


ACADEMIC YEAR (2022-2023)						
		J.K.K.MUNIRAJAH COLLEGE OF TECHNOLOGY 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
(2022-2023) Regulation-2021						
1	Project Work Phase I	PX5311	POWER ELECTRONICS & DRIVES	✓		2
2	Project Work Phase II	PX5411	POWER ELECTRONICS & DRIVES	✓		
3	Power Semiconductor Devices	PX5101	POWER ELECTRONICS & DRIVES	✓		
4	Solar and Energy Conservation Systems	PS5092	POWER ELECTRONICS & DRIVES	✓		
5	Wind Energy Conservation Systems	PX5071	POWER ELECTRONICS & DRIVES	✓		
6	Solid State Drives	PX5202	POWER ELECTRONICS & DRIVES	✓		
7	Power Electronics for Renewable Energy Systems	PX5072	POWER ELECTRONICS & DRIVES	✓		


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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

MASTER OF ENGINEERING

POWER ELECTRONICS & DRIVES

2022-2023

S.N O	REG.NO	STUDENT NAME	PROJECT	INTERNSHIP	FIELD VISIT
1	731221415001	DEIVAMANI.P	✓		
2	731221415002	MANIMEGALAI.P	✓		

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

S.No	Name of the Course that include experiential learning through Project Work/Internship/Field Visit
1	Project Work
2	Electric Energy Generation,Utilization and Conservation
3	High Voltage Direct Current Transmission
4	Renewable Energy Systems
5	High Voltage Engineering
6	Power System Operation and Control
7	Protection and Switchgear
8	Microprocessors and Microcontrollers
9	Power Electronics
10	Transmission and Distribution

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PROJECT WORK

PX5101

POWER SEMICONDUCTOR DEVICES

L T P C
3 0 0 3

OBJECTIVES:

- To improve power semiconductor device structures for adjustable speed motor control applications.
- To understand the static and dynamic characteristics of current controlled power semiconductor devices
- To understand the static and dynamic characteristics of voltage controlled power semiconductor devices
- To enable the students for the selection of devices for different power electronics applications
- To understand the control and firing circuit for different devices.

UNIT I INTRODUCTION

9

Power switching devices overview – Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Device selection strategy – On-state and switching losses – EMI due to switching - Power diodes - Types, forward and reverse characteristics, switching characteristics – rating.

UNIT II CURRENT CONTROLLED DEVICES

9

BJT's – Construction, static characteristics, switching characteristics; Negative temperature coefficient and second breakdown; - Thyristors – Physical and electrical principle underlying operating mode, Two transistor analogy – concept of latching; Gate and switching characteristics; converter grade and inverter grade and other types; series and parallel operation; comparison of BJT and Thyristor – steady state and dynamic models of BJT & Thyristor- Basics of GTO, MCT, FCT, RCT

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- Integrated gate commutated thyristor (IGCT) - omparison of all power devices.

UNIT IV FIRING AND PROTECTING CIRCUITS

9

Necessity of isolation, pulse transformer, optocoupler – Gate drives circuit: 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 for power device.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to determine the suitable device for the application.
- Ability to design of semiconductor device and its parameters.


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PS5092

SOLAR AND ENERGY STORAGE SYSTEMS

L T P C
3 0 0 3

OBJECTIVES:

- To Study about solar modules and PV system design and their applications
- To Deal with grid connected PV systems
- To Discuss about different energy storage systems

UNIT I INTRODUCTION

9

Characteristics of sunlight – semiconductors and P-N junctions –behavior of solar cells – cell properties – PV cell interconnection

UNIT II STAND ALONE PV SYSTEM

9

Solar modules – storage systems – power conditioning and regulation - MPPT- protection –stand alone PV systems design – sizing

UNIT III GRID CONNECTED PV SYSTEMS

9

PV systems in buildings – design issues for central power stations – safety – Economic aspect –Efficiency and performance - International PV programs

UNIT IV ENERGY STORAGE SYSTEMS

9

Impact of intermittent generation – Battery energy storage – solar thermal energy storage –pumped hydroelectric energy storage

UNIT V APPLICATIONS


9

Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will develop more understanding on solar energy storage systems
- Students will develop basic knowledge on standalone PV system
- Students will understand the issues in grid connected PV systems


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PX5072

POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS

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OBJECTIVES:

- To provide knowledge about the stand alone and grid connected renewable energysystems.
- To equip with required skills to derive the criteria for the design of power converters forrenewable energy applications.
- To analyse and comprehend the various operating modes of wind electrical generatorsand solar energy systems.
- To design different power converters namely AC to DC, DC to DC and AC to ACconverters for renewable energy systems.
- To develop maximum power point tracking algorithms

UNIT I INTRODUCTION

9

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) -Qualitative study of different renewable energy resources ocean, Biomass, Hydrogen energy systems : operating principles and characteristics of: Solar PV, Fuel cells, wind electrical systems-control strategy, operating area.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION

9

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III POWER ELECTRONICS FOR SOLAR

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- standalone PV systems - Grid tied and grid interactive inverters- grid connection issues.

UNIT IV POWER ELECTRONICS FOR WIND

9

Three phase AC voltage controllers-AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, matrix converters- Stand alone operation of fixed and variable speed wind energy conversion systems- Grid connection Issues -Grid integrated PMSG and SCIG Based WECS.

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS

9

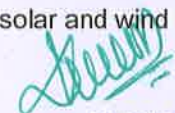
Need for Hybrid Systems -Range and type of Hybrid systems-Case studies of Wind-PV- Maximum Power Point Tracking (MPPT).

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Analyze the impacts of renewable energy generation on environment.
- Understand the importance and qualitative analysis of solar and wind energy sources.


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**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


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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

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PROFESSOR,

HEAD OF THE DEPARTMENT,

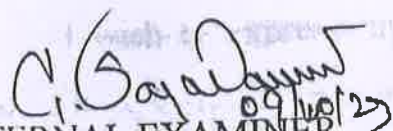
Department of Electrical and

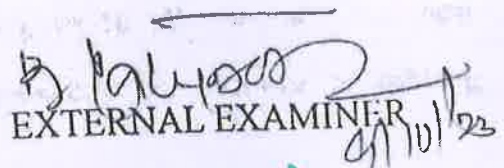
Electronics Engineering,


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


INTERNAL EXAMINER


EXTERNAL EXAMINER 09/10/23


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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.


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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.



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[3] J. S. Lee and K. B. Lee, "New modulation techniques for a voltage current reduction and a neutral point voltage N-point in transformerless photovoltaic conversion using a three-level inverter," *IEEE Trans Power Electron*, vol. 29, no. 4, pp. 1020-1030, Apr. 2014.

PX5202

SOLID STATE DRIVES

L T P C
3 2 0 4

OBJECTIVES:

- To study and analyze the operation of the converter / chopper fed DC drives, both qualitatively and quantitatively.
- To familiarize the students on the operation of VSI and CSI fed induction motor drives.
- To understand the field oriented control of induction machines.
- To impart knowledge on the control of synchronous motor drives

UNIT I RECTIFIER CONTROL OF DC DRIVES

9

Principle of phase control – Fundamental relations; Analysis of series and separately excited DC motor with single-phase and three-phase converters – waveforms, performance parameters, performance characteristics. Continuous and discontinuous armature current operations; Current ripple and its effect on performance; Operation with freewheeling diode; Implementation of braking schemes; Drive employing dual converter.

UNIT II CHOPPER CONTROL OF DC DRIVES

9

Introduction to time ratio control and frequency modulation; Class A, B, C, D and E chopper controlled DC motor – performance analysis, multi-quadrant control - Chopper based implementation of braking schemes; Multi-phase chopper; Related problems.

UNIT III CONTROL OF INDUCTION MOTOR DRIVES- STATOR

SIDE AND ROTOR SIDE

9

AC voltage controller circuit – six step inverter voltage control-closed loop variable frequency PWM inverter with dynamic braking-CSI fed variable frequency drives – comparison Static rotor resistance control - injection of voltage in the rotor circuit – static Scherbius drives - power factor considerations – modified Kramer drives

UNIT IV FIELD ORIENTED CONTROL OF INDUCTION MOTOR DRIVES

9

Field oriented control of induction machines – Theory – DC drive analogy – Direct and Indirect methods – Flux vector estimation - Direct torque control of Induction Machines – Torque expression with stator and rotor fluxes, DTC control strategy.

UNIT V SYNCHRONOUS MOTOR DRIVES

9

Wound field cylindrical rotor motor – Equivalent circuits – performance equations for operation from a voltage source – starting and braking - V curves - Self control-margin angle control-torque control-power factor control-Brushless excitation systems

TOTAL : 45+30 = 75 PERIODS

OUTCOMES:

Students,

- Will be able to formulate, design and analyze power supplies for generic loads and machine loads.
- Will acquire knowledge on the operation of VSI and CSI fed induction motor drives.

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PX5071

WIND ENERGY CONVERSION SYSTEMS

L T P C

3 0 0 3

OBJECTIVES:

- To learn the design and control principles of Wind turbine.
- To understand the concepts of fixed speed and variable speed, wind energy conversionsystems.
- 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 WIND TURBINES

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 FIXED SPEED SYSTEMS

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 VARIABLE SPEED SYSTEMS

9

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

UNIT V GRID CONNECTED 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:

- Acquire knowledge on the basic concepts of Wind energy conversion system.
- Understand the mathematical modeling and control of the Wind turbine


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**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




J.K.K. MUNIRAJAH COLLEGE OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS

ENGINEERING

ANNA UNIVERSITY CHENNAI - 600 025


OCTOBER-2023


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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 09/10/23

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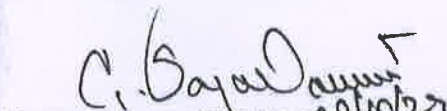

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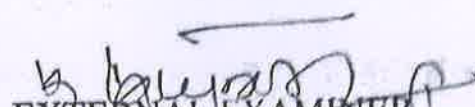
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INTERNAL EXAMINER 09/10/23


EXTERNAL EXAMINER 09/10/23


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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.


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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.



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