Programme Class: Diploma	Year: **Second**	Semester: **Third**
Subject: **PHYSICS**		
Course Code: **(B010301T)**	Course title: **Electromagnetic Theory & Modern Optics**	

Course Outcome:
- Better understanding of electrical and magnetic phenomenon in daily life.
- To troubleshoot simple problems related to electrical devices.
- Comprehend the powerful applications of ballistic galvanometer.
- Study the fundamental physics behind reflection and refraction of light (electromagnetic waves).
- Study the working and applications of Michelson and Fabry-Perot interferometers.
- Recognize the difference between Fresnel's and Fraunhofer's class of diffraction.
- Comprehend the use of polarimeters.
- 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: Electromagnetic Theory		
I	**Electrostatics:** 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:**	

	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, magnetization, auxiliary field **H**, magnetic susceptibility and permeability.		8
III	**Time Varying Electromagnetic Fields:** 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:** 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: Physical Optics & Lasers		
V	**Interference:** 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:** 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	**Polarization:** Polarization by dichroic 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:** 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). Types of lasers and laser.		7

Suggested Readings:

PART A

1. H. K. Malik and A.K. Singh "Engineering Physics", McGraw Hill Education (India) Private Limited, 2018, 2e.
2. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 2", Pearson Education Limited, 2012
3. D. J. Griffiths, "Introduction to Electrodynamics", Prentice-Hall of India Private Limited, 2002, 3e
4. E. M. Purcell, "Electricity and Magnetism (In SI Units): Berkeley Physics Course Vol 2", McGraw Hill, 2017, 2e
5. D.C. Tayal, "Electricity and Magnetism", Himalaya Publishing House Pvt. Ltd., 2019, 4e

PART B

6. H. K. Malik, "Engineering Physics", McGraw Hill Education (India) Private Limited, 2018, 2e.
7. Francis A. Jenkins, Harvey E. White, "Fundamentals of Optics", McGraw Hill, 2017, 4e
8. Samuel Tolansky, "An Introduction to Interferometry", John Wiley & Sons Inc., 1973, 2e
9. A. Ghatak, "Optics", McGraw Hill, 2017, 6e

Local Author's Books

1. Optics, Brij Lal and Subrahmanyam, S. Chand Publication.
2. Physical Optics and Lasers, Agarwal, Jain & Sharma, Krishna Prakashan.
3. भौतिक प्रकाशिकी व लेजर, अग्रवाल, जैन व शर्मा, कृष्णा प्रकाशन ।

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

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

Quiz/ Assignment	(05 marks)
Class Test-I	(10 marks)
Class Test-II	(10 marks)

- The course is elective and open to all.
- **PREREQUISITE:** passed semester I, theory paper-1 (B010101T)

Programme Class: **Diploma**	Year: **Second**	Semester: **Third**
Subject: **PHYSICS**	
Course Code: **(B010302P)**	Course Title: **Demonstrative Aspects of Electricity & Magnetism**	

Course Outcome:
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	
	1. Variation of magnetic field along the axis of single coil 2. Variation of magnetic field along the axis of Helmholtz coil 3. Ballistic Galvanometer: Ballistic constant, current sensitivity and voltage sensitivity 4. Ballistic Galvanometer: High resistance by Leakage method 5. Ballistic Galvanometer: Low resistance by Kelvin's double bridge method 6. Ballistic Galvanometer: Self-inductance of a coil by Rayleigh's method 7. Ballistic Galvanometer: Comparison of capacitances 8. Carey Foster Bridge: Resistance per unit length and low resistance 9. Deflection and Vibration Magnetometer: Magnetic moment of a magnet and horizontal component of earth's magnetic field 10. Earth Inductor: Horizontal component of earth's magnetic field 11. Newton's Rings: Wavelength of sodium light 12. Plane Diffraction Grating: Spectrum of mercury light 13. Spectrometer: Refractive index of the material of a prism using sodium light 14. Spectrometer: Dispersive power of the material of a prism using mercury light 15. Polarimeter: Specific rotation of sugar solution	60
	Online Virtual Lab Experiment List/Link	
	Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=192 1. Tangent galvanometer 2. Magnetic field along the axis of a circular coil carrying current 3. Deflection magnetometer 4. Van de Graaff generator 5. Barkhausen effect 6. Temperature coefficient of resistance 7. Anderson's bridge 8. Quincke's method	

Suggested Readings:

1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e
2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e
3. R.K. Agrawal, G. Jain, R. Sharma, "Practical Physics", Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019
4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014, 2e

Suggestive Digital Platforms / Web Links:

- Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=192
- 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)
Viva Voce	(05 marks)
Class Interaction	(10 marks)

- The course is elective and can be opted by Botany / Chemistry / Computer Science / Mathematics / Statistics / Zoology
- **PREREQUISITE:** Opted / Passed Semester III, Theory Paper-1 (B010301T)

Further Suggestions:

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