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|-----------------------------|------------------------------------------------------------------|
| <b>Branch Name:</b>         | Electrical Engineering                                           |
| <b>ProgramCode:</b>         | ET213                                                            |
| <b>CourseName:</b>          | Modeling & Simulation of Renewable Energy Sources Practical      |
| <b>CourseCode:</b>          | 2ET2130205P                                                      |
| <b>Pre-requisiteCourse:</b> | Fundamental Knowledge of Electrical Machines & Renewable Sources |

### Course Objectives:

1. To understand the Modelling & Simulation of electrical machines is a subject where a student will learn the generalized theory of machines, reference frame theories and varies types of transformation which will help then to analyze the machines.
2. To identify The major objective of the subject is to develop modelling concepts of various renewable energy sources.
3. To understand various impact of renewable energy on power system.

### Teaching and Examination Scheme:

| Credit | Teaching Scheme<br>Hours per week |   |   |       | Evaluation Scheme (Marks) |      |      |      |                   |      |      |      |                  |
|--------|-----------------------------------|---|---|-------|---------------------------|------|------|------|-------------------|------|------|------|------------------|
|        |                                   |   |   |       | Theory (Marks)            |      |      |      | Practical (Marks) |      |      |      | Total<br>(Marks) |
|        | L                                 | T | P | Total | SEE                       |      | CCA  |      | SEE               |      | CCA  |      |                  |
|        |                                   |   |   |       | Min.                      | Max. | Min. | Max. | Min.              | Max. | Min. | Max. |                  |
| 1      | -                                 | - | 2 | 2     | -                         | -    | -    | -    | 10                | 25   | 10   | 25   | 50               |

### Course Contents:

| Sr. No. | Detail of Practical                                                             | Content Hours |
|---------|---------------------------------------------------------------------------------|---------------|
| 1       | Simulation study on Solar PV Energy System.                                     | 04            |
| 2       | Experiment on “VI-Characteristics and Efficiency of 1kWp Solar PV System”.      | 02            |
| 3       | Experiment on “Shadowing effect & diode based solution in1kWp Solar PV system”. | 04            |
| 4       | Simulation study on Wind Energy Generator.                                      | 04            |
| 5       | Experiment on Performance assessment of micro Wind Energy Generator.            | 02            |
| 6       | Simulation study on Hybrid (Solar-Wind) Power System.                           | 04            |
| 7       | Simulation study on Hydel Power                                                 | 04            |
| 8       | Simulation study on Intelligent Controllers for Hybrid Systems.                 | 04            |

### Reference Books:

1. Variable Speed Generators, Ion Boldea, CRC press, Taylor & FrancisGroup.
2. Renewable and Efficeint Electric Power Systems, Gilbert. M. Masters, Wiley- Interscience, A John Wiley & Sons, Inc,Publication.
3. Wind Energy Generation Modelling and Control, Olimpo Anaya-Lara, NickJenkins.
4. JanakaEkanayake, Phill Cartwright, Mike Hughes, Wiley, A John Wiley & Sons, Inc,

Publication.

**Journal papers:**

1. IEEE Power Electronics Letters
2. Electric power systems research.
3. Int. Journal of electric power and energy systems
4. IEEE Power & Energy Magazine
5. IEEE Journal of Photovoltaic.

**Course Learning Outcomes (CLO): On completion of this course, the students will be able to:**

| CLO  | Description                                                                                              | Bloom's Taxonomy Level   |
|------|----------------------------------------------------------------------------------------------------------|--------------------------|
| CLO1 | Acquire the knowledge regarding modelling of renewable energy sources.                                   | 1 Remembering            |
| CLO2 | Understand the various simulation studies.                                                               | 2 Understanding          |
| CLO3 | Solve various real world power system grid integration issues of renewable energy sources in smart grid. | 3 Applying<br>5 Evaluate |
| CLO4 | Know about permanent magnet synchronous motor and generator .                                            | 1 Remembering            |
| CLO5 | Analyze and design of photovoltaic cell.                                                                 | 4 Analyze<br>6 Creating  |
| CLO6 | Analyze and design of wind and solar hybrid power system.                                                | 4 Analyze<br>6 Creating  |

**Mapping of CLOs with POs & PSOs**

| Course Learning Outcomes | Program Outcomes (POs) |     |     |     |     |     |     |     |     |      |      |      | Program Specific Outcomes (PSOs) |      |      |      |
|--------------------------|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|----------------------------------|------|------|------|
|                          | PO1                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1                             | PSO2 | PSO3 | PSO4 |
| CLO1                     |                        |     |     | L   |     | H   |     |     | M   |      |      | M    |                                  |      |      | L    |
| CLO2                     |                        |     |     | M   |     |     | L   |     |     |      | M    |      | M                                |      |      | L    |
| CLO3                     | H                      | L   |     |     | H   | M   |     | L   |     |      | L    |      |                                  | H    | L    |      |
| CLO4                     |                        |     |     | L   |     | H   |     |     | M   |      |      | M    |                                  |      |      | L    |
| CLO5                     |                        |     | L   |     | M   |     |     | M   |     | L    |      | M    |                                  | M    | H    |      |
| CLO6                     |                        |     | L   |     | M   |     |     | M   |     | L    |      | M    |                                  | M    | H    |      |

H: High, M: Medium, L: Low