Vidya Pratishthan's Kamalnayan Bajaj Institute of Institute of Engineering and Technology, Baramati

Faculty of Science & Technology

Board of Studies

Electrical Engineering

Double Minor Degree in Renewable Energy

(Pattern: 2024)

(w.e.f. AY: 2025-26)

Syllabus: Double Minor Degree in Renewable Energy (BoS: Department of Electrical Engineering)
2024 Pattern w.e.f. AY:2025-2026

Course Code	NEP Category	Sem	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
				TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
EL24261	DM	III	Electrical Engginering and Measurements	2	2	-	10		60	30			100	2	1	-	3
EL24271	DM	IV	Power genetation Technology	2	2	-	10		60	30			100	2	1	-	3
EL24361	DM	V	Utilization of Electrical Energy	3	2	-	10	30	60	30			130	3	1	-	4
EL24371	DM	VI	Electrical energy literacy and safety	3	2	-	10	30	60	30			130	3	1	-	4
EL24461	DM	VII	Fundamental of solar and wind energy	3	2	-	10	30	60	30			130	3	1	-	4
Total				13	10	0	50	90	300	150	0	0	590	13	5	0	18

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Dr. C. B. Nayak
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Dr. S. M. Bhosle
Dean Academics
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Dr. S. B. Lande
Principal
VPKBIET, Baramati

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EL24261: Electrical Engineering and Measurements		
Teaching Scheme: **TH: 02 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:03**	**Examination Scheme:** **Course Activity: 10 Marks** **End-Semester Exam: 60 Marks** **Term-Work: 30 Marks**

Prerequisite Courses:

Basic Electrical Engineering

Course Objectives:

1. To gain a deep understanding of the fundamental concepts of electrical.
2. To develop a comprehensive understanding of the fundamental principles of measurement.
3. Learn to differentiate between work, power, and energy and understand their units and dimensions.
4. To explore different types of energy sources and their applications.
5. To develop practical skills for basic electrical measurements and troubleshooting.
6. To familiarize students with various types of instrumentation technologies used in industry, such as analog and digital sensors, measurement devices, and control instruments.

Course Outcomes

On completion of the course, learner will be able to:

CO-1: Understand various characteristics and classification of measuring instruments.

CO-2: Describe construction, working principle of various types of instruments for measurement of power.

CO-3: Describe construction, working principle of various types of instruments for measurement of energy.

CO-4: Application of CRO for measurement of voltage, current and frequency. Classify transducers, sensors and apply it for measurement of physical parameters in real time.

Course Contents

Unit I: Measuring Instruments (7 Hrs)

Characteristics of measuring instruments: static and dynamic, accuracy, linearity, speed of response, dead zone, repeatability, resolution, span, reproducibility, drifts. Necessity of calibration, standards and their classification, absolute and secondary instruments, types of secondary instruments: indicating, integrating, and recording, analog and digital. Laser distance meter, Laser tachometer, Ammeter, and Voltmeter Theory: Essentials of indicating instruments deflecting, controlling, and damping systems.

Unit II: Measurement of Power **(7 Hrs)**

Construction, working principle, torque equation, errors and their compensation, advantages and disadvantages of dynamometer type wattmeter, low power factor wattmeter, poly-phase wattmeter. Active & reactive power measurement in three phase system for balanced and unbalanced load using three wattmeter method, two wattmeter method & one wattmeter method.

Unit III: Measurement of Energy **(7 Hrs)**

Construction, working principle, torque equation of single phase conventional (induction type) energy meter. Block diagram and operation of single phase and three phase static energy meter. Calibration of static energy meter, TOD meter, Digital energy meter, Bidirectional net meter.

Unit IV: Oscilloscope, Transducers & Sensors **(7 Hrs)**

Introduction, various parts, front panel controls, use of CRO for measurement of voltage, current, period, frequency. Phase angle & frequency by Lissajous pattern. Introduction to DSO. Introduction, classification, types: resistive, inductive, capacitive, basic requirements for transducers. Position sensors, Pressure sensors, Temperature sensors, Force sensors, Vibration sensors, Piezo sensors, Humidity sensors, Fluid property sensors.

Books & Other Resources:

Text Books:

"Electricity and Electronics Fundamentals" by Stan Gibilisco.

Reference Books:

1. "Principles of Electric Circuits" by Thomas L. Floyd.
2. "Electrical Measurements and Measuring Instruments" by Golding & Waddis.

Guidelines for Laboratory - Term work Assessment:

1. The distribution of weightage of term work marks should be informed to students before the start of the semester.
2. Term work assessment should be on a continuous basis. At frequent intervals students are expected to inform about their progress/lagging.

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.
6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment for the TW.
9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

List of Practicals (Any 8 experiments to be performed by students)

1. To study different types of meters used for measurement of electrical quantities.
2. To perform measurement of voltage, current, power of 1-phase load using voltmeter, ammeter, and wattmeter.

3. To perform measurement of line voltage in star connection.
4. To perform measurement of line current in star connection.
5. To perform measurement of phase voltage in star connection.
6. To perform measurement of phase current in star connection.
7. To perform measurement of line voltage in delta connection.
8. To perform measurement of line current in delta connection.
9. To perform measurement of phase voltage in delta connection.
10. To perform measurement of phase current in delta connection.
11. To perform measurement of the displacement by using LVDT and plotting its characteristics.
12. To perform demonstration of power analyser for measurement of various electrical quantities.

Note : The list of experiments is not limited to the above, but a course coordinator may design few new experiments based on recent technologies/trends in the relevant Engineering Domain. However the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Course Activity (Any ONE of the following):

For the assessment of Course Activity, a student must complete at least ONE activity out of the following:

1. Chart preparation
2. Power point presentation

Mr. A. B. Akhade	Mrs. P. N. Jaiswal	Mrs. V. V. Deokate
PAC Member 1	PAC Member 2	PAC Member 3

EL24271: Power generation Technology		
Teaching Scheme: **TH: 02 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:03**	**Examination Scheme:** **Course Activity: 10 Marks** **End-Semester Exam: 60 Marks** **Term Work: 30 Marks**

Prerequisite Courses:

Basic knowledge of physics and mathematics. Familiarity with introductory engineering concepts.

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To introduce students to the fundamental principles of conventional energy sources.
2. To provide an understanding of the technological aspects of the wind energy system.
3. To provide an understanding of the technical qualities of a hydro power plant.
4. To equip students with the knowledge and skills necessary to understand the principles of hydropower generation.
5. To enable students to design and analyze photovoltaic (PV) systems for various applications.
6. To analyse the environmental and socio-economic implications of renewable energy utilization.

Course Outcomes

On completion of the course, learner will be able to:

CO-1: Identify components and elaborate working principles of conventional power plants.

CO-2: Understand the fundamental principles of wind energy and wind turbine engineering.

CO-3: Describe the basic principles of hydropower generation including the conversion of potential energy from water into mechanical and electrical energy.

CO-4: Recognize the importance and opportunities of renewable energies.

Course Contents

Unit I: Thermal Power Plant **(7 Hrs)**

Thermal power plant site selection, Thermal power plant layout, Main parts and its working, Types of boilers (fire tube and water tube), Fuel handling, Ash disposal and collection, Basics of thermodynamic cycle.

Unit II: Wind Energy Systems **(7 Hrs)**

Historical development of wind energy, types of wind turbine, Wind turbine generators, Environmental impacts of wind turbines. Change in wind turbine blades and its effect on generation. Control of wind turbine generator.

Unit III: Hydro Power Plant **(7 Hrs)**

Site selection, Hydrology, storage and pondage, general arrangements and operation of hydro power plant, Hydraulic turbines, turbine size, Pelton wheel turbine, Francis and Kaplan turbines, selection of turbines, Dams, Spillways, gates, intake and outtake works, canals and layout of penstocks, water hammer and surge tank.

Unit IV: Solar Energy **(7 Hrs)**

Photovoltaic effect. Solar thermal energy systems. Solar photovoltaic (PV) systems and PV current equation. Solar cell, solar module and solar array. Effect of series and parallel cells arrangement. Solar radiation and its measurement.

Books & Other Resources:

Text Books:

1. P. K. Nag, "Power Plant Engineering", Tata McGraw Hill Publications.
2. Dr. P. C. Sharma, "Power Plant Engineering", S.K. Kataria Publications.
3. R. K. Rajput, "A text book on Power System Engineering", Laxmi Publications (P) Ltd.
4. Chakrabarti, Soni, Gupta, Bhatnagar, "A text book on Power System Engineering", DhanpatRai publication.

5. Chetan singh solanki "Solar Photovoltaics: Fundamentals, Technology and Application" PHI Publications.

Reference Books:

1. Arora and Domkundwar, "A Course in Power Plant Engineering", Dhanpat Rai Publication.
2. Dr. S. P. Sukhatme, "Solar Energy", Tata McGraw Hill Publication.
3. Mukund Patel, "Wind and Solar Power Plants", CRC Press.
4. G. D. Rai, "Renewable Energy Sources", Khanna Publications.

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7. Graph and Conclusions.
8. There should be continuous assessment for the TW.
9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

List of Practicals (Any 08 to be performed by the student)

1. Study of major parts in thermal power plant.
2. Analysis of wind turbine power output based on wind speed data.
3. Compare the performance of wind turbine blades made from different materials.
4. Investigate the effect of tower height on wind turbine performance.
5. Study of major parts in Hydro power plant.
6. Study of different turbine designs affecting the efficiency of a hydropower plant.
7. Test the power output of a solar panel under different light sources.
8. Plot the V-I Characteristics of the solar cell.
9. Measure the efficiency of a solar panel.
10. Industrial visit to Thermal power plant.
11. Industrial visit to wind turbine.
12. Industrial visit to solar rooftop plant.

Note : The list of experiments is not limited to the above, but a course coordinator may design few new experiments based on recent technologies/trends in the relevant Engineering Domain. However the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Course Activity (Any ONE of the following):

For the assessment of Course Activity, a student must complete at least ONE activity out of the following:

1. Quiz on different power plants.
2. Power point presentation

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PAC Member 1	PAC Member 2	PAC Member 3

VPKBIET BARAMATI * PUNE (MS.) *