MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous& NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Skills Enhancement Program (SEP) - 2022

Name of Department	**Department of Electrical Engineering**
Module Name	**Design analysis of grid-connected and off-grid system**
Module Coordinators	1)Dr. Shishir Dixit 2) Dr. Himmat Singh 3) Dr. Yashwant Sawle
Module Objective	• The main aim of the program is to make participants familiar with present energy scenario in Indian prospective. That combined conventional and non-conventional energy sources and reactive power management for maximum utilization of existing utility system. • There are two main types of renewable energy generation resources: **distributed generation**, which refers to small-scale renewables on the distribution grid where electricity load is served; and **centralized, utility-scale generation**, which refers to larger projects that connect to the grid through transmission lines. • To facilitate the students to achieve a clear conceptual understanding of technical and commercial aspects of Wind and Alternative Sources of Energy. • To enable the students to develop managerial skills to assess feasibility of alternative approaches and drive strategies regarding Wind and Alternative Sources of Energy. • Understand the difference between renewable and nonrenewable energy resources. • Identify strengths and limitations associated with the different renewable energy technologies. • The Flexible AC Transmission System (FACTS) are power electronics based devices which are capable of managing reactive power of the system (by injecting or absorbing the reactive power of system) under operational constant of a power system. These devices provide fast and flexible control and thus an alternate solution to address some of these problems of a power system including RPM. Main objectives of FACTS technology are to increase transmission capacity allowing secure loading of the transmission up to their thermal capacities, to enable better utilization of available generation and to control the outages from spreading to wider areas. However, the huge financial investment is required in installation of these devices; the optimal location and sizing of these devices are intensively investigated with some suitable optimizing techniques.

MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous& NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Skills Enhancement Program (SEP) - 2022

Module Content	• Energy Scenario in India • Importance of Renewable Energy Resources • Availability of resources Renewable Energy Resources • Sizing of various Renewable Energy Resources • Economic details of hybrid system components for sizing. • Grid connected system • Off-grid system • Energy storage • Introduction to Hybrid Optimization of Multiple Energy Resources software. • Introduction and Need of the of FACTS Devices • Classification of FACTS Devises • Optimal Placement of FACTS Devices • Future role of High Power Electronics Converters in Power Systems • Traditional optimization techniques • Differential Evolution • Hands on Training • Quiz /Assessment during and at the end of Session
Module Methodology	Implementation and verification using Hybrid Optimization of Multiple Energy Resources software.
Module Outcome/ Impact	• The understanding of optimization techniques to solve different types of grid and off-grid system problems using Hybrid Optimization of Multiple Energy Resources software. • Application of Advanced net metering in Power System • Understand the need of energy conversion and the various methods of energy storage.
Duration	5 Weeks (30 days)
Module Coordinator **Email ID** **Mobile No.**	,Dr.Shishir Dixit[1], Dr.Himmat Singh[2] Dr. Yashwant Sawle[3] shishir.dixit1@gmail.com ahirwar.himmat@mitsgwalior.in yashwant@mitsgwalior.in 898982730, 9826501588 & 9575005868

MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous& NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Skills Enhancement Program (SEP) - 2022

Day Wise Schedule

	Date	Day	Module Contents to be covered/Interactive Session/Assignment/Quiz/Exercises/Daily practice sheets (DPP)/Tutorial/Project etc (10:00 AM onward, 2-3 Hrs/ Day)	Faculty
Week 1	**13-06-2022**	Mon	Introduction/ Discussion on subject	Dr. Shishir Dixit / Dr. Yashwant Sawle
	14-06-2022	Tue	Energy Scenario in India	Dr. Yashwant Sawle
	15-06-2022	Wed	Feasibility analysis for design of hybrid system	Dr. Yashwant Sawle
	16-06-2022	Thu	Calculate the major parameters of sun movement, solar radiation, and tracking systems.	Dr. Yashwant Sawle
	17-06-2022	Fri	Calculate the major parameters of wind turbine, speed.	Dr. Yashwant Sawle
Week 2	**20-06-2022**	Mon	Impact of battery in hybrid system	Dr. Yashwant Sawle
	21-06-2022	Tue	Hands of training	Dr. Yashwant Sawle
	22-06-2022	Wed	Research paper related to renewable energy using Hybrid Optimization of Multiple Energy Resources software	Dr. Yashwant Sawle
	23-06-2022	Thu	Research paper related to renewable energy using Hybrid Optimization of Multiple Energy Resources software	Dr. Yashwant Sawle
	24-06-2022	Fri	Introduction of Reactive Power Dispatch	Dr.Himmat Singh
Week 3	**27-06-2022**	Mon	Introduction of Reactive Power Dispatch	Dr.Himmat Singh
	28-06-2022	Tue	Importance of Reactive power	Dr. Himmat Singh
	29-06-2022	Wed	Importance of Reactive power	Dr.Himmat Singh
	30-06-2022	Thu	Differential Evolution	Dr.Himmat Singh
	01-07-2022	Fri	Differential Evolution	Dr.Himmat Singh
Week 4	**04-07-2022**	Mon	Differential Evolution	Dr.Himmat Singh

	05-07-2022	Tue	Load flow Methods: Gauss-Siedel, Newton-Raphson, Fast-Decoupled method	Dr. Shishir Dixit
	06-07-2022	Wed	Load flow Methods: Gauss-Siedel, Newton-Raphson, Fast-Decoupled method	Dr. Shishir Dixit
	07-07-2022	Thu	Load flow Methods: Gauss-Siedel, Newton-Raphson, Fast-Decoupled method	Dr. Shishir Dixit
	08-07-2022	Fri	Introduction, and Need of the of FACTS Devices	Dr. Shishir Dixit
Week 5	**11-07-2022**	Mon	Introduction, and Need of the of FACTS Devices	Dr. Shishir Dixit
	12-07-2022	Tue	Classification of FACTS Devises	Dr. Shishir Dixit
	13-07-2022	Wed	Optimal Placement of FACTS Devices	Dr. Shishir Dixit
	14-07-2022	Thu	Traditional optimization techniques	Dr. Shishir Dixit
	15-07-2022	Fri	Concluding Remarks by all Faculties	All faculty

Eligibility and Important Instructions :-

1. The Finishing School Program/ Online Summer Internship Program is designed only for pre-final & final year students of **Electrical Engineering Department.**
2. Participants must have Laptop/Desktop and also preliminary knowledge of MATLAB software.
3. The students may apply on line.
4. The Skill enhancement program/ Online Summer Internship Program is free for the participants of pre-final & final year students of MITS.
5. The participants outside the Institute may also join the Program on payment basis.
6. This online module will be conducted under the Skill enhancement program which will be considered equivalent to Online Internship of Pre-final year students who could not get any Internship during this situation.
7. Duration of this program will be of five weeks which is equivalent to summer Internship period as per AICTE and our Institute policy. Daily no. of hours of online training may be flexible.
8. Certificates will be issued to candidates who have attendance 75% or more and also score more than 60% in the test.

MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous& NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Skills Enhancement Program (SEP)-2022

Name of Department	**Department of Electrical Engineering**
Module Name	**Hybrid Power Generation using Solar and Wind Energy: A Case Study of MITS Campus**
Module Coordinators	• Prof. Saurabh Kumar Rajput • Prof. Bhavna Rathore
Module Objective	• Renewable energy systems (RESs) are expected to become more popular over time as a consequence of rapid environmental implications and rising energy costs associated with the use of traditional energy sources. • The purpose of this module is to provide an overview of hybrid system architecture, modelling, renewable energy sources, hybrid system optimization and control methodologies, and software utilised for optimal sizing. • A case study of grid connected PV-Wind energy system of MITS Gwalior, India will be discussed and the most optimal solution regarding cost and emission will be covered. • The module is designed with the objective to provide the industry oriented detailed information about latest developments in renewable energy systems. • This module aims to explore the concept of optimal demand supply management, smart metering, controller design and tuning of parameters.
Module Content	**The content of module is divided into following major parts:** • Present energy scenario & Government policies • Solar PV technology basics, performance and power plant. • Solar PV impact on transformer performance. • Solar PV impact on Grid supply parameters & economic analysis • Integration of PV and wind to the grid. • Control techniques for the control of renewable energy sources • Impact of renewable energy sources on steady state and transient response of the system • Power Quality analysis and control designer of renewable energy integrated network

Skills Enhancement Program (SEP)-2022

	• Economic load dispatch solution for renewable integrated power system **Experimental/Simulation work/Field Visit** • Visit and data collection from 2 kWp PV plant at rooftop of Renewable Energy Lab. • Visit and data collection from 100 kWp PV plant at rooftop of MITS building. • Introduction to LabVIEW, PSCAD and MATLAB • Control Panel design for electrical signals monitoring • EMTDC simulation for transient analysis
Module Methodology	The SEP will start with present energy scenario and the need for smart renewable technologies for improving energy efficiency. The theoretical concept of Renewable energy technology topics such as PV, Wind, Grid power & its performance parameter will also be covered in the starting stage of SEP. Further, Various field visits, real-time data collection its analysis from hybrid power system will be done for developing the real understanding in the students. The hands-on sessions are also scheduled on various software like LabVIEW, PSCAD, MATLAB etc.
Module Outcome/ Impact	After completion of the module the students will be able to: • **Describe** the basic concepts of Renewable energy technology • **Inculcalte** the concept of smart metering • **Analyze** the impact of renewable energy sources on power quality and stability of the system. • **Design** the DC/DC, DC/AC, voltage controller, current controller, PWM controller, and filter circuit etc. for the microgrid. • **Develop** and solve the economic load dispatch problem for renewable integrated power system • **Simulate** the renewable energy integrated electrical network in MATLAB and PSCAD environment.
Duration	30 days

MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous& NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Skills Enhancement Program (SEP)-2022

Day Wise Schedule				
	Date	**Day**	**Module Contents to be covered/Interactive Session/Assignment/Quiz/Exercises/Daily practice sheets (DPP)/Tutorial/Project etc** **(3-4 Hrs/ Day)**	**Faculty**
Week 1	13.06.2022 To 17.06.2022	Monday to Friday	Solar energy capacity, National mission, Future of solar in India (BiPV technology), Net Zero energy building etc. Solar cell material selection and working, concept of fill factor and I-V Curve, Solar modules and its types, Series and parallel connections of solar modules, Solar PV performance parameters as per IEC 61724 standards. **Solar PV power plant:** Components, design & types Solar PV power plant components & their size selection as per load requirements: DC/ AC cables, junction box, solar converter, charge controller and battery system; concept of MPPT, Single line diagram representation, Net and gross metering. **Experimental work** *Comparison of two Low voltage distribution power systems (one with PV and another without PV), and finding the energy savings, electricity saving, CO_2 mitigation.* **Field work** *Visit of 2 kWp PV plant on the rooftop of Renewable Energy Lab, Weather data monitoring.* *Setup off-grid PV plant and measurement of PV performance parameters.* *Setup of on-grid PV plant and measurement of PV performance parameters.*	Prof. Saurabh Kumar Rajput
Week 2	20.06.2022 To 24.06.2022	Monday to Friday	Solar PV impact on transformer performance and sizing (IEEE C57.91-1995), Impact of harmonics on transformer performance (IEEE C57.110-2018), Hot spot temperature & ageing of transformer, impact on OLTC operation and single/ three phase transformer, Electricity bill analysis. Economic analysis of PV plant with Levelized cost of electricity (LCOE). **Field work** *Visit of 100 kWp PV plant on the rooftop of institute building, collection of real time data and finding the impact*	Prof. Saurabh Kumar Rajput

			of PV integration (with grid) on the loading of three phase distribution transformer. *Real time data collection and calculation of payback time with unit cost of PV produced electricity*	
Week 3	27.06.2022 To 01.07.2022	Monday to Friday	Integration of PV and wind to the grid: Power electronic interfacing circuit requirement for the connection of PV and wind to the grid. DC/DC, DC/AC and AC/AC converter. Design of filter circuit, PWM control etc. Control techniques for the control of renewable energy sources: Centralized control: Master slave control, Centre level control, Distributed current control, Decentralized control: Droop control, Reverse droop control. Impact of renewable energy sources on steady state and transient response of the system **Simulation work:** *Introduction to LabVIEW, PSACD and MATLAB, Control Panel design for electrical signals monitoring, EMTDC simulation for transient analysis.* *MATLAB Simulation: Converter circuit design, pulse generation for the converter, filter design, Battery control circuit, Open loop control: current control, voltage control design etc.* *Master slave and distributed current control of inverter, Droop control of inverter, islanded and grid connected mode of operation etc* *Virtual inertia control of micro-grid to provide inertial support*	Prof. Bhavna Rathore
Week 4	04.07.2022 To 08.07.2022	Monday to Friday	Power Quality analysis and control designer of renewable energy integrated network: Operation of micro-grid for linear and non-linear load, THD analysis, voltage sag, voltage swell conditions, under-voltage, overvoltage, unbalancing condition, power factor correction etc. Economic load dispatch solution for renewable integrated power system: load flow methods, problem formulation for economic load dispatch solution, cost analysis, optimization control techniques etc. optimal placement and sizing of distributed generator.	Prof. Bhavna Rathore

MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous& NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Skills Enhancement Program (SEP)-2022

			Simulation work: ● *Active power filter design, capacitor bank design* ● *STATCOM design* ● *DVR design* ● *Distributed generator control* ● *MATLAB code for economic load dispatch problem solution with and without distributed generator using Particle swarm optimization, teaching learning algorithm and Jaya algorithm etc.*	
Module Coordinators Email Id and Mobile Number			● Prof. Saurabh Kumar Rajput saurabh9march@mitsgwalior.in (+91-9555969573) ● Prof. Bhavna Rathore rathore.puja@mitsgwalior.in (+91-7275765537)	

Eligibility and Important Instructions:-

1. The Skill Enhancement Program (SEP) is designed only for Pre-final & Final Year students of Electrical Engineering Department.

2. The students may apply online.

3. The SEP is free for the participants of Pre-final & Final year students of MITS, Gwalior.

4. The participants outside the Institute may also join the Program on payment basis.

5. This modules conducted under the SEP, will be considered equivalent to Internship of Pre-final year students.

6. Duration of this program will be of one month which is equivalent to summer Internship period as per AICTE and our Institute policy. Daily no. of hours of online training may be flexible.

7. Certificates will be issued to candidates who have attendance 75% or more and also score more than 60% in the test.