Name of Institute: Institute of Sciences, Humanities and Liberal Studies
Name of Faculty: Dr. Manisha Vithalpura

Course code: PH0011
Course name: Engineering Physics

Pre-requisites: 12th Std Physics (Vector analysis, Introduction of Electromagnetism, De Broglie concept)
Credit points: 04
Offered Semester: I

Course Coordinator (weeks 01 - 18)
Full Name: Dr. Manisha Vithalpura
Department with sitting location: Physics Department, Physics lab
Telephone: 3314 (sitting location), 7874636405 (Mobile)
Email: manishavithalpura.gd@indusuni.ac.in
Consultation times: 1:30 pm to 4:45 pm (Thursday)

Course Lecturer (weeks 01 - 18)
Full name: Dr. Manisha Vithalpura
Department with sitting location: Physics Department, Physics lab
Telephone: 3314 (sitting location), 7874636405 (Mobile)
Email: manishavithalpura.gd@indusuni.ac.in
Consultation times: 1:30 pm to 4:45 pm (Thursday)

Students will be contacted throughout the Session via Mail with important information relating to this Course.

Course Objectives

By participating in and understanding all facets of this Course a student will:

1) To describe the basic laws of Physics, mathematical foundations and Engineering theory and to apply the knowledge in modeling and designing a real-world problem **(fundamental engineering analysis skills).**
2) To analyze a problem, identify and formulate using the concept of physics and to solve engineering problem **(engineering problem solving skills).**
3) To analyze and interpret experimental data using concepts of Physics **(information retrieval skills).**
4) To analyze and use current techniques, skills and tools necessary for Physics and engineering practice **(practical engineering analysis skills).**

Course Outcomes (CO)

1. To understand the basic concept of physics in the engineering field
2. To analyze a problem, identify and formulate using the concept of physics and to solve engineering problem
3. To understand the properties of dielectric and magnetic material and their applications in electric and magnetic devices
4. To understand the basic principle of superconductivity and ultrasound with specific applications in engineering
5. To analyze the concept of quantum mechanics and semiconductor physics and its applications in engineering field
6. To understand the optical phenomena of light like Interference and Diffraction and its application in optical devices

Course Outline

UNIT-I : Introduction to Electromagnetic

Module:1 Electrostatics & Dielectrics
Coulomb's law for distribution of charges, Gauss's law and applications, Electric field intensity, Electric flux, Electric dipole moment, Electric field due to dipole, Introduction to dielectrics, Polarizability, Types of polarization – electronic, ionic, orientational, Polarization of dielectrics, Gauss's law in presence of dielectric, Dielectric constant, Electric susceptibility and Permittivity, Internal (Local) field in dielectric, Clausius Mossotti equation (with derivation)

Module:2 Magnetism
Magnetic field, Steady current, Ampere's law, Biot-Savart law and its applications, Faradays law of Induction, Lenz's Law; Effect of magnetic field on current carrying conductor, Lorentz force.
Basic important terms and units in Magnetism, Concept and origin of magnetic moment, magnetic susceptibility, Total angular momentum, Diamagnetism, Paramagnetism, Ferromangnetism, Ferrimagnetism, Antiferromagnetism, Domain theory of Ferromagnetism, Curie temperature and hysteresis loss

UNIT-II : Superconductivity and Sound

Module 1: Superconductivity
Superconductivity: Zero resistance, Critical temperature, Meissner effect, Critical field, General properties of superconductors, Type-I and Type-II superconductors, BCS theory of Superconductor, High temperature superconductors, Applications of Superconductors: SQUID, Maglev etc.

Module 2: Sound
Introduction to sound waves, Characteristics and Properties of Sound, Absorption co-efficient, Reverberation time, Sabine's formula (without derivation), Factors affecting architectural acoustics,

Introduction of Ultrasonic waves, Generation of ultrasonic waves, Detection of ultrasonic waves, Applications of Ultrasonic waves: NDT, SONAR & others.

UNIT-III : Introduction to Quantum and Semiconductor Physics

Module 1: Quantum Mechanics

Black body radiation: Planck's law; Wave nature of Particles: De-Broglie theorem, Uncertainty principle; Schrodinger's wave equation – Time independent and time dependent equations; Born interpretation, probability current; Solution of stationary-state Schrodinger equation for one dimensional problems– particle in a box

Module 2 : Introduction to solids and Semiconductor Physics

Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram; Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass.
Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction diode.

UNIT-IV : Wave Optics& Laser

Module 1: Wave optics

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Farunhofer diffraction from a single slit, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power, Michelson interferometer

Module 2: Laser

Einstein's theory of matter radiation interaction and A and B coefficients; Amplification of light by population inversion, Properties of laser beams: mono-chromaticity, coherence, directionality and brightness; Different types of lasers: gas lasers (He-Ne), solid-state lasers (Neodymium); Applications of lasers in science, engineering and medicine.

Method of delivery

(Face to face lectures, Power Point Presentation, Self assessment, Active Learning Techniques)

Study time

(3 hours per week for lectures, 2 hours per week for Practical)

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department of _____Graduate Capabilities
Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.	**1 Professional knowledge, grounding & awareness** **Basic concept of basic physics** **Also application of the physics principle in engineering field**
Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	**2 Information literacy, gathering & processing** Critical and logical thinking is developed through numerical practice. Used various sources of the material and technology to perform the experimental part.
Problem solvers Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.	**4 Problem solving skills** **By practicing numerical, logical and critical thinking will be developed.**
Effective communicators Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.	**5 Written communication** **Conducting frequent unit test will develop their written communication skill**
	6 Oral communication **Arranging presentation on different physics topics throughout the semester**
	7 Teamwork **Group discussion in class and lab is arranged**
Responsible Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	**10 Sustainability, societal & environmental impact**

Practical work:

Experiment no.	Title
1	**Dielectric constant: T**o determine the dielectric constant of a dielectric substance.
2	To determine the**magnetic field at the center of a coil and its variation with distance and radius of the coil.**
3	To verify the **Faraday's law of electromagnetic induction.**
4	**Hysteresis loss:**To determine the Hysteresis loss in a Ferromagnetic material.
5	**Ultrasonic Interferometer:** To determine the wavelength and velocity of ultrasonic wave through ultrasonic interferometer.
6	**Planck's Constant:**To determine the Planck's Constant using LED
7	To study the **V-I characteristics of p-n junction diode**
8	To verify the Inverse Square Law using Photocell
9	To determine the **refractive index of prism** using Spectrometer
10	**Resolving power of grating**: To determine resolving power of a diffraction grating.
11	**Newton's Ring:**To determine the wavelength of monochromatic light
12.	**Determination of Wavelength of Laser:** To determine the wavelength of LASER using diffraction grating.

Lecture/tutorial times

Example:

Lecture	Monday	1.30 – 2.25 pm	Room Class-01/02/03
	Tuesday	11:50 – 12:50 am	Room Class-01/02/03
	Thursday	09:00 – 09:55 am	Room Class-01/02/03
Practicals	Wednesday	11:00 -12:50 pm	Room Physics lab
	Friday	9:00 – 10:50 pm	Room Physics lab

Details of referencing system to be used in written work

Unit test will be conducted in the classes and test papers will be kept with course coordinator for the future reference.

Text books

1. Engineering Physics by H K Malik, A K Singh, Tata Mc Graw-Hill Education Pvt. Ltd., 2nd edition, 2018, ISBN: 978-93-5260-695-5
2. Engineering Physics by D.K. Bhattacharya, Poonam Tandon,Oxford University Press, first published, 2015, ISBN-13:978-0-19-945281-1
3. An Introduction to Mechanics — D Kleppner& R Kolenkow, Tata Mc Graw-Hill Education Pvt. Ltd., Paperback edition, 2017, ISBN: 0-07-035048-5

Additional Materials

1. Engineering Physics;Fundamentals and Modern applications by P. Khare& A. Swarup, Jones & Bartlett Learning, 2009, ISBN-13: 978-0763773748
2. A textbook of Engineering Physics by S.O. Pillai and Sivakami,New Age International, Third edition, 2011, ISBN:978-81-224-3162-9
3. David Griffiths, Introduction to Electrodynamics
4. An introduction to Electrodynamics by David Griffiths,Pearson Education, 3th edition, 1999,ISBN:9780138053260
5. Optics by A. Ghatak, McGraw-Hill Education India Private Limited, 6th edition, 2017, ISBN-13:978-9339220907
6. Engineering Electromagnetics by W H Hayt& J A Buck, McGraw-Hill Education, 8th edition, 2017, ISBN-13:978-9339203276
7. Engineering Physics by K. Rajagopal,Prentice Hall of India Pvt. Ltd., 2007, ISBN: 9788120332867
8. A Textbook of Engineering Physics by M. N. Avadhanulu, P. G. Khirsagar, S.Chand Pub., Revised edition, 1992, ISBN: 9788121908177
9. University Physics, Sears and Zemansky, Pearson Education India, 13th edition, 2013, ISBN-13:978-8131790274

Web resources:

1. **Topics: Acoustics & Optics**: http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Guwahati/engg_physics/index_cont.htm

2. **Course: Engineering Physics**: http://www.nptelvideos.in/search?q=engineering+physics
3. **Topic: Laser:**http://science.howstuffworks.com/laser1.htm
4. **Topic: Optics:** http://www.pitt.edu/~poole/physics.html#light
5. **Topic: Magnetism: https://www.khanacademy.org/science/physics/magnetic-forces-and-magnetic-fields**
6. **Topic: Interference: https://www.khanacademy.org/science/physics/light-waves**
7. **Topic: Quantum Mechanics: https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/index.htm**

MOOCs:
https://www.edx.org/course/subject/physics

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

Continuous Internal Evaluation (Theory)		
Test 1	20% (week 6) , Unit-1/2, Objective (1,2,5)	
Project/Presentation/Assignment	**10% (Week 11/12), Objective (1,2,5)**	
Test II	20% (week 13), Unit 3,/4, Objective (1,2,6)	
Attendance	**10% (end of the semester)**	
Total	**60% (CIE theory)**	
Final exam (*closed book*)	40%	Objectives (1-6)

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in mid semester or end semester will be considered for supplementary assessment in the respective components (i.e mid semester or end semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (mid semester or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Practical Work Report/Laboratory Report:

Student has to complete the experiment in their respective lab in a week, will be evaluated weekly basis. A report on practical work is to be submitted after completion of the lab by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of -% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.
Do not share your work with other students (except where required for a group activity or assessment.

Course schedule(subject to change)

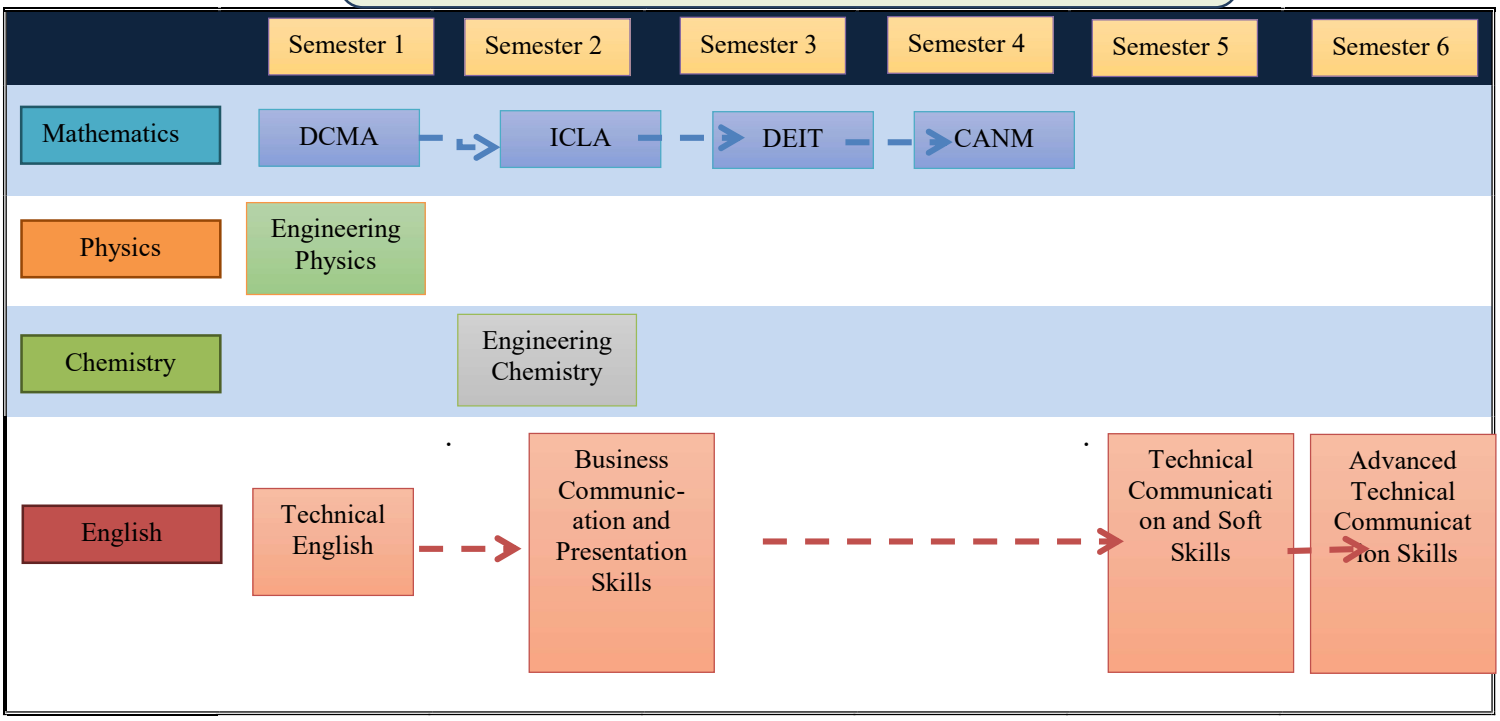
(Mention quiz, assignment submission, breaksetcas well in the table under the Teaching Learning Activity Column)

	Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
	Weeks 1	**M-1**: Coulomb's law for distribution of charges, Gauss's law and applications, Electric current and Equation of continuity, Electric field intensity, Electric flux, Electric dipole moment, Divergence and curl of electrostatic field, Introduction to dielectrics, Polarizability, Types of polarization – electronic, ionic, orientational, Polarization of dielectrics, Gauss's law in presence of dielectric, Dielectric constant, Electric susceptibility and Permittivity,	1,2,5	PPt, chalk and board
	Weeks 2	Internal (Local) field in dielectric, Clausius Mossotti equation (with derivation), **M-2:** Magnetic field, Steady current, Biot-Savart law, Ampere's law, Divergence and curl of static magnetic field, vector potential and calculating it for a given magnetic field using Stokes' theorem,	1,2,3	Chalk and Board
	Week 3	Effect of magnetic field on current carrying conductor, Lorentz force, Faraday's law in terms of EMF produced by changing magnetic flux; Lenz's law; **M-3:** Basic important terms and units in Magnetism, Concept and origin of magnetic moment, magnetic susceptibility, Total angular momentum	1,2,3	Chalk and Board
	Week 4	Diamagnetism, Paramagnetism, Ferromangnetism, Domain theory of Ferromagnetism, hysteresis loss, numerical,	1,2,3	Chalk and Board
	Week 5	Introduction to Superconductors and its properties, types of it	1,2,4	PPT and chalk-board
	Week 6	Numerical practice, Unit test I	1,2,4	Chalk and board
	Week 7	Types-I , II superconductor, BCS theory and introduction to Sound wave	1,2,4	Ppt and chalk and board

	Week 8	Audible sound and its characteristics, factor affecting and ultrasound	1,2,4	Ppt and chalk-board
	Week 9	Introduction to subject, **M-1**: Introduction, Black body radiation and laws if Black body radiation, De-Broglie theorem, Uncertainty principle; Schrodinger's wave equation	1,2,5	PPt, chalk and board
	Week 10	Born interpretation, probability current; Solution of stationary-state, Schrodinger equation for one dimensional problems– particle in a box, Numerical practice	1,2,5	PPt, chalk and board
	Week 11	Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass., Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics),	1,2,5	Chalk and board
	Week 12	Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction diode & Numericals, Unit test-1	1,2,5	Chalk and board, Test
	Week 13	**M-1:** Wave front, Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting, Young's double slit experiment, Newton's rings, Numerical, test II	1,2,6	PPTs and Chalk and board, Test II
	Week 14	Farunhofer diffraction from a single slit, the Rayleigh criterion for limit of resolution and its application to vision;, Diffraction gratings and their resolving power, Michelson interferometer, numerical	1,2,6	PPTs and Chalk and Board
	Week 15	**M-2:** Einstein's theory of matter radiation interaction and A and B coefficients; Amplification of light by population inversion, Properties of laser beams: mono-chromaticity, coherence, directionality and brightness; Different types of lasers: gas lasers (He-Ne), solid-state lasers (Neodymium);	1,2,6	PPTs
	Week 16	Applications of lasers in science, engineering and medicine., Numericals	1,2,6	PPTs

PROGRAM MAP for Bachelor of Engineering
(Institute of Sciences, Humanities and Liberal Studies)

Subject Mind Mapping



To be used for the following Branches: Automobile; Metallurgy; Civil; Mechanical