


ACADEMIC YEAR (2021-2022)						
			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
(2021-2022) Regulation-2021						
1	Project work,	PX 5411	POWER ELECTRONICS & DRIVES	✓		1
2	Power semiconductor devices	PX 5101	POWER ELECTRONICS & DRIVES	✓		
3	Analysis of Electrical machines	PX 5151	POWER ELECTRONICS & DRIVES	✓		
4	Analysis and design of power converters	PX 5152	POWER ELECTRONICS & DRIVES	✓		
5	Wind energy conversion systems	PX 5071	POWER ELECTRONICS & DRIVES	✓		
6	Solar and Energy storage system	PS 5092	POWER ELECTRONICS & DRIVES	✓		

  
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PX5101

**POWER SEMICONDUCTOR DEVICES**

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**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**

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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**

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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**

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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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**WIND ENERGY CONVERSION SYSTEMS**

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**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**

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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**

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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**

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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**

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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**

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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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**SOLAR AND ENERGY STORAGE SYSTEMS**

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**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**

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

**UNIT II STAND ALONE PV SYSTEM**

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

**UNIT III GRID CONNECTED PV SYSTEMS**

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

**UNIT IV ENERGY STORAGE SYSTEMS**

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

**UNIT V APPLICATIONS**


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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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