GUJARAT TECHNOLOGICAL UNIVERSITY
Syllabus for Bachelor of Vocation (B.Voc.), 4th Semester
Branch: Solar & Renewable Energy
Subject Name: O & M Electrical and Instrumentation Technician-Wind Power Plant
Subject Code: 1140707

Type of course: Elective

Prerequisite: None.

Rationale: O&M Electrical & Instrumentation Technician – wind power plant is expected to inspect, diagnose, troubleshoot and repair electrical & instrumentation systems of wind power plant. To perform operation and maintenance of switchgear, transformer, O/H and U/G Lines, SCADA, communication system (Fibre Optics) and complying with all operational manuals, applicable codes/standards, and safety requirements

Teaching Scheme and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical		
L	T	P	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
0	0	15	15	0	0	100	100	200

L- Lectures; P- Practical; OJT- On Job Training; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment

Course Content:

Sr. No.	Topic	No. of hours	% Weightage
01	**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	05
02	**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	50	25

	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.		
03	**Perform basic health and safety practices at project site (Ground and Height)** 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,	60	30

	burns, choking, electric shock, poisoning, or any other situation such as a cardiac arrest. Demonstrate how to dispose hazardous waste as per organizational norms		
04	**Effective and Efficient Working Practices** 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	60	30
05	**Carry out maintenance of electrical & instrumentation system of power plant** 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,	20	10

	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**

Reference Books:

1. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
2. 2. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.
3. 3. S. P. Sukhatme and J.K. Nayak, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 3 rd ed., 2008.
4. 4. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd., 2006.
5. 5. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.
6. 6. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991.
7. 7. B.H. Khan, "Non-Conventional Energy Resources", McGraw Hill 2nd Edition 2017.
8. 8. G.D. Rai, "Non-Conventional Sources of Energy", Khanna Publishers, 4th Edition, 2009

Course Outcome:

After learning the course the students should be able to:

Sr. No.	CO Statement	Marks % Weightage
CO-1	Carry out operation and Maintenance of electrical and Instrumentation of Wind Power Plant.	25%
CO-2	Perform basic health and safety practices at project site.	30%
CO-3	O&M electrical & instrumentation technician is expected to inspect, diagnose and repair electrical & instrumentation systems of wind power plant.	30%
CO-4	To perform operation and maintenance of switchgear, transformer, O/H and U/G Lines, SCADA communication system and complying with all operational manuals.	15%

List of Open Source Software/learning website:

1. https://nptel.ac.in
2. http://web.mit.edu/renewable-iap09
3. https://www.digimat.in/index.html