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National Education Policy-2020

Common Minimum Syllabus for Uttarakhand State Universities and Colleges

Four Year Undergraduate Programme- FYUP/Honours Programme/Master in Science

PROPOSED STRUCTURE FOR FYUP/MASTER'S PHYSICS SYLLABUS

DEPARTMENT OF PHYSICS

Semester-wise List and Titles of the Papers for B.Sc. Degree in Physics					
Year	**Sem.**	**Course Code**	**Paper Title**	**Theory/ Practical**	**Credits**
Undergraduate Certificate Course in Physics					
FIRS TYEAR	I	DSC A1	Mechanics and Theory of Oscillations	Theory	3
		DSC Pr1	Mechanics and Theory of Oscillations Lab	Practical	1
		GE P1	Basic Physics I	Theory + Tutorial	3+1
		SEC P1	Basic Instrumentation Skills I	Theory	02
	II	DSC A2	Electricity and Magnetism	Theory	3
		DSC Pr2	Electricity and Magnetism Lab	Practical	1
		GE P2	Basic Physics II	Theory + Tutorial	3+1
		SEC P2	Basic Instrumentation Skills II	Theory	02
Diploma in Applied Physics					
SECOND YEAR	III	DSC A3	Thermodynamics and Statistical Physics	Theory	3
		DSC Pr3	Thermodynamics and Statistical Physics Lab	Practical	1
		DSE A1	Waves and Acoustics	Theory	3
		DSE Pr1	Waves and Acoustics Lab	Practical	1
		GE P3	Fundamental Mechanics	Theory + Tutorial	3+1
		SEC P3	Basic Instrumentation Skills III	Theory	(02)
	IV	DSC A4	Optics	Theory	3
		DSC Pr4	Optics Lab	Practical	1
		DSE A2	Solid State and Statistical Physics	Theory	3
		DSE Pr2	Solid State and Statistical Physics Lab	Practical	1
		GE P4	Basic Electricity and Magnetism	Theory + Tutorial	3+1
		SEC P4	Basic Instrumentation Skills IV	Theory	(02)
Bachelor of Science					
THIRD YEAR	V	DSC A5	Modern Physics	Theory	3
		DSC Pr5	Modern Physics Lab	Practical	1
		DSE A3	Basic Quantum Mechanics	Theory	3
		DSE Pr3	Basic Quantum Mechanics Lab	Practical	1
		GE P5	Basics of Heat Transfer	Theory + Tutorial	3+1

		SEC P5	Advanced Instrumentation and Measurement Techniques-I Or Electrical circuit network Skills - I	Theory	(02)
		IAPC	IAPC	-	04
	VI	DSC A6	Electronics	Theory	3
		DSC Pr6	Electronics Lab	Practical	1
		DSE A4	Special Theory of Relativity	Theory	3
		DSE Pr4	Special Theory of Relativity Lab	Practical	1
		DSE A5	Research Methodology in Physics	Theory + Tutorial	3+1
		GE P6	Basics of Digital Electronics	Theory + Tutorial	3+1
		SEC P6	Advanced Instrumentation and Measurement Techniques-II or Electrical circuit network Skills – II	Theory	2
		IAPC	IAPC	-	04

Semester-wise List and Titles of the Papers for M.Sc. Degree in Physics

Year	Sem.	Course Code	Paper Title	Theory/ Practical	Credits
			Major in Physics		
FOURTH YEAR	VII	DSC A7	Mathematical Physics	Theory	3
		DSE A6	Classical Mechanics	Theory	3
		DSE A7	Quantum Mechanics	Theory	3
		DSE A8	Communication Electronics	Theory	3
			Practical	Practical	4
		DSE A5	Research Methodology in Physics	Theory + Tutorial	3+1
		GE P7	Renewable Energy Resources	Theory + Tutorial	3+1
		GE P8	Radiation Physics	Theory + Tutorial	3+1
			Dissertation		(06)
	VIII	DSC A8	Electrodynamics	Theory	3
		DSE A9	Atomic and Molecular Physics	Theory	3
		DSE A10	Nuclear Physics	Theory	4
		DSE A11	Elementary Particle Physics	Theory	3
			Practical	Practical	4
		GE P9	Physics of Weather and Climate	Theory +	3+1

				Tutorial	
		GE P 10	Digital Electronics and Computer Architecture	Theory + Tutorial	3+1
			Dissertation		(06)
Master in Physics					
FIFTH YEAR	IX	DSC A9	Advanced Quantum Mechanics	Theory	3
		DSE A12	Plasma Physics	Theory	3
		DSE A13	Advanced Electronics-I/Astrophysics-I/ High Energy-I/Spectroscopy-I/Condensed Matter Physics-I	Theory	3
		DSE A14	Advanced Electronics-II/Astrophysics-II/ High Energy-II/Spectroscopy-II/ Condensed Matter Physics-II	Theory	3
			Practical	Practical	4
		GE P11	BIO physics/ Photonics-I	Theory + Tutorial	3+1
		GE P 12	Nanoscience and Nanotechnology	Theory + Tutorial	3+1
			Dissertation		(06)
	X	DSC A10	Solid State Physics	Theory	3
		DSE A15	Statistical Physics	Theory	3
		DSE A16	Advanced Electronics-III/Astrophysics-III/ High Energy-III/Spectroscopy-III/ Condensed Matter Physics-I	Theory	3
		DSE A17	Advanced Electronics-IV/Astrophysics-IV/ High Energy-IV/Spectroscopy-IV/ Condensed Matter Physics-II	Theory	3
			Practical	Practical	4
		GE P13	Medical Physics/ Photonics-II	Theory + Tutorial	3+1
		GE P 14	Basics of Astrophysics	Theory + Tutorial	3+1
			Dissertation		(06)

Abbreviations-
DSC-Discipline Specific Course; DSE- Discipline Specific Electives; GE-Generic Electives

Programme outcomes (POs):

Students having Degree in B.Sc. (with Physics) should have knowledge of different concepts and fundamentals of Physics and ability to apply this knowledge in various fields of academics and industry. They may pursue their future career in the field of academics, research and industry.

PO 1	1. Competence in the methods and techniques of calculations using Mechanics. 2. Students are expected to have hands-on experience to apply the theoretical knowledge tosolve practical problems.
PO2	1. Students are expected to have deep understanding of electricity and magnetism. 2. Student should be able to make basic electrical circuits and handle electrical instruments.
PO 3	1. Competence in the concepts of Thermodynamics. 2. Students are expected to have hands on experience in Thermal Physics Experiments.
PO 4	1. Knowledge of different concepts in Geometrical Optics. 2. Students are expected to have hands on experience of Experiments of GeometricalOptics
PO 5	1. Knowledge of basic concepts of optical instruments with their applications in technology 2. Students are expected to have an insight in handling electronic instruments.
PO 6	1. Comprehensive knowledge of Analog & Digital Principles and Applications. 2. Learn the integrated approach to analog electronic circuitry and digital electronics forR&D.

Programme specific outcomes (PSOs):
UG I Year /Undergraduate Certificate Course in Physics

After completing this certificate course, the student should have:

1. Acquired the basic knowledge of Mechanics, Electricity and Magnetism.
2. Hands-on experience to apply the theoretical knowledge to solve practical problems of basic physical phenomena. Student should be able to carry out experiments to understand the laws and concepts of Physics.
3. An insight in understanding electrical circuits and in handling electrical instruments.

Programme specific outcomes (PSOs):

UG II Year/ (Diploma in Applied Physics)

After completing this diploma course, the student should have

1. Knowledge of different concepts in Thermodynamics, and Geometrical Optics.
2. Knowledge of different aspects of Thermal Physics which serves as a basis for many physical systems used in industrial applications and deals with the physics and technology of Engines and Refrigerators.
3. A deeper insight in Ray Optics to understand the Physics of many optical instruments which are widely used in research and Industry, Optoelectronics, IT and communication devices, and in industrial instrumentation.

4. Knowledge of basic concepts of optical instruments with their applications in technology.

Programme specific outcomes (PSOs):
UG III Year / Bachelor of Science

After completing this degree course, the student should have:

PSO 1	1. Knowledge of Mechanics and basic properties of matter. 2. The course will empower him to apply his theoretical knowledge in various physical phenomena that occur in day-to-day life and he can use this scientific knowledge for the betterment of the society.
PSO2	1. Understanding of basic concepts related to Electricity and Magnetism. 2. Students should be proficient in designing and handling different electrical circuits
PSO3	1. Expertise in different aspects of Thermal Physics which serves as a basis for many physical systems used in industrial applications and deals with the physics and technology of Engines and Refrigerators.
PSO4	1. Proficient in the field of Optics which will increase his demand in research and industrial establishments engaged in activities involving optical instruments.
PSO5	1. Basic knowledge in the field of Modern physics, which have utmost importance at both undergraduate and graduate level.
PSO6	1. Comprehensive knowledge of Analog & Digital Principles and Applications. Learn the integrated approach to analog electronic circuitry and digital electronics for R&D.

SEMESTER-I

UNDERGRADUATE CERTIFICATE COURSE IN PHYSICS

DISCIPLINE SPECIFIC COURSE (DSC A1)		
Programme: ***Undergraduate Certificate Course in Physics***	**Year: I**	**Semester: I**

Subject: Physics

Course Title & Code	**Credits**	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical		
DSC A1: Mechanics and Theory of Oscillations	4	3	0	1	12th pass	Physics and Mathematics in 12th

Course Outcomes

1. Understanding of Vector Algebra and Vector Calculus.
2. Understanding the physical interpretation of gradient, divergence and curl.
3. Study of gravitational field and potential and understanding of Kepler's laws of Planetary motion.
4. Understanding of different frames of references and conservation laws.
5. Understand the dynamics of rigid body and concept of moment of inertia. Study of moment of inertia of different bodies and its applications.
6. Study the properties of matter, response of the classical systems to external forces and their elastic deformation and its applications.
7. Comprehend the dynamics of Fluid and concept of viscosity and surface tension along with its applications.
8. Comprehensive study of the theory of oscillations.

THEORY COMPONENT

Unit	**Topic**	**No. of Lectures**
Unit I	**Vectors Algebra** Vector algebra. Scalar and vector products, scalar and vector triple products Derivative of a vector with respect to a parameter, Line, surface and volume integral of a vector function. Del operator, gradient, divergence and curl,, applications of divergence and curl, Gauss divergence theorem, Stokes curl theorem and Green's theorem and their applications.	**05**

Unit II	**Gravitation field and potential** Gravitational field and potential, Gravitational potential energy, Gravitational field Intensity and potential due to a ring, a spherical shell, solid sphere and circular disc, inertial and gravitational mass, gravitational self-energy, gravitational self-energy of a uniform solid sphere, Inverse square law of forces, Kepler's laws of planetary motion.	**10**
Unit III	**Rotational and translational motion & Conservation Laws** Frames of reference, Concept of inertial and Non-inertial frames of references, Work energy theorem, Conservative and non-Conservative forces, Linear restoring force, Gradient of potential, Conservation of energy for the particle; Energy function, Concept of Centre of mass, translatory and rotatory motion, equation of motion for rotating rigid bodies, Angular momentum and torque, Laws of conservation of total energy, total linear momentum and total angular momentum along with their examples.	**10**
Unit IV	**Dynamics of rigid body and Moment of Inertia and Properties of matter** Moment of inertia, Theorem of parallel and perpendicular axes, Moment of inertia of a rod, lamina, ring, disc, spherical shell and solid sphere, kinetic energy of rotation, basic concepts about elasticity, Hook's law, Young's modulus, Bulk modulus, modulus of rigidity, poisson ratio, relation connecting various elastic constants, bending moment, Viscosity, Equation of continuity of flow, Bernoulli's theorem, Posieuille's formula, Stokes's law, Surface tension and its molecular interpretation.	**10**
Unit V	**Theory of Oscillations** Simple Harmonic Motion (S.H.M.),differential equation of S.H.M. and its solution ,energy of harmonic oscillator, Lissajous' figures for equal frequencies ratio and 2:1 frequencies ratio, damping forces, damped harmonic oscillator , differential equation of damped harmonic oscillator and its solution, power dissipation in a damped harmonic oscillator, relaxation time, quality factor, simple and compound pendulum, forced or driven harmonic oscillator, its differential equation, amplitude resonance, velocity resonance, sharpness of resonance.	**10**

Suggested Reading

1. R. Resnick and D. Hilliday : Physics Vol-I 2.Berkeley Physics Course : Mechanics Vol-I
2. R.P. Feynman, R.B.Lightan and M.Sand : The Feynman Lectures in Physics
3. D.S. Mathur : Mechanics
4. Murray Spiegel, Seymour Lipschutz, Dennis Spellman, "Schaum's Outline Series: Vector Analysis", McGraw Hill, 2017.
5. J. C. Upadhaya: Mechanics, S. Chand

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

PRACTICAL COMPONENT

1. To determine the Moment of Inertia of a Flywheel.
2. To determine g and velocity for a freely falling body using DigitalTiming Technique.
3. To determine Coefficient of Viscosity of water by Capillary FlowMethod (Poiseuille's method).
4. To determine the Young's Modulus of a Wire by Optical LeverMethod.
5. To determine the Young's Modulus by bending of beam.
6. To determine the Modulus of Rigidity of a Wire by Maxwell'sneedle.
7. To determine the elastic Constants of a wire by Searle's method.
8. To determine the coefficient of damping, relaxation time, and quality factor of damped simple harmonic motion using simple pendulum
9. To determine the value of g using Bar Pendulum.
10. To determine the value of g using Kater's Pendulum.
11. To determine Surface Tension.

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd.,London, 1962.
2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd.,2015.
3. Indu Prakash: Practical Physics
4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014.

Suggestive Digital Platforms / Web Links:

1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists byindividual Universities

GENERAL ELECTIVE (GE P1) -- BASIC PHYSICS-I						
Programme: **General Elective**				**Year: I**	**Semester: I**	
Course Title & Code	**Credits**	**Credit distribution of the course**			**Eligibility Criteria**	**Pre-requisite of the course**
		Lecture	**Tutorial**	**Practical**		
GE P1: Basic Physics I	4	3	1	0	12th pass	12th pass

Course Outcomes:

1. To understand the nature of forces and Newton's laws of motion.
2. To understand the rotational motion and angular variables.
3. To explore the concepts of work and energy.

Unit	Topic	No. of Lectures
Unit I	Rest and motion, Distance and displacement, Speed, velocity and acceleration, Motion in a straight line, Motion in a plane, Newton's first, second and third law of motion, Pseudo forces, Vector and scalars, Equality of vectors, addition and subtraction of vectors, Resolution of vectors, scalar and vector product of two vectors.	15
Unit II	Forces: Gravitational, electromagnetic, nuclear and weak forces, scope of classical physics, Friction as a component of central force, Kinetic and static frictions, Laws of Frictions, Friction at atomic levels.	` 15
Unit III	Circular Motion, angular variables, acceleration in a circular motion, Dynamics of a circular motion, Circular turnings and banking of roads, Centrifugal and centripetal forces, Effect of Earth's rotation on apparent weight.	15
Unit IV	Work and energy: Kinetic and potential energy, Work and work energy theorem, Calculation of work done, work energy theorem for a system of particles, Conservative and non-conservative forces, Gravitational potential energy, Conservation of mechanical energy, mass-energy equivalence.	15

Suggested Reading

1. H. C. Verma: Concepts of Physics
2. Robert Resnick Jearl Walker, David Halliday: Principles Of Physics
3. Halliday, Resnick , Walker: Fundamentals of Physics Extended(Old Edition)

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

SKILL ENHANCEMENT COURSE (SEC P1) - Basic Instrumentation Skills -I						
Programme: **Skill Enhancement Course**				**Year: I**	**Semester: I**	
Course Title & Code	**Credits**	**Credit distribution of the course**			**Eligibility Criteria**	**Pre-requisite of the course**
		Lecture/Theory	**Tutorial**	**hands on training**		
SEC P1: Basic Instrumentation Skills -I	2	1	0	2	12th pass	Physics and Mathematics in 12th

Course Outcomes:

1. To understand the basic gain of mechanical tools and errors.
2. To understand the hand on experience of different mechanical and electrical tools.
3. To gain the knowledge of electrical cables, and their specifications.

Unit	Topic (Theory / Experiments/hands on training)	No. of Lectures
Unit I	**Errors and Mechanical Tools:** Instruments accuracy, precision, sensitivity, resolution, range, least count of different instruments, Errors in measurements, Types of errors. Hand tools and their Uses: Identification, specifications, uses and maintenance of commonly used hand tools: Tweezers Screwdriver (Combination Set), Pliers, Wire Cutters, Wire Strippers, Crimping Tools, Sockets & Hex drivers, Clamps, Rotary Tools: Grinders, Portable Drill Machine, Small Hand Saws.	**15**
Unit II	**Electrical & Electronics Cables and Connector** Different type of electrical cables and their Specifications. Types of wires & cables, Standard wire gauge (SWG), Practice on different type of cable joint. Testing phase , neutral and Earth by tester and multi-meter and test lamp.	**15**

Suggested Reading

1. B L Theraja : A text book in Electrical Technology
2. M G Say: Performance and design of AC machines
3. S. Salivahanan & N. S. Kumar : Electronic Devices and Circuits, , 3rd Edn
4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
5. M. Lotia, Modern Basic Electrical & House Wiring Servicing

SEMESTER-II

UNDERGRADUATE CERTIFICATE COURSE IN PHYSICS

DISCIPLINE SPECIFIC COURSE (DSC A2)		
Programme: ***Undergraduate Certificate Course in Physics***	**Year: I**	**Semester: II**

Subject: Physics

Course Title & Code	**Credits**	**Credit distribution of the course**			**Eligibility Criteria**	**Pre-requisite of the course**
		Lecture	**Tutorial**	**Practical**		
DSC A2: Electricity and Magnetism	4	3	0	1	As per the university ordinance	As per the university ordinance

Course Outcomes:

1. Understanding of Electric Field and Potential. Evaluation of Electric Field and Potential for different types of charge distributions.
2. Study of Electric and Magnetic Fields in matter. Understand the concept of polarizability, Magnetization and Electric Displacement Vector.
3. Study of Steady and Varying electric currents.
4. Understanding of different aspects of alternating currents and its applications.
5. Understand the Magnetostatics, Lorentz Force and Energy stored in magnetic Field.
6. Comprehend the different aspects of Electromagnetic induction and its applications.

Theory Component

Unit	**Topic**	**No. of Lectures**
Unit I	**Electric field and potential** Coulomb law, Gauss' theory, its integral and differential forms, line integral of Electric field, Electric field and potential due to an arbitrary charge distribution. Electrostatic energy, energy stored in an Electric field. Electric field and potential due to long charged wire, Spherical shell, sphere, disc, dipole.	**08**
Unit II	**Electric and Magnetic fields in Matter** Moments of charge distributions, Polar and non-polar molecule, polarization vector, electric displacement vector, three electric vectors, dielectric susceptibility and permittivity, polarizability, Clausius-Mossotti relation. Magnetization, magnetic susceptibility, diamagnetic, paramagnetic and ferromagnetic substances, Hysteresis and B-H curve, Langevin's theories of Diamagnetism and paramagnetism, Weiss theory of ferromagnetism.	**10**

Unit III	**Electric Currents (Steady and Varying)** Current density, Equation of Continuity, Ohm's law and electrical conductivity, Lorentz Drude theory, Wiedmann-Frenz law, Kirchhoff's laws and their applications, Transient current, Growth and decay of D. C. in L - R and L - C circuits, charging and discharging of a capacitor through a resistance.	**08**
Unit IV	**Magnetostatics** Lorentz force, Bio-Savert's law, Ampere's law, Application of Bio-Savert law, magnetic field due steady current in a long straight wire, Interaction between two wires, field due a Helmholtz coil, solenoid and current loop, magnetic vector potential, permeability, Energy stored in Magnetic field.	**09**
Unit V	**Electromagnetic Induction and Alternating Current** Faraday's laws of induction, Lenz's law, Electromotive force, Measurement of magnetic field, Eddy current, Mutual inductance, Self-inductance. Impedance, admittance and reactance, R-C, R-L and L-C circuits with alternating e.m.f. source, series and parallel L-C-R circuits, resonance and sharpness, Quality factor, Power in A. C. circuits, Choke coil.	**10**

Suggested Reading

1. Edward M. Purcell : Electricity and Magnetism
2. J.H. Fewkes&J.Yarwood : Electricity & Magnetism, Vol. I
3. D C Tayal : Electricity and Magnetism ", Himalaya Publishing House Pvt. Ltd., 2019.
4. D.J.Griffiths : Introduction to Electrodynamics .
5. Lal and Ahmed : Electricity and Magnetism
6. H. K. Malik and A.K. Singh "Engineering Physics", McGraw Hill Education (India) PrivateLimited, 2018.
7. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on PhysicsVol. 2", Pearson Education Limited, 2012.

Suggested Online Link:

2. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
3. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
4. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Practical Component

1. Calibration of Voltmeter by potentiometer.
2. Calibration of ammeter by potentiometer.
3. Specific resistance determination.
4. Conversion of a Galvanometer into a Voltmeter.
5. Conversion of a Galvanometer into Ammeter.

6. Variation of magnetic field along the axis of a current carrying circular coil.
7. Comparison of capacities by Ballistic Galvanometer.
8. Determination of Ballistic Constant.
9. Electrochemical equivalent.
10. De Sauty's bridge- C1/ C2
11. R1/R2 by potentiometer.
12. Determination of self inductance, mutual inductance.
13. Magnetic field determination by search coil and ballistic galvanometer
14.

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd.,London, 1962.
2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd.,2015.
3. Indu Prakash: Practical Physics
4. S.L. Gupta, V. Kumar, "Practical Physics", PragatiPrakashan, Meerut, 2014.

Suggestive Digital Platforms / Web Links:

1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists byindividual Universities

GENERAL ELECTIVE (GE P2) -- BASIC PHYSICS-II						
Programme: **General Elective**				**Year: I**	**Semester: II**	
Course Title & Code	**Credits**	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical		
GE P2: Basic Physics II	4	3	1	0	As per University Ordinance	As per University Ordinance

Course Outcomes:
1. To understand the linear and angular motion
2. To understand the Gravitational field and Simple Harmonic Motion
3. To learn about the mechanical properties of matter.

Unit	**Topic**	**No. of Lectures**
Unit I	Center of mass, Motion of the center of mass, Linear momentum and its conservation, Rocket propulsion, Collision, Elastic collision in one dimensions, Impulse and Impulsive forces, Rotation of rigid body about a given fixed line, Rotational dynamics, Torque of force about the axis of rotation. Angular momentum and conservation of angular momentum.	**15**
Unit II	Gravitation: Historical introduction, measurement of gravitational constant 'G', Gravitational potential energy, Gravitational potential, Gravitational field, Relation between gravitational field and potential, Variation in the value of acceleration due to gravity, Planets and satellites, Kepler's law, Weightlessness in a satellite, Escape velocity, Gravitational binding energy, Black holes.	` **15**
Unit III	Simple Harmonic Motion (SHM): Qualitative nature of SHM, Equation of motion of a SHM, Terms associated with SHM, SHM as a projection of a circular motion, Energy conservation in SHM, Angular SHM.	**15**
Unit IV	Mechanical properties of matter: Molecular structure of a material, Elasticity, Stress, Strain, Hooke's law and the modulus of elasticity, Relation between longitudinal stress and strain, Elastic potential energy of a strained body, Surface tension and energy, Viscosity, Poiseuille's equation, Stoke's law.	**15**

Suggested Reading

1. H. C. Verms: Concepts of Phyiscs
2. Robert Resnick Jearl Walker, David Halliday: Principles Of Physics
3. Halliday, Resnick , Walker: Fundamentals of Physics Extended(Old Edition)

SKILL ENHANCEMENT COURSE (SEC P2) - Basic Instrumentation Skills -II						
Programme: **Skill Enhancement Course**				**Year: I**		**Semester: II**
Course Title & Code	**Credits**	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture/Theory	Tutorial	**Hands-on training**		
SEC P2: Basic Instrumentation Skills -II	2	1	0	2	As per University Ordinance	The student should have done the Basic Instrumentation Skill **I** course in Sem I

Course Outcomes:

1. To understand the different types of batteries, maintenances and their uses.
2. Knowledge of secondary cells
3. To get the knowledge of the testing of batteries.

Unit	Topic (Theory / Experiments/hands on training)	No. of Lectures
Unit I	**Batteries and Maintenance:** Types of Batteries, Primary Cell, Secondary Cell, Wet charged, Dry-charged, Low maintenance, Construction of Battery, Case Cover plates, Separator, Cells, Electrolyte, Principles of Batteries, Lead Acid battery, Electrochemical reaction, Measure the voltages of the given cells/battery using analog/ digital multimeter, Charge and discharge the battery through load resistor, Maintain the secondary cells, Measure the specific gravity of the electrolyte using hydrometer.	**15**
Unit II	**Testing of Batteries:** Testing Factors affecting charging, Cause of battery failure, diagnosis and testing, visual inspection, Heavy load test Professional, Test a battery and verify whether the battery is ready for use of needs recharging.	**15**

Suggested Reading

1. B L Theraja : A text book in Electrical Technology
2. M G Say : Performance and design of AC machines
3. S. Salivahanan& N. S.Kumar : Electronic Devices and Circuits, , 3rd Edn
4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
5. M. Lotia, Modern Basic Electrical & House Wiring Servicing

Suggested Online Link:

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2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

SEMESTER-III
DIPLOMA IN APPLIED PHYSICS

DISCIPLINE SPECIFIC COURSE (DSC A3)						
Programme: ***DIPLOMA IN APPLIED PHYSICS***					**Year: II**	**Semester: III**
Subject: Physics						
Course Title & Code	**Credits**	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical		
DSC A3: Thermodynamics and Statistical Physics	4	3	0	1	As per the university ordinance	As per the university ordinance

Course Outcomes:
1. Understand First, Second and Third Law of Thermodynamics and concept of Entropy.
2. Understand the physical significance of thermodynamical potentials.
3. Comprehend the kinetic model of gases with respect to various gas laws.
4. Study the implementations and limitations of fundamental radiation laws.
5. Understand basics of statistical Physics and concept of thermodynamic probability

Theory Component

Unit	Topic	No. of Lectures
Unit I	**Laws of thermodynamics**: Zeroth and first law of thermodynamics, Heat Capacities, Adiabatic Processes, Vander Wall equation, Distinction between Joule, Joule-Thompson and Adiabatic expansion of a gas, Carnot's Engine and Carnot's Cycle, Second law of thermodynamics, Carnot's Theorem, Thermodynamic scale of temperature, Entropy, T-S diagram and its applications, Evaluation of Entropy changes in simple cases, Third law of thermodynamics.	**10**
Unit II	**Thermodynamic Relations:** Thermodynamic potentials, Maxwell's equation from thermodynamic potentials, Some useful manipulations with partial derivatives (cooling in adiabatic processes and Adiabatic stretching of a wire), The Clausius–Clapeyron's equations, Triple point, Applications of Maxwell's thermodynamical relations.	**10**
Unit III	**Transport of Heat :** Conduction, Convection and Radiation, Fourier's law, One dimensional steady state conduction, Thermal conductivity and its experimental detection, Newton's law of cooling, Black body radiation, Thermodynamics of radiations inside a hollow enclosure, Kirchoff's Laws, Stefan Boltzmann Law, Wien's displacement law, Raleigh Jean's Law, Quantum theory of Radiation, Planck's formula, Wien's law.	**10**

Unit IV	**Basics of Statistical Physics:** Basic postulates of Statistical Physics, Macro and Micro States, Phase Space, Condition of equilibrium, Postulate of equal a priori probability, Entropy and Thermodynamic probability, Boltzmann entropy relation, Maxwell-Boltzmann (M-B) statistics and Distribution law.	**08**
Unit V	**Kinetic Theory of Gases:** Kinetic theory of gases, Microscopic description of an Ideal gas, Degrees of freedom, Law of Equipartition of Energy, Distribution law of velocities, Most probable speed, Average speed and root mean square velocity of molecules, Pressure exerted by a perfect gas, Kinetic Interpretation of Temperature.	**07**

Suggested Reading

1. S. Loknathan : Thermodynamics, Heat and Statistical Physics
2. Sharma and K.K. Sarkar : Thermodynamics, and Statistical Physics
3. Brijlal and Subrahmanyam : Heat and Thermodynamics
4. Garg, Bansal and Ghose : Thermal Physics, McGraw Hill, 2012.
5. M.W. Zemansky, R. Dittman, "Heat and Thermodynamics", McGraw Hill, 1997.
6. Enrico Fermi, "Thermodynamics", Dover Publications, 1956.
7. MeghnadSaha, B.N. Srivastava, "A Treatise on Heat", Indian Press, 1973
8. F.W. Sears, G.L. Salinger, "Thermodynamics, Kinetic theory & Statistical thermodynamics", Narosa Publishing House, 1998.
9. Singhal and Prakash: Heat and Thermodynamics, Pragati Prakashan

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Practical Component

1. Thermal conductivity of a bad conductor by Lee's method.
2. Mechanical equivalent of heat by Searle's method.
3. Stefan's law
4. Platinum resistance thermometer.
5. J by Callendar and Barnes method.
6. Random throw- statistical method.
7. Newton's law of cooling, sp. heat of Kerosene oil.
8. Constant volume thermometer.
9. Variation of thermo-emf across two junctions of a thermocouple with temperature.

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.
2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.

3. Indu Prakash: Practical Physics
4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014

Suggestive Digital Platforms / Web Links:

1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities

DISCIPLINE SPECIFIC ELECTIVE (DSE A1)						
Programme: ***DISCIPLINE SPECIFIC ELECTIVE***					**Year: II**	**Semester: III**
Course Title & Code	**Credits**	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical		
DSE A1: Waves and Acoustics	4	3	0	1	As per the university ordinance	As per the university ordinance

Course Outcomes:

1. To understand the wave motion
2. To understand the Ultrasonic waves and its application
3. Measurement of acoustic intensity and energy density
4. To understand the application of wave propagation in various physical cases.

Theory Component

Unit	Topic	No. of Lectures
Unit I	**Analysis of wave motion:** Characteristics, Differential equation of a wave motion, principle of superposition, Interference, Beats, stationary waves, Energy of stationary waves, Wave velocity and group velocity, Fourier theorem, Fourier analysis of square, triangular and saw-tooth waves.	**15**
Unit II	**Ultrasonics:** Classification of Sound waves, Ultrasonics, Quartz crystal and Piezo electric effect, Magnetostriction effect, Properties of Ultrasonic, Detection of ultrasonicwaves, Determination of velocity of ultrasonic waves in liquid (Acoustic grating method) . Application of Ultrasonics.	**10**
Unit III	**Acoustics** : Energy density of plane acoustic waves, Acoustic intensity, Measurement of acoustic intensity – the dB scale, Characteristics and loudness of Musical sound, Acoustic impedance, Reflection and transmission of acoustic waves.	**10**
Unit IV	**Applications** : Application of wave propagation in various physical cases, Applications of Ultrasonics, Acoustics of buildings, reverberation time, Sabine's formula, Principle of sonar system.	**10**

Suggested Reading

1. R. Resnick and D. Hilliday : Physics Vol-I

2. D.S. Mathur : Mechanics
3. Brijlal and Subrahmanyam : Waves and Oscillations
4. B.S.Semwal and M.S.Panwar : Wave Phenomena and MaterialScience
5. Berkeley Physics Course : Mechanics Vol-I
6. R.K.Ghose : The mathematics of waves an Vibrations
7. D.P.Khandelwal : Oscillations and Waves
8. I.I.Pain : Physics of Vibration
9. A. P. French : Vibrations and Waves

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

PRACTICAL COMPONENT

1. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
2. To determine the frequency of tuning fork with the help of sonometer.
3. To determine the frequency of AC mains with a Sonometer using magnetic wire.
4. To determine the frequency of AC mains with a Sonometer using non- magnetic wire.
5. To determine the frequency of AC mains by Melde's experiment.
6. To determine the velocity of sound in air at room temperature with Kundt's tube.
7. To determine the velocity of Ultrasonic wave in a given liquid.
8. To compare the velocities of sound in two gasses at room temperature.

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd.,London, 1962.
2. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd.,2015.
3. Indu Prakash: Practical Physics
4. S.L. Gupta, V. Kumar, “Practical Physics”, Pragati Prakashan, Meerut, 2014.

Suggestive Digital Platforms / Web Links:

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GENERAL ELECTIVE (GE P3)						
Programme: **General Elective**				**Year: II**	**Semester: III**	
Course Title & Code	**Credits**	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical		
GE P3: Fundamental Mechanics	4	3	1	0	As per University Ordinance	As per University Ordinance

Course Outcomes:

1. To gain the knowledge of vector algebra.
2. To understand the frames of references and Newton's law of motion.
3. Study of the Keplelr's laws of motion .
4. To understand the elasticity related to different laws.

Unit	Topic	No. of Lectures
Unit I	**Vectors Algebra and Ordinary Differential Equations** Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients.	**15**
Unit II	**Translatory and Rotatory Motion and Conservation Laws** Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass, Conservation of momentum. Work and energy Conservation of energy. Motion of rockets, Angular velocity and angular momentum. Torque. Conservation of angular momentum.	**15**
Unit III	**Gravitation** Newton's Law of Gravitation. Motion of a particle in a central force field (motion in a plane, angular momentum conservation). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Basic idea of global positioning system (GPS). Weightlessness. Physiological effects on astronauts.	**15**
Unit IV	**Elasticity** Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire.	**15**

Suggested Reading

1. Sears, Zemansky and Young : University Physics
2. Berkeley Physics Course : Volume-1 Mechanics
3. Resnick, Halliday & Walker Fundamentals of Physics

4. Basudeb Bhattacharya : Engineering Mechanics 2nd Edn
5. Ronald Lane Reese : University Physics
6. B.L. Flint and H.T. Worsnop : Advanced Practical Physics forStudents

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

SKILL ENHANCEMENT COURSE (SEC P3)						
Programme: **Skill Enhancement Course**				**Year: II**	**Semester: III**	
Course Title & Code	**Credits**	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture/Theory	Tutorial	**Hands-on training**		
SEC P3: Basic Instrumentation Skills -III	2	1	0	2	As per University Ordinance	As per University Ordinance

Course Outcomes:

1. Hands on practice of domestic wiring and electrical systems.
2. To understand the soldering and practice it's on different electronic components.

Unit	**Topic (Theory and hands on practice)**	**No. of Lectures**
Unit I	**Domestic Wiring** Introduction and explanation of electrical wiring systems, cleat wiring, casing & Capping, house wiring, specification and types, rating & material. Demonstration & Practice on connecting common electrical accessories in circuits and testing them in series board., Testing & replacement of different types of fuses, switches, plug, sockets. Identification of different wiring materials and their specification, Removal of insulation from assorted wires and cable, Making a switchboard with electrical accessories, Making an Extension board.	**15**
Unit II	**Soldering :** Solders, flux and soldering technique. Different types of soldering guns related to Temperature and wattages, types of tips, Solder materials and their grading. Use of flux and other materials, Selection of soldering gun for specific requirement, Soldering and De-soldering stations and their specifications. Soldering/ De-soldering and Various Switches, Practice soldering on different electronic components, small transformer, Practice de-soldering	**15**

Suggested Reading

1. B L Theraja : A text book in Electrical Technology
2. M G Say : Performance and design of AC machines
3. S. Salivahanan& N. S. Kumar : Electronic Devices and Circuits, , 3rd Edn
4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
5. M. Lotia, Modern Basic Electrical & House Wiring Servicing

SEMESTER IV

DIPLOMA IN APPLIED PHYSICS

DISCIPLINE SPECIFIC COURSE-DSC A4		
Programme: ***DIPLOMA IN APPLIED PHYSICS***	**Year: II**	**Semester: IV**
Subject: Physics		

Course Title & Code	**Credits**	**Credit distribution of the course**			**Eligibility Criteria**	**Pre-requisite of the course**
		Lecture	Tutorial	Practical		
DSC A4: Optics	4	3	0	1	As per the university ordinance	As per the university ordinance

Course Outcomes:

1. Study of Fermat's Principle of Extremum Path and understand fundamental physics behindreflection and refraction of light.
2. Understand the theory of image formation by an optical system.
3. Study of different types of optical Aberrations and techniques for their reduction.
4. Study of different types of optical instruments used in industry and research
5. Study of Interference of light. Interference by division of wavefront and division of amplitude.
6. Understanding Diffraction of Light and concept of Zone Plate.
7. Understand the polarization of light.
8. Study of different types of associated optical instruments based on interference and diffraction oflight which are widely used in industry and research.

Theory Component

Unit	**Topic**	**No. of Lectures**
Unit I	**Fermat's Principle and Theory of Image Formation:** Fermat's principle of extremum path and its application to deduce laws of reflection and refraction, Refraction at concave surface, Principal foci, Lateral and longitudinal magnifications, Aplanatic points of spherical surface; Gauss's general theory of image formation, Coaxial symmetrical system, Cardinal points of an optical system, Thick and Thin lens, Newton's formula, Coaxial lens system, Lagrange's equation of magnification, Refraction through a thick lens; Nodal Slide, Eyepiece, Ramsden's, Huygen's and Gaussian eyepieces, Astronomical refracting telescope, Microscopes, Spectrometer and its uses.	**10**

Unit II	**Optical Aberrations and Dispersion:** Aberrations in images, Spherical aberration, Monochromatic and Chromatic aberration, Condition of achromatism, Achromatic combination of lenses in contact and separated lenses, Spherical mirrors and Schmidt corrector plates, Theory of dispersion.	**O7**
Unit III	**Interference:** The principle of superposition, Two slit interference, coherence, Optical path retardations, lateral shift of fringes, Fresnel biprism, Interference with multiple reflection, Thin films, Application for precision measurements, Haidinger fringes, Fringes of equal thickness and equal inclination; Michelson intereferometer and its application for precise measurement of wavelength, Wavelength difference and width of spectral lines, Fabry-Perot interferometer and Etalon	**10**
Unit IV	**Diffraction:** Fresnel's and Fraunhofer diffraction: Diffraction of single slit, Zone plates, intensity distribution, Resolution of image, Rayleigh criterion, Resolving power of telescopes and microscopes, Diffraction due to 2-slits and N-slits, Diffraction grating, Resolving power of grating and comparison with resolving powers of prisms.	**08**
Unit V	**Polarization:** Plane polarized, Circular polarized and elliptically polarized light, Malus law, Brewster's law, Double reflection and uniaxial crystals, Application of bi-refringence, Dichroism, Optical rotation, Rotation of plane of polarization, Optical rotation in liquids and crystals, Polarimeter.	**10**

Suggested Reading

1. D.P. Khandelwaland : Optics and Atomic Physics
2. Jenkins and White : Fundamentals of Optics
3. A.K. Ghatak : Physical Optics
4. Brijlal and Subrahmanyam : Optics
5. K.D. Moltev : Optics
6. B. K. Mathur : Optics
7. B. D. Guenther : Modern Optics, Oxford Press
8. E. Hecht: Optics, Pearson.

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Practical Component

1. Nodal slide assembly, Location of cardinal points of lens system.
2. Newton's formula.
3. Dispersive power of prism.
4. Resolving power of a telescope.

5. To determine the Resolving Power of a Prism.
6. To find the thickness of the wire using optical bench.
7. To determine the thickness of mica-sheet by using Biprism
8. Biprism- determination of λ.
9. Newton's ring experiment- Determination of λ.
10. Zone-plate experiment study of different orders.
11. Malus Law
12. Polarimeter: Specific rotation of sugar solution.

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd.,London, 1962.
2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd.,2015.
3. Indu Prakash, Practical Physics
4. S.L. Gupta, V. Kumar, "Practical Physics", PragatiPrakashan, Meerut, 2014.

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DISCIPLINE SPECIFIC ELECTIVE (DSE A2)						
Programme: ***DISCIPLINE SPECIFIC ELECTIVE***				**Year: II**	**Semester: IV**	
Subject: Physics						
Course Title & Code	**Credits**	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical		
DSE A2 Elementary Solid-State Physics	4	3	0	1	As per the university ordinance	As per the university ordinance

Theory Component

Unit	Topic	No. of Lectures
Unit I	Crystalline and non - crystalline sate of solids. Single and polycrystalline forms of matters, Lattice, Basis, primitive and non-primitive unit cells, coordination number. Translational vectors, symmetry operations, point and space groups. Types of lattices and seven crystal system. Lattice planes and Miller indices. Structure of SC, BCC, FCC (with examples) and closed packed structures. Structure of diamond.	**10**
Unit II	Lattice constant, Inter-planar spacing, density of lattice points, atomic packing fractions. Reciprocal lattices and their properties, X-rays diffraction by matter, Bragg's law, Laue methods of X-rays diffraction. Brillouin zones and their applications.	**10**
Unit III	Free electron theory of metals, Lorentz Drude theory and its limitations, Somerfield theory of free electrons. Specific heat, Dulong and Petit's law, departure of the law at low temperatures. Einstein's theory of specific heat and its limitations, Debye's theory of specific heat of solids,	**15**
Unit IV	Motion of an electron in periodic potential, Kronig-Penny model. Energy bands in solids, distinction between conductors, semiconductors and insulators, Intrinsic and Extrinsic semiconductors, Fermi level and Fermi energy, effective mass of electron.	**10**

Suggested Reading

1. Agarwal and Agarwal "Fundamentals of Modern Physics" (Pragati Prakashan- Meerut)
2. Dekker "Solid State Physics" (Laxmi Publications)
3. C.Kittel "Introduction to Solid State Physics"(Wiley)
4. S.O.Pillai "Solid State Physics"(New Age International)
5. Saxena, Gupta and Saxena, "Fundamental of Solid-State Physics" (PragatiPrakashan-Meerut)

Practical Component

1. Thermal conductivity of a good conductor by Searle's method.
2. To determine Hall voltage and Hall coefficient in n-type semiconductor.
3. To determine the number of charge carriers per unit volume in n-type semiconductor.
4. To determine Hall angle and mobility in n-type semiconductor.
5. To determine the band gap in a semiconductor using a p-n junction diode.
6. To determine the ionization potential of gas filled Thyratorn.
7. To plot the characteristics of thermistor and hence find the temperature coefficient of resistance.

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd.,London, 1962.
2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd.,2015.
3. Indu Prakash, Practical Physics
4. S.L. Gupta, V. Kumar, "Practical Physics", PragatiPrakashan, Meerut, 2014.

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GENERAL ELECTIVE (GE P4)						
Programme: **General Elective**					**Year: II**	**Semester: IV**
Course Title & Code	**Credits**	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical		
GE P4: Basic Electricity and Magnetism	4	3	1	0	As per University Ordinance	As per University Ordinance

Course Outcomes:

1. Understanding of Electric Field and Potential. Evaluation of Electric Field and Potential for differenttypes of charge distributions.
2. Study of Steady and Varying electric currents.
3. Understanding of different aspects of alternating currents and its applications.
4. Understand the Magnetostatics, Lorentz Force and Energy stored in magnetic Field.

Unit	Topic	No. of Lectures
Unit I	**Electrostatics:** Electrostatic Field, electric flux, Gauss's theorem of electrostatics Applications of Gauss theorem- Electric field due to point charge infinite line of charge, uniformly charged spherical shell and solid sphere plane charged sheet, charged conductor. Electric potential as line integral of electricfield, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere.	**10**
Unit II	**Magnetism** Magnetostatics: Biot-Savart's law and its applications- straigh conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.	**15**
Unit III	**Electromagnetic Induction and Alternating Current** Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.	**10**
Unit IV	**Maxwell`s equations and Electromagnetic wave propagation** Equation of continuity, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave and its transverse nature.	**10**

Suggested Reading

1. Edward M. Purcell : Electricity and Magnetism

2. J.H. Fewkes & J.Yarwood : Electricity & Magnetism, Vol. I
3. D C Tayal : Electricity and Magnetism
4. Ronald Lane Reese : University Physics
5. D.J.Griffiths : Introduction to Electrodynamics, 3rd Edn.
6. B.L.Flint & H.T.Worsnop : Advanced Practical Physics for Students
7. M. Nelson and J. M. Ogborn : Advanced level Physics Practicals, 4th Ed
8. I.Prakash & Ramakrishna : A Text Book of Practical Physics, 11th Ed
9. S.Panigrahi & B.Mallick : Engineering Practical Physics

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3. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

SKILL ENHANCEMENT COURSE (SEC P4)						
Programme: **Skill Enhancement Course**				**Year: II**	**Semester: IV**	
Course Title & Code	**Credits**	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture/Theory	Tutorial	**Hands-on training**		
SEC P4: Basic Instrumentation Skills -IV	2	1	0	2	As per University Ordinance	As per University Ordinance

Course Outcomes:

1. To understand the theory and use of CRO
2. To understand the Signal and pulse Generators

Unit	Topic (Theory and hands on practice)	No. of Lectures
Unit I	**Impedance Bridges:** Block diagram of bridge. Working principles of basic (balancing) RLC bridge, Specifications of RLC bridge, Block diagram and working principle as of a Q-meter, Digital LCR bridges.	**15**
Unit II	**Electronic Voltmeter:** Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter, AC millivoltmeter: Type of AC millivoltmeters, Block diagram ac milli -voltmeter, specifications and their significance.	**15**

Suggested Reading

1. B L Theraja: A text book in Electrical Technology
2. M G Say: Performance and design of AC machines
3. S. Salivahanan& N. S. Kumar: Electronic Devices and Circuits, , 3rd Edn
4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
5. M. Lotia, Modern Basic Electrical & House Wiring Servicing

SEMESTER V
BACHELOR IN SCIENCE

DISCIPLINE SPECIFIC COURSE (DSC A5)						
Programme: DISCIPLINE SPECIFIC COURSE				**Year: III**	**Semester: V**	
Subject: Physics						
Course Title & Code	**Credits**	**Credit distribution of the course**			**Eligibility Criteria**	**Pre-requisite of the course**
		Lecture	**Tutorial**	**Practical**		
DSC A5: Modern Physics	4	3	0	1	As per the university ordinance	As per the university ordinance

Course Outcomes:

1. **Study of different atomic models.**
2. **Study of optical spectra, X- rays and LASERS.**
3. **Study of structure of atomic nucleus**
4. **X-rays: their production and spectra: continuous and characteristic X-rays, Moseley Law.**
5. **Lasers and their working principle, spontaneous and stimulated emissions and absorption.**
6. **Einstein's A and B coefficients, Metastable states, components of a laser and lasing action in He-Ne lasers and free electron laser.**

Theory Component

Unit	Topic	No. of Lectures
Unit I	**Atomic Models :** Thomson model, Rutherford model, Bohr model and spectra of hydrogen atom, Fine structure, Bohr Magnetron, Larmor‟s precession, Somerfield model, Stern-Gerlach experiment, Vector atomic model, Space Quantization and Spinning of an electron.	**08**
Unit II	**Optical Spectra and X-rays :** Optical spectra, Spectral notations, L-S, J-J coupling, Selection rules and intensity rules, Explanation of fine structure of Sodium D line, Zeeman effect, X-ray spectra(characteristics and continuous), Moseley‟s law.	**07**
Unit III	**Theory of Lasers : Einstein A and B coefficients, Spatial and Temporal coherence, Optical pumping, Population inversion, Laser action, Basic idea of LASER and MASER, Ruby Laser and He-Ne laser, Some applications.**	**10**
Unit IV	**Molecular Spectroscopy : Franck-Condon Principle, Molecular spectra, Rotational, Vibration and Electronic spectra of diatomic molecules, General features of electronic spectra, Luminescence, Basics of Raman effect.**	**10**

Unit V	**Subatomic Physics** **Structure of atomic nucleus, nuclear properties (charge, mass, spin, shape), nuclear binding energy, liquid drop model and semi-empirical mass formula**	**10**

Suggested Reading

1. H.S. Mani and Mehta : Introduction to Modern Physics
2. A. Beiser : Perspective of Modern Physics
3. Ahmad and Lal, : Modern Physics
4. B.V.N. Rao : Modern Physics
5. R. Murugeshan : Modern Physics
6. S.N. Ghosal : Nuclear Physics
7. C. B. Banwell : Fundamentals of Molecular Spectroscopy

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Practical Component

1. Absorption coefficient of a liquid with the help of voltaic cell.
2. Frank-Hertz Experiment.
3. To verify Malus law using MASER and LASER.
4. Stern-Gerlach experiment.
5. To determine the wavelength and angular spread of He-Ne laser
6. Determination of Ionization Potential using thyratron valve.
7. To determine the value of electronic change by Millikan's method.

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd.,London, 1962.
2. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd.,2015.
3. Indu Prakash: Practical Physics
4. S.L. Gupta, V. Kumar, “Practical Physics”, Pragati Prakashan, Meerut, 2014.

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DISCIPLINE SPECIFIC ELECTIVE (DSE A3)						
Programme: DISCIPLINE SPECIFIC ELECTIVE					**Year: III**	**Semester: V**
Course Title & Code	**Credits**	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical		

DSE A3: Basic Quantum Mechanics	4	3	0	1	As per the university ordinance	As per the university ordinance

Course Outcomes:

1. Main aspects of the inadequacies of classical mechanics as well as understanding of the historical development of quantum mechanics.
2. Heisenberg's Uncertainty principle and its applications, photoelectric effect and Compton scattering.
3. The Schrodinger equation in 1-dimension, wave function, probability and probability, current densities, normalization
4. Particle in a box problem, energy levels.

Theory Component

Unit	Topic	No. of Lectures
Unit I	**Origin of Quantum theory:** Origin of quantum theory, limitation of Classical Physics, Black body Radiation, Planck's radiation law and Einstein's explanation, The photo electric effect and Einstein correction, Compton effect.	**10**
Unit II	**Wave-Particle Duality:** De Broglie's Hypothesis, Wave-Particle Duality, Davisson-Germer Experiment, G.P Thomson experiment, Taylor's experiment, Wave description of Particles by Wave Packets, Group and Phase Velocities, Principle of Complimentarity, Heisenberg Uncertainty principle, Gamma ray microscope, Single slit experiment.	**10**
Unit III	**Formalism of Quantum mechanics:** Linear vector space, Linear Operator, Definition of position, momentum , Energy and Angular momentum operator, Eigen value and Eigen functions, Hermitian operators, Postulates and basic theorems of Quantum mechanics, Operator method for solving Eigen values problem, Energy of Harmonic oscillator.	**10**
Unit IV	**Schrödinger equation – The first law of Quantum Mechanics :** Origin of non relativistic Quantum Mechanics, Overview of wave mechanics, Simple one dimensional quantum system Oscillator, Time independent and time dependent one dimensional Schrödinger equation, Steady state solutions, Physical interpretation of wave functions, probability current density, Ehrenfest's theorem, Particle in a box, Idea of Tunneling	**15**

Suggested Reading

1. L.I. Schiff, "Quantum Mechanics" (McGraw Hill Book Co.)
2. Chris J. Isham, "Lectures on Quantum Theory" (Allied Publisher)
3. B.S. Rajput , "Advanced Quantum Mechanics" (Pragati Prakashan)
4. Ghatak and Lokanathan , "Quantum Mechanics" (Macmillan Pub.)
5. Mathew and Venkatesan , "Quantum Mechanics"(Tata McGraw-Hill)

Practical Component

1. Determination of Rydberg's constant.
2. Determination of 'h' Planck's constant by Photoelectric effect.
3. 'e/m' by Thomson method.
4. 'e/m' Magnetron method.
5. 'e/m' Helical method
6. To determine the Planck's constant using LEDs of at least 4 different colours.

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd.,London, 1962.
2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd.,2015.
3. Indu Prakash: Practical Physics
4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014.

Suggestive Digital Platforms / Web Links:

1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists byindividual Universities

GENERAL ELECTIVE (GE P5)						
Programme: **General Elective**					**Year: III**	**Semester: V**
Course Title & Code	**Credits**	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical		
GE P5: Basics of Heat Transfer	4	3	1	0	As per University Ordinance	As per University Ordinance

Course Outcome:

1. To understand the of Heat Transfer processes.
2. Thermal radiation, Kirchoff's Laws, Derivation of Stefan Boltzmann law, and Wein's displacement law.
3. To understand the black body radiation and related laws.

Unit	Topic	No. of Lectures
Unit I	**Conduction :** Modes of heat transfer via Conduction: Fourier's law, One dimensional steady state conduction, Heat conduction through plane and composite walls. Cylinders and spheres, Electrical analogy, Thermal conductivity and its experimental detection.	**10**
Unit II	**Convection**: Modes of heat transfer via Convection : Newton's law of cooling Dimensional analysis applied to forced and free convection, Dimensionless numbers and their physical significance.	**10**
Unit III	**Thermal Radiation**: Physical quantities associated with Radiation, Black body, Radiation from non-black-bodies, Thermodynamics of radiations inside a hollow enclosure, Kirchoff's Laws, Derivation of Stefan Boltzmann Law, Wein's displacement law.	**15**
Unit IV	**Black Body Radiation:** Black body spectrum formula- early attempts, Raleigh Jean's Law, Quantum theory of Radiation, Planck's formula for black body spectrum, Wien's law, Radiation as a photon gas.	**10**

Suggested Reading:

1. S. Loknathan, “Thermodynamics, Heat and Statistical Physics” (Prentice Hall India)
2. Sharma and K.K. Sarkar “Thermodynamics, and Statistical Physics” (Himalaya Pub.)
3. Brijlal and Subrahmanyam, “Heat and Thermodynamics”(S Chand)
4. Saha and Srivastav “Treatise on heats”, (The Indian Press Publications)

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

SKILL ENHANCEMENT COURSE (SEC P5)						
Programme: **Skill Enhancement Course**					**Year: III**	**Semester: V**
Course Title & Code	**Credits**	**Credit distribution of the course**			**Eligibility Criteria**	**Pre-requisite of the course**
		Lecture/Theory	**Tutorial**	**Hands-on Training**		
SEC P5: Advanced Instrumentation and Measurement Techniques -I	2	1	0	2	As per University Ordinance	As per University Ordinance

Course Outcome:

1. To understand the Impedance Bridges.
2. To understand the Principle and uses of electronic voltmeter.

Unit	Topic (Theory and hands on practice)	No. of Lectures
Unit I	**Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Advantage over conventional multimeter for voltage measurement with respectto input impedance and sensitivity.	**15**
Unit II	**Digital Multimeter:** Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/frequency counter, time-base stability, accuracy and resolution.	**15**

Suggested Reading

1. B L Theraja : A text book in Electrical Technology
2. M G Say : Performance and design of AC machines
3. S. Salivahanan& N. S.Kumar : Electronic Devices and Circuits, , 3rd Edn
4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
5. M. Lotia, Modern Basic Electrical & House Wiring Servicing

OR

SKILL ENHANCEMENT COURSE (SEC P5)			
Programme: **Skill Enhancement Course**		**Year: III**	**Semester: V**

Course Title & Code	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture/Theory	Tutorial	Hands-on Training		
SEC P5 Electrical circuit network Skills - I	2	1	0	2	As per University Ordinance	As per University Ordinance

Course Outcome:

1. To understand the Impedance Bridges.
2. To understand the Principle and uses of electronic voltmeter.

Unit	Topic (Theory and hands on practice)	No. of Lectures
Unit I	**Electrical Circuit Fundamentals and Series Circuits:** Zero Reference level, Chassis Ground, Ohm's Law, Graphical representation of Ohm's Law, Linear and Non-linear resistor, Cells in series in electrical circuits, Resistances in series circuit, Characteristics, Case of zero IR drop, Polarity of IR drops, Total Power, Series Aiding and series opposing voltages, Proportional voltage formula in series circuits, Series Voltage dividers, opens and Shorts in a series circuit.	**15**
Unit II	**Parallel Electrical circuits:** Cells in parallel in electrical circuits, Parallel resistive circuits, Laws of parallel circuits, Special case of equal resistances in all branches and only two branches, Any branch resistance, Proportional current formula, opens and shorts in a parallel circuit.	15

Suggested Reading

1. B L Theraja : A text book in Electrical Technology
2. B L Theraja : A text book in Basic Electronics
3. M G Say : Performance and design of AC machines
4. S. Salivahanan& N. S.Kumar : Electronic Devices and Circuits, , 3rd Edn
5. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
6. M. Lotia, Modern Basic Electrical & House Wiring Servicing

SEMESTER VI

BACHELOR IN SCIENCE

DISCIPLINE SPECIFIC COURSE (DSC A6)		
Programme: DISCIPLINE SPECIFIC COURSE	**Year: III**	**Semester: VI**
Subject: Physics		

Course Title & Code	Credits	Credit distribution of the course			Eligibility Criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical		
DSC A6: Electronics	4	3	0	1	As per the university ordinance	As per the university ordinance

Course Outcomes:

1. Study of different Network Theorems for simplifying complicated electronics circuits.
2. Study of Regulated Power Supply. Understand different types of Rectifiers, Filters and Voltage Regulator.
3. Study of different types of special diodes and their applications
4. Study of Bipolar Junction Transistors.
5. Study of Field Effect Transistor

Theory Component

Unit	Topic	No. of Lectures
Unit I	**Network Theorems and Power Supplies:** Superposition Theorem, Thevenin's Theorem, Norton‟s Theorem, Maximum power transfer theorem, Semiconductor diode: P-N Junction diode, Diode as a: Half and Full wave rectifiers, Bridge rectifiers, Efficiency, Ripple factor, Filters: Low pass and High pass filters, Band pass and Band stop filters, L and π – filters, Zener diode, its characteristics,Voltage regulation	**10**
Unit II	**Solid State Devices :** Tunnel diode, Varactor diode, V-I characteristic of these diodes, Optoelectronic devices: Light emitting diode, Photodiode, Bipolar junction transistor, Transistor operation and its Biasing rule, Transistor currents, Transistor circuit configuration (CB, CE, and CC configuration), Transistor characteristics in different configuration, cut-off and saturation points, Active region, Relation between transistor current in various configuration, General idea of FETs	**10**
Unit III	**Amplifiers :** Single-stage transistor amplifiers, Common base (CB) amplifier, Common emitter (CE) amplifier, Common collector (CC) amplifier, Amplifier based on biasing condition, Power amplifiers, Noise and Distortion in amplifiers, RC- coupled two stage amplifier and its frequency response, Feedback amplifiers, positive and negative feedback, Advantage of negative feedback.	**10**
Unit IV	**Oscillators :** Classification of oscillators, Frequency of oscillating current, Frequency stability of an oscillator, Essential of a feedback LC oscillator, Tuned base oscillator, Tuned collector oscillator, Hartley oscillator, Colpitt oscillator, Clapp oscillator, Tunnel diode oscillator, Crystal oscillator, Phase shift oscillator, Wien Bridge oscillator, Relaxation oscillator, Multivibrators (Astable, monostable and bistable).	**08**

Unit V	**Digital Electronics:** Number systems, Decimal, Binary, Octal and Hexadecimal number systems, Binary to decimal conversion, Boolean algebra, Laws of Boolean algebra, De Morgan's theorems, Logic gates, OR gate, Exclusive OR gates, AND gate, NOT gate, NOR gate, NAND gate, NAND and NOR as universal gates, XNOR gate, Half Adder, Full adder, Half subtractor and Full subtractor.	**07**

Suggested Reading

1. M.K. Baagde, S.P. Singh and Kamal Singh : Elements of Electronics
2. B.L. Theraja : Basic Electronics
3. V.K. Mehta : Elements of Electronics
4. J.D. Ryder : Networks, Lines and Fields
5. J.D. Ryder : Electronic Fundamentals and Applications.
6. Millman and Halkias : Integrated Electronics

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Practical Component

1. To study the characteristics of integrating and differentiating circuit.
2. To draw the characteristics of P-N junction diode.
3. To draw the characteristics of PNP and NPN junction transistor.
4. Measurements of h-parameters of a transistor.
5. Study of different types of Rectifiers and Filters.
6. Verification of Network theorems.
7. Child Langmuir law.
8. Triode/ Tetrode/ Pentode characteristics and constants.
9. Study of power supply (Ripple factor).
10. Study of Zener diode and regulation (taking different source voltage andloads).
11. To study the Characteristics of a Photo-diode.

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd.,London, 1962.
2. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd.,2015.
3. Indu Prakash: Practical Physics
4. S.L. Gupta, V. Kumar, “Practical Physics”, Pragati Prakashan, Meerut, 2014.

Suggestive Digital Platforms / Web Links:

1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by

individual Universities

DISCIPLINE SPECIFIC ELECTIVE (DSE A4)						
Programme: Discipline Specific Elective				**Year: III**	**Semester: VI**	
Subject: Physics						
Course Title & Code	**Credits**	**Credit distribution of the course**			**Eligibility Criteria**	**Pre-requisite of the course**
		Lecture	**Tutorial**	**Practical**		
DSE A4: Special Theory of Relativity	4	3	0	1	As per the university ordinance	As per the university ordinance

Course Outcome:

1. To understand the special theory of relativity
2. Lorentz Transformations and its Consequences
3. To understand the Maxwell's equations and their physical significance
4. To understand about the four vector and four vector formulation of current and continuity equation

Theory Component

Unit	Topic	No. of Lectures
Unit I	**Foundation of Special theory of Relativity :** Frames of reference, Galilean transformations, Ether hypothesis, Failure of Michelson-Morley experiment, Postulates of Special theory of relativity, Lorentz transformations.	**10**
Unit II	**Consequences of Lorentz Transformations :** Length contraction, Time dilation, Velocity transformations and Law of velocity addition, Variation of mass with velocity, Relativistic energy and mass energy equivalence, Concept of four vector, Examples of position and momentum four vectors.	**10**
Unit III	**Electromagnetic waves :** Maxwell's equations in differential and integral forms, Electromagnetic energy and Poynting theorem , Wave equations, Plane electromagnetic waves in free space, Maxwell's equations for isotropic, nonisotropic and dielectric medium, Plane Electromagnetic wave in Conducting and non-conducting (dielectric) medium.	**15**
Unit IV	**Relativity of Electromagnetism :** Notations for Four- vectors, space and light like separations, Energy-Momentum Four Vector, Four vector potential, electromagnetic field tensor, Lorentz invariance, Lorentz force, covariant form of Maxwell's equations, four vector formulation of current and continuity equation.	**10**

Suggested Reading

1. H.S. Mani and Mehta, Introduction to Modern Physics , (Allied East West Press)
2. A. Beiser , Perspective of Modern Physics, , (Tata McGraw Hill)
3. Ahmad and Lal, Modern Physics (S. Chand and Co.)
4. B.V.N. Rao, Modern Physics (New Age International)
5. B.B.Laud Electromagnetics (Wiley Eastern limited)
6. Berkely Physics course, Vol II "Electricity and Magnetism" (McGraw Hill.)
7. A. S. Mahajan and A. Rangwala "Electricity and Magnetism" (Tata McGraw Hill.)

Practical Component

1. Speed of light in air.
2. To verify the Cauchy's dispersion formula.
3. Determination of wavelength using grating and spectrometer.
4. Measurement of wavelength difference of Na using Michelson Interferometer.
5. Measurement of thickness of mica sheet using Michelson Interferometer.
6. To demonstrate interference & Doppler effect in waves.

Suggested Reading:

1. Worsnop, B. L., Flint, H. T., "Advanced Practical Physics for Students", Methuen & Co., Ltd.,London
2. Panigrahi, S., Mallick, B. "Engineering Practical Physics", Cengage Learning India Pvt. Ltd.,
3. Gupta and Kumar, Practical Physics, Pragati Prakashan
4. Srivastava, Anchal , and Shukla, R. K., New Age International (P) Ltd

GENERAL ELECTIVE (GE P6)						
Programme: **General Elective**					**Year: III**	**Semester: VI**
Course Title & Code	**Credits**	**Credit distribution of the course**			**Eligibility Criteria**	**Pre-requisite of the course**
		Lecture	**Tutorial**	**Practical**		
GE P6: Basics of Digital electronics	4	3	1	0	As per University Ordinance	As per University Ordinance

Course outcome:

1. To understand the different number systems
2. To understand the concept of Boolean algebra
3. Different type of Logic gates
4. To understand the different combination circuits

Unit	Topic	No. of Lectures
Unit I	**Number System**: Number systems, Decimal, Binary, Octal and Hexadecimal number systems, Binary to decimal conversion, Double-Dadd method, Binary operations, Binary addition, Binary subtravtion, Complement of a number (1"s complement and 2"s complement), Binary divison, Representation of a Binary number as electrical signals, Conversion of Binary to octal, Binary to hexadecimal and vice-versa (Inter-conversion).	**15**
Unit II	**Boolean Algebra:** BCD, GREY, EXCESS-3 codes, Boolean algebra, Features of Boolean algebra, Laws of Boolean algebra, Equivalent switching circuit, De Morgan's theorems and Duals.	**10**
Unit III	**Logic Gates :** Positive and Negative logic, Two input OR gate, Diode OR gate and transistor OR gate, Three input OR gate and its truth table, Exclusive OR gates, The AND gate, Diode AND gate and transistor AND gate, The NOT gate, Bubbled gates, The NOR gate, The NAND gate, NAND and NOR as universal gates, The XNOR gate,	**10**
Unit IV	**Combinational Circuits:** Adders and subtractors, Half Adders, Full adders, Parallel binary adder, Half subtractor and Full subtractor.	**10**

Suggested Reading

1. M.K. Baagde, S.P.Singh and Kamal Singh ,Elements of Electronics ,(S. Chand and Co.)
2. B.L.Thereza, Basic Electronics, (S. Chand and Co.)
3. V.K.Mehta, Elements of Electronics, (S. Chand and Co.)
4. Brophy, Communication Electronics (McGraw-Hill Education)
5. R Boylested , Electronic Devices & Circuit theory (PHI)

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd

3. Swayam Prabha - DTH Channel,
   https://www.swayamprabha.gov.in/index.php/program/current_he/8

SKILL ENHANCEMENT COURSE (SEC P6)						
Programme: **Skill Enhancement Course**					**Year: III**	**Semester: VI**
Course Title & Code	**Credits**	**Credit distribution of the course**			**Eligibility Criteria**	**Pre-requisite of the course**
		Lecture/Theory	**Tutorial**	**Hands-on training**		
SEC P6 Advanced Instrumentation and Measurement Techniques-II	2	1	0	2	As per University Ordinance	As per University Ordinance

Course Outcomes:

To understand the function of analog and digital Multimeter.

Unit	Topic	No. of Lectures
Unit I	**Cathode Ray Oscilloscope:** Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only–no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.	**15**
Unit II	**Signal and pulse Generators** Block diagram, explanation and specifications of low frequency signal generator and pulse generator. Brief idea for testing, specifications. Distortion factor meter,wave analysis.	**15**

Suggested Reading

1. B L Theraja : A text book in Electrical Technology
2. M G Say : Performance and design of AC machines
3. S. Salivahanan& N. S.Kumar : Electronic Devices and Circuits, , 3rd Edn
4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
5. M. Lotia, Modern Basic Electrical & House Wiring Servicing

OR

SKILL ENHANCEMENT COURSE (SEC P6)						
Programme: **Skill Enhancement Course**				**Year: III**	**Semester: VI**	
Course Title & Code	**Credits**	**Credit distribution of the course**			**Eligibility Criteria**	**Pre-requisite of the course**
		Lecture/Theory	**Tutorial**	**Hands-on training**		
SEC P6: Electrical circuit network Skills - II	2	1	0	2	As per University Ordinance	As per University Ordinance

Course Outcomes:

To understand the types of electrical circuits and method of making different types of electrical circuits.

Unit	Topic	No. of Lectures
Unit I	**Series-Parallel electrical circuits and Kirchhoff's:** Series –parallel circuits, Analysing series-parallel circuits, Opens and Shorts in series-parallel circuits, Voltage division in a complex Series-Parallel circuits. Kirchhoff's laws: Kirchhoff's current law, Kirchhoff's voltage law, Determination of Algebraic sign, Assumed direction of current flow, Solving circuit problems using Kirchhoff's laws.	**`15**
Unit II	**Network Theorems:** Concept of electrical Network, Different types of Network Theorems: Superposition Theorem, Application of superposition theorem for solving electrical network problems, Thevenin's Theorem, Procedure for Thevenizing an electrical circuit, Application of Thevenin's theorem, Norton's Theorem, Procedure to Nortonise an electrical circuit, Application of Norton's theorem, Maximum Power Transfer Theorem.	**15**

Suggested Reading

1. B L Theraja : A text book in Electrical Technology
2. B L Theraja : A text book in Basic Electronics
3. M G Say : Performance and design of AC machines
4. S. Salivahanan& N. S.Kumar : Electronic Devices and Circuits, , 3rd Edn
5. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
6. M. Lotia, Modern Basic Electrical & House Wiring Servicing