INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

ENGINEERING PHYSICS LABORATORY								
I Semester: AE | ME | CE | ECE | EEE | CSE (AI & ML) | CSE (DS) **II Semester:** CSE | IT								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AHSE05	**Foundation**	-	-	2	1	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		
Prerequisite: Basic Principles of Physics								

I. COURSE OVERVIEW:
The aim of the course is to provide hands on experience for experiments in different areas of physics. Students will be able to perform the experiments with interest and an attitude of learning. This laboratory includes experiments involving electromagnetism and optoelectronics. These also develop student's expertise in applying physical concepts to practical problem and apply it for different applications.

II. COURSES OBJECTIVES:
The students will try to learn:

I Familiarize with the lab facilities, equipment, standard operating procedures.

II The different kinds of functional magnetic materials which paves a way for them to use in various technical and engineering applications.

III The analytical techniques and graphical analysis to study the experimental data for optoelectronicdevices.

IV The application of characteristics of lasers and its propagation in optical fiber communication.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO1 Identify the type of semiconductor using the principle of Hall effect and also determine the energy gap and resistivity of a semiconductor diode using four probe method.

CO2 Illustrate principle, working and application of wave propagation and compare the results of frequency with theoretical harmonics and overtones.

CO3 Investigate the energy losses, curie temperature and properties associated with a given Ferro magnetic material.

CO4 Examine launching of light through optical fiber from the concept of light gathering capacity of numerical aperture and determine the divergence of Laser beam

CO5 Graph V-I /L-I characteristics of various optoelectronic devices like Light Emitting diode, Solar cell at different intensities to understand their basic principle of functioning as well as to infer the value of Planck's constant.

CO6 Analyze the variation of magnetic field induction produced at various points along the axis of current carrying coil.

IV. COURSE CONTENT:

1. GETTING STARTED EXCERCISES

1.1 On Errors and Uncertainty in a measurement:

When a number represents a physical measurement, it is never exact because of the limitations of the instrument used or the way it was employed etc. It is essential, therefore, that each experimental result be presented in a way that indicates its reliability. The accuracy of result is important, for example, the calibration of the measuring instruments or systematic errors on the part of whoever is taking the data.

The following table is useful in thinking about these concepts:

Problem	Remedy
Mistakes and blunders	Repeat measurements several times to check yourself
Systematic errors	Use calibrated instruments properly and carefully
Random errors	Treat data statistically and report on the average magnitude of errors

1.2 Making a good graph:

- Keep your axes straight: If you need to plot "A vs B", or "A as a function of B", then A is on the vertical axis and B is on the horizontal axis.
- The crucial part is choosing the range and scale for each axis. The range must be just large enough to accommodate all data and small enough that the scale is readable.
- The scale should be spread out enough so that data take up most of the graph area and labeled so that plotting (and reading) is easy. Where appropriate, error bars should be included to indicate the uncertainty in measurements.
- When a line is drawn, it should be a smooth one that best fits data. In general, there should be as many points on one side of the line as on the other. If data is taken properly, the line should pass inside of the error bars for each point.
- If graph shows that one quantity is proportional to another, it should be a straight line that starts at the origin and passes through the plotted data with as many points on one side as the other.
- If the slope of the line is to be found, choose two points on the line that are as far apart as possible. This will minimize the error that is introduced in reading the value of those points.
- The slope is the difference between the vertical values of those points divided by the difference in the horizontal values of those points.

1.3 Data recording and worksheets

- Write the work sheets for the allotted experiment and keep them ready before the beginning of each lab.
- Perform the experiment and record the observations in the worksheets.
- Analyze the results and get the work sheets evaluated by the faculty.
- Upload the evaluated reports online from CMS LOGIN within the stipulated time.

GETTING STARTED WITH EXPERIMENTATION

2. HALL EFFECT (LORENTZ FORCE)

2.1 Study the phenomenon of Hall effect and determine the charge carrier density and Hall coefficient of a given sample.

2.2 Hint whether the given semiconductor is p - type or n - type using the principle of hall effect.

3. ENERGY GAP OF A SEMICONDUCTOR DIODE

3.1 Determination of energy gap of a given semiconductor diode by measuring the variation of current as a function of temperature.

3.2 Try to find the Fermi level of the given semiconductor

4. RESISTIVITY – FOUR PROBE METHOD

4.1 Determination of the resistivity by forcing current through two outer probes

4.2 Formulate the reading of voltage across the two inner probes of semiconductor by four probe method.

5. MAGNETIC MOMENT

5.1 Determination of magnetic moment of a bar magnet.

5.2 Try to find horizontal component of earth's magnetic field.

6. B-H CURVE WITH CRO

6.1 Evaluate the energy loss per unit volume of a given magnetic material per cycle by tracing the hysteresis loop (B-H curve).

6.2 Observe the hysteresis loss of ferro magnetic materials.

7. FERROMAGNETIC MATERIAL

7.1 Determine the curie temperature (Tc) of a ferromagnetic material.

7.2 Evaluate the relative permeability (μ_r) of a ferromagnetic material.

8. OPTICAL FIBER

8.1 Determine the numerical aperture of a given optical fiber.

8.2 Calculate the acceptance angle of a given optical fiber.

9. LASER DIVERGENCE

9.1 Determination of the beam divergence of the given laser beam.

9.2 Try to estimate the laser output

10. SOLAR CELL

10.1 Studying the characteristics of solar cell at different intensities

10.2 Try to get the maximum workable power.

11. LIGHT EMITTING DIODE

11.1 Studying V-I characteristics of LED in forward bias for different LEDs.

11.2 Measure the threshold voltage and forward resistance, and try for the dynamic Resistance

12. PLANCK'S CONSTANT

12.1 Determination of Planck's constant by measuring threshold voltage of given LED.

12.2 Draw the L -I characteristics of the given LED.

13. STEWART GEE'S APPARATUS

13.1 Study the magnetic field along the axis of current carrying coil – Stewart and Gee's method.

13.2 Estimate the magnetic lines of force.

V. TEXT BOOKS:

1. Laboratory Experiments in College Physics", C.H. Bernard and C.D. Epp, John Wiely and Sons, Inc., New York, 1995.

VI. REFERENCE BOOKS:

1. C. L. Arora, "Practical Physics", S. Chand & Co., New Delhi, 3rd Edition, 2012.
2. Vijay Kumar, Dr. T Radhakrishna, "Practical Physics for Engineering Students", SM Enterprises, 2nd Edition, 2014.
3. Dr. Rizwana, "Engineering Physics Manual", Spectrum Techno Press, 2018.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/translation
2. https://nptel.ac.in/courses/115105120
3. NPTEL:: courses-Sem 1 and 2 - Engineering Physics and Applied Physics I
4. Experimental Physics I - Course (nptel.ac.in)
5. NPTEL:: Physics - Waves and Oscillations

VIII. MATERIALS ONLINE:

1. Course template
2. Lab manual