as relativity and quantum mechanics and familiarize about basic electronic components such as amplifiers, oscillators and fiber optics together with their working.
10	Outline syllabus:	
	Unit 1	**Introduction to Relativity-Experimental Background and Relativistic Kinematics**

	A	Structure of space & time in Newtonian mechanics and inertial & non-inertial frames. Galilean transformations. Newtonian relativity. Galilean transformation and Electromagnetism.
	B	Attempts to locate the Absolute Frame: Michelson-Morley experiment and significance of the null result. Einstein's postulates of special theory of relativity. Structure of space & time in Relativistic mechanics and derivation of Lorentz transformation equations (4-vector formulation included).
	C	Consequences of Lorentz Transformation Equations (derivations & examples included): Transformation of Simultaneity (Relativity of simultaneity); Transformation of Length (Length contraction); Transformation of Time (Time dilation); Transformation of Velocity (Relativistic velocity addition); Transformation of Acceleration; Transformation of Mass (Variation of mass with velocity). Relation between Energy & Mass (Einstein's mass & energy relation) and Energy & Momentum.
	Unit 2	**Inadequacies of Classical Mechanics and Introduction to Quantum Mechanics**
	A	Particle Properties of Waves: Spectrum of Black Body radiation, Photoelectric effect, Compton effect and their explanations based on Max Planck's Quantum hypothesis.
	B	Wave Properties of Particles: Louis de Broglie's hypothesis of matter waves and their experimental verification by Davisson-Germer's experiment and Thomson's experiment.
	C	Matter Waves: Mathematical representation, Wavelength, Concept of Wave group, Group (particle) velocity, Phase (wave) velocity and relation between Group & Phase velocities. Wave Function: Functional form, Normalisation of wave function, Orthogonal & Orthonormal wave functions and Probabilistic interpretation of wave function based on Born Rule.
	Unit 3	**Transistor Biasing and Amplifiers**
	A	Faithful amplification & need for biasing. Stability Factors and its calculation for transistor biasing circuits for CE configuration: Fixed Bias (Base Resistor Method), Emitter Bias (Fixed Bias with Emitter Resistor), Collector to Base Bias (Base Bias with Collector Feedback) &, Voltage Divider Bias. Discussion of Emitter-Follower configuration.
	B	Classification of amplifiers based on Mode of operation (Class A, B, AB, C & D), Stages (single & multi stage, cascade & cascode connections), Coupling methods (RC, Transformer, Direct & LC couplings), Nature of amplification (Voltage & Power amplification) and Frequency capabilities (AF, IF, RF & VF).
	C	Theory & working of RC coupled voltage amplifier (Uses of various resistors & capacitors, and Frequency response) and Transformer coupled power amplifier (calculation of Power, Effect of temperature, Use of heat sink & Power dissipation). Calculation of Amplifier Efficiency (power efficiency) for Class A Series-Fed, Class A Transformer Coupled, Class B Series-Fed and Class B Transformer Coupled amplifiers.
	Unit 4	**Feedback & Oscillator Circuits**

	A	Feedback Circuits: Effects of positive and negative feedback. Voltage Series, Voltage Shunt, Current Series and Current Shunt feedback connection types and their uses for specific amplifiers.		
	B	Estimation of Input Impedance, Output Impedance, Gain, Stability, Distortion, Noise and Band Width for Voltage Series negative feedback and their comparison between different negative feedback connection types.		
	C	Oscillator Circuits: Use of positive feedback for oscillator operation. Barkhausen criterion for selfsustained oscillations. Feedback factor and frequency of oscillation for RC Phase Shift oscillator and Wein Bridge oscillator. Qualitative discussion of Reactive Network feedback oscillators (Tuned oscillator circuits): Hartley & Colpitt oscillators.		
	Unit 5	**Introduction to Fiber Optics**		
	A	Basics of Fiber Optics, step index fiber, graded index fiber		
	B	light propagation through an optical fiber, acceptance angle & numerical aperture,		
	C	qualitative discussion of fiber losses and applications of optical fibers.		
	Mode of examination	Theory		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	• Beiser, Shobhit Mahajan, "Concepts of Modern Physics: Special Indian Edition", McGraw Hill, 2009, 6e • J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e		
	Suggestive Digital Platforms / Web Links	• MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ • National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd • Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx • Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8		
	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/		

BPH402 Laser and Applications

School: SBSR		**Batch: 2021-2024**
Program: B.Sc.		**Current Academic Year: 2022-2023**
Branch: DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS		**Semester: IV**
1	Course Code	**BPH402**
2	Course Title	**Laser and Applications**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Major 11
5	Course Objective	Lasers, optical fiber and holography and their applications have become integral part of our society. This course will provide the knowledge of fundamental concepts and working principle of various laser, optical fiber and holography with their applications.
6	Course Outcomes	CO1: Provides the students a thorough understanding of the fundamentals of lasers and their unique properties. CO2: Knowledge of different lasers design and its various applications. CO3: Knowledge of basics of holography, construction and re-contraction of hologram and recording materials. CO4: Understanding of Interferometry and different types of hologram and its applications. CO5: Adequate knowledge of basic concepts of optical fibers, properties and industrial applications of optical fibers. CO6: Describe the basic laser physics, working of lasers, holography and theory of optical fibers.
7	Course Description	This course provides the basic understanding about the various laser systems and their applications. Provide knowledge about structure of optical fiber, light propagation in optical fiber, construction, reconstruction of hologram and their applications.
8	Outline syllabus	
	Unit 1	**Concepts of Laser**
	A	Introduction, coherent sources, Absorption, Spontaneous and Stimulated emission, Einstein's coefficients.
	B	Optical amplification, Population inversion and Optical pumping, Active components of laser
	C	Optical Resonators: Stable and unstable resonators, Threshold condition for laser action.
	Unit 2	**Types of Laser**
	A	Solid state laser (Ruby, Nd:Yag),
	B	gas laser (He-Ne, CO_2 laser)

	C	Semiconductor diode laser: Homo and Hetero junction, applications of lasers.
	Unit 3	**Holography**
	A	Introduction, basic principle of holography, Recording of hologram, Reconstruction of hologram, Hologram of a point source,
	B	Requirements in making hologram, Transmission and Reflection holograms, Plane and Volume holograms,
	C	Recording materials for holograms: silver halides, dichromatic gelatin, photoresist etc,
	Unit 4	**Interferometry and Imaging**
	A	Interferometry: Michelson interferometer, Fabry Perot interferometer,
	B	Optical Data storage, Display, HOEs (Holographic optical elements),
	C	Colour holography: Recording with multiple wavelength, White light holograms and acoustic holography
	Unit 5	**Optical Fiber**
	A	Introduction, Structure of optical fibers, light propagation through an optical fiber , parameters related to an optical fiber
	B	Classification of optical fibers, attenuation, dispersion
	C	Advantages and disadvantages of optical fiber, Introduction of optical fibre communication system..
	Mode of examination	Theory
	Weightage Distribution	CA (25%) and MTE+ETE (75%)
	Text book/s*	An introduction to Lasers: Theory and Applications by M. N. Avadhanulu (Text book)
	Other References	1. Lasers (Theory and Application) by K.Thyagarajan & A.K.Ghatak 2. Lasers and Non Linear Optics by B.B. Laud (New Age International, Second Edition) (text book) 3. Introduction to fiber by A.K. Ghatak& K. Thyagarajan 4. Optical fibre communications by John M. Senior (Second Edition)

BPH403 Advanced Mathematical Physics

School: SBSR		**Batch: 2021-2024**
Program: DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS		**Current Academic Year: 2022-2023**
Branch: Physics		**Semester: IV**
1	Course Code	**BPH403**
2	Course Title	**Advanced Mathematical Physics**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
4	Course Status	Major 12
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	This course provides an opportunity to develop knowledge and understanding of the mathematical methods and functions and physical principles involved in the subject of mechanics.
8	Course Outcomes	CO1: The objective of this course is to familiarize the students with various methods of solving differential equations, partial differential equations of first order and second order and to have qualitative applications. CO2: After completing this course, a student will be able to take more courses on wave equation, heat equation, diffusion equation, gas dynamics, nonlinear evolution equation etc. These entire courses are important in engineering and industrial applications for solving boundary value problem. CO3: The object of the paper is to give students knowledge of basic mechanics such as simple harmonic motion, motion under other laws and forces. CO4: The student, after completing the course can go for higher problems in mechanic such as hydrodynamics; this will be helpful in getting employment in industry. (K3,K4) CO5: Describe the Virtual work, Stable and Unstable equilibrium, and evaluate the Catenary, Catenary of uniform strength. CO6: Describe and analyze the basic concepts of Motion of particles of varying mass and its applications.
9	Course Description	This course provides students a full exposure to various important mathematical functions and physical principles involved in understanding the subject of mechanics.
10	Outline syllabus:	

	Unit 1	**Introduction to Mechanics**		
	A	Frame of reference, work energy principle, Forces in three dimensions, Poinsot's central axis, Wrenches, Null lines and planes.		
	B			
	C			
	Unit 2	**Work and Equilibrium**		
	A	Virtual work, Stable and Unstable equilibrium, Catenary, Catenary of uniform strength.		
	B			
	C			
	Unit 3	**Different types of motions**		
	A	Velocities and accelerations along radial and transverse directions, and along tangential and normal directions, Simple Harmonic motion, Motion under other law of forces. Elastic strings, Motion in resisting medium, Constrained motion, Motion on smooth and rough plane curves.		
	B			
	C			
	Unit 4	**Laws of motion and Coordinate systems.**		
	A	Motion of particles of varying mass, Rocket motion, Central orbit, Kepler's laws of motion, Motion of particle in three dimensions, Rotating frame of reference, Rotating Earth, Acceleration in terms of different coordinates systems.		
	B			
	C			
	Unit 5	**Frobenius Method and Special Functions**		
	A	Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations.		
	B	Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials.		
	C	Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions ($J_0(x)$ and $J_1(x)$) and Orthogonality.		
	Mode of examination	Theory		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	• R.C. Hibbeler, Engineering Mechanics-Dynamics, Prentics Hall Publishers. • A. Nelson, Engineering Mechanics Statics and Dynamics, Tata McGraw Hill. • G.F. Simmons, Differential Equations with Application and Historical Notes, Tata –McGrawHill.		
	Suggestive Digital Platforms / Web Links	NPTEL/SWAYAM/MOOCs		

COC401 Physical Education and Yoga

School: SBSR		**Batch: 2021-2024**
Program: Certificate		**Current Academic Year: 2022-2023**
Branch: Physics		**Semester: IV**
1	Course Code	**COC401**
2	Course Title	**Physical Education and Yoga**
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
4	Course Status	Compulsory Co-Curricular
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	The objective of this course is to provide an opportunity to learn about the weight management and lifestyle of an individual and the relation of Yoga with mental health and value Education.
8	Course Outcomes	CO1. Students will learn the introduction of Physical Education. CO2. Students will learn the concept of fitness and wellness. CO3. Students will learn the weight management and lifestyle of an individual. CO4. The student will also learn about the relation of Yoga with mental health. CO5. The student will also learn about the relation of Yoga with value Education. CO6. In this course student will also learn about the aspects of the traditional games of India.
9	Course Description	This course provides students a full exposure to the concept of fitness and wellness, Weight management and lifestyle of an individual and the relation of Yoga with mental health and value Education.
10	Outline syllabus	
	Unit 1	**Physical Education**
	A	Meaning, Definition, Aim and Objective. Misconception About Physical Education.
	B	Need, Importance and Scope of Physical Education in the Modern Society. Physical Education Relationship with General Education.
	C	Physical Education in India before Independence. Physical Education in India after Independence.
	Unit 2	**Concept of Fitness and Wellness, Weight Management and Lifestyle**
	A	• Meaning, Definition and Importance of Fitness and Wellness. • Components of Fitness.

		• Factor Affecting Fitness and Wellness.		
	B	• Meaning and Definition of Obesity. • Causes of Obesity. • Management of Obesity. • Health problems due to Obesity.		
	C	• Meaning, Definition, Importance of Lifestyle. • Factor affecting Lifestyle. • Role of Physical activity in the maintenance of Healthy Lifestyle.		
	Unit 3	**Yoga and Meditation**		
	A	• Historical aspect of yoga. • Definition, types scopes & importance of yoga. • Yoga relation with mental health and value education. • Yoga relation with Physical Education and sports.		
	B	• Definition of Asana, differences between asana and physical exercise. • Definition and classification of pranayama. • Difference between pranayama and deep breathing.		
	C	**Practical:** Asana, Suraya-Namaskar, Bhujang Asana, Naukasana, Halasana, Vajrasan, Padmasana, Shavasana, Makrasana, Dhanurasana, Tad Asana. Pranayam: Anulom, Vilom.		
	Unit 4	**Traditional Games of India and Recreation in Physical Education**		
	A	• Meaning. • Types of Traditional Games- Gilli- Danda Kanche Stapu Gutte, etc.		
	B	• Importance/ Benefits of Traditional Games. • How to Design Traditional Games.		
	C	• Meaning, Definition of Recreation. • Scope and Importance of Recreation. • General Principles of Recreation. • Types of Recreational Activities. • Aerobics and Zumba.(Fir India Movement)		
	Mode of examination	Thoery		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	• Singh, Ajmer, Physical Education and Olympic Abhiyan, “Kalayani Publishers”, New Delhi, Revised Addition, 2006 • Patel, Shri krishna, Physical Education, “Agrawal Publishers”, Agra, 2014-15		
	Suggested Equivalent Online Courses	• IGNOU. • Rajarshi Tandan Open University.		

BPP453 Vocational Course in Computation Physics

School: SBSR		**Batch: 2021-2024**
Program: DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS		**Current Academic Year: 2022-2023**
Branch: Physics		**Semester: IV**
1	Course Code	**BPP453**
2	Course Title	**Vocational course in Computation Physics using Sci Lab**
3	Credits	3
4	Contact Hours (L-T-P)	0-0-5
4	Course Status	Vocational
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	• To Understand Scilab basics • To learn inbuild functions of scilab and will learn to define new function and Students will have good understanding of Linear algebra • Students will able to evaluate, analyze and plot results, To verify various physics laws • The course contents will enable the students to learn basic SCILAB programming for to develop skills of writing programs to solve problems • After training over this course, learners may teach this programming as a helper • In different companies (HCL, Wipro, etc..), learners may use this programming to analyse risk analysis and to compare prices in consideration of other factors
8	Course Outcomes	CO1. Students will know about the importance of the programming. They will learn how to install an open access programming plate form sci lab software. CO2. Students will able to define variables, arrays, conditional statements. They will also learn inbuild functions as well as able to understand how to make user define functions. CO3. Students will able to solve mathematical problems and Vector analysis. Students will able to solve first order and second order differential equations using Sci lab. CO4. Students will have good understanding of 1d, 2d and 3d plotting and plotting of different types of functions. Also they will able to solve problems using different types of loops.

		CO5. Simple science problems can be solved using Sci lab programming easily to understand them clearly. CO6. This course will develop the skills of the students to write different programs for real life problems which is the requirement of current era.		
9	Course Description	This course is about to understand scilab basics, to learn inbuild functions of scilab and will learn to define new function, to verify various physics laws and to solve mathematical problems.		
10	Outline syllabus: This course is about to understand scilab basics, to learn inbuild functions of scilab and will learn to define new function, to verify various physics laws and to solve quantum mechanics problems.			
	Unit 1	**Introduction to Scilab and its installation**		
	A	Sub Unit a: Command window, Figure window, Editor window		
	B	Sub Unit b: Variables and arrays, Initializing variables in Scilab		
	C	Sub Unit c: Introduction to Scilab file processing, file opening and closing		
	Unit 2	**Inbuild functions and User Defined Functions**		
	A	Sub Unit a: Built in Scilab functions: their uses and applications		
	B	Sub Unit b: Solution of real-life problems using inbuild functions and user Defined Functions, displaying output data		
	C	Sub Unit c: break and continue statements, use of functions in analysis, probability and statistics		
	Unit 3	**Mathematical problems and Vector analysis**		
	A	Sub Unit a: Addition, subtraction, multiplication, increment, decrement		
	B	Sub Unit b: supplements on metrices and vectors, operations in metrices		
	C	Sub Unit c: solving first order and second order differential equations		
	Unit 4	**Plotting and Problem-solving skills using loops in Sci lab**		
	A	Sub Unit a: Introduction to plotting, 2D and 3D plotting, plotting of bivariate statistical data,		
	B	Sub Unit b: relational and logical operators, the while loop, for loop, details of loop operations, break and continue statements		
	C	Sub Unit c: nested loops, logical arrays and vectorization, comparison operators		
	Unit 5	**Practical related to solve Schrodinger equation for hydrogen atom**		
	A	Sub Unit a: Omh's law, Hook's law, Calculation of spring constant		
	B	Sub Unit b: How to draw a straight line with and without regression method using some experimental data, Equation of motions,		
	C	Sub Unit c: Simple harmonic oscillations, developing the skills of writing a program		
	Mode of examination	Practical		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	Scilab text book companion for Modern Physics by K. S. Krane, Edition 2, John Wiley & Sons, 1996		

	Suggestive Digital Platforms / Web Links	• Scilab Software • Computational Physics, D.Walker, 1st Edn., 2015, Scientific International Pvt. Ltd. • Scilab by Dr. Ranjit Kumar • Introduction to Scilab, Consortium Scilab, Domaine de Voluceau - B.P. 105-78153 Le Chesnay Cedex France
	Suggested Equivalent Online Courses	NA

BPP451 Physics Lab 7: Basic Electronics Instrumentation Lab

School: SBSR		**Batch: 2021-2024**
Program: DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS		**Current Academic Year: 2022-2023**
Branch: Physics		**Semester: IV**
1	Course Code	**BPP451**
2	Course Title	**Physics Lab 7: Basic Electronics Instrumentation**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
4	Course Status	Major Lab 8
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	This course provides an opportunity to study and determine the electronic properties using different electronic components /instruments and to give an insight in simulation techniques and provide a basis for modelling.
8	Course Outcomes	After the completion of this course, CO1. Students will know about the different biasing modes of a transistor and bias stability. CO2. Students will able to understand how to use a transistor as an amplifier and perform different types of amplifier configurations like CE, CB and CC amplifiers. CO3. Students will be able to use transistors in the circuit as Clippers and Clampers & Emitter Follower. CO4. Students will have good understanding of carrying out measurement of frequency response of single stage RC coupled amplifier and single stage Transformer coupled amplifier.

		CO5. Students will be able to comprehend the effect of negative feedback on frequency response of RC coupled amplifier and will be able to carry out complete study of Schmitt Trigger. CO6. Students will be able to gain good understanding and working of Hartley oscillator and Wein Bridge oscillator.
9	Course Description	This course has the most striking impact on the industry wherever the components / Instruments are used to study and determine the electronic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling..
10	Outline syllabus: This course involves the study of different components /instruments for determining the electronic properties through which measurement precision and perfection can be achieved.	
	Unit 1	**Transistor Bias Stability and Comparative Study of CE, CB and CC amplifier**
	A	To study the different biasing modes of a transistor and understand bias stability.
	B	To study and understand the function of a BJT transistor as a switch and load lines for a BJT transistor.
	C	To use a transistor as an amplifier and study different types of amplifier configurations like CE, CB and CC amplifiers.
	Unit 2	**Clippers & Clampers and Study of Emitter Follower**
	A	To understand Clipping Circuits by constructing a positive clamper circuit.
	B	To understand Clipping Circuits by constructing a negative Clamper circuit.
	C	To understand Clipping Circuits by constructing a positive biased Clamper circuit.
	Unit 3	**Frequency response of single stage RC coupled amplifier and single stage Transformer coupled amplifier**
	A	To study and understand the basics of RC coupled amplifier and Transformer coupled amplifier.
	B	To study the Frequency response of single stage RC coupled amplifier.
	C	To study the Frequency response of single stage Transformer coupled amplifier.
	Unit 4	**Effect of negative feedback on frequency response of RC coupled amplifier and Study of Schmitt Trigger**
	A	To study and understand the basics of introducing negative feedback on amplifier and its advantages.
	B	To study the effect of negative feedback on frequency response of RC coupled amplifier.
	C	Oscillator Circuits: Use of positive feedback for oscillator operation. Barkhausen criterion for selfsustained oscillations. Feedback factor and frequency of oscillation for RC Phase Shift oscillator and Wein Bridge oscillator. Qualitative discussion of Reactive Network feedback oscillators (Tuned oscillator circuits): Hartley & Colpitt oscillators.
	Unit 5	**Study of Hartley oscillator and Wein Bridge oscillator**

	A	To study and understand the basics of Hartley oscillator and Wein Bridge oscillator.		
	B	To design and set up a Hartley oscillator using BJT and to observe the sinusoidal output waveform.		
	C	To design and set up a Wein Bridge oscillator using BJT and to observe the sinusoidal output waveform.		
	Mode of examination	Practical		
	Weightage Distribution	CA		ETE
		25%		75%
	Text book/s*	• J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e • B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e		
	Suggestive Digital Platforms / Web Links	• Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in/psac/# • Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in/be/# • Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/index.php?sub=1&brch=201 • Virtual Labs at Amrita Vishwa Vidyapeetham, http://vlab.amrita.edu/index.php?sub=59&brch=269		

BPP452 Physics Lab 8: Optics and Lasers Lab

School: SBSR		**Batch: 2021-2024**
Program: B.Sc.		**Current Academic Year: 2022-2023**
Branch: DIPLOMA IN APPLIED PHYSICS WITH ELECTRONICS		**Semester: IV**
1	Course Code	**BPP452**
2	Course Title	**Physics Lab 8: Optics & Lasers Lab**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
	Course Status	Major Lab 9
5	Course Objective	To make the students familiar with the instruments which are used to study and determine the optical properties.
6	Course Outcomes	After the completion of this course, CO1. Students will know about the working and use of Fresnel Biprism. CO2. Students will know about the working and use of Newton's Rings. Setup. CO3. Students will know about the working and use of Plane Diffraction Grating. CO4. Students will know about the working and use of Spectrometer. CO5. Students will know about the working and use of single slit diffraction setup. CO6. Students will be able to gain good understanding and working of optical and laser instruments.
7	Course Description	Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the optical properties. Measurement precision and perfection will be achieved through the Lab Experiments of this course.
8	Outline syllabus	
	Unit 1	**Fresnel Biprism: Wavelength of sodium light**
	A	To determine the wavelength of sodium light by fresnel's biprism.
	B	
	C	
	Unit 2	**Newton's Rings: Wavelength of sodium light**
	A	To determine the wavelength of sodium light by Newton's ring.
	B	

	C	
	Unit 3	**Plane Diffraction Grating: Spectrum of mercury light**
	A	To study diffraction of light using a diffraction grating spectrometer and to measure the wavelengths of certain lines in the spectrum of the mercury arc lamp.
	B	
	C	
	Unit 4	**Spectrometer: Refractive index of the material of a prism using sodium light**
	A	To determine the refractive index of the material of a prism using sodium light.
	B	
	C	
	Unit 5	**Wavelength of Laser light using diffraction by single slit**
	A	To determine the wavelength of laser light using single slit diffraction pattern.
	B	
	C	
	Mode of examination	Practical
	Weightage Distribution	CA (25%) and ETE (75%)
	Text book/s*	• S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e • R.K. Agrawal, G. Jain, R. Sharma, "Practical Physics", Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019
	Suggestive Digital Platforms / Web Links	• Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=189 • Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/index.php?sub=1&brch=281

THIRD YEAR

DETAILED SYLLABUS FOR

DEGREE

IN

BACHELOR OF SCIENCE

BACHELOR IN APPLIED PHYSICS

WITH

ELECTRONICS

SEMESTER V

BPH501 Classical and Statistical Mechanics

School: SBSR		**Batch: 2021-2024**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2023-2024**
Branch: Physics		**SEMESTER: V**
1	Course Code	**BPH501**
2	Course Title	**Classical & Statistical Mechanics**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 13
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	1. This subject provides an in-depth knowledge of mechanical systems and an analysis of the constraints present within them. 2. To get introduced about the concept of Hamiltonian and Hamilton's equations of motion, Central forces and its applications. 3. To establish an understanding of the basics of Statistical mechanics and students are made aware of the concept of phase space, ensembles and the types of ensembles. The students aware of classical and quantum statistical distribution laws and their applications.
9	Course Outcomes	CO1: Understand the concepts of generalized coordinates and D'Alembert's principle. CO2: Understand the Lagrangian dynamics, the importance of cyclic coordinates. CO3: Study the difference between Lagrangian and Hamiltonian dynamics. Understand the important features of central force and its application in Kepler's problem. CO4: Recognize the difference between macrostate and microstate and comprehend the concept of ensembles. CO5: Understand the classical, quantum statistical distribution laws and its applications CO6: appreciate classical and statistical mechanics and can apply it on problems.
10	Course Description	This course provides students a full exposure to the basic principles and essential concepts of Classical and Statistical Mechanics including description of Constrained Motion, Lagrangian Formalism, Hamiltonian Formalism, Central Force, Macrostate & Microstate, Concept of Ensemble, Distribution Laws, Applications of Statistical Distribution Laws etc.

11	Outline syllabus	
		Part A: Mathematical Physics
	Unit 1	**Constrained Motion**
	A	Constraints - Definition, Classification and Examples. Degrees of Freedom and Configuration space. Constrained system, Forces of constraint and Constrained motion.
	B	Generalised coordinates, Transformation equations and Generalised notations & relations,
	C	Principle of Virtual work and D'Alembert's principle.
	Unit 2	**Lagrangian Formalism**
	A	Lagrangian for conservative & non-conservative systems, Lagrange's equation of motion (no derivation), Comparison of Newtonian & Lagrangian formulations,
	B	Cyclic coordinates, and Conservation laws (with proofs and properties of kinetic energy function included).
	C	Simple examples based on Lagrangian formulation.
	Unit 3	**Hamiltonian Formalism and Central Force**
	A	Phase space, Hamiltonian for conservative & non-conservative systems, Physical significance of Hamiltonian, Hamilton's equation of motion (no derivation), Comparison of Lagrangian & Hamiltonian formulations
	B	Cyclic coordinates, and Construction of Hamiltonian from Lagrangian. Simple examples based on Hamiltonian formulation. Definition and properties (with prove) of central force. Equation of motion and differential equation of orbit.
	C	Bound & unbound orbits, stable & non-stable orbits, closed & open orbits and Bertrand's theorem. Motion under inverse square law of force and derivation of Kepler's laws. Laplace-Runge- Lenz vector (Runge-Lenz vector) and its applications.
		Part B: Introduction to Statistical Mechanics
	Unit 4	**Macrostate & Microstate and Concept of Ensemble**
	A	Macrostate, Microstate, Number of accessible microstates and Postulate of equal a priori. Phase space, Phase trajectory, Volume element in phase space, Quantisation of phase space.
	B	Number of accessible microstates for free particle in 1D, free particle in 3D & harmonic oscillator in 1D. Problem with time average, concept of ensemble, postulate of ensemble average and Liouville's theorem (proof included).
	C	Micro Canonical, Canonical & Grand Canonical ensembles. Thermodynamic Probability, Postulate of Equilibrium and Boltzmann Entropy relation.
	Unit 5	**Distribution Laws and Applications of Statistical Distribution Laws**
	A	Statistical Distribution Laws: Expressions for number of accessible microstates, probability & number of particles in ith state at equilibrium for Maxwell-Boltzmann, Bose-Einstein & Fermi-Dirac statistics. Comparison of statistical distribution laws and their physical significance.

		Canonical Distribution Law: Boltzmann's Canonical Distribution Law, Boltzmann's Partition Function,		
	B	Proof of Equipartition Theorem (Law of Equipartition of energy) and relation between Partition function and Thermodynamic potentials. Application of Bose-Einstein Distribution Law: Photons in a black body cavity and derivation of Planck's Distribution Law.		
	C	Application of Fermi-Dirac Distribution Law: Free electrons in a metal, Definition of Fermi energy, Determination of Fermi energy at absolute zero, Kinetic energy of Fermi gas at absolute zero and concept of Density of States (Density of Orbitals).		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**PART A** 1. Herbert Goldstein, Charles P. Poole, John L. Safko, "Classical Mechanics", Pearson Education, India, 2011, 3e 2. N.C. Rana, P.S. Joag, "Classical Mechanics", McGraw Hill, 2017 3. R.G. Takwale, P.S. Puranik, "Introduction to Classical Mechanics", McGraw Hill, 2017 **PART B** 1. F. Reif, "Statistical Physics (In SI Units): Berkeley Physics Course Vol 5", McGraw Hill, 2017, 1e 2. B.B. Laud, "Fundamentals of Statistical Mechanics", New Age International Private Limited, 2020, 2e 3. B.K. Agarwal, M. Eisner, "Statistical Mechanics", New Age International Private Limited, 2007, 2e		
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8		
	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/		

BPH502 Quantum Physics and Spectroscopy

School: SBSR		**Batch : 2021-2024**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2023-2024**
Branch: Physics		**SEMESTER: V**
1	Course Code	**BPH502**
2	Course Title	**Quantum Physics & Spectroscopy**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 14
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	This course provides an opportunity to understand the key principles and applications of Quantum Physics & Spectroscopy
9	Course Outcomes	CO1: Understand the significance of operator formalism in Quantum mechanics. CO2: Study the eigen and expectation value methods and to understand the basis and interpretation of Uncertainty principle. CO3: Develop the technique of solving Schrodinger equation for 1D and 3D problems and comprehend the success of Vector atomic model in the theory of Atomic spectra. CO4: Study the different aspects of spectra of Group I & II elements and to study the production and applications of X-rays. CO5: Develop an understanding of the fundamental aspects of Molecular spectra. CO6: Understanding the concepts of Quantum Physics & Spectroscopy
10	Course Description	This course provides students a full exposure to the basic principles and essential concepts of Quantum Mechanics, Eigen & Expectation Values, Uncertainty Principle & Schrodinger Equation, Spectra of Alkali & Alkaline Elements etc.
11	Outline syllabus	
		Part A: Introduction to Quantum Mechanics
	Unit 1	**Operator Formalism**
	A	Operators: Review of matrix algebra, definition of an operator, special operators, operator algebra and operators corresponding to various physical-dynamical variables.
	B	Commutators: Definition, commutator algebra and commutation relations among position, linear momentum & angular momentum and energy & time.
	C	Simple problems based on commutation relations.
	Unit 2	**Eigen & Expectation Values; Uncertainty Principle & Schrodinger Equation**
	A	Eigen & Expectation Values: Eigen equation for an operator, eigen state (value) and eigen functions. Linear superposition of eigen functions and Non-degenerate &

		Degenerate eigen states. Expectation value pertaining to an operator and its physical interpretation. Hermitian Operators: Definition, properties and applications. Prove of the hermitian nature of various physical-dynamical operators.
	B	Uncertainty Principle: Commutativity & simultaneity (theorems with proofs). Non commutativity of operators as the basis for uncertainty principle and derivation of general form of uncertainty principle through Schwarz inequality. Uncertainty principle for various conjugate pairs of physical- dynamical parameters and its applications.
	C	Schrodinger Equation: Derivation of time independent & time dependent forms, Schrodinger equation as an eigen equation, Deviation & interpretation of equation of continuity in Schrodinger representation, and Equation of motion of an operator in Schrodinger representation.
	Unit 3	**Applications of Schrodinger Equation;** **<u>PART B</u> Introduction to Spectroscopy;** **Vector Atomic Model**
	A	Application to 1D Problems: Infinite Square well potential (Particle in 1D box), Finite Square well potential, Potential step, Rectangular potential barrier and 1D Harmonic oscillator. Application to 3D Problems: Infinite Square well potential (Particle in a 3D box) and the Hydrogen atom (radial distribution function and radial probability included). (Direct solutions of Hermite, Associated Legendre and Associated Laguerre differential equations to be substituted).
	B	**Vector Atomic Model** Inadequacies of Bohr and Bohr-Sommerfeld atomic models w.r.t. spectrum of Hydrogen atom (fine structure of H-alpha line). Modification due to finite mass of nucleus and Deuteron spectrum.
	C	Vector atomic model (Stern-Gerlach experiment included) and physical & geometrical interpretations of various quantum numbers for single & many valence electron systems. LS & jj couplings, spectroscopic notation for energy states, selection rules for transition of electrons and intensity rules for spectral lines. Fine structure of H-alpha line on the basis of vector atomic model.
	Unit 4	**Spectra of Alkali & Alkaline Elements; X-Rays & X-Ray Spectra**
	A	Spectra of alkali elements: Screening constants for s, p, d & f orbitals; sharp, principle, diffuse & fundamental series; doublet structure of spectra and fine structure of Sodium D line. Spectra of alkaline elements: Singlet and triplet structure of spectra.
	B	Nature & production, Continuous X-ray spectrum & Duane-Hunt's law, Characteristic X-ray spectrum & Mosley's law
	C	Fine structure of Characteristic X-ray spectrum, and X-ray absorption spectrum.
	Unit 5	**Molecular Spectra**
	A	Discrete set of energies of a molecule, electronic, vibrational and rotational energies. Quantisation of vibrational energies, transition rules and pure vibrational spectra.
	B	Quantisation of rotational energies, transition rules, pure rotational spectra and determination of inter nuclear distance.
	C	Rotational-Vibrational spectra; transition rules; fundamental band & hot band; O, P, Q, R, S branches.

	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**PART A** 1. D.J. Griffiths, "Introduction to Quantum Mechanics", Pearson Education, India, 2004, 2e 2. E. Wichmann, "Quantum Physics (In SI Units): Berkeley Physics Course Vol 4", McGraw Hill, 2017 3. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 3", Pearson Education Limited, 2012 4. R Murugeshan, Kiruthiga Sivaprasath, "Modern Physics", S. Chand Publishing, 2019, 18e **PART B** 1. H.E. White, "Introduction to Atomic Spectra", McGraw Hill, 1934 2. C.N. Banwell, E.M. McCash, "Fundamentals of Molecular Spectroscopy", McGraw Hill, 2017, 4e 3. R Murugeshan, Kiruthiga Sivaprasath, "Modern Physics", S. Chand Publishing, 2019, 18e 4. S.L. Gupta, V. Kumar, R.C. Sharma, "Elements of Spectroscopy", Pragati Prakashan, Meerut, 2015, 27e		
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8		
	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/		

BPH503 Atmospheric and Astrophysics

School: SBSR		**Batch : 2021-2024**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2023-2024**
Branch: Physics		**SEMESTER: V**
1	Course Code	**BPH503**
2	Course Title	**Atmospheric and Astrophysics**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 15
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	This course will provide students with a knowledge of modern techniques, theory, and observational results relating to energetic processes in astrophysics, and introduce the physics of planetary atmospheres with special emphasis on the atmosphere of the Earth. It will also provide students with knowledge of the physical processes that govern weather and climate. Content will include: Introduction to planetary atmospheres and the solar system.
9	Course Outcomes	CO1: Understand the Concepts of Celestial Coordinates, Time and Earth's Atmosphere. CO2: Understand the Climate in the Tropics. CO3: Study the Planetary Magnetism and Disturbing the Earth – Contemporary dilemmas. CO4: Study the Sun and basic Astrophysics. CO5: Understand the Stellar Structure. CO6: Appreciate Atmospheric and Astrophysics and can apply it on problems.
10	Course Description	This course provides students a full exposure to the basic principles and essential concepts of Atmospheric and Astrophysics including description of Celestial Coordinates, Time and Earth's Atmosphere, Climate in the Tropics Planetary Magnetism and Disturbing the Earth – Contemporary dilemmas, Astrophysics, the sun and Stellar Structure etc.
11	Outline syllabus	
		Part A: Atmospheric Physics
	Unit 1	**Celestial Coordinates, Time and Earth's Atmosphere**
	A	The celestial sphere and coordinate system, celestial poles, measurement of latitude and declination, wandering of celestial poles, galactic latitude and longitude, sidereal and solar time, time system conversion, navigation, civil time and time zones, development of the calendar: Julian calendar, Gregorian calendar and Julian dates.

	B	Origin and evolution of the atmosphere, vertical structure of the atmosphere, hydrostatic equilibrium, diffusive equilibrium, temperature structure of the atmosphere; adiabatic lapse rate, thermodynamics of dry and moist air, Greenhouse effect, atmospheric ozone: classical ozone reactions, tropospheric ozone, catalytic destruction of ozone and the ozone depletion problem; atmospheric aerosols
	C	Atmospheric Dynamics: Basic concepts, effect of Coriolis force on Earth's rotation, geostrophic wind, atmospheric motions, basic idea of atmospheric waves: sound waves and gravity waves.
	Unit 2	**Climate in the Tropics**
	A	Weather elements, radiation, global warming, pressure, rainfall, weather system
	B	cloud formation and rain, different types of clouds, tropical disturbances, cyclones, tropical circulations and monsoon
	C	El Nino and southern oscillation, climate over the Indian region and the Indian monsoon, contribution of satellites for tropical prediction
	Unit 3	**Planetary Magnetism and Disturbing the Earth – Contemporary dilemmas**
	A	The geomagnetic coordinate system, origin of the main field, disturbance indicators, geomagnetic storms, magnetosphere and the solar wind, Heliosphere, rapid fluctuations, daily variations, space exploration and satellite study of heliosphere.
	B	Human population growth, Atmosphere: Greenhouse gas emissions, climate change, air pollution,
	C	Hydrosphere: Fresh water depletion, Geosphere: Chemical effluents, nuclear waste, Biosphere: Biodiversity loss. Deforestation. Robustness and fragility of ecosystems.
		PART B: ASTROPHYSICS
	Unit 4	**Astrophysics and The Sun**
	A	Physical principles: Gravitation in Astrophysics (Virial Theorem, Newton versus Einstein), Systems in Thermodynamic Equilibrium, Theory of Radiative Transfer (Radiation Field, Radiative Transfer Equation),
	B	Optical Depth; Solution of Radiative Transfer Equation, Local Thermodynamic Equilibrium (Solar Parameters, Solar Photosphere, Solar Atmosphere, Chromosphere. Corona, Solar Activity, Basics of Solar Magnetohydrodynamics. Helioseismology). The solar family: Solar System: Facts and Figures,
	C	Origin of the Solar System: The Nebular Model, Tidal Forces and Planetary Rings, Extra-Solar Planets. Stellar spectra and classification Structure (Atomic Spectra Revisited, Stellar Spectra, Spectral Types and Their Temperature Dependence, Black Body Approximation, H R Diagram, Luminosity Classification)
	Unit 5	**Stellar Structure**
	A	Stellar structure: Hydrostatic Equilibrium of a Star, Some Insight into a Star: Virial Theorem, Sources of Stellar Energy,

	B	Modes of Energy Transport, Simple Stellar Model, Polytropic Stellar Model.		
	C	Star formation: Basic composition of Interstellar medium, Interstellar Gas, Interstellar Dust, Formation of Protostar, Jeans criterion, Fragmentation of collapsing clouds, From protostar to Pre-Main Sequence, Hayashi Line.		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**PART A** 1 Fundamental of Atmospheric Physics – Murry L Salby; Academic Press, Vol 61, 1996 2 The Physics of Atmosphere – John T. Houghton; Cambridge University press; 3rd edn. 2002. 3 An Introduction to dynamic meteorology – James R Holton; Academic Press, 2004 4 Radar for meteorological and atmospheric observations – S Fukao and K Hamazu, Springer Japan, 2014 **PART B** 1 Modern Astrophysics, B.W. Carroll & D.A. Ostlie, Addison-Wesley Publishing Co. 2 Introductory Astronomy and Astrophysics, M. Zeilik and S.A. Gregory, 4th Edition, Saunders College Publishing. 3 The physical universe: An introduction to astronomy, F.Shu, Mill Valley: University Science Books. 4 Fundamental of Astronomy (Fourth Edition), H. Karttunen et al. Springer 5 K.S. Krishnasamy, 'Astro Physics a modern perspective,' Reprint, New Age International (p) Ltd, New Delhi,2002. 6 Baidyanath Basu, 'An introduction to Astro physics', Second printing, Prentice - Hall of India Private limited, New Delhi,2001. 7 Textbook of Astronomy and Astrophysics with elements of cosmology, V.B. Bhatia, Narosa Publication.		
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8		
	Suggested Equivalent	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics		

	Online Courses	2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/

BPH504 Plasma Physics

School: SBSR		**Batch : 2021-2024**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2023-2024**
Branch: Physics		**SEMESTER: V**
1	Course Code	**BPH504**
2	Course Title	**PLASMA PHYSICS**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 16
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	The course would be a basic course in plasma physics with focus on techniques of plasma production and measurements, waves and instabilities, single particle motion in electric and magnetic fields, plasma confinement, and applications to medium and short-wave communication, plasma processing of materials, laser driven fusion and magnetic fusion.
9	Course Outcomes	CO1: Understand the basics of Plasma (Microscopic and Macroscopic) and Debye shielding. CO2: Understand the motion of charge particles in electric and magnetic field. CO3: Study the collision process in plasma. CO4: Study the solar phenomenon and diffusion. CO5: Study the production and characteristics of Plasma. CO6: Appreciate plasma physics and can apply it on problems.
10	Course Description	This course provides students a full exposure to the basic principles and essential concepts of plasma physics including basics of plasma (Microscopic and Macroscopic), motion of charge particles in electric and magnetic field, collision process in plasma, solar phenomenon and diffusion and also production and characteristics of plasma.
11	Outline syllabus	
	Unit 1	**Unit 1: Plasma – Basic Idea**
	A	Introduction to plasma; Composition and characteristics
	B	Microscopic and macroscopic description of plasma
	C	Debye shielding
	Unit 2	**Motion of Charged Particle**
	A	Motion in uniform electric ‘E’ and magnetic field ‘B’; B-drift; curvature drift;

	B	magnetic confinement of plasma Mirror confinement, Plasma oscillations, Waves in unmagnetized plasmas,
	C	Solitons, Two stream instability, Rayleigh Taylor instability, Vlasov equation and Landau damping, Waves in magnetized plasmas (fluid theory).
	Unit 3	**Collision Processes in Plasma**
	A	Non-Coulomb collisions; electron plasma oscillation and ion plasma oscillation;
	B	Pinch effect - Quasi equilibrium pinch effect
	C	pinch effect and dynamic or time varying pinch effect.
	Unit 4	**Solar Phenomenon**
	A	Solar corona and Solar wind; Van Allen radiation belt.
	B	Transport phenomena in plasma-diffusion and mobility
	C	Ambipolar diffusion and its coefficient.
	Unit 5	**Production & Characterization**
	A	Plasma production & characterization,
	B	Plasma processing of materials, Laser driven fusion
	C	Cerenkov free electron laser, Applications to astrophysics and astronomy.
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction
	Weightage Distribution	CA | | MTE+ETE 25% | | 75%
	Text book/s*	5 Introduction to plasma physics: R.J Goldston' Paul Harding Rutherford 6 Physics of Plasma: T. J. M. Boyd and J. J. Sanderson
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8
	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/

COC501 Analytic Ability and Digital Awareness

School: SBSR		**Batch : 2021-2022**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2023-2024**
Branch: Physics		**SEMESTER: V**
1	Course Code	COC501
2	Course Title	**Analytic Ability and Digital Awareness**
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
4	Course Status	Theory
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	The course is designed to aim at imparting a basic level appreciation programme for the students. It covers basics of computer system, MS office word, Excel and digital awareness, so that students can apply these skills while studying subjects like Maths, Physics, Chemistry etc.
8	Course Outcomes	**CO: 1** Familiarize with analogy, number system, set theory and its applications, number system and puzzles. **CO: 2** To understand the basics of Syllogism, figure problems, critical and analytical reasoning. **CO: 3** Familiarize with word processing application. **CO: 4** Familiarize with worksheet processing application. **CO: 5** To understand the basics of web surfing and cyber security. **CO: 6** To understand the basics computer system and their applications.
9	Course Description	This course is designed to develop computational thinking, analytical, and problem-solving skills. It covers basics of computer system, MS office word, Excel and digital awareness, so that students can apply these skills while studying subjects like Maths, Physics, Chemistry etc.
10	Outline syllabus	

	Unit 1	
	A	Alphabet test, Analogy, Arithmetic Reasoning,
	B	Blood relations, Coding and Decoding,
	C	Inequalities, Logical Venn diagram, Seating Arrangements, Puzzles and Missing numbers
	Unit 2	
	A	Syllogism, Pattern completion and figure series, Embeded Figure and counting of figures,
	B	Cube & Dice, Paper cutting and folding, Data sufficiency, Course of Action
	C	Critical Reasoning, Analytical and decision making
	Unit 3	
	A	Block diagram of Digital Computer, Classification of Computers
	B	Memory System, Primary storage, Auxiliary memory, Cache memory, Computer Software (System/Application Software)
	C	**MS Word Basics:** The word screen, Getting to word documents, typing and Revising text, Finding and Replacing, Editing and Proofing tools, Formatting text characters, Formatting Paragraph, Document templates., Page set up, tables, Mail Merge, Macros, protecting documents, printing a document.
	Unit 4	
	A	**MS-Excel** Introduction, Worksheet basics, Creating worksheet, Heading information, Data & Text, Date & Time, Alphanumeric values, Saving & quitting worksheet, Opening and moving around in an existing worksheet, Toolbars and Menus, Excel shortcut and function keys,
	B	Working with single and multiple workbooks, working with formulae & cell referencing, Auto sum, coping formulae, Absolute & relative addressing, Worksheet with ranges, Formatting of worksheet, Previewing & Printing worksheet,
	C	Graphs and charts, Database, Creating and using macros, Multiple worksheets- concepts, **Introduction of Open-Source Applications:** LibreOffice, OpenOffice and Google Docs etc.
	Unit 5	
	A	**Web Surfing:** An Overview: working of Internet, Browsing the Internet, E-Mail, Components of E-Mail, Address Book, Troubleshooting in E-Mail, Browsers: Netscape Navigator,

	B	Microsoft Internet Explorer, Google Chrome, Mozilla Firefox, Tor, Search Engines lik Google, DuckDuckGo etc, Visiting web sites: Downloading.		
	C	**Cyber Security:** Introduction to Information System, Type of information system, CIA model of Information Characteristics, Introduction to Information Security, Need of Information Security, Cyber Security, phishing, spamming, fake news, general issues related to cyber security, Business need, Ethical and Professional issues of security.		
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction		
	Weightage Distribution	CA		ETE
		25%		75%
	Text book/s*	1. Sharma, A., "How to prepare for Data Interpretation and Logical Reasoning for the CAT" McGraw Hill Education Pvt. Ltd., New Delhi, India, 2011, Ed. 5, ISBN 978 2007 070 481 2. Aggarwal, R.S., "A Modern Approach to Verbal and Non-verbal Reasoning" S. ChandPublishers New Delhi, India, 2010, ISBN 10: 8121905516 3. Madan , Sushila, Introduction to Essential tools, Jain Book Agency, New Delhi/India, 2009, 5th ed.. 4. Goel, Anita, Computer Fundamentals, Pearson Education, India, 2012 5. Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security," Sixth Edition, Cengage Learning, 2017 **Note: Course Books published in Hindi may be prescribed by the Universities.**		

BPP553 Community Connect

<table>
<tr><td colspan="2">SCHOOL: SBSR</td><td>Batch :2021-2023</td></tr>
<tr><td colspan="2">Program: BSc</td><td>Current Academic Year: 2022-23</td></tr>
<tr><td colspan="2">Branch: Physics</td><td>Semester: II</td></tr>
<tr><td>1</td><td>Course Number</td><td>Course Code: BPP553 (Previously: CCU401 Course ID: 30804)</td></tr>
<tr><td>2</td><td>Course Title</td><td>Community Connect</td></tr>
<tr><td>3</td><td>Credits</td><td>3 Course Status: Training/Survey/Project</td></tr>
<tr><td>4</td><td>(L-T-P)</td><td>(0-0-6)</td></tr>
<tr><td>5</td><td>Learning Hours</td><td><table><tr><td>Contact Hours</td><td>30</td></tr><tr><td>Project/Field Work</td><td>20</td></tr><tr><td>Assessment</td><td>00</td></tr><tr><td>Guided Study</td><td>10</td></tr><tr><td>Total hours</td><td>60</td></tr></table></td></tr>
<tr><td>6</td><td>Course Objectives</td><td>1. Contribute to the holistic development of students by making them more aware of socially and economically disadvantaged communities and their specific issues
2. Provide more richer context to classrooms, so as to make them more effective laboratories of learning by aligning them to social realities beyond textbooks
3. Provide scope to faculty members to align their teaching and research goals by giving them ample opportunity to carry out community -oriented projects
4. Ensure that the community connect programs provides benefits to communities in tangible ways so that they may feel perceptibly better off post the interaction and involvement of the Sharda academic community
5. Provide ample opportunity for Sharda University academic community to contribute effectively to society and nation building</td></tr>
<tr><td>7</td><td>Course Outcomes</td><td>After completion of this course students will be able to:
CO1: Students learn to be sensitive to the living challenges of disadvantaged communities.</td></tr>
</table>

		CO2: Students learn to appreciate societal realities beyond textbooks and classrooms **CO3:** Students learn to apply their knowledge via research, and training for community benefit **CO4:** Students learn to work on socio-economic projects with teamwork and timely delivery **CO5:** Students learn to engage with communities for meaningful contribution to society
8	**Theme**	**Major themes for research:** 1. ***Survey and self-learning***: In this mode, students will make survey, analyze data and will extract results out of it to correlate with their theoretical knowledge. E.g. Crops and animals, land holding, labour problems, medical problems of animals and humans, savage and sanitation situation, waste management etc. 2. ***Survey and solution providing***: In this mode, students will identify the common problems and will provide solution/ educate rural population. E.g. air and water pollution, need of after treatment, use of renewable (mainly solar) energy, electricity saving devices, inefficiencies in cropping system, animal husbandry, poultry, pest control, irrigation, machining in agriculture etc. 3. ***Survey and reporting***: In this mode students will educate villagers and survey the ground level status of various government schemes meant for rural development. The analyzed results will be reported to concerned agencies which will help them for taking necessary/corrective measures. E.g. Pradhan Mantri Jan Dhan Yojana, Pradhan Mantri MUDRA Yojana, Pradhan Mantri Jeevan Jyoti Bima Yojana, Atal pension Yojana, Pradhan Mantri Awas Yojana, Pradhan Mantri FasalBima Yojana, Swachh Bharat Abhiyan, Soil Health Card Scheme, Digital India, Skill India Program,BetiBachao, BetiPadhao Yojana, DeenDayal Upadhyaya Gram Jyoti Yojana, Shyama Prasad Mukherjee Rurban Mission, UJWAL Discom Assurance Yojana, PAHAL,Pradhan Mantri Awas Yojana-Gramin, Pradhan Mantri Yuva Yojana, Pradhan Mantri Jan Aushadhi Yojana, Pradhan Mantri KhanijKshetra Kalyan Yojana, Pradhan Mantri Suraksha Bima Yojana, UDAN scheme, DeenDayal Upadhyaya Grameen Kaushalya Yojana, Pradhan Mantri Sukanya Samriddhi Yojana, Sansad Adarsh Gram Yojana, Pradhan Mantri SurakshitMatritva Abhiyan, Pradhan Mantri

		RojgarProtsahan Yojana, Midday Meal Scheme, Pradhan Mantri Vaya Vandana Yojana, Pradhan Mantri Matritva Vandana Yojana, and Ayushman Bharat Yojana.
9.1	**Guidelines for Faculty Members**	It will be a group assignment. There should be not more than 10 students in each group. The faculty guide will guide the students and approve the project title and help the student in preparing the questionnaire and final report. The questionnaire should be well design and it should carry at least 20 questions (Including demographic questions). The faculty will guide the student to prepare the PPT. The topic of the research should be related to social, economical or environmental issues concerning the common man. The report should contain 2,500 to 3,000 words and relevant charts, tables and photographs. **Plagiarism check of the report must**. ETE will conduct out of 100, divided in three parts (i) 30 Marks for report (ii) 30 Marks for presentation (iii) 40 Marks for knowledge. The student should **submit the report** to CCC-Coordinator signed by the faculty guide by …… The students have to send the hard copy of the **report and PPT**, and then only they will be allowed for ETE.
9.2	**Role of CCC-Coordinator**	The CCC Coordinator will supervise the whole process and assign students to faculty members. 1. PG- M.Sc.-Semester II - the students will be allocated to faculty member (mentors/faculty member) in odd term.
9.3	**Layout of the Report**	Abstract (250 words) a. Introduction b. Literature review(optional) c. Objective of the research d. Research Methodology e. Finding and discussion f. Conclusion and recommendation g. References

		Note: Research report should base on primary data.
9.4	**Guideline for Report Writing**	**Title Page: The following elements must be included:** • Title of the article; • Name(s) and initial(s) of author(s), preferably with first names spelled out; • Affiliation(s) of author(s); • Name of the faculty guide and Co-guide **Abstract:** Each article is to be preceded by a succinct abstract, of up to 250 words, that highlights the objectives, methods, results, and conclusions of the paper. **Text: Manuscripts should be submitted in Word.** • Use a normal, plain font (e.g., 12-point Times Roman) for text. • Use italics for emphasis. • *Use the automatic page numbering function to number the pages.* • *Save your file in docx format* (Word 2007 or higher) or doc format (older Word versions) **Reference list:** The list of references should only include works that are cited in the text and that have been published or accepted for publication. The entries in the list should be in alphabetical order. Journal article Hamburger, C.: Quasimonotonicity, regularity and duality for nonlinear systems of partial differential equations. Ann. Mat. Pura Appl. 169, 321–354 (1995) Article by DOI Sajti, C.L., Georgio, S., Khodorkovsky, V., Marine, W.: New nanohybrid materials for biophotonics. Appl. Phys. A (2007). doi:10.1007/s00339-007-4137-z Book Geddes, K.O., Czapor, S.R., Labahn, G.: Algorithms for Computer Algebra. Kluwer, Boston (1992) Book chapter

		Broy, M.: Software engineering — from auxiliary to key technologies. In: Broy, M., Denert, E. (eds.) Software Pioneers, pp. 10–13. Springer, Heidelberg (2002) Online document Cartwright, J.: Big stars have weather too. IOP Publishing PhysicsWeb. http://physicsweb.org/articles/news/11/6/16/1 (2007). Accessed 26 June 2007 Always use the standard abbreviation of a journal's name according to the ISSN List of Title Word Abbreviations, see www.issn.org/2-22661-LTWA-online.php For authors using EndNote, Springer provides an output style that supports the formatting of in-text citations and reference list. EndNote style (zip, 2 kB) **Tables: All tables are to be numbered using Arabic numerals.** **Figure Numbering: All figures are to be numbered using Arabic numerals**.
9.5	**Format:**	**The report should be Spiral/ hardbound** The Design of the Cover page to report will be given by the Coordinator-CCC Cover page Acknowledgement Content Project report Appendices
9.6	**Important Dates:**	Students should prepare questionnaire and get it approved by concern faculty member and submit the final questionnaire within …….to CCC- Coordinator. Students will complete their survey work within …….. and submit the same to concern faculty member. (Each group should complete 50 questionnaires) The student should show the 1st draft of the report to concern faculty member within …….. and submit the same to concern faculty member.

		Faculty members should give required inputs, so that students can improve their project work and make the final report submission on …….. The students should submit the hard copy and soft copy of the report to CCC-Coordinator signed by the faculty guide within ……. **The students should submit the soft copy of the PPT to CCC-Coordinator signed by the faculty guide within** ……. **The final presentation will be organized on ……...**
9.7	**ETE**	**The students will be evaluated by panel of faculty members on the basis of their presentation on ……**

10	**Course Evaluation**	
10.01	**Continuous Assessment**	**25**
	Questionnaire design	
	Report Writing	
10.02	**ETE (PPT presentation)**	**75**

BPP551 Demonstrative Aspects of Optics and Lasers

School: SBSR		**Batch : 2021-2022**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2023-2024**
Branch: Physics		**SEMESTER: V**
1	Course Code	**BPP551**
2	Course Title	**Demonstrative Aspects of Optics & Lasers**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
4	Course Status	Major Lab 10
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	1. To provide students an understanding of prism, Fresnel's biprism, and spectrometer. 2. Students will learn about plane transmission grating and Newton's ring method.
8	Course Outcomes	CO1: Students will also learn to determine the wavelength of light Fresnel Biprism method. CO2: Students will learn to determine the wavelength of light through Newton's Ring method. CO3: Students will learn to determine the wavelength of light through Plane diffraction grating method. CO4: Students will learn about the plane diffraction grating and its application. CO5: Students will learn about the prism, dispersive power and its application. CO6: Students will learn about the fundamentals of optics i.e., dispersion, diffraction, interference etc. Students will be able to correlate theory and practical together through the experiments and get the clear understanding of the concepts behind them.
9	Course Description	This course will help students to have basic understanding of basics of Optics. It also helps them to understand the working of spectrometer, Newton's ring, plane diffraction grating, prism and Fresnel Biprism.

10	Outline syllabus	
	Unit 1	
	A	Fresnel Biprism: Wavelength of sodium light
	B and C	Fresnel Biprism: (Thickness of mica sheet)
	Unit 2	
	A	Newton's Rings: Wavelength of sodium light
	B and C	Newton's Rings: Refractive index of liquid
	Unit 3	
	A	Plane Diffraction Grating: Resolving power
	B and C	Plane Diffraction Grating: Spectrum of mercury light
	Unit 4	
	A	Spectrometer: Refractive index of the material of a prism using sodium light
	B and C	Spectrometer: Dispersive power of the material of a prism using mercury light
	Unit 5	
	A	Polarimeter: Specific rotation of sugar solution
	B and C	Wavelength of Laser light using diffraction by single slit
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce

		05 marks for Class Interaction		
	Weightage Distribution	CA		ETE
		25%		75%
	Text book/s*	1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e 3. R.K. Agrawal, G. Jain, R. Sharma, "Practical Physics", Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019 4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014, 2e ***Books published in Hindi & Other Reference / Text Books may besuggested / added to this list by individual Universities.*** **Online Virtual Lab Experiment List / Link** Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=189 1. Michelson's Interferometer 2. Michelson's Interferometer: Wavelength of laser beam 3. Newton's Rings: Wavelength of light 4. Newton's Rings: Refractive index of liquid 5. Brewster's angle determination 6. Laser beam divergence and spot size Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/index.php?sub=1&brch=281 7. Spectrometer: Refractive index of the material of a prism 8. Spectrometer: Dispersive power of a prism 9. Spectrometer: Determination of Cauchy's constants 10. Diffraction Grating		

SEMESTER VI

BPH601 Solid State and Nuclear Physics

School: SBSR		**Batch : 2021-2024**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2023-2024**
Branch: Physics		**SEMESTER: VI**
1	Course Code	**BPH601**
2	Course Title	**Solid State & Nuclear Physics**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 17
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	To make the students familiar with the concepts of Solid State & Nuclear Physics
9	Course Outcomes	CO1: Understand the crystal geometry w.r.t. symmetry operations. CO2: Comprehend the power of X-ray diffraction and the concept of reciprocal lattice. Study various properties based on crystal bindings. CO3: Recognize the importance of Free Electron & Band theories in understanding the crystal properties. Study the salient features of nuclear forces & radioactive decays. CO4: Understand the importance of nuclear models & nuclear reactions. Comprehend the working and applications of nuclear accelerators and detectors. CO5: Understand the classification and properties of basic building blocks of nature. CO6: Understanding the different concepts of Solid State & Nuclear Physics
10	Course Description	This course provides students a full exposure to the basic principles and essential concepts of Crystal Structure, Crystal Diffraction, Crystal Bindings, Nuclear Forces & Radioactive Decays, Elementary Particles etc.
11	Outline syllabus	
		PART A **Introduction to Solid State Physics**
	Unit 1	**Crystal Structure**
	A	Lattice, Basis & Crystal structure. Lattice translation vectors, Primitive & non-primitive cells. Symmetry operations, Point group & Space group.
	B	2D & 3D Bravais lattice. Parameters of cubic lattices. Lattice planes and Miller indices.

	C	Simple crystal structures - HCP & FCC, Diamond, Cubic Zinc Sulphide, Sodium Chloride, Cesium Chloride and Glasses.
	Unit 2	**Crystal Diffraction; Crystal Bindings**
	A	X-ray diffraction and Bragg's law. Experimental diffraction methods - Laue, Rotating crystal and Powder methods. Derivation of scattered wave amplitude. Reciprocal lattice, Reciprocal lattice vectors and relation between Direct & Reciprocal lattice. Diffraction conditions, Ewald's method and Brillouin zones. Reciprocal lattice to SC, BCC & FCC lattices. Atomic Form factor and Crystal Structure factor.
	B	Classification of Crystals on the Basis of Bonding - Ionic, Covalent, Metallic, van der Waals (Molecular) and Hydrogen bonded. Crystals of inert gases, Attractive interaction (van der Waals- London) & Repulsive interaction
	C	Equilibrium lattice constant, Cohesive energy and Compressibility & Bulk modulus. Ionic crystals, Cohesive energy, Madelung energy and evaluation of Madelung constant.
	Unit 3	**Lattice Vibrations;** **PART B Introduction to Nuclear Physics**
	A	Lattice Vibrations: Lattice vibrations for linear mono & di atomic chains, Dispersion relations and Acoustical & Optical branches (qualitative treatment). Qualitative description of Phonons in solids. Lattice heat capacity, Dulong-Petit's law and Einstein's theory of lattice heat capacity. Free Electron Theory: Fermi energy, Density of states, Heat capacity of conduction electrons, Paramagnetic susceptibility of conduction electrons and Hall effect in metals. Band Theory: Origin of band theory, Qualitative idea of Bloch theorem, Kronig-Penney model, Effectice mass of an electron & Concept of Holes & Classification of solids on the basis of band theory.
	B	**Nuclear Forces & Radioactive Decays** General Properties of Nucleus: Mass, binding energy, radii, density, angular momentum, magnetic dipole moment vector and electric quadrupole moment tensor. Nuclear Forces: General characteristic of nuclear force and Deuteron ground state properties.
	C	Radioactive Decays: Nuclear stability, basic ideas about beta minus decay, beta plus decay, alpha decay, gamma decay & electron capture, fundamental laws of radioactive disintegration and radioactive series.
	Unit 4	**Nuclear Models & Nuclear Reactions** **; Accelerators & Detectors**
	A	Nuclear Models: Liquid drop model and Bethe-Weizsacker mass formula. Single particle shell model (the level scheme in the context of reproduction of magic numbers included). Nuclear Reactions: Bethe's notation, types of nuclear reaction, Conservation laws, Cross-section of nuclear reaction, Theory of nuclear fission (qualitative), Nuclear reactors and Nuclear fusion.
	B	Accelerators: Theory, working and applications of Van de Graaff accelerator, Cyclotron and Synchrotron.

	C	Detectors: Theory, working and applications of GM counter, Semiconductor detector, Scintillation counter and Wilson cloud chamber.		
	Unit 5	**Elementary Particles**		
	A	Fundamental interactions & their mediating quanta. Concept of antiparticles. Classification of elementary particles based on intrinsic-spin, mass, interaction & lifetime.		
	B	Families of Leptons, Mesons, Baryons & Baryon Resonances.		
	C	Conservation laws for mass-energy, linear momentum, angular momentum, electric charge, baryonic charge, leptonic charge, isospin & strangeness. Concept of Quark model.		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**PART A** 1. Charles Kittel, "Introduction to Solid State Physics", Wiley India Private Limited, 2012, 8e 2. A.J. Dekker, "Solid State Physics", Macmillan India Limited, 1993 3. R.K. Puri, V.K. Babbar, "Solid State Physics", S. Chand Publishing, 2015 **PART B** 1. Kenneth S. Krane, "Introductory Nuclear Physics", Wiley India Private Limited, 2008 2. Bernard L. Cohen, "Concepts of Nuclear Physics", McGraw Hill, 2017 3. S.N. Ghoshal, "Nuclear Physics", S. Chand Publishing, 2019		
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8		
	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/		

BPH602 Analog and Digital Principles & Applications

School: SBSR		**Batch : 2021-2024**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2023-2024**
Branch: Physics		**SEMESTER: VI**
1	Course Code	**BPH602**
2	Course Title	**Analog & Digital Principles & Applications**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
5	Course Status	Major 18
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	1. To develop understanding of semiconductor physics and working principle of PN junction diodes and Bipolar junction transistor. 2. To demonstrate JFET and MOSFET and variety of special diodes used in electronic industry. 3. To provide students an understanding of different number systems and their conversion. 4. To develop concepts of Boolean algebra and logic circuitry such as adders, subractors, encoders, decorder and parity checkers. 5. To provide knowledge of basics of flip flops used in sequential circuits.
9	Course Outcomes	CO1: Study the drift and diffusion of charge carriers in a semiconductor and understand the Two-Port model of a transistor. CO2: Study the working, properties and uses of FETs and Comprehend the design and operations of SCRs and UJTs. CO3: Understand various number systems, binary codes and familiarize with binary arithmetic. CO4: Study the working and properties of various logic gates. CO5: Comprehend the design of combinational and sequential circuits. CO6: Students will get the deep insight of analog and digital electronic devices useful in day to today life.
10	Course Description	This course will help students to know about the fundamentals of various analog and digital devices.
11	Outline syllabus	
		PART A **Analog Electronic Circuits**
	Unit 1	**Semiconductor Junctions and Transistor Modeling**

	A	Expressions for Fermi energy, Electron density in conduction band, Hole density in valence band, Drift of charge carriers (mobility & conductivity), Diffusion of charge carries and Life time of charge carries in a semiconductor. Work function in metals and semiconductors. Expressions for Barrier potential, Barrier width and Junction capacitance (diffusion & transition) for depletion layer in a PN junction.
	B	Expressions for Current (diode equation) and Dynamic resistance for PN junction. Transistor as Two-Port Network. Notation for dc & ac components of voltage & current. Quantitative discussion of Z, Y & h parameters and their equivalent two-generator model circuits.
	C	h-parameters for CB, CE & CC configurations. Analysis of transistor amplifier using the hybrid equivalent model and estimation of Input Impedance, Output Impedance and Gain (current, voltage & power).
	Unit 2	**Field Effect Transistors and Other Device**
	A	JFET: Construction (N channel & P channel); Configuration (CS, CD & CG); Operation in differentregions (Ohmic or Linear, Saturated or Active or Pinch off & Break down); Important Terms (Shorted Gate Drain Current, Pinch Off Voltage & Gate Source Cut-Off Voltage); Expression for Drain Current (Shockley equation); Characteristics (Drain & Transfer); Parameters (Drain Resistance, Mutual Conductance or Transconductance & Amplification Factor); Biasing w.r.t. CS configuration (Self Bias & Voltage Divider Bias)
	B	Amplifiers (CS & CD or Source Follower); Comparison (N & P channels and BJTs & JFETs). MOSFET: Construction and Working of DE-MOSFET (N channel & P channel) and E-MOSFET(N channel & P channel); Characteristics (Drain & Transfer) of DE-MOSFET and E-MOSFET; Comparison of JFFET and MOSFET.
	C	SCR: Construction; Equivalent Circuits (Two Diodes, Two Transistors & One Diode-One Transistor); Working (Off state & On state); Characteristics; Applications (Static switch, Phase control system & Battery charger). UJT: Construction; Equivalent Circuit; Working (Cutoff, Negative Resistance & Saturation regions); Characteristics (Peak & Valley points); Applications (Trigger circuits, Relaxation oscillators & Sawtooth generators).
		PART B **Digital Electronics**
	Unit 3	**Number System and Binary Arithmetic**
	A	Number Systems: Binary, Octal, Decimal & Hexadecimal number systems and their interconversion.
	B	Binary Codes: BCD, Excess-3 (XS3), Parity, Gray, ASCII & EBCDIC Codes and their advantages & disadvantages. Data representation.
	C	Binary Addition, Decimal Subtraction using 9's & 10's complement, Binary Subtraction using 1's& 2's compliment, Multiplication and Division.
	Unit 4	**Logic Gates**
	A	Truth Table, Symbolic Representation and Properties of OR, AND, NOT, NOR, NAND, EX-OR & EX-NOR Gates.

	B	Implementation of OR, AND & NOT gates (realization using diodes & transistor).De Morgan's theorems. NOR & NAND gates as Universal Gates.		
	C	Application of EX-OR & EX- NOR gates as pairty checker. Boolean Algebra. Karnaugh Map.		
	Unit 5	**Combinational & Sequential Circuits**		
	A	Combinational Circuits: Half Adder, Full Adder, Parallel Adder, Half Subtractor, Full Subtractor.		
	B	Data Processing Circuits: Multiplexer, Demultiplexer, Decoders & Encoders.		
	C	Sequential Circuits: SR, JK & D Flip-Flops, Shift Register (transfer operation of Flip-Flops), and Asynchronous & Synchronous counters.		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	**PART A** 1. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e 2. J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e 3. B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e 4. J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e 5. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e **PART B** 1. D. Leach, A. Malvino, Goutam Saha, "Digital Principles and Applications", McGraw Hill, 2010, 7e 2. William H. Gothmann, "Digital Electronics: An Introduction to Theory and Practice", Prentice-Hall of IndiaPrivate Limited, 1982, 2e 3. R.P. Jain, "Modern Digital Electronics", McGraw Hill, 2009, 4e ***Books published in Hindi & Other Reference / Text Books may besuggested / added to this list by individual Universities.***		
	Suggestive Digital Platforms / Web Links	1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8		

	Suggested Equivalent Online Courses	1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics 2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html 3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy 4. edX, https://www.edx.org/course/subject/physics 5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/

BPH603 Instrumentation

School: School of Basic Sciences and Research		**Batch: 2023-24**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2021-2022**
Branch: Physics		**Semester: VI**
1	Course Code	**BPH603**
2	Course Title	Instrumentation
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Major 19
5	Course Objective	1. To provide students an understanding of fundamentals of various measurement techniques and errors along with the working principle of digital and analog instruments. 2. To demonstrate CRO, variety of transducers and sensors used in physics, material sciences, chemistry, nanotechnology and electronics. 3. To provide knowledge of various mechanical pumps in line with physics principles and theories.
6	Course Outcomes	After the completion of this course, CO1: Students will show that they have learned basic measurements techniques and errors CO2: Students will differentiate among digital and analog instruments used in daily life CO3: Students will gain knowledge of CRO to analyze input output signals CO4: Students will have a clear understanding of fundamentals of various transducers and sensors used in professional and scientific community. CO5: Students will learn the concept of different types of mechanical pumps and their uses in research problems. CO6: Students have complete knowledge of various instruments used in laboratories and day to day life.
7	Course Description	This course provides basic knowledge of various instruments used in scientific laboratories and the measurement errors encountered during experiments.
8	Outline syllabus	
	Unit 1	**Measurement and Errors Analysis**
	A	Instruments accuracy, precision, sensitivity and resolution range, Errors in measurements

	B	Statistical analysis – T test and chi^2 test		
	C	Units and Standards of Measurements, Fundamental and Derived Units, Hierarchy of Standards.		
	Unit 2	**Analog and Digital Instrumentation**		
	A	Galvanometer (moving coil, and moving magnet), Voltmeter and ammeter - Principle and working, Impedance and sensitivity, measurement of high/ low voltage, AC and DC options.		
	B	Digital Instruments: Principle and working of digital meters. Comparison of analog& digital instruments.		
	C	Multimeter: Principles of measurement, Specifications of a multimeter and its significance		
	Unit 3	**Cathode Ray Oscilloscope**		
	A	Block diagram of basic CRO, Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only), Front panel controls		
	B	Use of CRO for the measurement of voltage (dc and ac frequency, time period, Special features of dual trace),		
	C	Introduction to digital oscilloscope, probes, Digital storage Oscilloscope: Block diagram and principle of working.		
	Unit 4	**Transducers & Sensors**		
	A	Static and dynamic characteristics of measurement Systems.		
	B	Transducers and their characteristics, Temperature transducers. Thermocouples.		
	C	Sensors – definition and classification, LDR, Photo diode.		
	Unit 5	**Fundamental of Vacuum System**		
	A	Characteristics of vacuum: Mean free path. Applications of vacuum.		
	B	Measurement of Vacuum: Pressure gauges – Pirani and Penning Gauge.		
	C	Mechanical pumps, Rotary Vane Pumps, Diffusion & Molecular pump, pumping speed.		
	Mode of examination	Theory		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	1. Industrial Instrumentation and Control; S. K. Singh; The McGraw-Hill. 2. Electronic Instrumentation: Second Edition, H. S. Kalsi; The McGraw-Hill 3. Electrical Measurements and Measuring Instruments (EMMI), A. K. Sawhney. 4. Modern Electronic Instrumentation and Measurement Techniques, Albert D. Helfrik and William D. Cooper.		
	Other References	1. Instrumentation Devices and Systems, C.S. Rangan, G.R. Sarma, V.S.V. Mani, Tata McGraw Hill 2. Principles of Electronic Instrumentation, D. Patranabis, PHI Learning Pvt. Ltd. 3. Statistical Methods, S. P. Gupta		

BPH604 Nanomaterials

School: School of Basic Sciences and Research		**Batch: 2023-24**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2021-2022**
Branch: Physics		**Semester: VI**
1	Course Code	**BPH604**
2	Course Title	**Nanomaterials**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Major 20
5	Course Objective	To provide students an understanding of fundamentals of nanomaterials. To provide knowledge of various characterization techniques of nanomaterials.
6	Course Outcomes	After the completion of this course, CO1: Students will show that they have learned basics of nanotechnology CO2: Students will differentiate among various methods of the Synthesis of nanomaterials CO3: Students will gain knowledge of various characterization techniques of nanomaterials CO4: Students will have a clear understanding of fundamentals of Carbon based nanomaterials CO5: Students will learn the applications of nanomaterials. CO6: Students will have the knowledge of the basics of nanotechnology and nanomaterials, their characterization techniques and various applications
7	Course Description	This course provides basic knowledge of nanomaterials and nanotechnology
8	Outline syllabus	
	Unit 1	**Introduction to Nanotechnology**
	A	Background of Nanoscience and Nanotechnology
	B	Various types of Nanomaterials
	C	Applications of Nanomaterials
	Unit 2	**Synthesis of nanomaterials**
	A	Nanomaterials and quantum dots
	B	Common synthesis method: Sol-gel method
	C	Hydrothermal and solvothermal method, Template method
	Unit 3	**Characterization of nanomaterials**

	A	Scanning Electron Microscopy (SEM), Transmission Electron Microscopy(TEM)		
	B	Atomic force microscopy (AFM), UV-visiblespectroscopy		
	C	FT-IR absorption spectroscopy,X-ray diffraction.		
	Unit 4	**Carbon based nanomaterials**		
	A	Fullerenes- preparation, characterization and application		
	B	Graphene - preparation, characterization and application		
	C	Carbon nanotube-preparation, characterization and application.		
	Unit 5	**Application of nanomaterials**		
	A	Application of nanomaterials in Batteries and Fuel Cells		
	B	Application of nanomaterials in Solar cell		
	C	Application of nanomaterials in Sensors		
	Mode of examination	Theory		
	Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text books	1. Carbon Nanotubes: Synthesis, Characterization and Applications by Kamal K Kar, Research Publishing, Singapore, 2011 2. Principles of Nanoscience and Nanotechnology –M. A. Shah, Tokeer Ahmad (Narosa Publishing House, New Delhi, 2011)		
	Other References	3. Chemistry of nanomaterials: Synthesis, properties and applications by CNR Rao (Taylor & Francis 2008) 4. Introduction to Nanotechnology - Charles P. Poole Jr. and Franks. J. Qwens (Wiley Interscience, 2003)		

COC601 Communication Skills and Personality Development

School: SBSR		**Batch : 2021-2024**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2023-2024**
Branch: Physics		**SEMESTER: VI**
1	Course Code	**COC601**
2	Course Title	**Communication Skills and Personality Development**
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
5	Course Status	Co-Curricular Compulsory
6	Max. Marks	25+75 = 100
7	Min. Marks	
8	Course Objective	This course provides an opportunity to develop knowledge and understanding of Communication Skills and Personality Development
9	Course Outcomes	CO1: To understand the concept of Personality. CO2: To learn what personal grooming pertains. To learn to make good resume and prepare effectively for interview. CO3: To learn to perform effectively in group discussions. To explore communication beyond language. CO4: To learn to manage oneself while communicating. CO5: To acquire good communication skills and develop confidence. CO6: To develop knowledge and understanding of Communication Skills and Personality Development
10	Course Description	This course provides students a full exposure to gain the knowledge and understanding of Communication Skills and Personality Development.
11	Outline syllabus	
	Unit 1	PERSONALITY AND PERSONAL GROOMING
	A	Understanding Personality Definition and Meaning of Personality Types of Personality Components of Personality Determinants of Personality Assessment of Personality
	B	Grooming Self Dress for success Make up & skin care

	C	Hair care & styles for formal look Art of accessorizing Oral Hygiene		
	Unit 2	INTERVIEW PREPARATION AND GROUP DISCUSSION		
	A	Meaning and Types of Interview [Face to Face, Telephonic, Video] Interview procedure [Opening, Listening, Closure] Preparation for Interview		
	B	Resume Writing LinkedIn Etiquette Meaning and methods of Group Discussion		
	C	Procedure of Group Discussion. Group Discussion simulation Group discussion common error		
	Unit 3	BODY LANGUAGE AND BEHAVIOUR		
	A	Concept of human behavior Individual and group behavior Developing Self-Awareness Behaviour and body language Dimensions of body language: Proxemics Haptics Oculesics Paralanguage Kinesics Sign Language Chromatics Chronemics Olfactics		
	B	Cultural differences in Body Language Business Etiquette & Body language		
	C	Body Language in the Post Corona Era Virtual Meeting Etiquette Social Media Etiquette		
	Unit 4	ART OF GOOD COMMUNICATION		
	A	Communication Process Verbal and Non-verbal communication		
	B	7 C's of effective communication Barriers to communication		
	C	Paralinguistics Pitch Tone Volume Vocabulary Word stress Pause		
	Unit 5			
	A	Types of communication Assertive Aggressive Passive Aggressive		
	B	Listening Skills Questioning Skills		
	C	Art of Small Talk Email Writing		
	Mode of examination	20 marks for Test / Quiz / Assignment / Seminar. 05 marks for Class Interaction		
	Weightage Distribution	CA		MTE+ETE
		25%		75%

	Text book/s*	Suggested Readings: Cloninger, S.C., "Theories of Personality : Understanding Person", Pearson, New York, 2008, 5th edition. Luthans F, "Organizational Behaviour", McGraw Hill, New York, 2005, 12th edition. Barron, R.A. & Brian D, "Social Psychology", Prentice Hall of India, 1998, 8th edition. Adler R.B., Rodman G. & Hutchinson C.C. , "Understanding Human Communication", Oxford University Press : New York, 2011.

BPP653 Research Project

School: School of Basic Sciences and Research		**Batch: 2023-24**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2021-2022**
Branch: Physics		**Semester: VI**
1	Course Code	**BPP653**
2	Course Title	**Research Project**
3	Credits	3
4	Contact Hours (L-T-P)	0-0-6
	Course Status	Training/Survey/**Project**
5	Course Objective	• Deep knowledge of a specific area of specialization. • Develop research skills especially in project writing and oral presentation. • Develop time management skills. • Develop skill to summarize the published work by literature survey • Inculcate Team spirit
6	Course Outcomes	**CO 1:** The course gives an introduction to the concept of research within the subject, as regards approaching a question, collecting and analyzing background material and presenting research questions and conclusions. **CO 2:** investigation of a physics-based or physics-related problem **CO 3:** planning, management and operation of an investigation to test a hypothesis **CO 4:** development of information retrieval skills **CO 5:** Try to publish the research work done during the course **CO 6:** To understand that how to do a research in the area of physics and the establishment of co-operative working practices with colleagues.
7	Course Description	Reading in a field of special interest under the supervision of a faculty member. Intended for students interested in studying topics not offered in regularly available courses. Format and grading are determined by the supervising faculty member and then approved by the Head of Department.
8	Outline syllabus	
	Unit 1	**Introduction**
	Unit 2	**Hypothesis**
	Unit 3	**Case study/Lab work**

	Unit 4	**Report**		
	Unit 5	**Presentation**		
	Mode of	Jury/Practical/Viva		
	Examination Weightage Distribution	CA		MTE+ETE
		25%		75%
	Text book/s*	5 Recent International Journal Articles of repute.		
	Other References	-		

List of tasks introduced and deliverables: Since this is related to projects, studies, dissertations, etc, the detailed units should comprise of weekly schedule of tasks introduced and deliverables details of the assigned task.

Week	**Unit**	**Deliverables**
Week 1-4	**1a-1c**	Introduction: investigation of a physics-based or physics-related problem
Week 5-6	**2a-2c**	Select 5 Recent International Journal Articles
Week 7-11	**3a-3c**	Complete the case study from the selected articles
Week-12-13	**4a-4c**	Preparation of the report.
Week 14-15	**5a-5c**	Preparation of the presentation.

BPP651 Analog & Digital Circuits

School: SBSR		**Batch : 2021-2024**
Program: DEGREE IN BACHELOR OF SCIENCE		**Current Academic Year: 2023-2024**
Branch: Physics		**SEMESTER: VI**
1	Course Code	**BPP651**
2	Course Title	**Physics Lab 11 Analog & Digital Circuits**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
4	Course Status	Major Lab 12
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	Analog & digital circuits have the most striking impact on the industry wherever the electronics instruments are used to study and determine the electronic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.
8	Course Outcomes	CO1: Understanding of experimental method to determine the energy band gap of semiconductor. CO2: Able to explain the characteristics of FET, MOSFET SCR, UJT and their applications. CO3: Understand the AND and OR gates. CO4: Understand the NAND and NOR universal gates. CO5: Understand the NOT and Ex-OR universal gates. CO6: Able to explain analog and digital electronic components like, PN junction, Bipolar Junction Transistor, FET, MOSFET, NOT, AND, OR, NAND, NOR and Ex-OR gates.
9	Course Description	This course provides students a full exposure to the basic principles and essential concepts of performing experiments and calculating mechanical parameters.

10	Outline syllabus			
	Unit 1			
	A	Energy band gap of semiconductor by reverse saturation current method		
	B	Energy band gap of semiconductor by four probe method		
	C	Hybrid parameters of transistor		
	Unit 2			
	A	Characteristics of FET, MOSFET, SCR, UJT		
	B	FET Conventional Amplifier		
	C	FET as VVR and VCA		
	Unit 3			
	A	Study and Verification of AND gate using TTL IC 7408		
	B and C	Study and Verification of OR gate using TTL IC 7432		
	Unit 4			
	A	Study and Verification of NAND gate and use as Universal gate using TTL IC 7400		
	B and C	Study and Verification of NOR gate and use as Universal gate using TTL IC 7402		
	Unit 5			
	A	Study and Verification of NOT gate using TTL IC 7404		
	B and C	Study and Verification of Ex-OR gate using TTL IC 7486		
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction		
	Weightage Distribution	CA		ETE
		25%		75%

	Text book/s*	1. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e 2. J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e 3. B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e 4. J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e 5. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e 6. D. Leach, A. Malvino, Goutam Saha, "Digital Principles and Applications", McGraw Hill, 2010, 7e 7. William H. Gothmann, "Digital Electronics: An Introduction to Theory and Practice", Prentice-Hall of IndiaPrivate Limited, 1982, 2e 8. R.P. Jain, "Modern Digital Electronics", McGraw Hill, 2009, 4e ***Books published in Hindi & Other Reference / Text Books may besuggested / added to this list by individual Universities.*** Virtual Labs an initiative of MHRD Govt. of India http://vlabs.iitkgp.ac.in/ssd/# 1. ID-VD characteristics of Junction Field Effect Transistor (JFET) 2. Silicon Controlled Rectifier (SCR) characteristics 3. Unijunction Transistor (UJT) and relaxation oscillator Virtual Labs an initiative of MHRD Govt. of India https://de-iitr.vlabs.ac.in/List%20of%20experiments.html 4. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates 5. Construction of half and full adder using XOR and NAND gates and verification of itsoperation 6. To study and verify half and full subtractor 7. Realization of logic functions with the help of Universal Gates (NAND, NOR) 8. Construction of a NOR gate latch and verification of its operation 9. Verify the truth table of RS, JK, T and D Flip Flops using NAND and NOR gates

		10. Design and Verify the 4-Bit Serial In - Parallel Out Shift Registers 11. Implementation and verification of decoder or demultiplexer and encoder using logic gates 12. Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates 13. Design and verify the 4-Bit Synchronous or Asynchronous Counter using JK Flip Flop 14. Verify Binary to Gray and Gray to Binary conversion using NAND gates only 15. Verify the truth table of 1-Bit and 2-Bit comparator using logic gates

BPP652 Physics Lab 12

School: SBSR		**Batch : 2021-2024**
Program: BACHELOR IN APPLIED PHYSICS WITH ELECTRONICS		**Current Academic Year: 2023-2024**
Branch: Physics		**SEMESTER: VI**
1	Course Code	**BPP652**
2	Course Title	**Physics Lab-12**
3	Credits	2
4	Contact Hours (L-T-P)	0-0-4
4	Course Status	Major Lab 18
5	Max. Marks	25+75 = 100
6	Min. Marks	
7	Course Objective	1. To gain knowledge on the synthesis procedures of various nanomaterials. 2. To understand laboratory experiments to investigate the properties of materials. 3. To learn the operation of the advanced characterization instruments. 4. To understand the structural, electrical, mechanical and optic properties of materials
8	Course Outcomes	CO1: Student will be able to use UTM machine and calculate stress, strain (mechanical properties) of materials CO2: Student will be able to know about young modulus and how to find out the value of young modules of a wire. CO3: Student will be able to synthesis nano materials by different methods CO4: Student will be able to operate different characterization tools. CO5: Student will be able to analysis the output of different characterization techniques CO6: Student will be able to find out the structural, electrical, optical and mechanical properties of nano materials and how to tune them by chemical substitution method.
9	Course Description	In this course of BSc (Physics), students will synthesis nano materials and nano composite by different chemical methods. How to use different characterization tools to understand the structural, electrical, optical and mechanical properties of nano materials.
10	Outline syllabus	

	Unit 1	**Practical based on mechanical properties**
		1. To determine tensile strength by Universal Testing Machine. 2. To determine Young's Modulus of Steal wire by applying Load.
	Unit 2	**Practical related to --**
		3. To synthesis Zinc Oxide nanoparticle by chemical method. 4. To determine dielectric and optical properties of Zinc Oxide nano particles
	Unit 3	**Practical related to---**
		5. To synthesis Composite by chemical method.
	Unit 4	**Practical related to---**
		6. Growth of nanoparticles by sputtering/thermal evaporation.
	Unit 5	**Practical related to---**
		7. Growth of nanoparticles by mechanical milling. 8. Growth of nanoparticles by nano-porous soft template method. 9. Analysis of uv/vis absorption spectrum of nanomaterials.
	Mode of examination	15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments) 05 marks for Viva Voce 05 marks for Class Interaction
	Weightage Distribution	CA | | ETE
		25% | | 75%
	Text book/s*	

B030201T Matrices and Differential Equations & Geometry: Available with OBE of Mathematics Department

B020103T Fundamental of Physical Chemistry/ Elective: Available with OBE of Chemistry Department

B010507P Physics Lab-10: To be designed

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