Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 3**
Type of Course	-	
Prerequisite		
Rationale	In the field of Solar & Renewable Energy, Industrial Safety is the major portion. Because there are many components in the Solar Application and Renewable energy sources which requires higher safety standards and the components should be environment friendly. That they will provide the required output with no hazard.	
Effective From A.Y.	2025-26	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE T**	**IAT**	**SEE P**	**CCE**	**Total Marks**
3	1	-	4	50	-	-	20	70

***SEE** - Semester End Examination, **IAT** - Internal Assessment Test, **CCE** - Continues & Comprehensive Evaluation*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Industrial Safety** Objectives, Definition of safety, Types of safety, Definition of industrial safety, Importance of industrial safety, Overview of industrial accidents and safety regulations, Emergency Symbols.	6	15
2	**Electrical Safety Management** Safety Management during Operation and Maintenance, Clearance and Creepages, Electric Shock, need of Earthing, different methods of Earthing, factors affecting the Earth Resistance, methods of measuring the Earth Resistance, Equipment Earthing and System Grounding, Earthing Procedure - Building installation, Domestic appliances, Industrial premises, Earthing of substation, generating station and overhead line.	13	30
3	**Hazard Identification and Risk Assessment** Methods for identifying workplace hazards, Risk assessment techniques e.g., Hazard and Operability Studies (HAZOP),Hazard Identification Study (HAZID), Prioritizing and mitigating risks, Work place Management	10	20
4	**Personal Protective Equipment (PPE)** Types of PPE and their applications, Selection, proper use, and maintenance of PPE, PPE regulations and standards, First Aid, CPR	9	20
5	**Emergency Preparedness and Response** Developing emergency response plans, Evacuation procedures and drills, Handling emergencies such as fires, Emergency rescue teams and medical emergencies	7	15
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application
Weightage	40	40	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Various types of industrial safety practices and their significance in different industrial environments.
CO2	Define electrical safety and apply effective electrical safety management techniques in industrial settings.
CO3	Classify and analyze hazards using standard Hazard Identification and Risk Assessment methods.
CO4	Demonstrate the ability to develop and implement emergency preparedness plans and response strategies in industrial contexts.
CO5	Evaluate workplace safety systems and recommend improvements based on risk assessments and safety audit findings.

Reference Books

1.	**Industrial Safety and Maintenance management** By M.P.Poonia, S.C.Sharma | Khanna Publication
2.	**Testing, Commissioning, Operation and Maintenance of Electrical Equipment** By S. Rao | Khanna Publications

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 3**
Type of Course	-	
Prerequisite		
Rationale	-	
Effective From A.Y.	2025-26	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
Lecture	Tutorial	Lab	Credit	SEE T	IAT	SEE P	CCE	
3	1	-	4	50	-	-	20	70

***SEE** - Semester End Examination, **IAT** - Internal Assessment Test, **CCE** - Continues & Comprehensive Evaluation*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Solar PV system** Block diagram to Solar PV system, PV module & array, Types of solar PV system, Solar Plant Components. Design Methodology of PV system. Grid-Connected System and Standalone system.	8	20
2	**Component Selection and Protection Devices** Basics of system components, Charge controller, Battery types, MCB, MCCB, Fuse, Wire sizing, Power electronic converters (DC-DC, DC-AC), MPPT	8	20
3	**System Design & Layout** Detailed PV system design, Panel angle, Series-parallel configuration, String design, ACDB & DCDB, Component rating, Single-line diagram.	9	15
4	**Performance analysis Solar PV System** Power output of solar PV system. Monitoring of operating data and presentation, Power control and management systems for grid Synchronizing, Issues in integration of Synchronizing, Bidirectional metering concept. Unit cost of generated electricity. Simple Payback Period.	12	30
5	**Solar PV Application** Solar Water Pumps, Solar street lights, Solar kit design for remote location, (Battery sizing & Design) Solar thermal power generation.	8	15
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application
Weightage	40	40	20

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Describe the structure, components, and types of Solar PV systems including grid-connected and standalone systems.
CO2	Explain and select appropriate system components like batteries, MPPTs, MCBs, and converters for a reliable PV system.
CO3	Design an efficient solar PV layout using appropriate tilt angles, panel configurations, and single-line diagrams.
CO4	Analyze the performance of a solar PV system using output data, control systems, and cost calculations.
CO5	Identify and describe various applications of Solar PV systems such as pumps, lighting, and thermal systems in different environments.

Reference Books

1.	**Solar Photovoltaic: Fundamentals, Technologies and Application** By Chetan Singh Solanki | PHI Learning Pvt., Ltd., 2009
2.	**Renewable Energy Source & Emerging Technologies** By D P Kothari, K C Singal | PHI Learning Pvt. Ltd.
3.	**3. Renewable Energy Technologies; A Practical Guide for Beginners** By Chetan Singh Solanki | PHI School Books, Pub. Year 2008

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 3**
Type of Course	-	
Prerequisite		
Rationale	-	
Effective From A.Y.	2025-26	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE T**	**IAT**	**SEE P**	**CCE**	**Total Marks**
3	-	-	3	50	-	-	-	50

***SEE** - Semester End Examination, **IAT** - Internal Assessment Test, **CCE** - Continues & Comprehensive Evaluation*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Concepts of Measurement** Measurement System, Classification of instrument system, Methods of Measurement, Static Characteristics like accuracy, precision, sensitivity, linearity, range, drift, threshold, dead zone etc. Errors in measurement.	7	15
2	**Transducers and Sensors** Definition, different types of transducers, criteria for selection, general characteristics and dynamic characteristics, transducers for measurement of temperature (Thermocouple and RTD), pressure, strain, displacement, speed, Distance.(Sensors – basic concept – Speed and position sensors)	11	20
3	**Measurement of Parameters** PMMC & Moving Iron instrument. Electrodynamometer Instrument. Extending the range of meters - Shunts, Instrument Transformer and their applications. Measurement of voltage, current, power, energy, power factor. (constructions and operating principles of corresponding instruments)	11	30
4	**Measurement of R, L and C** Different methods of measuring resistances using Wheatstone Bridge, Measurement of inductance & capacitance with the help of AC Bridges (Maxwell bridge, Schering Bridge), Measurement of Frequency using Wien Bridge. Measurement of Insulation resistance using Megger.	9	20
5	**Digital Instrument for Measurement** Different types of digital measuring instrument like DVM and Digital multi meter, Clamp on meter, LCR meter. Digital Storage Oscilloscope. Digital Energy Meter. (Block Diagram, theory and applications)	7	15
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application
Weightage	20	40	40

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Describe the basic concepts and characteristics of measurement systems including accuracy, precision, sensitivity, and types of errors.
CO2	Explain the types, characteristics, and applications of transducers and sensors used for measuring various physical quantities like temperature, pressure, and speed.
CO3	Analyze the construction, working, and application of analog measuring instruments such as PMMC, moving iron, and electrodynamometer instruments.
CO4	Apply AC and DC bridge methods for accurate measurement of resistance, inductance, capacitance, frequency, and insulation resistance.
CO5	Interpret the functionality and applications of various digital measuring instruments such as DVM, DMM, LCR meter, and digital storage oscilloscopes.

Reference Books

1.	**A Course in Electronics and Electrical Measurements and Instrumentation** By Gupta J. B | S. K. Kataria & Sons.
2.	**Electrical and Electronic Measurements and Instrumentation** By A. K. Sawhney | DHANPAT RAI & CO.
3.	**Electronic Measurements & Instrumentation** By R. K. Rajput | S. CHAND & COMPANY LTD

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 3**
Type of Course	-	
Prerequisite		
Rationale	-	
Effective From A.Y.	2025-26	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE T**	**IAT**	**SEE P**	**CCE**	
3	-	-	3	50	-	-	-	50

***SEE** - Semester End Examination, **IAT** - Internal Assessment Test, **CCE** - Continues & Comprehensive Evaluation*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Power Semiconductor Devices** Diode, Thyristor, MOSFET, IGBT; Static characteristics of these devices; Operation of power devices as switches.	8	15
2	**AC-DC converter** Single phase half-wave and full-wave diode rectifiers, Three phase diode rectifier, Single phase half wave and full wave controlled rectifiers, Three phase half wave, full wave or bridge rectifier.	10	25
3	**DC-DC Converters for Solar PV Systems** Linear voltage regulator, Introduction of switch mode power supply, Principle of Basic DC-DC converter topologies: Buck, Boost and Buck Boost converter.	9	20
4	**Inverters for Solar PV Systems** Working principle of inverter, single phase and 3 phase inverters, PWM methods and PWM inverter, Operation of grid-tied and off grid inverter.	8	20
5	**Solar Photovoltaic Systems** Overview of solar energy and PV technology, Components of a solar PV system, MPPT techniques and algorithms, Energy Storage Systems in Solar PV Applications, Efficiency optimization and design considerations.	10	20
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze
Weightage	20	20	30	30

NOTE : This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand various power semiconductor devices (Diode, Thyristor, MOSFET, IGBT) and their switching behaviour.
CO2	Construct and understand different AC-DC converters including single-phase and three-phase rectifiers.
CO3	Analyze DC-DC converter topologies like Buck, Boost, and Buck-Boost in Solar PV applications.
CO4	Demonstrate the working of single-phase and three-phase inverters including PWM, grid-tied, and off-grid systems.
CO5	Appreciate PV system components, MPPT techniques, storage options, and efficiency optimization strategies.

Reference Books

1.	**Power electronics** By Bimbhra, P. S. | Khanna Publishers
2.	**Power Electronics Converters, Applications, and Design** By Tore M. Undeland and William P. Robbins | Ned Mohan
3.	**Power Electronics Circuits, Devices, and Applications** By Rasid, M. H. | Prentice-Hall of India

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 3**
Type of Course	-	
Prerequisite		
Rationale	-	
Effective From A.Y.	2025-26	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	SEE T	IAT	SEE P	CCE	Total Marks
-	-	2	1	-	-	30	20	50

***SEE** - Semester End Examination, **IAT** - Internal Assessment Test, **CCE** - Continues & Comprehensive Evaluation*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	To demonstrate usage of Digital multi meter to measured different Parameter.	2	
2	Measurement of unknown resistance, inductance & capacitance by LCR meter.	2	
3	To study & perform characteristics and use of LVDT.	2	
4	To study measurement of temperature using RTD.	2	
5	To study measurement of weight using strain gauge.	2	
6	Measurement of unknown capacitance by Schering bridge.	2	
7	Measurement of unknown inductance by Maxwell's bridge.	2	
8	To measure insulation resistance using Megger.	2	
9	To measure the power by using wattmeter.	2	
10	To demonstrate usage of DSO for steady state periodic waveforms produced by a function generator.	2	
	Total	20	

Course Outcomes

At the end of this course, students will be able to:	
CO1	Basics concept of different sensors.
CO2	Comprehend practical us of digital instrument.
CO3	Basic learning to measure different parameter.
CO4	Apply AC and DC bridges for measurement of electrical parameters.
CO5	Analyze sensor outputs using digital tools and electrical bridges.

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 3**
Type of Course	-	
Prerequisite		
Rationale	-	
Effective From A.Y.	2025-26	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	SEE T	IAT	SEE P	CCE	Total Marks
-	-	2	1	-	-	30	20	50

***SEE** - Semester End Examination, **IAT** - Internal Assessment Test, **CCE** - Continues & Comprehensive Evaluation*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	To Perform And Plot The V-I Characteristics Of The SCR.	2	
2	To Perform And Plot The V-I Characteristics Of The MOSFET.	2	
3	To Perform And Plot The V-I Characteristics Of The IGBT.	2	
4	To Perform Various Firing Circuits Of SCR.	2	
5	To Perform Gate Based Driver Circuit Of The MOSFET.	2	
6	To Perform Single Phase Half Wave Controlled Rectifier With R And RL Load.	2	
7	To Perform Single Phase Full Wave Controlled Rectifier With R And RL Load.	2	
8	To Perform Step Down Chopper Using MOSFET.	2	
9	To Perform The Working Of Single Phase VSI Inverter.	2	
10	To Perform The Working Of Three-Phase VSI Inverter In 120o, 180o And SPWM Mode.	2	
	Total	**20**	

Course Outcomes

At the end of this course, students will be able to:	
CO1	Proficiency in Device Characteristics.
CO2	Competence in Firing Circuit Design
CO3	Practical Expertise in Rectification Techniques
CO4	Mastery of Power Conversion and Inverter Operation.
CO5	Analyze and interpret power electronic waveforms using digital tools effectively.

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 3**
Type of Course	-	
Prerequisite		
Rationale	-	
Effective From A.Y.	2025-26	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	Tutorial	Lab	Credit	SEE T	IAT	SEE P	CCE	Total Marks
-	-	16	6	-	-	100	100	200

***SEE** - Semester End Examination, **IAT** - Internal Assessment Test, **CCE** - Continues & Comprehensive Evaluation*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction to Solar PV Installer Course.**	10	5
	Explain the role of Solar PV Installer and emerging jobs & entrepreneurial opportunities. Illustrate the advantages of doing this course. Explain the importance of basic skills for communication; along with how to work effectively with others while respecting gender and disability concerns. Explain the importance of reading and interpreting signs, notices and/or cautions at project site.		
2	**Basics of Solar Energy and Electrical Concepts**	10	5
	Explain Ohm's Law. Explain the basics of solar energy/ electricity and electrical concepts. Explain the relevance of Diffused Normal Irradiance (DNI) and Global Horizontal Irradiance (GHI) along with differences in Irradiance & Irradiation. Illustrate the movement of the sun and assess its effect on the performance of the solar power plant.		
3	**Basics of Solar Photovoltaic system and its Components**	40	20
	Explain various terminologies used in the solar industry. Identify the different components of a Solar PV system and explain its basic operation. Explain the working of different types of Solar PV systems. Discuss the latest and innovative technologies used in system configurations like "Plug & Play" energy systems. Describe the different types, sizes and specifications of modules, inverters, charge controllers, cables, conduits, junction boxes, solar batteries, and allied accessories. Explain about the manufacturing data specification sheets of different types of solar PV components.		
4	**Identification and Use of different tools used for installation of solar PV system**	40	20
	Explain about the different tools & tackles used for specific purpose in an installation of Solar PV system. Explain the process of installing the mounting structure along with structural supports and accessories for safe & weatherproof installation as per site conditions. Identify and describe various tools & tackles used for civil/mechanical installation. Identify opportunities for material and energy conservation, along with use of environmentally friendly materials in civil/mechanical installation. Explain and show how to follow waste management practices.		
5	**Site Survey for Installation of Solar PV System and asses the customer's Solar PV Requirement**	30	15
	Describe how to observe Sun path diagram and explain the importance of shading analysis. Explain the importance of assessing various site conditions for safe installation of solar PV system. Assess the location, any site level prerequisites and optimise the route plan Identify and list the load to be connected to the Solar PV system.		
6	**Installation of Electrical components of a Solar PV System**	30	15
	Discuss how to implement site safety plan and inspect & utilize electrical installation toolkit. Identify tools and tackles for electrical component installation for Solar PV Power plant. Describe the process of installing the electrical components including inverter, batteries, junction boxes, energy meters, cables, and conduits other electrical components. Explain the Do's and Don'ts of DC wiring.		
7	**Test and Commission Solar PV system**	20	10

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
	Describe the importance of conducting testing of all solar PV components and performing fault finding and analysis, continuity checks, polarity check and other commissioning activities. Explain how to prepare testing and inspection report Explain the concerned regulations & standards for grid interconnection. Describe the commissioning process for the solar PV system.		
8	**Maintain Personal Health & Safety at project site** Explain the requirements for safe work area. Explain the importance of administering first aid. Identify the personal protective equipment used for the specific purpose. Identify the hazards associated with photovoltaic installations; Identify and report any hazards, risks, or breaches in site safety to the appropriate authority Identify work safety procedures and instructions for working at height. Explain how to use safety signs, labels, charts, and notices at workplace Explain the importance of Occupational health & Safety standards and regulations for installation of Solar PV system. Incorporate good housekeeping practices and infection control guidelines.	20	10
	Total	**200**	**100**

Course Outcomes

At the end of this course, students will be able to:	
CO1	Functioning of major equipment's of Solar PV Modules.
CO2	Installation of Solar PV Modules, Its Service and Maintenance.
CO3	Identification and rectification of problem/ causes of minor/ major problems.
CO4	Use of PPE, basic health and safety practices at the workplace and identify risks and hazards at workplace.
CO5	Analyze performance issues in solar systems and apply corrective measures.

Reference Books

1.	**Electrical Wiring Residential** By Ray C. Mullin and Phil Simmons | Cengage Learning
2.	**Electricity for the Trades** By Frank Petruzella | McGraw-Hill Education
3.	**Principles of Power System** By V. K. Mehta, Rohit Mehta | S. Chand Publications
4.	**Elements of Electrical Design** By J. G. Jamnani | Mahajan Publication
5.	**Practical Electrical Wiring: Residential, Farm, Commercial, and Industrial** By Frederic P.Hartwell | McGraw-Hill Education

1SRE308 - ON-THE-JOB TRAINING (OJT): LINEMAN- POWER DISTRIBUTION

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 3**
Type of Course	-	
Prerequisite		
Rationale	-	
Effective From A.Y.	2025-26	

Teaching Scheme (Contact Hours)				Examination Scheme				
				Theory Marks		Practical Marks		
Lecture	**Tutorial**	**Lab**	**Credit**	**SEE T**	**IAT**	**SEE P**	**CCE**	**Total Marks**
-	-	16	6	-	-	100	100	200

***SEE** - Semester End Examination, **IAT** - Internal Assessment Test, **CCE** - Continues & Comprehensive Evaluation*

Course Content

T - Teaching Hours | **W** - Weightage

Sr.	Topics	T	W
1	**Introduction** Functions of Power Distribution Companies, Relevant Legislation, Electricity act 2003, Job role and responsibilities. Distribution system diagram.	5	5
2	**Basic of Electricity** Explain the basic key concepts of Voltage, Current, Capacitance,Resistance, KVA, KWh. Elements of power systems, transmission, distribution and generations.	30	12
3	**Distribution Line Works(Materials and Accessories)** To be able to identify material and accessories for the distribution lines. Screw driver, combination plier, measuring tape, roller stool chain pulley, come along clamp and other accessories.	40	20
4	**11kV Distribution Transformer Substation (Materials & Accessories)** To understand the functioning of 11Kv distribution transformer and various accessories including AB switches, Lightning Arrestors, Drop Out fuse, Pole Structure etc.	40	20
5	**11kV Distribution line maintenance** To identify and adopt correct maintenance procedure for 11Kv distribution lines, understand pole mounted substation and different equipment's used.	35	16
6	**11kV Distribution Transformer Maintenance** To identify and adopt correct maintenance procedure for distribution transformer. To identify different types of faults and testing kit like Oil testing kits, Tripod, Chain pulley, Megger.	30	15
7	**Basic Health & Safety practices for power related work** To understand basic health and safety practices, how to issue of work permit. Usage of PPE Firefighting, First-Aid, Helmet, Gloves, Discharge rod, Safety rope, rubber mat, fire extinguisher, ladder, Neon tester etc.	15	7
8	**Soft Skills** To work effectively in a team. Effective communication, good interpersonal relation, discipline behaviour, developing a positive attitude and building self-confidence.	5	5
	Total	200	100

Course Outcomes

At the end of this course, students will be able to:	
CO1	Gain knowledge about distribution system and network.
CO2	Functioning of major equipment's use in distribution line maintenance.
CO3	Perform the testing and maintenance work in distribution line.
CO4	Use of PPE, basic health and safety practices at the workplace and identify risks and hazards at workplace.
CO5	Analyze faults in distribution systems and suggest appropriate corrective actions.

Reference Books

1.	**Electrical Power system** By V.K. Mehta | S. Chand & Co., New Delhi | 2011
2.	**A Course in Power Systems** By J.B. Gupta | S.K. Kataria & Sons
3.	**Electrical Power Systems** By Uppal S.L. , S. Rao | Khanna Publications
4.	**Electrical Power systems** By C. L .Wadhwa | New Age International Publishers