ACADEMIC YEAR (2023-2024)						
	J.K.K.MUNIRAJAH COLLEGE OF TECHNOLOGY(AUTONOMOUS) T.N.PALAYAM(PO),GOBI(TK)-638506, ERODE(DT).					Metric No 1.3.2
S.No	Name of the course	course code	programme offering	Project work	Internship	Number of students
(2023-2024) Regulation-2021						
1	Power Semiconductor Devices	EE8811	POWER ELECTRONICS AND DRIVES	✓		2
2	Renewable Energy Technology	EE8015	POWER ELECTRONICS AND DRIVES	✓		
3	Wind Energy Conversion System	EE8017	POWER ELECTRONICS AND DRIVES	✓		
4	Analysis of Electrical Drives	EE8402	POWER ELECTRONICS AND DRIVES	✓		
5	Power Electronics for Renewable Energy Systems	EE8551	POWER ELECTRONICS AND DRIVES	✓		
6	Project Work Phase I	EE8552	POWER ELECTRONICS AND DRIVES	✓		
7	Project Work Phase II	EE8601	POWER ELECTRONICS AND DRIVES	✓		

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M.E. POWER ELECTRONICS AND DRIVES

2023-2024

M.E.(PED) II YEAR)

S.NO	REG.NO	STUDENT NAME	PROJECT WORK	INTERNSHIP
1	731222415001	DEIVAMANI.P	✓	
2	731222415003	MANIMEGALAI.P	✓	

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POWER ELECTRONICS AND DRIVES

S.No	Name of the Course that include experiential learning through Project Work/Internship/Field Visit
1	Power Semiconductor Devices
2	Renewable Energy Technology
3	Wind Energy Conversion System
4	Analysis of Electrical Drives
5	Power Electronics for Renewable Energy Systems
6	Project Work Phase I
7	Project Work Phase II

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PROJECT WORK

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POWER ELECTRONICS AND DRIVES

PG PROJECT BATCH LIST (2023-24)

BATCH NO	S.NO	REG. NO.	NAME	TITLE	SUPERVISOR
1	1	731221415001	P.DEIVAMANI	SINGLE PHASE TRANSFORMERLESS PHOTOVOLTAIC INVERTER FOR GRID CONNECTED	Mr.A.VIGNESHKUMAR, M.E
2	2	731221415003	P.MANIMEGALAI	IMPLEMENTATION OF WIND POWER SYSTEM USING HIGH VOLTAGE GAIN DC-DC CONVERTER	Mr.T.S.THAMBIRAN, M.E

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PX4005 **POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS**

L T P C 3 0 0 3

OBJECTIVES:

- To provide knowledge about different types of renewable energy systems.
- To analyze the various electrical Generators used for the Wind Energy ConversionSystems.
- To design a power converter used in renewable energy systems such as AC-DC, DC-DC, and AC-AC converters.
- To understand the importance of standalone, grid-connected, and hybrid operation inrenewable energy systems.
- To analyse various maximum power point tracking algorithms

UNIT I **INTRODUCTION TO RENEWABLE ENERGY SYSTEMS** **9**

Classification of Energy Sources – Importance of Non-conventional energy sources – Advantages and disadvantages of conventional energy sources - Environmental aspects of energy - Impacts of renewable energy generation on the environment - Qualitative study of renewable energy resources: Ocean energy, Biomass energy, Hydrogen energy, - Solar Photovoltaic (PV), Fuel cells: Operating principles and characteristics, Wind Energy: Nature of wind, Types, control strategy, operating area

UNIT II **ELECTRICAL MACHINES FOR WIND ENERGY CONVERSION SYSTEMS (WECS)** **9**

Review of reference theory fundamentals –Construction, Principle of operation and analysis: Squirrel Cage Induction Generator (SCIG), Doubly Fed Induction Generator (DFIG) - Permanent Magnet Synchronous Generator (PMSG).

UNIT III **POWER CONVERTERS AND ANALYSIS OF SOLAR PV SYSTEMS** **9**

Power Converters: Line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing.

Analysis: Block diagram of the solar PV systems - Types of Solar PV systems: Stand-alone PV systems, Grid integrated solar PV Systems - Grid connection Issues

UNIT IV **POWER CONVERTERS AND ANALYSIS OF WIND SYSTEMS** **9**

Power Converters: Three-phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid-Interactive Inverters - Matrix converter.

Analysis: Stand-alone operation of fixed and variable speed WECS-Grid integrated SCIG and PMSG based WECS.

UNIT V **HYBRID RENEWABLE ENERGY SYSTEMS** **9**

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Diesel-PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems - Maximum Power Point Tracking (MPPT).

TOTAL : 45 PERIODS

OUTCOMES:

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

CO1: Analyze the impacts of renewable energy technologies on the environment anddemonstrate them to harness electrical power.

CO2: Select a suitable Electrical machine for Wind Energy Conversion Systems.

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PX4001 **POWER SEMICONDUCTOR DEVICES** **L T P C 3 0 0 3**

OBJECTIVES:

- To understand the concepts related with power switches and its requirements.
- To know about the developments and characteristics of Silicon Carbide (SiC) and GaliumNitride (GaN) devices..
- To understand the working, steady state and switching characteristics of current controlled andvoltage controlled silicon devices.
- To study the working of driving circuits, protection circuits for power devices.
- To understand the thermal characteristics of power devices and the ability to design heat sinkfor the power devices.

UNIT I INTRODUCTION **9**

Power switching devices overview – Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Power diodes - Types, forward and reverse characteristics, switching characteristics – rating. Features and Brief History of Silicon Carbide- Promise and Demonstration of SiC Power Devices- Physical Properties of Silicon Carbide devices
-Unipolar and Bipolar Diodes- GaN Technology Overview

UNIT II CURRENT CONTROLLED DEVICES **9**

BJT's – Construction, static characteristics, switching characteristics; Negative temperature coefficient and second breakdown; - Thyristors – Construction, working, static and transient characteristics, types, series and parallel operation; comparison of BJT and Thyristor – steady state and dynamic models of BJT &Thyristor- Basics of GTO, SiC based Bipolar devices- Applications- Building a GaN Transistor -GaN Transistor Electrical Characteristics

UNIT III VOLTAGE CONTROLLED DEVICES **9**

Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs - and IGCT. New semiconductor materials for devices – Intelligent power modules- study of modules like APTGT100TL170G, MSCSM70TAM05TPAG. Integrated gate commutated thyristor (IGCT) - SiC based unipolar devices-applications

UNIT IV DEVICE SELECTION , DRIVING and PROTECTING CIRCUITS **9**

Device selection strategy – On-state and switching losses – EMI due to switching. Necessity of isolation, pulse transformer, optocoupler – Gate drive integrated circuit: Study of Driver IC – IRS2110/2113. SCR, MOSFET, IGBTs and base driving for power BJT. - Over voltage, over current and gate protections; Design of snubbers

UNIT V THERMAL PROTECTION **9**

Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour – phase cooling; Guidance for hear sink selection – Thermal resistance and impedance - Electrical analogy of thermal components, heat sink types and design – Mounting types-switching loss calculation forpower device

TOTAL : 45 PERIODS

OUTCOMES:

After completing the above course, students will be able to

CO1: Identification of suitable device for the application.
CO2: Know the advantages of Silicon Carbide devices and Galium Nitride devices.

SINGLE PHASE TRANSFORMERLESS PHOTOVOLTAIC INVERTER FOR GRID CONNECTED

PROJECT REPORT

Submitted by

DEIVAMANI P

(731221415001)

In partial fulfillment for the award of the degree of

MASTER OF ENGINEERING

IN

POWER ELECTRONICS AND DRIVES

JKK MUNIRAJAH COLLEGE OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ANNA UNIVERSITY CHENNAI - 600025

MARCH-2023

ANNA UNIVERSITY, CHENNAI 600 025

BONAFIDE CERTIFICATE

Certified that this project report **"SINGLE PHASE TRANSFORMERLESS PHOTOVOLTAIC INVERTER FOR GRID CONNECTED"** is the bonafide work of **DEIVAMANI.P (Reg.no: 731221415001)** who carried out the Project work under my supervision. Certified further that to the best of my knowledge the work reported here in does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate

SIGNATURE

Mr. A.VIGNESHKUMAR, M.E.,

SUPERVISOR,

ASSISTANT PROFESSOR,

Department of Electrical and

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T.N.Palayam-638506.

SIGNATURE 09/10/23

Dr.C.SARAVANAN, M.E., MISTE., Ph.D,

PROFESSOR,

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Department of Electrical and

Electronics Engineering,

J.K.K.M College of Technology,

T.N.Palayam-638506.

Submitted for the Project Viva-Voce examination held on ..09/10/23.....

INTERNAL EXAMINER 09/10/23

EXTERNAL EXAMINER 9/10/23

Principal
J.K.K.Munirajah College of Technology
(Autonomous)
T.N.Palayam, Gobi (Tk),
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ABSTRACT

Single phase transformer less inverter is widely being adopted for grid connected PV systems due to their high efficiency, lower cost and high power density. However, leakage current is the main concern in these inverters which needs to be addressed carefully. Moreover, PV inverters should also be capable of injecting a definite amount of reactive power into the grid as prescribed by the international regulations. In this paper, an improved common mode voltage clamped topology with modified modulation strategy is proposed. The proposed topology offers low loss ac side decoupling, complete elimination of leakage current via clamping and reactive power generation capability. The proposed modulation technique facilitates the flow of current in order to generate zero voltage state during negative power flow.

Principal
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CHAPTER 8

CONCLUSION

In this project, an alternative inverter topology is proposed for the PV system connected to the single-phase grid under the safety regulation. The main principle of operation of this topology depends on decoupling the DC link from the AC side during the zero voltage levels of inverter output voltage. The proposed inverter topology has the advantages of using a single DC link capacitor, eliminating the possible resonance due to the junction capacitors and oscillations in the common mode voltage of improved. It keeps the common mode voltage constant while providing almost the same efficiency. The use of single DC link capacitor eliminates possible voltage unbalance with the existence of two or more capacitors and it reduces the failure probability of more electrolytic capacitors used in the system. Also, this proposed inverter topology is fully compatible with the standard switching enabling the use of PWM ports of digital signal processors.

PX4012 **RENEWABLE ENERGY TECHNOLOGY** **L T P C 3 0 0 3**

OBJECTIVES:

To impart knowledge on

- Different types of renewable energy technologies
- Standalone operation, grid connected operation of renewable energy systems

UNIT I INTRODUCTION **9**

Classification of energy sources – Co2 Emission - Features of Renewable energy - Renewable energy scenario in India -Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment Per Capital Consumption - CO_2 Emission - importance of renewable energy sources, Potentials – Achievements– Applications.

UNIT II SOLAR PHOTOVOLTAICS **9**

Solar Energy: Sun and Earth-Basic Characteristics of solar radiation- angle of sunrays on solar collector-Estimating Solar Radiation Empirically - Equivalent circuit of PV Cell-Photovoltaic cell- characteristics: P-V and I-V curve of cell-Impact of Temperature and Insolation on I-V characteristics-Shading Impacts on I-V characteristics-Bypass diode - Blocking diode.

UNIT III PHOTOVOLTAIC SYSTEM DESIGN **9**

Block diagram of solar photo voltaic system : Line commutated converters (inversion mode) - Boost and buck-boost converters - selection of inverter, battery sizing, array sizing - PV systems classification- standalone PV systems - Grid tied and grid interactive inverters- grid connection issues.

UNIT IV WIND ENERGY CONVERSION SYSTEMS **9**

Origin of Winds: Global and Local Winds- Aerodynamics of Wind turbine-Derivation of Betz's limit- Power available in wind-Classification of wind turbine: Horizontal Axis wind turbine and Vertical axis wind turbine- Aerodynamic Efficiency-Tip Speed-Tip Speed Ratio-Solidity-Blade Count-Power curve of wind turbine - Configurations of wind energy conversion systems: Type A, Type B, Type C and Type D Configurations- Grid connection Issues - Grid integrated SCIG and PMSG based WECS.

UNIT V OTHER RENEWABLE ENERGY SOURCES **9**

Qualitative study of different renewable energy resources: ocean, Biomass, Hydrogen energy systems, Fuel cells, Ocean Thermal Energy Conversion (OTEC), Tidal and wave energy, Geothermal Energy Resources.

TOTAL : 45 PERIODS

OUTCOMES:

After completion of this course, the student will be able to:

CO1:Demonstrate the need for renewable energy sources.

CO2:Develop a stand-alone photo voltaic system and implement a maximum power pointtracking in the PV system.

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PX4013	WIND ENERGY CONVERSION SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about the basic concepts of wind energy conversion system
- To learn the design and control principles of Wind turbine.
- To understand the concepts of fixed speed wind energy conversion systems.
- To understand the concepts of Variable speed wind energy conversion systems.
- To analyze the grid integration issues.

UNIT I INTRODUCTION **9**

Components of WECS-WECS schemes-Power obtained from wind-simple momentum theory- Power coefficient-Sabinin's theory-Aerodynamics of Wind turbine

UNIT II WINDTURBINES **9**

HAWT-VAWT-Power developed-Thrust-Efficiency-Rotor selection-Rotor design considerations- Tip speed ratio-No. Of Blades-Blade profile-Power Regulation-yaw control- Pitch angle control- stall control-Schemes for maximum power extraction.

UNIT III FIXEDSPEEDSYSTEMS **9**

Generating Systems- Constant speed constant frequency systems -Choice of Generators- Deciding factors-Synchronous Generator-Squirrel Cage Induction Generator- Model of Wind Speed- Model wind turbine rotor - Drive Train model- Generator model for Steady state and Transient stability analysis.

UNIT IV VARIABLESPEED SYSTEMS **9**

Need of variable speed systems-Power-wind speed characteristics-Variable speed constant frequency systems synchronous generator- DFIG-PMSG -Variable speed generators modelling - Variable speed variable frequency schemes.

UNIT V GRIDCONNECTED SYSTEMS **9**

Wind interconnection requirements, low-voltage ride through (LVRT), ramp rate limitations, and supply of ancillary services for frequency and voltage control, current practices and industry trends wind interconnection impact on steady-state and dynamic performance of the power system including modeling issue.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to:

CO1: Attain knowledge on the basic concepts of Wind energy conversion system.

CO2: Attain the knowledge of the mathematical modelling and control of theWind turbine

IMPLEMENTATION OF WIND POWER SYSTEM USING HIGH VOLTAGE GAIN DC-DC CONVERTER

PROJECT REPORT

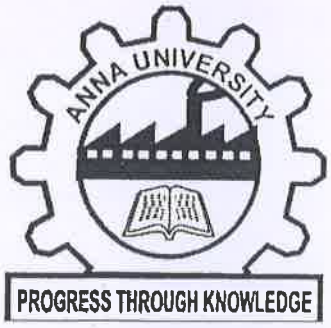
Submitted by

MANIMEGALAI.P

(731221415003)

In partial fulfillment for the award of the degree of

MASTER OF ENGINEERING
IN
POWER ELECTRONICS AND DRIVES



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ANNA UNIVERSITY CHENNAI - 600 025

OCTOBER-2023

ANNA UNIVERSITY, CHENNAI 600 025

BONAFIDE CERTIFICATE

Certified that this project report **"DESIGN AND IMPLEMENTATION OF WIND POWER SYSTEM USING HIGH VOLTAGE GAIN DC-DC CONVERTER"** is the bona fide work of **(Reg.no: 731221415003)** who carried out the Project work under my supervision. Certified further that to the best of my knowledge the work reported here in does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate

SIGNATURE 9/10/23

Mr. T.S.THAMBIRAN, M.E.,

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Submitted for the Project Viva-Voce examination held on ..9.10.2023.....

INTERNAL EXAMINER 9/10/23

EXTERNAL EXAMINER 9/10/23

Principal
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T.N.Palayam, Gobi (Tk),
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ABSTRACT

Wind energy is one of the most promising and developed renewable energy resources. A power electronic interface is needed in order to connect a Wind Energy Conversion System (WECS) to the load or the utility grid. Control of this interface, which consists of Interleaved DC-DC converter, is a very important and demanding task. The main purpose of controlling the quasi DC-DC converter is implementing PIC microcontroller. In this project, MPPT algorithm is modified using PIC in a way that its performance has been enhanced in terms of accuracy and speed. This modified algorithm enables the system to continuously extract the maximum energy from the wind by generating an appropriate feedback voltage reference. Verify the satisfactory performance of the control scheme and the modified algorithm.

Principal
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CHAPTER 8

CONCLUSION

In this work, a novel architecture for a high Gain interleaved DC-DC boost converter with continuous input and output current is introduced. How to increase the voltage, time intervals of ON/OFF mode of the main power switch and all of the diodes are illustrated. In this topology the Wind power transfer ratio is improved without using any isolated transformers or coupled inductors. Compared to the conventional boost converter, this converter offers much lower voltage stress across its power switch which contributes to the much higher reliability in practice. Also, the voltage stresses across all diodes are same as voltage power switch which are considerably low. It should be noted that due to the presence of the inductor on the input and output of the converter, the proposed converter offers much proper choice to be used in applications such as wind power application.