SYLLABUS

Minor *in*

POWER ENGINEERING

OFFERED BY: Department of Electrical and Electronics Engineering (EE)

ELIGIBLE DEPARTMENTS: AD, CA, CC, CE, CS, EC, ER, ME

2024 SCHEME

Semester V & VI

SEMESTER S5

SOLAR AND WIND ENERGY CONVERSION SYSTEM

Course Code	**24SJMNEET 509**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	4:0:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Introduction to Power Engineering/ Energy Systems	**Course Type**	Theory

Course Objectives:

1. To introduces about solar and wind energy conversion systems.
2. Design of wind and solar power systems

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction – Basic concept of Energy – Sources of Solar Energy- Formation of the Atmosphere- Solar Spectrum- Solar Constant – Air Mass- Solar Time- Sun- Earth Angles - Solar Radiation-Instruments to Measure Solar Radiation-Pyrheliometer –Pyranometer - Sunshine Recorder- Solar Radiation on a Horizontal Surface - Extraterrestrial Region.- Terrestrial Region -Solar Radiation on an Inclined Surface -Conversion Factors -Total Solar Radiation on an Inclined/Tilted Surface -Monthly Average Daily Solar Radiation on Inclined Surfaces.	**12**
2	Solar Thermal system-Principle of Conversion of Solar Radiation into Heat, –Solar thermal collectors –General description and characteristics –Flat plate collectors –Heat transfer processes –Solar concentrators (parabolic trough, parabolic dish, Central Tower Collector) – performance evaluation. Applications -Solar heating system. Solar PV Systems-Introduction - Fundamentals of Semiconductor and Solar Cells - Photovoltaic Effect - Solar Cell (Photovoltaic) Materials - Basic Parameters of the Solar Cell.	**12**
3	Wind Turbines - Introduction -Origin of Winds- Nature of Winds – Classification of Wind Turbines -Wind Turbine Aerodynamics - Basic principles of wind energy extraction – Extraction of wind turbine power(Numerical problems)- Weibull distribution-Wind power generation curve-Betz's Law-Modes of wind power generation.	10

4	Wind Energy Conversion Systems-Introduction-Components of WECS - Fixed speed drive scheme- Variable speed drive scheme - Wind–Diesel Hybrid System –Induction generators- Doubly Fed Induction Generator(DFIG)-Squirrel Cage Induction Generator(SCIG)-Power converters in renewable energy system-AC-DC Converters, DC-DC Converters, DC-AC Converters(Block Diagram Only)-Effects of Wind Speed and Grid Condition (System Integration) -Environmental Aspects - Wind Energy Program in India	**12**

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	Internal Examination- 1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8 x 3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4 x 9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Explain the basics of solar energy conversion systems.	**K2**
CO2	Design a standalone PV system.	**K3**
CO3	Describe different wind energy conversion systems.	**K2**

Note: *KI- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3									2
CO2	3	3	1								2
CO3	3	3									2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), No Correlation*

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Solar Energy Engineering	A. A. M. Sayigh (Ed)	Academic Press	1st Edition (2012)
2	Wind Power Plants and Project Development	Earnest J. & T. Wizelius	PHI Learning	2nd Edition (2011)
3	Principles of Solar Engineering	F. Kreith & J.F. Kreider	McGraw-Hill / CRC Press	2nd Edition (2000)
4	Solar Energy – Fundamentals, Design, Modelling and Applications	G. N. Tiwari	Narosa (Alpha Science)	1st Edition (2002)
5	Handbook of Solar Energy: Theory, Analysis and Applications	G.N. Tiwari, Arvind Tiwari, Shyam	Springer	1st Edition (2016)
6	Renewable Energy Sources and Emerging Technologies	D.P. Kothari, K.C. Singal, Rakesh Ranjan	Prentice Hall India / PHI	3rd Edition (2021)

SEMESTER S6

INSTRUMENTATION AND AUTOMATION OF POWER PLANTS

Course Code	**24SJMNEET609**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Introduction to Power Engineering/ Energy Systems	**Course Type**	Theory

Course Objectives:

1. To introduce measurements and instruments used in power plants.
2. To discuss automation of power plants and Supervisory control and data acquisition

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Measurements in power plants: Electrical measurements – current, voltage, power, frequency, power factor etc. – non electrical parameters – flow of feed water, fuel, air and steam with correction factor for temperature – steam pressure and steam temperature – drum level measurement – radiation detector – smoke density measurement- dust monitor	12
2	Measurement in boiler and turbine: Metal temperature measurement in boilers, piping. System for pressure measuring devices - smoke and dust monitor - flame monitoring. Introduction to turbine supervising system - pedestal vibration - shaft vibration - eccentricity measurement. Installation of non-contracting transducers for speed measurement	11
3	Control in Boilers- Boiler drum level measurement methods - feed water control - soot blowing operation - steam temperature control - Coordinated control- boiler following mode operation - turbine following mode operation - selection between boiler and turbine following modes. Distributed control system in power plants interlocks in boiler operation - Cooling system - Automatic turbine runs up systems.	11
4	Introduction to SCADA systems: - Elements of a SCADA system - benefits of SCADA system - SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system. SCADA System Components: - Remote Terminal Unit-(RTU), Intelligent Electronic Devices (IED) - PLC: Block diagram, Ladder diagram, Functional block diagram	12

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	Internal Examination- 1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8 x 3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4 x 9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Analyse different instruments used for measuring parameters in a power plant.	**K2**
CO2	Explain various control systems in power plants.	**K2**
CO3	Identify different components of SCADA for applications in power plants.	**K3**

Note: *KI- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3									1
CO2	3	3									1
CO3	3	3									1

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), No Correlation*

Text Books				
SI. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Power Plant Engineering	P. K. Nag	Tata McGraw-Hill Education	2002
2	Mechanical and Industrial Measurements	R.K.Jain	Khanna Publishers, New Delhi	2nd Edition, 2006
3	The Control of Boilers	Sam G. Dukelow	ISA Press, New York	1991
	SCADA: Supervisory Control and Data Acquisition	Stuart A. Boyer	Instrument Society of America	4th Edition – 2010