GOKUL GLOBAL UNIVERSITY
Approved By Govt. of Gujarat
(Recognized by UGC under Section 22 & 2(f) of 1956)
(Gujarat Private State University Act 4 of 2018)

COURSE STRUCTURE

Bachelor of Science

Physics

Faculty of Science
Gokul Science College
University Campus, State Highway-41,
Siddhpur - 384151, **Dist.** Patan, Gujarat, INDIA, **Mobile :** 9510973863
E- Mail : dean.fac.sci@gokuluniversity.ac.in, **Website :** www.gokuluniversity.ac.in

Semester I

SR. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDIT	COTACT HRS/WK
			L	T	P		
THEORY							
1	BPHY101 UDSC	Mechanics and Basic Electronics (MAE)	4	0	0	4	4
2	MPHY101 USE	INSTRUMENTATION MEASUREMENT AND ANALYSIS	2	0	0	2	2
3	BMAT101 UDSC	DIFFERENTIAL CALCULUS	4	0	0	4	4
4	BCHE101 DSC	INORGANIC, ORGANIC, PHYSICAL CHEMISTRY & VOLUMETRIC-I	4	0	0	4	4
5	B101EG	Communication Skills	2	0	0	2	2
PRACTICALS							
1	BPHY101 UPRA	Practical Module-01	0	0	1	2	2
2	BMAT101 UPRA	MATHEMATICS PRACTICAL – I	0	0	2	2	4
3	BCHE101P RA	Practical Core Course- I	0	0	4	4	4
TOTAL			16	0	7	24	26

Semester II

SR. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDIT	COTACT HRS/WK
			L	T	P		
THEORY							
1	BPHY201 UDSC	Wave, Optics, Electronics & Semiconductor Device (WOES)	4	0	0	4	4
2	MPHY201 USE	ELECTRONIC CIRCUIT ELEMENTS AND ENERGY SOURCES	2	0	0	2	2

3	BMAT201 UDSC	INTEGRAL CALCULUS & DIFFERENTIAL EQUATION	4	0	0	4	4
4	BCHE201 DSC	INORGANIC, ORGANIC, PHYSICAL CHEMISTRY & VOLUMETRIC-II	4	0	0	4	4
5	B201EG	Disaster Management	2	0	0	2	2
PRACTICALS							
1	BPHY201 UPRA	Practical Module-01	0	0	1	2	2
2	BMAT201 UPRA	MATHEMATICS PRACTICAL – II	0	0	2	2	4
3	BCHE201P RA	Practical Core Course- II	0	0	4	4	4
TOTAL			16	0	7	24	26

Semester III

SR. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDIT	COTACT HRS/WK
			L	T	P		
THEORY							
1	BPHY301 UDSC	OPTICS, MODERN PHYSICS & LASER(OMPL)	3	0	0	3	3
2	BPHY302 UDSC	SOLID STATE, NUCLEAR & MATHEMATICAL PHYSICS(SSNM)	3	0	0	3	3
3	BPHY301 USE	Space Physics	2	0	0	2	2
4	BMAT301 UDSC/ BCHE301 DSC	LINEAR ALGEBRA AND CALCULUS / INORGANIC & ORGANIC CHEMISTRY-I	3	0	0	3	3
5	BMAT302 UDSC/ BCHE302 DSC	NUMERICAL ANALYSIS / PHYSICAL CHEMISTRY-I	3	0	0	3	3
6	B301EG	Personality Development	2	0	0	2	2
PRACTICALS							

1	BPHY301 UPRA	PHYSICS PRACTICAL-301	0	0	1	1.5	3
2	BPHY302 UPRA	PHYSICS PRACTICAL-302	0	0	1	1.5	3
3	BMAT301 UPRA	MATHEMATICS PRACTICAL -III	0	0	1	3	3
4	BCHE301P RA	Practical Core Course- II	0	0	6	6	6
TOTAL			16	0	9	28	31

Semester IV

SR. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDIT	COTACT HRS/WK
			L	T	P		
THEORY							
1	BPHY401 UDSC	ELECTROMAGNETISM, ELECTRONICS & PLASMA PHYSICS (EMEP)	3	0	0	3	3
2	BPHY402 UDSC	QUANTUM MECHANICS, SOLID STATE & THERMODYNAMICS(QM SST)	3	0	0	3	3
3	MPHY401 USE	VACUUM PUMPS, PRESSURE GUAGES AND INSTRUMENTS	2	0	0	2	2
4	BMAT401 UDSC/ BCHE401 DSC	ADVANCED CALCULUS / INORGANIC & ORGANIC CHEMISTRY-II	3	0	0	3	3
5	BMAT402 UDSC/ BCHE402 DSC	ADVANCED LINEAR ALGEBRA / PHYSICAL CHEMISTRY & SPECTROSOCPY	3	0	0	3	3
6	B401EG	Human Rights	2	0	0	2	2
PRACTICALS							

1	BPHY401 UPRA	PHYSICS PRACTICAL-401	0	0	1	1.5	3
2	BPHY402 UPRA	PHYSICS PRACTICAL-402	0	0	1	1.5	3
3	BMAT401 UPRA	MATHEMATICS PRACTICAL - IV	0	0	1	3	3
4	BCHE401P RA	Practical Core Course- II	0	0	6	6	6
TOTAL			16	0	9	28	31

Semester V

SR. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDIT	COTACT HRS/WK
			L	T	P		
THEORY							
1	BPHY501DSC	MATHEMATICAL PHYSICS, CLASSICAL MECHANICS & QUANTUM MECHANICS(MCQM-01)	3	0	0	3	3
2	BPHY502DSC	MOLECULAR SPECTRA, STATISTICAL MECHANICS & SOLID-STATE PHYSICS(MSSP)	3	0	0	3	3
3	BPHY503DSC	ELECTROMAGNETISM AND PLASMA PHYSICS(EMPP)	3	0	0	3	3
4	BPHY504DSC	ELECTRONICS	3	0	0	3	3
5	MPHY501SE OR BPHY502SE	Instruments OR Remote Sensing and Transducers	2	0	0	2	2

6	B501EG	Environment and Sustainable Development	2	0	0	2	2
PRACTICALS							
1	BPHY501PRA	PHYSICS PRACTICAL-501	0	0	1	1.5	3
2	BPHY502PRA	PHYSICS PRACTICAL-502	0	0	1	1.5	3
3	BPHY503PRA	PHYSICS PRACTICAL-503	0	0	1	1.5	3
4	BPHY504PRA	PHYSICS PRACTICAL-504	0	0	1	1.5	3
TOTAL			16	0	4	22	28

Semester VI

SR. NO.	CODE	SUBJECT	TEACHING SCHEME			CREDIT	COTACT HRS/WK
			L	T	P		
THEORY							
1	BPHY601DSC	Mathematical Physics, Classical Mechanics & Quantum Mechanics (MCQM-02)	3	0	0	3	3
2	BPHY602DSC	Nuclear Physics (NP)	3	0	0	3	3
3	BPHY603DSC	Statistical Mechanics, Solid State Physics & Optics (SSPO)	3	0	0	3	3
4	BPHY604DSC	Electronics & C-Programming	3	0	0	3	3
5	MPHY601SE OR BPHY602SE	Atmospheric Science OR Nanoscience & Nanotechnology	2	0	0	2	2
6	B601EG	Stress Management	2	0	0	2	2
PRACTICALS							
1	BPHY601PRA	PHYSICS PRACTICAL-601	0	0	1	1.5	3
2	BPHY602PRA	PHYSICS PRACTICAL-602	0	0	1	1.5	3
3	BPHY603PRA	PHYSICS PRACTICAL-603	0	0	1	1.5	3

4	BPHY604PRA	PHYSICS PRACTICAL-604	0	0	1	1.5	3
TOTAL			16	0	4	22	28

BPHY101UDSC: - MECHANICS AND BASIC ELECTRONICS(MAE)

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include Vectors algebra & Calculus Basic Electronics and Linear circuits, Laws of Motion & Dynamics of System of Particles and Elasticity, Oscillations, Gravitation. Some industry relevant topics are also covered under which basic concepts are taught.

Credits: - 04

Module No.	Contents	Teaching Hours.
I	**Vectors algebra & Calculus** Vectors and Scalars, Addition of Vectors, Resolution of Vectors, Scalar and Vector Products, Triple Products of Vectors, Scalar Triple Products, Some Important Conclusions from Scalar Triple Product, Vector Triple Products, Differentiation of a Vector with Respect to time , Scalar and Vector Fields, Partial Differentiation and Gradient, Operation with ∇, The rate of flow of a Vector Field, Vector Integration, Surface Integral, Gauss's Divergence Theorem, Stoke's Theorem, Derivation of Green's Theorem from Gauss Divergence Theorem	15
II	**Basic Electronics and Linear circuits** Electronic components, Basic idea of Passive components and Active components, Source of Electric Power, Batteries, Concept of Voltage Sources, Ideal Voltage Source, Concept of Current Source, Practical Current Source, Conversion of Voltage Source into Current Source and vice versa, RC circuits analysis and time constant (Capacitor charging and discharging), RL circuits analysis(Growth and Decay of current), Ideal LC circuit, Series LCR circuit (for charge case)	15
III	**Laws of Motion & Dynamics of System of Particles** Frames of reference, Newton's law of motion, Kinetic energy, Work and Work-Energy theorem, Calculation of Work done, Conservative and Non-Conservative force(definition), Potential Energy and Conservation of Energy, Definition of Center of Mass, Center of mass of Two particle and several group of particles,	15

	Linear momentum and its Conservation Principle, Rocket Propulsion, Collisions, Inelastic Collisions, Elastic Collisions (one- and two-dimension explanation)	
IV	**Oscillations & Gravitation** Simple Harmonic Motion, Equation for SHM and its Solutions, Terms Associated with SHM, SHM as a Projection of Circular Motion, Energy Conservation in SHM, Newton's law of Gravitation, Gravitation Potential Energy, Gravitation Potential, Gravitational Field, Calculation of Gravitational Potential and Field due to a point mass, kepler's Laws, Motion of Planets and Satellite in circular orbit, Geosynchronous orbits, Weightlessness, Escape velocity	**15**

Reference Books:

- Concept of physics by H C Verma part 1 Publisher: Bharati Bhawan
- Electricity and Magnetism by K.K.Tewary Publisher: S.Chand & Company Ltd.
- Basic electronics and linear circuits by N N Bhargava, D C Kushreshtha,S C Gupta Publisher: Technical Teachers Training Institutes Chandigarh
- Mechanics Berkeley Physics course Vol 1
- B.Sc. Practical physics By C.L.Arora Pub: S.chand.
- A text book of Practical Physics By Indu Prakash & Ramkrishna Pub: Kitab Mahal, New Delhi.

Suggested Readings:

- Lectures on physics, R.P.Feynman, Vol 1
- Physics – Resnick and Holiday
- Principles of electronics by V.K.Mehta, S.Chand
- Electronics Device and Circuits by Allen Mottershead Pub: PHI

Online Resources:

1. https://www.makerspaces.com/basic-electronics/
2. https://www.electronics-tutorials.ws/
3. https://www.electronics-notes.com/articles/basic_concepts/

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to relate different kind of oscillations to standard differential equations. They will be able to explain various natural vibration phenomena.
CO2	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results
CO3	Apply the various procedures and techniques for the experiments

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**1**	**1**		**2**		**2**			
CO2	**3**	**3**	**3**			**1**	**2**	**1**	**2**			
CO3	**3**	**3**	**3**		**1**		**1**		**1**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**3**
CO2													**2**	**2**
CO3													**2**	**3**

BPHY101UPRA: - Practical Module-01

Credit: - 02

Practical / Activities:

1. To determine the Moment of Inertia of a Fly Wheel.
2. To determine ‘g’ by bar pendulum.
3. To determine the Young's Modulus of long wire by Searl's method.
4. To study of Charging and Discharging of Capacitor and RC time constant.
5. To determine Low resistance by Projection method.
6. Decay of Potential across condenser.
7. Verification of Steafan’s law using AC source.
8. Damping coefficient, Relaxation and quality factor in the damped motion of a Simple Pendulum.

9. Study of Resonator.
10. Refractive index liquid using convex lens.

BPHY101USE: - INSTRUMENTATION MEASUREMENT AND ANALYSIS

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include instrumentation measurement and analysis. Some industry relevant topics are also covered under which basic concepts are taught.

Credits: - 02

Module No.	Contents	Teaching Hours.
I	**Vernier Calipers, Micrometer Screw, Spherometer** Introduction, Theory, Figure, Description of the instrument, Detail study of Least count, Errors, Positive Error, Negative Error, Determination of Magnitude of Positive and Negative Errors. Introduction, Theory, Figure, Description of the instrument, Definition of pitch and its Determination, study of least count, Meaning of the Error and explanation of positive and negative Errors, Determination of positive and Negative Errors, Method of taking observation with the help of micrometer screw. Introduction, Theory, Figure, Description of the instrument, to determine the pitch of the screw, To Determine the Least count of the Spherometer, Zero Error, Derivation of Formula for the Radius of Curvature Of Curved Surface.	15
II	**Wheastone Bridge, Post-Office box, Construction of Galvanometer, Spectrometer** Introduction, Theory with Figure, The Figure of Meter Bridge used in Laboratory, Construction of Meter Bridge, Introduction, Theory, Circuit Diagram, Circuit Diagram, explanation of working with necessary formula. Introduction, Theory, Sensitivity and Figure of merit of Galvanometer. Introduction, Construction and explanation of three main parts of spectrometer, Mercury Discharge lamp, Sodium Discharge lamp, the adjustment, levelling and the method of recording the observation of spectrometer.	15

Reference Books:

- Experimental book for Physics.

- A course in Electrical And Electronic Measurements and Instrumentation by A.K. Sawhney,Puneet Sawhney

Suggested Readings:

- A course in Electrical and Electronic Measurements and Instrumentation by J.B. Gupta
- Electronic instrumentation and measurements by David A bell

Online Resources:

1. https://www.makerspaces.com/basic-electronics/
2. https://www.electronics-tutorials.ws/
3. https://www.electronics-notes.com/articles/basic_concepts/

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to relate different kind of instruments to standard their uses and analysis. They will be able to explain various parts of the instruments.
CO2	Develop basic communication skills through working in groups, Apply the various procedures and techniques for the experiments

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**2**	**1**				**2**			
CO2	**3**	**3**	**3**	**2**	**1**				**2**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**3**	**2**

BPHY201UDSC: - WAVE, OPTICS, ELECTROSTATICS & SEMICONDUCTOR DEVICE (WOES)

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include Vectors algebra & Calculus Basic Electronics and Linear circuits, Laws of Motion & Dynamics of System of Particles and Elasticity, Oscillations, Gravitation. Some industry relevant topics are also covered under which basic concepts are taught.

Credits: - 04

Module No.	Contents	Teaching Hours.
I	**Waves Motion, Sound & Ultrasonic Waves** Wave motion, Transverse Wave Travelling in String, Velocity of a Wave in a String, Interference and the principle of Superposition, Standing waves on a String, Normal Modes of a String, Laws of Transverse Vibrations of a String, Melde's Experiment. Speed of Sound Wave in a material medium, Speed of Sound in Gas-Newton's Formula and Laplace's Correction, Intensity and loudness of Sound Wave - Decibels, Beats, Musical Scale, Acoustics of Buildings, Application of Acoustic phenomena, Doppler Effect, Ultrasonic, Production of Ultrasonic Waves, Detection of Ultrasonic Waves, Applications of Ultrasonic waves	15
II	**Semiconductor Physics** Semiconductor materials, Energy Bands in solid metals insulators and semiconductor, PN junction, Formation of PN junction, PN junction with Forward and Reverse biasing, V-I Characteristic of a PN junction diode, Zener Diode, Zener Breakdown, V-I Characteristic of a Zener diode, Zener Diode as Voltage Regulator Half-Wave Rectifier, Full-Wave Rectifier, Centre-tap Rectifier, Bridge Rectifier, Performance of Half-Wave & Full-Wave Rectifier Comparison of Rectifiers, Filter Circuit, Capacitor Filter, Inductor Filter, LC filter, π Filter,	15
III	**Thermodynamics & Electrostatics** Second Law of Thermodynamics (2.8) , Carnot's theorem (2.9), Thermodynamic Scale of temperature (2.10), Identity of Perfect Gas Scale and Absolute Scale (2.11), Thermodynamics of	15

	Refrigeration (4.2) - Entropy (2.13), Change of Entropy in a reversible process (2.14), change of entropy in an irreversible process (2.15), Principle of increase of entropy of degradation of energy (2.16), Formulation of the second law in term of entropy (2.17) , Entropy and second law (2.18) - Third law of Thermodynamics (Nernst's heat theorem) (2.19) The Electric Field, Introduction, Coulomb's law, Continuous Charge Distribution, Electric Potential, Introduction to Potential, Comments on Potential, The Potential of a Localized charge distribution, Work and Energy in Electrostatics, the work done to move a charge, the energy of a point charge distribution, Current and Current density, Conservation of charge, Continuity equation, ohm's law at a point, Wiedmann and franz law, the relaxation time	
IV	**Wave Optics** Electromagnetic nature of Light, Wave Front, Huygens Principle. Superposition of Waves, Conditions for Interference, Techniques of Obtaining Interference: Division of Amplitude and Division of Wave front, Young's Double Slit Experiment, Lloyd's Single Mirror- Determination of Wavelength of Light, Fresnel Biprism – Experiment Arrangement & Determination of Wavelength of Light, Interference in Thin Films, Types of thin film –Parallel and wedge-shaped films, Newton's Rings: Determination of Wavelength of Light & refractive index	**15**

Reference Books:

- Waves and Oscillation by N.Subrahmanym and Brij Lal Pub: Vikas Publising House Pvt. Ltd., New Delhi
- Elements of Electronics By Bagde & Singh Publisher : S.chand
- A Text Book of OPTICS By N.Subrahmanyam, Brijlal, M.N. Avadhanulu Publisher: S.chand.
- Introduction to Electrodynamics by David J. Griffiths Publisher: Prentice Hall India 3rd edition
- Electricity and Magnetism by K.K.Tiwari Pub: S.Chand & Company Ltd.
- Fundamentals of OPTICS By Gulati and Khanna Publisher: R.Chand

Suggested Readings:

- Physics – Resnick and Holiday

- Principles of electronics by V.K.Mehta, S.Chand
- Electronics Device and Circuits by Allen Mottershead Pub: PHI
- Heat and Thermodynamics by Zeemansky
- Heat and Thermodynamics by A.B. Gupta and H. P. Roy (New Central Book)

Online Resources:

1. https://www.makerspaces.com/basic-electronics/
2. https://www.electronics-tutorials.ws/
3. https://www.electronics-notes.com/articles/basic_concepts/

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to relate different kind of oscillations to standard differential equations. They will be able to explain various natural vibration phenomena
CO2	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results
CO3	Apply the various procedures and techniques for the experiments

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**1**	**1**		**2**		**2**			
CO2	**3**	**3**	**3**			**1**	**2**		**2**			
CO3	**3**	**3**	**3**		**1**		**1**	**1**	**1**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**3**
CO2													**2**	**2**
CO3													**2**	**3**

BPHY201UPRA: - Practical Module-02

Credit: - 02

Practical / Activities:

LIST OF EXPERIMENTS

1) To determine the unknown frequency of Tuning Fork By Melde' s Experiment.
2) To Verify the Laws of vibrating strings by Melde's Experiment.
3) To determine wavelength of light using Newton's Ring.
4) To study Half-Wave Rectifier.
5) To Study of a Transformer.
6) To study Characteristics of Photo diode.
7) Study of line spectra.
8) Determination of self-inductance 'L' of inductor.
9) Study of parallel resonance with frequency variation.
10) To study Bridge Rectifier
11) Find out Refractive index of prism using Spectrometer.
12) To study Zener diode Characteristics

BPHY201USE: - ELECTRONIC CIRCUIT ELEMENTS AND ENERGY SOURCES

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include instrumentation measurement and analysis. Some industry relevant topics are also covered under which basic concepts are taught.

Credits: - 02

Module No.	Contents	Teaching Hours.
I	**PASSIVE CIRCUIT ELEMENT: RESISTOR, INDUCTOR, CAPACITOR** Generals, Resistor type, Wire wound resistor, Carbon composition resistor, Carbon film resistor, Ceramic film resistor, Metal film resistor, Power resistor, value tolerance resistor, Variable resistor, Potentiometer, Rheostats, Fusible resistor, Resistor color, Resistor color bond, Resistor under 10 ohm, Resistor troubles, Checking resistor with ohmmeter. Inductor, comparison of different coils, Inductance of an Inductor, Another definition of Inductance, Mutual inductance, Co-efficient of coupling, variable inductors, inductor in series and parallel without M, series combination with m, Energy storage magnetic field, DC resistance of coils. Capacitor, Capacitor connect to battery, capacitance, factors controlling capacitance, type of capacitors, fixed capacitor, variable capacitor, voltage rating of capacitor, leakage resistance, troubles capacitors, checking capacitor with ohmmeter.	15
II	**ENERGY SOURCES: CELLS AND BATTERY, TRANSFORMER.** Primary and secondary cells and batteries, voltage and current o cell, cell life, different type of dry cell, carbon zinc cell, alkaline cell, manganese alkaline cell, Nickel-cadmium cell, mercury cell, silver oxide cell, lead acetate cell, Battery rating, Testing dry cell, Photoelectric cell, Solar cell. Transformer working, Transformer impedance, Can a Transformer operate on DC, RF shielding, Auto-Transformer	15

Reference Books:

- Basic electronics by B. L. Tharaja, Pub. S. Chand & Company 3rd Edition.

- A course in Electrical And Electronic Measurements and Instrumentation by A.K. Sawhney,Puneet Sawhney

Suggested Readings:

- A course in Electrical And Electronic Measurements and Instrumentation by J.B. Gupta
- Electronic instrumentation and measurements by David A bell

Online Resources:

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2. https://www.electronics-tutorials.ws/
3. https://www.electronics-notes.com/articles/basic_concepts/

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to relate different kind of instruments to standard their uses and analysis. They will be able to explain various parts of the instruments.
CO2	Develop basic communication skills through working in groups, Apply the various procedures and techniques for the experiments

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**2**	**1**	**1**		**1**	**2**			
CO2	**3**	**3**	**3**	**2**	**1**		**1**		**2**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**3**	**2**

BPHY301UDSC: - OPTICS, MODERN PHYSICS & LASER(OMPL)

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include Diffraction, Resolving power, Polarization, Laser, Modern Physics. Some industry relevant topics are also covered under which basic concepts are taught.

Credits: - 03

Module No.	Contents	Teaching Hours.
I	**Diffraction & Resolving Power** Distinction between Interference and diffraction (17.6), Fresnel and Fraunhofer types of diffraction (17.7), Fraunhofer diffraction at a double slit (18.4), Fraunhofer diffraction at double slit (Calculus method), (18.4.1), Distinct between single slit and double slit diffraction pattern (18.4.2), Fraunhofer diffraction at N slit (18.6 & 18.6.1), Plane diffraction grating (18.7), Theory of plane transmission grating (18.7.1), Dispersive power of Grating (18.7.7). Waves, Applications of Ultrasonic waves Resolving Power of Optical Instrument (19.5), Resolving Power of a telescope (19.7), Relation between magnifying power and resolving power of a telescope (19.7.1), Resolving Power of a Plane transmission grating (19.12).	15
II	**Polarization & Laser** Introduction (20.1), Polarization by double refraction (20.5.5), Double refraction (20.8.3), Huygens‟ explanation of double refraction (20.9 & 20.9.1), Types of polarized light, (20.15), Retarders or Wave plates (20.17), Quarter wave plate (20.17.1), Half wave plate (20.17.2), Production of Elliptically polarized light (20.18), Detection of Elliptically polarized light (20.18.1). Introduction (6.1), Properties of Lasers (6.2), Stimulated absorption, spontaneous emission and stimulated emission (6.3), Population inversion (6.5), Pumping (6.6), Main components of a laser (6.7), Nd:YAG Laser (6.8), Helium-Neon laser (6.9), CO2 laser (6.10), Semiconductor lasers (6.11), Applications of Laser (6.12 & 6.13)	15
	Modern Physics Orbital and Magnetic Dipole Moment (4.1), Larmor Precession (4.2), Space quantization (4.3), Electron spin (4.4), Vector model	

III	of atom (4.5), Spectroscopic terms and their notations (4.6), Stern Gerlach Experiment (4.7), Pauli's Exclusion Principle (4.8). Zeeman Effect- Normal Zeeman Effect and anomalous Zeeman Effect (12.1), Explanation of Normal Zeeman Effect (12.2), Explanation of Anomalous Zeeman Effect (12.3), Paschan back effect (12.4).	**15**

Reference Books:

- Principles of Optics by B.K. Mathur
- Optics by Ajoy Ghatak
- Fundamentals of Optics by Jonkin"s and White
- Engineering Physics by K. Rajgopal
- Atomic & Molecular spectra by Rajkumar Kedarnath Prakashan Meerut
- Engineering Physics by R.K Gaur and S.L. Gupta
- Concepts of Modern Physics by Arther Beiser.

Suggested Readings:

- A text book of OPTICS by Dr. N, Subrahmanyam, Brijlal, Dr, M,N, Avadhanulu - S.Chand
- A Text book of Light by D.N.Vasudeva - S. Chand & Co.

Online Resources:

1. https://en.wikipedia.org/wiki/Diffraction
2. https://testbook.com/learn/physics-diffraction-of-light/
3. https://www.olympus-lifescience.com/en/microscope-resource/primer/lightandcolor/diffraction/
4. https://byjus.com/physics/resolving-power-of-microscopes-and-telescopes/
5. https://www.britannica.com/technology/resolving-power
6. http://labman.phys.utk.edu/phys136core/modules/m9/resolving_power.html
7. https://byjus.com/physics/polarization-of-light/
8. https://www.physicsclassroom.com/class/light/Lesson-1/Polarization
9. https://en.wikipedia.org/wiki/Polarization_(waves)
10. https://www.geeksforgeeks.org/polarization-of-light-definition-types-methods-applications/

11. https://www.vedantu.com/physics/polarisation-of-light
12. https://www.edmundoptics.in/knowledge-center/application-notes/optics/introduction-to-polarization/
13. https://science.howstuffworks.com/laser-weapon.htm
14. https://www.ulsinc.com/learn
15. https://www.rp-photonics.com/lasers.html
16. https://openstax.org/books/university-physics-volume-3/pages/8-2-orbital-magnetic-dipole-moment-of-the-electron
17. https://opentextbc.ca/universityphysicsv3openstax/chapter/orbital-magnetic-dipole-moment-of-the-electron/

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to understand different kind of diffraction types and its comparison between single slit and double slit grating and also understand resolving power of different optical instruments and its types.
CO2	The student understands about polarization, types of polarized light, its production method, refraction types, and about laser types, properties, applications.
CO3	In this section student understand about orbital and magnetic dipole moment, different conditions of it, different laws to support this theorem.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**1**		**1**	**2**	**2**				
CO2	**3**	**2**	**1**	**1**	**1**			**1**				
CO3	**3**	**2**	**2**						**1**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**3**
CO2													**1**	**2**
CO3														**1**

BPHY301UPRA: - Practical Module-01

Credit: - 1.5

Practical / Activities:

LIST OF EXPERIMENTS

1) Resonance pendulum. Determination of „lo", „r" & „a"
2) Study of X-ray diffraction (Powder) Pattern.
3) Decay of Temperature when body is allowed to cool. (thermocouple)
4) To study elliptically polarized light using photocell and quarter wave plate.
5) To determine l using Hertzman formula
6) Activation energy of a semiconductor
7) Absorption co-efficient of liquid using photocell.

BPHY302UDSC: - SOLID STATE, NUCLEAR & MATHEMATICAL PHYSICS (SSNM)

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include atomic cohesion and crystal binding, atomic spectra, elementary particles, detectors, radioactivity, Q-Equation, Fourier series and co-Ordinator transformation. Some industry relevant topics are also covered under which basic concepts are taught.

Credits: - 03

Module No.	Contents	Teaching Hours.
	Atomic Cohesion and Crystal Binding, Atomic Spectra:	
	Cohesion of Atoms(2.1), Primary Bonds (2.2), The Covalent Bond (2.2.1), The Metallic Bond (2.2.2), The Ionic Bond (2.2.3), Mixed Bond (2.2.4), Secondary Bonds(2.3), The Vander wall's Bond	

I	(2.3.1), The Hydrogen Bond (2.3.2), The Cohesive Energy(2.4), Ionic Crystal (2.4.1), Noble Gas Crystal (2.4.2), Atomic Radi.Vs Lattice constants (2.5), Elastic constants of crystals (2.6), Elastic Stress (2.6.1), Elastic strain(2.6.2), Dilation(2.6.3), Elastic Compliance and Stiffness constant (2.7), Elastic Energy density (2.7.1), Application to Cubic crystal (2.7.2), Bulk Modulus and compressibility (2.7.3). Franck-Hertz experiment, Critical potentials Shortcomings of Bohr's Theory, Summerfield extension of Bohr theory	**15**
II	**Elementary Particles, Detectors, Radioactivity & The Q-Equation** Fundamental interactions in Nature (21.1), Dawn of elementary particle physics (21.2), Mediator of an interaction, (21.2.1), Pi-Mesons (21.2.2), Muons, Kaons and hyperons (21.2.3), Particles and antiparticles (21.3), Classifications of elementary particles (21.4) Introduction (1.1.1), Detectors for Nuclear Particles (1.1.3), (i) Proportional Counter (ii) Semiconductor detectors, (Review of Radioactive decay laws, half-life, mean life time etc.) Radioactive growth and decay (2.6) Ideal equilibrium (2.7) Transient equilibrium and secular equilibrium (2.8) Radioactive series (2.9) Introduction (3.1), Types of Nuclear Reactions (3.2), The Balance of Mass and Energy in Nuclear Reactions (3.3), The Q-Equation (3.4), Solution of the Q Equation (3.5).	**15**
III	**Fourier series & Co-ordinate Transformation** Introduction (7.1), Periodic functions (7.2), Application of Fourier series (7.3), Average values of a function (7.4), Fourier Co-efficient (7.5), Dirichlet's conditions (7.6), Complex form of Fourier series (7.7), Parseval Theorem Curvilinear Coordinates (10.6), Scale factors and basis vectors for orthogonal systems (10.7)	**15**

Reference Books:

- Mathematical method for physical sciences by M. L. Boss John Wiley Publication.
- Concepts of Modern Physics by Arther Beiser.
- Introduction to Solid State Physics by C. Kittle (John Willey)
- Fundamental of Solid-State Physics by Saxena, Gupta, Saxena (Pragati Prakashan)
- Solid State Physics by C. M. Kachhawa

- Engineering Physics by R.K Gaur and S.L. Gupta

Suggested Readings:

- Elements of Solid-State Physics. (2003) by J. P. Srivastava, PHI
- Nuclear Physics by S.B. Patel (New age International (p) Ltd. Publishers)
- Modern physics by G. Aruldhas, P. Rajagopal

Online Resources:

1. http://www.vpscience.org/materials/US04CPHY22_UNIT4.pdf
2. https://byjus.com/physics/atomic-spectra/
3. https://www.livescience.com/65427-fundamental-elementary-particles.html
4. https://en.wikipedia.org/wiki/Particle_detector
5. https://www.sciencedirect.com/topics/physics-and-astronomy/radioactivity#:~:text=Radioactivity%20is%20the%20phenomenon%20of,mass%20being%20converted%20to%20energy.
6. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Equilibria/Chemical_Equilibria/The_Reaction_Quotient#:~:text=This%20means%20that%20in%20the,there%20would%20be%20at%20equilibrium.
7. https://byjus.com/maths/fourier-series/#:~:text=A%20Fourier%20series%20is%20an,the%20sine%20and%20cosine%20functions.
8. http://motion.cs.illinois.edu/RoboticSystems/CoordinateTransformations.html
9. https://www.continuummechanics.org/coordxforms.html
10. https://math.etsu.edu/multicalc/prealpha/chap3/chap3-1/printversion.pdf

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to understand cohesion of atom, different types of bond, different crystal structure, and some properties of acting on it and also learn about its related experimental model
CO2	In this unit student will learn about elementary classification of particle, types of detectors, about radioactivity, and about the Q-equation.
CO3	In this unit student will learn about Fourier series, application and different function of it, and also learn about co-ordinate transformation.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**			**2**	**2**					
CO2	**3**	**2**	**1**	**1**				**2**	**1**			
CO3	**3**	**2**	**2**		**2**			**1**				

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**3**
CO2													**1**	**2**
CO3													**1**	**1**

BPHY302UPRA: - Practical Module-02

Credit: - 1.5

Practical / Activities:

LIST OF EXPERIMENTS

1) Study of B.G.: To determine current sensitivity, volt sensitivity, figure of merit and Rg of B.G.
2) High resistance by equal deflection method.
3) Low resistance by Carry foster bridg.
4) To determine low value of „C‟ using Schering bridge.
5) Characteristics of UJT & Determination of RBB, VD & h
6) Characteristics of a Photodiode
7) To verify Demorgan’s Theorems using IC-7400.

BPHY301USE: - ASTRO/SPACE PHYSICS

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include astronomical background, description about sun and its radiation related phenomena, cosmic radiation, types, its effects. Some industry relevant topics are also covered under which basic concepts are taught.

Credits: - 02

Module No.	Contents	Teaching Hours.
I	**Sun and Solar Radiation** Introduction, Astronomical background, General description of the sun, Solar structure, Sun's outer layers, Composition, Visible features on the sun, More about sun's outer atmosphere, Temperature of the corona, Solar activity and Sunspot cycles	15
II	**Cosmic rays and High energy astrophysics** An introduction to cosmic rays and high energy astrophysics: primary cosmic radiation, energy spectrum of primary cosmic rays, secondary cosmic rays, effect of geomagnetic field on cosmic rays, time variation of cosmic rays, photons in primary cosmic rays, origin of cosmic rays, basic facts about cosmic rays, region of confinement	15

Reference Books:

- An Introductory Course on Space Science Earth's Environment by S.S.Degaonker (Gujarat University Publication, Ahmedabad)

Suggested Readings:

- An Introductory Course on Space Science Earth's Environment by S.S.Degaonker (Gujarat University Publication, Ahmedabad)

Online Resources:

1. https://www.energy.gov/eere/solar/solar-radiation-basics#:~:text=Solar%20radiation%2C%20often%20called%20the,using%20a%20variety%20of%20technologies.
2. https://www.azom.com/article.aspx?ArticleID=16595
3. https://www.fondriest.com/environmental-measurements/parameters/weather/photosynthetically-active-radiation/
4. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/solar-radiation
5. https://www.sciencedirect.com/topics/chemistry/solar-radiation
6. https://www.newport.com/t/introduction-to-solar-radiation
7. https://web.astro.princeton.edu/research/computational-astrophysics
8. https://www.frontiersin.org/articles/10.3389/fspas.2019.00023/full
9. https://www.sciencedirect.com/topics/physics-and-astronomy/high-energy-cosmic-radiation

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to understand about sun, its radiation effect, different layers of atmospheres affected by radiation, and sunspot cycle.
CO2	The student understands about different type of cosmic radiations effect of geomagnetic field on cosmic rays, its time variation, its origin, basic facts and region of confinement.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**1**	**1**			**2**		**1**			
CO2	**3**	**2**	**1**		**1**	**1**		**2**				

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**1**
CO2													**1**	**2**

BPHY401UDSC: - ELECTROMAGNETISM, ELECTRONICS & PLASMA PHYSICS (EMEP)

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include Electrostatics in Dielectric, Magnetic Potentials, Magnetic Vector Potential, Magnetization, Transistors Biasing and Stabilization, Basic Transistor Amplifier and its parameters, different Solid-state Devices and Types of A.C. Bridges. Also, here students learn Digital electronic and they get Number systems like Decimal, Binary, Hexadecimal and Octal and its conversions, different type subtractor. They also introduce with concept of plasma. In Plasma, study on Composition and Characteristics of a Plasma.

Credits: - 03

Module No.	Contents	Teaching Hours.
I	**Electrostatics in Dielectric & Magneto statics** Gaseous Non-Polar Dielectrics (2.11), Gaseous Polar Dielectrics (2.12), Non- Polar Liquids (2.13), Solid Dielectrics-Electrets (2.14). The Magnetic Potentials (4.9- a & b), Magnetic Vector Potential due to Small Current Loop (4.12), An alternative method for finding the Vector Potential A and the Field B due to Current Loop (4.13), Magnetization (4.15), Magnetic Field Vector (4.16), Magnetic Susceptibility and Permeability (4.17), Boundary Conditions (4.18), Uniformly magnetized Sphere in External Magnetic Field (4.19), A Comparison of Static Electric and Magnetic Fields (4.20).	15
II	**Transistors Biasing and Stabilization, Basic Transistor Amplifier, Solid state Devices & A.C. Bridges** Bias Stabilization (Operating point stabilization) (8.7, 8.7.1 & 8.7.2), Stability factor (8.8), Stabilization by Collector Base Resistance (8.9) Stabilization by potential divider and Emitter resistor (8.10) Transistor as a four pole (9.2), h-parameters with h-parameters equivalent circuit (9.5 complete), Grounded Emitter Circuit -	15

	Mathematical analysis using h parameters only (9.6), Comparative Study of three types of Amplifiers (9.9). JFET (12.1 to 12.6), UJT (26.6, 26.6.1 to 26.6.3). A.C. Bridges (17.5), Maxwell Bridge (17.6.1), Schering Bridge.	
III	**Digital Electronics & The Basic concepts of Plasma** Introduction (21.1), Number systems used in Digital Electronics (21.2), Decimal, Binary, Hexadecimal and Octal (21.2.1 to 21.2.4), Binary Codes-(A) BCD, (B) Gray, (C) Excess-3 Codes (21.4), Arithmetic Circuits – Exclusive - OR Gate (21.9), Applications of X-OR Gate: (i) Binary to Gray Code Converter (ii) A Parity Checker (iii) The Half Adder (iv) The Full Adder (v) Parallel Adder (vi)Half subtractor (vii)Full subtractor. Introduction (1.1), Composition and Characteristics of a Plasma (1.2), Collisions (1.3), Elastic collisions (1.3.1), Inelastic collisions (1.3.2), Surface Phenomena (1.4), Transport Phenomena (1.5), Diffusion and Mobility (1.6), Viscosity, Conductivity (1.7), Recombination (1.8), Ohm's law (1.9), Gas Discharge (1.10), Composition of various natural and Man-made Plasma (1.11), Plasma diagnostics (1.12), Plasma waves and Instabilities Confinement of Plasma (1.13), Space Plasma (1.14).	**15**

Reference Books:

- Electromagnetic by B.B. Laud, New Age Int. Publisher
- Hand book of Electronics by Gupta & Kumar 30th Revised Edition,2002 Pragati Prakashan
- Electronics and Radio Engineering by M.L. Gupta (9th Edition-2002) D Raj & Sons
- Electricity and Magnetism by Maharajan and Rangwala, THM
- Electronic Devices and Circuits by A.Mottershead Prentice – Hall of India.
- Basic Electronics and Linear Circuits by N.N.Bhargava, D.C.Kulshreshtha, S.C.Gupta McGraw
- Electricity and Magnetism Berkeley Physics course Vol.-II by EDWARD M PURCELL.
- Integrated Electronics by Millman & Halkias.

Suggested Readings:

- Electricity and Magnetism By K.K.Tewari (S.Chand.& Company Ltd.)
- Elements of Plasma Physics by S.N.Goswami New Central book Agency (P) Ltd., Calcutta.
- Advanced Magneto hydrodynamics by J. P. Goedbloed; Rony Keppens; Stefaan Poedts.
- Plasma Physics An Introduction By Richard Fitzpatrick

Online Resources:

- https://www.electronics-tutorials.ws/
- www.youtube.com
- https://www.britannica.com/science/plasma-state-of-matter/Plasma-oscillations-and-parameters
- http://silas.psfc.mit.edu/introplasma/

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to known different kind of Magnetization, transistor biasing and different types A.C Bridge.
CO2	They Develop their basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results
CO3	They also develop their basics instrumental knowledge with experiment skill and active their digital electronic calculation skill. They also get plasma related knowledge.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**		**1**				**2**			
CO2	**2**	**2**	**1**	**1**			**1**	**1**				
CO3	**2**	**1**	**1**			**1**						

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**

CO2													**2**	**1**
CO3													**1**	**1**

BPHY401UPRA: - Practical Module-01

Credit: - 1.5

Practical / Activities:

LIST OF EXPERIMENTS

1. Coaxial Viscometer
2. To determine wave length of bright lines of mercury light using grating.
3. R.P. of Telescope
4. Searl's Goneometer. Determination of cardinal points and do
5. Kundt's tube. Determination of "y"
6. Diffraction by Adser 'A' Pattern
7. e/k by Power Transistor

BPHY402UDSC: - QUANTUM MECHANICS, SOLID STATE & THERMODYNAMICS (QMSST)

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected topics of physics. The topics include Schrodinger Equations, The operator correspondence and the Schrodinger equation for a particle subject to forces , Normalization and Probability Interpretation, Non-Normalizable Wave functions and Box Normalization, Conservation of Probability, Crystal Structure, Some importance crystal structure, Face Centered Cubic Structure, Wigner-Seitz Cells, Miller Indices , Newtonian Relativity, Relativity of Simultaneity, Heat and Thermodynamics, The Helmolt'z and Gibb's function, Maxwell's Distribution Law of Velocities Some industry relevant topics are also covered under which basic concepts are taught.

Credits: - 03

Module No.	Contents	Teaching Hours.
I	**Schrodinger Equations, Physical Interpretation and Condition on 'ψ ', & Stationary States and Energy Spectra** A free particle in one dimension (2.1), Generalization to three dimensions (2.2), The operator correspondence and the Schrodinger equation for a particle subject to forces (2.3), Normalization and Probability Interpretation (2.4), Non-Normalizable Wave functions and Box Normalization (2.5). Conservation of Probability (2.6), Expectation values, Ehrenfest"s Theorem (2.7), Admissibility Condition on the Wave function (2.8) Stationary states: The time Independent Schrödinger Equation (2.9), A particle in a square well potential (2.10), Bound States in a square well (E > 0) (2.11), The square well: non-localized states (E > 0) (2.12).	15
II	**Crystal Structure & Special Theory of Relativity** Structure, Translational Symmetry, Space, Unit Cell and Primitive Cell, Symmetry Elements in Crystals, The Seven crystal Systems, Coordination Number, some importance crystal structure, Simple Cubic Structure, Body Centered Cubic Structure, Face Centered Cubic Structure, Wigner-Seitz Cells, Miller Indices, The spacing of a set of crystal planes Newtonian Relativity (14.1), Michelson-Morley experiment (14.2), Special theory of relativity (14.3), Lorentz Transformation (14.4), Consequences of Lorentz Transformation (14.5) -(a) Relativity of Simultaneity (b) the Lorentz-Fitz Gerald length Contraction (c) Time Dilation, Addition of Velocities (14.6), Mass-energy relation (14.8), Space time (14.9), Compton scattering (14.11).	15
III	**Heat and Thermodynamics & Kinetic Theory of Gases** Characteristic functions, Enthalpy, The Helmolt'z and Gibb's function, Two Mathematical Theorems, Maxwell's equations, The T-ds equations, Energy equation, The Thermal Expansivity, Compressibility, Joule-Kelvin effect (Porous plug Experiment), Liquefaction of Gases by Joule-Kelvin effect Maxwell's Distribution Law of Velocities, Deduction of Maxwell–Boltzmann law, Determination of the values of constants 'a' and 'b', Experimental Test of Maxwell's Law	15

Reference Books:

- Elements of Solid State Physics. (2003) by J. P.Srivastava, PHI
- Nuclear Physics by S.B. Patel (New age International (p) Ltd. Publishers)
- Mathematical method for physical sciences by M. L. Boss John Wiley Publication.
- Concepts of Modern Physics by ArtherBeiser.
- Introduction to Solid State Physics By C.Kittle (John Willey)
- Fundamental of Solid State Physics By Saxena, Gupta, Saxena (PragatiPrakashan)
- Solid State Physics by C. M. Kachhawa
- Engineering Physics by R.K Gaur and S.L. Gupta

Suggested Readings:

- Modern physics by G. Aruldhas, P. Rajagopal
- Nuclear Physics in a Nutshell by Carlos A. Bertulani
- Nuclear Physics: Principles and Applications by John Lilley
- Fundamentals of Physics (Mechanics, Relativity, and Thermodynamics) by R. Shankar
- Heat and Thermodynamics by Pramila Shukla , Shefali Kanwar & Shivani
- An Introduction to the Kinetic Theory of Gases by James Jeans.

Online Resources:

- www.youtube.com
- https://en.wikipedia.org/
- https://galileo.phys.virginia.edu/classes/252/home.html

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to relate different kind of Schrodinger Equation. They will be able to explain various Normalization and Probability.
CO2	Develop basic structure knowing skills through working in groups in performing the laboratory experiments and by interpreting the results.
CO3	They learn different types of Relativity concept, Thermodynamics.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	**3**	**3**	**3**		**1**				**2**			
CO2	**2**	**1**	**2**	**1**		**2**		**2**				
CO3	**1**	**2**	**1**				**2**		**1**			

CO-PO & CO-PSO Mapping

Course Outcomes	**Program Outcomes**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**3**
CO2													**1**	**2**
CO3													**2**	**2**

BPHY402UPRA: - Practical Module-02

Credit: - 1.5

Practical / Activities:

LIST OF EXPERIMENTS

1) Absolute value of capacity using B.G. or S.G.
2) Low resistance by method of Projection
3) Comparison of capacity (C1/C2) by Desauty method
4) To determine self-inductance by Anderson Bridge
5) Characteristics of a C.B. Transistor (PNP)
6) Characteristics of JFET & Determination of μ, rd, gm
7) Construction of AND, OR, NOT Gates using NAND & NOR Universal gates.

BPHY401USE: - Vacuum Pumps, Pressure Gauges and Instruments

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include different **Vacuum Pumps like** Rotary Oil Pumps, Molecular Pump, Diffusion Pump, and Pressure gauges like McLeod gauge, Pirani gauge, Thermocouple gauge, Ionization gauge. Errors of observations, Types of errors- Normal law of errors, Average, standard and probable errors, Percentage error. How Travelling Microscope works.

Credits: - 02

Module No.	Contents	Teaching Hours.
I	**Vacuum Pumps, Pressure Gauges & Errors in measurement** Exhaust Pumps and their characteristics, Rotary Oil Pumps, Molecular Pump, Diffusion Pump, Other methods of producing Low Pressures, Pressure gauges- McLeod gauge, Pirani gauge, Thermocouple gauge, Ionization gauge Errors of observations, Types of errors, Normal law of errors, Average, standard and probable errors, Percentage error	15
II	**Optical Instruments** Travelling Microscope, Cathetometer and Optical bench Objective and Eyepiece, Kellner's Eyepiece, Huygens Eyepiece, Ramsden Eyepiece, Comparison of Ramsden Eyepiece and Huygens Eyepiece, Gauss Eyepiece, Telescopes, Refracting Astronomical Telescope, Reflecting Telescope, Newton's Telescope, Other reflecting Telescope	15

Reference Books:

- An advanced Course in Practical Physics by D. Chattopadhyay, P.C. Rakshit, B.SAHA, New Central Book Ltd.
- A text book of OPTICS by Dr. N. Subrahmanyam, Brijlal, Dr. M.N. Avadhanulu- S.Chand
- Mechanics by D.S. Mathur, S.Chand.

Suggested Readings:

- Handbook of *vacuum* science and technology / Dorothy M. Hoffman,. Bawa Singh, John H. Thomas

- Handbook of Measurement Error Models By Grace Y. Yi, Aurore Delaigle, Paul Gustafson
- Fundamentals and Basic Optical Instruments By Daniel Malacara Hernández
- Basic Optics and Optical Instruments: Revised Edition by Fred A. Carson

Online Resources:

- www.youtube.com
- https://www.vacuumscienceworld.com/blog/vacuum-pressure-measurement
- https://www.tutorialspoint.com/
- https://en.wikipedia.org
- http://hyperphysics.phy-astr.gsu.edu/hbase/geoopt/opinst.html

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to understand Exhaust Pumps and their characteristics, Different types of pumps and Pressure gauges, Different types of measurements errors. Learn the different Travelling Microscope working process and how its Different eyepiece use full.
CO2	They Develop their skills through working in groups in performing the Instruments and by interpreting the results, They also develops their working Instruments knowledge, find the error of instruments and resolved the instruments measurements error.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**	**1**			**1**	**1**	**1**			
CO2	**3**	**3**	**3**		**2**	**2**			**1**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**3**
CO2													**1**	**3**

BPHY501DSC: - MATHEMATICAL PHYSICS, CLASSICAL MECHANICS & QUANTUM MECHANICS(MCQM-01)

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include Differential equations, 2nd order differential equations, lagrangian formulation, motion of a rigid body, general formalism of wave mechanics. Some industry relevant topics are also covered under which basic concepts are taught.

Credit: -03

Unit	Content	Credit	Weightage
I	**Differential Equations**	1	34 %
	Some partial differential Equations Physics (2.1), The method of separation of variables (2.2A), Separation of Helmholtz equation in Cartesian Coordinates (2.2B), Separation of Helmholtz equation in spherical polar Coordinates (2.2C), separation of Helmholtz equation in cylindrical coordinates (2.2D), Laplace's equation in various coordinate systems (2.2E).		
	2nd order differential equations		
	Ordinary and singular points (3.1), Series solution around and ordinary point (3.2), Series Solution around a regular singular point (The method of Frobenius) (3.3).		
II	**Lagrangian Formulation**	1	33 %
	Introduction, Constraints, holonomic and non-holonomic constraints, scleronomous and rheonomous constraints (8.1), generalized coordinates(8.2), D'Alembert's principle(8.3), Lagrange's equations(8.4), a general expression for kinetic energy(8.5), Symmetries and the laws of conservation(8.6), Cyclic or ignorable coordinates (including illustrations)(8.7), Velocity dependent potential of electromagnetic field(8.8), Rayleigh's dissipation function(8.9).		
	Motion of a rigid body:		

	Introduction, Euler's theorem (10.1), Angular momentum and kinetic energy (10.2), The inertia tensor (10.3), Euler's equations of motion (10.4)		
III	**General formalism of Wave Mechanics** The Schrodinger equation and Probability interaction for N- particle system(3.1), The fundamental postulates of wave mechanics(3.2), Adjoint of an operator and self Adjointness(3.3), The Eigen value problem(3.4), Degeneracy(3.5), Eigen values and Eigen functions of self-adjoint operators(3.6), The Dirac delta function(3.7), Observables, completeness and normalization of Eigen functions(3.8), Closer, physical interpretation of Eigen values, Eigen function and expansion coefficients(3.9), Momentum Eigen functions : wave functions in momentum space(3.10), uncertainly Principle(3.11), States with minimum value for uncertainly product(3.12), commuting observable : Removal of degeneracy(3.13), Evolution of system with time Constants of the motion(3.14).	1	33 %

Reference Books:

- Mathematical Physics by P. K. Chatopadhyay. Wiley East Ltd.
- Mathematical Physics by B.D.Gupta.
- Mathematical Physics by H.K.Dass.
- Introduction to classical mechanics by Takawale and Puranic. THM Publication.
- Classical Mechanics, by Goldstein. Narosa Publishing House, New Delhi.
- Classical Mechanics by Yasvant Waghmare.
- Classical Mechanics by N.C.Rana and P.S.Joag, THM Publication.
- A text book of Quantum Mechanics by P.M. Methews and K. Venkateshan, THM Publication.
- Quantum Mechanics by Ghatak and Loknathan, The Macmillan company of India Limited.
- Quantum Mechanics by John, L. Powell and B. Crasemann.
- Quantum Mechanics by Schiff.
- Quantum Mechanics by Fschwabi, Narosa Publishing House, New Delhi.

Suggested Readings:

- Mathematical Physics by P. K. Chatopadhyay. Wiley East Ltd.
- Mathematical Physics by B.D.Gupta.
- Mathematical Physics by H.K.Dass.
- A text book of Quantum Mechanics by P.M. Methews and K. Venkateshan, THM Publication.
- Quantum Mechanics by Ghatak and Loknathan, The Macmillan company of India Limited.

Online Resources:

1. https://byjus.com/maths/differential-equation/
2. https://en.wikipedia.org/wiki/Differential_equation
3. https://www.cuemath.com/calculus/differential-equation/
4. https://www.cuemath.com/calculus/second-order-differential-equation/
5. https://www.mathsisfun.com/calculus/differential-equations-second-order.html
6. https://tutorial.math.lamar.edu/classes/de/introsecondorder.aspx
7. https://en.wikipedia.org/wiki/Lagrangian_mechanics#:~:text=In%20physics%2C%20Lagrangian%20mechanics%20is,his%201788%20work%2C%20M%C3%A9canique%20analytique.
8. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Statistical_Mechanics/Advanced_Statistical_Mechanics/Classical_microstates%2C_Newtonian%2C_Lagrangian_and_Hamiltonian_mechanics/The_Lagrangian_formulation_of_classical_mechanics
9. http://www.unishivaji.ac.in/uploads/distedu/SIM2013/M.%20Sc.%20Maths%20Classifical%20Mechanics/Chapter%20I.pdf
10. https://brilliant.org/wiki/lagrangian-formulation-of-mechanics/
11. https://www.brown.edu/Departments/Engineering/Courses/En4/notes_old/RigidKinematics/rigkin.htm#:~:text=Characteristics%20of%20rigid%20body%20motion,a%20rotation%20about%20the%20point.
12. https://www.geeksforgeeks.org/motion-of-a-rigid-body/
13. https://byjus.com/physics/rigid-body-and-rigid-body-dynamics/
14. https://nios.ac.in/media/documents/SrSec312NEW/312_Physics_Eng/312_Physics_Eng_Lesson7.pdf

15. https://qm1.quantumtinkerer.tudelft.nl/9_formalism/#:~:text=The%20formalism%20of%20quantum%20mechanics%20is%20built%20upon%20two%20fundamental,%2C%20%7C%CE%A8%E2%9F%A9%E2%88%88H.
16. https://en.wikipedia.org/wiki/Mathematical_formulation_of_quantum_mechanics
17. https://math.mit.edu/~dav/quantum.pdf
18. http://www.damtp.cam.ac.uk/user/tong/qm/qm3.pdf

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to understand different kind of differential equations, a method of separation in different coordinates, Laplacian equation in different coordinates and 2nd order differential equation in regular singular point.
CO2	The student understands about different types of lagrangian formulation for holonomic, non-holonomic constrain D'Alembert's principal, Rayleigh's dissipation function and Euler's theorem.
CO3	In this section student understand about Schrodinger equation and probability interaction, fundamental postulate of wave mechanics, different types of operators there eigen value problem, eigen value functions, uncertainty principal and evolution of system with time constant of the motion.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**			**2**			**1**			
CO2	**2**	**3**	**3**		**2**		**1**	**1**				
CO3	**2**	**1**	**2**	**1**					**1**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**2**	**1**
CO3													**2**	**1**

BPHY501PRA: - Practical Module-501

Credit: - 1.5

Practical / Activities:

LIST OF EXPERIMENTS

1) Acceleration due to gravity (g) using Katter's pendulum (with movable and fixed knife edges)
2) Determination of Thermal conductivity 'K' of a rubber tube.
3) Study of thermocouple
4) Velocity of sound in air using CRO
5) G.M. Counter (Plateau Characteristics)

BPHY502DSC: - MOLECULAR SPECTRA, STATISTICAL MECHANICS & SOLID-STATE PHYSICS(MSSP)

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include molecular spectra and statistical mechanics of solid-state physics. Some industry relevant topics are also covered under which basic concepts are taught.

CREDIT: - 03

Unit	Content	Credit	Weightage
I	**MOLECULAR SPECTRA** **Pure Rotational and Vibrational - Rotational Spectra :** Types of Molecular Spectra(17.2), Salient Features of Rotational Spectra(18.1), Molecular requirement for Rotational Spectra(18.2), Experimental Arrangement(18.3), The molecule as a rigid rotator: Explanation of rotational spectra(18.4), The Non-rigid Rotator(18.5), The Isotope Effect(18.6), Salient Features of Vibrational-Rotational Spectra(19.1), The Molecule as a Harmonic Oscillator(19.2). **Raman and Electronic Spectra** : Nature of the Raman Effect(20.1), Experimental Arrangement for Raman Spectra(20.2), Classical Theory of Raman Effect(20.3), Quantum theory of Raman Effect(20.4), Raman Spectra and Molecular Structure(20.5), Infra-red Spectra Versus Raman Spectra(20.6), Salient Features of Molecular Electronic Spectra(21.1), Formation of Electronic Spectra(21.2).	1	33 %
II	**STATISTICAL MECHANICS :**	1	34 %

	Some Application of Statistical Mechanics : Thermodynamics(6.3), Reversible and Irreversible processes(6.3.1), The Laws of Thermodynamics(6.3.2) ((i) Zero (ii) First Law (iii) Second Law), Statistical interpretation of the basics thermodynamic variables(6.4, 6.4.1 to 6.4.8), Thermodynamic functions in terms of grand partition function(6.7), Ideal gas(6.8), Gibbs's Paradox Inclusive Sackur-Tetrode equation(6.9), The equipartition theorem(6.10). **Bose Einstein and Fermi Dirac Distributions :** Symmetry of wave functions(8.1), the Quantum Distribution functions(8.2), the Boltzmann limit of Boson and Fermions Gases(8.3), Evaluation of the Partition function(8.4), Partition function for Diatomic Molecules(8.5) ((a) translation partition function (b) rotational partition function (c) vibration partition function (d)electronic partition function), Equation of state for an Ideal gas(8.6), The quantum mechanical Para magnetic susceptibility(8.7), problems		
III	**SOLID STATE PHYSICS :** **Free Electron Theory of Metal :** Thermal conductivity of metals(6.1.2), The F.D. distribution function(6.3), The Sommerfield Model(6.4), Density of states(6.4.1), The free electron gas at 0◦ K(6.4.2), Energy of electron at 0◦ K(6.4.2), The electron heat capacity(6.5), The Sommerfield Theory of conduction in metals(6.6), The Hall coefficient(6.6.1). **Application to Plasmons, Polaritons and Polarons** : (**Note: Qualitative description of dielectric constant should be given equation 10.45 to 10.49**)Application to Plasma(10.7), Plasma oscillations(10.7.1), Transverse optical mode in plasma(10.7.2), Application to optical phonon modes in ionic crystals(10.8), The longitudinal optical mode(10.8.1), Transverse optical mode(10.8.2), The interaction of electromagnetic waves with optical modes(10.9).	1	33 %

Reference Books:

- Atomic and Molecular Spectra : Laser by Rajkumar, Kedar Nath & Ram Nath
- Fundamentals of Statistical Mechanics by B. B. Laud. New Age International Publisher
- Elements of Solid State Physics by J.P. Srivastava, PHI New Delhi 2003

Suggested Readings:

- Statistical Mechanics and Properties of Matter by E.S.R.Gopa 2. Solid State Physics by A. J. Dekker.
- Introduction to Solid State Physics by C. Kittle. 7th Edition, John Willy and Sons
- Molecular spectroscopy by Herz-Berg.

- Molecular spectroscopy by Banewell.

Online Resources:

1. https://www.smvdu.ac.in/images/stories/pdf/Academics/M.Sc_Physics/Final_Syllabus%20for%20all%20MSc%20Physics%20Programme%20at%20SoP.pdf
2. https://www.sxccal.edu/wp-content/uploads/2022/06/Solid-State-Physics-and-Atomic-and-Molecular-Physics.pdf
3. www.wikipedia.com
4. Swayam portal

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to relate different kind of molecular spectra and statistical. They will be able to explain various solid-state physics.
CO2	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results
CO3	Apply the various procedures and techniques for the experiments

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**		**1**			**1**				
CO2	**3**	**2**	**2**	**2**	**1**		**1**		**1**			
CO3	**3**	**2**	**1**			**1**			**2**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**3**
CO2													**3**	**2**
CO3													**2**	**1**

BPHY502PRA: - Practical Module-502

Credit: - 1.5

Practical / Activities:

LIST OF EXPERIMENTS

1) Refractive index 'μ 'by total internal Reflection method using Gauss eye piece

2) Resolving power of grating

3) To study absorption spectra of Iodine gas molecule

4) Newton's Ring (determination of R)

5) To study absorption spectra of liquid (KMnO4)

BPHY503DSC: - ELECTROMAGNETISM AND PLASMA PHYSICS(EMPP)

Course Objective:

a) Electromagnetism extends our understanding beyond classical mechanics because it introduces the concept of charge – a property we can observe in macroscopic objects and the smallest building blocks of matter.
b) Electromagnetism is the invisible hand that allows charged objects to interact with each other.

Credit: - 03

Unit	Content	Credit	Weightage
I	**Boundary Value Problems in Electrostatic Fields: Special Techniques** Laplace's Equation(3.1), Introduction(3.1.1), Laplace's Equation in one dimensions(3.1.2), Laplace's Equation in two dimensions(3.1.3), Laplace's Equation in three dimensions(3.1.4), Boundary conditions and Uniqueness theorems(3.1.5), The method of images(3.2), The classic image problem(3.2.1), Induced surface charge(3.2.2), Force and energy(3.2.3), other image problems(3.2.4), Separation of variables(3.3), Cartesian Coordinates(3.3.1), Spherical coordinates(3.3.2), Multipole Expansion(3.4), Approximate Potential at large distances(3.4.1), The monopole and dipole terms(3.4.2), Origin of Coordinates in Multipole Expansions(3.4.3).	**15**	**33%**

II	**ELECTROMAGNETICS** **Electromagnetic Induction** Faraday's law(7.2.1), The Induced Electric Field(7.2.2), Maxwell's Equation : Electrodynamics before Maxwell(7.3.1), How Maxwell fixed Ampere's Law(7.3.2), Maxwell's Equations(7.3.3), The Potential Formulation : Scalar and Vector Potentials(10.1.1), Gauge Transformations(10.1.2), Coulomb Gauge and Lorentz Gauge(10.1.3) **Electromagnetic Waves** Electromagnetic Waves in Vacuum: The Wave equation for E and B(9.2.1), Energy and Momentum in Electromagnetic Waves(9.2.3), Electromagnetic Waves in Matter: Propagation in Linear Media(9.3.1), Electromagnetic Waves in conductors(9.4.1), And The frequency dependence of permittivity(9.4.3).	**15**	**33%**
III	**PLASMA PHYSICS** **Characteristics of a Plasma in a Magnetic field** Description of plasma as a gas mixture(3.1), Properties of plasma in magnetic field(3.2), Force on plasma in magnetic field(3.3), Current in Magnetised Plasma(3.4), Diffusion in a Magnetic field(3.5), Collisions in fully ionized magneto-plasma(3.6), Pinch Effect(3.7), Oscillations and waves in the plasma(3.8), Plasma frequency(3.8.1), Maxwell's equation in a homogenous plasma(3.8.2), Electromagnetic or Transverse Oscillations(3.8.3), Electrostatic or Longitudinal oscillations(3.8.4), Oscillations of the plasma(3.8.5), Hydromagnetic waves(3.8.6), Resonances and cut-offs or reflection points(3.8.7). **Applications of Plasma** Controlled Thermonuclear Reactions(7.1), Lawson criterion(7.1.1), The Coulomb Barrier(7.1.2), Heating and Confinement of the Plasma(7.1.3), Radiation loss of energy(7.1.4), Magnetohydrodymic conversion of energy(7.2), Plasma propulsion(7.3), Other plasma devices(7.4).	**15**	**34%**

Reference Books:

a) Introduction to Electrodynamics by David J. Griffths. 3 rd EditionPearson Education Asia.

b) Electromagnetics by B. B. Laud, 2nd Edition, Wiley Eastern Ltd.

c) Elements of Plasma Physics by S. N. Goswami New Central Book Agency (P). Ltd. Calcutta.

Suggested Readings:

a) Introduction to Plasma Physics by F.F.Chen. Plenum Press.

b) Plasma Physics by S. N. Sen., Pragati Prakashan, Meerut

Online Resources:

a) https://youtu.be/7cuuCj1btcU

b) https://youtu.be/YounWzEh0LA

Course Outcomes: At the end of the course, students shall be able to

CO1	Electromagnetism has important scientific and technological applications.
CO2	It is used in many electrical appliances to generate desired magnetic fields.
CO3	It is even used in a electric generator to produce magnetic fields for electromagnetic induction to occur.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**			**2**		**1**	**1**			
CO2	**3**	**2**	**2**	**1**		**1**		**2**				
CO3	**1**	**3**	**1**		**2**		**2**		**2**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**1**	**3**
CO2													**2**	**2**
CO3													**3**	**2**

BPHY503PRA: - Practical Module-503

Credit: - 1.5

Practical / Activities:

LIST OF EXPERIMENTS

1) Comparison of capacity (C1/C2) using method of mixture
2) Measurement of frequency f and phase difference 'θ' of a.c. wave using CRO
3) Calibration of magnetic field
4) Determination of M and H using Deflection and Vibrational Magnetometer
5) e/m Thomson method

BPHY504DSC: - ELECTRONICS

Course Objective:

The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include Principle of duality, different type of bridge, Karnaugh Maps and its Don't Care Conditions, Multiplexer, Demultiplexer, Basic Transistor Amplifiers, Multistage Amplifiers, Principle of Feedback Amplifiers & its Feedback, some Transistor Oscillators.

Credit: - 03

Unit	Content	Credit	Weightage
I	**1.1. Network Transformations**	1	33 %
	Principle of duality(1.3), Reduction of Complicated network(1.4), Conversions between T and π sections(1.5), The bridged-T network(1.6), The Lattice Network(1.7), The Reciprocity theorem(1.9), The compensation theorem(1.12), Driving point impedance, transfer impedance(1.14), The parallel-T network(1.17).		
	1.2. Digital Electronics		
	Simplification using Karnaugh Maps, Don't Care Conditions, BCD-to7 Segment Decoder, Digital Comparator, Multiplexer, Demultiplexer.		
II	**2.1. Basic Transistor Amplifiers**	1	34 %
	Current and Voltage amplifiers(9.10), Common Emitter Amplifiers with Emitter Resistor(9.11), Simplified Common Emitter Hybrid		

	Model(9.12), Effect of An Emitter Bypass Capacitor in low frequency Response(9.13).		
	2.2. Multistage Amplifiers		
	Multistage Transistor Amplifiers(10.1), R-C- coupled Amplifiers(10.2), Transformer Coupled Amplifiers(10.3) and Direct coupled Amplifiers(10.4), Effect of cascading on Band width(10.5).		
III	**3.1. Feedback Amplifier**	1	33%
	Feedback(11.1), Principle of Feedback Amplifiers(11.2), Advantages of Negative Feedback(11.3), Reasons for Negative Feedback(11.4).		
	3.2. Transistor Oscillators (Sinusoidal)		
	Tuned Collector Oscillators(14.1), Hartley Oscillator(14.4), Colpitt's Oscillators (Circuit operation and alternative treatment only)(14.5), Phase Shift oscillator(14.6), R-C- Oscillator(14.6.1), Wien Bridge Oscillator(14.6.2), Crystal Oscillator(14.7).		

Reference Books:

- Networks, Lines and Fields by J. D.Ryder. Pretice Hall.
- Hand Book of Electronics by Gupta and Kumar. 30th revised Edition 2002.

Suggested Readings:

- Fundamentals of electronics. Book 2, Amplifiers, analysis and design, Thomas F. Schubert, Jr. and Ernest M. Kim.
- "Transistor Theory and Circuits Made Simple" by Harvey Pollack
- Evaluating Feedback in Amplifiers and Oscillators: Theory, Design and Analogue Applications: No. 4 (Communications Systems, Techniques & Applications S.)

Online Resources:

- https://www.allaboutcircuits.com/textbook/semiconductors/chpt-4/feedback/

- https://www.electronics-tutorials.ws/
- www.youtube.com
- https://www.allaboutcircuits.com/textbook/semiconductors/chpt-4/feedback/

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to known the principal of Duality, different types of Bridge Networks, The Reciprocity theorem, The compensation theorem, Karnaugh Maps, Don't Care Conditions, BCD-to7 Segment Decoder, Digital Comparator, Multiplexer, Demultiplexer. They we knowledge about Basic Transistor Amplifier like Current and Voltage amplifiers, Common Emitter Amplifiers with Emitter Resistor, Effect of An Emitter Bypass Capacitor in low frequency Response, also learn the different types of Multistage Amplifiers, Principle of Feedback Amplifiers, Advantages of Negative Feedback, Reasons for Negative Feedback, get knowledge about Transistor Oscillators like Tuned Collector Oscillators, Hartley Oscillator, Colpitt's Oscillators , Phase Shift oscillator, R-C- Oscillator, Wien Bridge Oscillator, Crystal Oscillator.
CO2	They develop their basic communication & Computer coding skills through working in groups in performing the laboratory experiments and by interpreting the results.
CO3	They also develop their basics instrumental knowledge with experiment skill and active their digital electronic calculation skill. They also get plasma related knowledge.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**1**	**2**		**1**		**1**				
CO2	**2**	**3**	**2**		**1**		**2**		**1**			
CO3	**1**	**2**	**3**	**1**		**2**			**1**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**3**
CO2													**1**	**3**
CO3													**2**	**3**

BPHY504PRA: - Practical Module-504

Credit: - 1.5

Practical / Activities:

LIST OF EXPERIMENTS

1) A study of transistorized Hartley Oscillator using CRO/Wave meter
2) I/P and O/P impedance of a R-C CE amplifier at different frequency using VTVM/CRO
3) A study of Transformer coupled Amplifier using VTVM/CRO (voltage gain frequency response and band width)
4) Diac characteristics
5) Characteristic of SCR

BPHY501SE: - INSTRUMENTS

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics Michelson's interferometer, babinet compensator its construction, principal, working, uses, applications, then learn about C.R.O and G.M. Counter. Some industry relevant topics are also covered under which basic concepts are taught.

Credit: - 2

Unit	Content	Credit	Weightage
I	**Michelson's Interferometer**	1	50 %
	Principle(15.7), Construction, Working, Circular fringes ,Localized fringes, White light fringes, Visibility of fringes(15.7.1 to 15.7.7), Applications of Michelson Interferometer(15.8),Measurement of wavelength, Determination of difference in the wavelengths of two waves, Thickness of a thin transparent sheet, Determination of the refractive index(15.8.1 to 15.8.4).		
	Babinet Compensator		
	Construction(20.21.1), Production of polarized light(20.21.2), analysis of elliptically polarized light(20.21.3).		
II	**C.R.O.**	1	50 %

	CR Tube(3.5), Electrostatic Deflection Sensitivity(3.5.1), Magnetic Deflection Sensitivity(3.5.2), CRT connections(3.5.3), Uses of C.R.O(3.5.4).		
	G. M. Counter		
	Principle, Construction, Working, Dead time, recovery time, True counting rate, Efficiency of counting, Quenching of G M counter, Operation and testing of G.M. counter, Plateau, Applications of GMC, Advantages and limitations of GMC.		

Reference Books:

- A textbook of Optics by Dr. N. Subrahmanyam, Brijlal and Dr. M.N. Avadhanulu, S. Chand & Co. (for M.I and B.C.)
- Hand Book of Electronics by Gupta and Kumar. 30th revised Edition 2002. (For CRO)
- Refresher Course in Physics Vol-III, S. Chand & Co. Ltd. (7 th edition-2006) (for GMC, Ch-28)6. Space Plasma Physics, A C Das Narosa Pub

Suggested Readings:

- A textbook of Optics by Dr. N. Subrahmanyam, Brijlal and Dr. M.N. Avadhanulu, S. Chand & Co. (for M.I and B.C.)

Online Resources:

1. https://en.wikipedia.org/wiki/Michelson_interferometer
2. https://www.niser.ac.in/sps/sites/default/files/basic_page/Michelson%20Interferometer_P744%20-%20Optics.pdf
3. https://www.rp-photonics.com/babinet_soleil_compensators.html
4. https://www.holmarc.com/babinet_compensator.php
5. https://www.elprocus.com/cro-cathode-ray-oscilloscope-working-and-application/
6. https://en.wikipedia.org/wiki/Geiger_counter
7. https://byjus.com/physics/geiger-counter/

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to understand about Michelson's interferometer, babinet compensator its construction, principal, working, uses, applications.
CO2	The student understands about C.R.O. its uses and about G.M. counter principal, working, construction, applications, advantages and limitations.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**1**	**1**		**1**	**1**	**2**	**2**			
CO2	**2**	**2**	**2**	**1**	**1**	**2**		**2**	**1**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**3**
CO2													**1**	**3**

BPHY601DSC: - MATHEMATICAL PHYSICS, CLASSICAL MECHANICS & QUANTUM MECHANICS(MCQM-02)

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include some special functions in physics, variational principle: Lagrange's and Hamiltonian equations, exactly soluble eigen value problems. Some industry relevant topics are also covered under which basic concepts are taught.

Credit: - 03

Unit	Content	Credit	Weightage
I	**Some special functions in Physics** Legendre differential equation(6.1), Generating Function of Legendre Polynomial(6.2), Rodriguez's formula for Legendre Polynomial(6.3), Orthogonal properties of Legendre Polynomial(6.4), Hermite differential equation and Hermite Polynomial(6.11), Generating function of Hermite	1	33 %

	Polynomial(6.12), Recurrence formula for Hermite Polynomial(6.13), Rodriguez's formula for Hermite Polynomial(6.14).		
II	**Variational principle : Lagrange's and Hamiltons equations** Configuration space(11.1), Some techniques of calculus of variation(11.2), Applications of the Variational principle(11.3), Hamilton's principle(11.4). Equivalence of Lagrange's and Newton's equations(11.5), Advantages of the Lagrangian formulation-Electromechanical analogies(11.6), Lagrange's undetermined multipliers(11.7), Lagrange's equation for non-holononiic system(11.8), Application of the Lagrangian method of undetermined multipliers(11.9), Hamilton's equations of motion(11.10), Some applications of the Hamiltonian formulation(11.11), Phase space(11.12), Comments on the Hamiltonian formulation(11.13).	1	34 %
III	**Exactly soluble Eigenvalue problems** Introduction, the simple harmonic oscillator, the Schrödinger equation and energy eigenvalues(4.1), the energy eigenfunctions(4.2), properties of stationary states(4.3), the abstract operator method(4.4), Coherent states(4.5), the angular momentum operators(4.6), the eigenvalue equation for L^2, separation of variables(4.7), admissibility conditions on solutions, eigenvalues(4.8), the eigenfunctions, Spherical harmonics(4.9), Physical interpretation(4.10), Parity(4.11), Angular momentum in stationary states of systems with spherical symmetry(4.12)	1	33 %

Reference Books:

- Mathematical Physics by P. K. Chatopadhyay. Wiley East Ltd.
- Mathematical Methods for Physicists by G. Arfken, Academic Press
- Mathematical Methods in the Physical Sciences by Mary L. Boas, Wiley India Pvt. Ltd.
- Introduction to classical mechanics by Takawale and Puranic. THM Publication.
- Classical Mechanics, by Goldstein. Narosa Publishing House, New Delhi.
- Classical Mechanics by Yasvant Waghmare.
- Classical Mechanics by N.C.Rana and P.S.Joag, THM Publication.
- Quantum Mechanics by Satya Prakash, Pragati Prakashan (Reprint-2008)

- A text book of Quantum Mechanics by P.M. Methews and K. Venkateshan, THM Publication.
- Quantum Mechanics by Ghatak and Loknathan, The Macmillan company of India Limited.
- Quantum Mechanics by John, L. Powell and B. Crasemann.
- Quantum Mechanics by Schiff.
- Quantum Mechanics by Fschwabi, Narosa Publishing House, New Delhi.

Suggested Readings:

- Mathematical Physics by P. K. Chatopadhyay. Wiley East Ltd.
- Mathematical Physics by B.D.Gupta.
- Mathematical Physics by H.K.Dass.
- A text book of Quantum Mechanics by P.M. Methews and K. Venkateshan, THM Publication.
- Quantum Mechanics by Ghatak and Loknathan, The Macmillan company of India Limited.

Online Resources:

1. https://byjus.com/maths/differential-equation/
2. https://en.wikipedia.org/wiki/Differential_equation
3. https://www.cuemath.com/calculus/differential-equation/
4. https://www.cuemath.com/calculus/second-order-differential-equation/
5. https://www.mathsisfun.com/calculus/differential-equations-second-order.html
6. https://tutorial.math.lamar.edu/classes/de/introsecondorder.aspx
7. https://en.wikipedia.org/wiki/Lagrangian_mechanics#:~:text=In%20physics%2C%20Lagrangian%20mechanics%20is,his%201788%20work%2C%20M%C3%A9canique%20analytique.
8. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Statistical_Mechanics/Advanced_Statistical_Mechanics/Classical_microstates%2C_Newtonian%2C_Lagrangian_and_Hamiltonian_mechanics/The_Lagrangian_formulation_of_classical_mechanics
9. http://www.unishivaji.ac.in/uploads/distedu/SIM2013/M.%20Sc.%20Maths%20Classifical%20Mechanics/Chapter%20I.pdf

10. https://brilliant.org/wiki/lagrangian-formulation-of-mechanics/
11. https://www.brown.edu/Departments/Engineering/Courses/En4/notes_old/RigidKinematics/rigkin.htm#:~:text=Characteristics%20of%20rigid%20body%20motion,a%20rotation%20about%20the%20point.
12. https://www.geeksforgeeks.org/motion-of-a-rigid-body/
13. https://byjus.com/physics/rigid-body-and-rigid-body-dynamics/
14. https://nios.ac.in/media/documents/SrSec312NEW/312_Physics_Eng/312_Physics_Eng_Lesson7.pdf
15. https://qm1.quantumtinkerer.tudelft.nl/9_formalism/#:~:text=The%20formalism%20of%20quantum%20mechanics%20is%20built%20upon%20two%20fundamental,%2C%20%7C%CE%A8%E2%9F%A9%E2%88%88H.
16. https://en.wikipedia.org/wiki/Mathematical_formulation_of_quantum_mechanics
17. https://math.mit.edu/~dav/quantum.pdf
18. http://www.damtp.cam.ac.uk/user/tong/qm/qm3.pdf

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will learn about Legendre differential equation, its generating functions, Rodriguez's formula, Hermite differential equation, its generating function, its recurrence formula, and Rodriguez's formula.
CO2	The student learns about different types of lagrangian formulation in advance, Hamiltonian equation of motion, its application, phase space, configuration space, some tequnics of calculus of variation, application of variational principle.
CO3	In this section student will learn about simple harmonic oscillator, Schrodinger equation and energy eigenvalues, energy eigenfunctions, property of stationary state, abstract operator method, coherent state, angular momentum operator, eigenvalue equation for L^2 spherical harmonics, physical interpretation, parity, angular momentum in stationary states of systems with spherical symmetry.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**2**					**1**			
CO2	**3**	**2**	**1**		**2**		**2**	**1**	**2**			
CO3	**2**	**3**	**2**	**1**		**2**			**1**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**2**	**1**
CO3													**2**	**3**

BPHY601PRA: - Practical Module-601

Credit: - 1.5

Practical / Activities:

LIST OF EXPERIMENTS

1) Young modulus 'y' by Koening method.
2) Optical Lever
3) Viscosity by Log decrement
4) I-V Characteristic of solar cell and determination of F.F, V.F.& n.
5) G.M. Counter (Comparison of Intensities)

BPHY602DSC: - NUCLEAR PHYSICS(NP)

Course Objective:

(i) The objective of the course to impart o impart knowledge about basic nuclear physics properties and nuclear models for understanding of related reaction dynamics. Some industry relevant topics are also covered under which basic concepts are taught.

Credit: 03

Unit	Content	Credit	Weightage
I	**Alpha Rays: Spectra and Decay, Beta Rays: Spectra and Decay** Range of alpha particles (4.II.1), Disintegration energy of the spontaneous alpha decay (4.II.2), Alpha decay paradox - barrier penetration (4.II.3). Introduction(4.III.1), Continuous Beta ray spectrum - difficulties encountered to understand it(4.III.2), Pauli's Neutrino	1	33 %

	Hypothesis(4.III.3), Fermi's theory of Beta decay(4.III.4), the detection of neutrino(4.III.5), Parity non-conservation in Beta decay(4.III.6).		
II	**Gamma-Ray Emission , The liquid drop model of the nucleus** Introduction (4.IV.1), Gamma-ray emission – selection rules (4.IV.2), Internal conversion (4.IV.3), Nuclear isomerism (4.IV.4) Introduction(5.1), Binding energies of nuclei : plot of B/A against A(5.2), Weizsacher's semi empirical mass formula Mass parabolas(5.3): prediction of stability against Beta decay for members of an isobaric family(5.4), Stability limits against spontaneous fission(5.5), Barrier penetration - decay probabilities for spontaneous fission(5.6), Nucleon emission(5.7).	1	34 %
III	**Nuclear Energy, Elementary Particles** Introduction(6.1), Neutron Induced Fission(6.2), Asymmetrical Fission-Mass Yield(6.3), Emission of Delayed Neutrons by Fission Fragments(6.4), Energy Released in the Fission of U^{235}(6.5), Fission of Lighter Nuclei(6.6), Fission Chain Reaction(6.7), neutron cycle in a Thermal Nuclear Reactor(6.8), Nuclear Reactors(6.9). Leptons (14.4), Hadrons(14.5), Elementary particle quantum numbers(14.6), Isospin(14.7), Symmetries and- conservation principles(14.8), Quarks(14.9), fundamental Interactions(14.10).	1	33 %

Reference Books:

- Nuclear Physics by S. B. Patel, Willey Eastern Ltd.
- Concept of Modern Physics by A.Beiser, 5th edition, McGraw-Hill.
- Introduction to Nuclear Physics by H.Enge, Addison Wesley

Suggested Readings:

- Nuclear Physics by D. C. Tayal, Himalaya Publisher
- Nuclear Physics by Irving Kaplan

Online Resources:

- https://www.smvdu.ac.in/images/stories/pdf/Academics/M.Sc_Physics/Final_Syllabus%20for%20all%20MSc%20Physics%20Programme%20at%20SoP.pdf
- https://www.sxccal.edu/wp-content/uploads/2022/06/nuclear-physics.pdf

- www.wikipedia.com
- Swayam portal

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to relate the beta decays. They will be able to explain various reaction equations and related Q values and energy of beta particles.
CO2	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results
CO3	Apply the various procedures and techniques for the experiments

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**1**		**1**			**1**	**1**			
CO2	**2**	**3**	**3**	**1**		**1**			**2**			
CO3	**1**	**2**	**2**		**2**			**2**				

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**1**	**3**
CO2													**2**	**1**
CO3													**2**	**2**

BPHY602PRA: - Practical Module-602

Credit: - 1.5

Practical / Activities:

LIST OF EXPERIMENTS

- To determine air gape ‘t’ between two plates of F.P. Etalon and determination of wavelength ‘ λ ’ of monochromatic light
- Temperature of Flame
- Newton’s Ring (Determination of Wave length of Light)

- To determine λ and dλ of sodium light using Michelson interferometer
- Determination of wavelength of light by Lloyd's mirror.

BPHY603DSC: - Statistical Mechanics, Solid State Physics, Optics

Course Objective:

a) The course aims to provide a formal understanding of the underlying energy distribution of systems containing many particles.
b) The consequences of the distribution are related to classical descriptions of thermodynamics and the behavior of electrons in solids.

Credit: - 04

Unit	Content	Credit	Weightage
I	**Macroscopic and Microscopic states** Macroscopic States, Microscopic States, Phase Space, μ-Space, τ-Space, Postulate of equal a priori probability. **Statistical Ensembles** Micro canonical ensemble, Canonical ensemble, Alternative method for the derivation of canonical distribution, Mean value and Fluctuations, Grand Canonical Ensemble, Alternative derivation of Grand Canonical Distribution, Fluctuations in the number of particle of a system in a grand canonical ensemble, Reduction of a Gibb's distribution to Maxwell's and Boltzmann distribution, Barometric formula, Experimental verification of the Boltzmann's distribution	15	33%
II	**Superconductivity** Phenomena without observable Quantization, Zero resistance and persistent currents, Perfect Diamagnetisms : Meissner Effect, London Equation, Critical Field : Type I and Type II super conductors, BCS Theory : A qualitative approach, Cooper pair formation, BCS ground state, Important predictions of the BCS theory and comparison with experiments, Critical temperature, Ginzburg-Landau Theory, Magnetic	15	34%

	flux Quantization, Coherence Length, Type-II superconductivity, Josephson tunneling, Applications.		
II	**HOLOGRAPHY AND FIBER OPTICS** **Holography** Introduction, Principle of Holography, Theory, Important properties of Hologram, Advances, Applications. **Fiber Optics** Introduction, Optical Fiber, Critical angle of Propagation, Modes of Propagation, Acceptance angle, Fraction of refractive index, Numerical aperture, Types of optical fiber, Normalized frequency, Pulse dispersion, Attenuation, Application, Fiber optic Communication system, Advantages.	15	34%

Reference Books:

a) Fundamentals of Statistical Mechanics by B. B. Laud. New Age International Publisher

b) Statistical Mechanics and Properties of Matter by E.S.R.Gopa

Suggested Readings:

a) Solid State Physics by Saxena. Pragati Prakashan.

b) Solid State Physics by C. M. Kachhawa

Online Resources:

c) https://youtu.be/afzahVskyeY

d) https://youtu.be/BQG0EuiH6yw

Course Outcomes: At the end of the course, students shall be able to

CO1	Apply the definitions and results of statistical mechanics to deduce physical properties of the systems studied in the lectures and other systems of similar complexity, drawing in part on your knowledge of the microstates of simple systems from core courses in quantum mechanics and solid-state physics.
CO2	Calculate the density of states based on the Fermi statistics.
CO3	Understand the principles of superconductivity

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**3**		**1**		**1**		**2**			
CO2	**3**	**3**	**3**	**1**					**1**			
CO3	**3**	**3**	**3**		**2**	**1**		**1**				

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**2**	**1**
CO3													**2**	**1**

BPHY603PRA: - Practical Module-603

Credit: - 1.5

Practical / Activities:

LIST OF EXPERIMENTS

1) Mutual induction ‘M’ of two coils using B.G.
2) High resistance ‘R’ using leakage method
3) Maxwell’s Bridge
4) Solenoid Inductor
5) Susceptibility of FeCl3 using Quienk’s method

BPHY604DSC: - Electronics And C-Programming

Course Objective:

The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics include Wave form Amplitude modulated voltage, Frequency Modulation, Frequency

deviation and carrier swing, Modulation index. Classification of Photoelectric devices, Declaration of Variables, declaring a Variable as Constant, declaring a Variable as Volatile, Introduce different types of Operators.

Credit: - 03

Unit	Content	Credit	Weightage
I	**1.1.Modulation** Introduction(20.1), Expression for Amplitude modulated voltage(20.2), Wave form Amplitude modulated voltage(20.3), Side band produced in Amplitude modulated wave(20.4), Modulated power output(20.5), Frequency Modulation(20.6), Frequency deviation and carrier swing(20.7), Modulation index(20.8-20.8.1 to 20.8.3), Expression for frequency modulated wave(20.9), Phase modulation(20.10). **1.2. Regulated DC Power Supply** Transistor Series voltage Regulator(25.2), Negative Feedback Voltage Regulator(25.3), Transistor Shunt Regulator(25.4), Transistor Current Regulator(25.5), Glow-tube Voltage regulator(25.6).	1	33 %
II	**2.1. Photo Electric Devices and Thyristors** Classification of Photoelectric devices(27.1), Photoconductive cells(27.10), Photovoltaic cells(27.11), SCR(26.1-16.1.1 to 26.1.4), Triac(26.4) and Diac(26.5). **2.2. Constants, Variables & Data Types** Introduction(2.1), Character Set(2.2), C Tokens(2.3), Keywords and Identifiers(2.4), Constants(2.5), Variables(2.6), Data Types(2.7), Declaration of Variables(2.8), Declaration of Storage Class(2.9), Assigning Values of Variables(2.10), Defining Symbolic Constants(2.11), Declaring a Variable as Constant(2.12), Declaring a Variable as Volatile(2.13), Overflow and Underflow of Data(2.14).	1	34 %
III	**3.1. Operators and Expressions** Introduction(3.1), Operators: Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, Bitwise, Special(3.2-3.9). Arithmetic Expressions(3.10), Evolution of Expressions(3.11), Precedence of Arithmetic Operators(3.12), Some Computational Problems(3.13), Type Conversion in	1	33%

	Expressions(3.14), Operator Precedence and Associatively(3.15), Mathematical Functions(3.16).		
	3.2. Managing Input and Output Operations		
	Introduction(4.1), Reading and writing a Character(4.2-4.3), Formatted Input and Output(4.4-4.5).		

Reference Books:

- Electronics and Radio Engineering by M. L. Gupta. 9 th Enlarged Edition reprint 2002. Dhanpat Rai Publication
- Programming in ANSI C by E. Balaguruswami (THM) (3rd Edition)

Suggested Readings:

- Electronic Devices and circuits – An introduction by Allen Mottershead
- The complete reference C++ : Herbert Schildt, TMH.

Online Resources:

- https://www.electronics-tutorials.ws/
- www.youtube.com
- https://www.tutorialspoint.com/cprogramming/index.htm
- https://electricala2z.com/electronics/photoelectric-devices-and-their-applications/

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to known different kind of modulation, basic concept of C language like Constants, Variables & Data Types, Operators and Expressions.
CO2	They develop their basic communication & Computer coding skills through working in groups in performing the laboratory experiments and by interpreting the results.
CO3	They also develop their basics instrumental knowledge with experiment skill and active their digital electronic calculation skill. They also get plasma related knowledge.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**3**			**1**			**2**			
CO2	**2**	**1**	**3**	**1**		**2**	**1**					
CO3	**2**	**1**	**3**	**2**	**1**			**1**	**2**			

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**3**
CO2													**2**	**3**
CO3													**1**	**3**

BPHY604PRA: - Practical Module-604

Credit: - 1.5

Practical / Activities:

LIST OF EXPERIMENTS

1. A study of transistorized Colpitt's oscillator using CRO/Wave meter
2. Negative Feedback Amplifier
3. A study of Half subtractor and Full subtractor.
4. To determine frequency of AFO using Wien bridge
5. Use of Computer- Programming in 'c' language.

BPHY602SE: - ATMOSPHERIC SCIENCE

Course Objective:

(i) The objective of the course to impart fundamental knowledge about some selected aspects of physics. The topics introduction and chemistry of earth's atmosphere, and atmospheric aerosols. Some industry relevant topics are also covered under which basic concepts are taught.

Credit: - 02

Unit	Content	Credit	Weightage
I	**Introduction and Chemistry of Earth's atmosphere** Evolution of earth's atmosphere, Nitrogen, hydrogen halogen, sulfur, carbon-containing compounds in the atmosphere, ozone and neutral chemistry, chemical and photochemical processes, Chemical and dynamical life time of atmospheric constituent. Eddy diffusion and Turbulence.	1	50 %
II	**Atmospheric aerosols** Concentration and size, sources, and transformation, Chemical composition, transport and sinks, residence times of aerosols, geographical distribution and atmospheric effects, Air Pollution: Sources of anthropogenic pollution, Emission Inventory, Atmospheric effects- smog, visibility. Measurements of Particulate matters, SOx, NOx and CO	1	50 %

Reference Books:

- Introduction to Atmospheric Chemistry by P.V. Hobbs
- Atmospheric Chemistry and Physics : From Air Pollution to Climate Change by John H. Seinfeld, Spyros N. Pandis
- Chemistry of the Upper and Lower Atmosphere by Barbara J. Finlayson-Pitts, Jr., James N. Pitts.
- Chemistry of Atmospheres by Richard P. Wayne.
- Basic Physical Chemistry for Atmospheric Sciences by P.V. Hobbs

Suggested Readings:

- Introduction to Atmospheric Chemistry by P.V. Hobbs
- Atmospheric Chemistry and Physics : From Air Pollution to Climate Change by John H. Seinfeld, Spyros N. Pandis

Online Resources:

1. https://www.encyclopedia.com/earth-and-environment/atmosphere-and-weather/atmospheric-and-space-sciences-atmosphere/atmospheric-

chemistry#:~:text=The%20atmosphere%20is%20a%20mixture,that%20has%20altered%20atmospheric%20chemistry.
2. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/atmospheric-chemistry
3. https://www.nasa.gov/centers/langley/news/factsheets/Aerosols.html
4. https://www.sciencedirect.com/topics/chemistry/atmospheric-aerosol
5. https://www.nature.com/scitable/knowledge/library/aerosols-and-their-relation-to-global-climate-102215345/
6. http://irina.eas.gatech.edu/ATOC3500_Fall1998/Lecture25.pdf
7. https://en.wikipedia.org/wiki/Aerosol

Course Outcomes: At the end of the course, students shall be able to

CO1	The student will be able to understand about evolution of earth's atmosphere, different kind of gases and carbon containing compounds in atmosphere, ozone and neutral chemistry, chemical and photochemical processes, eddy diffusion and turbulence.
CO2	The student understands about concentration and size, sources and transformation chemical composition, transport and sinks, residence time of aerosols, geographic distribution and atmospheric effect, air pollution, sources of anthropogenic pollution, emission inventory, atmospheric effects- smog, visibility, measurement of particulate matters and knowledge about Sox, NOx, and CO.

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**3**	**1**		**1**		**2**	**2**			
CO2	**2**	**2**	**3**		**1**		**1**					

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**2**
CO2													**3**	**1**

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