# NATIONAL EDUCATION POLICY-2020

## Syllabus for Sri Dev Suman Uttarakhand University, Badshahithaul, Tehri (Garhwal) and Affiliated Colleges

# UG PHYSICS SYLLABUS

## 2023

## Sri Dev Suman Uttarakhand University

## Badshahithaul, Tehri (Garhwal)

# Curriculum Design Committee, Uttarakhand

| S. No. | Name & Designation | |
|---|---|---|
| 1. | Prof. N.K. Joshi<br>Vice-Chancellor, Sridev Suman Uttarakhand University, New Tehri | Chairman |
| 2. | Vice-Chancellor, Kumaun University, Nainital | Member |
| 3. | Prof. Jagat Singh Bisht<br>Vice-Chancellor, Soban Singh Jeena University Almora | Member |
| 4. | Prof. Surekha Dangwal<br>Vice-Chancellor, Doon University, Dehradun | Member |
| 5. | Prof. O. P. S. Negi<br>Vice-Chancellor, Uttarakhand Open University, Haldwani | Member |
| 6. | Prof. M.S.M. Rawat<br>Advisor, Rashtriya Uchchatar Shiksha Abhiyan, Uttarakhand | Member |
| 7. | Prof. K. D. Purohit<br>Advisor, Rashtriya Uchchatar Shiksha Abhiyan, Uttarakhand | Member |

# Syllabus Preparation Committee

## A: Department of Physics, Sri Dev Suman Uttarakhand University Pt. Lalit Mohan Sharma Campus, Rishikesh

| S.N. | Name | Designation |
|---|---|---|
| 1. | Dr. Yogesh Kumar Sharma | Professor & Head |
| 2. | Dr. Manoj Yadav | Professor |
| 3. | Dr. Bimal Prkash Bahuguna | Professor |
| 4. | Dr. Hemant Singh | Associate Professor |

## B: Experts from Other Institutions

| S. N. | Name | Designation and Address |
|---|---|---|
| 1. | Prof. G. K. Dhingra | Dean. Faculty of Science, Pt. L.M.S. Campus Rishikesh |
| 2. | Prof. L. P. Purohit | Professor, Department of Physics, Gurukula Kangri (Deemed to be) University Haridwar |
| 3. | Prof. Pushpa Negi | Principal & Professor of Physics, Govt. P. G. College, New Tehri |
| 4. | Prof. Pankaj Pant | Principal, Govt. P. G. College, Nagnath Pokhari |
| 5. | Prof. Kuldeep Singh Negi | Principal, Govt. P. G. College, Khanpur |
| 6. | Prof. Anita Rawat | Director, USERC, Dehradun |

Gmail **Kathait Ajaib Singh <singhajaib81@gmail.com>**

# Fw: syllabus

1 message

**Yogesh Sharma** <dryksharma@yahoo.com> Sat, Jul 15, 2023 at 7:51 AM
To: "singhajaib81@gmail.com" <singhajaib81@gmail.com>

**Dr Yogesh Kumar Sharma**
**Professor and Head**
**Department of Physics**
**S. D. S. Uttarakhand University**
**Pt. L M S Campus Rishikesh, (Dehradun) Uttarakhand**
**Pin Code -249201**
**dryksharma@yahoo.com**
**yksharmaphysics@gmail.com**

----- Forwarded message -----
**From:** L.P. Purohit <lppurohit@gmail.com>
**To:** Yogesh Sharma <dryksharma@yahoo.com>
**Sent:** Tuesday, 11 July 2023 at 09:58:08 pm GMT+5:30
**Subject:** Re: syllabus

Dear Prof. Y.K. Sharma,
I have gone through the syllabus of the Four Year UG Programme of B.Sc. (Physics) and one Year P.G. Programme of M.Sc. Physics designed as per the recommendation of NEP 2020. I hereby approve the same.
With regards,
Prof. L.P. Purohit
External member/Subject Expert

> On Tue, Jul 11, 2023 at 11:09 AM Yogesh Sharma <dryksharma@yahoo.com> wrote:
> PFA
>
> **Dr Yogesh Kumar Sharma**
> **Professor and Head**
> **Department of Physics**
> **S. D. S. Uttarakhand University**
> **Pt. L M S Campus Rishikesh, (Dehradun) Uttarakhand**
> **Pin Code -249201**
> **dryksharma@yahoo.com**
> **yksharmaphysics@gmail.com**

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Dr. L.P. Purohit
Professor & Head
Department of Physics
Dean, Faculty of Science
Gurukula Kangri University

Haridwar - 249 404 (Uttarakhand), INDIA
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Tel. +91 7300761217

# राजकीय स्नातकोत्तर महाविद्यालय

NAAC द्वारा "B" ग्रेड प्रदत्त

(श्रीदेव सुमन, उत्तराखण्ड विश्वविद्यालय श्रीदरबारीखाल, टिहरी गढ़वाल से सम्बद्ध)

नई टिहरी (टिहरी गढ़वाल) उत्तराखण्ड

☎ : 01376 - 234964 E-mail : gpgcollegentt@gmail.com Website : www.gpgcnewtehri.com


पत्रांक 537 दिनांक 11/07/23

I,(Prof.) Pushpa Negi attended Board of studies online meeting on dated 11-07-2023.

The attached syllabus of UG.& PG Physics is approved and recommended.

11.7.2023

Prof. Pushpa Negi

Principal

Govt. P.G. College

College New Tehri

राजकीय स्नातकोत्तर महाविद्यालय,
नई टिहरी, टिहरी गढ़वाल

# National Education Policy-2020

# Syllabus for Sri Dev Suman Uttarakhand University and All Affiliated Colleges for B.Sc. in Physics.

**2023**

## List of Papers in Six 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*** | | |
| FIRST YEAR | Sem I | CPT1001 | Mechanics | Theory | (04) |
| | | CPP 1002 | Mechanical Properties of Matter | Practical | (02) |
| | Sem II | CPT 1003 | Electricity and Magnetism | Theory | (04) |
| | | CPP 1004 | Demonstrative Aspects of Electricity & Magnetism | Practical | (02) |
| | | | ***Diploma in Applied Physics*** | | |
| SECOND YEAR | Sem III | DPT 2001 | Thermodynamics and Statistical Physics | Theory | (04) |
| | | DPP 2002 | Demonstrative Aspects of Thermal Properties & Statistical Physics | Practical | (02) |
| | Sem IV | DPT 2003 | Optics | Theory | (04) |
| | | DPP 2004 | Demonstrative Aspects of Geometrical and Physical Optics | Practical | (02) |
| | | | ***Bachelor of Science*** | | |
| THIRD YEAR | Sem V | BPT3001 | Solid State Physics | Theory | (04) |
| | | BPP3002 | Demonstrative Aspects of Solid State Physics | Practical | (02) |
| | | BPT 3003 | Basic Electronics | Theory | (04) |
| | | BPP 3002 | Demonstrative Aspects of Basic Electronics | Practical | (02) |
| | Sem VI | BPT 3003 | Modern Physics & Elementary Quantum Mechanics | Theory | (04) |
| | | BPP3004 | Demonstrative Aspects of Modern Physics & Elementary Quantum Mechanics | Practical | (02) |
| | | BPT 3005 | Analog and Digital Electronics | Theory | (04) |
| | | BPP 3006 | Demonstrative Aspects of Analog & Digital Circuits | Practical | (02) |

**Subject prerequisites:**

1. For SemesterI: 12th pass with subjects Physics, Chemistry & Mathematics
2. For SemesterII: Passed Semester I with Physics
3. For SemesterIII: Passed Semester II with Certificate Course in Basic Physics
4. For SemesterIV: Passed Semester III
5. For SemesterV: Passed Semester IV with Diploma in Applied Physics
6. For SemesterVI: Passed SemesterV

**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.<br>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.<br>2. Student should be able to make basic electrical circuits and handle electrical instruments. |
| **PO 3** | 1. Competence in the concepts of Thermodynamics and Statistical Physics.<br>2. Students are expected to have hands on experience in Thermal and Statistical Physics Experiments. |
| **PO 4** | 1 Knowledge of different concepts in Geometrical and Physical Optics.<br>2 Students are expected to have hands on experience of Experiments of Geometrical and Physical Optics. |
| **PO 5** | 1. Knowledge of basic concepts of solid state physics with their applications.<br>2. Students are expected to have an insight in handling in solid state and basic electronic instruments. |
| **PO 6** | 1. Comprehensive knowledge of modern physics, elementary quantum mechanics, Analog & Digital electronics and their Applications.<br>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, statistical physics, Geometrical and Physical Optics.
- Knowledge of different aspects of Thermal Physics and Statistical Mechanics 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 proficienct in designing and handling different electrical circuits* |
| **PSO3** | Expertise in different aspects of Thermal and Statistical 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.<br>*Proficient in the field of Optics which will increase his demand in research and industrial establishments engaged in activities involving optical instruments.* |
| **PSO4** | *Proficient in the field of Solid State Physics which will increase his demand in R & D.* |
| **PSO5** | *Basic knowledge in the field of Modern physics and Quantum Mechanics* which have utmost importance at both undergraduate and graduate level. |
| **PSO6** | Comprehensive knowledge of Basic Electronics, Analog & Digital Principles and their Applications.<br>Learn the integrated approach to analog electronic circuitry and digital electronics for R&D. |

| | Year wise Structure of B.Sc. in Physics (CORE / ELECTIVE COURSES & PROJECTS) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Subject: Physics | | | | | | | | | | | | | |
| **Type of Programme** | **Year** | **Sem** | **Paper I** | **Credit /hrs** | **Paper 2** | **Credit/ hrs** | **Paper 3** | **Credits /hrs** | **Paper 4** | **Credits /hrs** | **Elective Paper** | **Credits /hrs** | **Research Project** | **Credit/hrs** |
| **Certificate** | I | I | **Mechanics (Theory)** | 4/60 | **Mechanical Properties of Matter (Lab)** | 2/60 | | | | | EL1 (One from the list) (04) | 4/60 | | |
| | | II | **Electricity and Magnetism (Theory)** | 4/60 | **Demonstrative Aspects of Electricity& Magnetism (Lab)** | 2/60 | | | | | | | | |
| **Diploma** | II | III | **Thermodynamics and Statistical Physics (Theory)** | 4/60 | **Demonstrative Aspects of Thermal Properties of Matter and Statistical Physics (Lab)** | 2/60 | | | | | EL2 (One from the list) (06) | 4/60 | | |
| | | IV | **Optics (Theory)** | 4/60 | **Demonstrative Aspects of Geometrical and Physical Optics (Lab)** | 2/60 | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bachelor of Science** | III | V | **Solid State Physics (Theory)** | 4/60 | **Basic Electronics (Theory)** | 4/60 | **Demonstrativ e Aspects of Solid State Physics (Lab)** | 2/60 | **Demonstrative Aspects of Basic Electronics (Lab)** | 2/60 | | | Industrial Training/Res earch Project | Qualifying |
| | | VI | **Modern Physics & Elementary Quantum Mechanics (Theory)** | 4/60 | **Analog and Digital Electronics (Theory)** | 4/60 | **Demonstrativ e Aspects of Modern Physics & Quantum Mechanics (Lab)** | 2/60 | **Demonstrative Aspects of Analog & Digital Circuits (Lab)** | 2/60 | | | Industrial Training/Res earch Project | Qualifying |

**CERTIFICATE COURSE IN BASIC PHYSICS**

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

**Subject: Physics**

| **Course Code:** | **Course Title: Mechanics** |
|---|---|

**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.

| **Credits: 04** | **Core Compulsory** |
|---|---|
| **Max. Marks: 100**<br>**External Exam: 75**<br>**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**<br>Vector algebra. Scalar and vector products, scalar and vector triple products. Derivative of a vector with respect to a parameter, Del operator, gradient divergence and curl, Gauss divergence theorem, Stokes curl theorem and Green's theorem, Line, surface and volume integral of a vector function. | **10** |
| **Unit II** | **Gravitation field and potential**<br>Gravitational field and potential, Gravitational potential energy, Gravitational field Intensity and potential due to a ring, a spherical shell, solid sphere and circular disc, gravitational self-energy, Inverse square law of forces, Kepler's laws of planetary motion. | **10** |

| | | |
|---|---|---|
| **Unit III** | **Conservation Laws**<br>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, 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**<br>Translatory and Rotatory motion, Equation of motion for Rotating rigid body, angular momentum vector and moment of inertia, Theorem of parallel and perpendicular axes, Moment of inertia of a cylinder, rod, lamina, ring, disc, spherical shell, solid sphere, kinetic energy of rotation, rolling along a slope, Application to compound pendulum. | **10** |
| **Unit V** | **Properties of Matter**<br>Basic concept, Elastic constants and their Interrelations, torsion of cylinder, bending of beam, bending moment, Cantilever, shape of Girders/ rail tracks.<br>Viscosity, Stokes's law, Posieuille's formula, Equation of continuity, Bernoulli's theorem, Surface tension and its molecular interpretation. | **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.D.S. Mathur : Elements of Properties of Matter
6. Murray Spiegel, Seymour Lipschutz, Dennis Spellman, "Schaum's Outline Series: Vector Analysis", McGraw Hill, 2017.
7. 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

**This course can be opted as an elective by the students of following subjects:** The course can be opted as an elective, which is open to all students.

**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/ attendance- (10+10+5)**

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

**CERTIFICATE COURSE IN BASIC PHYSICS**

| **Programme:** ***Certificate Course in Basic Physics*** | **Year: I** | **Semester: I Practical (Lab)** |
|---|---|---|

**Subject: Physics Practical (Lab)**

| **Course Code** | **Course Title:** Mechanical Properties of Matter (Lab) |
|---|---|

**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**<br>**Internal (Record File): 15**<br>**External Practical Exam: 20**<br>**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.<br>2. To determine the Moment of Inertia of a Flywheel.<br>3. To determine g and velocity for a freely falling body using Digital Timing Technique.<br>4. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).<br>5. To determine the Young's Modulus of a Wire by Optical Lever Method.<br>6. To determine the Young's Modulus by bending of beam.<br>7. To determine the Modulus of Rigidity of a Wire by Maxwell' needle. To determine the elastic Constants of a wire by Searle' method.<br>8. To determine the value of g using Bar Pendulum.<br>9. To determine the value of g using Kater's Pendulum.<br>10. To determine Surface Tension.<br>11. To determine the modulus of rigidity by Barton's Appratus (Horizontal and Vertical)<br>12. To determine the elastic constants by Searle's method | **60** |

**Suggested Readings:**

1. M. Yadav, Practical Physics, Vol 1, KedarNath Ramnath Publication, 2023.
2. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962.
3. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015. 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)**

**PREREQUISITE:** Opted / Passed Semester I, Theory Paper-1

**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:I Vocational/ Minor** |
| **Subject:Physics** | | |
| **Course Code:** | **CourseTitle: Basic Instrumentation Skills-I** | |
| | | |
| **Credits:03** | | **Vocational/Minor (Experiments/hands on training)** |
| **Max. Marks:100**<br>**External Exam:75**<br>**Internal Assessment:25** | | **Min.PassingMarks:33** |
| **Total No. of Lectures-Tutorials-Practical (in hours per week):3-0-0** | | |

| Unit | Topic | No. of Lectures |
|---|---|---|
| **UnitI** | **Errors and Mechanical Tools:**<br>Instruments accuracy, precision, sensitivity, resolution, range, least count of different instruments, Errors in measurements, Types of errors. Hand tools and their<br>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** |
| **UnitII** | **Electrical & Electronics Cables and Connector**<br>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** |
| **UnitIII** | **Domestic Wiring**<br>Introduction and explanation of electrical wiring systems, cleat wiring, casino & 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 differen1 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. Sa1ivahanan& 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, Modem Basic Electrical & House Wiring Servicing

**Suggested OnlineLink:**

1. MITOpenLearning-MassachusettsInstituteofTechnology,https://openlearning.mit.edu/
2. NationalProgrammeonTechnologyEnhancedLearning(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 (25Marks):**

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

**Class Test/Assignment/ attendance- (10+10+5)**

**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**<br>**External Exam: 75**<br>**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**<br>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**<br>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)**<br>Current density, Equation of Continuity, Ohm's law and electrical conductivity, Lorentz Drude theory, Wiedmann-Frenz law, Kirchhoff's<br>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 | **10** |
| **Unit IV** | **Magnetostatics**<br>Lorentz force, Bio-Savert's law, Ampere's law, Application of Biot-Saver 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. | **10** |
| **Unit V** | **Electromagnetic Induction and Alternating Current**<br>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

**This course can be opted as an elective by the students of following subjects:** The course can be opted as an elective, which is open to all students.

**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/ attendance- (10+10+5)**

**Course Prerequisites:** Passed semester I, theory paper-1

| CERTIFICATE COURSE IN BASIC PHYSICS | | |
|---|---|---|
| **Programme:** ***Certificate Course in Basic Physics*** | **Year: I** | **Semester: II Practical (Lab)** |
| **Subject: Physics Practical (Lab)** | | |
| **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**<br>**Internal (Record File): 15**<br>**External Practical Exam: 20**<br>**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.<br>2. Calibration of Voltmeter by potentiometer.<br>3. Calibration of ammeter by potentiometer.<br>4. Specific resistance determination.<br>5. Conversion of a Galvanometer into a Voltmeter.<br>6. Conversion of a Galvanometer into Ammeter.<br>7. Variation of magnetic field along the axis of a current carrying circular coil.<br>8. Comparison of capacities by Ballistic Galvanometer.<br>9. Determination of Ballistic Constant.<br>10. Electrochemical equivalent.<br>11. De Sauty's bridge- C1/ C2<br>12. R1/R2 by potentiometer.<br>13. Study of R-C, L-C-R circuits.<br>14. Determination of self inductance, mutual inductance.<br>15. Magnetic field determination by search coil and ballistic galvanometer. | **60** |

**Suggested Readings:**


1. M. Yadav, Practical Physics, Vol 1, KedarNath Ramnath Publication, 2023.
2. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.

3. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015. 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)**

**PREREQUISITE:** Passed Semester I

**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.

| CERTIFICATECOURSEINBASICPHYSICS | | |
|---|---|---|
| **Programme:***Certificate Course in Basic Physics* | **Year: I** | **Semester: II Vocational/Minor** |
| **Subject:Physics** | | |
| **Course Code:** | **CourseTitle: Basic Instrumentation Skills -II** | |
| | | |
| **Credits:03** | Vocational **(Experiments/hands on training )** | |
| **Max.Marks:100**<br>**ExternalExam:75**<br>**InternalAssessment:25** | **Min.PassingMarks:33** | |
| **TotalNo.ofLectures-Tutorials-Practical (inhoursperweek):3-0-0** | | |

| Unit | Topic | No. of Lectures |
|---|---|---|
| **UnitI** | **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** |
| **UnitII** | **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** |
| **UnitIII** | **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/ Desoldering and Various Switches, Practice soldering on differeni electronic components, small transformer, Practice de-soldering | **15** |

**SuggestedReading**


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 OnlineLink:**

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 (25Marks):**

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

**Class Test/Assignment/ attendance- (10+10+5)**

**Minor/Elective (04 Credit, One from the list El 1)**

**Students having major in Physics will have to choose the elective/minor from sl. no. 1-4 only. Other faculty students (Arts/Commerce) have to choice sl. no. 1.**

1. Elementary Physics-I
2. Numerical Methods
3. Computer Programming
4. Waves and Oscillations

| **CERTIFICATE COURSE IN BASIC PHYSICS** | | |
|---|---|---|
| **Programme:** ***Certificate Course in Basic Physics*** | **Year: I** | **Semester: I/II** |
| **Subject: Physics** | | |
| **CourseCode:** | **CourseTitle: Elementary Physics-I** | |
| | | |
| **Credits:04** | **Minor/Elective** | |
| **Max.Marks:100**<br>**External Exam:75**<br>**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** | Basic Idea of Physics and it's uses in daily life, Electric charge, Conductors, Insulators and Semiconductors, Coulomb's law, Quantization and conservation of charge, Basic Idea of electric field | **15** |
| **Unit II** | Resistance, Resistance in Series and Parallel, Direct and Alternating Current, Color codes for Resistors, Household Circuits, Wiring in Houses, Importance of fuse, Power and Power Losses, Unit of power loss, Heating effect of electric current, Uses of heating effect of current. | **15** |
| **Unit III** | Transformers, Types of transformers, Step up transformer, Step down transformer, Auto transformer, Central tape transformer, Wiring of transformer. | **10** |
| **Unit IV** | Short and open circuits, Shorts in series circuit, shorts in parallel circuit, Open in series circuit, Open in parallel circuit, Duality in series and parallel circuits. | **10** |

| | | |
|---|---|---|
| **Unit V** | Ammeters- Voltmeters and their uses, Measurements of thickness, Diameter and depth by Vernier- calipers Screw gauge and Spherometer, Multimeter and its uses, Dynamometer and Wattmeter, Block diagram of basic CRO, Construction of CRT, Electron gun, electrostatic focusing and acceleration. | **10** |

**Suggested Reading:**

1. Physics: Rowell and Herbert, Cambridge University Press,

2. Electrical Technology : B. L. Theraja, S. Chand & company.

**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/ attendance- (10+10+5)**

| CERTIFICATE COURSE IN BASIC PHYSICS | | |
|---|---|---|
| **Programme:** ***Certificate Course in Basic Physics*** | **Year: I** | **Semester: I/II** |
| **Subject: Physics** | | |
| **Course Code:** | **Course Title: Numerical Methods** | |

| | |
|---|---|
| **Credits: 04** | **Minor/Elective** |
| **Max. Marks: 100**<br>**External Exam: 75**<br>**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** | **Ordinary Differential Equations**<br>Brief review of ordinary differential equations, Exact equations, Equations reducible to exact equations, Equations of the first order and higher degrees Clairaut's equation. Applications of ODEs in concerned engineering branch Linear differential equations with constant co-efficient, Complimentary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with constant co-efficient (Cauchy's and Legendre's linear equations), Initial and Boundary value problems<br>Simultaneous linear equations with constant co-efficient, Applications of differential equations in concerned engineering branch. | **15** |
| **Unit II** | **Partial Differential Equations**<br>Formulation of Partial Differential Equations (PDE), Solution of PDE, Linear PDE of First Order (Lagrange's Linear Equation), Non-linear Equation of First Order (Standard Forms), Charpit's Method, Homogeneous Linear Equations with Constant Coefficients, Non-homogeneous Linear Equations. Applications of PDE: Method of separation of variables, Solution of one dimensional wave and heat equation and two dimensional Laplace's equation. | **15** |
| **Unit III** | **Transforms Theory**<br>Laplace Transform: Laplace Transforms of standard functions and their properties, Inverse Laplace Transforms, General Properties of inverse Laplace transforms and Convolution Theorem, Laplace Transforms of periodic functions, Dirac-delta Function, Heaviside's Unit Function, Solution of ODE | **15** |
| | and linear simultaneous differential equations using Laplace transforms Fourier Transform: Fourier integral representation, Fourier sine, cosine and complex transform, Finite Fourier Transforms and their applications. Z – Transforms: Z–Transforms & its properties, inversion of Z – transform and applications of Z – transform | |

| | | |
|---|---|---|
| **Unit IV** | **Probability and Statistics**<br>Review of probability, Conditional probability and sampling theorems, Discrete and Continuous Probability Distribution, Probability Mass & Probability Density Functions, Distribution function, Discrete and Continuous probability distributions, Binomial, Poisson and Normal distributions. | **15** |

**Suggested Reading**


1. Advanced Engineering Mathematics by E. Kreyszig, John Wiley and Sons, NC, New York.
2. Differential Equations by S. L. Ross, John Wiley & Sons, New York.
3. An Introduction to Probability Theory & its Applications by W. Feller, Wiley.
4. Probability and Statistics for Engineers and Scientists by R.E. Walpole, S. L. Myers and K. Ye, Pearson.
5. Integral Transforms and Their Applications by Lokenath Dennath and Dambaru Bhatta, Chapman and Hall/CRC Press.


**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/ attendance- (10+10+5)**

| CERTIFICATE COURSE IN BASIC PHYSICS | | |
|---|---|---|
| **Programme:** ***Certificate Course in Basic Physics*** | **Year: I** | **Semester: I/II** |
| **Subject: Physics** | | |
| **Course Code:** | **Course Title: Computer Programming** | |

| | |
|---|---|
| **Credits: 04** | **Minor/Elective** |
| **Max. Marks: 100**<br>**External Exam: 75**<br>**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** | **Programming Fundamentals**<br>Introduction to computer, block diagram and organization of computer, number system and binary arithmetic, processing data, hardware, software, firmware, types of programming language -Machine language, Assembly level language, higher level language, source file, object file, translator-assembler, compiler, interpreter. Evolution and classification of programming languages. | **15** |
| **Unit II** | **Programming Techniques**<br>Steps in program development, algorithm, flowchart, pseudo code.<br>**C Language**: 'C' character set, literals, keywords, identifiers, data types and size, variable declaration, expression, labels, statements, formatted input output statements, types of operators, data type conversion, mixed mode arithmetics, control structures. | **15** |
| **Unit III** | **Data Structures**<br>Storage classes, scope rules and visibility, arrays, pointers, dynamic storage allocation, structures and unions, self-referential structures. Relationship between pointers and arrays, dynamic arrays: Introduction to dynamic data structures linked lists, stack, and binary trees. | **15** |
| **Unit IV** | **Functions and File Handling**<br>'C' functions, library functions, parameter passing, recursion, 'C' files function for file handling, 'C' pre-processors and command line arguments macros and conditional compiler directives. | **15** |

**Suggested Reading**


1. C Programming Language by Briain W. Kenigham and Dennis Ritchie, Prentice Hall of India.
2. Programming with C by Byron Gottfried, Tata McGraw Hill.
3. The Complete Reference C by Herbert Schildt, Tata McGraw Hill.
4. Let us C by Yashwant Kanetkar, BPB Publication.

5. A Structured Programming Approach in C by B.A. Forouzan and R.F. Gilberg, Cengage Learning.

**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/ attendance- (10+10+5)**

| CERTIFICATE COURSE IN BASIC PHYSICS | | |
|---|---|---|
| **Programme:** ***Certificate Course in Basic Physics*** | **Year: I** | **Semester: I/II** |
| **Subject: Physics** | | |
| **Course Code:** | **Course Title: Waves and Oscillations** | |

| | |
|---|---|
| **Credits: 04** | **Minor/Elective** |
| **Max. Marks: 100**<br>**External Exam: 75**<br>**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**<br>Characteristics, Differential equation of a wave motion, principle o 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**<br>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**<br>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**<br>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/ attendance- (10+10+5)**

**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. Recognize the difference between reversible and irreversible processes.
2. Understand First and Second Law of Thermodynamics and concept of Entropy.
3. Understand the physical significance of thermo dynamical potentials.
4. Comprehend the kinetic model of gases w.r.t. various gas laws.
5. Study the implementations and limitations of fundamental radiation laws.

| **Credits: 04** | **Core Compulsory** |
|---|---|
| **Max. Marks: 100**<br>**External Exam: 75**<br>**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 60** |
|---|---|---|
| **Unit I** | **Basic concepts and First law of thermodynamics**<br>Thermodynamic Systems, Thermal equilibrium and Zeroth law of thermodynamics, Equation of state and First law of thermodynamics, Discussion of Heat and Work, Quasi-static Work; Reversible and Irreversible; Path Dependence; Heat Capacities Adiabatic Processes, Vander Wall equation, Distinction between Joule, Joule- Thompson and Adiabatic expansion of a gas. | **10** |
| **Unit II** | **Second law of Thermodynamics and Entropy**<br>Insufficiency of first law of thermodynamics, Condition of Reversibility, Carnot‟s Engine and Carnot‟s Cycle, Second law of thermodynamics, Carnot‟s Theorem, Thermodynamic scale of temperature and its identity to perfect gas, scale of temperature. Entropy, Mathematical formulation of Second law of thermodynamics,<br>Entropy of an ideal gas, T-S diagram and its applications, Evaluation of Entropy changes in simple cases, Third law of thermodynamics. | **10** |
| **Unit III** | **Thermodynamic Relations**<br>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‟sthermo | **10** |
| | dynamical relations. | |

| | | |
|---|---|---|
| **Unit IV** | **Transport of Heat and Kinetic theory of Gases**<br>Black body radiation, Thermodynamics of radiations inside a hollow enclosure, Kirchoff‟s Laws, Derivation of Stefan Boltzmann Law, Wein‟s displacement law, Black body spectrum formulaearly attempts, Raleigh Jean‟s Law, Quantum theory of Radiation, Planck‟s formula for black body spectrum, Wien‟s law, Radiation as a photon gas. Degree of Freedom Law of Equipartition of Energy, Distributive law of velocities, Most Probable speed, Average and root mean square velocities. | **15** |
| **Unit V** | **Fundamentals of Statistical Mechanics:** Probability and thermodynamic probability, postulates of statistical mechanics, macrostates and microstates, equilibrium and fluctuation constraints, ensemble and average properties, phase space, □-space and gamma space, division of phase space into cells, Micro canonical, canonical and grand canonical ensembles, Entropy and probability, interpretation of second law of thermodynamics, Boltzmann canonical distribution law. Classical and Quantum statistics, Comparison of three statistics. | **15** |

**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. R. K Pathria, Statistical Mechanics, Elsevier
7. Meghnad Saha, B.N. Srivastava, “A Treatise on Heat”, Indian Press,1973 **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

**This course can be opted as an elective by the students of following subjects:** The course can be opted as an elective, which is open to all students. **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/ attendance- (10+10+5)**

**Course Prerequisites:** Passed Certificate course in Basic Physics.

**DIPLOMA IN APPLIED PHYSICS**

| **Programme:** ***Diploma in Applied Physics*** | **Year: II** | **Semester: III Practical (Lab)** |
|---|---|---|

**Subject: Physics Practical (Lab)**

| **Course Code:** | **Course Title:** Demonstrative Aspects of Thermodynamics 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**<br>**Internal (Record File): 15**<br>**External Practical Exam: 20**<br>**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.<br>2. Mechanical equivalent of heat by Searle's method.<br>3. Stefan's law<br>4. Platinum resistance thermometer.<br>5. Thermal conductivity of a good conductor by Searle's method.<br>6. J by Callendar and Barnes method.<br>7. Random throw- statistical method.<br>8. Newton's law of cooling, sp. heat of Kerosene oil.<br>9. Variation of thermos emf across two junctions of a thermocouple with temperature<br>10. To show that deviation of probability of an event from theoretical values decreases with increase in the number of events (throuch coins and dices)<br>11. To verify the laws of probability distribution and to verify laws of probability of throwing one coin, two coin and ten coins<br>12. Study of statistical distribution from the given data and to find most probable value, averge value and rms value | **60** |

**Suggested Readings:**

1. M. Yadav, Practical Physics, Vol 2, KedarNath Ramnath Pubaws of lication, 2023.
2. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962.
3. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015.
4. Indu Prakash: Practical Physics
5. 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)**

**PREREQUISITE:** Passed Certificate course in Basic Physics **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.

| DIPLOMAINAPPLIEDPHYSICS | | |
|---|---|---|
| **Programme:** ***Diploma in Applied Physics*** | **Year: II** | **Semester: III Vocational/Minor** |
| **Subject: Physics** | | |
| **Course Code:** | **Course Title: Basic Instrumentation Skills - III** | |
| | | |
| **Credits:03** | **Vocational/Minor** | |
| **Max.Marks:100**<br>**ExternalExam:75**<br>**InternalAssessment: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**<br>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**<br>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**<br>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 Books**

**Recommended:**


1. B L Theraja : A text book in Electrical Technology
2. M G Say : Performance and design of AC machines
3. S. Sa1ivahanan& N. S.Kumar: Electronic Devices and Circuits, , 3rd Edn
4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.


**Suggested equivalent online courses:** This course can be opted as an elective by the students of following subjects: The course can be opted as an elective, which is open to all students.

**Suggested Continuous Evaluation (25Marks):**

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

**Class Test/Assignment/ attendance- (10+10+5)**

**Course Prerequisites:** Passed Certificate course in Basic Physics and Passed Semester III.

**DIPLOMA IN APPLIED PHYSICS**

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

**Subject: Physics**

| **Course Code:** | **Course Title: 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 Aberration sand techniques for the irreduction.
4. Study of different types of optical instruments used in industry and research.

| **Credits:04** | **Core Compulsory** |
|---|---|
| **Max.Marks:100**<br>**External Exam:75**<br>**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** | **Geometrical Optics:** Fermat's Principle: Principle of extremum path and its application to deduce laws of reflection and refraction, Gauss's general theory of image formation: Coaxial symmetrical system, Cardinal points of an optical system, general relationship, thick lens and lens combinations. | **10** |
| **Unit II** | **Optical Instruments:** Entrance and exit pupils, need for a multiple lens eyepiece, Ramsden's, Huygen's and Gaussian eyepieces, Astronomical refracting telescope, Spectrometer, Aberrations in images: Chromatic aberrations, achromatic combination of lenses in contact and separated lenses, Monochromatic aberrations and their reduction: aspherical mirrors and Schmidt corrector plates, aplantic points, oil immersion objectives meniscus lens. | **15** |
| **Unit III** | **Interference of Light:** 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 IV** | **Diffraction of Light:** Fresnel Diffraction: Half-period zones, Zone plate, Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. Fraunhofer diffraction: Diffraction of a Single slit; Double Slit, Multiple slits and Diffraction grating. | **10** |
| **Unit V** | **Polarization of Light:** Transverse nature of light waves, Concept of Plane polarized light – production and analysis, Malus law, Brewster's law, Nicol prism, Circular and elliptical polarization, Double refraction. | **10** |

**Suggested Reading**


1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
2. Principles of Optics, B. K. Mathur, 1995, Gopal Printing
3. Fundamentals of Optics, H. R. Gulati and D.R. Khanna, 1991, R. Chand Publication
4. A Textbook of Optics, N. Subramanyam and Brijlal.
5. Optics and Atomic Physics, D. P. Khandelwal.
6. Physical Optics, A. K. Ghatak.
7. Optics, Eugene Hecht, Pearson Publishers.
8. Optics, Satya Prakash.


**Suggested OnlineLink:**

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 equivalent online courses:**

**This course can be opted as an elective by the students of following subjects:** The course can be opted as an elective, which is open to all students.

**Suggested Continuous Evaluation (25Marks):**

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

**Class Test/Assignment/ attendance- (10+10+5)**

**Course Prerequisites:** Passed Certificate course in Basic Physics and Passed Semester III.

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

**Course Outcomes:**

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

| | |
|---|---|
| **Credits: 02** | **Core Compulsory** |
| **Max. Marks: 50**<br>**Internal (Record File): 15**<br>**External Practical Exam: 20**<br>**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.<br>2. Newton's formula.<br>3. Dispersive power of prism.<br>4. Resolving power of a telescope.<br>5. To determine the Resolving Power of a Prism.<br>6. To verify the Cauchy's dispersion formula.<br>7. To find the thickness of the wire using optical bench.<br>8. To determine the thickness of mica-sheet by using Biprism<br>9. Newtons ring experiment<br>10. To determine specific rotation of cane sugar using polarimeter<br>11. Diffraction grating<br>12. Malus Law<br>13. Sextant | **60** |

**Suggested Readings:**

1. M. Yadav, Practical Physics, Vol 2, KedarNath Ramnath Publication, 2023.

2. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962.
3. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015.
4. Indu Prakash, Practical Physics
5. 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)**

**PREREQUISITE:** Passed Certificate course in Basic Physics and Semester III.

**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**<br>**Vocational/Minor** |
| **Subject: Physics** | | |
| **Course Code:** | **Course Title: Basic Instrumentation Skills -IV** | |
| | | |
| **Credits:03** | | **Vocational (Experiments/hands on training )** |
| **Max.Marks:100**<br>**External Exam:75**<br>**Internal Assessment:25** | | **Min. Passing Marks:33** |

**TotalNo.ofLectures-Tutorials-Practical (in hours per week):3-0-0**

| Unit | Topic | No. of Lectures |
|---|---|---|
| **UnitI** | **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.<br>Digital storage Oscilloscope: Block diagram and principle of working. | **20** |
| **UnitII** | **Signal and pulse Generators**<br>Block diagram, explanation and specifications of low frequency signal generator and pulse generator. Brief idea for testing, specifications.<br>Distortion factor meter,wave analysis. | **10** |
| **UnitIII** | **Impedance Bridges**<br>Block diagram of bridge. Working principles of basic (balancing) RLC bridge, Specifications of RLC bridge, Block diagram and working principle as of a Qmeter, Digital LCR bridges. | **15** |

**Suggested Reading Books**

**Recommended:**


1. B L Theraja: A text book in Electrical Technology
2. M G Say: Performance and design of AC machines
3. S. Sa1ivahanan& N. S. Kumar: Electronic Devices and Circuits, 3rd Edn
4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.


**Suggested OnlineLink:**

1. MITOpenLearning-MassachusettsInstituteofTechnology,https://openlearning.mit.edu/
2. NationalProgrammeonTechnologyEnhancedLearning(NPTEL),htt ps://www.youtube.com/user/nptelhrd
3. SwayamPrabha - DTH

**Minor/Elective (04 Credit, One from the list El2)**

## Students having major in Physics will have to choose the elective/minor from sl. no. 1-6. Other faculty students (Arts/Commerce) have to choice sl. no. 1.

1. **Elementary Physics-II**
2. **Elements of Modern Physics**
3. **Electromagnetic Theory**
4. **Optoelectronic Devices**
5. **Opto-Electronics and Laser Instrumentation**
6. **Classical Dynamics**

| **DIPLOMA IN APPLIED PHYSICS** | | |
|---|---|---|
| **Programme:** ***Diploma in Applied Physics*** | **Year: II** | **Semester: III/IV** |
| **Subject: Physics** | | |
| **Course Code:** | **Course Title: Elementary Physics-II** | |

| **Credits: 04** | **Minor/Elective** |
|---|---|
| **Max. Marks: 100**<br>**External Exam: 75**<br>**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** | Semiconductors- P- type, n-type, Semiconductor materials, pn diode, Depletion region, Working of pn diode, characteristics, Diode as a rectifier, Transistors PNP and NPN and their working. | **15** |
| **Unit II** | OPTICS- Mirrors and lenses, image formation, lens formula, Ramsden and Huygens eyepieces. | **10** |
| **Unit III** | Newton's first and Second Law, Concept of force and mass, Some particular forces, Newton's third law, Friction, Properties of friction. | **10** |
| **Unit IV** | Rectilinear motion, laws of motion, Work and energy, conservation of energy, law of gravitation and Kepler's law (not derivation). | **10** |
| **Unit V** | Thermodynamics systems, Thermal equilibrium, Zeroth law, work done, first law of thermodynamics, Internal energy, enthalpy. | **15** |

**Suggested Reading:**

1- Physics: Resnick and Halliday, John Wiley, New York.
2- Mechanics: D S Mathur, S Chand & company.
3- Semiconductor materials and devices, M S Tyagi, John Wiley, New York. 4- Basic Electronics: B L Theraja, S Chand & company. **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/ attendance- (10+10+5)**

| DIPLOMA IN APPLIED PHYSICS | | |
|---|---|---|
| **Programme:** ***Diploma in Applied Physics*** | **Year: II** | **Semester: III/IV** |
| **Subject: Physics** | | |
| **Course Code:** | **Course Title: Elements of Modern Physics** | |

| **Credits: 04** | **Minor/Elective** |
|---|---|
| **Max. Marks: 100**<br>**External Exam: 75**<br>**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**<br>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**<br>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**<br>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**<br>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. Ogbor: 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/ attendance- (10+10+5)**

| DIPLOMA IN APPLIED PHYSICS | | |
|---|---|---|
| **Programme:** ***Diploma in Applied Physics*** | **Year: II** | **Semester: III/IV** |
| **Subject: Physics** | | |
| **Course Code:** | **Course Title: Electromagnetic Theory** | |

| | |
|---|---|
| **Credits: 04** | **Minor/Elective** |
| **Max. Marks: 100**<br>**External Exam: 75**<br>**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**<br>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**<br>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**<br>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.<br>Total internal reflection, | **15** |
| **Unit IV** | **Polarization of Electromagnetic Waves**<br>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/ attendance- (10+10+5)**

| DIPLOMA IN APPLIED PHYSICS | | |
|---|---|---|
| **Programme:** ***Diploma in Applied Physics*** | **Year: II** | **Semester: III/IV** |
| **Subject: Physics** | | |
| **Course Code:** | **Course Title: Optoelectronic Devices** | |

| | |
|---|---|
| **Credits: 04** | **Minor/Elective** |
| **Max. Marks: 100**<br>**External Exam: 75**<br>**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** | **Properties of semiconductors**<br>Electron and photon distribution: density of states, effective mass and band structure, effect of temperature and pressure on band gap, recombination processes.<br><br>Basics of semiconductor optics: Dual nature of light, band structure of various semiconductors, light absorption and emission, photoluminescence electroluminescence, radioactive and non-radiative recombination, wave trains. | **15** |
| **Unit II** | **Semiconductor light-emitting diodes and Semiconductor lasers**<br>Structure and types of LEDs and their characteristics, guided waves and optical modes, optical gain, confinement factor, internal and external efficiency, semiconductor heterojunctions, double hetero structure LEDs.<br><br>Semiconductor lasers: Spontaneous and stimulated emission, principles of a laser diode, threshold current, effect of temperature, design of an edge-emitting diode, emission spectrum of a laser diode, quantum wells, quantum-well laser diodes. | **15** |
| **Unit III** | **Semiconductor light modulators**<br>Modulating light (direct modulation of laser diodes, electro-optic modulation, acousto-optic modulation), isolating light (magneto-optic isolators), inducing optical nonlinearity (frequency conversion, switching) | **15** |
| **Unit IV** | **Semiconductor light detectors**<br>I-V characteristics of a p-n diode under illumination, photovoltaic and photoconductive modes, load line, photocells and photodiodes, pi-n photodiodes, responsivity, noise and sensitivity, photodiode materials, electric circuits with photodiodes, solar cells. | **15** |

**Suggested Reading:**


1. Semiconductor Optoelectronics: Physics and Technology, Jasprit Singh, McGraw Hill Companies, ISBN 0070576378
2. Optoelectronics, E. Rosencher and B. Vinter, Cambridge Univ. Press, ISBN 052177813.
3. Photonic Devices, J. Liu, Cambridge Univ. Press, ISBN 0521551951.
4. Semiconductor Optoelectronic Devices 2nd Edition", P. Bhattacharya, Prentice Hall, ISBN 0134956567.
5. Physics of Semiconductor Devices, by S. M. Size (2nd Edition, Wiley, New York, 1981)


**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/ attendance- (10+10+5)**

| DIPLOMA IN APPLIED PHYSICS | | |
|---|---|---|
| **Programme:** ***Diploma in Applied Physics*** | **Year: II** | **Semester: III/IV** |
| **Subject: Physics** | | |
| **Course Code:** | **Course Title: Opto-Electronics and Laser Instrumentation** | |

| | |
|---|---|
| **Credits: 04** | **Minor/Elective** |
| **Max. Marks: 100**<br>**External Exam: 75**<br>**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** | **Introduction**<br><br>Characteristics of optical radiation, luminescence, irradiance – Optical Sources – Photo Detectors – Opto-couplers and their application in analog and digital devices. Optical Fiber Fundamentals – modes, types of optical fibers – fiber coupling – Fiber optic sensors for common industrial parameters – V, I pressure, temperature – IR sources and detectors – fiber optic gyroscope. | **15** |
| **Unit II** | **Characteristics of LASERS**<br>Einstein's equations – population inversion two, three and four level system Laser rate equation, properties – modes – Resonator configurations – Q switching and mode locking, cavity dumping, single frequency operation – Types of Lasers. Applications – Lasers for measurement of distance and length velocity, acceleration, atmospheric effects, pollutants. | **15** |
| **Unit III** | **Applications**<br><br>Lasers for measurement of distance and length, velocity, acceleration atmospheric effects, pollutants. Material processing applications – Laser heating melting, scribing, splicing, welding and trimming of materials, removal and vaporization. | **15** |
| **Unit IV** | **Holographic Interferometry and Applications**<br><br>Holography for non-destructive testing – medical applications – lasers and tissue interaction -surgery – dermatology. | **15** |

**Suggested Reading**

1. Wilson and Hawkes, “Opto Electronics-An Introduction”, Third Edition, Pearson Education, 1998.
2. John Ready, “Industrial Applications of Lasers”, Second Edition, Academic Press, 1997.
3. Bhattacharya P, “Semiconductor Optoelectronics”, Second Edition, Pearson Education, 1998.
4. Djafar K. Mynbaev, Lowell L. Scheiner, “Fiber-Optic Communications Technology”, First Edition, Prentice Hall of India Pvt. Limited, 2000.
5. R. P. Khare, “Fiber Optics and Optoelectronics”, Oxford Press, 2004.

**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/ attendance- (10+10+5)**

| DIPLOMA IN APPLIED PHYSICS | | |
|---|---|---|
| **Programme:** ***Diploma in Applied Physics*** | **Year: II** | **Semester: III/IV** |
| **Subject: Physics** | | |
| **Course Code:** | **Course Title: Classical Dynamics** | |

| **Credits: 04** | **Minor/Elective** |
|---|---|
| **Max. Marks: 100**<br>**External Exam: 75**<br>**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** | **Classical Mechanics of Point Particles**<br>Review of Newtonian Mechanics; Generalized coordinates and velocities Hamilton's principle, Lagrangian and the Euler-Lagrange equations, onedimensional Simple Harmonic Oscillations and falling body in uniform gravity; applications to simple systems such as coupled oscillators Canonical momenta & Hamiltonian. Hamilton's equations of motion. Applications: Hamiltonian for a harmonic oscillator, particle in a central force field | **15** |
| **Unit II** | **Small Amplitude Oscillations**<br>Minima of potential energy and points of stable equilibrium, expansion of the potential energy around a minimum, small amplitude oscillations about the minimum, normal modes of oscillations example of N identical masses connected in a linear fashion to (N -1) - identical springs. | **15** |
| **Unit III** | **Special Theory of Relativity**<br>Postulates of Special Theory of Relativity. Lorentz Transformations Minkowski space. The invariant interval, light cone and world lines. Spacetime diagrams. Time-dilation, length contraction and twin paradox. Fourvectors: space-like, time-like and light-like. Four-velocity and acceleration Metric and alternating tensors. Four-momentum and energy-momentum relation. Doppler effect from a four-vector perspective. Concept of fourforce. Conservation of four-momentum. Relativistic kinematics. Application to two-body decay of an unstable particle. | **15** |
| **Unit IV** | **Fluid Dynamics**<br>Density and pressure in a fluid, an element of fluid and its velocity continuity, equation and mass conservation, stream-lined motion, laminar flow, Poiseuille's equation for flow of a liquid through a pipe, Navier-Stokes | **15** |
| | equation, qualitative description of turbulence, Reynolds number, Basic physics of fluids: Definition of a fluid- shear stress; Fluid, propertiesviscosity, thermal conductivity, mass diffusivity, other fluid properties and equation of state; Flow visualization - streamlines, pathlines, Streaklines | |

**Suggested Reading**

1. H. Goldstein: Classical Mechanics
2. N.C. Rana & P. S. Jog: Classical Mechanics
3. Landau and Lifshitz: Mechanics
4. Sommerfeld: Mechanics
5. Whittaker: Analytical Dynamics of Particles and Rigid Bodies
6. Raychaudhuri: Classical Mechanics

**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/ attendance- (10+10+5)**

| DEGREE IN APPLIED PHYSICS | | |
|---|---|---|
| **Programme:** ***Degree in Applied Physics*** | **Year:III** | **Semester:V**<br>**Paper I** |
| **Subject: Physics** | | |
| **Course Code:** | **Course Title:** Solid State Physics | |

| | |
|---|---|
| **Credits:04** | **Core/Compulsory** |
| **Max.Marks:100**<br>**ExternalExam:75**<br>**InternalAssessment:25** | **Min. PassingMarks:33** |
| **Total No. of Lectures-Tutorials-Practical(in hours per week):4-0-0** | |

| Unit | Topic | No. of Lectures |
|---|---|---|
| **Unit I** | **Crystal Structure**<br>Amorphous and Crystalline Materials. Lattice and Basis. Types of Lattices. Bravais lattices, Unit Cell. Primitive and non-primitive lattice, Symmetry elements, point group and space group, Simple structure of Sodium chloride (fcc), Cesium chloride (bcc), hcp, packing fraction of sc, fcc, bcc and hcp, Miller Indices. | **10** |
| **Unit II** | **Reciprocal Lattice:** Reciprocal lattice, Brillouin Zones. Reciprocal lattice and Brillouin Zone of sc, fcc and bcc structure, Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor. Extinction conditions of diffraction for sc, bcc and fcc lattice, Experimental methods of crystal structure determination-Laue, single crystal and powder method. | **15** |
| **Unit III** | **Elementary Lattice Dynamics:** Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T3 law | **10** |
| **Unit IV** | **Crystal Binding and Elastic Properties:** Ionic, covalent, metallic and hydrogen bond, Analysis of stress and strain, Elastic compliance and stiffness constant, elastic constant for cubic crystal, Elastic waves and velocity in cubic crystal with example of 100 direction, Experimental determination of elastic constants | **10** |
| **Unit V** | **Magnetic Properties of Matter:** Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia – and Paramagnetic Domains.<br>Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss | **15** |

**Reference Books:**


- Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning
- Solid-state Physics, H.Ibach and H Luth, 2009, Springer
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications
- NPTEL ( http://nptel.ac.in)
- Virtual Labs (http://www.vlab.co.in)


**Suggested OnlineLink:**

1. MITOpenLearning-
MassachusettsInstituteofTechnology,https://openlearning.mit.edu/ 2.
NationalProgrammeonTechnologyEnhancedLearning(NPTEL),htt
ps://www.youtube.com/user/nptelhrd
3. SwayamPrabha - DTH
Channel,https://www.swayamprabha.gov.in/index.php/pr
ogram/curr ent_he/8

**This course can be opted as an elective by the students of following subjects:**
The course can be opted as an elective, which is open to all students.

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

**Class Test/Assignment/ attendance- (10+10+5)**

**CoursePrerequisites:** Passed Semester IV.

| **DEGREE IN SCINCE** | | |
|---|---|---|
| **Programme:** ***Degree in Science*** | **Year: III** | **Semester: V** |

| | | |
|---|---|---|
| | | **Practical (Lab)** |
| **Subject: Physics Practical (Lab)** | | |
| **Course Code:** | **Course Title:** Demonstrative Aspects of Solid State Physics (Practical) | |
| **Course Outcomes:**<br>1. To understand the magnetic properties of materials.<br>2. To measure the band gap of semiconductor.<br>3. To familiar with SCR & UJT.<br>4. To understand the characteristics of light emitting diode. | | |
| **Credits: 02** | | **Core Compulsory** |
| **Max. Marks: 50**<br>**Internal (Record File): 15**<br>**External Practical Exam: 20**<br>**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. Measurement of Energy Band Gap of given semiconductor.<br>2. To measure the Magnetic susceptibility of Solids.<br>3. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.<br>4. To find the corrosivity and retentivity of ferromagnetic sample.<br>5. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150 oC).<br>6. To determine the Hall coefficient of a semiconductor sample.<br>7. To study & evaluation of Stefan's law by thermal method.<br>8. To study the VI characteristic of SCR.<br>9. To study UJT trigger circuit for half wave and full wave control.<br>10. To study the characteristic of LED.<br>11. To show the effect of varying voltage and frequency on Hysteresis loop. | **60** |

## Suggested Readings:


1. M. Yadav, Practical Physics, Vol 3, KedarNath Ramnath Publication, 2023.
2. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.
3. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.
4. Indu Prakash: Practical Physics 5. 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)**

**PREREQUISITE:** Passed Semester IV.

**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: 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 Transistors and their applications in different types of Amplifiers.

| **Credits: 04** | **Core Compulsory** |
|---|---|
| **Max. Marks: 100**<br>**External Exam: 75**<br>**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 |
|---|---|---|
| **UnitI** | **Network Theorems:**<br>Constant voltage and constant current source, Conversion of voltage source into current source and vice-versa, Superposition theorem, Thevenin's theorem and procedure for finding Thevenin equivalent circuit, Norton's theorem and procedure for finding Norton equivalent circuit, Reciprocity theorem, maximum power transfer theorem, Applications of network theorems | **7** |
| **UnitII** | **Semiconductor Diodes:**<br>Intrinsic and extrinsic semiconductors, P and N type semiconductors, Barrier formation in PN junction diode, qualitative idea of current flow mechanism in forward and reverse biased diode, PN junction and its characteristics, Static and dynamic resistance, Special diodes: Tunneling effect (Tunnel diode), Zener diode, Varactor diode, Point contact diode, V-I characteristic of these diodes, Principle and structure of Opto-electronic devices: LED, Photodiode, Solar cell. | **15** |
| **UnitIII** | **Power Supplies:**<br>Block diagram of power supply (regulated and unregulated), 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 $\pi$ – filters (Series inductor, Shunt capacitor, LC, CLC filters), Zener diode as a voltage regulator. | **8** |
| **UnitI IV** | **Transistors**<br>N-P-N and P-N-P transistors, Transistor currents, Characteristics of CB, CE and CC,<br>Current gains $\alpha$, $\beta$ and □, Relations between $\alpha$, $\beta$ and □, Basic CE amplifier circuit, Load Line analysis of transistors, DC Load line and Q-point, performance of | **15** |

| | | |
|---|---|---|
| | transistor amplifier in CE mode: Input resistance, Output resistance, Effective collector load, Current, Voltage and Power gains, Active, Cutoff, and Saturation regions, Basic Idea of FET, MOSFET, & UJT. | |
| **UnitI V** | **Transistor Amplifiers:**<br>Transistor biasing: Needs and requirements, Stability factor, Fixed-bias circuit, Collector to base bias circuit, Bias circuit with emitter resistor, Voltage divider biasing circuit, 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, Basic Idea of Power amplifiers (Class A, Push Pull amplifier, Class B and Class C), RC-coupled two stage amplifier and its frequency response. | **15** |

**SuggestedReading**


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 OnlineLink:**

4. MITOpenLearning-
   MassachusettsInstituteofTechnology,https://openlearning.mit.edu/ 5.
   NationalProgrammeonTechnologyEnhancedLearning(NPTEL),htt
   ps://www.youtube.com/user/nptelhrd
6. SwayamPrabha - DTH
Channel,https://www.swayamprabha.gov.in/index.php/pr
ogram/curr ent_he/8

**This course can be opted as an elective by the students of following subjects:**

The course can be opted as an elective, which is open to all students.

**Suggested Continuous Evaluation(25Marks):**

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

**Class Test/Assignment/ attendance-**
**(10+10+5) Course Prerequisites:**

Passed SemesterIV.

| | | |
|---|---|---|
| **DEGREE IN SCINCE** | | |
| **Programme:** ***Degree in Science*** | **Year: III** | **Semester: V Practical (Lab)** |
| **Subject: Physics Practical (Lab)** | | |
| **Course Code:** | **Course Title:** Demonstrative Aspects of Basic 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**<br>**Internal (Record File): 15**<br>**External Practical Exam: 20**<br>**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 characteristics of R-C coupled Amplifier with and without feedback.<br>2. To study the characteristics of integrating and differentiating circuit.<br>3. To draw the characteristics of P-N junction diode.<br>4. To draw the characteristics of PNP and NPN junction transistor.<br>5. Measurements of h-parameters of a transistor.<br>6. Study of different types of Rectifiers and Filters.<br>7. Verification of Network theorems.<br>8. Child Langmuir law.<br>9. Study of power supply (Ripple factor).<br>10. Study of Zener diode and regulation (taking different source voltage and loads).<br>11. Phase measurement using a C.R.O.<br>12. Study characteristics of Transformr coupled Amplifier with and without feedback | **60** |

## Suggested Readings:


1. M. Yadav, Practical Physics, Vol 3, KedarNath Ramnath Publication, 2023.
2. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962.
3. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015.
4. Indu Prakash: Practical Physics 5. S.L. Gupta, V. Kumar, “Practical Physics”, PragatiPrakashan, Meerut, 2014.


## Suggestive Digital Platforms / Web Links:

3. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74 4. 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)**

**PREREQUISITE:** Passed Semester IV.

**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 APPLIED PHYSICS | | | |
|---|---|---|---|
| **Programme:** ***Degree in Applied Physics*** | | **Year:III** | **Semester:VI**<br>**Paper I** |
| **Subject: Physics** | | | |
| **Course Code:** | **Course Title: Modern Physics & Elementary Quantum Mechanics** | | |
| **Credits:04** | | **Core Compulsory** | |
| **Max. Marks:100**<br>**External Exam:75**<br>**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** | Thomson model, Rutherford model, Bohr model and spectra of hydrogen atoms, Shortcomings of these models, Bohr-Sommerfeld's model, Stern-Gerlach Experiment, Bohr magneton, Larmor's precession, Vector atom model, Spatial quantization and electron spin. | **10** |
| **Unit II** | Optical spectra and spectral notations, L-S and J-J coupling, selection rules and intensity rules, Explanation of fine structure of sodium D line, Normal Zeeman effect, X-ray spectra (Characteristic and continuous), Moseley's law. | **10** |
| **Unit III** | Origin of Quantum theory, Failure of Classical Physics to explain the phenomena such as Black body spectrum, Photoelectric effect, Characteristics and Einstein's explanation, Planck's quantum hypothesis, Planck's constant and light as a collection of photons; Compton scattering | **10** |
| **Unit IV** | De Broglie hypothesis of matter waves and De Broglie wavelength; DavissonGermer experiment, Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principleimpossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle. | **15** |

| | | |
|---|---|---|
| **Unit V** | Schrodinger's equation (Time independent and Time dependent), Postulates of Quantum Mechanics, Properties of Wave Function, Physical interpretation of Wave Function, Probability and probability current densities in three dimensions; Conditions for Physical acceptability of Wave Functions, Normalization, Eigenvalues and Eigenfunctions, Operator, position, momentum and Energy operators; Expectation values, Wave Function of a Free Particle. | **15** |

**SuggestedReading**


1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill.
2. Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A .Dubson,2009, PHI Learning.
3. Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill.
4. Modern Physics, R. A. Serway, C. J. Moses, and C. A. Moyer, 2005, Cengage Learning.
5. A Text book of Quantum Mechanics, P. M. Mathews & K. Venkatesan, 2nd Ed., 2010, McGraw Hill
6. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn., 2002, Wiley.
7. Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.
8. Quantum Mechanics, G. Aruldhas, 2ndEdn. 2002, PHI Learning of India.


**Suggested OnlineLink:**

4. MITOpenLearning-
MassachusettsInstituteofTechnology,https://openlearning.mit.edu/ 5.
NationalProgrammeonTechnologyEnhancedLearning(NPTEL),htt
ps://www.youtube.com/user/nptelhrd
6. SwayamPrabha-
DTHChannel,https://www.swayamprabha.gov.in/index.php/pr
ogra m/current_he/8

**SuggestedContinuousEvaluation(25Marks):**

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

**Class Test/Assignment/ attendance- (10+10+5)**

| DEGREE IN SCINCE | | |
|---|---|---|
| **Programme:** ***Degree in Science*** | **Year: III** | **Semester: VI Practical (Lab)** |
| **Subject: Physics Practical (Lab)** | | |
| **Course Code:** | **Course Title:** Demonstrative Modern Physics & Elementary Quantum Mechanics (Practical) | |

**Course Outcomes:**

**1.** Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the modern physics concepts.

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

| | |
|---|---|
| **Credits: 02** | **Core Compulsory** |
| **Max. Marks: 50**<br>**Internal (Record File): 15**<br>**External Practical Exam: 20**<br>**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.<br>2. Determination of 'h' Planck's constant by Photoelectric effect.<br>3. 'e/m' by Thomson method.<br>4. 'e/m' Magnetron method.<br>5. 'e/m' Helical method<br>6. To determine the Planck's constant using LEDs of at least 4 different colours.<br>7. To determine the wavelength of laser source using diffraction of single slit.<br>8. To determine the wavelength of laser source using diffraction of double slits.<br>9. Determination of Ionization Potential using thyratron valve.<br>10. Inverse square law.<br>11. Verification of Cauchy Formula | **60** |

## Suggested Readings:


1. M. Yadav, Practical Physics, Vol 3, KedarNath Ramnath Publication, 2023.
2. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.

3. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015.
4. Indu Prakash: Practical Physics 5. S.L. Gupta, V. Kumar, “Practical Physics”, PragatiPrakashan, Meerut, 2014.

## Suggestive Digital Platforms / Web Links:

5. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74 6. 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)**

**PREREQUISITE:** Passed Semester IV.

**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**<br>**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**<br>**External Exam: 75**<br>**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 |
|---|---|---|
| **UnitI** | **FeedbackAmplifiers**<br>Concept of feedback in amplifier, Types of feedback, Voltage gain of feedback amplifier, Advantages of negative feedback, Gain stability, Decreased distortion, Increased bandwidth, Increase in input impedance, Decrease in output impedance, Amplifier circuits with negative feedback, Advantage of positive feedback. | **10** |
| **UnitII** | **Oscillators**<br>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, Astable, monostable and bistable multivibrator, Schmitt trigger, Saw-tooth generator. | **15** |
| **UnitIII** | **Operational Amplifiers (Black box approach):**<br>Characteristics of an ideal and practical Op-Amp (IC-741), Open-loop & closed-loop gain. CMRR, Concept of virtual ground. applications of OpAmps: (1) Inverting and non-inverting amplifiers, (2) Adder, (3) Subtractor,<br>(4) Differentiator, (5) Integrator, (6) Zero crossing detector | **10** |
| **UnitIV** | **Number System:**<br>Decimal, Binary, Octal and Hexadecimal number systems, Inter-conversion of different number systems, Binary addition and subtraction, unsigned binary numbers, Sign-magnitude numbers, Complement of a number (1's complement and 2's complement), BCD, GREY, EXCESS-3 codes. | **10** |

| | | |
|---|---|---|
| **UnitV** | **Logic Gates and Boolean Algebra:**<br>Positive and negative logic, AND, OR and NOT gates (Realization using diodes and transistor), NAND and NOR Gates as universal gates, XOR and XNOR gates. De Morgan's theorems, Boolean laws, Simplification of logic circuit using Boolean algebra, Fundamental products, Minterms and maxterms, Conversion of a truth table into an equivalent logic circuit by (1) Sum of products method and (2) Karnaugh map, Half adder, Full adder and Subtractor, 4-bit binary adder-Subtractor. | **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

**This course can be opted as an elective by the students of following subjects:**

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**Suggested Continuous Evaluation (25 Marks):**

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**Class Test/Assignment/ attendance- (10+10+5) Course Prerequisites:**

Passed Semester V

| | | |
|---|---|---|
| **DEGREE IN SCINCE** | | |
| **Programme:** ***Degree in Science*** | **Year: III** | **Semester: VI Practical (Lab)** |
| **Subject: Physics Practical (Lab) (Practical)** | | |
| **Course Code:** | **Course Title:** 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**<br>**Internal (Record File): 15**<br>**External Practical Exam: 20**<br>**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. Transistor Bias Stability<br>2. Comparative Study of CE, CB and CC amplifier<br>3. Clippers and Clampers<br>4. Study of Emitter Follower<br>5. Frequency response of single stage RC coupled amplifier 6. Frequency response of single stage Transformer coupled amplifier<br>7. Effect of negative feedback on frequency response of RC coupled amplifier<br>8. Study of Schmitt Trigger<br>9. Study of Hartley oscillator<br>10. Study of Wein Bridge oscillator<br>11. Study of Logic Gates<br>12. Verification of De Morgan's Theorem<br>13. Study of Half Adder<br>14. Study of Full Adder | **60** |

## Suggested Readings:


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2. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962.
3. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015.
4. Indu Prakash: Practical Physics 5. S.L. Gupta, V. Kumar, “Practical Physics”, Pragati Prakashan, Meerut, 2014.


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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)**

**PREREQUISITE:** Passed Semester V.

**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.