Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 4**
Type of Course	-	
Prerequisite	Wind Energy System Design	
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	0	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 Wind Energy** Definition and significance of wind energy, Historical development of wind energy, Global trends and future prospects, Wind energy potential assessment methodologies, Socio-economic benefits and challenges of wind energy deployment	5	10
2	**Wind Resource Assessment** Basics of wind resource assessment, Instruments and methods for measuring wind speed and direction (anemometers, wind vanes, LiDAR), Data collection for Wind installation.	5	15
3	**Wind Turbine Technology** Types of wind turbines (horizontal-axis: fixed and variable speed, vertical-axis: Savonius, Darrieus), Aerodynamics of wind turbine blades, Mechanical components (yaw system, pitch system, gearbox, brake system)	10	20
4	**Wind Energy Conversion Systems** Power output equation for wind power generation, Power extraction from wind: Betz limit and power coefficient, Control strategies for maximizing power output (pitch control, yaw control, and stall control). Electrical generator types: synchronous, asynchronous, direct drive. Wind turbine load characteristics.	13	30
5	**Wind Farm Design and Layout** Wind farm siting considerations (wind resource assessment, environmental impact assessment), Layout optimization techniques (grid integration, wake effect mitigation), Micro-siting and optimization. Economic analysis and financing models for wind farm projects	12	25
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	30	40	20	5	5	0

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	Explain wind energy fundamentals, historical development, global trends, and socio economic impacts.
CO2	Perform wind resource assessment using measurement instruments, data collection, and analysis techniques.
CO3	Demonstrate competence for different wind turbine types
CO4	Demonstrate competence for wind energy conversion system.
CO5	Apply wind energy concepts in design and operation of Wind Farm

Reference Books

1.	**Renewable Energy Source & Emerging Technologies** By D P Kothari, K C Singal | PHI Learning Pvt. Ltd.

Useful Links

1. www.nptel.ac.in

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 4**
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	-	0	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	**DC Machines:** DC Generator: Basic construction and operating principles. Induced EMF equation, field excitation types (separately excited, shunt, series), and voltage build-up in a shunt generator, test on D.C generator. Application DC Motor: Basic construction and operating principles. Back EMF and torque equations, field excitation types, Losses and Efficiency, test on D.C-motor. Application.	12	27
2	**Transformer:** Review of single phase transformer, working principal, Construction, ,E.M.F. equation, Types of Transformers(1Φ & 3Φ), Losses, efficiency, conditions for maximum efficiency, voltage regulation using Direct load test, O.C. and S.C. Test, Polarity test,. Parallel operation of transformers and Load sharing under different operating conditions. Auto transformer.	8	18
3	**Induction Machine and Synchronous Machine** Induction Machine: Working principal of induction motor, construction and its types squirrel cage and slip ring induction motor, Induction generator operation. Synchronous Machine: Working principal of synchronous machine, construction and its type's synchronous generator and synchronous motor, Emf generation & Parallel Operation generator Starting methods of synchronous motor, Hunting of synchronous machines and its prevention.	10	22
4	**Electrical System Components** LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Protection components-Fuse, MCB, MCCB, ELCB, Symbols for wiring components, Single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.	7	15
5	**Wind & Solar Electrical Systems:** HT connection, Pole mounted substation, Transformer selection, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Active power, Reactive power, Power factor correction – kVAR calculations.	8	18
	Total	**45**	**100**

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	40	40	20	0	0	0

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	Explain DC machines' construction, principles, EMF equations, characteristics, control, test and applications.
CO2	Describe the fundamental principles of single-phase transformer, including Construction, working, testing methods, Evaluate the performance parameters and parallel operation.
CO3	Comprehend the construction, working principle, Testing, Evaluate the Performance Parameters and operational feasibility of Induction machine and synchronous machine.
CO4	Explain LT wiring components, cable selection, protection devices, SLDs, control devices, and essential electrical safety practices.
CO5	Explain wind and solar electrical systems including HT connection, substations, transformer selection, and power factor correction.

Reference Books

1.	**Theory and Performance of Electrical Machines** By J B Gupta | Katson Publication
2.	**Electrical Technology Vol. II** By B. L. Theraja | S Chand and Co., New Delhi
3.	**Renewable and Efficient Electric Power Systems** By G. M. Masters | John Wiley and Sons

Useful Links

1. www.nptel.ac.in

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 4**
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	-	0	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	**Supply Systems:** Electric Supply System, Typical A.C. Power Supply Scheme, Comparison of D.C. and A.C. Transmission, Comparison of overhead and underground power system, A.C. Transmission Advantages of High Transmission Voltage, Various Systems of Power Transmission Comparison of Conductor Material in Overhead System, Elements of a Transmission line.	12	25
2	**Transmission Line Components and Analysis:** Main Components of Overhead Lines, Conductor Materials, Line Supports, Insulators, Types of Insulators, Skin effect, proximity effect and Ferranti effect. Corona effect, Advantages and Disadvantages of Corona.	12	25
3	**Distribution Systems:** Distribution System, Requirements of a Distribution System, Classification of Distribution Systems, A.C. Distribution, D.C. Distribution, Connection Schemes of Distribution System, Design Considerations in Distribution System.	8	20
4	**Sub-Stations:** Sub-Station, Classification of Sub-Stations, Comparison between Outdoor and Indoor Sub-Stations, Transformer Sub-Stations, Pole Mounted Sub-Station, Symbols for Equipment in Sub-Stations, Equipment in a Transformer Sub-Station, Key Diagram of 66/11 KV Sub-Station, Key Diagram of 11kV/400 V Sub Station.	8	20
5	**Underground Cables and Earthing:** Underground Cables, Classification of Cables, Construction of Cables, Insulating Materials for Cables, Earthing and its classification.	5	10
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	30	30	20	10	10	0

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 Supply Systems.
CO2	Explain mechanical design of transmission line
CO3	Compare DC and AC distribution
CO4	Acquire knowledge about substation equipment's & layout.
CO5	Understand types of cable and its construction and methods of earthing.

Reference Books

1.	**Principles of Power System** By V. K. Mehta, Rohit Mehta | S. Chand Publications
2.	**Wind Power Technology** By Earnest Joshua | PHI Learning
3.	**Solar Energy: Principles of Thermal Collection and Storage** By S. P. Sukhatme and J. K. Nayak | Tata McGraw Hill
4.	**Power System Analysis** By Hadi Saadat | McGraw Hill
5.	**Electrical Power systems** By C. L .Wadhwa | New Age International Publishers
6.	**Electrical Power Systems** By Dr. S. L. Uppal, Prof. S. Rao | Khanna Publications

Useful Links

1. www.nptel.ac.in

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 4**
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	0	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 Energy Policy:** Green energy policy initiatives for large-scale de-carbonization in India, Mapping India's energy policy towards net zero emissions, Draft Electricity Rules to push green energy use in industries, Types of tariffs.	6	10
2	**Solar Energy policy :** Basic concepts of solar power generation (ON Grid/OFF Grid), Unit generation and billing calculations. Net metering policy for domestic and industrial consumers. Solar roof top installation policy and subsidy declare by the government. Solar Mega park installation policy. Agricultural policy for installation of solar power plant.	12	25
3	**Wind Energy policy :** Energy Laws, Power bidding process for wind energy, tariff policy in wind energy. System parameters and testing procedure for grid connectivity of wind farm.Power pricing and purchasing agreement Tariff policy framework.	12	25
4	**Solar &Wind Hybrid policy :** Solar & Wind hybrid system. System parameter for grid with hybrid operation. Government policy framework for operation of hybrid plant.	7	20
5	**Carbon neutral and sustainability :** Roll of solar and wind energy policy in sustainability of environment. Carbon neutral concept for green energy. Carbon neutral policy framework. Advantages of carbon neutral and sustainability.	8	20
	Total	45	100

Suggested Distribution Of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyze	Evaluate	Create
Weightage	40	40	20	0	0	0

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	Explain India's green energy policies, tariffs, and pathways toward net-zero emissions.
CO2	Analyze solar energy policies including net metering, rooftop subsidies, and billing calculations.
CO3	Interpret wind energy laws, bidding processes, tariff frameworks, and power purchase agreements.
CO4	Evaluate solar–wind hybrid policies, grid integration parameters, and hybrid system operation frameworks.
CO5	Assess carbon neutrality concepts and the role of renewable energy policies in environmental sustainability.

Reference Books

1.	**Renewable Energy: Policies, Project Management and Economics: Wind and Solar Power (India) (Springer Tracts in Electrical and Electronics Engineering)**
2.	**Wind Energy Policy: International Frameworks and Comparative Analysis** By David A. T. P. Murphy

Useful Links

1. https://guj-epd.gujarat.gov.in/Home/GujaratREPolicy
2. https://guj-epd.gujarat.gov.in/Home/gujaratsolarpowerpolicy
3. https://guj-epd.gujarat.gov.in/Home/gujaratwindpowerpolicy
4. https://guj-epd.gujarat.gov.in/Home/gujaratwindsolarhybridpowerpolicy

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 4**
Type of Course	-	
Prerequisite		
Rationale	This course provides foundational knowledge of DC Machine, Transformers, Induction and synchronous machine, essential components in electrical power systems and industrial applications. It equips students with analytical and practical skills for evaluating machine performance, efficiency, and motion control methods. By integrating theoretical concepts with hands-on analysis, the course prepares students for real-world challenges in power engineering and motion industry In view of this, it is important for the electrical engineers to understand the components of residential, commercial and industrial electrical systems. This subject deals with the introduction to components of industrial electrical systems.	
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 study the dc machine, ac machine and mcc (motor control center) overview and ratings.**	2	
2	**To study construction and working of dc machine.**	2	
3	**To study construction and working of transformer.**	2	
4	**To study construction and working of induction motor.**	2	
5	**To perform OC & SC test on Transformer.**	2	
6	**To carry out direct load test on a single phase transformer and determine its efficiency.**	2	
7	**To perform self-excited condition of dc compound generator.**	2	
8	**To perform direct load test on alternator and find out voltage regulation.**	2	
9	**Study and identify LT wiring components, protection devices (Fuse, MCB, MCCB, ELCB), and prepare the Single Line Diagram (SLD) for a small building.**	2	
10	**Prepare Single Line Diagram (SLD) of Wind Farm.**	2	

Course Content

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

Sr.	Topics	T	W
	Total	**20**	

Miscellaneous

Major Equipment:
1. Various Trainer kit.
2. Measuring instruments: Voltmeter, Ammeter, and Multi-meter.
3. Clam on meter.
4. Digital Storage Oscilloscopes.
5. DC-Generator.
6. DC-Motor.
7. Transformer.
8. Induction motor.
9. Synchronous Motor.
10. Resistive Load Bank

Useful Links

1. www.vlab.co.in
2. www.nptel.ac.in

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 4**
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	
0	0	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 STUDY ABOUT SINGLE LINE DIAGRAM OF ELECTRICAL SUPPLY SYSTEM.	2	
2	DEMONSTRATION OF DIFFERENT TYPES OF INSULATORS AND TOWERS USE IN TRANSMISSION AND DISTRUBUTION.	2	
3	DEMONSTRATION OF CONSTRUCTION OF CABLE.	2	
4	PREPARE A REPORT AFTER STUDYING DISTRIBUTION SYSTEM OF A RESIDENTIAL COLONY.	2	
5	PREPARE A REPORT ON SUBSTATION WITH ITS LAYOUT AFTER VISITING A NEARBY SUBSTATION.	2	
6	TO STUDY & PERFORM EARTHING SYSTEM.	2	
7	TESTING OF INSULATION RESISTANCE OF CABLE.	2	
8	TO UNDERSTAND CORONA FORMATION USING HORNGAP APPRATUS.	2	
9	DETERMINATION OF BREAKDOWN VOLTAGE FOR DIFFERENT TYPES OF INSULATING MATERIALS.	2	
10	DEMONSTRATION OF HOW TO USE SAFETY EQUIPMENT.	2	
	Total	**20**	

Course Outcomes

At the end of this course, students will be able to:	
CO1	Understand Supply Systems.
CO2	Explain mechanical design of transmission line
CO3	Compare DC and AC distribution.
CO4	Acquire knowledge about substation equipment's & layout
CO5	Understand types of cable and its construction and methods of earthing

Miscellaneous

Major Equipment:

1. Various Trainer kit.
2. Measuring instruments: Voltmeter, Ammeter, Multi-meter, Techo-meter, VFD-drive,
3. Earth tester.
4. Different type of insulators.
5. Cable Construction.

Useful Links

1. www.vlab.co.in
2. www.nptel.ac.in

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 4**
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 Wind Power Sector** Identify different types of wind technology and overview of wind energy sector in India. Understand key insights in the sector though various market research reports and magazines. Identify different types of wind power plant, its components and working principles. Understand basics of electrical concepts like voltage, current, power, energy, etc. Explain the benefits of wind energy over conventional sources of energy. Describe the typical specifications, functioning, operating principle, maintenance requirements, warranties, and safe operating & handling procedures of different wind power plant components like blades, towers, motors, monitoring system and other components. Identify various ways to optimize material, energy/electricity consumption across processes and follow specified process for waste disposal.	**10**	**5**
2	**Carry out operation of electrical & instrumentation system of wind power plant** Explain how to identify the design, drawings and specification of equipment for inspection. Demonstrate to select the relevant PPE to carry out a specific activity. Explain how to carry out scheduled & preventive inspections of electrical/instrumentation components & equipment. Discuss how to verify and record the running parameters of WTG, transformer and switchgear with design document Discuss how to identify the location the conduit, cables & other undergoing devices prior to performing maintenance work. Demonstrate to select the relevant PPE to carry out a specific activity. Explain how to measure and record for performance parameters of transformer like input voltage/ output voltage, frequency, phase sequence, etc. Explain how to maintain log of all performance parameters of switchgear Demonstrate how to monitor the working efficiency of WTG and associated wind power plant equipment Explain to prepare report to be submitted to site in-charge/plant head for further action. Show how to check all the intersections & joints (termination) in the line and cable for faults like loose joint, short circuit, open circuit etc. Demonstrate how to acquire required approvals and permit to work (PTW) from the concerned authority.	**50**	**25**
3	**Perform basic health and safety practices at project site (Ground and Height)**	**60**	**30**

Course Content

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

Sr.	Topics	T	W
	Explain the importance of selecting the relevant protective clothing/equipment for specific tack and work. Demonstrate how to use appropriate personal protective equipment (PPE) while performing work. Discuss about relevant documents and people responsible for health and safety at project site. Identify possible causes of risk at project site and their mitigation measures. Employ appropriate techniques while handling tools and equipment to ensure safety of self and others. Explain how to identify and follow warning signs on site. Discuss how to establish safe working practices when working at heights, confined areas and trenches. Demonstrate how to properly work while sitting or lifting heavy materials as per standards ergonomic principles to avoid injury. Identify methods of accident. Prevention in the work environment. Discuss how to follow safe operating procedures for lifting, carrying and transporting heavy objects & tools. Inspect the project site on a regular basis for any signs of spillage. Perform the steps to clean and disinfect material, tools, equipment and other supplies before starting work and after completing the job. Ensure safe storage of flammable materials and machine lubricating oil. Explain how to apply good housekeeping practices at all times by removal/disposal of waste products. Demonstrate how to participate in emergency and evacuation drills to be able to take necessary action in case of accidents, fires and natural calamities. Explain how to promptly inform relevant authorities about any abnormal situation/behaviour of any equipment/ system. Exhibit the use of various appropriate fire extinguishers on different types of fires. Identify rescue techniques applied during fire hazard. Demonstrate correct techniques to move an injured person during an emergency. Explain how to administer appropriate first aid to victims were required e.g. in case of bleeding, burns, choking, electric shock, poisoning etc. Demonstrate how to use appropriate fire extinguishers for different types of fire at workplace. Discuss how to respond promptly and appropriately to an accident situation or medical emergency in real or simulated environments. Explain how to report the accident to the relevant authority in the prescribed format. Show how to provide first aid to a victim in case of exposed wounds, cuts, burns, choking, electric shock, poisoning, or any other situation such as a cardiac arrest. Demonstrate how to dispose hazardous waste as per organizational norms.		
4	**Effective and Efficient Working Practices**	**60**	**30**
	Describe the legislation, standards, policies, and procedures to be followed at the workplace within one's own scope of work. Demonstrate how to communicate verbal, non-verbal and written information timely, accurately and clearly using an inclusive language that is gender, disability and culturally sensitive. Identify the different types of communication and the basic etiquette involving verbal and non- verbal communication. Show how to interact using appropriate behaviour and gestures/body language, taking gender and disability into consideration to depict equal treatment for all clients, colleagues and co-workers Explain how to collect complete information and instructions from concerned authority/person. Discuss the importance of communicating without any personal, gender, disability, caste, and religion, colour, and culture biases. Outline various methods to escalate and report grievances and issues to concerned authority as per organizational procedure to resolve them and avoid conflict. Demonstrate how to collaborate with other and participate in group activities and tasks. Distinguish between different types of disabilities with their respective consideration and limitations. Elaborate how to assist others in their tasks using positive attitude to maximize effectiveness and efficiency at work. Describe the communication etiquette to be followed at workplace. Explain the importance of listening actively while interacting with others at work. Outline basic characteristics that define responsible and disciplined behaviour at the workplace. Discuss the need to attain common grounds with clients, team members, and other working personnel to enable smooth efficient workflow while considering and respecting the opinions, creativity, values, beliefs and perspectives of others. Elaborate the need of ensuring a friendly, cooperative environment that is conducive to employees' sense of belonging at workplace.		
5	**Carry out maintenance of electrical & instrumentation system of power plant**	**20**	**10**

Course Content

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

Sr.	Topics	T	W
	Explain to ensure that power supply is isolated prior to carrying out work. Demonstrate how to select the appropriate PPE to carry out the specific activity. Explain how to perform visual inspection of the electrical and instrumentation system and record any defects. Demonstrate how to acquire required approvals and permit to work (PTW) from the concerned authority. Discuss to arrange for tools and replacement equipment from the supervisor, if required. Show how to measure and record all parameters of WTG and associated components like continuity, earthing resistance, etc Explain how to carry out repair or replacement of faulty equipment's/components of WTG, transformer, switchgear etc. as per standard operating procedures. Demonstrate how to report to the supervisor in case of any deviations from standard values.		
	Total	**200**	**100**

Course Outcomes

At the end of this course, students will be able to:	
CO1	Carry out operation and Maintenance of electrical and Instrumentation of Wind Power Plant.
CO2	O&M electrical & instrumentation technician is expected to inspect, diagnose and repair electrical & instrumentation systems of wind power plant.
CO3	Perform basic health and safety practices at project site.
CO4	Perform effective work technic on wind power site.
CO5	To perform operation and maintenance of switchgear, transformer, O/H and U/G Lines, SCADA communication system and complying with all operational manuals.

Reference Books

1.	**"Wind Power in Power Systems"** By Thomas Ackermann | Wiley-IEEE Press
2.	**Renewable and Efficient Electric Power Systems** By G. M. Masters | John Wiley and Sons
3.	**Solar Energy: Principles of Thermal Collection and Storage** By S. P. Sukhatme and J. K. Nayak | Tata McGraw Hill
4.	**Renewable Energy Applications** By 1. G. N. Tiwari and M. K. Ghosal | Narosa Publications
5.	**Solar Engineering of Thermal Processes** By J. A. Duffie and W. A. Beckman | John Wiley & Sons
6.	**Non-Conventional Energy Resources** By B. H. Khan | Tata McGraw Hill
7.	**Non-Conventional Sources of Energy** By G. D. Rai | Khanna Publishers
8.	**Grid integration of wind energy conversion systems** By H. Siegfried and R. Waddington | John Wiley and Sons Ltd | 2006.

Useful Links
1. https://nptel.ac.in 2. http://web.mit.edu/renewable-iap09 3. https://www.

Program	BACHELOR OF VOCATION (B.Voc.)	**Semester - 4**
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 Wind Power Sector** Identify different types of Wind technology and overview of Wind power sector in India. Understand the various market research reports and industrial magazines present in the market. Identify the different types of wind power plant, its components and working principles. Understand basics of electrical concepts like voltage, current, power, energy, etc. Explain the benefits of wind energy over conventional sources of energy. Describe the typical specifications, functioning, operating principle, maintenance requirements, warranties, and safe operating & handling procedures of different Wind power plant components like Blades, towers, motors, monitoring system and other components.	24	12
2	**Carry out installation of Electrical components of wind power plant** Select the appropriate PPE (Personal Protective Equipment) to carry out the specific activity. Identify the relevant technical drawings and schematic drawing. Prepare site for erection of electrical components. Assist seniors at site in materials planning and handling. Conduct route survey for each WTG base point. Arrange all tools, tackles, equipment and associated components. Carry out the erection of the tower shells as per standard operating procedures. Carry out torqueing of the joints to ensure optimum tightness. Carry out the correct placement of the nacelle assembly at the top of the tower shell. Carry out the proper alignment of the nacelle assembly with the centre of tower foundation. Modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent Magnet Synchronous Generators, Power electronics converter, Generator Converter configurations, Converter Control. Carry out alignment of turbine hub gearbox assembly with the turbine generator gearbox assembly. Install anemometer as per schematic drawing.	52	26
3	**Perform testing and commissioning of Electrical components of wind power plant** Select The Appropriate PPE (Personal Protective Equipment) To Carry Out The Specific Activity. Assess The Work Area And Prepare For Carrying Out Testing And Commissioning. Identify Required Approvals And Permit To Work (PTW) From The Concerned Authority. Arrange For The Relevant Tools For Carrying Out The Testing And Commissioning Of WTG. Visually Inspect Each Electrica Equipment. Carry Out Visual Inspection Of WTG To Ensure Absence Of Damage, Defects Or Any Signs Of Deterioration. Check And Ensure Tightness And Torqueing Of All Joints In The Wind Turbine Tower As Per Design Specifications. Check And Ensure The Turbine Hub As Per Design Specifications. Check And Ensure The Alignment Of WTG With Shell Foundation As Per Design Specification. Carry Out The Greasing And Lubrication Of WTG Gear Box As Per Design. Carry Out The Calibration Of All Relevant Control And Monitoring Equipment As Per Design Specifications And Ensure Their Proper Functioning. Assist In The Commissioning Of WTG As Per Standard Operating. Procedures. Record And Document All Readings As Per Relevant Industry Standards.	52	26
4	**Perform basic health and safety practices at power project site (Ground and Height)**	54	27

Course Content

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

Sr.	Topics	T	W
	Select the relevant protective clothing/equipment for specific tasks and work. State the name and location of relevant documents and people responsible for health and safety in the project site. Identify possible causes of risk at project site and their mitigation measures. Identify and follow warning signs on site. Establish safe working procedures at the project site. Ensure safe working practices when working at heights, confined areas and trenches. Identify methods of accident prevention in the work environment. Follow safe operating procedures for lifting, carrying and transporting heavy objects & tools. Inspect the project site on a regular basis for any signs of spillage. Ensure safe storage of flammable materials and machine lubricating oil. Apply good housekeeping practices at all times by removal/disposal of waste products. Inform relevant authorities about any abnormal situation/behaviour of any equipment/system promptly. Competent, the user/ individual must be able to: Exhibit the use of various appropriate fire extinguishers on different types of fires correctly. Demonstrate rescue techniques applied during fire hazard. Administer appropriate first aid to victims were required e.g. in case of bleeding, burns, choking, electric shock, poisoning etc. Respond promptly and appropriately to an accident situation or medical emergency in real or simulated environments. Participate in emergency procedures: raising alarm, safe/efficient, evacuation, correct means of escape, correct assembly point, roll call and correct return to work. Report the accident to the relevant authority in the prescribed format.		
5	**Work effectively with others** Accurately pass on information to the authorized persons who require it and within agreed timescale and confirm its receipt. Assist others in performing tasks in a positive manner where required and possible. Consult and assist others to maximize effectiveness and efficiency in carrying out tasks. Display appropriate communication etiquette while working. Display active listening skills while interacting with others at work. Demonstrate responsible and disciplined behaviours at the workplace. Escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict. Identify the need for common grounds with clients, team members, etc. and negotiate in an effective manner to achieve the same. Consider and respect the opinions, creativity, values, beliefs and perspectives of others. Ensure collaboration and group participation to achieve common goals. Promote a friendly, co-operative environment that is conducive to employee's sense of belonging. Facilitate an understanding and appreciation of the differences among team members.	**18**	**9**
	Total	**200**	**100**

Course Outcomes

At the end of this course, students will be able to:	
CO1	Carry out the installation of Electrical Components of wind power plants.Carry out the installation of Electrical Components of wind power plants.
CO2	Perform testing and commissioning of electrical components of wind power plants.
CO3	Perform basic health and safety practices at project site.
CO4	Work effectively with others.

Reference Books

1.	**"Wind Power in Power Systems"** By Thomas Ackermann | Wiley-IEEE Press
2.	**Renewable and Efficient Electric Power Systems** By G. M. Masters | John Wiley and Sons
3.	**Wind Power Technology** By Earnest Joshua | PHI Learning