Unit I

Fundamentals of Renewable Energy: Energy and sustainability, renewable Energy, requirement of energy transition from fossil fuels to renewable energy, types of renewable energy sources: solar energy, wind energy, hydropower, biomass and bioenergy, geothermal and tidal energy, Green Hydrogen advantages and limitations of each source, applications of renewable energy (mainly Solar energy)

Unit II

India's Renewable Energy Vision & the Road Ahead: India's Global Climate Commitments and leadership (Paris Agreement, COP26, G20, International Solar Alliance, OSOWOG), the energy transition: national goals and timelines, growth and trends in renewable energy in India deployment, Key terms (Watt, MW, GW, Grid, Off grid, Grid parity, net metering, carbon footprint) role of State governments and local bodies

Unit III

Stronger Grids, Smarter Energy: Green energy corridor, energy storage systems: 1) pumped hydro, 2) battery storage, 3) green hydrogen, smart grids and digital management, smart meters and demand side management (DSM)

Unit IV

Government Schemes and Policy Support for Renewable Energy: PM-KUSUM scheme, rooftop solar programme and surya ghar yojana, national green hydrogen mission, waste to energy and bioenergy promotion, off-grid Solar and decentralized applications, financial support: subsidies, loans, PLI scheme

References:

1. O.P. Chopra – नवीन और नवीकरणीय ऊर्जा स्रोत (Lakshmi Publications, Hindi)
2. B.L. Thapa – ऊर्जा के वैकल्पिक स्रोत (हिंदी ग्रंथ अकादमी, Bhopal, Hindi)
3. D.P. Kothari, K.C. Singal & Rakesh Ranjan – Renewable Energy and Environment (PHI Learning, New Delhi)
4. G.D. Rai – Non-Conventional Energy Resources (Khanna Publishers, New Delhi)
5. Annual Report, Ministry of New and Renewable Energy

240/PHY/SE201-A

Skill Enhancement Course

Course ID - 240/PH[illegible]
BASICS OF PROGRAMMING

Max. Marks: 35 **Credit 2 (30Hrs)**

Internal Assessment: 15 **Time: 3 hrs**

Note: *The paper setter is to set* ***Nine*** *questions. Question no. 1 (compulsory based on the entire syllabus) will consist of short answer type questions. The rest of the* ***eight*** *questions will be set uniformly, with two questions from each unit selected. A student is required to attempt* ***five*** *questions, selecting one from each unit along with compulsory question no 1. The question paper shall contain 20 % numerical problems in the relevant papers.*

Course Objective: Grasping fundamental programming concepts and Python syntax involves understanding how to declare and use variables, recognize different data types (integers, floats, strings, and booleans), and perform basic operations such as arithmetic, string concatenation, and logical operations. This foundation enables beginners to write and understand basic Python code effectively.	**Course Outcome:** Upon successful completion of this course, students will be able to understand and utilize the Python interpreter, execute basic print statements, perform variable assignments, develop programs using Python's control flow mechanisms, including loops and conditional statements, implement and use functions, lists, strings, dictionaries, and other data structures in Python to solve computational problems.

Unit-I

Basics of Python: The Python Interpreter; The print statement; Variables and Assignments; Strings; Comments and Docstrings; Debugging; Input; Data types and Data conversion.

Unit-II

Operations: Lists and List Operations; Comparison Operations; Logical Operations; Practice Programs: Mathematical operations, Convert Celsius to Fahrenheit, Solve Quadratic Equation.

Unit-III

Control Flow: Sequencing, Iteration and Selection; For and While Loops; Conditional Statements: if, if-else, elif; Break and Continue Statements; Ranges; Practice Programs: Simple Harmonic Motion, Motion of a Ball Under Gravity, Projectile Motion.

Unit-IV

Functions: Built-in Functions, List and String Functions, User-defined function, Dictionaries and Dictionary Functions, Tuples, Sets, List Comprehensions; Practice Programs: Make a Simple Calculator, Ohm's Law and Power Calculation.

References:

1. Python Crash Course by Eric Matthes (No Starch Press, 2nd ed., 2019).
2. Python Programming: An Introduction to Computer Science by John Zelle (Franklin, Beedle & Associates Inc., 2003).
3. Computation Physics: Problem Solving with Python, 3rd Edition by Rubin H. Landau, Manuel J Páez, Cristian C. Bordeianu (Wiley VCH, 2015).
4. Python documentation available at the Python web page (https://docs.python.org/3/).

BASICS OF PROGRAMMING LAB

Marks (External) : 20
Marks (Internal Assessment) : 05

Credits : 1(30Hrs)
Time : 3 Hrs

1. Each student should perform at least five experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

List of Experiments:

1. Program to calculate the factorial of a number.
2. Program to print sequences/series using loops.
3. Program to generate Fibonacci series up to n terms.
4. Program for performing basic arithmetic operations (addition, subtraction, multiplication, division) based on user input.
5. Program to convert Celsius to Fahrenheit.
6. Programs to add and multiply two matrices.
7. Program to count the number of lines, words, and characters in a file
8. Least square fitting for linear regression.
9. Solution of ordinary differential equations using built in python functions.
10. Solution of a Quadratic equation.

References:

1. Python Crash Course by Eric Matthes (No Starch Press, 2nd ed., 2019).
2. Python Programming: An Introduction to Computer Science by John Zelle (Franklin, Beedle & Associates Inc., 2003).
3. Computation Physics: Problem Solving with Python, 3rd Edition by Rubin H. Landau, Manuel J Páez, Cristian C. Bordeianu (Wiley VCH, 2015).
4. Python documentation available at the Python web page (https://docs.python.org/3/).
5. Computer programming in Fortran 77 by V. Rajaraman, Phi learning.