

APPLIED PHYSICS II

Subject Code :

No. of Credits : 3 (TH:2,T:1,P:2)

I. RATIONALE:

Applied Physics includes the study of dynamic and diverse topics all related to things that go on in the world around us. Aim of learning this is to give an understanding of this world both by observations and by prediction of the way in which objects will behave. Study of physics in first year is essential for engineering diploma students because it provides the fundamental principles that lie behind engineering and helps students in developing technical skills that are useful in upcoming semesters. There is requirement of offering learners sufficient conceptual background of physics which would ultimately make them proficient to meet the challenges of engineering problems in upcoming time. Concrete utilization of physical principles and analysis in various fields of engineering and technology are given prominence in this course.

II. INDUSTRY/EMPLOYER EXPECTED OUTCOME:

This course is to be taught and implemented with the aim to develop in the students, the course outcomes (COs) leading to the attainment of following industry identified outcome expected from this course. Apply principles of Physics to solve broad based relevant engineering problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS):

Students will be able to achieve & demonstrate the following COs on completion of course based learning:

- CO1: Apply Coulomb's law and Gauss's law to find out force and electric field due to charge.
- CO2: Apply basics of magnetism and electrical measuring instruments to solve engineering problems.
- CO3: Understand how semiconductors are vital in present day for engineering devices.
- CO4: Apply appropriate engineering materials for solving engineering problems.
- CO5: Apply basic principles of photoelectric effect, X Rays, Lasers, Optical fibers and nano science to solve engineering problems.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT FOR APPLIED PHYSICS-II:

Sr. No	Theory Learning Outcomes (TLOs) aligned to COs	Learning content mapped with Theory Learning Outcomes (TLOs) and COs.	Suggested Learning Pedagogies.	No of Lecture	CO
1	<p>TLO 1.1 Explain electric field and electric flux</p> <p>TLO 1.2 Calculate electric field due to point charge, straight charged conductor and plane charged sheet.</p> <p>TLO 1.3 Differentiate between direct and alternating current.</p> <p>TLO 1.4 Explain series and parallel combinations of resistances, inductors and capacitors.</p> <p>TLO 1.5 Find current in resistances of an electrical circuit with the help of Kirchhoff's laws.</p>	<p>UNIT- I: Charge and Electricity</p> <p>1.1 Electric Charge, Basic properties of electric charge, Coulomb's law, Electric Potential, electric Potential difference, Electric field, electric field intensity, Electric lines of force, electric flux.</p> <p>1.2 Gauss's law, Applications of Gauss's law in finding electric field of point charge, straight charged conductor, plane charged sheet and between two plane parallel charged sheets</p> <p>1.3 Concept of electricity, current and its unit, direct and alternating current, voltage, potential difference and e.m.f.</p> <p>1.4 Ohm's law and its applications, Concept of resistance, conductance, specific resistance, effect of temperature on resistance, Heating effect of current, series and parallel combination of resistors. Inductors series and parallel combination of Inductors, Capacitors: series and parallel combination of capacitors.</p> <p>1.5 Kirchhoff's laws, Wheatstone bridge and its applications (meter Bridge).</p>	<p>Chalk and board Improved lecture, Tutorial Assignment, Demonstration</p>	13	CO 1
2	<p>TLO 2.1 Find direction of magnetic field with the help of right-hand thumb rule.</p>	<p>UNIT- II: Magnetism:</p> <p>2.1 Magnetic field and its unit, magnetic intensity, magnetic lines of force, magnetic flux and their units, Right hand thumb rule, magnetic lines of force due to straight conductor, circular coil and solenoid.</p>	<p>Chalk and board Improved lecture, Tutorial Assignment, Demonstration</p>	09	CO 2

	<p>TLO 2.2 Calculate force on a charge moving in a uniform magnetic field.</p> <p>TLO 2.3 Explain principle, construction and working of moving coil galvanometer</p> <p>TLO 2.4 Explain electromagnetic induction</p>	<p>2.2 Force on a charge moving in a uniform magnetic field (Lorentz force). Force on a current carrying straight conductor. Torque on a current carrying rectangular coil. Force between two infinite parallel current carrying conductor.</p> <p>2.3 Moving coil galvanometer; its principle, construction and working, conversion of a galvanometer into ammeter and voltmeter, Multimeter.</p> <p>2.4 Electromagnetic induction; Faradays Laws, Lenz's Law. Self and Mutual Induction. Eddy current</p>			
3	<p>TLO 3.1 Explain Bohr's Model.</p> <p>TLO 3.2 Explain Conductor, insulator and semiconductor on basis of Energy bands.</p> <p>TLO 3.3 Differentiate between half wave and full wave rectifier.</p>	<p>UNIT- III: Semiconductor Physics</p> <p>3.1 Bohr's Model</p> <p>3.2 Energy bands, Conductor, insulator and semiconductor, intrinsic and extrinsic semiconductors, p-n junction diode and its characteristics</p> <p>3.3 Diode as rectifier – half wave and full wave rectifier. Transistor: pnp and npn (concept only).</p>	Chalk and board Improved lecture, Tutorial Assignment, Demonstration	08	CO 2
4	<p>TLO 4.1 Explain engineering materials.</p> <p>TLO 4.2 Applications of Copper, Aluminium, Gold, Silver.</p> <p>TLO 4.3 Applications of tungsten, nichrome, manganin in engineering.</p> <p>TLO 4.4 Differentiate between Class I and Class II Superconductors.</p> <p>TLO 4.5 Uses of mica, porcelain, steatite and enamels in engineering.</p>	<p>UNIT- IV: Basics of Engineering materials:</p> <p>4.1 Engineering materials: Fundamental of engineering materials.</p> <p>4.2 Conducting Materials: Copper, Aluminium, Gold, Silver.</p> <p>4.3 High resistivity Materials: Tungsten, Nichrome, Manganin.</p> <p>4.4 Superconductors: Class I and Class II</p> <p>4.5 Insulating Materials: Mica, Ceramics such as Porcelain and steatite, Enamels for winding wires.</p>	Chalk and board Improved lecture, Tutorial Assignment, Demonstration	08	CO 4

5	<p>TLO 5.1 Calculate energy of photon to emit electron from metal.</p> <p>TLO 5.2 Explain Properties of X-rays.</p> <p>TLO 5.3 Differentiate between spontaneous and stimulated emission and explain engineering and medical applications of Lasers.</p> <p>TLO 5.4 Explain principle of Optical fiber and its application in communication engineering.</p> <p>TLO 5.5 Applications of nano technology in modern engineering era.</p>	<p>UNIT - V Modern Physics</p> <p>5.1 Photo electric effect and work function, applications in engineering.</p> <p>5.2 X rays' properties, applications of X- rays in medicine and industries.</p> <p>5.3 Lasers: spontaneous and stimulated emission; lasers and its characteristics, population inversion, types of lasers and its engineering and medical applications.</p> <p>5.4 Refraction and refractive index, total internal Reflection, optical fiber materials, types of optical fiber, applications of optical fiber in Communication Engineering.</p> <p>5.5 Nanoscience and nanotechnology: Introduction, nanoparticles, nanomaterials, nanotechnology, applications.</p>	Chalk and board Improved lecture, Tutorial Assignment, Demonstration	10	CO 5
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V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL/ TUTORIAL EXPERIENCES FOR APPLIED PHYSICS-II:

Sr. No.	Practical / Tutorial /Laboratory Learning Outcome (LLO)	Laboratory Experiment/ Practical Titles/ Tutorial Titles	No. of Hrs.	Relevant Cos
1	LLO 1.1 Verify ohm's laws by drawing a graph between voltage and current.	To verify ohm's law by drawing a graph between voltage and current.	2	CO1
2	LLO 2.1 Verify laws of resistances in series and in parallel combinations.	To verify laws of resistances in series and in parallel combinations.	2	CO1
3	LLO 3.1 Verify Kirchhoff's Laws.	Verification of Kirchhoff's Laws.	2	CO1
4	LLO 4.1 Assemble the components of a given electrical circuit	To assemble the components of a given electrical circuit.	2	CO1
5	LLO 5.1 Calibrate voltmeter by using potentiometer.	Calibration of a voltmeter with a potentiometer.	2	CO2
6	LLO 6.1 Calibrate ammeter by using potentiometer.	Calibration of an ammeter with a potentiometer.	2	CO2

7	LLO 7.1 Convert Galvanometer into an Ammeter of given range.	Conversion of Galvanometer into an Ammeter of given range.	2	CO2
8	LLO 8.1 Convert Galvanometer into a Voltmeter of given range.	Conversion of Galvanometer into Voltmeter of given range.	2	CO2
9	LLO 9.1 Draw characteristics of a PN junction diode. LLO 9.2 Find resistance of PN Junction diode.	To draw characteristics of a PN junction diode and find resistance of diode.	2	CO3
10	LLO 10.1 Identify a Diode, LED, transistor, Resistor, Capacitor from mixed collection of such items.	To identify a Diode, LED, transistor, Resistor, Capacitor from mixed collection of such items and draw their notation.	3	CO3
11	LLO 11.1 Use Multi meter to measure value of given resistance, distinguish between n-p-n and p-n-p transistors. LLO 11.2 Examine unidirectional flow of current in Diode and LED.	Use of Multi meter to: To measure value of given resistance, distinguish between n-p-n and p-n-p transistors, See unidirectional flow of a current in case of a Diode and LED.	3	CO2 CO3
12	LLO 12.1 Determine resistivity of two or three wire by plotting a graph between potential difference and current.	Determine the resistivity of two or three wire by plotting a graph between potential difference and current.	2	CO4
13	LLO 13.1 Determine resistivity of any wire by Meter bridge.	Determination of resistivity by Meter bridge.	2	CO4
14	LLO 14.1 Verify the law of refraction (Snell's law) Using glass slab.	To verify the law of refraction (Snell's law) Using glass slab.	2	CO5
15	LLO 15.1 Determine refractive index of glass slab.	Determination of the refractive index of glass slab.	2	CO5
<p>Note: Out of above suggestive LLOs - Minimum 70% of the above listed lab experiments are to be performed. Judicious mix of LLOs is to be performed to achieve desired outcomes.</p>				

VI. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING):

MICRO PROJECT:

- Prepare models for combination of series and parallel resistances.
- Prepare models for combination of series and parallel inductors.
- Prepare models for combination of series and parallel capacitors.

- Prepare models to demonstrate magnetic lines of lines of forces of different types of magnets.
- Conductivity: Collect different materials such as metal, plastics, glass etc. and prepare models.
- Prepare model to demonstrate energy band diagram.
- Prepare model to demonstrate spontaneous emission and Stimulated emission.
- Convert given galvanometer into ammeter of desired range.
- Convert given galvanometer into voltmeter of desired range.
- Optical Fiber and TIR: Prepare model to demonstrate total internal reflection and the propagation of light.
- Collect information by library survey regarding engineering material used in various industries.
- Calibrate given ammeter.
- Calibrate given voltmeter.
- Prepare Charts on given topics.
- Prepare Charts for practical.
- Optical Fiber and TIR: Prepare model to demonstrate total internal reflection and the propagation of light.
- Prepare model to demonstrate Kirchoff's law.
- Prepare model to demonstrate Ohm's law.
- Prepare model to demonstrate Coulomb's law.
- Prepare model to demonstrate Gauss's law.

ASSIGNMENTS:

- Enlist information like band gap, material used, dimension etc about different semiconductor devices.
- Give details about the explanation of concept like electrostatics, magnetic domain, current electricity.
- Demonstrate the variation of angle of refraction with respect to refractive index using online tools.
- Determine Energy Band Gap of Semiconductor. (Virtual lab)
- Determination of wavelength of helium neon laser (Virtual Lab)
- Determination of the Numerical Aperture (NA) of optical fiber. (Virtual lab)
- Determine attenuation constant of optical fiber. (Virtual Lab)

VII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED:

Sr. No.	Equipment/Instrument/Tools Name with Broad Specifications	Relevant LLO No.
1	Experiment board for Kirchoff's law with connecting wires and power supply.	3
2	Experiment board for PN junction Diode characteristics with connecting wires and Power supply.	9
3	Meter Bridge	2,13
4	Potentiometer	5,6
5	Galvanometer: (30-0-30)	5,6,7,8
6	Ammeter: (0-3 A)	1,6,7,12
7	Voltmeter: (0-3 V)	1,5,8,12
8	Battery Eliminator: Output 2-12 V DC in steps of 2, 4, 6, 8, 10 & 12 Volts	5,6,7,8
9	Rheostats: 100-150 Ohm	1,5,6,7,8
10	Low resistance box: 1-100 Ohm	13
11	High resistance box: 1-10000 Ohm	7,8
12	Standard Resistances: 1 Ohm, 2 Ohm, 5 Ohm, 10 Ohm	1,2,5,13
13	Multimeter Digital: Functions: Voltage Testing, Current Testing, Continuity Check and Testing, AC testing, DC Testing and All electronics units' measurements. Transistor Test: (NPN & PNP), Diode Test: Yes, with audible continuity check, Power Supply: 9V battery, Operating Temperature: 0°C to 40°C, Display: 3 ½ digit LCD, with a maximum reading of 1999, Diode Test: Yes, with visual indication.	11
14	Diode, LED, NPN Transistor, PNP Transistor, Resistor, Capacitor	10,11
15	Travelling microscope: The microscope consists of a heavy cast iron base fitted with three leveling screws with the top machined over which slides a gun metal carriage. The slide can be clamped at any position by means of a clamping screw. Fine Adjustments for final reading are done with a micrometer screw. A vertical slide operating in a similar way is fitted on the horizontal carriage. The microscope with rack and pinion is fitted on the vertical or horizontal position of microscope. Microscope tube is fitted with high quality eye piece. Travels horizontally and vertically. Guaranteed accurate vernier reading 0.02 or 0.01 mm. Packed in a sturdy wooden box.	14
16	Spirit level: 180°, 90° and 45° high visibility vials facilitate easy reading of measurements	14
17	Glass slab: Size: 7.5cm x 15cm x 12mm	15,14
18	One way key and two-way key	1,2,5,6,7,8

VIII. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE
(Specification Table):

Sr. No.	Unit	Unit Title	Aligned COs	Learning Hours (L+T)	Weightage %
1	I	Charge and Electricity	CO1	13	27
2	II	Magnetism	CO2	09	19
3	III	Semiconductor Physics	CO3	08	17
4	IV	Basics of Engineering Materials	CO4	08	17
5	V	Modern Physics	CO5	10	20
Grand Total				48	100

IX. SUGGESTED COS - POS MATRIX FORM:

Applied Physics - I							
Course Outcomes (COs)	Programme Outcomes (POs)						
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life long Learning
CO1	3	1	2	1	1	-	1
CO2	3	1	2	3	1	1	1
CO3	3	1	-	-	1	1	1
CO4	3	1	2	2	1	1	1
CO5	3	1	2	2	1	-	1

Legends: - High:03, Medium:02, Low:01

X. SUGGESTED LEARNING MATERIALS / BOOKS:

Sr. No.	Author	Title	Publisher with ISBN Number
1	J.V Narlikar, A. W Joshi, A. K. Ghatak et al	Physics Textbook Part I - Class XI	National Council of Education Research and Training, ISBN: 8174505083
2	J.V Narlikar, A. W Joshi, A. K. Ghatak et al	Physics Textbook Part II - Class XI	National Council of Education Research and Training, ISBN: 8174505660
3	J.V Narlikar, A. W Joshi, A. K. Ghatak et al	Physics Textbook Part I - Class XII	National Council of Education Research and Training, ISBN: 8174506314

4	J.V Narlikar, A. W Joshi, A. K. Ghatak et al	Physics Textbook Part II - Class XII	National Council of Education Research and Training, ISBN: 8174506713
5	David Halliday, Robert Resnik and Jearl Walker	Fundamentals of Physics	John Wiley & sons, Hoboken, 2014 ISBN: 812650823X
6	B. N. Ivanov	Fundamentals of Physics	CBS
7	Yakov Perelman	Physics at every step	Prodinnova, ISBN: 2917260564
8	H. C. Verma	Concepts of physics	Bharti Bhawan, ISBN: 8177091875

XI. LEARNING WEBSITES & PORTALS:

Sr. No.	Link / Portal	Description
1	www.sciencejoywagon.com/physiczone	Electricity, Magnetism and Semiconductors, basic of fiber optics
2	https://phet.colorado.edu	Electricity, Magnetism and Semiconductors, Thermometry and basic of fiber optics
3	www.physicsclassroom.com	Concepts of basic physics
4	EDUPOINT	Concepts of basic physics
5	NPTEL	Concepts of basic physics
6	SWAYAM	Concepts of basic physics
7	Vlab (Virtual Lab)	To perform practical virtually.

Note: Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students
