| Programme/Class: **Diploma** | Year: **Second** | Semester: **Third** |
|---|---|---|
| Subject: **Physics** | | |
| Course Code: **B010301T** | Course Title: **Electromagnetic Theory & Modern Optics** | |

**Course Outcomes (COs)**

1. Better understanding of electrical and magnetic phenomenon in daily life.
2. To troubleshoot simple problems related to electrical devices.
3. Comprehend the powerful applications of ballistic galvanometer.
4. Study the fundamental physics behind reflection and refraction of light (electromagnetic waves).
5. Study the working and applications of Michelson and Fabry-Perot interferometers.
6. Recognize the difference between Fresnel's and Fraunhofer's class of diffraction.
7. Comprehend the use of polarimeters.
8. Study the characteristics and uses of lasers.

| Credits: **4** | Core Compulsory / Elective |
|---|---|
| Max. Marks: **25+75** | Min. Passing Marks: |

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

| Unit | Topics | No. of Lectures |
|---|---|---|
| | **PART A**<br>**Electromagnetic Theory** | |
| **I** | **Electrostatics**<br>Electric charge & charge densities, electric force between two charges. General expression for Electric field in terms of volume charge density (divergence & curl of Electric field), general expression for Electric potential in terms of volume charge density and Gauss law (applications included). Study of electric dipole. Electric fields in matter, polarization, auxiliary field **D** (Electric displacement), electric susceptibility and permittivity. | 8 |
| **II** | **Magnetostatics**<br>Electric current & current densities, magnetic force between two current elements. General expression for Magnetic field in terms of volume current density (divergence and curl of Magnetic field), General expression for Magnetic potential in terms of volume current density and Ampere's circuital law (applications included). Study of magnetic dipole (Gilbert & Ampere model). Magnetic fields in matter, magnetisation, auxiliary field **H**, magnetic susceptibility and permeability. | 8 |
| **III** | **Time Varying Electromagnetic Fields**<br>Faraday's laws of electromagnetic induction and Lenz's law. Displacement current, equation of continuity and Maxwell-Ampere's circuital law. Self and mutual induction (applications included). Derivation and physical significance of Maxwell's equations. Theory and working of moving coil ballistic galvanometer (applications included). | 7 |
| **IV** | **Electromagnetic Waves**<br>Electromagnetic energy density and Poynting vector. Plane electromagnetic waves in linear infinite dielectrics, homogeneous & inhomogeneous plane waves and dispersive & non-dispersive media. Reflection and refraction of homogeneous plane electromagnetic waves, law of reflection, Snell's law, Fresnel's formulae (only for normal incidence & optical frequencies) and Stoke's law. | 7 |

| | | |
|---|---|---|
| **PART B**<br>**Physical Optics & Lasers** | | |
| **V** | **Interference**<br>Conditions for interference and spatial & temporal coherence. Division of Wavefront - Fresnel's Biprism and Lloyd's Mirror. Division of Amplitude - Parallel thin film, wedge shaped film and Newton's Ring experiment. Interferometer - Michelson and Fabry-Perot. | 8 |
| **VI** | **Diffraction**<br>Distinction between interference and diffraction. Fresnel's and Fraunhofer's class of diffraction. Fresnel's Half Period Zones and Zone plate. Fraunhofer diffraction at a single slit, n slits and Diffracting Grating. Resolving Power of Optical Instruments - Rayleigh's criterion and resolving power of telescope, microscope & grating. | 8 |
| **VII** | **Polarisation**<br>Polarisation by dichronic crystals, birefringence, Nicol prism, retardation plates and Babinet's compensator. Analysis of polarized light. Optical Rotation - Fresnel's explanation of optical rotation and Half Shade & Biquartz polarimeters. | 7 |
| **VIII** | **Lasers**<br>Characteristics and uses of Lasers. Quantitative analysis of Spatial and Temporal coherence. Conditions for Laser action and Einstein's coefficients. Three and four level laser systems (qualitative discussion). | 7 |

**Suggested Readings**

**PART A**


1. D.J. Griffiths, "Introduction to Electrodynamics", Prentice-Hall of India Private Limited, 2002, 3e
2. E.M. Purcell, "Electricity and Magnetism (In SI Units): Berkeley Physics Course Vol 2", McGraw Hill, 2017, 2e
3. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 2", Pearson Education Limited, 2012
4. D.C. Tayal, "Electricity and Magnetism", Himalaya Publishing House Pvt. Ltd., 2019, 4e


**PART B**


1. Francis A. Jenkins, Harvey E. White, "Fundamentals of Optics", McGraw Hill, 2017, 4e
2. Samuel Tolansky, "An Introduction to Interferometry", John Wiley & Sons Inc., 1973, 2e
3. A. Ghatak, "Optics", McGraw Hill, 2017, 6e


***Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.***

**Suggestive Digital Platforms / Web Links**

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx
4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

**Course Prerequisites**

Passed Semester I, Theory Paper-1 (B010101T)

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

Open to all

| Suggested Continuous Internal Evaluation (CIE) Methods |
|---|
| 20 marks for Test / Quiz / Assignment / Seminar<br>05 marks for Class Interaction |
| **Suggested Equivalent Online Courses** |
| 1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics<br>2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html<br>3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy<br>4. edX, https://www.edx.org/course/subject/physics<br>5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/ |
| **Further Suggestions** |
| • Other Digital Platforms / Web Links and Equivalent Online Courses may be suggested / added to the respective lists by individual Universities.<br>• **In End-Semester University Examinations, equal weightage should be given to Part A (units I to IV) and Part B (units V to VIII) while framing the questions.** |

| Programme/Class: **Diploma** | Year: **Second** | Semester: **Third** |
|---|---|---|
| Subject: **Physics** | | |
| Course Code: **B010302P** | Course Title: **Demonstrative Aspects of Electricity & Magnetism** | |

**Course Outcomes (COs)**

Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the electric and magnetic properties. Measurement precision and perfection is achieved through Lab Experiments. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

| Credits: **2** | Core Compulsory / Elective |
|---|---|
| Max. Marks: **25+75** | Min. Passing Marks: |

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

| Unit | Topics | No. of Lectures |
|---|---|---|
| | **Lab Experiment List**<br><br>1. Variation of magnetic field along the axis of single coil<br>2. Variation of magnetic field along the axis of Helmholtz coil<br>3. Ballistic Galvanometer: Ballistic constant, current sensitivity and voltage sensitivity<br>4. Ballistic Galvanometer: High resistance by Leakage method<br>5. Ballistic Galvanometer: Low resistance by Kelvin's double bridge method<br>6. Ballistic Galvanometer: Self inductance of a coil by Rayleigh's method<br>7. Ballistic Galvanometer: Comparison of capacitances<br>8. Carey Foster Bridge: Resistance per unit length and low resistance<br>9. Deflection and Vibration Magnetometer: Magnetic moment of a magnet and horizontal component of earth's magnetic field<br>10. Earth Inductor: Horizontal component of earth's magnetic field<br><br>**Online Virtual Lab Experiment List / Link**<br><br>Virtual Labs at Amrita Vishwa Vidyapeetham<br>https://vlab.amrita.edu/?sub=1&brch=192<br><br>1. Tangent galvanometer<br>2. Magnetic field along the axis of a circular coil carrying current<br>3. Deflection magnetometer<br>4. Van de Graaff generator<br>5. Barkhausen effect<br>6. Temperature coefficient of resistance<br>7. Anderson's bridge<br>8. Quincke's method | 60 |

| Suggested Readings |
|---|
| 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e<br>2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e<br>3. R.K. Agrawal, G. Jain, R. Sharma, "Practical Physics", Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019<br>4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014, 2e<br><br>***Books published in Hindi & Other Reference / Text Books may be suggested / added to this list by individual Universities.*** |
| **Suggestive Digital Platforms / Web Links** |
| 1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=192<br>2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities. |
| **Course Prerequisites** |
| Opted / Passed Semester III, Theory Paper-1 (B010301T) |
| **This course can be opted as an Elective by the students of following subjects** |
| Botany / Chemistry / Computer Science / Mathematics / Statistics / Zoology |
| **Suggested Continuous Internal Evaluation (CIE) Methods** |
| 15 marks for Record File (depending upon the no. of experiments performed out of the total assigned experiments)<br>05 marks for Viva Voce<br>05 marks for Class Interaction |
| **Suggested Equivalent Online Courses** |
| |
| **Further Suggestions** |
| • The institution may add / modify / change the experiments of the same standard in the subject.<br>• The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List.<br>• The institution may suggest a minimum number of experiments (say 3) to be performed by each student per semester from the Online Virtual Lab Experiment List / Link. |