REPORT OF ONE-DAY SEMINAR/WORKSHOP ORGANISED BY CENTRES / OVERSEAS CHAPTERS

Name of Centre / Overseas Chapter:	DURGAPUR LOCAL CENTRE

Title of Activity:	One day Seminar on 'Power Electronics Technology Adopted for Drives and Electrical System Design'		
Activity under Divisional Board	ELDB		
Date:	30/03/2019	Venue:	Seminar Hall, DIATM, Rajbandh

Photo of Inaugural Session with banner of IEI

Photo of Technical Session

Report of One-Day Seminar/Workshop

Brief Details about the Programme:

The seminar was started with the welcome address by Past Chairman Durgapur Local Centre, Prof. H B Goswami and also Council Member ELDB, IEI in absence of Chairman Prof. K C Ghanta and explained in detail about the importance of such seminar. He also briefed about the seminar theme and said that the importance of power electronics within the task of providing sustainable, flexible and cost efficient individual mobility in the years to come very soon. He also explained with an example of energy generation along with technologies needed to build up a mobility system based on electricity. Charging infrastructure is considered and special focus is placed on power electronic devices for electric buses used in public transportation.

Guest of Honour, Prof (Dr) P K Sinha, Principal, DIATM mentioned that Power electronics is the engineering study of converting electrical power from one form to another. At a world-wide average rate of 12 billion kilowatts every hour of every day of every year, more than 80% of the power generation is being reprocessed or recycled through some form of power electronic systems. A lot of energy is wasted during this power conversion process due to low power conversion efficiency. It is estimated that the power wasted in desktop PCs sold in one year is equivalent to seventeen 500 MW power plants! It is therefore very important to improve the efficiency of these power conversion systems. It is estimated that with the widespread use of efficient and cost-effective power electronics technology, the world could see a 35% reduction in energy consumption. The power electronic converter is made of solid state devices and handles the flow of bulk power from the source to the motor input terminals. The advances in the power semiconductor technology over the past several

decades enabled the development of compact, efficient and reliable DC and AC electric motor drives.

The controller is made of microcontroller or digital signal processor and associated small signal electronics. The function of the controller is to process the user commands and various sensor feedback signals to generate the gate switching signals for the power converter semiconductor switches following a motor control algorithm. The sensor signals include machine rotor position, phase currents, inverter bus voltage, and machine and inverter temperature outputs. Fault protection and diagnostics are also part of the motor controller algorithm.

Special Guest Prof (Dr) C T Bhunia, Director, Rahul Foundation deliberated that the power electronics is the technology associated with the efficient conversion, control and conditioning of electric power by static means from its available input form into the desired electrical output form. Power electronic converters can be found wherever there is a need to modify the electrical energy form (i.e. modify its voltage, current or frequency.) With "classical" electronics, electrical currents and voltage are used to carry information, whereas with power electronics, they carry power. Some examples of uses for power electronic systems are DC/DC converters used in many mobile devices, such as cell phones or PDAs, and AC/DC converters in computers and televisions. Large scale power electronics are used to control hundreds of megawatt of power flow across our nation. Research in this area includes power electronics applications to control large scale power transmission and distribution as well as the integration of distributed and renewable energy sources into the grid. NCSU also has a strong program on the emerging applications of wide band gap semiconductor devices that offer high operating temperatures, higher efficiency and higher power density.

Power management ICs are used to manage the accurate power flow in portable and handheld devices, such as cell phone power amplifiers and LED display, CPU, DRAM, Graphics, High Speed I/O and USB. In addition, under-voltage or other fault conditions are monitored to prevent damage to the system. The soft-start feature reduces stress on power supply components and increase product reliability. Implementation is typically done using analog integrated circuits but there is a strong trend to move towards digital or mixed signal implementation.

Power semiconductor devices are semiconductor devices used as switches or rectifiers in power electronic circuits (switch mode power supplies for example). They are also called power devices or when used in integrated circuits, called power IC's.

He also explained and told that some common power devices are the power diode, thyristor, power MOSFET and IGBT (insulated gate bipolar transistor). A power diode or MOSFET, for example, operates on similar principles as its low-power counterpart, but is able to carry a larger amount of current and typically is able to support a larger reverse-bias voltage in the off-state. Research needs in this area include on one hand to increase the maximum power handling capability of the power devices, on the other hand include the need to increase the speed they can switch. Power semiconductor is also the key in determining the power conversion efficiency. Researcher concentrates on power devices that use wide band gap semiconductor materials (e.g. SiC and GaN).
Research projects also focused on the analysis of power device structures using numerical simulations and the development of analytical models based on semiconductor transport physics. Scholars are encouraged to validate the theoretical analysis using electrical characterization of commercially available devices and by the fabrication of novel device structures. The impact of improvements in power device characteristics on specific applications allows an understanding of trade-offs between on-state characteristics, reverse blocking capability, and switching performance.

Chief Guest, Prof Sujit Biswas, Past Chairman, IEEE Kolkata section and former Professor

and Head of Electrical Engineering, Jadavpur University deliberated on the modern trend of power electronics. He explained with historical notes that why speed control is required in the Industry. He explained the components of electrical drives and technologies available for controlling speed control of drives. With the torque equation he deliberated the growth of drive applications. He discussed and compared advantages of constant power and constant voltage drives.He further discussed PWM and problems with PWM. He concluded with future trends and applications for smart system.

Guest of Honour, Mr Arijit Basuroy, Managing Director, NEO-TELE-TRONIX PVT LTD deliberated on considerations for motor & transformer insulation working under repetitive pulsed voltage. He described about the motors for power electronics applications and insulation matters. He described the motors, transformers and how to improve with latest technology. Insulation conditions between turns and layers of coils of Transformers, Reactors or Rotating machines are different under Pulsed Voltage.He described further VFD Motor control system being initially the most demanding requirement, high frequency converter technology developed immensely during these days and serving a lot more application like PWM based power supplies High Voltage Modulators and Pulse Power technology. In Renewable energy system Transformers are also being Inverter Driven. One of the major concerns is the effect of repetitive fast rise-time, relatively high voltage surges on the insulation system of windings of the transformers and inductors used in the PWM converter as well as motor stator causing premature stator winding failure. He concluded with the following remedies.

REMEDIES

- Low Stress Design.
- Selection of proper Dielectric material
- Moisture Free & Void Free Insulation System by Proper Vacuum Impregnation.
- Avoid Interfaces.
- Build Equipotential with Conducting or semiconducting layers.

Guest of Honour Dr. Arindam Biswas , Kazi Nazrul University, Asansol, WB Highlighted the topic Frequency and Power: Thz GaN Impatt Ossilator

- He described IMPATT, an acronym for *Impact Avalanche Transit Time.*
- The most powerful solid-state source of microwave and mm-waves.
- In its simplest form an IMPATT is a *p-n* junction diode reverse-biased to avalanche breakdown.
- Embedded in a cavity resonator generates High frequency oscillation.
- Possible base materials – Si, GaAs, InP, SiC, GaN, type-II(b) diamond and different hetero junctions.

Er M Biswal, Hony. Secretary offered a vote of thanks to all the concerned and said that such type of activities should be continued for the betterment of IEI and as well as for the academic Institutions. He also distributed the certificates to all the participants.

Details of the Sessions:

Forenoon: **(Inaugural Session)** Inaugural programme and two invited lectures	1. Invited .Lecture by: Prof C T Bhunia on trends of power electronics 2. Invited Lecture by:. Dr Sujit Biswas on modern trends of power electronics
Afternoon: **(Technical Session)** Two invited lectures and Paper Presentations	1. Invited Lecture 1-- by: Mr Arijit Basu Roy 2. Invited Lecture 2 --by: Dr Arindam Biswas 3. Paper Presentation by: Mr S Pal