Department of Electrical & Electronics Engineering

Report

Five-Day International Online Faculty Development Program (FDP)

on

"Application of Artificial Intelligence (AI) in Electrical Engineering (EE) for The Performance Improvement of Various Sectors (AAIEEPIVS-2021)"

Organised by

Department of Electrical and Electronics Engineering

Duration: 24th – 28th August 2021

Organized in association with: **Institution Innovation Council**

Submitted by:

1. Dr Pratap Ranjan Mohanty, Associate Professor., Dept. of EEE
2. Dr. Aurobinda Bag, Sr. Asst. Professor, Dept. of EEE

Attendance: 55 participants from different institutions of INDIA and abroad

Day 1 (24.08.2021)

Session 1 (9.30 AM – 11 AM): Inaugural Session & Lecture on "Power Quality Issues in Power System" by Prof. Anup Kumar Panda, Professor HAG, Dept. of EE, NIT Rourkela, INDIA

The session was started at 9.30 AM. Dr. A V Pavan Kumar, Associate Professor & Head, EEE Dept. (Convener, AAIEEPIVS-2021) initiated the inaugural session and welcome the dignitaries and the participants to the Five-Day International Online Faculty Development Program (FDP) on "Application of Artificial Intelligence (AI) in Electrical Engineering (EE) for The Performance Improvement of Various Sectors (AAIEEPIVS-2021)". Dr.C. Yuvaraj, Principal (Patron, AAIEEPIVS-2021) addressed the meeting and signifies the efforts of MITS, Madanapalle for making platform like research interaction and knowledge sharing even in pandemic situation. Besides, he indicated in brief regarding the importance of programs like FDP and formally announced the opening of the international FDP AAIEEPIVS-2021. The objective and diversity of AAIEEPIVS-2021 was mentioned by Dr. Aurobinda Bag, Sr. Assistant Professor, EEE Dept. (Coordinator, AAIEEPIVS-2021). The Chief Guest & Resource Person for tht session-1 Prof. Anup Kumar Panda, Professor HAG (Higher Administrative Grade), Dept. of EE, NIT Rourkela, INDIA was introduced by Dr. Pratap Ranjan Mohanty, Associate Professor, Dept. of EEE (Coordinator, AAIEEPIVS-2021).

The resource dignitary addressed the power quality issues in power system. The eminent resource person concluded that the p-q scheme yields inadequate results under non-ideal supply voltage conditions. The $i_d - i_q$ scheme provides comparatively better result under distorted and unbalanced supply conditions. Also, the $i_d - i_q$ scheme is efficient for a wide variety of supply voltage and loading conditions with significant lower %THD in source current.

Session 2 (11.15 AM – 12.45 PM) Lecture on "High performance Control 3/5 Phase Induction Motor Drives for EV and Traction Applications" by Dr. Ranjan Kumar Behera, Associate Professor, Dept. of EE, IIT Patna, INDIA

The prominent speaker focused on the performance analysis of the controlled 3/5 phase Induction Motor (IM) Drives for EV and traction applications. Both the simulation and experimental studies have been carried out in his presentation. The closed agreement between the simulated and experimental results from a laboratory prototype was validated in his lecture.

Session 3 (2 PM – 3.15 PM) Lecture on "GMPPT Algorithm with Partial Shading Detection in PV Systems" by Dr. M Chakrapani, Lecturer, Electronics & Inst. Engineering, Assam Energy Institute, Sivasagar (Centre of Rajiv Gandhi Institute of Petroleum Technology, Jais, Amethi), INDIA

The eminent speaker focused on effect of partial shading on PV string, existing GMPPT techniques, need for partial shading detection in PV string. He explained the detection of partial shading through flow chart.

Session 4 (3.30 PM – 4.45 PM) Lecture on "Machine Learning in IoT" by Dr. Rashmi Ranjan Rout, Associate Professor, Department of Computer Science & Engineering, NIT Warangal, INDIA

The distinguished speaker discussed on IoT, its application, different IoT architecture and Technology Domain for IoT. Also, he presented some of real time applications of IoT such as; High speed rail, emergency vehicle routing (IoT system development for Smart city), Smart City IoT Projects, Smart Healthcare-Wearable Sensors, Smart Grid Application-Smart power meter etc. Besides, he underlined regarding Machine Learning, Reinforcement learning, sensing & human interactions, functionalities/ranges of a sensor node, machine learning in industry with certain case study. Also, he discussed about learning on IoT data and Deep learning in IoT.

Day 2 (25.08.2021)

Session 1 (9.30 AM – 11 AM): Lecture on "Data Engineering & AI" by Mr. Ashok Jena, Director of Product Engineering Neudesic, California

The resource dignitary focussed on Data Engineering, Machine Learning and Artificial Intelligence. Also, he highlighted regarding implementation of SCADA (Supervisory Control and Data Acquisition) systems for Electrical Distribution.

Session 2 (11.15 AM – 12.45 PM) Lecture on "Smart Irrigation Systems using IoT" by Dr. Dr. T Narasimhulu, Assistant Professor, Dept. of EEE, ANITS, Vizag, INDIA

The prominent speaker focused on IoT based SMART FARMING SYSTEM for Live Monitoring of Temperature and Soil Moisture by using Arduino. He concluded that the System has high efficiency and accuracy in fetching the live data of temperature and soil moisture. The IoT based smart farming System was being presented. The speaker remarked that his proposed system would assist farmers in increasing the agriculture yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results.

Session 3 (2 PM – 3.15 PM) Lecture on "Performance Improvement of Micro-Grid Using AI Techniques" Prof. Pravat Kumar Ray, Associate Professor, Dept. of EE, NIT Rourkela, INDIA

The eminent speaker focused on AI techniques for the performance improvement of Micro-Grid. In the session, VLLMS based control scheme for PV-UPQC system is discussed under different dynamic conditions in addition to steady-state conditions through simulation as well as through hardware implementation. The speaker concluded that the shunt compensator is working satisfactorily under dynamic load condition and makes the grid current sinusoidal. It compensates for load reactive power demand and load harmonics. Also, the load voltage is maintained at the rated value (415 V) by the series compensator, under sudden variation in grid voltage level (sag and swell). THD of source current and load voltage is maintained within IEEE standards (IEEE 519).

Session 4 (3.30 PM – 4.45 PM) Lecture on "High Power Converters" Dr. Y Suresh, Assistant Professor, Dept. of EEE, NIT Karnataka, INDIA

The distinguished speaker discussed on design of high power converters for different applications. The mathematical modelling and Simulink model for various power converters are explained. The selection of filter inductor/capacitor for any power converter is highlighted.

Day 3 (26.08.2021)

Session 1 (9.30 AM – 11 AM): Lecture on "AI Technique for PV System – Modeling & Control " by Prof. Bidhyadhar Subudhi, Professor, School of Electrical Science, IIT Goa, INDIA

The resource speaker focussed on the Modelling & Controlling of PV system by using AI technique. In the presentation, the RL-IPT-SMC Control scheme is proposed for integration of a PV system to grid. RL MPPT algorithm for obtaining maximum power form the PV panel during variation in solar irradiance and temperature. The RL-IPT-SMC scheme outperforms as compared to FL-IPT-SMC and IC-IPT-SMC schemes. It provides better MPPT tracking performance after properly learned as compared to FL-IPT-SMC and IC-IPT-SMC, which can be observed from the simulation and experimental results. This scheme yields more output power as compared to FL-IPT-SMC and IC-IPT-SMC schemes. THD of grid current in RL-IPT-SMC scheme is smaller than that yielded in case of FL-IPT-SMC and IC-IPT-SMC schemes, which is within IEEE-519 standard.

Session 2 (11.15 AM – 12.45 PM) Lecture on "Multilevel Inverter fed PMSM Drives" by Dr. T Ramesh Assistant Professor, Dept. of EE, NIT Andhra Pradesh, INDIA

The prominent speaker focused on Scalar Control, Vector Control or Field Oriented Control (FOC), Direct Torque Control, Direct Torque Control with Space Vector Modulation. The session had included the validation of 2-level inverter fed PMSM drive, 2-level inverter fed PMSM drive, 2-level inverter fed PMSM drive, Sensorless control methods and Fuzzy logic control based PMSM drive.

Session 3 (2 PM – 3.15 PM) Lecture on "Inductive Learning" by Dr. Pragya Dwivedi, Assistant Professor, Dept. of CSE, MNNIT Allahabad, INDIA

The eminent speaker focused on Inductive Learning, various methods and different applications. Decision Tree Induction and Inductive Learning Algorithm (ILA) are being

discussed with certain working examples. Also, the speaker pointed the issues in decision tree induction based ID3. In the presentation, the C4.5 is being discussed. The speaker concluded the session with comparative study between Inductive Learning Algorithm and ID3.

Session 4 (3.30 PM – 4.45 PM) Lecture on "AI & Machine Learning for Bio-Signals" by Dr. Udit Satija, Assistant Professor, Dept. of EE, IIT Patna, INDIA

The distinguished speaker discussed on AI & Machine Learning for Bio-signals. The resource person highlighted the issues related to Bio-signals and discussed the certain research objectives for the implementation of AI & Machine learning with performance analysis.

Day 4 (27.08.2021)

Session 1 (9.30 AM – 11 AM): Lecture on "Advanced Direct Energy Conversion Technologies for Power Generation" by Dr. Ravita Lamba, Assistant Professor, Dept. of EE, MNIT Jaipur, INDIA

The resource speaker focussed on advanced direct energy conversion techniques for power generation. The importance of solar energy and various solar PV technologies are discussed. The significance of advanced technologies in various solar harvesting methods are being focussed in the session. Also, the methods to increase the efficiency of PV system is explained. Also, the conversion of sunlight by improved photon-enhanced thermionic emission (PETE) method is presented in the session.

Session 2 (11.15 AM – 12.45 PM) Lecture on "Energy Management in Distribution System with DERs" by Dr. Kushal M Jagtap, Assistant Professor, Dept. of EE, NIT Srinagar, INDIA

The prominent speaker focused on massive installations of distributed energy resources (DERs), system automation, net- metering and bilateral electricity flow, integration of communication networks and efficient information transfer for efficient energy management in distribution system. Also, the speaker discussed about the architecture and operation with elaborate research objective for energy management (EM) system. Besides, the required tools for EM challenges are discussed.

Session 3 (2 PM – 3.15 PM) Lecture on "Opportunities & Challenges in Electric Vehicle Technology" by Dr. Nishant Patnaik, Associate Professor, Dept. of EEE, ANITS, Vizag, INDIA

The eminent speaker highlighted the opportunities & challenges in electric vehicle (EV) technology. The presentation included a comparative energy sources used for transport. The propulsion force in different types of EV is also discussed. Different types of EV configurations with functional block diagram is discussed to understand the challenges in fuel cell based EV technology. Besides, the speaker underlined about the recent research topic related to EVs.

Session 4 (3.30 PM – 4.45 PM) Lecture on "Channel Estimation and Pilot Duration Optimization in Powerline Communication Systems" by Dr. Soumya Prakash Dash, Assistant Professor, School of Electrical Science, IIT Bhubaneswar, INDIA

The distinguished speaker discussed on channel estimation and pilot duration optimization in powerline communication systems by using certain techniques. In the presentation, the estimates of the channel gains are obtained by using the MMSE technique, utilizing which the ML based receiver structure is obtained. Also, the closed form expression for the SEP of the system is obtained using c.f. approach. The optimization framework is proposed. Also, The optimal pilot symbol duration fraction to maximize the normalized error-free data rate is obtained.

Day 5 (28.08.2021)

Session 1 (9.30 AM – 11 AM): Lecture on "Power Control of Grid Connected Induction Generators under Distorted Grid Conditions" by Dr. Asha Rani M A, Assistant Professor, Dept. of EE, NIT Silchar, INDIA

The prominent speaker highlighted the technical challenges associated with Renewable Power Generation. Also, the challenges involved in power control of grid connected induction generators are discussed. The significance of synchronization techniques, rotor speed/position estimation in power control is also explained. Also, the power control of DFIG under balanced and unbalanced grid conditions are also discussed.

Session 2 (11.15 AM – 12.45 PM) Lecture on "Occupational Health & Safety" by Mr. Amit Kumar Panda, Safety Executive, Dept. of Safety, Gignode India Limited, Jamshedpur, INDIA

The prominent speaker highlighted the occupational health & safety through certain case studies. The session included various online exercise for the participants for understanding the fundamental safety concerns in work place. Besides, the speaker focused on precautions and required safety actions in various conditions.

Session 3 (2 PM – 3.15 PM) Lecture on "Artificial Intelligence & Machine Learning for Industry" by Mr. JP Anand Kumar, Sr. Manager, Process Excellence & Transformation, Digital Center of Excellence, JSW Steel, INDIA

The eminent speaker focused on AI and machine learning for industry through certain real-time industrial case study. The session was about Robust Real Time Hearth Liquid Level (HLL) Model in Blast Furnace and Strategies Adopted to Improve Accuracy of Prediction through Artificial Intelligence.

Session 4 (3.30 PM – 4.45 PM) Lecture on "Blockchain Based AI Technique for Demand Side Management Application" by Dr. Deepak Kumar, Assistant Professor, Dept. of EEE, BIT Mesra, INDIA and Valedictory Session

The distinguished speaker discussed on the working of Blockchain. The presentation included certain visual demo to understand the Blockchain based AI technique for demand side management application. The resource person proposed Microgrid Energy Transaction and

DSM Design Framework in the session. Also, the key research challenges in the field of demand side management is being highlighted.

Dr. Aurobinda Bag, Coordinator, AAIEEPIVS – 2021 open the valedictory session with an appreciation note to all the participants for their persistent of attending the five-day long FDP AAIEEPIVS – 2021. Dr. Pratap Ranjan Mohanty, Coordinator, AAIEEPIVS – 2021 shared his view and experience regarding the success of the program. Many participants shared their experience, valuable comments about the FDP. Dr. A V Pavan Kumar, Convener, AAIEEPIVS- 2021 proposed a vote of thanks and announced the successful completion of the FDP.

Feedback: The participants were moreover passionate to participate in every sessions and interacted with resource persons to enhance their research contribution ahead.

Participation Certificate: Participation E-Certificates are distributed to all the active participants through their email.

Photos:

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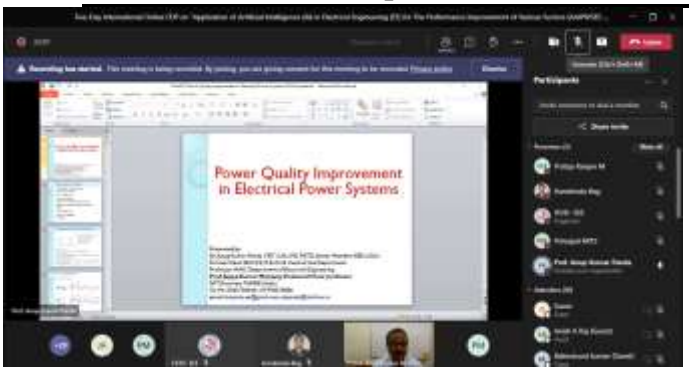
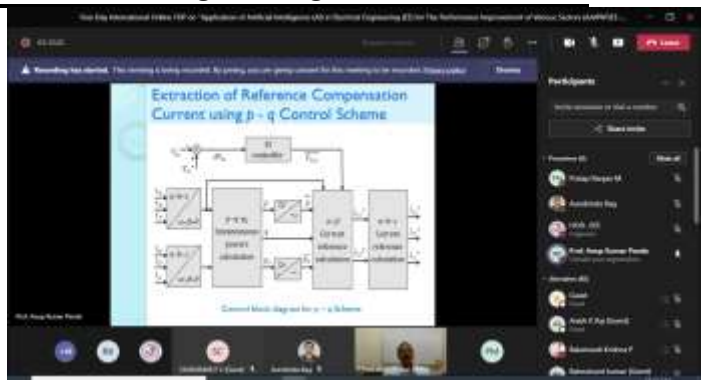
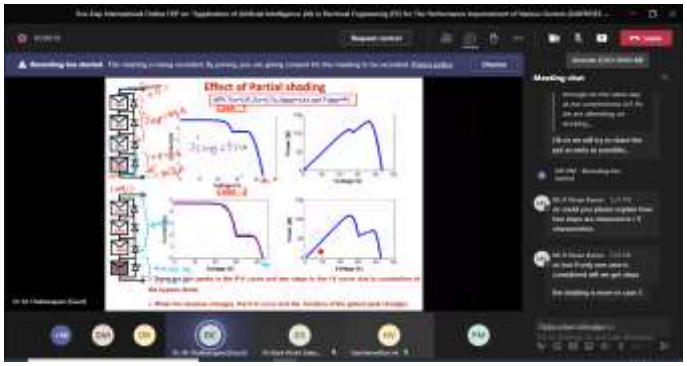
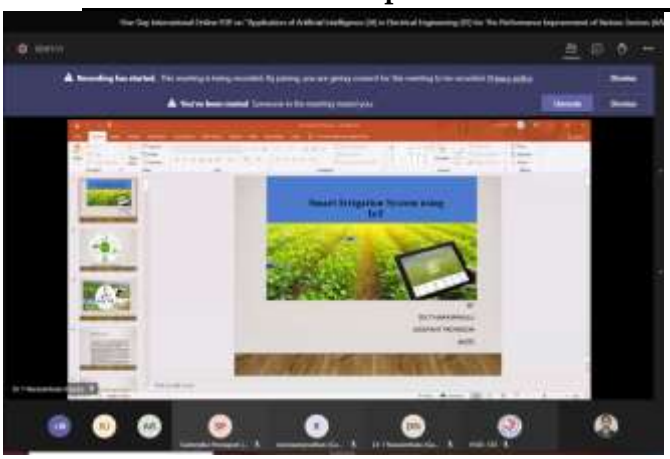
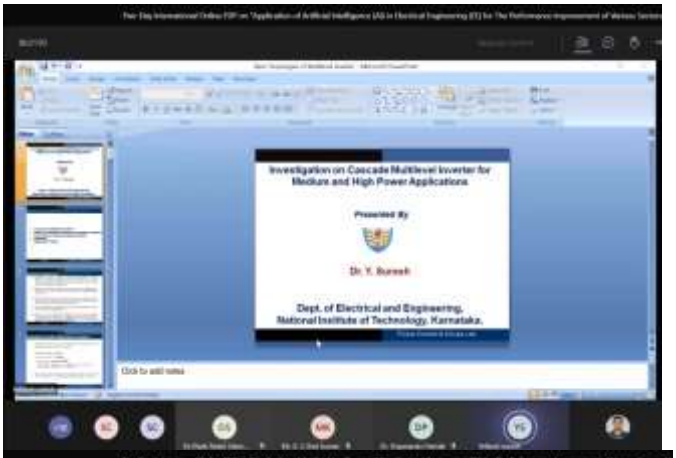


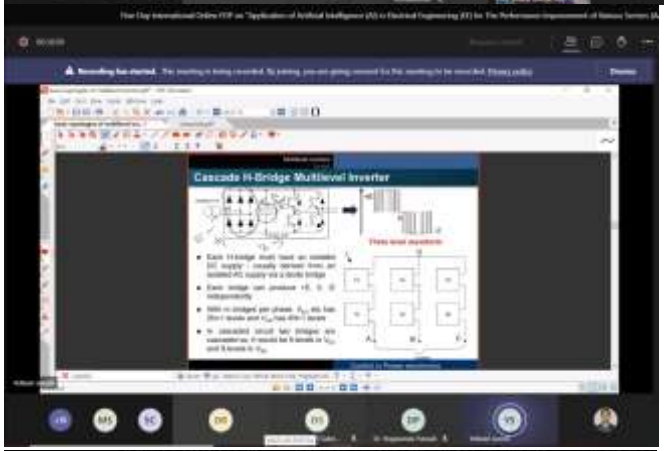




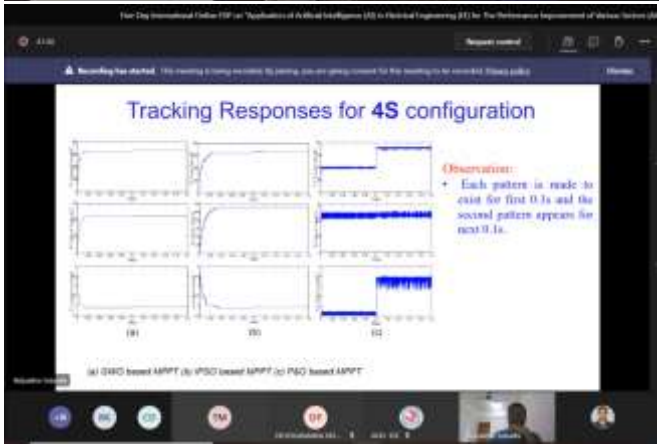


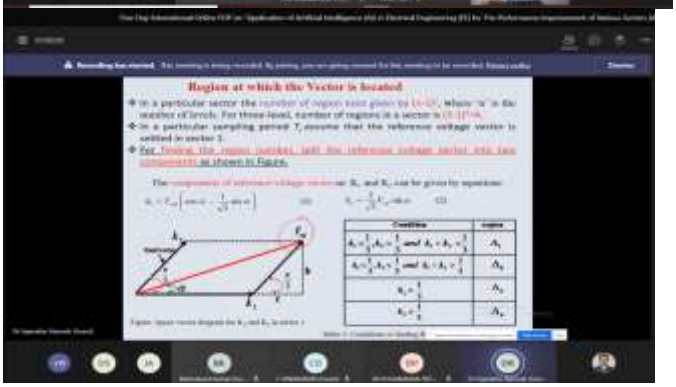

Brief Overview on Microgrid

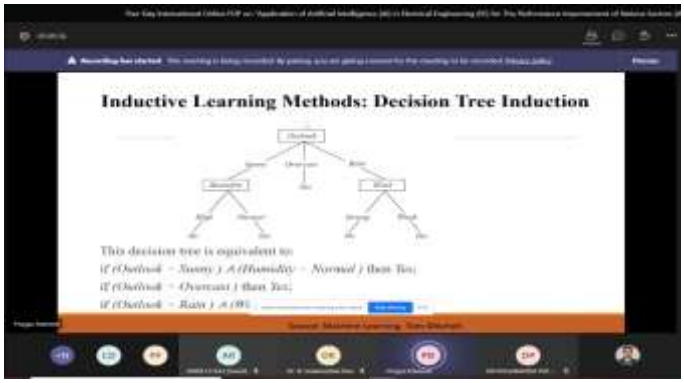

Investigation on Cascade Multilevel Inverter for Medium and High Power Applications
Presented By
Dr. Y. Suresh
Dept. of Electrical and Engineering,
National Institute of Technology, Karnataka.


Cascade H-Bridge Multilevel Inverter


BFO Parameter Extraction Method


Tracking Responses for 4S configuration
Observation:
Each pattern is made to exist for first 0.1s and the second pattern appears for next 0.1s.


Region at which the Vector is located


Inductive Learning Methods: Decision Tree Induction

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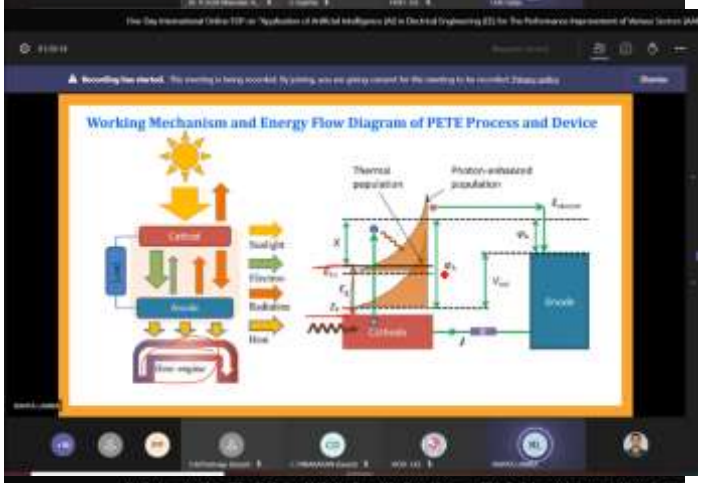

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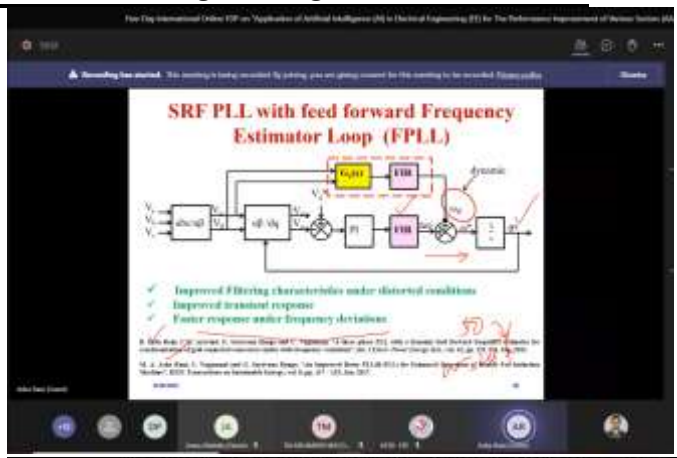

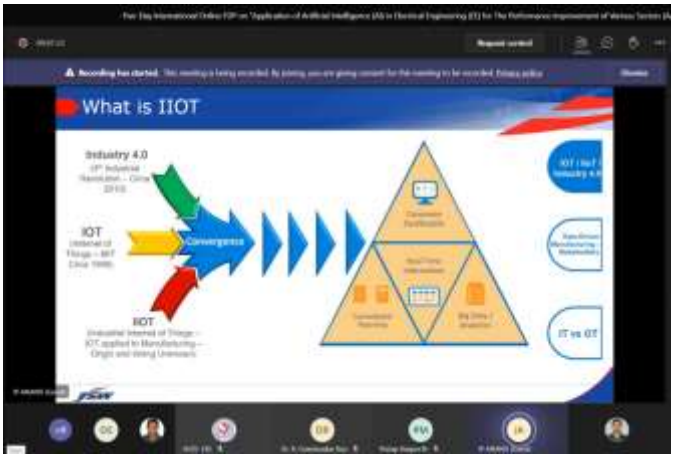

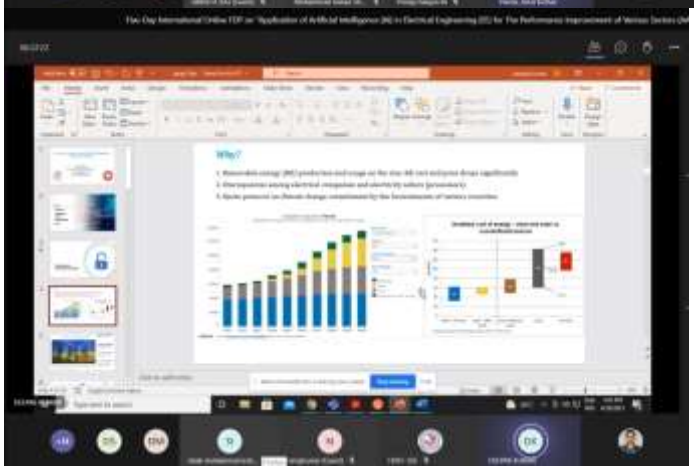

Sample e-Certificate

Aurobinda Bag

Signature of the Coordinator

(Dr Pratap R Mohnaty, Dr Aurobinda Bag)

Signature of HoD