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

Faculty of Science and Technology

Board of Studies

Electrical Engineering

Syllabus

Multidisciplinary Minor

(Pattern: 2023)

(w.e.f. AY: 2024-25)

Syllabus: Multidisciplinary Minor courses offered by Electrical Engineering Departement Pattern (2023) w.e.f. AY:2024-2025																
SEMESTER-III, IV, V, VI, VII																
Course Code	NEP Category	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
MDEL23051	MDM	Fundamentals of Solar Technology	2	2	-	20	20	50	20			110	2	1	-	3
MDEL23052	MDM	Industrial Automation	2	2	-	20	20	50	20			110	2	1	-	3

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VPKBIET, Baramati

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VPKBIET BARAMATI
Affiliated to
S. P. P. U : Pune
PUNE (MS.)

MDEL23052: Industrial Automation		
Teaching Scheme:	**Credits:03**	**Examination Scheme:**
TH: 02 Hrs/Week		**Course Activity: 20 Marks**
PR: 02 Hrs/Week		**In-Semester Exam: 20 Marks**
		End-Semester Exam: 50 Marks
		Term Work:20 Marks

Prerequisite Courses:

Logic gates operations, Boolean algebra, Relay logic

Course Objectives:

The course aims:-

- To understand Industrial Automation system concepts.
- the architecture and constituent components of a Programmable Logic Controller.
- To understand various input output device interfacing with PLC
- To understand logic and programming of PLC with various applications.

Course Outcomes

Upon successful completion of this course, the students will be able to:-

1. To understand the concept of automation and its role in industry.
2. Develop and explain the working of PLC with the help of a block diagram.
3. Classify input and output interfacing devices with PLC
4. To apply knowledge gained from programming of PLC systems to real-life industrial applications.

Course Contents

Unit no.1

Introduction to Automation

Role of automation in Industries, Architecture of Industrial Automation system of Industrial Automation system, Industrial bus systems: modbus & profibus, Advantages & disadvantages and present trends in Industrial automation.

Unit no.2

Introduction to PLC

Necessity of PLC, History and evolution of PLC, Definition as per NEEMA (National Electrical Engineering Manufacturers' Association), types – fixed/modular/dedicated, Overall PLC system, PLC Input and output modules (along with interfaces), CPU, programmers and monitors, power supplies, selection criterion, advantages and disadvantages, specifications,

comparison of various PLCs manufactured by Allen Bradley, Siemens, ABB, Mitsubishi, GE, Fanuc and Schneider.

Unit no.3

Interfacing of PLC with I/O devices

Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices Sensors-temperature, pressure, flow, level Actuators-Electrical, pneumatic, hydraulic Encoders, Incremental, Absolute Transducers, Limit switches, proximity sensors Control Elements- Mechanical, Electrical, Fluid valves.

Unit no.4

Programming of PLC and its Applications

Programming languages for PLC, Ladder diagram fundamentals, Rules for proper construction of ladder diagram Timer and counter- types along with timing diagrams, Reset instruction, latch instruction MCR (master control relay) and control zones Developing ladder logic for Sequencing of motors, ON OFF, Tank level control, ON OFF temperature control, elevator, bottle filling plant, car parking, traffic light controller.

PLC Applications in developing systems- Tank level controller using analog signals, temperature controller using RTD, speed control of electric motor

Books & Other Resources:

Text Books:

[T1] John W. Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", PHI Learning, New Delhi, 5th Edition

[T2] John R. Hackworth, Frederick D., Hackworth Jr., "Programmable Logic Controllers Programming Methods and Applications", PHI Publishers

[T3]Sunil S. Rao, "Switchgear and Protections", Khanna Publication

[T4] Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson, 2nd Edition

Reference Books:

[R1]Curtis Johnson, "Process Control Instrumentation Technology", Prentice Hall of India

[R2] Batten G. L., "Programmable Controllers", McGraw Hill Inc., Second Edition

[R3] Krishna Kant, "Computer Based Industrial Control", PHI

[R4] P. K. Srivstava, "Programmable Logic Controllers with Applications", BPB Publications

[R5] Bennett Stuart, "Real Time Computer Control", Prentice Hall, 1988

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. Give the safety instructions to students.
3. Allow 4-5 students per group for performing the experiment.
4. Explain theory related to the experiment to be conducted.

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. Ladder Diagram
5. Students are expected to draw the ladder diagrams on 1mm graph paper.
6. Outputs and Conclusions.
7. There should be continuous assessment for the TW.
8. 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 various industrial sensors & transducers like proximity detector, rotary encoder, touch sensor, accelerometer, RTDs, temperature & humidity sensor
2. Study of various actuators like relay, solenoid valve, process control valve & motors (servo motor or stepper motor) for control application.
3. Interfacing of lamp and button with PLC for ON and OFF operation. Verify all logic gates.
4. Combination of counter and timer for lamp ON/OFF operation.
5. DOL starter and star delta starter operation by using PLC.
6. PLC based thermal ON/OFF control
7. Logic implementation for traffic control application
8. Logic implementation for bottle filling application
9. Experiment to implement PID controller using ladder logic
10. Performance of Pneumatic OR and AND Gate operation
11. Performance of Hydraulic OR and AND Gate operation
12. PLC based speed, position, flow, level, pressure measurement system.

Course Activities (Any ONE of the following):

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

1. Powerpoint presentation on Industrial Applications
2. Case study

MDEL23051 : Fundamentals of Solar Technology		
Teaching Scheme:	**Credits:03**	**Examination Scheme:**
TH: 02 Hrs/Week		**Course Activity: 20 Marks**
PR: 02 Hrs/Week		**In-Semester Exam: 20 Marks**
		End-Semester Exam: 50 Marks
		Term Work: 20 Marks

Prerequisite Courses:

Knowledge of fundamentals of Engineering Physics, basics of Electrical Engineering and Engineering Chemistry.

Course Objectives:

1. To summarize concept of solar cell, its connections and solar PV Technology
2. To understand the concepts related to solar thermal energy and its applications.
3. To study different power converters, charge controller, MPPT and inverter required in solar technology
4. To study designing of PV system

Course Outcomes

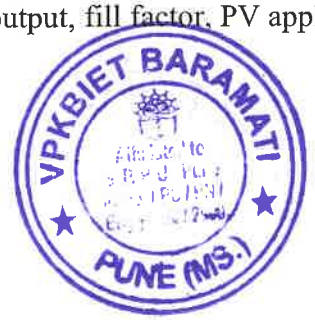
On completion of the course, learner will be able to:

CO-1:	Explain the concept of solar cell structure, solar electric power generation and PV technologies
CO-2:	Understand the solar thermal energy conversion and associated applications
CO-3:	Explain the working principle of maximum power tracking and power electronics interface.
CO-4:	Understand the designing of stand alone and grid connected PV system

Course Contents

Unit I: SOLAR PHOTOVOLTAIC ENERGY **(8 Hrs)**

Overview of global and Indian energy scenario, need of solar energy, basics of p-n junction, p-n junction exposure to light, photovoltaic cell/module/array characteristics, effects of light intensity and temperature variations, solar cell connecting arrangements, solar electric power generation, conversion efficiency and power output, fill factor, PV applications (domestic loads, battery storage and irrigation)



Unit II: SOLAR THERMAL ENERGY **(7 IIrs)**

Introduction, solar thermal energy storage systems, fundamentals of thermal collectors, flat plate collectors, analysis of liquid flat plate solar collectors (LFPC), concentrating collectors (parabolic and paraboloid), solar air heaters, solar pond, solar cooker, solar thermal application in power production (stand alone and grid), advances in solar thermal collectors

Unit III: POWER ELECTRONICS INTERFACE FOR SOLAR PV **(6 Hrs)**

Power MOSFET and IGBT, buck Converter, boost converter, fly back Converter, inverters, DC to DC converter, AC to DC Converter, battery charge controller, maximum power point tracking algorithms

Unit IV: PV SYSTEM DESIGN **(7 Hrs)**

Different thin film PV technologies, solar energy measuring instruments, Standalone PV system: Components and design of standalone system, fundamentals of battery system, Grid connected PV system: components and design of grid connected PV systems

Books & Other Resources:

Text Books:

1. Non-conventional Sources of Energy , G.D Rai, Khanna Publishers, Delhi -2008
2. Solar Power Hand Book, Dr. H. Naganagouda (2014)
3. Chetan Singh Solanki, "Solar Photovoltaics: Fundamental, Technologies and applications", 2nd Edition, PHI Learning Pvt. Limited, New Delhi, 2011.
4. Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Signal K.C New Arrivals –PHI; 2 Edition (2011)
5. A Text book of Power System Engineering, A Chakrabarti, M. L Soni, P. V. Gupta, U. S. Bhatnagar, Dhanpat Rai Publication

Reference Books:

1. Renewable Energy Technologies; A Practical Guide for Beginners
2. S. P. Sukhatme, "Solar Energy - Principles of thermal collection and storage", TMH, 2008
3. NPTEL Solar Photovoltaics :Fundamental Technology and Applications by Prof. Soumitra Satapathi Department of Physics Indian Institute of Technology-Roorkee.
   NPTEL :: Physics - NOC:Solar Photovoltaics Fundamentals, Technology And Applications

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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:

1. The Student's Lab Journal should contain following related to every experiment –
2. Theory related to the experiment.
3. Apparatus with their detailed specifications.
4. Connection diagram /circuit diagram.
5. Observation table/ simulation waveforms.
6. Sample calculations for one/two readings.
7. Result table.
8. Graph and Conclusions.
9. There should be continuous assessment for the TW.
10. 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. Static VI characteristic of SCR / GTO
2. Static VI characteristic of TRIAC
3. Study and measurement of Voc and Isc of a Solar PV Panel
4. Obtain I-V and P-V characteristics of PV modules: for single PV module
5. Obtain I-V and P-V characteristics of PV modules: for series connection of PV modules
6. Obtain I-V and P-V characteristics of PV modules: for parallel connection of PV modules.
7. Observe the I-V and P-V curve of a solar cell/module with different light intensities
8. Observe the I-V and P-V curve of a solar cell/module with different operating temperatures
9. Design of PV system for residential and commercial applications
10. Develop MATLAB simulation model of Perturb & Observe MPPT algorithm for a PV panel connected with DC-DC Boost converter through a resistive load.
11. Develop MATLAB simulation model of Incremental conductance MPPT algorithm for a PV panel connected with DC-DC Boost converter through a resistive load.

Course Activity (Any one of the following)

For the assessment of course activity students must complete at least ONE activity out of the following:

1. Unit Wise Quiz
2. PowerPoint Presentation on recent trends in solar technology