Darrang College (Autonomous), Tezpur-784001

Syllabus for FYUGP B.Sc. Physics (SEC)

Approved by :

Board of Studies meeting held on 20-12-2025
&
Academic Council vide Resolution no. 2, dated 29-12-2025

FYUGP PHYSICS MAJOR SEC SYLLABUS

(The syllabus is approved in the Board of Studies meeting held on 20th December, 2025)

DEPARTMENT OF PHYSICS

DARRANG COLLEGE (AUTONOMOUS)

Tezpur, Assam

W.e.f. January 2026

The syllabus is subject to modifications as deem fit by the Academic Council, Darrang College (Autonomous)

SKILL ENHANCEMENT COURSE (SEC) STRUCTURE

SUBJECT: PHYSICS (MAJOR)

SEM	Type	Course	Code	Course Type	Credit (Th+P)	Marks Distribution				Total
						Th	Th IA	P	P IA	
I	Major	Renewable Energy and Energy Harvesting	PHY-SEC-01013	Theory+ Field work	3 (3+0)	45	30	0	0	75
II	Major	Basic Skills on Electronic Equipment	PHY-SEC-02013	Theory +Practical	3 (1+2)	15	10	40	10	75
III	Major	Data Processing and Analysis	PHY-SEC-03013	Theory +Practical	3 (1+2)	15	10	40	10	75

Semester	Course	Unit	Content	Lecture (Hours)	Tutorial (Hours)	Practical (Hours)	Total (Hours)
I	**Renewable Energy and Energy Harvesting**	I	Fossil fuels and Alternate Sources of energy	10	15	0	45
		II	Solar energy	7			
		III	Wind Energy Harvesting	3			
		IV	Ocean Energy	3			
		V	Tidal Energy	2			
		VI	Geothermal Energy	2			
		VII	Hydro Energy	3			
		VIII	Carbon Capture	3			
		IX	Field Study	4			
II	**Basic Skills on Electronic Equipment**	I	Basic Electronic Components	3	0	60	75
		II	Basic Electronic Circuits	3			
		III	Use of laboratory instrument	3			
		IV	Soldering Technique	3			
		V	Electrical switch Board, Power Supply and PCB	3			
III	**Data Processing and Analysis**	I	Computer Basics	3	0	60	75
		II	Operating System	3			
		III	Scientific Graphing and Data Analysis	9			

*1 Credit= 1 hour of lecture per week; 1 Credit= 2 hours of practical class per week

*Th: Theory; P: Practical; IA: Internal Assessment; L: Lecture; T: Tutorial

SEMESTER: FIRST

Subject: Physics (Major)

Course Type: Skill Enhancement Course (SEC)

Course Name: Renewable Energy and Energy Harvesting

Course Code: PHY-SEC-01013

Credit: 3 (2 Theory + 1 Tutorial + 0 Practical)

COURSE OBJECTIVE

The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning on the necessity of renewable energy resources for sustainable future.

COURSE OUTCOME

At the end of the course, the students shall be able to understand the need of renewable energy, different forms of renewable energy.

Title of the course Course code	**Renewable Energy and Energy Harvesting** **PHY-SEC-01013**
Total Credit	3 (2 Theory+ 1 Tutorial+ 0 Practical)
Contact hours	30 (L)+15 (T)+0 (P)
Distribution of Marks	Internal Assessment: 30 End Semester: Theory=45; Practical=0

Course Summary

Unit	Topic	Lecture (hours)	Tutorial (hours)	Practical (hours)	Total (hours)
I	Fossil fuels and Alternate Sources of energy	10	4	0	45
II	Solar energy	7	2		
III	Wind Energy Harvesting	3	3		
IV	Ocean Energy	3	2		
V	Tidal Energy	2	1		
VI	Geothermal Energy	2	1		
VII	Hydro Energy	3	1		
VIII	Carbon Capture	3	1		
IX	Field Study	4			

DETAILED SYLLABUS

Theory **(Credit: 3; Lectures: 26; Tutorial: 15)**

Unit I: Fossil fuels and Alternate Sources of energy **(Lectures 10; Tutorial 4)**

Fossil fuels and Nuclear Energy, their limitation, non-conventional energy sources and their potential, need of renewable energy. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy, tidal energy, Hydroelectricity, Piezoelectric Energy.

Unit II: Solar energy **(Lectures 7; Tutorial: 2)**

Solar energy, it's potential and importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems.

Unit III: Wind Energy Harvesting **(Lectures 3; Tutorial 3)**

Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

Unit IV: Ocean Energy **(Lectures 3; Tutorial 2)**

Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.

Unit V: Tidal Energy **(Lectures 2; Tutorial 1)**

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

Unit VI: Geothermal Energy **(Lectures 2; Tutorial 1)**

Geothermal Resources, Geothermal Technologies.

Unit VII: Hydro Energy **(Lectures 3; Tutorial 1)**

Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

Unit VIII: Carbon Capture **(Lectures 3; Tutorial 1)**

Introduction to Carbon capture technologies

Unit IX: Field Study **(04 Hours)**

Suggested reading list

- Non-conventional energy sources – G.D Rai – Khanna Publishers, New Delhi
- Solar energy – M P Agarwal – S Chand and Co. Ltd.
- Solar energy – Suhas P Sukhative Tata McGraw – Hill Publishing Company Ltd.
- Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
- Dr. P jayakumar, Solar Energy: Resource Assessment Handbook, 2009, J. Balfour, M. Shawand S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
- http://en.wikipedia.org/wiki/Renewable_energy

Course designed by:

- Dr. Barsha Borgohain, Assistant Professor, Department of Physics, Darrang College(Autonomous)
- Dr. Rajib Kr. Basumatary, Assistant Professor, Department of Physics, Darrang College(Autonomous)
- Prof. Manoj Kr. Sarma, Assistant Professor, Department of Physics, Darrang College(Autonomous)

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SEMESTER: SECOND

Subject: Physics (Major)

Course Type: Skill Enhancement Course (SEC)

Course Title: Basic Skills on Electronic Equipment

Course code: PHY-SEC-02013

Credit: 3 (1 Theory+ 0 Tutorial+ 2 Practical)

OBJECTIVE OF THE COURSE

This course aims at making the students introduced to the working of electronic equipment used in daily life and to repair and maintenance of these equipment's.

COURSE OUTCOME

At the end of the course, the students shall be able to identify the fault, repair & do maintenance of daily use electronic equipment's.

Title of the course Course code	**Basic Skills on Electronic Equipment** **PHY-SEC-02013**
Total Credit	3 (1 Theory+ 0 Tutorial+ 2 Practical)
Contact hours	15 (L)+0 (T)+60 (P)

Distribution of Marks	Internal Assessment: 10 End Semester: Theory=15; Practical=50

Course Summary

Unit	Topic	Lecture (hours)	Tutorial (hours)	Practical (hours)	Total (hours)
I	Basic Electronic Components	2	0	60	75
II	Basic Electronic Circuits	3			
III	Use of laboratory instrument	3			
IV	Soldering Technique	3			
V	Electrical switch Board, Power Supply and PCB	4			

DETAILED SYLLABUS

Theory **(Credit-1; Lecture-15; Tutorial: 0)**

Unit-I: Basic Electronic Components **(Lecture: 02)**

Introduction to Resistor, Capacitor, Inductor, Diode, Transistor, Transformer, battery / cell (Brief idea, use and application only)

Unit-II: Basic Electronic Circuits **(Lecture: 03)**

Ohm's Law, Kirchhoff's current & voltage law, series and parallel circuit's connection, rectifier circuit using diode.

Unit-III: Use of laboratory instrument **(Lecture: 03)**

Use of Vernier slide calliper, screw gauge, spherometer, Digital Multi-Meter (DMM), Testers, different type of fuse, electronic balance, breadboard.

Unit-IV: Soldering Technique **(Lecture: 03)**

Introduction to Soldering and Desoldering Techniques: Soldering tools, Soldering iron, Solder joint, Dry solder joint, Cold solder joint, Good and bad solder joints.

Unit -V: Electrical switch Board, Power Supply and PCB **(Lecture: 04)**

Circuit design for electrical switch board. Circuit design and principle of regulated power supply (AC to DC). Fabrication of PCB (Printed Circuit Board): Types of PCBs-Steps involved in development of PCB using FeCl3 solution.

Practical **(Credit: 2; Contact hours: 60 Hours)**

At least five experiments should be performed from the following

1. Identification of electronic components (Active or Passive)
   (a) Resistor (b) Capacitor (c) Inductor (d) Diode (c) LED (d) Transistor (e) IC
2. Use Multimeter to measure the followings:
   (a) AC/DC current (b) AC/DC voltage (c) Resistance (d) capacitance
3. Use Multimeter to check the continuity of the following:
   (a) Diode (b) Transistor (c) LED (d) Cable wire
4. Use of Vernier slide calliper, screw gauge, spherometer to measure the following physical quantity of given specimen:
   (a) Length (b) radius (inner /outer) (c) volume (d) thickness (e) depth
5. Soldering and de-soldering of given circuit board.
6. Circuit connection of house hold switch board containing both socket, plug and switch.
7. To convert AC to DC using (a) Half-wave rectifier (b) full-wave rectifier (c) bridge rectifier.
8. Fabrication of printed circuit board (PCB) using FeCl3 solution.

Suggested Readings List

- A text of Applied Electronics, R.S. Sedha – S. Chand (2005) Basic Electronics, B. L. Theraja (S. Chand)
- EASY Laser Printer Maintenance & Repair By Stephen J. Bioelow

Course designed by:

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- Prof. Arup Kr. Deka, Assistant Professor, Department of Physics, Darrang College(Autonomous)

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SEMESTER: THIRD

Subject: Physics (Major)

Course Type: Skill Enhancement Course (SEC)

Course Title: Data Processing and Analysis

Course code: PHY-SEC-03013

COURSE OBJECTIVE

a) The basic objectives of the course are
   i) To introduce essential primary components in computer.
   ii) To introduce the idea about some basic operating systems.
   iii) To introduce the methods of scientific graphing and data analysis.
b) The course will consist of hands-on training on the data processing and analysis.

COURSE OUTCOME

On successful completion of the course, students will be able to understand the basics of computer systems and gain an insight into the different types of operating systems. They will be able to sample and analysis a given data set and derive different parameters using different data processing methods. The hands on sessions will help them in their future research fields.

Title of the course Course code	**Data Processing and Analysis** **PHY-SEC-03013**
Total Credit	3 (1 Theory+ 0 Tutorial+ 2 Practical)
Contact hours	15 (L)+0 (T)+60 (P)
Distribution of Marks	Internal Assessment: 10 End Semester: Theory=15; Practical=50

Course Summary

Unit	Topic	Lecture (hours)	Tutorial (hours)	Practical (hours)	Total (hours)
I	Computer Basics	3	0	60	75
II	Operating System	3			
III	Scientific Graphing and Data Analysis	9			

DETAILED SYLLABUS

Theory **(Credit: 1; Lecture: 15; Tutorial: 0)**

Unit I: Computer Basics **(Lecture: 03)**

Computer Basics: Components Of Computer system, Central Processing Unit, Concept of Hardware: Input devices, Output devices, Computer Memory, Processing concept of Computer.

Unit II: Operating System **(Lecture: 03)**

Windows 11 and working On Windows 11 environment, Introduction to Linux.

Unit III: Scientific Graphing and Data Analysis **(Lecture: 09)**

Creating chart in Microsoft excel, Types of chart-Column chart, line chart, Pie chart, Doughnut chart, bar chart, area chart, scatter chart, surface chart; Chart elements-Chart style, Chart filter, fine tune of chart; Chart Design tools, Design and format.

The Origin Workspace, Managing Data and Importing Data from different sources, Basic Data Manipulation, Processing of Imported Data, Creating and Customizing Graphs, Creating and Customizing Multi-layer Graphs, Data Exploration and Pre-selection, Advanced Nonlinear Fitting, including Creating Custom Fitting Functions.

Practical **Credit: 02; Contact hours: 60)**

1. Construct a 3D pi chart, 2D Column Chart and stacked Column chart from a given work sheet.
2. From a set of data go for Regression analysis.
3. Using Origin create your own multi-axes or multi-layer graphs and save as template for repeated use.
4. Fit a histogram with a Gaussian distribution in Origin Software.
5. Use Linear curve fitting function in Origin Software.
6. Use Non-linear curve fitting in Origin Software.
7. Identify slow, average and advance learner students using Quartile function in Microsoft Excel.
8. Sort and filter a data set using Microsoft Excel.
9. Find mean, median, mode and standard deviation of a given data set using formula in Microsoft Excel.

Suggested Reading list

- Mike Miller, *Computer Basics: Absolute Beginner's Guide, Windows 11 Edition*, Que Publishing.
- NIOS, "Basics of Computer" (Lesson 1 PDF).
- NCERT, Computer System

Course designed by:

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