



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Renewable Energy

Subject Code: DI04064041

Subject Name: Installation, Maintenance & Monitoring of
Renewable Energy Power Plant

w. e. f. Academic Year:	2025-26
Semester:	4 th
Category of the Course:	Professional Elective - II

Prerequisite:	-
Rationale:	<p>The global transition toward sustainable energy sources has created a growing demand for skilled professionals who can effectively install, maintain, and monitor renewable energy systems. As nations strive to meet carbon neutrality goals and reduce dependence on fossil fuels, renewable energy technologies—such as solar, wind and hydro are becoming integral to energy infrastructure.</p> <p>This subject is designed to equip students with the technical knowledge and practical skills required to support the deployment and operational efficiency of renewable energy power plants. It provides hands-on training and theoretical foundations in system installation, preventative and corrective maintenance, and performance monitoring using modern tools and software.</p>

Course Outcomes: After Completion of the Course, Student will be able to:

No	Course Outcomes	RBT Level*
01	Understand installation of solar power plant	R, U, A
02	Prepare maintenance schedule of wind power plant	R
03	Trouble shooting chart of hydro power plant	R, A
04	Understand renewable energy policies	R, U

*Revised Bloom's Taxonomy (RBT)



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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE(E)	PA(M)	PA(I)	ESE(V)	
3	0	2	4	70	30	20	30	150

Course Content: -

Unit No.	Content	No. of Hours	% of Weightage
1	<p><u>Solar power plant</u></p> <ul style="list-style-type: none"> • Site survey for site selection, Basics of installation and its requirements • ON grid and OFF grid solar power plant • Main components of solar power plant and its rating • Method to calculate load to decide size of solar system • Steps of solar panel installation and prerequisites • Assembling, fixing and precautions for mounting PV module structure • Installation of various components of PV system and skills required for installation • Connection and interconnection of components and precautions • Earthing & lightning protection • Maintenance: preventive, Scheduled and unscheduled Maintenance of PV system, Cleaning of panel, battery Maintenance, • Periodic maintenance schedule • Reasons of faults & Trouble shooting of PV system components Monitoring system and cyber security 	16	38%
2	<p><u>Wind power plant</u></p> <ul style="list-style-type: none"> • Site selection, Basics of Installation and its requirements • Main components of wind power Plant 	11	23%



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	<ul style="list-style-type: none"> Steps of wind turbine installation Predictive maintenance Maintenance of wind turbine Safety regulations Earthing and lightening protection Fault analysis and Trouble shooting of wind power system Monitoring of key components of wind power system Control system of wind power plant using SCADA systems 		
3.	<p><u>Hydro Power Plant</u></p> <ul style="list-style-type: none"> Basics of Installation and its requirements Main components of hydro power electrical system Installation of electrical equipment: switchboard, outfit, secondary ckt, transformer and its all accessories, high voltage electric equipment, bus bar, cable laying, auxiliary system motors Lightening protection & grounding Maintenance: - water intake, conduit system and equipment, Turbine and its auxiliaries, Generator and its auxiliaries, Transformer and switchyard, Emergency D.G set. Installation of safety monitoring system, computer monitoring system, video monitoring system, Condition monitoring system 	11	23%
4.	<p><u>Renewable Energy policies</u></p> <ul style="list-style-type: none"> Gujarat renewable energy policy-2023 Gujarat solar power policy 2021 Policy for development of small scale distributed solar projects 2019 Gujarat wind power policy 2016 Gujarat small hydel policy 2016 Gujarat wind-solar hybrid policy 2018 Challenges of renewable sector Opportunities in renewable sector 	7	14%
Total		45	100%



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Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
40%	40%	20 %	00	00	00

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Reference Books:

- 1 Rooftop solar pv(installation & maintenance), National Instructional Media Institute, National Instructional Media Institute, Chennai First Edition : July 2024
- 2 "Solar panel installation technician" Electronics sector skills council of india(essci), ESSCI First edition july 2022
- 3 "Best Practices for Operation and Maintenance of Photovoltaic and Energy Storage Systems",National Renewable Energy Laboratory, NREL/TP-7A40-73822 Technical report 2018 3rd Edition golden co.
- 4 Guidelines for the operation and maintenance of rooftop solar photovoltaic systems, Steve Williams,Chris Hewett, Solar Energy UK December 2021
- 5 Practical operation & maintenance (O&M) manual on solar pv system, Ing.Marina, D.K.Agortimevor, GIZ Green People's Energy Project,april 2023
- 6 Use, installation and maintenance of renewable energy system, Miguel A. Sanz-Bobi *Editor* Springer International Publishing Switzerland, 2014ISSN 1865-3529 ISSN 1865-3537 (electronic),ISBN 978-3-319-03223-8
- 7 Wind Power Plants Control SystemsBased on SCADA System, Khairy Sayed, Ahmed G. Abo-Khalil, and Ali M. Eltamaly, Springer Nature Switzerland AG 2021
- 8 Installation of Electromechanical Equipment Technical Guidelines for the, Development of Small Hydropower Plants, United nations industrial development organisation, SHP/TG 004-2: 2019

SOFTWARE/LEARNING WEBSITES

- <https://nimi.gov.in/pmsuryaghar/RooftopSolarPVTrainerNSQF4.0.pdf>
- <https://www.essc-india.org/participant-handook/English/EmbeddedAnalyst.pdf>
- <https://www.nrel.gov/docs/fy19osti/73822.pdf>
- <https://solarenergyuk.org/wp-content/uploads/2021/12/Solar-Energy-UK-Rooftop-OM->



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- https://gruene-buergerenergie.org/wp-content/uploads/Practical-Operation-Maintenance-Manual_Final.pdf
- <https://www.manualslib.com/manual/2783090/Enair-E70pro.html>
- <https://prescinto.ai/blog/scada-in-wind-and-solar-importance>
- https://www.iitr.ac.in/Departments/Hydro/RenewableEnergyDepartment/static/special_publ/vol_3.pdf
- <https://cea.nic.in/wp-content/uploads/2020/04/chapter-6.pdf>
- <https://www.sciencedirect.com/science/article/pii/S1474667015326343>
- <https://www.scribd.com/document/306149583/Teachers-Manual-Diploma-Hydropower-Engineering>
- <https://guj-epd.gujarat.gov.in/Home/GujaratREPolicy>

SUGGESTED PRACTICAL EXERCISES: -

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Identify the various components of solar PV system	I	2
2	Understand the installation procedure and set up solar PV system	I	2
3	Site visit of various types of solar power plant	I	2
4	Prepare maintenance schedule of solar PV system	I	2
5	Troubleshoot various faults in solar pv system	I	2
6	Identify various components of wind power plant	II	2
7	Understand the steps to install wind turbine	II	2
8	Prepare maintenance schedule of wind power plant	II	2
9	Troubleshoot various faults in wind power plant	II	2



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10	Measure Earth resistance in wind energy power plant	II	2
11	Identify various component and understand installation steps of hydro power plant	III	4
12	Understand various renewable energy policies of government	IV	4

MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Solar PV modules, batteries, charge controller	1,3,5
2	Inverter, cable, junction box, dist.box, mounting accessories, Tool kit	1,3,5
3	Digital Multimeter	5,9
4	Digital earth tester	10
5	Solar trainer kit, Digital solar meter,	1,5
6	Wind trainer kit	6,9
7	Digital Anemometer, wind vane, sensors	6,9

SUGGESTED STUDENT ACTIVITIES: -

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course. Students should perform following activities in group (or individual) and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

- Present seminar on various topics from course content
- Arrange workshops and hands on practices to install solar pv system
- Arrange an expert session from industry persons
- Group discussion on current scenario of renewable energy sector.



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The student should be encouraged to get their work assessed by the concerned teacher progressively during the term and at the end of the term the whole work should be submitted to the concerned teacher.

SUGGESTED PROJECTS: -

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-projects are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the micro project should be about **14-16 (fourteen to sixteen) student engagement hours** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs.

Similar micro-projects could be added by the concerned course teacher:

- a) Create a model of small solar pv system
- b) Create a model of small wind power plant
- c) Prepare maintenance schedule of various renewable energy power plant
- d) Prepare chart of various faults and its trouble shooting
- e) Prepare a report on visit of nearby renewable energy power plant
