



Swami Keshvanand Institute of Technology, Management & Gramothan

*(An Autonomous Institute Affiliated to Rajasthan Technical University, Kota)
(Accredited by NAAC with 'A⁺⁺' Grade)*

Approved by AICTE, Ministry of Education, Government of India
Recognized by UGC under Section 2(f) of the UGC Act, 1956

Research Facilities at Department of Electrical Engineering

🏠: RAMNAGARIA (JAGATPURA), JAIPUR-302017 (RAJASTHAN), INDIA

☎: +91-141-3500300, 2752165, 2752167, 2759609 | 📠 : 0141-2759555

✉ info@skit.ac.in | 🌐: www.skit.ac.in

1. Department overview: A brief introduction to the department, including its mission, research areas, faculty expertise, research students, project/ consultancy undertaken, total publication and patents

Mission of the Department:

M1: To impart quality education in the field of Electrical Engineering and to pursue research and higher studies by providing latest development through expert lectures, conferences and workshops.

M2: To facilitate and develop students for their better employability to adapt the changing needs.

M3: To encourage students and faculty members to undertake industry sponsored projects

Introduction (PG Programs)

The Department of Electrical Engineering is distinctly focused towards integrating academics with cutting edge technology in the field of Electrical Engineering. Department of Electrical Engineering (EE) was started in the year 2000. The PG program in Power systems was introduced in year 2009. The B. Tech. Program has been accredited five times in succession by NBA since 2009. All efforts are subtly harnessed with the aim of preparing the budding engineers to face the challenging dimensions of technical excellence in areas such as Electrical Machines & Drives, Control & Automation, Power Systems Design, Power Electronics and MATLAB Applications.

Research Center in Electrical Engineering Department was established in the year 2014, under the affiliation of Rajasthan Technical University, Kota for five years and provision extension during COVID Pandemic, it has been approved for the renewal in 2022-23 for further five years.

The department puts in consistent efforts for field Exposure to students through various research-oriented projects taken up for meeting the industry demands. The department offers a perfect blend of Electrical, Electronics and Computer related courses to help students pursue a professional career or higher studies.

The objectives of the Research center are

- To provide strategic guidance to the Research activities.
- To supervise the progress of the Research work.
- To Provide the Research Facilities of related work.
- To encourage the faculty and students for Patents and Publication.
- To guide the faculty and students to prepare research proposals/projects to be submitted to various funding agencies.

Presently **Six Faculty members are registered as Research Supervisor** with this Research center. **Six Research scholars are presently registered and Six Scholars has been completed their PhD.**

Every year Average 3-4 manuscript in reputed indexed Journals are being published. Also patents are being published.

International Conference and other events are being organizing and attending by the supervisors as well as scholars for enhancing the knowledge and for collaborations with other researchers. Research funding Proposal are being fill by the the faculty members and Scholars.

Research Areas: In the research Center the research areas that are offers to the scholars are the following:

1. Power Systems
2. Renewable Energy
3. Electricity Market

Faculty Expertise:

- Prof. Ramesh Pachar, Dr. Abhishek Gupta, Dr. Tarun Naruka, Mr. Jinendra Rahul, Mr. Jitendra Singh

Research Area: Power system network reconfiguration, Power quality

- Prof. Sarfaraz Nawaz, Dr. Ankush Tandon, Dr. Pooja Jain, Mr. Ajay Bhardwaj, Mr. Yusuf Sharif

Research Area: Distribution System, FACTS Devices, Application of AI in power system operation and control

- Prof. Dhanraj Chitara, Dr. Sanjeev Kumar, Dr. Prateek Singhal

Research Area: Small-signal stability, Transient stability, AI applications in modern & digital control

- Prof. Virendra Sangtani, Dr. Suman Sharma, Vivek Sharma

Research Area: Power Electronics, Electric Drives, Renewable Energy, Electricity Market

Research Students

S. No.	Name of the Scholar	Name of the supervisor	Title of the Thesis	Remarks
1	Ms. Pooja Jain	Dr. Akash Saxena	Intelligent Bidding Price Simulator for day-ahead Energy Market	Awarded in 2022

2	Mr. Ankit Sharma	Dr. Akash Saxena	Application and Development of intelligent Demand Side Management Strategies	Awarded in 2023
3	Ms. Kavita Jain	Dr. Akash Saxena	Development of Intelligent Bidding Strategy in Electricity Market	Awarded in 2022
4	Mr. Ankush Tandon	Dr. Sarfaraz Nawaz	Minimization of power losses and Enhancement of voltage profile by integration of renewable based DG and Var control units in distribution system.	Awarded in 2024
5	Mr. Abhishek Gupta	Dr. Ramesh Pachar	Multivariate Fault Analysis Algorithm for Protection of Power System with Renewable Energy Penetration	Awarded in 2024
6	Mr. Tarun Naruka	Dr. Ramesh Pachar	Improved Control Scheme for Optimal Power Management in Microgrid Structure	Awarded in 2024
7	Mr. Jinendra Rahul	Dr. Ramesh Pachar	Design and Optimization of Grid connected renewable energy systems: Modelling and Sustainability Assessment	Ongoing
8	Mr. Jitendra Singh	Dr. Ramesh Pachar	Optimal EVCS Scheduling for Sustainable Microgrids with Transactive Energy Framework	Ongoing
9	Mr. Ajay Bharadwaj	Dr. Sarfaraz Nawaz	A Smart Optimizer for Intelligent Bidding in a Day - Ahead Electricity Markets	Ongoing
10	Mr. Ankit	Dr. Sarfaraz Nawaz	NA	Ongoing
11	Mr. Vivek Sharma	Dr. Virendra Sangtani	NA	Ongoing
12	Mr. Sunil Jangid	Dr. Suman Sharma	NA	Ongoing

Project/ consultancy undertaken

Academic year	Ref. No. and date	Project Title	Name of Faculty Coordinator	Funding Agency	Amount
2021-2022	IDEARJ003028 23/07/2022	Net Zero automatic solar panel cleaning Robot	Ankit Vijayvargiya	Ministry of Micro, Small and Medium Enterprises, Govt. of India	15 Lacs
2021-2022	IDEARJ003565 23/07/2022	To design a controller for mitigation the temperature effect in PV array	Bharat Modi	Ministry of Micro, Small and Medium Enterprises, Govt. of India	15 Lacs

Total publication and patents

S. No	Name of the faculty	Academic Research		
		Number of quality publications in refereed/SCI Journals, citations, Books/Book Chapters etc.	Ph.D. guided /Ph.D. awarded during the assessment period while working in the institute	Number of Patents
1	Abhishek Gupta	12		
2	Ajay Bhardwaj	5		2
3	Dr.Ankit Vijayvargiya	27		2
4	Dr.Ankush Tandon	4	Ph.D Awarded	1
5	Dr. Bharat Modi	6	Ph.D Awarded	
6	Deepak Saini	1		
7	Deepti Arela	1		
8	Garvit Kumar Gupta	1		
9	Jinendra Rahul	3		
10	Jitendra Singh	2		
11	Dr. Pooja Jain	8		3
12	Dr. Ramesh Kumar Pachar	12		
13	Dr.Sarfaraz Nawaz	11		1
14	Smriti Jain	2		
15	Dr. S.L. Surana	4		
16	Dr. Suman Sharma	13		
17	Tarun Naruka	3	Ph.D Awarded	1

18	Vikas Ranveer Singh Mahala	4		
19	Vivek Sharma	3		
20	Dr. Virendra Sangtani	11		
21	Dr. Sanjeev Kumar	3		
22	Dr. Dhanraj Chitara	10		
23	Dr.,Jyoti Shukla	6		
24	Avdesh Sharma	1		
	Total	153	Ph.D Guided: 6 Ph.D Awarded:3	11

Patent Information

- **Pooja Jain, Akash Saxena, Ankit Sharma, Bhanu Soni, Shalini Shekhawat** " Multi Agent systems for intelligent bidding price selection for profit accumulation" Patent No: 2021105548.
- Praveen Kumar Jain, Pooja Choudhary, Ankit Agarwal, Satyendra Singh, Ruksar Zafar, Swati Arora, Ankur Saharia, Neha Janu, Manju Choudhary, **Pooja Jain**, " Internet of Things (IoT) sensor-based system for child monitoring & method thereof" Patent No: 2021104782.
- Arun Kumar Rana , Nirav Karelia , **Tarun Naruka** , Vipin Chandra Pal , Souvik Ganguli , Anurag Sohane ,“A system for movement of autonomous vehicle and a method there of” Patent No: 2021101516
- Ayush Swami,**Ankit Vijayvargiya**,”Automatic Solar Panel Cleaning Robot”, Patent No.:378285-001
- Ayush Swami,**Ankit Vijayvargiya**,”Automatic Solar Panel Cleaning Robot”, Patent No.:380426-001
- **Ajay Bhardwaj,Ankit Vijayvargiya**,Pravar Bhatt,Parul Verma,Parineeta Bagra,Lakshya Sharma,Nishi Chouhan,”A Smart System for Automatic Segregation and Recycling of a Biodegradable waste and a method there of.”Patent No.:202311012501A
- Jitendra Kurmi,Dilip Kumar Sharma,M.K.Sharma,Ajendra Sharma,Sanjeev Kumar,Nitesh Dhiman,Omkar Suresh,Ruchi Gupta,Subba Rao,Ankit Porwal,Priyanka Sharma,**Ajay Bhardwaj**,”Machine Learning based methodology for database migration in Cloud Computing Environment,Patent No.:202211052282
- **Ankush Tandon,Pooja Jain,Sarfaraz Nawaz**,Anshuman,Arun Prajapati,Archana

Jha,Anurag Singhal,"A Secured Password based circuit breaker system using GSM Technology and a method there of",Patent No.:202311018334

- **Sarfaraz Nawaz, Ankush Tandon,Pooja Jain, Sumit Saini,Sweha Rajora,Shubhnesh Sharma,Tanya Khandelwal,"ASmart System for Controlling the Ignition System and Location of a Vehicle",(Applied)**

2. Research Facilities: A list of all available research facilities (with photograph-preferably Geo tagged), including their description

Following Research facilities are available in the Research Center:

1. PV Module System

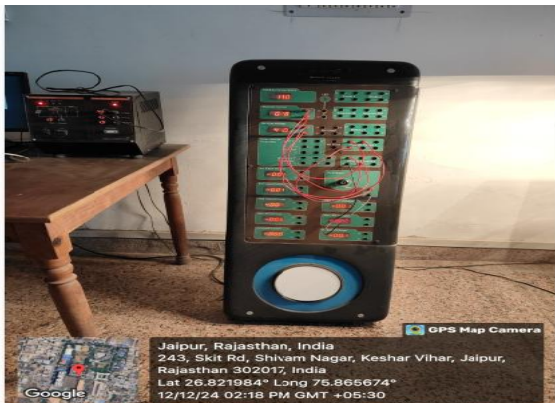
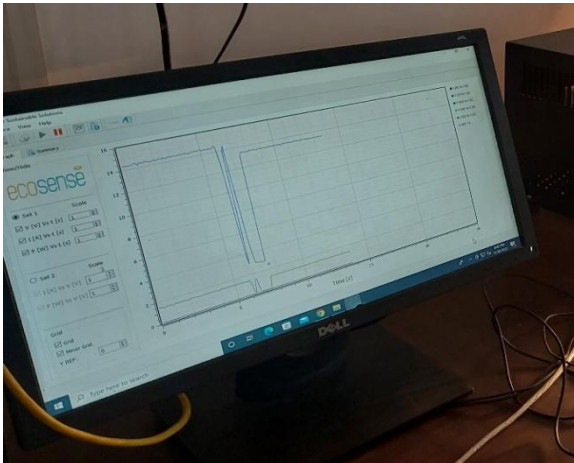


The Facility is equipped with the “**Solar PV Training & Research System (Stand Alone System)**”.The facility has been established keeping in view the RTU Curriculum and basic knowledge of solar PV system.By using this system, five experiments from the syllabus (RTU) are performed which are as follows:

1. To draw I-V and P-V characteristics of single solar panel for various resistive load and also observe Maximum Power Point (MPP).
2. To observe V_{max} , I_{max} , P_{max} & duty cycle of single solar plate at Maximum Power Point (MPP) using (a) PWM controller, (b) MPPT (Maximum Power Point Tracking) algorithm.
3. To observe voltage, current and power with shadowing effect for single, series and parallel connections of solar panels.

4. To perform the study of solar plate thermal collector operation with variation in (a) Mass Flow Rate, (b) Level of Radiation.
5. To draw I-V and P-V characteristics with series and parallel connections of solar panels for varying resistive load.

2. Data Logger

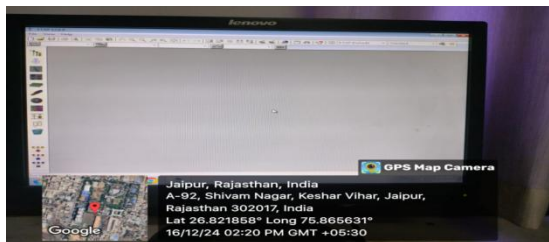


Salient Features of Solar PV Training and Research System using data logger are as follows:

- Experiments can be conducted indoor (using halogen light) as well as outdoor (Real time).
- Intensity of radiation can be controlled.
- Two PV modules can be used for experimentation.
- Manual tracking of PV modules.

- Cooling mechanism to control PV module temperature.
- Manual control of DC-DC converter and MPPT (Maximum Power Point Tracking). algorithm testing.
- Manual control of inverter.
- PC interfacing for data logging and plotting.

3. PSCAD (Power System Computer aided Design)



3.1 Introduction:

As power systems evolve, the need for accurate, intuitive simulation tools becomes more and more important. With PSCAD you can build, simulate, and model your systems with ease, providing limitless possibilities in power system simulation. Included is a comprehensive library of system models ranging from simple passive elements and control functions to electric machines and other complex devices.

3.2 PSCAD Software:

PSCAD is a general-purpose time domain simulation program for multi-phase power systems and control networks. It is mainly dedicated to the study of transients in power systems. A full library of advanced components allows a user to precisely model interactions between electrical networks and loads in various configurations. A graphical user interface and numerous control tools make PSCAD a convenient and interactive tool for both analysis and design of any power system.

PSCAD seamlessly integrated visual environment features all aspects of conducting a simulation, including circuit assembly, run-time control, analysis and reporting. Users can easily interact with the components during the simulation because of the variety of control tools. The solution meters and the plotting traces are also visible and available during the

simulation. Signals can be analyzed in real time. PSCAD features a broad range of models for power system and power electronic studies such as:

- Frequency dependent transmission lines and cables,
- Transformers (classical model with saturation/UmeC model)
- Various machines, (synchronous, asynchronous, DC)
- Various turbines (hydro, steam, wind),
- Converters & FACTS,
- Drive & control blocks,
- Relays.

3.3 Fast and Accurate:

The time steps interpolation technique combines accuracy and quickness: it allows the simulation to precisely represent the commutations of breakers and switches in the electrical model, for any model's size, up to extremely large models. PSCAD results are solved as instantaneous values, and can be converted to phasor magnitudes and angles via built-in transducers and measurement functions such as true-rms meters or FFT spectrum analyzers. The PSCAD simulation tool can duplicate the response of a power system at any frequency, because the computation step chosen by the user can go from several nanoseconds to several seconds.

3.4 Optimization:

PSCAD features multi-run capabilities, enabling a user to run a case multiple times with a set of parameters changed each time in a predetermined manner. This facility makes optimization an easy game as the optimum results (according the criterion the users defines before) are highlighted by the software.

3.5 Customization:

Create custom components? PSCAD features the built-in Component Workshop, the tool used to create all the Master Library components. The look of the components and the data forms are all designed graphically. It allows each user to easily create their own component library.

3.6 Applications:

1. Power lines & cables

2. Large non-linear industrial loads
3. Transformers with saturation
4. Power electronic systems & drives
5. FACTS/HVDC systems
6. Protection relay coordination
7. Arc furnace flicker
8. Distributed power generation
9. Rotating machines
10. Embedded systems

3.7 Strength of Department

Department of Electrical Engineering of SKIT has state of art research laboratory named as “MODROBS Lab” equipped with 20 latest configuration PC’s and 30 user license of genuine PSCAD (Power System Computer aided Design) Software installed. The aforesaid lab was funded against MODROBS scheme of AICTE in year 2012-13.

PSCAD software is very useful modern tool in research point of view. Both undergraduate and post-graduate students have been utilizing this software in their project and dissertation work. Two M.Tech students have completed their dissertation using PSCAD software. The details of the same are mentioned below:

3.8 Details of M.Tech. Dissertation

Student Details	Supervisor Name	Title of Dissertation
Rahul Parmar (14ESKPS606)	Dr. Sarfaraz Nawaz (Asso. Prof.) Mr. AnkushTandon(Asso. Prof.)	Comparison of Different techniques to identify suitable location of SVC in Transmission System
Mohammad Shabir (17ESKPS601)	Dr. Sarfaraz Nawaz (Assoc. Prof.) Mr. AnkitVijay (Asso. Prof.)	Voltage Stability Enhancement using SVC in PSCAD Software

Shubham Sharma (17 ESKPS609)	Dr. Sarfaraz Nawaz (Asso. Prof.) Mr. Ajay Bhardwaj (Asst. Prof)	Comparison of Different Indices For Optimal Allocation of STATCOM using PSCAD Software
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Some M.Tech Students have published their research work in reputed Scopus indexed Journals also. The detail of the publication is as follows:

S.No	Research Publication	Indexing of Journal
1	Rahul Parmar, Ankush Tandon, Sarfaraz Nawaz, "Comparison of Different Techniques to Identify The Best Location of SVC to Enhance the Voltage Profile" ICIC Express Letters, Volume 14, Number 1, January 2020	Scopus SJR=0.14 H-index=20
2	Mohammad Shabir, Sarfaraz Nawaz, Ankit Vijay "Voltage Stability Enhancement Using SVC in PSCAD Software" Lecture Notes in Electrical Engineering 661 Vol: 661, July 2020	Scopus SJR=0.14 H-index=28
3	Shubham Sharma, Ajay Bhardwaj, Sarfaraz Nawaz "Voltage Stability Improvement by Optimal Allocation of STATCOM" Test Engineering & Management Journal, August-2020	Scopus SJR=0.1 H-index=5
4	Mohammad Shabir, Sarfaraz Nawaz, Ankit Vijay vargiya "Enhancement of Voltage Stability using SVC in PSCAD Software" SKIT Research Journal, VOLUME 10; ISSUE 2: 2020	
5	Shubham Sharma, Ajay Bhardwaj, Dr. Sarfaraz Nawaz, "Voltage Stability Improvement by Optimal Allocation of STATCOM" Test Engineering & Management Journal, August 2020	Scopus H-index=10

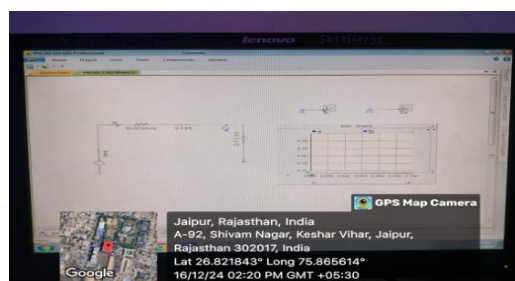
3.9 Name of Expert: Dr. Sarfaraz Nawaz, Asso. Prof., EE Dept.

UG and PG students of Electrical engineering are learning this modern toolbox of simulation other than their prescribed university syllabus. Various simulation based experiments are performed by III year and final year students under beyond syllabus. The list of experiments is given below:

Exp. No	Experiment Name
1	Three Phase breaker operation-I

2	Three Phase breaker operation-II
3	Three Phase breaker operation-III
4	Simulate GTO Controlled Single-Phase Half-Wave Rectifier with R load
5	Simulate GTO Controlled Single-Phase Half-Wave Rectifier with RL load.
6	Simulate GTO Controlled Single-Phase Full-Wave Rectifier with R load.
7	Simulate GTO Controlled Single-Phase Full-Wave Rectifier with RL load
8	Simulate various types of faults in transmission line
9	Simulate IEEE standard 14 bus system
10	Simulate IEEE standard 9 bus system
11	Simulate IEEE standard 30 bus system
12	Simulate IEEE standard 9 bus systems under various fault conditions
13	Simulate IEEE standard 9 bus system under different loading level with SVC
14	Simulate IEEE standard 9 bus system under fault condition with SVC
15	Simulate a Short Circuit Test on the Synchronous Machine Model

4 Power World Simulator:



Power World Simulator (Simulator) is a power system simulation package designed from the ground up to be user friendly and highly interactive. Simulator has the power for serious

engineering analysis, but it is also so interactive and graphical that it can be used to explain power system operations to non-technical audiences.

Simulator consists of a number of integrated products. At its core is a comprehensive, robust Power Flow Solution engine capable of efficiently solving systems of up to 100,000 buses. In Student version the maximum bus is limited to 13. This makes Simulator quite useful as a standalone power flow analysis package. Unlike other commercially available power flow packages, however, Simulator allows the user to visualize the system through the use of full-color animated oneline diagrams complete with zooming and panning capability. System models can be either modified on the fly or built from scratch using Simulator's full featured graphical case editor. Transmission lines can be switched in (or out) of service, new transmission or generation can be added, and new transactions can be established, all with a few mouse clicks. Simulator's extensive use of graphics and animation greatly increases the user's understanding of system characteristics, problems, and constraints, as well as of how to remedy them.

Simulator Add-On Tools

- Voltage Adequacy and Stability Tool (PVQV)
- Optimal Power Flow Tool (OPF)
- Security Constrained Optimal Power Flow Tool (SCOPF)
- Available Transfer Capability Analysis Tool (ATC)