CURRICULUM VITAE

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Passport No. J 1026883, valid up to: Nov-2020

OBJECTIVE:

Seeking a challenging position to utilize my skills as a research-engineer / designer / educator in the field of Electrical Engineering, specializing in Power Electronics / Machine Drives / Power Systems / Control Circuits, and to excel in this field

CAREER SUMMARY:

Ph.D., M.Tech. (EE), B.E. (EE), specializing in power electronics and machine drives; has 6 years of industrial experience in the field of power electronics and DSP/microcontroller-based converters; served the EE Dept. of IIEST Shibpur (formerly, BESU) as Assistant Professor (Grade-II) for about five years; currently serving as Assistant Professor (Grade-I) at the same department.

KEY TECHNICAL SKILLS:

- Proficient in designing and analyzing various power electronic converters
- Design of control circuits for various power electronic converters; includes feedback-loop design and stabilization etc.
- DSP / Microcontroller (8 & 16-bit) programming & circuit design to aid power-electronics / applications involving control
- Design and development of solid-state protection circuits for power-electronic and other electrical systems
- Testing and analyzing performance of electrical machines, design and development of machine drive schemes
- Software / Packages used: PSPICE, MATLAB-SIMULINK, Protel, Proteus, MPLAB, Mikro-C and ANSYS (Elementary E-Mag only), AutoCAD , ki-CAD etc.

EDUCATION:

PhD (Engineering): Department of Electrical Engineering, Indian Institute of Technology, Kharagpur (2004 – 2008)

Thesis Title	:	Power Converters Based on Controlled Capacitor Charging Technique
Research Area	:	Power-Electronic Converter-Topologies and their Control
Supervisor	:	Prof. Chandan Chakraborty
Summary	:	Proposes the techniques to charge capacitors in a 'controlled manner' to synthesize a desired voltage-waveform at the output of a power-electronic converter; the control circuits and power conversion topologies for dc/ac as well as dc/dc conversions are developed and analyzed; results are verified through experimentations and simulations

M. Tech. (Electrical Engineering): Indian Institute of Technology, Kharagpur (2002 – 2004); CGPA: 9.45

Specialization Area	:	Machine Drives and Power Electronics
Thesis Title	:	Development of a High Performance Electronic Ballast for Fluorescent Lamps
Supervisor	:	Prof. Chandan Chakraborty
Summary	:	Develops and designs a self-oscillating electronic ballast for fluorescent lamps; improves the input current-profile by utilizing (a) Boost rectifier and (b) Valley-Fill rectifier and compares between the two via simulation and experimentation

B. E. (Electrical Engineering): Bengal Engineering College (Deemed University), Sibpur (1998 – 2002); Aggregate: 85%

Thesis Title	:	Implementation of a Digital Chess Clock
Supervisor	:	Prof. Biswarup Basak
Summary	:	Designs and develops a digital clock, used by two players for time-keeping operations during a game of chess; the clock has provisions for down-counting time for each player, counting their moves, alarm facilities etc.; designed circuit tested experimentally
Industrial Training	:	At the CESC Limited, Kolkata, Sub-Station Division

Schooling from South Point High School, Kolkata (1984 – 1998)

HS (Class-XII) Examination (WBCHSE)	:	Aggregate: 81.2%; Phy. + Chem. + Maths + Stats (Addl.); Year 1998
Madhyamik (Class-X) Examination (WBBSE)	:	Aggregate: 84%; Addl. Mathematics; Year 1996

Academic Achievements:

- Continuous career with no compartmental or supplementary till date
- Regularly ranked in the top 3 of the section in school and during UG and PG courses
- Received the awards for academic excellence by the Electrical Engineering Department of Bengal Engineering College
- Awarded the ISLE Scholarship for securing 1st position in the Illumination Engineering course in 2002.
- Cleared the GATE Examination (2002) in first attempt with a score of 99.56 percentile and AIR 0053; was awarded MHRD Scholarship during M. Tech & Ph.D. courses
- Secured the top rank in EE Dept. at IIT Kharagpur in M. Tech. 1st Semester (overall rank: Second)
- Awarded the prestigious High Value Fellowship for research by IIT Kharagpur in 2006
- Publications at national/international journals/conference proceedings **(Annexure-I)**

WORK EXPERIENCE:

Indian Institute of Engineering Science and Technology, Shibpur (June-2013 onward): Joined as: Assistant Professor (Grade-II); Current Designation: Assistant Professor (Grade-I) at the Dept. of Electrical Engineering.

Involved in teaching and research in relevant fields of electrical engineering

Working with Stesalit Limited, Kolkata (October-2007 – May-2013):
Designations: Sr. Project Engineer (R & D) (Oct-'07 to Aug-'10), Asst. General Manager (R & D) (Aug-'10 to May-'13)

Job Profile : Guiding multiple teams of engineers and technicians for designing, development and testing of power electronic converters and the allied control circuits for Indian Railways and Department of Atomic Energy

Projects Undertaken (details in Annexure-II):

1. ***Motor-Inverter for CFM/FPM/CCM applications (Dec-'07- Present Day)*****:** Microcontroller-based 3-phase induction motors are used in diesel locomotives. This motor is to be driven from a 72V dc bus using a three phase inverter having soft-start and voltage / torque control features. Contributions are as follows:

- Designing the wide range SMPS for on-card supply
- Designing the μC-based card and driver circuits
- Protection circuits for O/V, U/V and O/C
- Firmware for microcontroller
- Inverter design with snubber circuit

2. ***High Current High Voltage DC Power Supplies with high stability (Nov-07-Present day)*****:** These DC PSUs are used for electron / ion beam acceleration, bending etc. Involved in the design and development of PSUs of the following ratings: (i) 600V, 5A, 300ppm (1 no.), (ii) 5V, 500A, 200ppm (1 no.), (iii) 80V, 200A, 100ppm (4 nos.) and (iv) 170A, 100V, 50ppm (1 no.), (v) 4.5kV, 3A Anode PSU (for RF Power Amplifier), (vi) 24V, 150A voltage controlled twin PSU for supplying interlocks (two PSUs in one cabinet), (vi) 80V, 150A, 50ppm (1 no.), (vii) 50V, 200A current controlled SMPS, (viii) 6V, 5A, 100ppm Linear PSU (2 nos.) (viii) 48V, 20A SMPS & (ix) 1kV, 10mA SMPS (lab-prototype), (x) -4kV, 400mA SCR-controlled DC-PSU and (xi) 80V, 200A, 50ppm DC current controlled PSU. Contributions to these projects are as follows:

- Designing main analogue closed loop controller for achieving the stable output, analog signal conditioning cards, on-board power supply cards, thyristor-triggering-cards
- Power-components-selection & designing the power circuit and
- Testing of the whole set-up

3. Inverters: (i) A 2.5kVA DSP based inverter is used for energizing non-AC electric coaches. Was a member for the development of this inverter, guiding the team in PWM strategies and implementation of the same in open and closed loop using the DSP (TMS320F2808 & dsPIC30F3011) and (ii) a Laptop-charger inverter for railways using microcontroller; was responsible for developing the software for the microcontroller for the closed loop single phase inverter.

4. General Development Work: Development of in-house lab-set ups (kindly see **Annexure-III**).

As a Teaching Assistant / Research student at Indian Institute of Technology, Kharagpur (June 2003 – August 2007)

Job Profile	:	Assisting faculty members at the EE Dept. in conducting UG Laboratory and tutorial classes
Classes undertaken	:	UG: Electrical Technology Tutorial & Lab, Electrical Machine Lab, Power Electronics Lab
Research Work	:	Research for the PhD degree; helped in developing experimental set ups for some PG students.

PERSONAL SKILLS:

Analytic problem solving ability, quick learner, a go-getter, good communicating abilities, seldom repeats a mistake, punctual, ability to work as a team-member in a group of professionals

PERSONAL PROFILE:

Name	:	Suvarun Dalapati	Nationality	:	Indian
Father's Name	:	Sri Sisir Kumar Dalapati	Hobbies	:	Listening to music, playing Sudoku, watching live sports, solving mathematical problems
Sex	:	Male			
Marital Status	:	Married	Date of Birth	:	26.04.1979

SOCIETIES AND PROFESSIONAL BODIES ATTACHED WITH:

IEEE, USA (Senior Member) (also served as Treasurer to the IEEE-IAS-Calcutta Chapter from Jan-'10 to Jan-'13 & Jan-'17 to Jan-'19; as Secretary, IEEE-IAS Kolkata Chapter from Jan-'15 to Jan-'17), Institute of Electronics and Telecommunications Engineers, India (Life-Member), Institution of Engineers, India (Life-Member) and Indian Society of Lighting Engineers (Life-Associate)

REFERENCE:

Dr. Chandan Chakraborty, Fellow-IEEE, Professor, Department of Electrical Engineering, Indian Institute of Technology, Kharagpur, West Bengal, India. Pin- 721302. Ph. No: +91-3222-283096. E-Mail: chakraborty@ieee.org

DECLARATION:

I declare that the above information is correct to the best of my knowledge and I bear the responsibility for the correctness of the above-mentioned particulars.

Place: Kolkata
Date: 11/10/2020

(Suvarun Dalapati)

ANNEXURE-I: LIST OF PUBLICATIONS AND PRESENTATIONS

International Transactions/Journals

[1] S. Dalapati and C. Chakraborty, "A Direct PWM Technique for a Single-Phase Full-Bridge Inverter through Controlled Capacitor Charging," IEEE Transactions on Industrial Electronics, Vol. 55, No. 8, August 2008, pp. 2912 - 2922.

[2] C. Chakraborty, S. Dalapati, and S. Bhattacharya, "Performance Evaluation of Controlled Capacitor Charging Type Inverters," IEEE Transactions on Industrial Electronics, Vol. 56, No. 1, January 2009, pp. 12 - 19.

[3] C. Chakraborty and S. Dalapati, "Analysis and Design of Controlled Capacitor Charging Type Power Frequency Inverter," International Journal of Power Electronics, Vol. 1, No. 3, 2009, pp. 301 - 317.

[4] S. Dalapati and C. Chakraborty, "Novel Regulated DC/DC and DC/AC Power Converters," International Journal of Renewable Energy Technology, Vol. 1, No. 1, 2009, pp. 114 – 138.

[5] S. Dalapati and C. Chakraborty, "Dynamic Performance of a Dead-Band Controlled Capacitor Charging Type Inverter," Elsevier- Simulation Modelling Practice and Theory 17 (2009), pp. 911 – 934.

[6] S. Dalapati and C. Chakraborty, "Simulation and Experimental Verification of New Universal Power Amplifiers," International Journal of Engineering Systems Modelling and Simulation, Vol. 1, No. 4, 2009, pp. 262 – 273.

[7] S. Dalapati and C. Chakraborty, "Design Simulation and Experimental Evaluation of a Three-Phase Controlled Capacitor Charging Type Inverter," International Journal of Power Electronics, Vol. 2, No. 3, 2010, pp. 326 - 344.

[8] S. Dalapati and C. Chakraborty, "Performance of a Single Phase PWM Inverter with a Proportional Band Tracking Controller," International Journal of Power and Energy Systems, Vol. 30, No. 2, 2010, pp. 108 – 118.

[9] S. Dalapati and C. Chakraborty, "A New Three-Phase ZCS Pulse Width Modulated Inverter," International Journal of Power and Energy Conversion, Vol. 2, No. 2, 2010, pp. 153 - 176.

[10] S. Dalapati and S. Pal, "Three-phase V/f Drive using AT89C52," International Journal of Engineering Research and Industrial Applications (Ascent Journals), Vol. 3, No. IV, November 2010, pp. 321 - 337.

[11] S. Pal and S. Dalapati, "Digital Simulation of eighty four pulse STATCOM for improvement of power quality," International Journal of Engineering Research and Industrial Applications (Ascent Journals), Vol. 5, No. III, August 2012, pp. 225 - 236.

[12] S. Dalapati and S. Pal, "Low distortion three-phase sine PWM using a general purpose micro-controller," International Journal of Power Electronics, Vol. 4, No. 4, 2012, pp. 378 - 408.

[13] S. Dalapati, "A predictive algorithm for minimising dead time distortions in sine-wave VSI with L-C output filter," International Journal of Power Electronics, Vol. 5, Nos. 5/6, 2013, pp. 392 - 429.

National Transactions/Journals

[1] S. Dalapati, S. Ray and C. Chakraborty, "Performance of a Series Resonant Converter by Pulse Density Modulation Technique", Published in the Journal of the Systems Science and Engineering of the Systems Society of India (SSI), Vol. 13, June 2006.

[2] S. Pal and S. Dalapati, "Digital Simulation of two level inverter based on space vector pulse width modulation," Indian Journal of Science and Technology, Vol. 5, No. 4, April 2012, pp. 2557 – 2568.

[3] S. Pal, S. Dalapati and N. C. Ganguly, "Application of multilevel voltage-source-converter in FACTS devices for power system voltage control & reactive power compensation," Indian Journal of Modern Engineering Research, Vol. 2, Issue 6, Nov-Dec 2012, pp. 4201 – 4206.

ANNEXURE-I: LIST OF PUBLICATIONS AND PRESENTATIONS (contd.)

International Conferences

[1] C. Chakraborty, S. Dalapati and S. Ray, "Dynamic Pulse Modulation: A Technique to Control Resonant DC-DC Converters", *Conf. Rec. IEEE-Industrial Electronics Society Annual Conference (IECON)*, November 2-6, 2004, Busan, South Korea, pp. 233-238.

[2] S. Dalapati, S. Ray, S. Chaudhuri and C. Chakraborty, "Control of a series resonant converter by pulse density modulation", in *Conf. Rec. IEEE-INDICON*, December 20-22, 2004, IIT Kharagpur, India, pp. 601-604.

[3] C. Chakraborty and S. Dalapati, "A New Voltage Source Inverter Realized by Controlled Capacitor Charging", *Conf. Rec. IEE (J)-International Power Electronics Conference (IPEC)*, April 4-8, 2005, Niigata, Japan, pp. 2023-2029.

[4] C. Chakraborty, S. Dalapati and S. Bhattacharya, "Variable Frequency Variable duty Cycle Operation of the Controlled Capacitor Charging (CCC) Type Inverter", *Conf. Rec. IEEE-Industrial Electronics Society Annual Conference (IECON)*, November 6-10, 2005, Raleigh, North Carolina, U.S.A, pp. 598-603.

[5] S. Dalapati, C. Chakraborty and S. Bhattacharya, "Single Phase, Full-Bridge Controlled Capacitor Charging (CCC) Type Inverter," *Conf. Rec. IEEE-International Conference on Industrial Technology (ICIT)- 2006*, December 15-17, 2006, Mumbai, India, pp. 265-270.

[6] S. Dalapati and C. Chakraborty, "A High Performance Electronic Ballast for Fluorescent Lamp Employing Current Feedback Scheme", in *Conf. Rec. IEEE-Industrial Electronics Society Annual Conference (IECON)*, November 2-6, 2004, Busan, South Korea, pp. 233-238. †

[7] S. Dalapati, C. Chakraborty and S. K. Biswas, "A Comparative Assessment of Passive and Active Power Factor Correction Techniques for Electronic Ballast", in *Conf. Rec. India International Conference on Power Electronics (IICPE)*, December 20-21, 2004, Mumbai, India. †

[8] A. Dasgupta, S. Dalapati and P. Syam, "Stepless Current Commutation in a Three Phase to Three Phase Matrix Converter," in *Conf. Rec. IEEE International Conference on Control, Instrumentation, Energy and Communication, 2014 (CIEC)*, January 31 – February 02, 2014, Kolkata, India.

[9] R. Banerjee, M. Sengupta and S. Dalapati, "Design and Implementation of Current mode control in a switched reluctance drive," in *Conf. Rec. IEEE International Conference on Power Electronics Drives and Energy Systems, 2014 (PEDES)*, December 16 – 19, 2014, Mumbai, India.

[10] S. Chatterjee, A. Mandal, S. Dalapati, P. Halder and K. Mukherjee, "Design, Simulation & Thermal Analysis of an Interior Permanent Magnet Synchronous Motor for A Fork-lift Truck Application," Proc. of the IEEE Int. Conf. CALCON 2020, pp. 206-211, 2020.

[11] D. Chatterjee and S. Dalapati, "Single-Phase Average Power Measurement Using Instantaneous Power Theory in a Fixed Point Processor", Proc. of the IEEE Int. Conf. CALCON 2020, pp. 299-303, 2020.

[12] D. Chatterjee and S. Dalapati, "Algorithm for Determining Instant and Magnitude of Peak of a Signal using 8-bit fixed Point Processor", Proc. of the IEEE Int.Conf. ISDCS 2020, pp. 64-69, 2020.

[13] D. Chatterjee and S. Dalapati, "Single-Phase Average Reactive Power Measurement Using Instantaneous Power Theory in a Fixed Point Processor", Proc. of the IEEE Int. Conf. ICEFEET 2020, pp. 337-342, 2020. *

[14] S. Dalapati, "A Control Systems Laboratory Experiment on Transfer Function Emulation," Proc. of the IEEE Int. Conf. ASPCON 2020, pp. 51-55, 2020.

[15] D. Chatterjee and S. Dalapati, "Space-Vector Pulse Width Modulation Algorithm Implementation in Low Cost 8-bit Digital Controller", accepted for publication in IEEE Int. Conf. INOCON 2020.

National Conferences

[1] S. Dalapati and C. Chakraborty, "Improved Performance Controlled Capacitor Charging (CCC)-type Inverter," in *Conf. Rec. 2nd National Power Electronics Conference (NPEC-'05)*, December 21-23, 2005, IIT Kharagpur, India, pp. 140-145.

†: denotes publications from the project-work done during M. Tech. course.
*: was awarded with the best presentation award for the session

ANNEXURE-I: LIST OF PUBLICATIONS AND PRESENTATIONS (contd.)

Academic Lectures / Presentations Delivered:

- Technical lecture on “Power Converters based on Controlled Capacitor Charging Technique,” delivered at IEEE-IAS Kolkata Chapter Technical Lecture Meeting, held at the Department of Electrical Engineering at Bengal Engineering and Science University, Shibpur, in December 2008.
- Technical lecture on “Special DC Power Supplies for Atomic Physics Experiments,” delivered at IEEE-IAS Kolkata Chapter Technical Lecture Meeting, held at the Department of Electrical Engineering at Bengal Engineering and Science University, Shibpur, in November 2010.
- Delivered lectures on “Carrier Based PWM Inverters: General Concepts,” during Short Term Course on Power Electronics, held at the Department of Electrical Engineering at Bengal Engineering and Science University, Shibpur in 2010 and 2011
- Technical lecture on PWM-Inverters at B. P. Poddar Institute of Engineering and Management (Feb-2017) and at Pailan College of Engineering and Management (March-2017)
- "Small Electric Drives in Diesel Electric Locomotives," on 30.10.2019 - IEEE Technical Lecture for IEEE-IAS Kolkata Chapter, at the Seminar Hall of the Electrical Engineering Department of IIEST Shibpur.
- "Power Electronics and Application of Power Electronics in Transmission and Distribution," on 24.01.2020 at the HR-Department of M/s CESC Limited at P-18, Taratala Road, Kolkata-88, for the Management Trainees of M/s CESC Limited.

ANNEXURE-II: DETAILS OF INDUSTRIAL PROJECTS (2007 – 2020)

1. High Voltage and High Current Power Supplies (Client: Dept. of Atomic Energy, Govt. of India):

Highly stable DC power supplies are required for controlling the motion of electron / ion beams in experiments in atomic physics. This stability is measured in the order of ppm (parts per million). Such a high degree of stability (of output voltage / current) cannot be achieved by normal / regular DC power supplies. Hence, special techniques / methods are followed to design and fabricate such highly 'stable' DC power supplies. Usually the high current power supplies are operated in linear mode, with the transistor base drives being controlled on the basis of output current feedback. In order to maximize efficiency of the power supply, sometimes, thyristorized pre-regulator circuits are also used in such power supplies. Power supplies, falling in this category, has been designed and developed. Ratings of the power supplies, in whose development, the author was involved are as follows: (i) 5V-500A (current-controlled), (ii) 80V-200A (current-controlled), (iii), 100V-170A (current-controlled)and (iv) 24V-150A (voltage-controlled twin PSU), (v) 80V, 200A, 50ppm PSU and (vi) 5V, 6A, 100ppm DC Linear PSU. Besides the above linear PSUs, the author was also involved in the design and testing of the following switched mode power supplies: (i) 50V-200A DC SMPS (output current controlled) and (ii) 48V, 20A voltage controlled compact SMPS.

High voltage power-supplies, are also used for various applications in experimental atomic physics. These power supplies may be designed following either controlled-rectifier type or switch mode type principles. The ratings of the various high voltage power supplies, where the author was involved in development and design are as follows: (i) 600V-5A (following controlled rectifier principle), (ii) 1kV, 10mA (following SMPS principle) and (iii) 4.5kV, 3A (involves AC voltage controller principle), (iv) -4kV, 400mA SCR-regulated PSU, and (v) 5 kV, 2 mA switch mode power supply (fed from 48 V DC input)

Apart from supplying the load in controlled current / voltage fashion, the power supplies are also having numerous protection and user-interface features, which is achieved by using a Micro-controller based CPU card or a purely relay-hardware based interlock card.

Principal Activities: Design, development and testing of power circuit, analogue controller, signal conditioners and feedback controllers and protection circuits for the power supply.

2. AC Small Motors with Individual Built-in Inverters (Client: Indian Railways):

The above product is used in diesel locomotives for the applications of (i) Cyclonic Filter and Dust Exhauster Blower Motor (0.87hp), (ii) Fuel Pump Motor (1.5hp) and (iii) Crank Case Motor (0.5hp).

Such locomotives usually have a 72V DC bus, from which all the on-board electrical units are energized. AC motors are employed for various applications in diesel locomotives. To make such motors operate from the available DC supply, each motor is fitted with an individual inverter, which will generate a 3-phase 40V balanced AC voltage output, to be fed to the motor. The inverter output is of the sine-PWM type with the output current having THD less than 5%. The inverter is controlled by a micro-controller based card, which is capable of controlling the motor both in constant power and constant torque modes, based upon line conditions. It also has soft-start feature for minimizing start-up current.

In addition, standard protection features such as over-voltage, over current, over-load and under-voltage and pulse over-lap, are also embedded in the same controller-card.

Principal Activities: Design, development and testing of microcontroller software for inverter-control, power circuit, analogue controller, signal conditioners and protection circuits for system.

3. Inverters (Client: Indian Railways):

110V, 2.5kVA single phase inverters are used for Indian Railways for electrification of non-ac coaches. These inverters are fed from the 110V DC input, commonly available in railway electric system. The job of this inverter is to convert the same to 110V, 50Hz single phase AC and supply the same to the coaches. This inverter uses a two-stage conversion technique. The first stage being a DC/DC boost converter, followed by a single phase inverter part, which converts the boosted DC voltage to 110V sinusoidal AC (THD < 3%). The inverter control was to be achieved by a DSP.

A similar converter, operating on identical principle and giving an output of 100VA, is used by Indian Railways as on-board Laptop-chargers. The same is to be controlled by any micro-controller of choice, satisfying the control and protection criteria.

Principal Activities: Development of the PWM strategy for the 2.5kVA inverter in open and closed loop mode for generating sinusoidal voltage output; helping in the implementation of these strategies with the DSP (TMS320F2808); development of the entire controller-software for the 110V Inverter with PIC18F4431.

4. General Development Work: Development of in-house lab-set ups for the following:

(i) General test board and software for testing inverter strategies using PIC18F4431, dsPIC30F3011, dsPIC30F4011, dsPIC30F2023, dsPIC30F6010A, dsPIC33FJ32MC204 and dsPIC33FJ64GS610

(ii) Board and software with PIC16F877A (for pump controller) and PIC16F84A

(iii) A fixed amplitude variable frequency single phase inverters using AT89C52 for testing transformers

(iv) Numerous single-PCB based lab power supplies for testing and development using TOPSwitch based Flyback topology.

5. Motor Test Set Up with a VVVF Inverter (for M/s Prime Mover Engineering):

This set up is capable of testing low voltage high current motors for fork-lift applications within a wide range of output AC line-voltage (0 – 144V) and output frequency (1Hz – 110Hz). Two numbers of potentiometers are provided, which enable mutually decoupled control of amplitude and frequency of the output PWM voltage. This PWM voltage is fed directly to the motor under test. The set up also has standard over-voltage, over-current protection. A thermal switch is used to provide a thermal interlock. In addition provisions are kept for adding four nos. of extra interlocks to the circuit.

Principal Activities: Full design of the set up, including power circuit, controller, driver and protection circuits, along with PCB layout design etc. Also, developed and algorithm and wrote the microcontroller-program for implementation of the above PWM strategy, protection schemes etc. Tested and commissioned the set-up successfully.

6. RPM Display Card (for M/s Prime Mover Engineering):

This card is used to test shaft-mounted quadrature encoders for motors. A slotted disk, placed on a motor shaft enables the emission of two nos. of pulse trains, phase apart by 90 degrees from a sensor. This card takes these pulse trains as input and displays the value of the shaft-speed in RPM on a 4-digit 7 segment LED display. The entire circuit is implemented via a single-microcontroller based PCB.

Principal Activities: Full design of the set up, along with PCB layout design etc. Also, developed and algorithm and wrote the microcontroller-program for implementation of the above strategy; testing.

7. Low Output Voltage-Ripple Three Phase Rectifier (for M/s Prime Mover Engineering):

This rectifier (output: 400 V, 100 A) is used for exciting the field coil of a dynamometer for testing electrical motors. The rectifier is based on the three phase diode-bridge topology.

Principal Activities: Full design including magnetic components, implementation and testing of the circuit.

8. Regulated Battery Charger for Indian Railways (for M/s Intellixa Pvt. Ltd.):

110 V, 4.5 kW regulated battery charger is used in electric coaches of Indian Railways for charging the on-board batteries and also supplying a few on-coach light and fan loads. This charger is fed from 350 - 480 V, 3-phase, 50 Hz AC input and delivers the rated output power, keeping the voltage and current ripple below a 2% limit. However, in case of input single-phasing also, the system is supposed to deliver about 35% of the rated power at the output, maintaining the desired voltage and current ripple. The system is based on a switch mode power conversion topology with isolation between input and output. The system is capable of running in both CV, as well as CC modes. Both the modes are user adjustable in a range (CV mode set voltage range: 110 – 135 V and CC mode set current range: 14 – 22 A). The set is backed by another 'emergency-mode 2.5 kW battery-charger', housed in the same cabinet, which operates from the single phase input in CV/CC mode, in case the main charger fails. The system is equipped with DSP based control with multiple protection based interlocks, as well the provision to communicate with a remote control panel (via serial communication based protocols).

Principal Activities: Selection of topology, design of the entire power circuit, including magnetic-components, design of the analogue controller part, testing of the power circuit in open loop and closed loop mode, loop stabilization, controller tuning, development of the PWM-generating closed loop power control firmware etc.

9. High Voltage Low Current DC PSU (for M/s Intellixa Pvt. Ltd.):

High voltage DC power supplies, fed from battery banks / low voltage DC sources are used frequently in large numbers in experiments on atomic physics. This power supply is fed from a 48 V DC input and generates an output of around -5 kV with respect to earth. Major features of the PSU are as follows: (a) fault current limit (in case of output short-circuit), (b) settable output voltage via key-pad, (c) alpha-numeric display, (d) microcontroller-based control circuit.

Principal Activities: Selection of topology, design of the entire power circuit, including magnetic-components, design of the analogue circuits for controller, testing of the power circuit in open loop and closed loop mode, loop stabilization, controller tuning etc.

10. Automatic Voltage Stabilizer (for M/s Intellixa Pvt. Ltd.):

Rural areas of India, particularly in the remote areas of North-East India, daily variation in voltage is far beyond declared values. Voltages in such cases often vary in the range of 130 V – 300 V AC. This 1 kVA stabilizer uses electromagnetic principles to control the output voltage by sensing the input voltage and then selecting the appropriate tap of an auto-transformer to step-up/down the output voltage, keeping the output in the range of 180 – 220 V. The entire operation is achieved with the help of a microcontroller, which also takes care of the OV/UV protection schemes. Provisions of display are kept via digital meters and LED indications.

Principal Activities: Selection of topology, design of the entire power circuit, including magnetic-components, design of the analogue and digital controller circuits, writing the source code for the controller, testing of the entire set-up, etc.

11. 60 V, 12 A / 15 A CV/CC Mode Battery Charger (for M/s Intellixa Pvt. Ltd.):

With the increase in number of electric-rickshaws and small electric vehicles on the roads of sub-urban Kolkata, the demand for fast battery-chargers for such vehicles has also increased. Usually such items are imported directly. This charger aims to replace such imports. It operates directly from 230 V, 50 Hz commercial AC lines, and generates an isolated DC output for charging the battery. Initially, when the battery is discharged, the charger operates in CC mode, pumping constant current to achieve rapid charging. After the voltage crosses a particular threshold, the operation is automatically switched-over to CV mode. The entire scheme is microcontroller-based with standard protections and display features. The set-up has been tested on a commercial electric vehicle and has performed faster charging than ordinarily available chargers of similar ratings.

Principal Activities: Selection of topology, design of the entire power circuit, including magnetic-components, design of the analogue circuits for controller, testing of the power circuit in open loop and closed loop mode, loop stabilization, controller tuning etc.

12. Single Phase PWM Inverter for Signalling Applications in Indian Railways (for M/s Electro-Star Limited)

Single phase PWM inverters, operating from 24 V, 48 V, 72 V and 110 V battery-banks are used in Indian Railways for signalling applications. This inverter runs on closed-loop voltage controlled mode and has standard protections for over-load, over-temperature and input over/under voltage, implemented using digital signal controllers.

Principal Activities: Design of magnetic-components; consultation on the development of firmware; overall layout design

ANNEXURE-III: LIST OF EXPERIMENTS ADDED TO TEACHING LABORATORIES (2013 – 2020)

Sl. No.	Name of the Lab Experiment	Approx. Date of Development	Course, where the experiment has been used	Course, where the experiment are being used / may be used
1.	Study of (I) Optically Isolated MOSFET Gate Drives	June-2014	Short Term Course in Power Electronics (June-2014)	Power Electronics Lab for UG/DD/PG students
2.	Study of Bootstrapped (Charge-Pump) MOSFET Gate Drives	- As Above -	- As Above -	- As Above -
3.	Study of SCR Gate Driver with Pulse Transformer Isolation	- As Above -	- As Above -	- As Above -
4.	Study of a Third Order System and its Compensator Using a Digital Controller	December-2014	NMEICT Workshop on Control Systems: Main Workshop	Control Systems Laboratory / Digital Controller Lab
5.	Performance Evaluation of a 3rd Order Plant using LSVF Controller	November-2018	N/A	Dual Degree (EE) / PG (EE) Control Systems Laboratory
6.	Study of Microcontroller Based Operation and Control of a PWM IC	July-2017	DSP & Embedded Systems Lab (EE-751) – offered to DD/B.Tech Exit Students	PG/DD Courses offered to ME/M.Tech. students of EE Dept.
7.	Digital Controller Based Generation of Single & Three Phase PWM Pulses	- As Above -	- As Above -	- As Above -
8.	Microcontroller Based Voltage-Measurement by using in-built ADC	- As Above -	- As Above -	- As Above -
9.	Transfer function emulation by a digital controller	November-2018	N/A	Dual Degree (EE) / PG (EE) Control Systems Laboratory
10.	Buck, Boost and Buck-Boost Converters	April - 2019	Power Electronics Laboratory	UG/DD/PG Laboratory
11.	VVVF Inverter	- As Above -	- As Above -	- As Above -