KUMAUN UNIVERSITY, NAINITAL

BACHELOR in PHYSICS

SYLLABUS FRAMED AS PER THE

NATIONAL EDUCATION POLICY-2020

(Effective from the Academic Year 2022-2023)

List of Papers across all Semesters (B.Sc. Degree)Semester-wise Titles of the Papers in Physics					
Year	**Sem.**	**Course Code**	**Paper Title**	**Theory/ Practical**	**Credits**
Certificate Course in Basic Physics					
FIRSTYEAR	I		Mechanics & Theory of Waves and Oscillations	Theory	(04)
			Mechanical Properties of Matter	Practical	(o2)
	II		Electricity and Magnetism	Theory	(04)
			Demonstrative Aspects of Electricity & Magnetism	Practical	(o2)
Diploma in Applied Physics					
SECOND YEAR	III		Thermodynamics and Statistical Physics	Theory	(04)
			Demonstrative Aspects of Thermal and Statistical Properties of Matter	Practical	(o2)
	IV		Geometrical Optics	Theory	(04)
			Demonstrative Aspects of Geometrical Optics	Practical	(o2)
Bachelor of Science					
THIRD YEAR	V		Physical Optics	Theory	(04)
			Basic Electronics	Theory	(04)
			Demonstrative Aspects of Physical Optics and Basic Electronics	Practical	(o2)
	VI		Modern Physics	Theory	(04)
			Analog and Digital Electronics	Theory	(04)
			Demonstrative Aspects of Modern Physics and Analog & Digital Circuits	Practical	(o2)

Subject prerequisites:

1. For Semester I: 12th pass with subjects Physics and Mathematics
2. For Semester II: As per the University Ordinance
3. For Semester III: As per the University Ordinance
4. For Semester IV: As per the University Ordinance
5. For Semester V: As per the University Ordinance
6. For Semester VI: As per the University Ordinance

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 to solve 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 Geometrical Optics
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 for R&D.

Programme specific outcomes (PSOs):

UG I Year / Certificate course in Basic Physics

After completing this certificate course, the student should have

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

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Programme specific outcomes (PSOs):
UG II Year/ (Diploma in Applied Physics)

After completing this diploma course, the student should have

• Knowledge of different concepts in Thermodynamics, and Geometrical Optics.

• 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.

• 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.

• 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	Knowledge of Mechanics and basic properties of matter. 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	Understanding of basic concepts related to Electricity and Magnetism. He should be proficient in designing and handling different electrical circuits
PSO3	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	Proficient in the field of Optics which will increase his demand in research and industrial establishments engaged in activities involving optical instruments.
PSO5	Basic knowledge in the field of Modern physics, which have utmost importance at both undergraduate and graduate level.
PSO6	• Comprehensive knowledge of Analog & Digital Principles and Applications. • Learn the integrated approach to analog electronic circuitry and digital electronics for R&D.

CERTIFICATE COURSE IN BASIC PHYSICS		
Programme: ***Certificate Course in Basic Physics***	**Year: I**	**Semester: I Paper-I**
Subject: Physics		
Course Code:	**Course Title: Mechanics & Theory of Waves and Oscillations**	

Course Outcomes

1. Understanding of Vector Algebra and Vector Calculus.
2. Understand 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 waves and oscillations.

Credits: 04	**Core Compulsory**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

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.	**10**
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 and their derivation.	**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.	**15**
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	**Waves and 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, wave motion, particle and wave velocity, differential equation of wave motion, Fourier theorem .Fourier analysis of square and saw tooth waves.	**15**

Suggested Reading

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

2.Berkeley Physics Course : Mechanics Vol-I

3.R.P. Feynman, R.B.Lightan and M.Sand : The Feynman Lectures in Physics

4.D.S. Mathur : Mechanics

5. Murray Spiegel, Seymour Lipschutz, Dennis Spellman, "Schaum's Outline Series: VectorAnalysis", McGraw Hill, 2017.

6. 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

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/Assignment- (25 marks)

Course Prerequisites: Physics and Mathematics in 12^{th}

CERTIFICATE COURSE IN BASIC PHYSICS

Programme: *Certificate Course in Basic Physics*	**Year: I**	**Semester: I Practical**

Subject: Physics (Practical)

Course Code	**Course Title:** Mechanical Properties of Matter (Practical)

Course Outcomes:

1. Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the mechanical properties.
2. Measurement precision and perfection is achieved through Lab Experiments.

Credits: 02	**Core Compulsory**
Max. Marks: 50 **Internal (Record File): 15** **External Practical Exam: 20** **External Viva Voce : 15**	**Min. Passing Marks: 17**

Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4

Unit	**Topic**	**No. of Lectures**
	Lab Experiment List	
	1. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity. 2. To determine the Moment of Inertia of a Flywheel. 3. To determine g and velocity for a freely falling body using Digital Timing Technique. 4. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method). 5. To determine the Young's Modulus of a Wire by Optical Lever Method. 6. To determine the Young's Modulus by bending of beam. 7. To determine the Modulus of Rigidity of a Wire by Maxwell's needle. To determine the elastic Constants of a wire by Searle's method. 8. To determine the value of g using Bar Pendulum. 9. To determine the value of g using Kater's Pendulum. 10. To determine Surface Tension.	**60**

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

Suggested Continuous Evaluation Methods:

Continuous internal evaluation shall be based on attendance of student in Lab and presentation of practical in the record file. The marks shall be as follows

Record File (15 marks)

Course Prerequisite: As per the university ordinance.

Further Suggestions:

• The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List

CERTIFICATE COURSE IN BASIC PHYSICS

Programme : ***Certificate Course in Basic Physics***	**Year: I**	**Semester: II Paper-I**

Subject: Physics

Course Code:	**Course Title: Electricity and Magnetism**

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.

Credits: 04	**Core Compulsory**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

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.	**15**
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.	**15**
Unit III	**Electric Currents (Steady and Varying)** Current density, Equation of Continuity, Ohm's law and electrical conductivity, LorentzDrude theory, Wiedmann-Frenz law, Kirchhoff's laws	**10**

	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.	
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, Interactionbetween two wires, field due a Helmholtz coil, solenoid and current loop, magnetic vector potential, permeability, Energy stored in Magnetic field.	**10**
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) Private Limited, 2018.

7. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics Vol. 2", Pearson Education Limited, 2012.

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

Suggested Continuous Evaluation (25 Marks): Continuous internal evaluation shall be based on allotted assignment and class tests. The marksshall be as follows:

Class Test/Assignment (25 marks)

Course Prerequisite: As per the university ordinance.

CERTIFICATE COURSE IN BASIC PHYSICS		
Programme: ***Certificate Course in Basic Physics***	**Year: I**	**Semester: II Practical**
Subject: Physics (Practical)		
Course Code:	**Course Title:** Demonstrative Aspects of Electricity & Magnetism (Practical)	

Course Outcomes:

1. Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the electric and magnetic properties.
2. Measurement precision and perfection is achieved through Lab Experiments.

Credits: 02	**Core Compulsory**
Max. Marks: 50 **Internal (Record File): 15** **External Practical Exam: 20** **External Viva Voce : 15**	**Min. Passing Marks: 17**

Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4

Unit	Topic	No. of Lectures
	Lab Experiment List	
	1. Frequency of A.C. Mains. 2. Calibration of Voltmeter by potentiometer. 3. Calibration of ammeter by potentiometer. 4. Specific resistance determination. 5. Conversion of a Galvanometer into a Voltmeter. 6. Conversion of a Galvanometer into Ammeter. 7. Variation of magnetic field along the axis of a current carrying circular coil. 8. Comparison of capacities by Ballistic Galvanometer. 9. Determination of Ballistic Constant. 10. Electrochemical equivalent. 11. De Sauty's bridge- C1/ C2 12. R1/R2 by potentiometer. 13. Study of R-C, L-C-R circuits. 14. Determination of self inductance, mutual inductance. 15. Magnetic field determination by search coil and ballistic galvanometer.	**60**

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 by individual Universities

Suggested Continuous Evaluation Methods:

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Record File (15 marks)

Course Prerequisite: As per the university ordinance.

Further Suggestions:

• The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List.

Minor/Elective (04 Credit)

Exclusively for Other faculty students

1. Basic Physics-I

For those students who have not opted physics as Major (One from the list only if applicable)

1. Fundamental Mechanics
2. Waves and Oscillations
3. Basic Electricity and Magnetism

MINOR ELEVTIVE -- BASIC PHYSICS-I			
Programme: ***Minor Elective***		**Year: I**	**Semester: I/II**
Subject: **Physics**			
Course Code:	Course Title: **Basic Physics- I**		
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.			
Credits: 04		**Minor/Elective**	
Max. Marks: 100 External Exam: 75 Internal Assessment: 25		Min. Passing Marks: 33	
Total No. of Lectures-Tutorials			
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)

MINOR ELECTIVE – FUNDAMENTAL MECHANICS		
Programme: *Minor Elective*	**Year: I**	**Semester: I/II**
Subject: Physics		
Course Code:	**Course Title: Fundamental Mechanics**	

Credits: 04	**Minor/Elective**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0	

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 – Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion – Torsional pendulum-Determination of Rigidity modulus and moment of inertia - q, η and σ by Searles method.	**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 for Students

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

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/ Assignment (25 marks)

MINOR ELECTIVE – WAVES AND OSCILLATIONS		
Programme: *Minor Elective*	**Year: I**	**Semester: I/II**
Subject: Physics		
Course Code:	**Course Title: Waves and Oscillations**	

Credits: 04	**Minor/Elective**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0	

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. 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. Acoustics of buildings, reverberation time, Sabine's formula, Principle of sonar system.	**15**
Unit II	**Ultrasonics** Classification of Sound waves, Ultrasonics, Quartz crystal and Piezo electric effect, Magnetostriction effect, Properties of Ultrasonic, Detection of ultrasonic waves, Determination of velocity of ultrasonic waves in liquid (Acoustic grating method) . Application of Ultrasonics.	**15**
Unit III	**Simple Harmonic Oscillations** Periodic motion, SHM in mechanical systems, Energy of Simple harmonic oscillator, Superposition of SHM(s), Oscillations of two masses connected by a spring, Non-linear (An-harmonic) oscillator and its applications to simple pendulum. Applications of Simple harmonic motion in compound pendulum, Torsional pendulum and LC circuit, Composition of two SHM(s) of different frequency ratio, Lissajous' figures for equal frequencies ratio and 2:1 frequencies ratio	**15**
Unit IV	**Damped and Forced Harmonic Oscillations** Damping force, Different cases for over, critical and under damping, Mechanical damped harmonic oscillators, Logarithmic decrement, Power Dissipation, Relaxation time & Quality Factor.	**15**

	Forced oscillations, Mechanical driven harmonic oscillators, Transient and steady state behavior, Power absorption, phenomenon of resonance, amplitude resonance, velocity resonance, sharpness of resonance/Fidelity, Bandwidth and quality factor.	

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 Material Science
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

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/Assignment (25 marks)

MINOR ELECTIVE – BASIC ELECTRICITY AND MAGNETISM		
Programme: *Minor Elective*	**Year: I**	**Semester: I/II**
Subject: Physics		
Course Code:	**Course Title: Basic Electricity and Magnetism**	

Credits: 04	**Minor/Elective**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0	

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 electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere.	**15**
Unit II	**Magnetism** Magnetostatics: Biot-Savart's law and its applications- straight 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 mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.	**15**
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.	**15**

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

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

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/Assignment (25 marks)

DIPLOMA IN APPLIED PHYSICS

Programme: *Diploma in Applied Physics*	**Year: II**	**Semester: III Paper-I**

Subject: Physics

Course Code:	**Course Title: Thermodynamics and Statistical Physics**

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 w.r.t. various gas laws.
4. Study the implementations and limitations of fundamental radiation laws.
5. Understand basics of statistical Physics and concept of thermodynamic probability

Credits: 04	**Core Compulsory**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

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.	**15**
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.	**15**
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.	**10**

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

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/Assignment (25 marks)

Course Prerequisite: As per the university ordinance.

DIPLOMA IN APPLIED PHYSICS		
Programme: ***Diploma in Applied Physics***	**Year: II**	**Semester: III Practical**
Subject: Physics (Practical)		
Course Code:	**Course Title:** Demonstrative Aspects of Thermal and Statistical Physics (Practical)	

Course Outcomes:

1. Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the thermal properties.
2. Measurement precision and perfection is achieved through Lab Experiments.

Credits: 02	**Core Compulsory**
Max. Marks: 50 **Internal (Record File): 15** **External Practical Exam: 20** **External Viva Voce : 15**	**Min. Passing Marks:17**

Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4

Unit	Topic	No. of Lectures
	Lab Experiment List	
	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. Thermal conductivity of a good conductor by Searle's method. 6. J by Callendar and Barnes method. 7. Random throw- statistical method. 8. Newton's law of cooling, sp. heat of Kerosene oil. 9. Constant volume thermometer. 10. Variation of thermo-emf across two junctions of a thermocouple with Temperature	**60**

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

Suggested Continuous Evaluation Methods:

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Record File (15 marks)

Course Prerequisite: As per the university ordinance.

Further Suggestions:

• The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List.

DIPLOMA IN APPLIED PHYSICS

Programme: *Diploma in Applied Physics*	**Year: II**	**Semester: IV Paper-I**

Subject: Physics

Course Code:	**Course Title: Geometrical Optics**

Course Outcomes:

1. Study of Fermat's Principle of Extremum Path and understand fundamental physics behind reflection 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

Credits: 04	**Core Compulsory**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

Unit	Topic	No. of Lectures
Unit I	**Fermat's Principle and its application**: Basics of Geometrical optics, Fermat's principle of extremum path and its application to deduce laws of reflection and refraction, Fermat's principle and refraction at concave surface, Principal foci, Lateral and longitudinal magnifications, Aplanatic points and planes of spherical surface.	**10**
Unit II	**Theory of image formation**: Gauss's general theory of image formation, Coaxial symmetrical system, Thick and Thin lens, lens combinations, Newton's formula, Coaxial lens system, Lagrange's equation of magnification, Refraction through a thick lens. Matrix theory of image formation: Translation, refraction and system matrix, System matrix for thick lens, System matrix for a combination of two thin lenses.	**15**
Unit III	**Cardinal Points and Eyepieces**: Cardinal points and planes of an optical system, Construction of the image using cardinal points, Cardinal points of a thick Lens, Construction of Eyepiece, Its advantages over single lens, Types of Eyepieces: Kellner's, Ramsden, Huygens and Gaussian eyepieces, their comparison. Cardinal points of different types of eyepieces.	**15**
Unit IV	**Optical Aberrations**: Theory of Dispersion, angular dispersion, dispersive power, Monochromatic aberrations: Spherical aberration, Coma, Astigmatism, Curvature of field, Distortion, Techniques for the reduction of monochromatic aberrations, Chromatic aberration, Condition of achromatism, Achromatic combination of lenses in contact and separated lenses, Circle of least chromatic aberration, corrector plates.	**10**
Unit V	**Related Instruments:** Nodal Slide, Astronomical telescopes, Types of telescopes, Reflecting and refracting telescope, Different types of telescopes: Gregory, Cassegrain, Coude , Plate scale of a telescope, Resolution of telescope, Compound microscope: principle and types, Spectrometer and its uses, Oil immersion objectives meniscus lens.	**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
3. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Suggested equivalent online courses:

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Assignment (05 marks)

Class Test/Assignment (25 marks)

Course Prerequisite: As per the university ordinance.

DIPLOMA IN APPLIED PHYSICS		
Programme: ***Diploma in Applied Physics***	**Year: II**	**Semester: IV Practical**
Subject: Physics (Practical)		
CourseCode:	**Course Title:** Demonstrative Aspects of Geometrical Optics (Practical)	

Course Outcomes:

1. Experimental physics has the most striking impact on the industry wherever the instruments are used tostudy and determine the optical properties.

2. Measurement precision and perfection is achieved through Lab Experiments.

Credits: 02	**Core Compulsory**
Max. Marks: 50 **Internal (Record File): 15** **External Practical Exam: 20** **External Viva Voce: 15**	**Min. Passing Marks:17**

Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4

Unit	Topic	No. of Lectures
	Lab Experiment List	
	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 verify the Cauchy's dispersion formula. 7. To find the thickness of the wire using optical bench. 8. To determine the thickness of mica-sheet by using Biprism	**60**

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 by individual Universities

Suggested Continuous Evaluation Methods:

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Record File (15 marks)

Course Prerequisite: As per the university ordinance.

Further Suggestions:

The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List.

Minor/Elective (04 Credit)

Exclusively for Other faculty students

1. Basic Physics-II

For those students who have not opted physics as Major (One from the list)

1. **Elements of Modern Physics**
2. **Electromagnetic Theory**

MINOR ELECTIVE – BASIC PHYSICS -II			
Programme: **Minor Elective**		**Year: II**	**Semester: III/IV**
Subject: **Physics**			
Course Code:	Course Title: **Basic Physics- II**		
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.			
Credits: 04		**Minor/Elective**	
Max. Marks: 100 External Exam: 75 Internal Assessment: 25		Min. Passing Marks: 33	
Total No. of Lectures-Tutorials			
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)

MINOR ELECTIVE – ELEMENTS OF MODERN PHYSICS		
Programme: *Minor*	**Year: II**	**Semester: III/IV**
Subject: Physics		
Course Code:	**Course Title: Elements of Modern Physics**	

Credits: 04	**Minor/Elective**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0	

Unit	Topic	No. of Lectures
Unit I	**Quantum Mechanics and Bohr Atom Model** Planck's quantum, Planck's constant and light as a collection of photons; Photoelectric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Rutherford model, Bohr's model, quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra.	**15**
Unit II	**Quantum Systems and Heisenberg Uncertainty Principle** Position measurement; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle.	**15**
Unit III	**Matter Waves and Schrödinger Equation** Two slit interference experiment with photons, atoms & particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wavefunction, probabilities and normalization; Probability and probability current densities in one dimension.	**15**
Unit IV	**Motion in a Potential Well** One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example; Quantum mechanical tunnelling in one dimension - across a step potential and across a rectangular potential barrier.	**15**

Suggested Reading

1. Arthur Beiser : Concepts of Modern Physics
2. J.R. Taylor, C.D. Zafiratos : Modern Physics
3. Thomas A. Moore : Six Ideas that Shaped Physics: Particle Behave like Waves
4. Berkeley Physics Course : Vol.4 (Quantum Physics)
5. Serway, Moses, and Moyer : Modern Physics
6. G. Kaur and G.R. Pickrell : Modern Physics
7. B.L. Flint and H.T. Worsnop : Advanced Practical Physics for Students
8. Michael Nelson and Jon M. Ogborn : Advanced level Physics Practicals, , 4th 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. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/ Assignment (25 marks)

MINOR ELECTIVE – ELECTROMAGNETIC THEORY		
Programme: ***Minor Elective***	**Year: II**	**Semester: III/IV**
Subject: Physics		
Course Code:	**Course Title:** **Electromagnetic Theory**	

Credits: 04	**Minor/Elective**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 25**
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0	

Unit	Topic	No. of Lectures
Unit I	**Maxwell's Equations** Review of electrostatic and electromagnetic equations, their differential and integral forms, Maxwell's equations. Displacement Current. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density.	**15**
Unit II	**EM Wave Propagation in Unbounded Media** Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth.	**15**
Unit III	**EM Wave in Bounded Media** Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection and Refraction, Fresnel's Formulae, Brewster's law. Total internal reflection,	**15**
Unit IV	**Polarization of Electromagnetic Waves** Description of Linear, Circular and Elliptical Polarization. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices.	**15**

Suggested Reading

1. D.J. Griffiths : Introduction to Electrodynamics

2. M.N.O. Sadiku : Elements of Electromagnetics

3. T.L. Chow : Introduction to Electromagnetic Theory

4. M.A.W. Miah : Fundamentals of Electromagnetics

5. R.S. Kshetrimayun : Electromagnetic field Theory
6. Willian H. Hayt : Engineering Electromagnetic
7. J.A. Edminster : Electromagnetics, Schaum Series, 2006
8. B.L. Flint and H.T. Worsnop : Advanced Practical Physics for Students
9. Michael Nelson and J. M. Ogborn : Advanced level Physics Practicals

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

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/ Assignment (25 marks)

DEGREE IN SCIENCE		
Programme: *Degree in Science*	**Year: III**	**Semester: V Paper-I**
Subject: Physics		
Course Code:	**Course Title: Physical Optics**	

Course Outcomes:

1. Study of Interference of light. Interference by division of wavefront and division of amplitude.
2. Understanding Diffraction of Light and concept of Zone Plate.
3. Understand the polarization of light..
4. Study of different types of associated optical instruments based on interference and diffraction of light which are widely used in industry and research.

Credits: 04	**Core Compulsory**
Max. Marks: 100 **External Exam: 75** **Internal assessment: 25**	**Min. Passing Marks: 33**

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

Unit	Topic	No. of Lectures
Unit I	**Electromagnetic Theory of Light:** Definition and Properties of wave front, Plane and Spherical Waves, Longitudinal and Transverse Waves, Maxwell's equations and their interpretations, Poynting's theorem, Energy flux of electromagneic wave, Huygen's Principle in homogeneous and inhomogeneous medium, Construction of Huygen's wave front.	**10**
Unit II	**Interference:** Interference The principle of superposition, Two slit interference, coherence, Division of wave front and amplitude, 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.	**15**
Unit III	**Diffraction:** 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.	**15**
Unit IV	**Polarizatioin:** 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**

Unit V	**Intereferometers:** Michelson intereferometer and its application for precise measurement of wavelength, Wavelength difference and width of spectral lines, Twyman-Green interferometer, Tolansky fringes, Fabry-Perot interferometer and Etalon.	**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

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

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test /Assignment (25 marks)

Course Prerequisite: As per the university ordinance.

DEGREE IN SCIENCE

Programme: *Degree in Science*	**Year: III**	**Semester: V Paper-II**

Subject: Physics

Course Code:	**Course Title: Basic Electronics**

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

Credits: 04	**Core Compulsory**
Max. Marks: 100 **External Exam: 75** **Internal Exam: 25**	**Min. Passing Marks: 33**

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

Unit	Topic	No. of Lectures
Unit I	**Network Theorems** Superposition Theorem, Constant voltage source and constant current source, Conversion of voltage source into current source, Thevenin's Theorem and procedure for finding thevenin equivalent circuit, Norton‟s Theorem and procedure for finding Norton equivalent circuit, Maximum power transfer theorem, Applications of Network Theorems	**10**
Unit II	**Power Supplies** Semiconductor diode: P-N Junction diode, Diode circuits with DC and AC Voltage sources, Diode as a rectifier: Half and Full wave rectifiers, Bridge rectifiers, Peak inverse voltage, Efficiency, Ripple factor, Filters: Low pass and High pass filters, Band pass and Band stop filters, L and π – filters (Series inductor, Shunt capacitor, LC, CLC filters), Zener diode, its characteristics, Voltage regulation	**15**
Unit III	**Special Diodes** Special Diodes Tunneling effect, Tunnel diode, Varactor diode, Point contact diode, V-I characteristic of these diodes, Optoelectronic devices: Light emitting diode (LED), Photo emissive devices, Photodiodes, P-N Junction Photodiodes, PIN photodiode. Avalanche Photodiode	**10**
Unit IV	Basic Transistor (BJT) Bipolar junction transistor, Transistor operation and its Biasing rule, Transistor currents, Transistor circuit configuration, CB configuration, CE configuration, Relations between α and β, CC configuration, Relations between transistor currents in various configuration. Leakage currents in a Transistor. Transistor	**10**

	static characteristics in common Base, common Emitter and common Collector configuration, cut-off and saturation points, Active region, h Parameters	
Unit V	Field Effect Transistors (FET) Junction FET, Static Characteristics of JFET, JFET Drain Characteristic with VGS =0, JFET Characteristic with External Bias , Transfer Characteristic, Small Signal JFET Parameters, DC Biasing of a JFET, DC load line, Advantages of FETs, MOSFET or IGFET, Depletion-enhancement (DE) MOSFET, Construction, working and Static Characteristics of a DE MOSFET, Enhancement only N-channel MOSFET, Transfer Characteristics, FETs as Switches, FET Applications, MOSFET Handling.	**15**

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

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/ Assignment (25 marks)

Course Prerequisite: As per the university ordinance.

DEGREE IN SCINCE		
Programme: ***Degree in Science***	**Year: III**	**Semester: V Practical**
Subject: Physics (Practical)		
Course Code:	**Course Title:** Demonstrative Aspects of Physical Optics and Demonstrative Aspects of Basic Electronics	

Course Outcomes:

1. Experimental physics has the most striking impact on the industry wherever the instruments are used tostudy the Electronics and its application in industry and research.
2. Measurement precision and perfection is achieved through Lab Experiments.

Credits: 02	**Core Compulsory**
Max. Marks: 50 **Internal (Record File):** **15 External Practical** **Exam: 20** **External Viva Voce : 15**	**Min. Passing Marks:17**

Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4

Unit	Topic	No. of Lectures
	Lab Experiment List	
	1. Biprism- determination of λ. 2. Newton's ring experiment- Determination of λ. 3. Determination of λ by a transmission grating. 4. Zone-plate experiment study of different orders. 5. Malus Law 6. Polarimeter: Specific rotation of sugar solution. 7. To study the characteristics of integrating and differentiating circuit. 8. To draw the characteristics of P-N junction diode. 9. To draw the characteristics of PNP and NPN junction transistor. 10. Measurements of h-parameters of a transistor. 11. Study of different types of Rectifiers and Filters. 12. Verification of Network theorems. 13. Child Langmuir law. 14. Triode/ Tetrode/ Pentode characteristics and constants. 15. Study of power supply (Ripple factor). 16. Study of Zener diode and regulation (taking different source voltage andloads).	**60**

	17. 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”, Pragat iPrakashan, 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

Suggested Continuous Evaluation Methods:

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as
follows:

Record File (15 marks)

Course Prerequisite: As per the university ordinance.

Further Suggestions:

• The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List.

DEGREE IN SCIENCE

Programme: *Degree in Science*	**Year: III**	**Semester: VI Paper-I**

Subject: Physics

Course Code:	**Course Title: Modern Physics**

Course Outcomes:

1. Study of different atomic models.
2. Study of optical spectra, X- rays and LASERS.
3. Study of structure of atomic nucleus and Elementary Particle Physics.
4. Understanding the concept of Quantum Physics.
5. Study of Special theory of relativity and relativistic physics

Credits: 04	**Core Compulsory**
Max. Marks: 100 **External Exam: 75** **Internal assessment: 25**	**Min. Passing Marks: 33**

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

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.	**15**
Unit II	**Optical Spectra, X-rays and Laser** 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. Basic idea of LASER, Einstein A and B coefficients,	**10**
Unit III	**Subatomic Physics and Elementary Particle Physics** Structure of nucleus; Charge, shape mass, energy spin, angular momentum, mass defects, Packing fraction and binding energy, liquid drop model and semi-empirical mass formula, Kinematics of nuclear reactions, Basic idea of nuclear fission and fusion, General idea of elementary particles and their classification.	**15**
Unit IV	**Quantum Mechanics** Origin of quantum theory, Limitation of classical physics, The photoelectric effect and Einstein correction, Black body radiation, Definition of position, momentum, energy operator, Time independent and time dependent one dimensional Schrodinger equation, Physical interpretation of wave function,	**10**

	probability current density, Particle in a box-, Heisenberg uncertainty principle.	
Unit V	**Special Theory of Relativity** Frame of References**,** Galliean transformation, postulates of Special theory of relativity, Basic idea of Ether hypothesis and negative results of Michelson Morley experiment, Lorentz transformation, Length contraction, Time dilation, Law of velocity addition, Relativistic energy and mass energy equivalence	**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

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/ Assignment (25 marks)

Course Prerequisite: As per the university ordinance.

DEGREE IN SCIENCE		
Programme: ***Degree in Science***	**Year: III**	**Semester: VI Paper-II**
Subject: Physics		
Course Code:	**Course Title: Analog and Digital Electronics**	

Course Outcomes:

1. Study of feedback in amplifiers along with their advantages and disadvantages.
2. Study of different types of oscillators.
3. Understand the concepts of Boolean Algebra and various number systems
4. Study of logic gates and their applications.

Credits: 04	**Core Compulsory**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

Unit	Topic	No. of Lectures
Unit I	**Transistor Amplifiers** Single-stage transistor amplifiers, Common base (CB), Common emitter (CE) and Common collector (CC) amplifier, Comparison of a amplifier configurations. Amplifier classification based on biasing condition, Power amplifiers (Class A, Push-Pull amplifier, Class B and Class C), Noise and Distortion in amplifiers, Multistage amplifier, Amplifier coupling, RC coupled two stage amplifier and its frequency response, Advantage of RC coupling	**15**
Unit II	**Feedback Amplifiers** Principle of feedback amplifiers, Classification of positive and negative feedback, Advantage of negative feedback, gain stability, Decreased distortion, Increased bandwidth, Forms of negative feedback, Positive feedback and its advantage.	**15**
Unit III	**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, Tunel diode oscillator, Crystal oscillator, Phase shift oscillator, Wien Bridge oscillator, Relaxation oscillator, Astable, monostable and bistable multivibrator, Schmitt trigger, Saw-tooth generator, Blocking oscillators	**10**

Unit IV	**Number Systems and Boolean Algebra** 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), BCD, GREY, EXCESS-3 codes.Boolean algebra, Features of Boolean algebra, Laws of Boolean algebra,Equivalent switching circuit, Demorgan"s theorems and duals	**10**
Unit V	**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, Adders and subtractors, Half Adders, Full adders.	**10**

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

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/ Assignment (25 marks)

Course Prerequisite: As per the university ordinance.

DEGREE IN SCINCE		
Programme: ***Degree in Science***	**Year: III**	**Semester: VI Practical**
Subject: Physics (Practical)		
Course Code:	**Course Title:** Demonstrative Aspects of Modern Physics and Demonstrative Aspects of Analog and Digital Electronics (Practical)	

Course Outcomes:

1. Experimental physics has the most striking impact on the industry wherever the instruments are used to study the Electronics and its application in industry and research.

2. Measurement precision and perfection is achieved through Lab Experiments.

Credits: 02	**Core Compulsory**
Max. Marks: 50 **Internal (Record File): 15** **External Practical Exam: 20** **External Viva Voce : 15**	**Min. Passing Marks: 17**

Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4

Unit	Topic	No. of Lectures
	Lab Experiment List	
	1. Frank-Hertz Experiment. 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. 7. Determination of Ionization Potential using thyratron valve. 8. Inverse square law. 9. Verification of Cauchy Formula 10. Transistor Bias Stability 11. Comparative Study of CE, CB and CC amplifier 12. Study of Emitter Follower 13. Frequency response of single stage RC coupled amplifier 14. Frequency response of single stage Transformer coupledamplifier 15. Effect of negative feedback on frequency response of RCcoupled amplifier 16. Study of Wein Bridge oscillator 17. Study of Logic Gates 18. Verification of De Morgan's Theorem 19. Study of Half Adder 20. Study of Full Adder	**60**

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

Suggested Continuous Evaluation Methods:

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Record File (15 marks)

Course Prerequisite: As per the university ordinance.

Further Suggestions:

• The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List.

The candidate shall have to undertake a Industrial Training/Survey/Research project in fifth and sixth semester (Third Year) which shall be qualifying in nature as per details given in annexure I.

**OPTIONS FOR VOCATIONAL COURSES SHALL BE SUBJECT TO THE GUIDELINES ISSUED BY THE UNIVERSITY FROM TIME TO TIME.

VOCATIONAL COURSE - **Basic Instrumentation Skills -I**		
Programme: ***Vocational Course***	**Year: I**	**Semester: I Vocational**
Subject: Physics		
Course Code:	**Course Title: Basic Instrumentation Skills -I**	
Credits: 03	**Vocational (Experiments/hands on training)**	
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 3-0-0		

Unit	Topic	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.	**10**
Unit III	**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, Removing of insulation from assorted wires and cable, Making a switch board with electrical accessories, Making Extension board.	**20**

Suggested Reading

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

VOCATIONAL COURSE - **Basic Instrumentation Skills -II**		
Programme: Vocational Course	**Year: I**	**Semester: II Vocational**
Subject: Physics		
Course Code:	**Course Title: Basic Instrumentation Skills -II**	
Credits: 03	**Vocational (Experiments/hands on training)**	
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 3-0-0		

Unit	Topic	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.	**20**
Unit II	**Testing of Batteries:** Testing Factor 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.	**10**
Unit III	**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

VOCATIONAL COURSE - **Basic Instrumentation Skills -III**		
Programme: *Vocational course*	**Year: II**	**Semester: III Vocational**
Subject: Physics		
Course Code:	**Course Title: Basic Instrumentation Skills -III**	
Credits: 03	**Vocational (Experiments/hands on training)**	
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 3-0-0		

Unit	Topic	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 respect to input impedance and sensitivity.	**20**
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.	**10**
Unit III	**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.

VOCATIONAL COURSE - **Basic Instrumentation Skills -IV**		
Programme: *Vocational Course*	**Year: II**	**Semester: IV Vocational**
Subject: Physics		
Course Code:	**Course Title: Basic Instrumentation Skills -IV**	
Credits: 03	**Vocational (Experiments/hands on training)**	
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 3-0-0		

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.	**20**
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.	**10**
Unit III	**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**

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.