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Sri Venkateswara
College of
Engineering



Technical Magazine
of
Short Time Training Program

on

**ELECTRIC VEHICLE EVOLUTION-
IMPACT ON POWER GRID**

Sponsored by
All India Council For Technical
Education (AICTE)

**Phase-I:
February 8th to 13th 2021**

**Phase-II:
March 22nd to 27th 2021**

**Phase-III:
April 19th to 24th 2021**

ORGANIZING COMMITTEE

Chief Patron



**Dr. M. Sivanandham,
Secretary,
SVEHT**

Patron



**Dr. S. Ganesh Vaidyanathan,
Principal**

Converner and Coordinator



**Dr. KR. Santha,
Vice-Principal**

Co ordinators



**Dr. S. G. Bharathidasan,
Asso. Professor/EEE**



**Dr. M. Sankar,
Asst. Professor/EEE**



**Dr. S. Kumaravel
Asst .Professor/EEE**



**Mr. S. S. Sethuraman,
Asst. Professor/EEE**



**Mr. S. Thamizmani,
Asst. Professor/EEE**

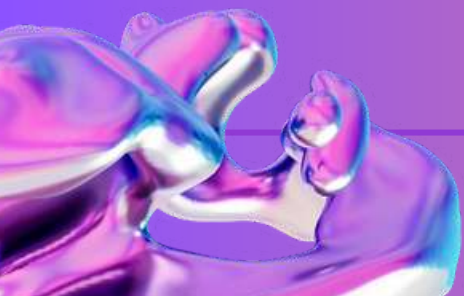
ABSTRACT

The future Electrical Power System operation and control has to be restructured to face the challenges of plug-in Electric Vehicles (EV) evolution. The knowledge in EV drive, Battery Energy Storage (BES), Fast-charging circuitry, Battery Management System (BMS) and its impact on smart and micro grid dynamics, coordinated BMS, control, protection and communication protocols are imperative for Engineers working in these domains. This STTP was aimed at training the participants on the present procedures and future expectations in the aforementioned areas by experts from Industry & Institutions. This STTP also facilitated the participants to acquire hands-on training in this field through various related systems modeling and simulation. After participating in this STTP, participants gained the expertise to select and design suitable motors, Battery management system and power converters for Electric Vehicles. They also gained expertise in identifying the changes to be done in Power System after EV incorporation in Micro and Smart grid environments.



OBJECTIVE

- **Familiarize the participants about EV configuration/ components and its interaction with power grid.**
- **Creating awareness on impact of EV evolution on operation and control of Electrical Power System.**
- **Inculcate charging/discharging of aggregated EV and its impact on micro grid.**
- **Training the delegates in design and analysis of EV drive motor using MAGNET, simulation of EV with battery energy storage (BES) using PWSIM, MATLAB and DIgSILENT.**
- **Offering expertise to the participants on operation of micro and smart grids with EV.**



Industry Expert Speakers



**Dr.S.Sankara Narayanan,
General Manager, Tamilnadu Energy
Development Agency,
Govt. of Tamilnadu**



**Dr.C.Veeramani,
Chief Engineer (Retd), TANGEDCO
(formerly TNEB)**



**Mr.S.Jayakrishnan,
General Manager, Hyundai Motor India Ltd**



**Dr.R.Kathiravan,
Assistant Executive Engineer, TANGEDCO**



**Dr.S.Sudhakar,
Senior Scientist, CSIR - Central
Electrochemical Research Institute,
Karaikudi**



**Dr.N.Sivakumar,
Global Technical lead, Rolls-Royce,
Singapore**



Industry Expert Speakers



**Mr.B.Saravanan,
Lead-Traction control, Alstom,
Bangalore.**



**Mr.Rathnakumar Devaraj,
Industrial & Systems,
Development Engineer,
CE+T Power, Wandre, Belgium**



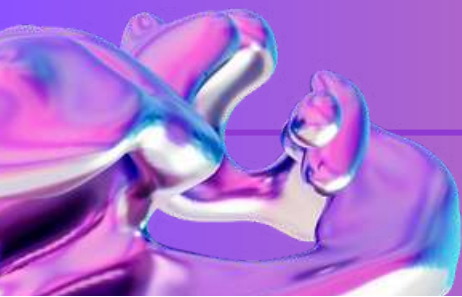
**Dr.A.Deepak,
EM Design Engineer,
ePropelled systems Pvt Ltd.**



**Dr.V.P. Boopathi,
Sr. Appn. Engineer,
PWSIM Engg. Solns Pvt Ltd.**



**Mr.Balasubramanian Ananthraman,
Scientist,
CSIR - Central Electrochemical
Research Institute, Chennai**



Academia Expert Speakers



**Dr.K.Shanti Swarup,
Professor, Indian Institute of Technology
Madras.**



**Dr.R.P.Kumudinidevi,
Professor, EEE Dept,
Anna University Chennai.**



**Dr.Sankara Narayanan,
Professor & Head, EEE Dept.,
National Institute of Technology,
Tiruchirappalli**



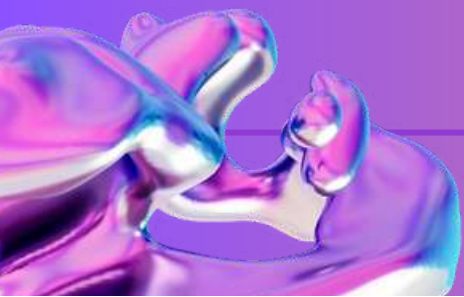
**Dr.S.Chandramohan,
Prof. & HOD/EEE Dept., Anna University,
Chennai.**



**Dr. R.Jayashri,
Professor, School of Electrical
Engineering and Telecommunications,
UNSW SYDNEY, AUSTRALIA.**



**Dr.P. Somasundaram,
Prof. EEE Dept.,
Anna University Chennai.**



Academia Expert Speakers



**Dr K.Rathnakannan,
Asso. Prof., EEE Dept., Anna University
Chennai.**



**Dr.D.Kalpana,
Asst. Prof., Dept. of Instrumentation Engg,
Madras Institute of Technology.**



**Dr.S.Kumaravel,
Asso. Prof., EEE Dept.,
National Institute of Technology,
Calicut.**



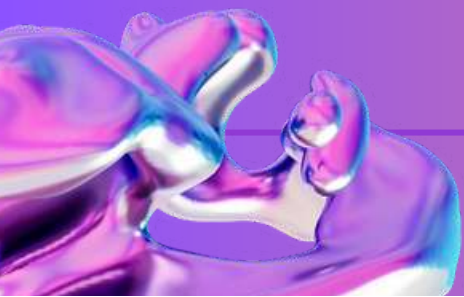
**Dr.P.Raja,
Asso. Prof., EEE Dept.,
National Institute of Technology,
Tiruchirappalli.**



**Dr.V.Gomathi,
Asso. Prof., EEE Dept, Anna University,
Chennai.**



**Dr.C.Christober Asir Rajan,
Professor, EEE Dept ,
Pondicherry Engineering College.**



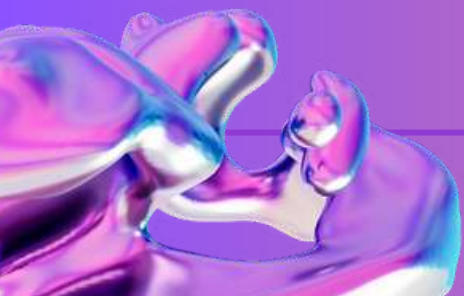
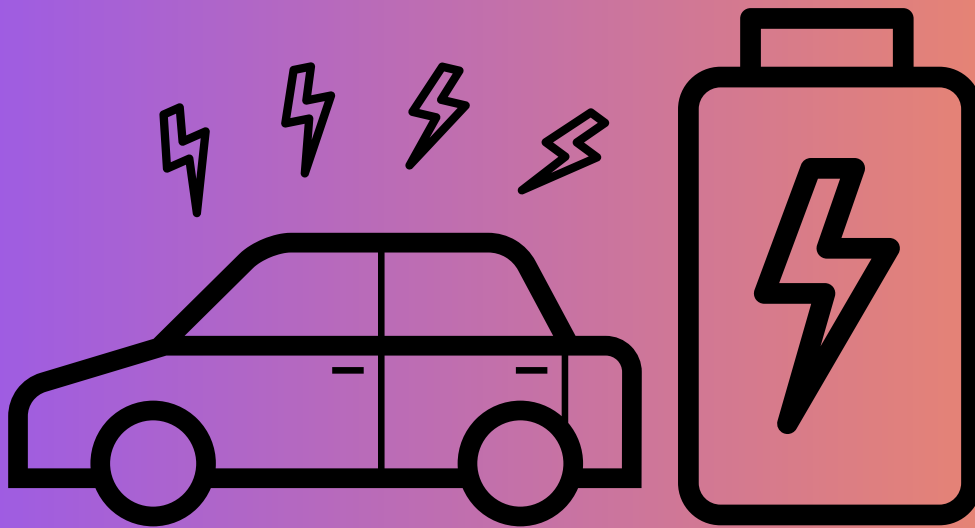
Academia Expert Speakers



**Dr.D.Maharajan,
Asso. Prof., EEE Dept.,
SRM University**



**Dr.V.Saravanan,
Professor, EEE Dept.,
Arunai Engineering College.**



About STTP

The AICTE sponsored STTP on ‘Electric Vehicle Evolution – Impact on Power Grid’ was organized by the Department of Electrical and Electronics Engineering, Sri Venkateswara College of Engineering in ONLINE mode in three phases as detailed below:

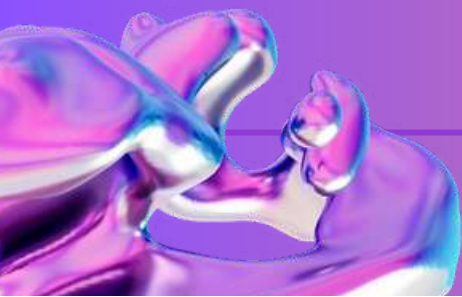
Phase-1: 8th February 2021 – 13th February 2021

Phase-2: 22nd March 2021 – 27th March 2021

Phase-3: 19th April 2021 – 24th April 2021

The brochure, schedule, inaugural invite and agenda of all the three phases are given in the Annexure 1, 2 and 3 respectively.

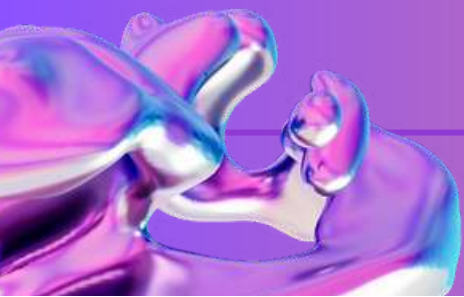
The Phase-1 of this STTP was hosted online on 8th Feb 2021 at 9.30 AM. The STTP started with a prayer song. Dr.KR.Santha, Vice Principal, Professor and HOD/EEE delivered the welcome address and briefed about significance and objectives of the STTP. Prof. Dr. S. Ganesh Vaidyanathan, Principal, Sri Venkateswara College of Engineering delivered the presidential address.



The Phase-1 of STTP was inaugurated by Dr.S.Sankara Narayanan, General Manager, Tamil Nadu Energy Development Agency. The Phase-2 of STTP was inaugurated by Er.C.Veeramani, Chief Engineer Regulatory Cell (Retd), TANGEDCO. The Phase-3 of STTP was inaugurated by Dr.R.Kathiravan, Executive Engineer, TANGEDCO. Following the inaugural address the dignitaries delivered an expert lecture on the topic “Impact of Renewable Energy Generation and Electric Vehicle on Power Grid - Future perspective and Preparedness”.

In all the phases of the STTP, the participants from industry and academia were trained in the area of ‘Electric Vehicle Evolution and its Impact on Power Grid’ through 18 sessions of expert lectures and hands-on by Eminent Industry and Academic experts as given in schedule (Annexure 1). 85 Participants attended Phase-1, 42 Participants attended Phase-2 and 79 Participants attended Phase-3.

The valedictory of the AICTE-STTP was held on 24th April 2021 at 3.30 PM. Dr.KR.Santha, Vice Principal, Professor and HOD/EEE delivered the valedictory address.





Department of Electrical & Electronics Engineering

Solicit your Esteemed Presence for the
INAUGURAL FUNCTION

of

AICTE sponsored six days online Short Term Training Programme (STTP) on

“ELECTRIC VEHICLE EVOLUTION - IMPACT ON POWER GRID”

8th February 2021, 09.30 AM

Mr.S.Sankara Narayanan,

*General Manager, Tamilnadu Energy Development Agency,
Govt. of Tamilnadu*

will inaugurate and deliver the inaugural address

Dr.S.Ganesh Vaidyanathan,

Principal, Sri Venkateswara College of Engineering

will preside over the function





PHASE 1 SCHEDULE: FEB 8TH TO 13TH 2021

08.02.2021

SESSION 1

INAUGURATION AND EXPERT LECTURE

09:30
AM

Dr.S.Sankara Narayanan,
General Manager, Tamilnadu Energy
Development Agency,
Govt. of Tamilnadu

SESSION 2

EXPERT LECTURE

11:15
AM

Dr.S.Sankara Narayanan,
General Manager,
Tamilnadu Energy Development Agency,
Govt. of Tamilnadu

SESSION 3

EXPERT LECTURE

02:00
PM

Dr.A.Deepak,
EM Design Engineer,
ePropelled systems Pvt Ltd.



PHASE 1 SCHEDULE: FEB 8TH TO 13TH 2021

09.02.2021

SESSION 1

EXPERT LECTURE

Dr.B.Chandra Sekhar,
Technical Lead,
Tata Consultancy Services,
Bangalore.

10:00
AM

SESSION 2

EXPERT LECTURE

Dr K.Rathnakannan,
Asso. Prof., EEE Dept., Anna University
Chennai.

11:15
AM

SESSION 3

EXPERT LECTURE

Dr.S.Sudhakar,
Senior Scientist,
CSIR - Central Electrochemical Research
Institute,
Karaikudi

02:00
PM



PHASE 1 SCHEDULE: FEB 8TH TO 13TH 2021

10.02.2021

SESSION 1

EXPERT LECTURE

Dr.K.Shanti Swarup,
Professor,
Indian Institute of Technology
Madras

09:30
AM

SESSION 2

EXPERT LECTURE

Dr.S.Kumaravel,
Asso. Prof., EEE Dept.,
National Institute of Technology,
Calicut

11:15
AM

SESSION 3

EXPERT LECTURE

Dr.Venkatakirthiga,
Asso. Prof., EEE Dept.,
National Institute of Technology,
Trichy

02:00
PM



PHASE 1 SCHEDULE: FEB 8TH TO 13TH 2021

11.02.2021

SESSION 1 EXPERT LECTURE

Dr.P.Raja,
Asso. Prof., EEE Dept.,
National Institute
of Technology, Tiruchirappalli

09:30
AM

SESSION 2 EXPERT LECTURE

Dr.V.Saravanan,
Professor,
EEE Dept.,
AEC.

11:15
AM

SESSION 3 EXPERT LECTURE

Dr.D.Maharajan,
Asso. Prof., EEE Dept.,
SRM University

02:00
PM



PHASE 1 SCHEDULE: FEB 8TH TO 13TH 2021

12.02.2021

SESSION 1 EXPERT LECTURE

Expert: Dr.D.Maharajan,
Asso. Prof., EEE Dept.,
SRM University

09:30
AM

SESSION 2 EXPERT LECTURE

Expert: Dr. R.Jayashri, Professor,
School of Electrical Engineering
and Telecommunications,
UNSW SYDNEY,
AUSTRALIA.

11:15
AM

SESSION 3 EXPERT LECTURE

Expert: Mr.Nandhakumar,
Design Engineer,
Power Grid
Corporation of India.

02:00
PM



PHASE 1 SCHEDULE: FEB 8TH TO 13TH 2021

13.02.2021

SESSION 1

EXPERT LECTURE

Expert: Mr.S.Jayakrishnan,
General Manager,
Hyundai Motor India
Ltd

09:30
AM

SESSION 2

EXPERT LECTURE

Expert: Dr.C.Christober Asir Rajan,
Professor, EEE Dept ,
Pondicherry
Engineering College

11:15
AM

SESSION 3

EXPERT LECTURE

Expert: Dr.V.P. Boopathi,
Sr. Appn. Engineer,
PWSIM Engg. Solns Pvt Ltd.

02:00
PM

SESSION DETAILS

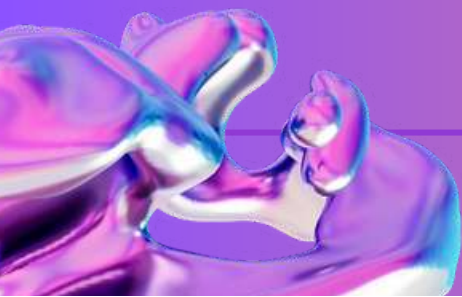
PHASE - I

DAY - 1
(08.02.2021)

**Welcome address by
Dr.KR.Santha, Vice Principal,
Professor and HOD/EEE**



Inaugural address by Dr.S.Sankara Narayanan, General Manager, Tamil Nadu Energy Development Agency followed by expert lecture on the topic “Impact of Renewable Energy Generation and Electric Vehicle on Power Grid - Future perspective and Preparedness.”



Session 2: Expert lecture by Dr.V.Ganesh, ASP/DAE/SVCE

Components of EV – Total vehicle resistance

- Each resistance can be calculated manually by a series of different equations.
- The total resistance acting on a vehicle is the sum of all the individual resistances involved.
- The general resistance equation of resistance can be given as:

$$R_t = a + bv + cv^2$$

- Here, R_t - Total resistance
a, b & c - Coefficients of resistance
v - Velocity of the vehicle.
- Hence we can see that the Total vehicle resistance is a function of velocity.

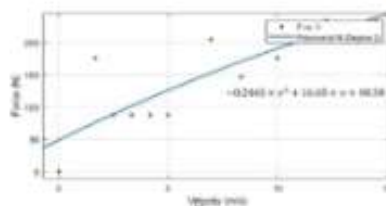


Figure 10: Graph plotted between total force and vehicle velocity

Experimental Procedure for calculating vehicle total resistance

Coast down test

- Coast down test is a test that can be conducted to calculate the Resistance equation.
- By conducting this test we can derive th

[https://www.researchgate.com/publication/318111111/figure/fig/1/figure-pdf/fig1.png?at=1](#)

Reuse – Second life

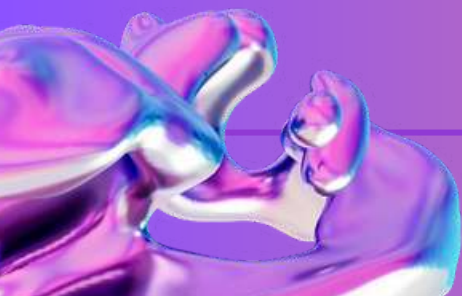


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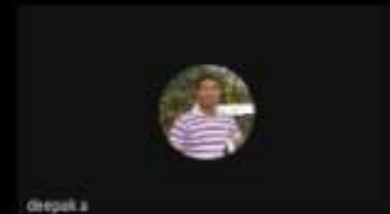
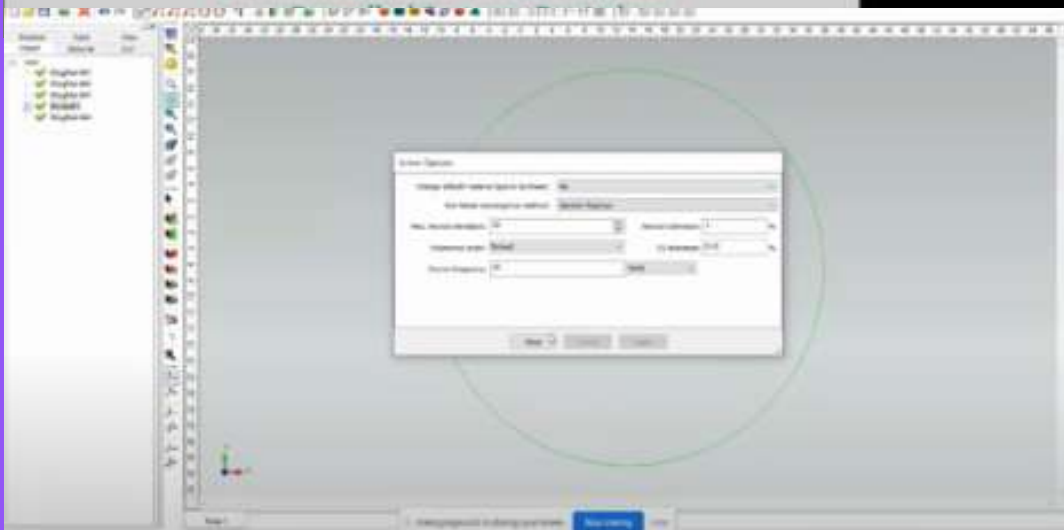


**Session-3:
Expert lecture by
Dr.A.Deepak,
EM Design Engineer,
ePropelled systems Pvt Ltd.**

**EV drive motor design aspects
- Hands on session using
MAGNET software**

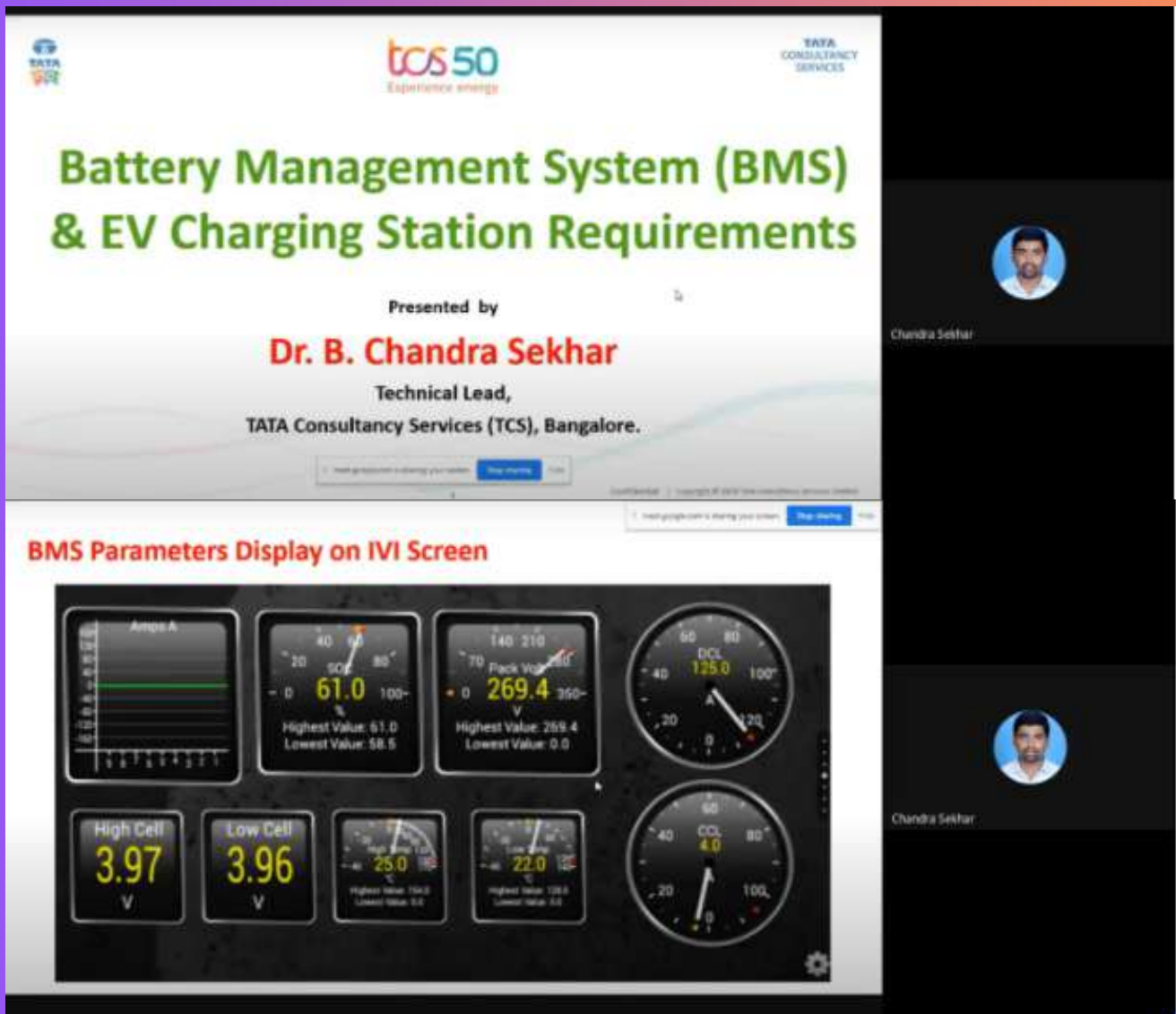


**By
Dr.A.Deepak
Electromagnetics - Design Engineer**



DAY - 2 (09.02.2021)

Session-1:
Expert lecture by
Dr.B.Chandra Sekhar, Technical Lead,
Tata Consultancy Services,
Bangalore

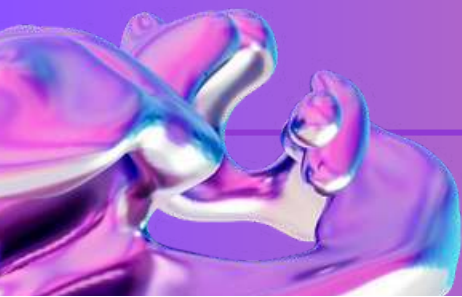


**Battery Management System (BMS)
& EV Charging Station Requirements**

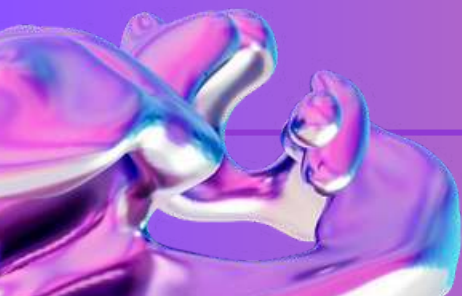
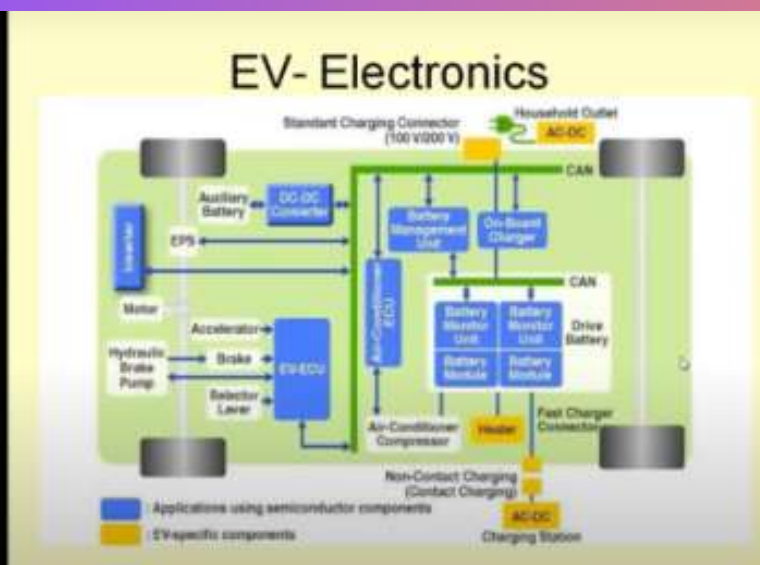
Presented by
Dr. B. Chandra Sekhar
Technical Lead,
TATA Consultancy Services (TCS), Bangalore.

BMS Parameters Display on IVI Screen

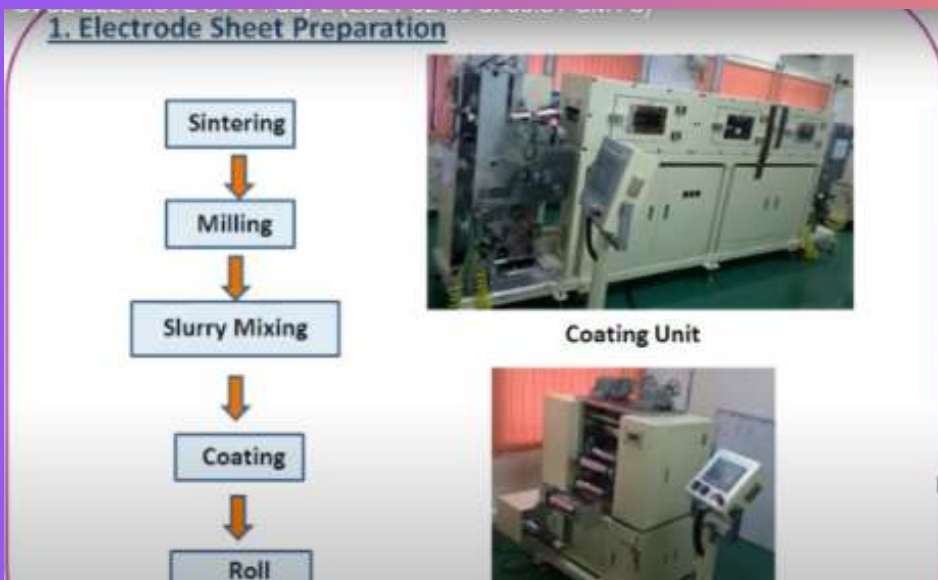
Parameter	Value	Highest Value	Lowest Value
SOX	61.0	61.0	58.5
Pack Vol	269.4	269.4	0.0
DCL	125.0	-	-
High Cell	3.97	-	-
Low Cell	3.96	-	-
High Temp	25.0	150.0	0.0
Low Temp	22.0	120.0	0.0
CCL	4.0	-	-



Session-2:
Expert lecture by
Dr K.Rathnakannan,
Asso. Prof. Department of EEE,
College of Engineering, Guindy,
Anna University,
Chennai



Session-3: Expert lecture by Dr.S.Sudhakar, Senior Scientist, CSIR - Central Electrochemical Research Institute, Karaikudi



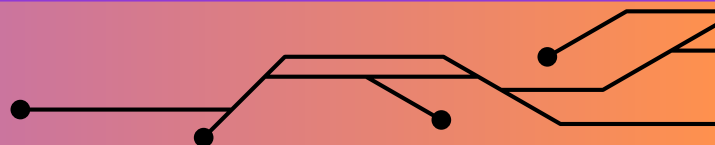
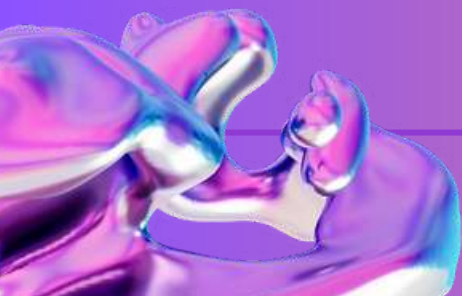
Inside View Of DRY Room



S

Sethakumar Sudhakar

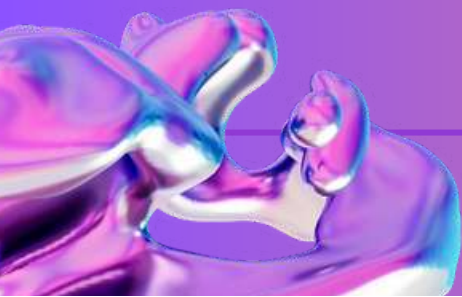
Sethakumar Sudhakar



**Session-3:
Expert lecture by
Dr.S.Sudhakar, Senior Scientist,
CSIR - Central Electrochemical Research Institute,
Karaikudi**



Battery Pack for Electric Cars (Tesla 1S Model)



DAY - 3 (10.02.2021)

**Session-1:
Expert lecture by
Dr.K.Shanti Swarup,
Professor, Indian Institute of Technology
Madras**

"ICTE SPONSORED SIX DAYS SHORT TERM TRAINING PROGRAM (STTP)"
DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
SRI VENKATESWARA COLLEGE OF ENGINEERING CHENNAI
ELECTRIC VEHICLE EVOLUTION- IMPACT ON POWER GRID
10th Feb 2021

Electric Vehicle and Power System Operation and Control - A Perspective

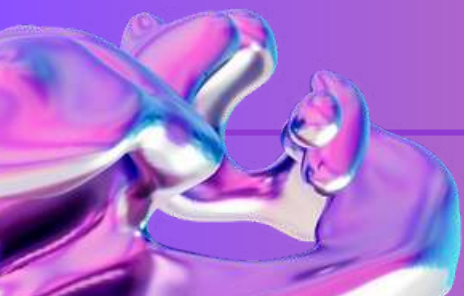
K. Shanti Swarup
Department of Electrical Engineering
IIT Madras, Chennai

INDIAN INSTITUTE OF TECHNOLOGY MADRAS
DEPARTMENT OF ELECTRICAL ENGINEERING
February 10, 2021

Latest Recent Apple EV

**Apple is the powerful Smart phone till date
Imagine what will happen to the Apple car.
Which New technologies will be used**

February 10, 2021



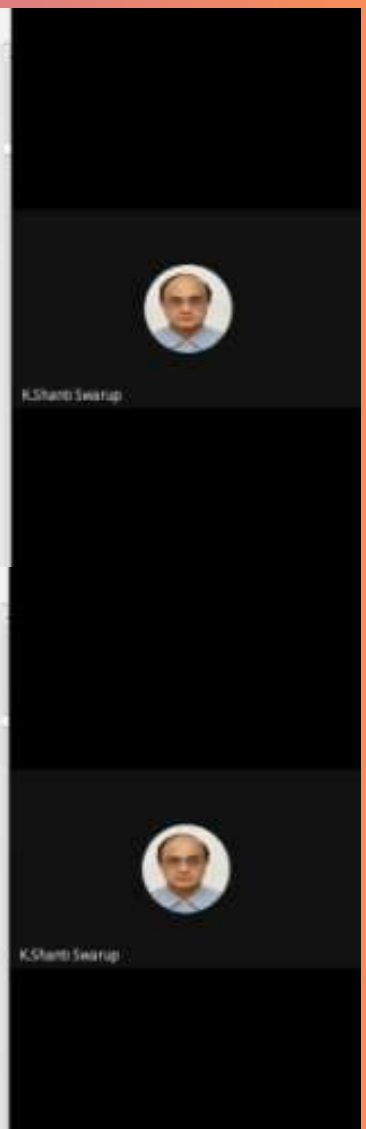
Session-1: Expert lecture by Dr.K.Shanti Swarup, Professor,Indian Institute of Technology Madras

EVS: Charging Demand Forecasting

Transformation and Mapping of Monthly Trips of EVs to daily Trips
Forecasting of Trips of EVs to Total Charging Demand
Aim: To Determine the **duration** and **timing of peak load**.

FRAMEWORK FOR V2V EV CHARGING

The slide contains two main parts. The top part, 'EVS: Charging Demand Forecasting', shows a line graph of 'Number of Trips' over 30 days, with peaks for 'Weekdays', 'Weekends', and 'Holidays'. An arrow points to a second graph showing 'Number of Trips' over 24 hours for 'Weekdays', 'Weekends', and 'Holidays'. Below this is a graph of 'Total Charging Demand Load (kW)' over 24 hours, with peaks for 'AP', 'MLP', and 'EPP'. The bottom part, 'FRAMEWORK FOR V2V EV CHARGING', is a schematic diagram showing a 'Distribution grid LV network' connected to a 'Substation' and a 'Transformer'. It illustrates 'V2V' charging between 'Smart homes' and a 'Parking lot'.



Session-2: Expert lecture by Dr.S.Kumaravel, Asso. Prof., EEE Dept., National Institute of Technology, Calicut

Dual-Input Super Boost (DISB) DC-DC Converter

Solar powered vehicle with a conventional converter configuration

Solar powered vehicle with the proposed converter configuration

Key features of the proposed converter structure

- ✓ Six modes of operations
- ✓ Input source can provide the power to load as well as charge / discharge the other source (battery) from the same PV
- ✓ Low components count, lesser weight and low cost

Ref: G. Geetha Kumar, Karthikeyan S., Sureshbabu A. and Edithyashan, "A Novel Dual Input Super Boost DC-DC Converter for Solar Powered Electric Vehicles", IET Electric Electronics vol. 13 no. 10 pp. 2770-2782

Implementation of DISB Converter

- An experimental prototype has been fabricated in the laboratory environment
- The converter prototype is tested with two different voltage levels for the validation of experimental setup with the simulation results
- The switching pulses are generated using TEKTRONIX APG1022 pulse generator with a switching frequency of 20 kHz
- The parameters for the experimental validations are given in Table and, the switches with diode are realized by SKM75GB12V IGBT modules

Laboratory experimental setup of DISB

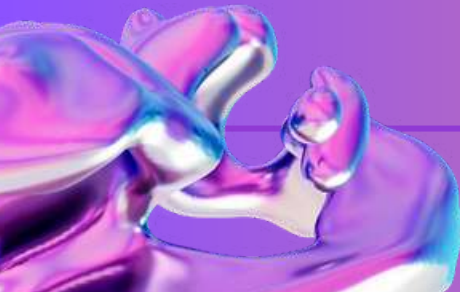
Parameters	Specifications
Source (P ₁)	110 V
Source (P ₂)	72 V
Capacitor	470 μF
Inductor	2 mH
Switching Frequency	20 kHz



Kumaravel S



Kumaravel S

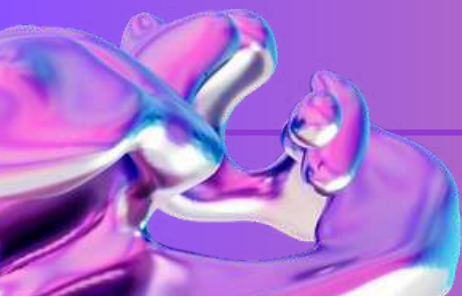
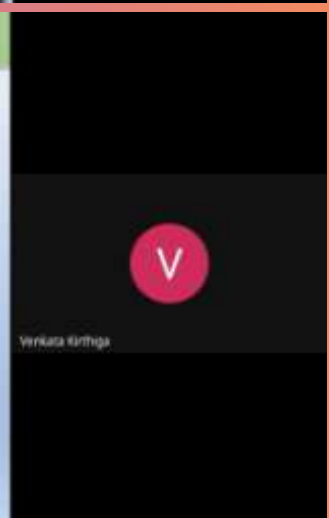
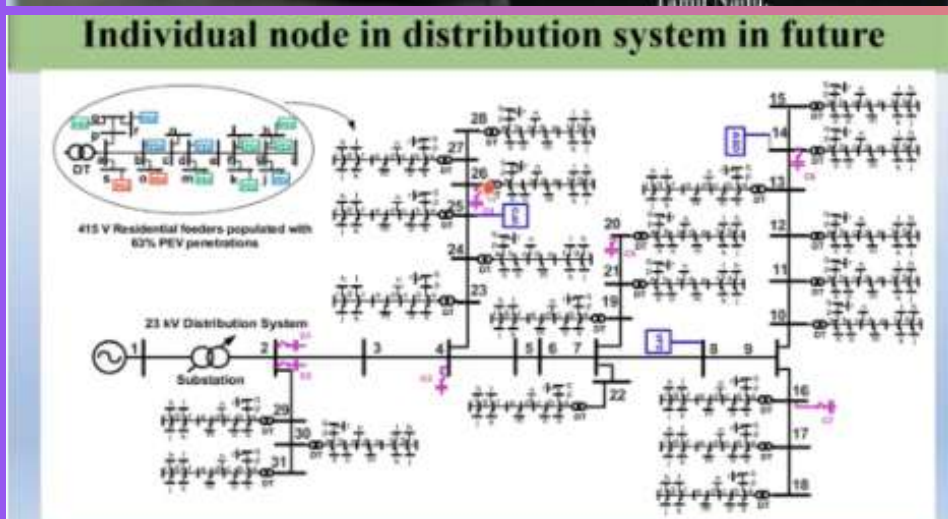


Session-3: Expert lecture by Dr.Venkatakirthiga, Asso. Prof., EEE Dept., National Institute of Technology, Trichy

EVs in De-regulated Power Systems



Dr. M. Venkata Kirthiga
Associate Professor
Department of EEE
National Institute of Technology Tiruchirappalli
Tamil Nadu.



DAY - 4 (11.02.2021)

Session-1:
Expert lecture by
Dr.P.Raja, Asso. Prof., EEE Dept.,
National Institute of Technology,
Tiruchirappalli

DC Short-circuit analysis

The slide illustrates a DC power system with a utility grid, a DC converter, and a DC line. It shows the current i_{DC} and voltage V_c during a short-circuit event. Two important states are identified: Natural response and Forced response.

The graphs show current i_{DC} (Amps) and voltage V_c (V) over time. Key time points t_{cr} and t_{sc} are marked. The text "select the point" is written on the graphs.

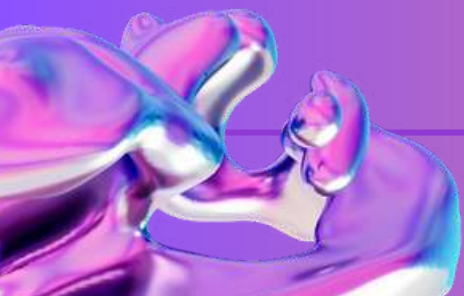
Protection Methods in DC Micro-grids*

✓ Local protection methods

The slide includes a flowchart for local protection methods and a diagram of a micro-grid system. The flowchart steps are:

- Measure line current
- Estimate $\Delta i = i_k - i_{k-1}$
- Decision: $\Delta i > \Delta i_{lim}$ (YES/NO)
- Decision: $\Delta i < \Delta i_{lim}$ (YES/NO)
- Estimate $\Delta V = \Delta V_k - \Delta V_{k-1}$
- Decision: $\Delta V > \Delta V_{lim}$ (YES/NO)
- NO Trip (if YES)
- Issue Trip Signal to Breaker (if YES)

The diagram shows a micro-grid with PV Array, Battery, and Inverter connected to a DC bus, which is then connected to a DC line.



Session-2: Expert lecture by Dr.V.Saravanan, Professor, EEE Dept., Arunai Engineering College

Selection of Battery

- High Power/Energy density
- Toxicity, Thermal capability
- Cycle/Service life
- Small size and light weight
- Safety and Cost

Energy source	Specific energy (Wh/kg)
Gasoline	12100
Natural gas	4700
Methanol	4200
Hydrogen	12000
Coal	8200
Lead acid battery	30
Nickel-metal hydride battery	80
LiMnO ₂ polymer battery	1200
LiMnO ₂ ion battery	150
Redox sulfur battery	190-200
Ultra capacitor	5-5

Sr. No.	Parameters	Lead Acid	NiCd	NiMH	Li-Ion
1	Energy Density (Wh/Kg)	30-50	45-80	60-120	120-260
2	Power Density (W/Kg)	150-400	80-150	200-300	600-800
3	O.C. Voltage/Cell (V)	2.125	1.3	1.35	4.2
4	Temperature Range (in °C)	-20 to +60	-40 to +60	-20 to +60	-30 to +60
5	Cycle Life (Charge-discharge)	200-300	1500	300-500	500-1000

27



1. Battery (Cont..)

EV Battery pack

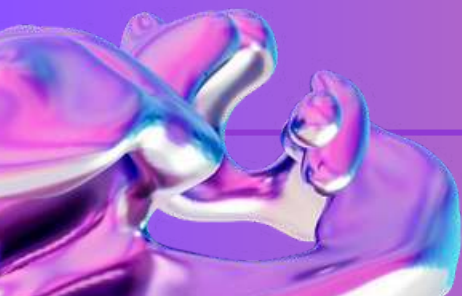


Tesla Battery pack

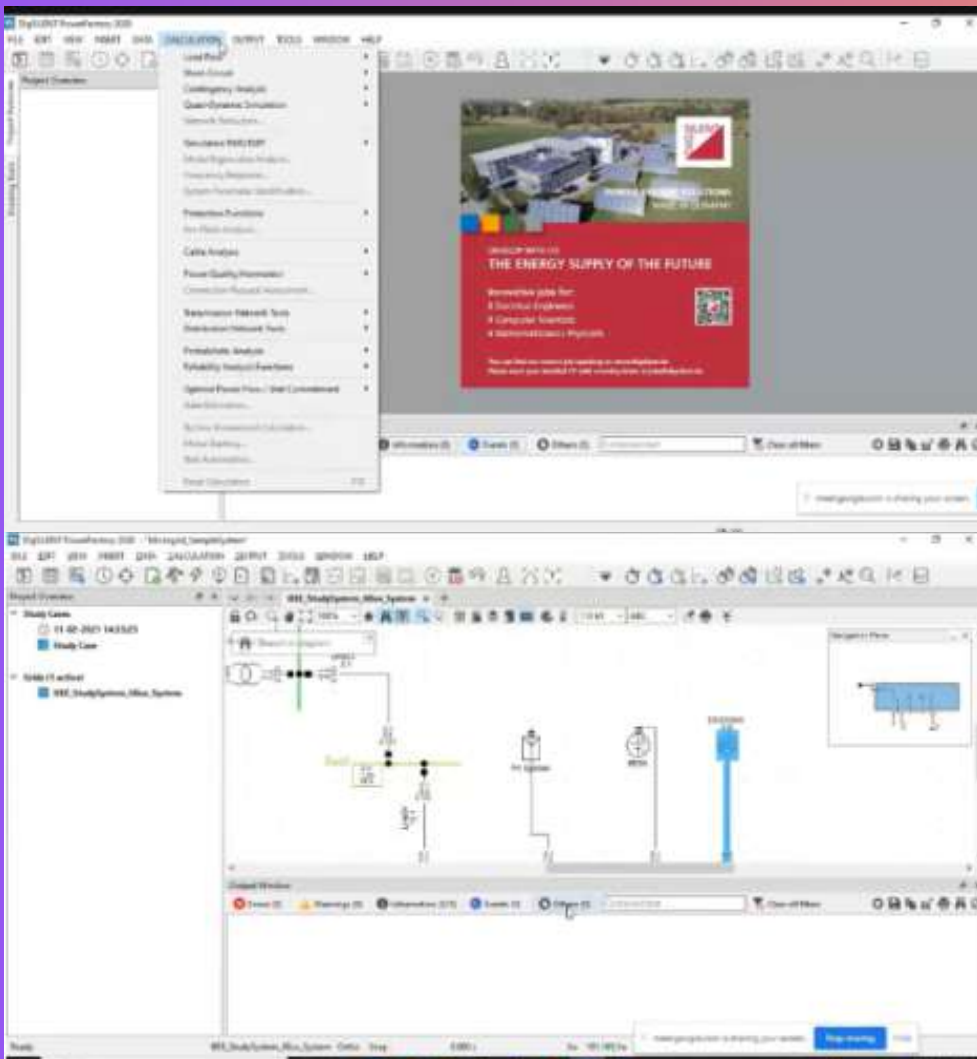


Nissan Battery pack

38

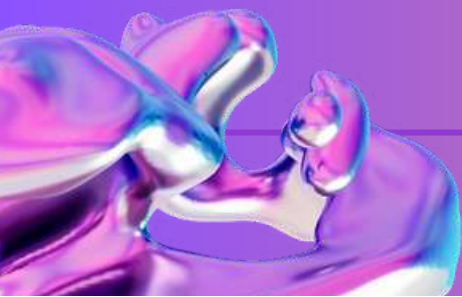
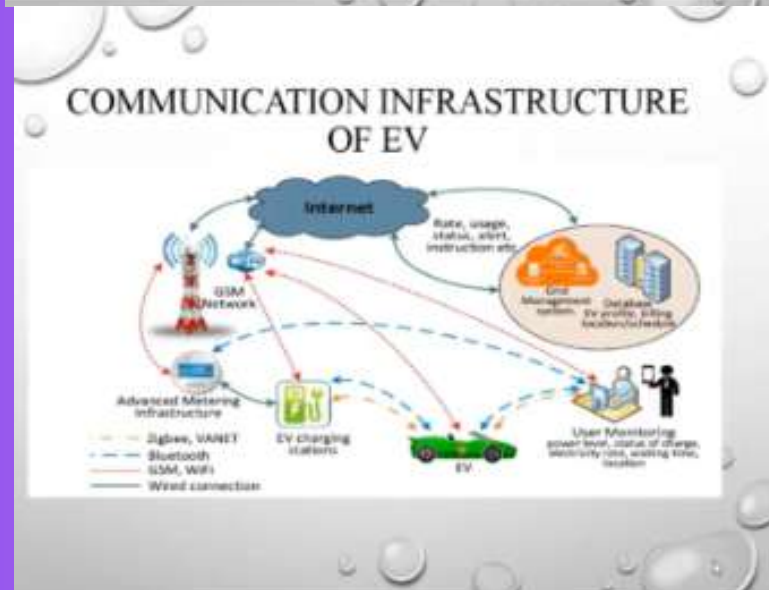
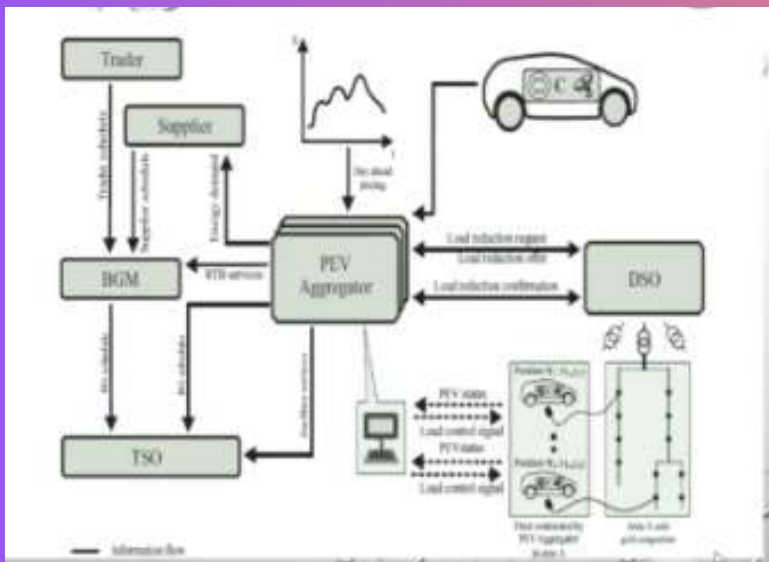


Session-3: Expert lecture and hands-on training by Dr.D.Maharajan, Asso. Prof., EEE Dept., SRM University



DAY - 5 (12.02.2021)

Session-1:
Expert lecture by
Dr.V.Gomathi, Asso. Prof., EEE Dept,
Anna University,
Chennai



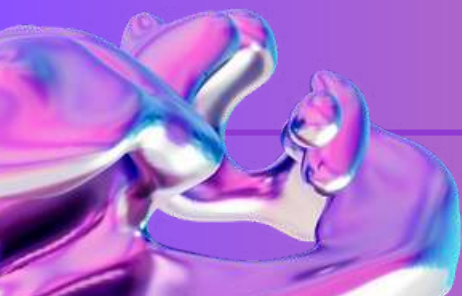
Session-2: Expert lecture by Dr. R.Jayashri, Professor, School of Electrical Engineering and Telecommunications, UNSW SYDNEY, AUSTRALIA

Progression of the Power Grid

Experiment in High Power AC

Labels in the experiment image:

- PV Emulator
- Oscilloscope
- Programmable Load
- PV Inverter
- Supply from Grid
- Battery Inverter
- BUS
- Measurement Probe
- Battery, PV Management Unit
- Battery
- Circuit Breaker



DAY - 6 (13.02.2021)

Session-1: Expert lecture by Mr.S.Jayakrishnan, General Manager, Hyundai Motor India Ltd

The rapid automobile market change has already began...

Shared Mobility

Sharing economy "Owner" to "Use"

Electrification

Expansion of "eco-friendly vehicles" with strong environmental regulations (CO₂)

Connectivity

Automotive ICT-based "vehicle to Everything"

Autonomous

"Artificial Intelligence" of automobiles in progress

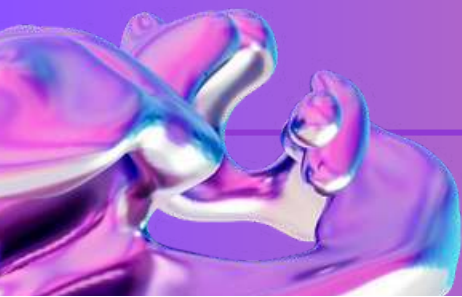
Post COVID, Uncertainty in the automobile industry has increased, but it won't be able to change the 'flow to the future'

Battery Cell Standardization

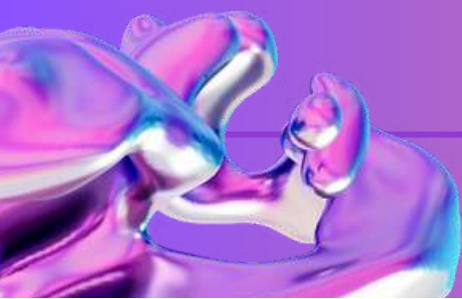
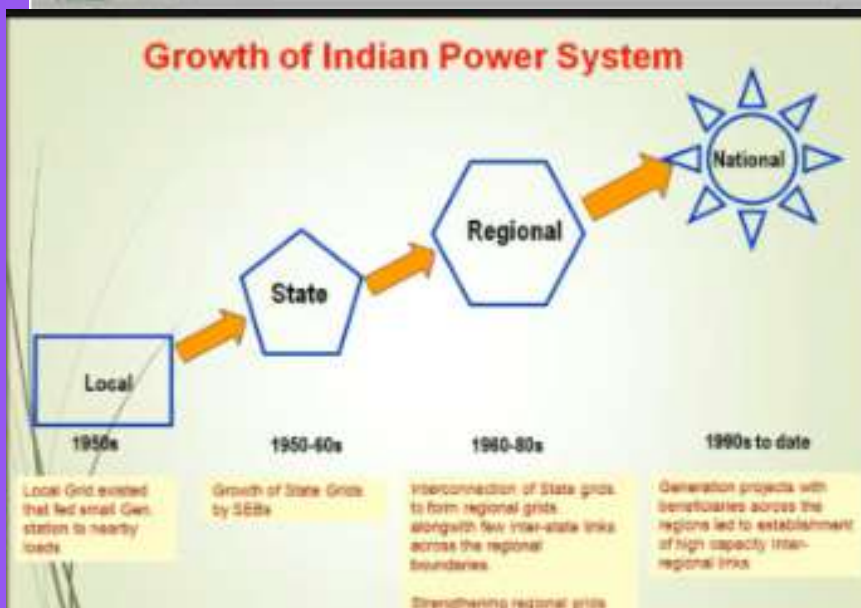
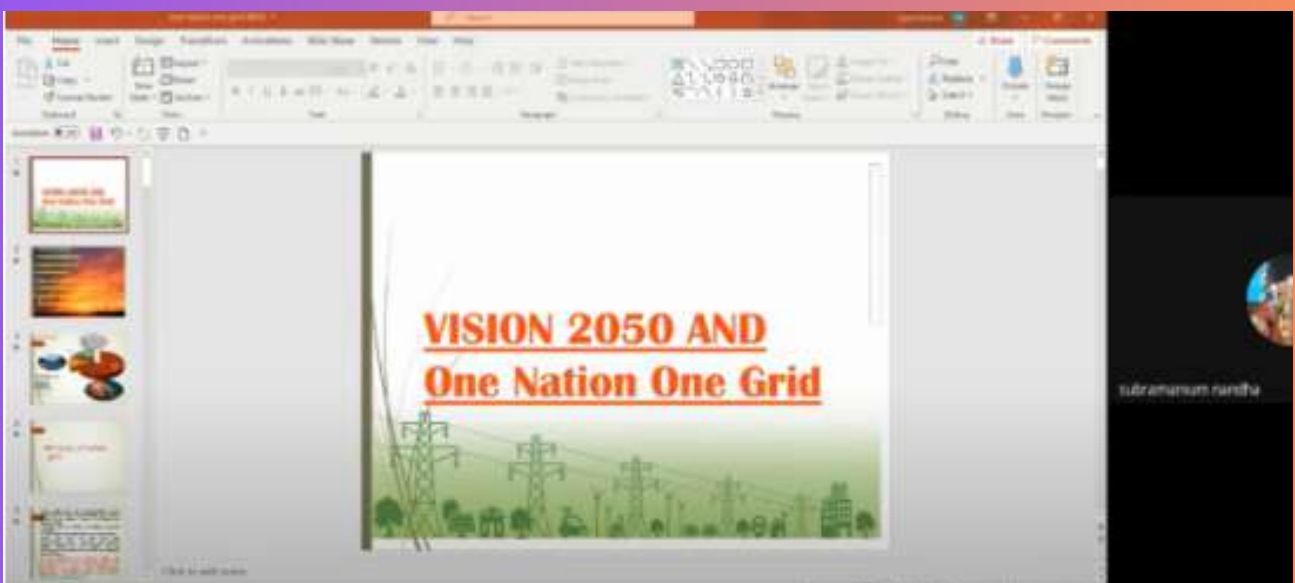
- The concept of battery cell standardization is proposed to reduce the battery cost of the electric vehicle by using the common battery cell.
 - Battery cost is about 30-40% of EV Price
- There are many issues with battery standardization.
 - Restriction on Package / Design / Vehicle performance etc.
 - When developing vehicles according to the battery, it is difficult to differentiate performance / design.
- Therefore, battery cell standardization is mandatory after 2020 for battery reduction

Hyundai Battery Package

Other OEM's EV Battery Package

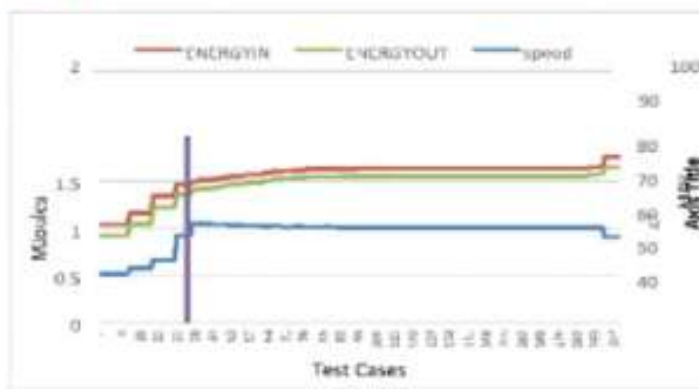


Session-2 (postponed session 3 of Day-5): Expert lecture by Mr.Nandhakumar, Design Engineer, Power Grid Corporation of India

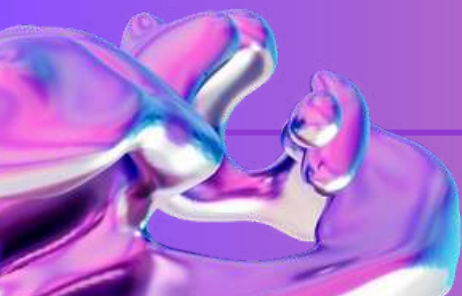
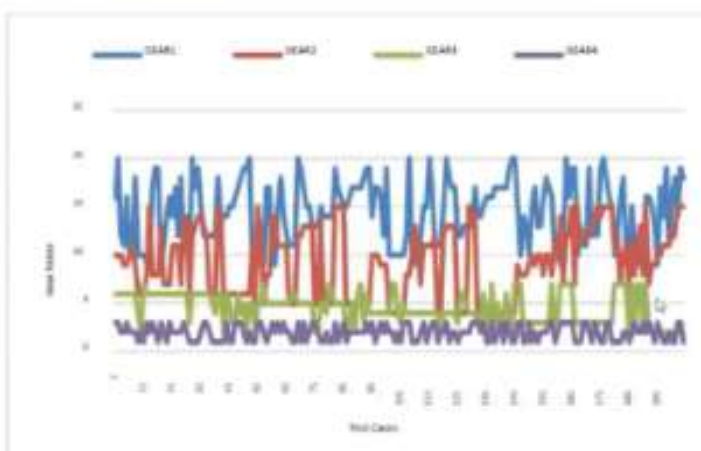


Session-3: Expert lecture by Dr.C.Christober Asir Rajan, Professor, EEE Dept , Pondicherry Engineering College

Sorted Test Cases with Step Input for Energy In (ENERGYIN), Energy Out (ENERGY OUT)



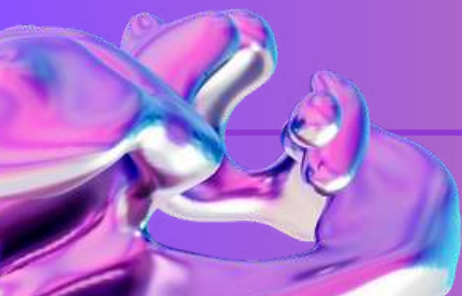
Gear Ratios vs. Test Cases with UDDS



Session-4: Expert lecture and hands-on training by Dr.V.P. Boopathi, Sr. Appn. Engineer, PWSIM Engg. Solns Pvt Ltd.

The image is a composite of three main parts:

- Top Left:** A presentation slide titled "Flexibility in Vehicle". It compares "Old Style" (a 3D cutaway of a traditional engine) with "New Style" (a 3D cutaway of an electric motor). Below this are images of various EV charging stations. Logos for "EMTP" and "pwsim" are visible at the bottom.
- Bottom Left:** A screenshot of a software interface. The title is "DETAILED MODEL OF A 3 PHASE EV CHARGER CONTROLLED BY PWM VOLTAGE CONTROLLER". It shows a circuit diagram with a 3-phase supply, a bridge rectifier, a DC-link capacitor, and an inverter connected to an EV battery. A "Scenarios" list includes: 1. 00000: The battery 400V of charge (SOC) is 94.50%, 2. From 0 to 2 seconds, the battery starts to charge, 3. At 2 seconds, the charge of the battery is stopped, 4. Around 7 seconds, the battery SOC is 50% (the higher SOC, the higher charging).
- Right Side:** Two vertical video call windows showing a man in a blue shirt and glasses, identified as Dr. V.P. Boopathi, speaking.





Department of Electrical & Electronics Engineering

Solicit your Esteemed Presence for the

INAUGURAL FUNCTION

of

AICTE sponsored six days online Short Term Training Programme (STTP) on

**“ELECTRIC VEHICLE EVOLUTION - IMPACT ON
POWER GRID”**

22nd March 2021, 09.30 AM

Er.C.Veeramani,

Chief Engineer Regulatory Cell (Retired),

TANGEDCO

will inaugurate and deliver the inaugural address

Dr.S.Ganesh Vaidyanathan,

Principal, Sri Venkateswara College of Engineering

will preside over the function





PHASE 2 SCHEDULE: MARCH 22ND TO 27TH 2021

22.03.2021

SESSION 1

EXPERT LECTURE

Expert: Dr.Veeramani
Chief Engineer (Retd),
TANGEDCO

09:30
AM

SESSION 2

EXPERT LECTURE

Dr.S.Sankara Narayanan,
General Manager, Tamilnadu Energy
Development Agency,
Govt. of Tamilnadu

11:15
AM

SESSION 3

EXPERT LECTURE

Expert : Dr.Nalin Kant Mohanty
Professor, EEE Dept,
SVCE.
Expert : Dr.Bharathidasan
Professor, EEE Dept,
SVCE.

02:00
PM



PHASE 2 SCHEDULE: MARCH 22ND TO 27TH 2021

23.03.2021

SESSION 1

EXPERT LECTURE

09:30
AM

Expert: Dr.B.Chandra Sekhar,
Technical Lead,
Tata Consultancy
Services, Bangalore.

SESSION 2

EXPERT LECTURE

11:15
AM

Expert : Dr S. Kalpana
Asst. Professor, Madras Institute of
Technology, Chrompet.
Anna University, Chennai.

SESSION 3

EXPERT LECTURE

02:00
PM

Dr.S.Sudhakar,
Senior Scientist,
CSIR - Central Electrochemical Research
Institute,
Karaikudi



PHASE 2 SCHEDULE: MARCH 22ND TO 27TH 2021

24.03.2021

SESSION 1

EXPERT LECTURE

09:30
AM

Expert: Dr.P.Raja,
Asso. Prof., EEE Dept., National
Institute of Technology,
Tiruchirappalli

SESSION 2

EXPERT LECTURE

11:15
AM

Dr.S.Kumaravel,
Asso. Prof., EEE Dept.,
National Institute of Technology,
Calicut

SESSION 3

EXPERT LECTURE

02:00
PM

Expert: Dr. S.Chandramohan
Prof. & HOD/EEE Dept.,
College of Engineering, Guindy, Anna
University,
Chennai.



PHASE 2 SCHEDULE: MARCH 22ND TO 27TH 2021

25.03.2021

SESSION 1

EXPERT LECTURE

09:30

AM

Expert: Dr. R.P.Kumudini Devi, Professor,
College of Engineering,
Guindy.
Anna University, Chennai-25

SESSION 2

EXPERT LECTURE

11:15

AM

Expert: Dr.V.Saravanan,
Professor, EEE Dept.,
AEC.

SESSION 3

EXPERT LECTURE

02:00

PM

Dr.A.Deepak, EM Design Engineer,
ePropelled systems Pvt Ltd.



PHASE 2 SCHEDULE: MARCH 22ND TO 27TH 2021

26.03.2021

SESSION 1

EXPERT LECTURE

09:30
AM

Expert: Dr. R.Jayashri, Professor,
School of Electrical Engineering and
Telecommunications, UNSW
SYDNEY, AUSTRALIA.

SESSION 2

EXPERT LECTURE

11:15
AM

Expert: Dr.N.Sivakumar,
Global Technical lead,
Rolls-Royce,
Singapore

SESSION 3

EXPERT LECTURE

02:00
PM

Dr.D.Maharajan,
Asso. Prof., EEE Dept.,
SRM University



PHASE 2 SCHEDULE: MARCH 22ND TO 27TH 2021

27.03.2021

SESSION 1

EXPERT LECTURE

09:30
AM

Expert: Mr.B.Saravanan,
Lead-Traction control, Alstom,
Bangalore

SESSION 2

EXPERT LECTURE

11:15
AM

Expert: Dr.P.Somasundaram
Prof./EEE Dept., College of
Engineering, Guindy, Anna
University, Chennai.

SESSION 3

EXPERT LECTURE

02:00
PM

Dr.V.P. Boopathi,
Sr. Appn. Engineer, PWSIM Engg. Solns Pvt
Ltd

SESSION DETAILS PHASE - II

**DAY - 1
(22.03.2021)**

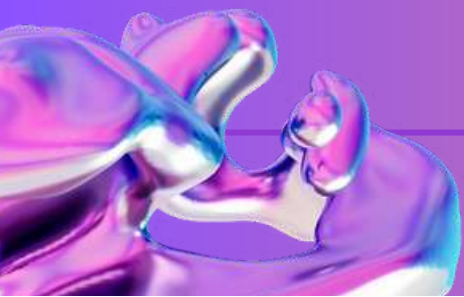
**Inauguration and Session-1
expert lecture by
Dr.Veeramani,
Chief Engineer (Retd),
TANGEDCO**

Different Types of Charging Technologies Followed in India

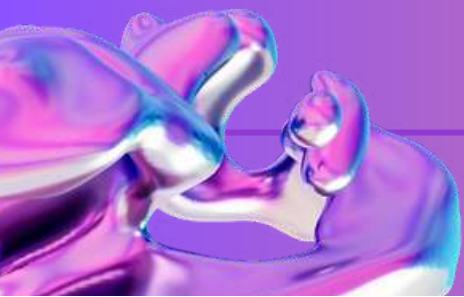
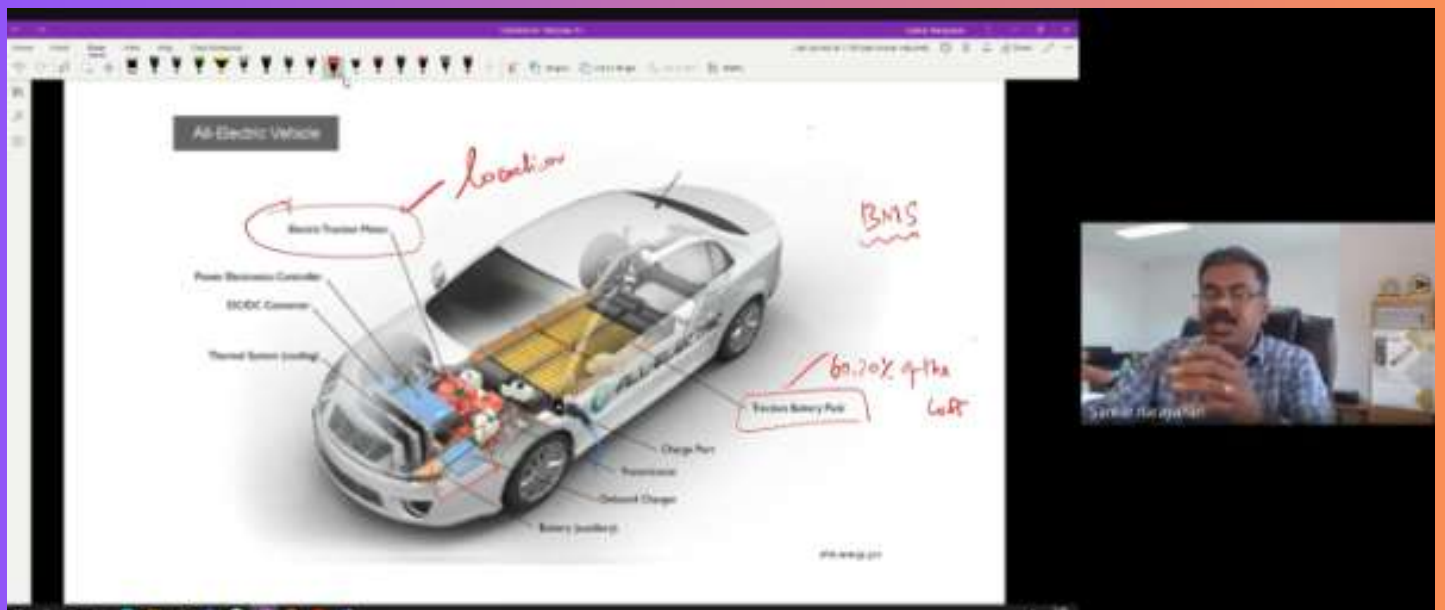
(a) AC charging station uses an onboard charger inside an EV

(b) A DC charging station directly charges the EV battery

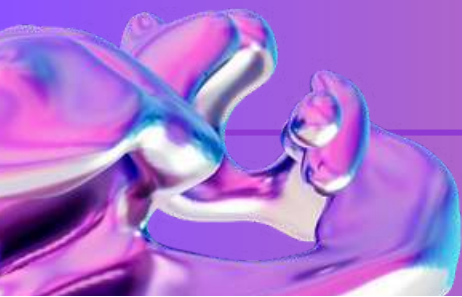
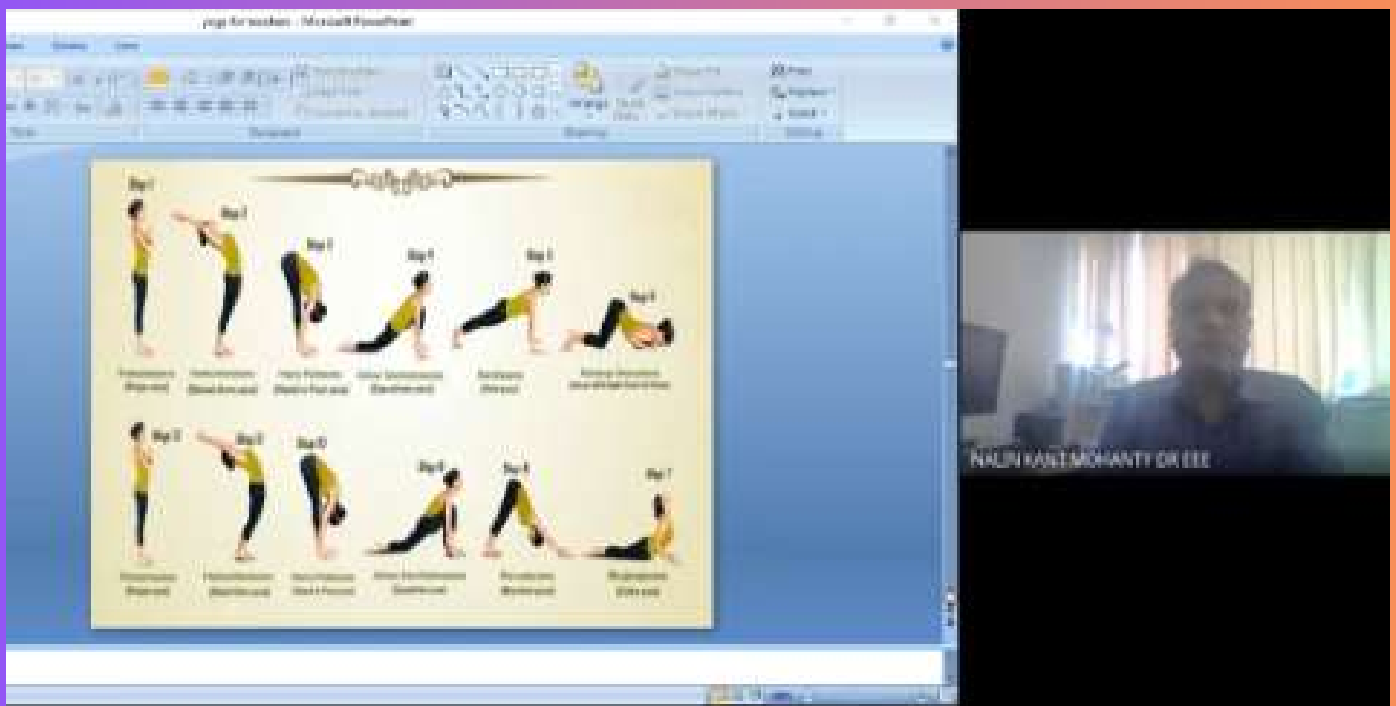
V
Veeramani Chinnakkannu



Session-2: Expert lecture by Dr. Sankara Narayanan, Professor & Head EEE Dept., National Institute of, Technology, Tiruchirappalli



Session-3: Expert lecture and online practice by Dr.Nalin Kant Mohanty Professor, EEE Dept, SVCE



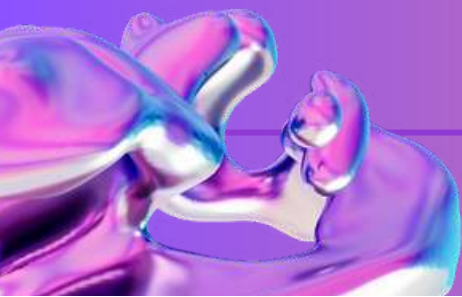
DAY - 2
(23.03.2021)

Session-1:
Expert lecture by
Dr S. Kalpana,
Asst. Professor,
Madras Institute of Technology,
Chennai

FAULT DIAGNOSIS IN FAST CHARGING BATTERY

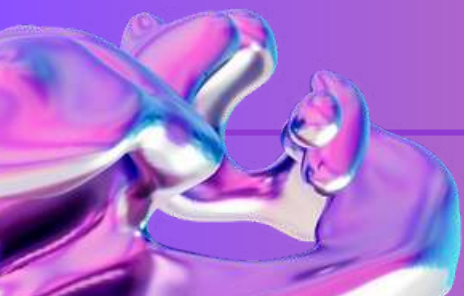
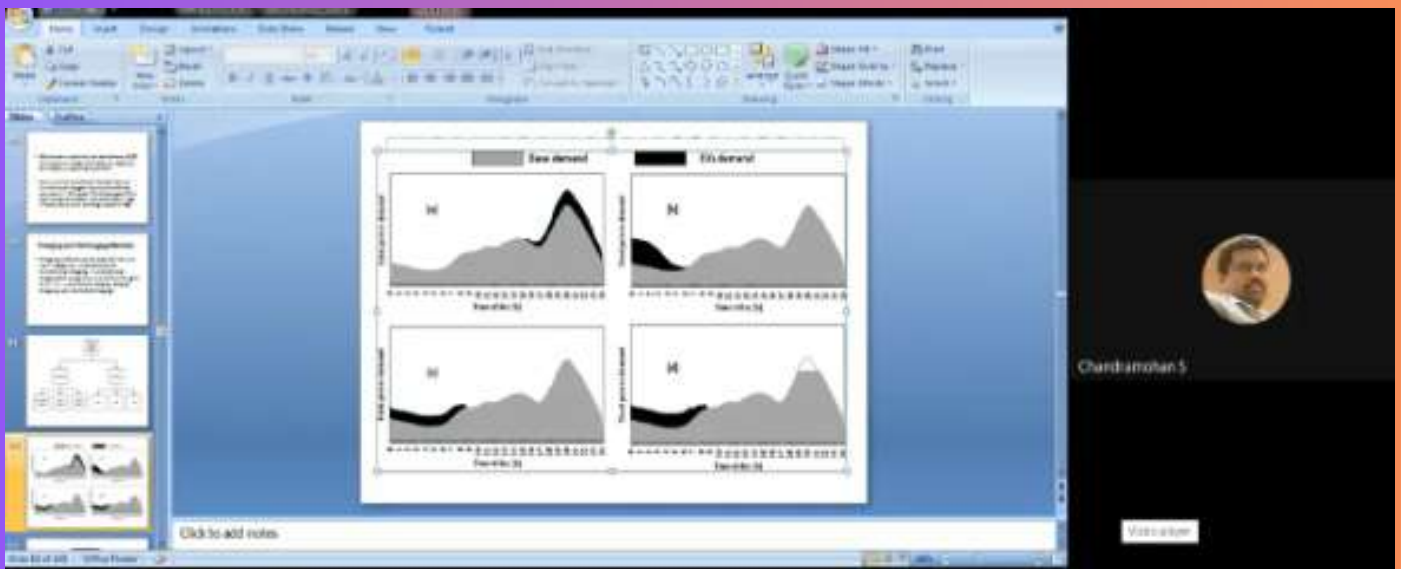
- Bias fault occurs in Fast charging battery system can be diagnosed by estimating the battery parameters such as charging time constant and internal resistance of the battery using **Adaptive Unscented Kalman Filter (AUKF)**.
- The standard deviations of the estimated battery parameters are compared with threshold values.

Kalpana Dharmalingam



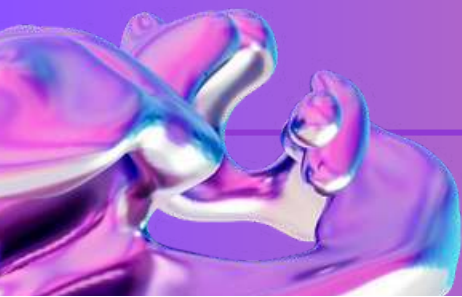
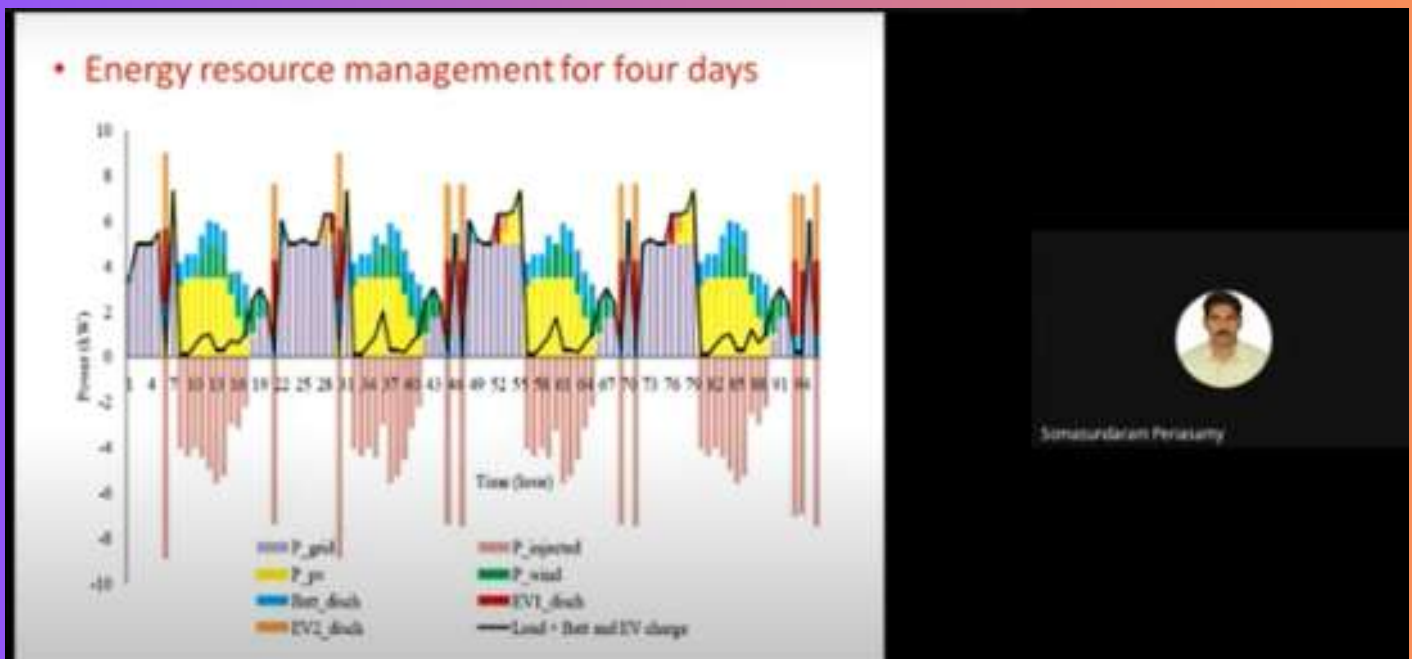
DAY - 3
(24.03.2021)

Session-2:
Expert lecture by
Dr. S.Chandramohan,
Prof. & HOD/EEE Dept.,
College of Engineering, Guindy,
Anna University,
Chennai



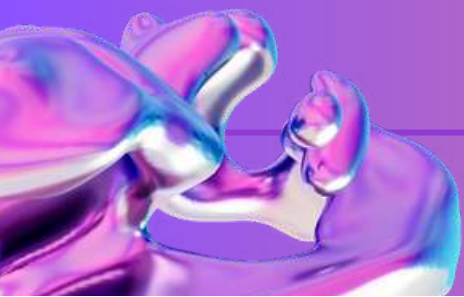
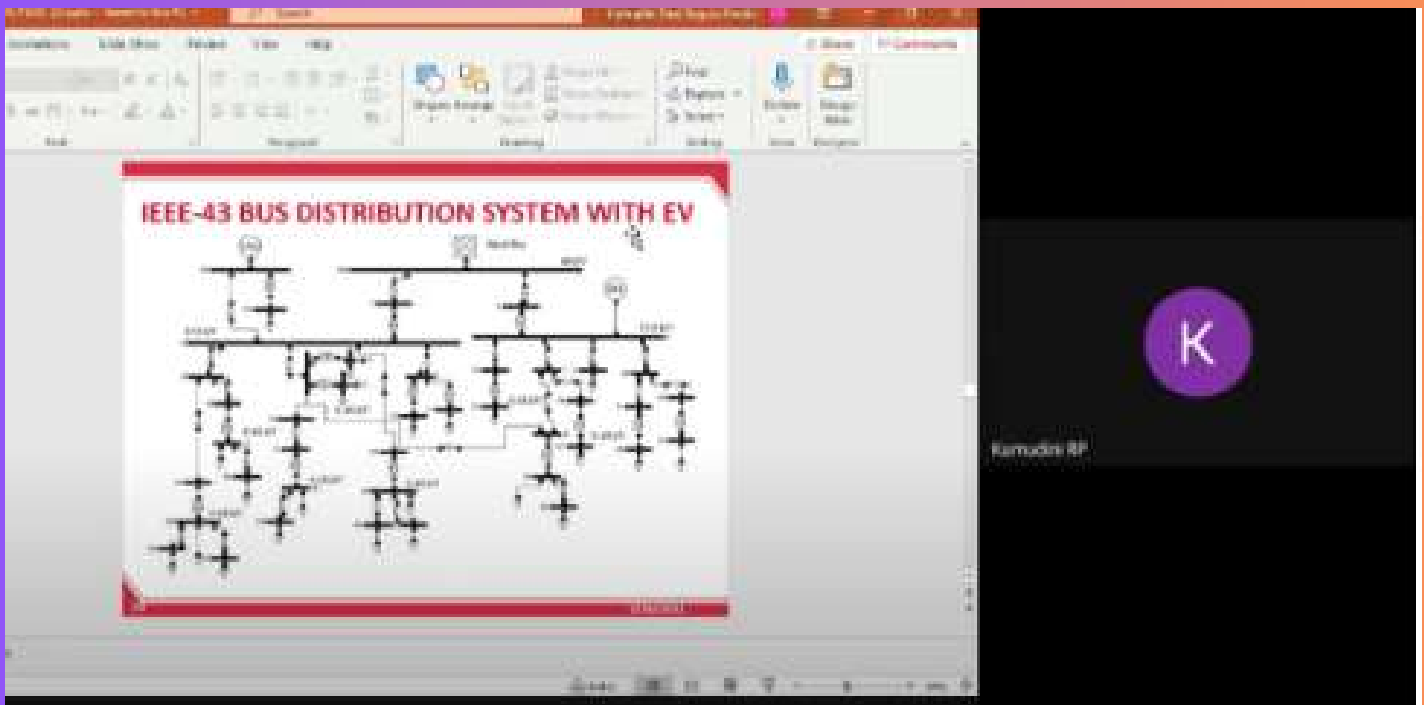
DAY - 4 (25.03.2021)

Session-1 :
Expert lecture by
Dr.P.Somasundaram,
Prof./EEE Dept.,
College of Engineering, Guindy,
Anna University,
Chennai



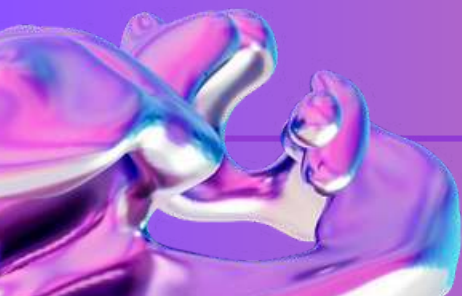
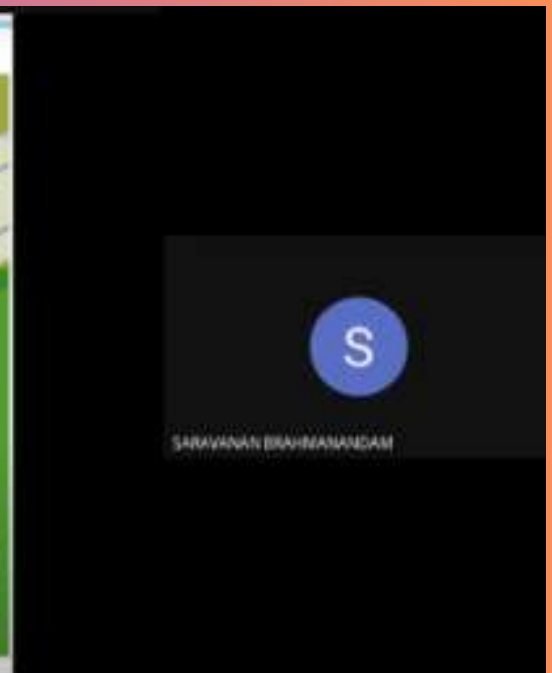
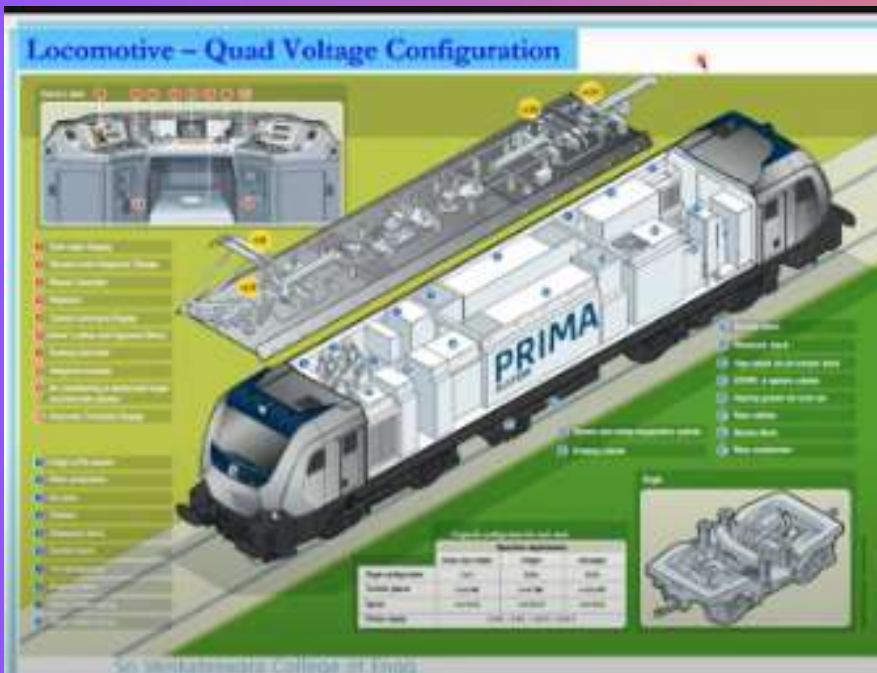
DAY - 5
(26.03.2021)

Session-2 :
Expert lecture by
Dr. R.P.Kumudini Devi,
Professor,
College of Engineering, Guindy,
Anna University,
Chennai



DAY - 6
(27.03.2021)

Session-1:
Expert lecture by
Mr.B.Saravanan,
Lead-Traction control,
Alstom,
Bangalore



Session-2 :

Expert lecture by Dr.N.Sivakumar, Global Technical lead, Rolls-Royce, Singapore

Electric Aircraft

Rolls-Royce eVTOL project

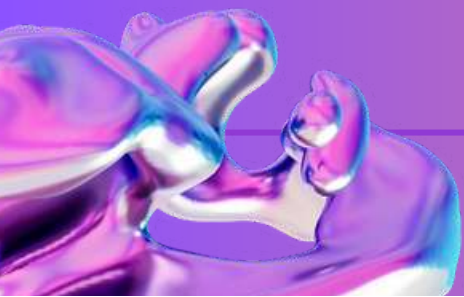
Another vehicle without a name, Rolls-Royce's eVTOL concept was first unveiled at the 2018 Paris-Moscow International Airshow.



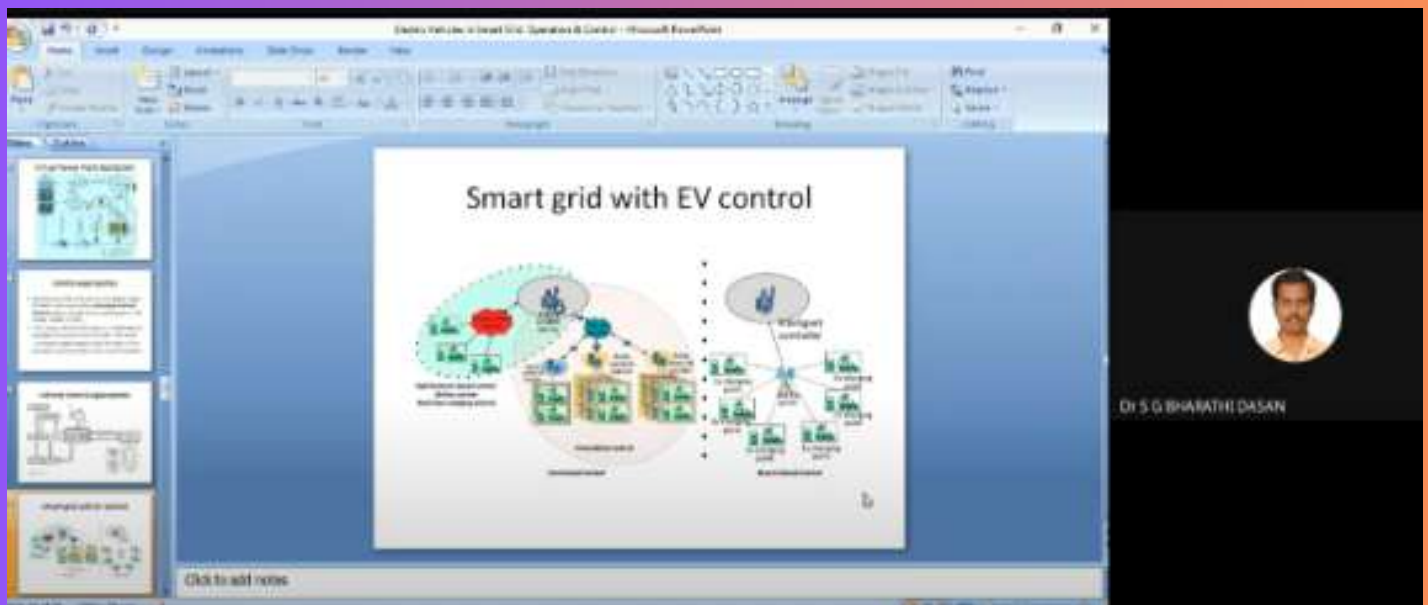
- The vehicle will be hybrid-powered with a modified Rolls Royce M250 gas turbine at the rear of the craft powering six electric propulsors specially designed to have a low noise profile. In this configuration it could carry four or five passengers at speeds up to 250mph for approximately 500 miles and would not require re-charging as the battery is charged by the gas turbine.



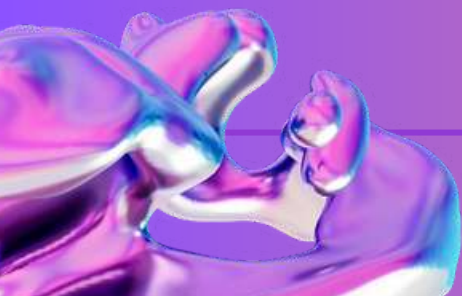
She N



Session-3: Expert lecture by Dr.S.G.Bharathidasan, Asso. Prof., EEE Dept., SVCE



The screenshot shows a presentation slide titled "Smart grid with EV control". The slide features a diagram of a smart grid system. On the left, there is a sub-diagram labeled "Smart Grid" showing a central power source connected to various loads and a "Smart Meter" at the bottom. On the right, there is a sub-diagram labeled "EV Control" showing a central "EV Control" node connected to several "EV" icons. The main diagram shows the integration of these two systems. The presentation is displayed in a Microsoft PowerPoint window. To the right of the slide, there is a circular profile picture of Dr. S.G. Bharathi Dasan and his name "Dr. S.G. BHARATHI DASAN" below it.





Department of Electrical & Electronics Engineering

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INAUGURAL FUNCTION

of

AICTE sponsored six days online Short Term Training Programme (STTP)

on

**“ELECTRIC VEHICLE EVOLUTION - IMPACT ON
POWER GRID”**

19th April 2021, 9.30 AM

Dr.R.Kathiravan,

Executive Engineer, TANGEDCO

will inaugurate and deliver the inaugural address

Dr.S.Ganesh Vaidyanathan,

Principal, Sri Venkateswara College of Engineering

will preside over the function





PHASE 3 SCHEDULE: APRIL 19TH TO 24TH 2021

19.04.2021

SESSION 1

EXPERT LECTURE

Expert: Dr. R. Kathiravan
Executive Engineer,
TANGEDCO.

09:30
AM

SESSION 2

EXPERT LECTURE

Expert: Dr. Sankara Narayanan
Professor & Head
EEE Dept., National Institute of
Technology, Tiruchirappalli

11:15
AM

SESSION 3

EXPERT LECTURE

Expert: Dr. V. Saravanan,
Professor, EEE Dept.,
AEC.

02:00
PM



PHASE 3 SCHEDULE: APRIL 19TH TO 24TH 2021

20.04.2021

SESSION 1

EXPERT LECTURE

09:30
AM

Expert: Dr.B.Chandra Sekhar,
Technical Lead, Tata Consultancy
Services, Bangalore.

SESSION 2

EXPERT LECTURE

11:15
AM

Dr K.Rathnakannan,
Asso. Prof., EEE Dept., Anna University
Chennai.

SESSION 3

EXPERT LECTURE

02:00
PM

Dr.S.Sudhakar,
Senior Scientist,
CSIR - Central Electrochemical Research
Institute,
Karaikudi



PHASE 3 SCHEDULE: APRIL 19TH TO 24TH 2021

21.04.2021

SESSION 1

EXPERT LECTURE

09:30
AM

Expert: Dr.P.Raja, Asso.
Prof., EEE Dept., National
Institute of Technology, Tiruchirappalli

SESSION 2

EXPERT LECTURE

11:15
AM

Dr.S.Kumaravel,
Asso. Prof., EEE Dept.,
National Institute of Technology,
Calicut

SESSION 3

EXPERT LECTURE

02:00
PM

Dr.Venkatakirthiga,
Asso. Prof., EEE Dept.,
National Institute of Technology,
Trichy



PHASE 3 SCHEDULE: APRIL 19TH TO 24TH 2021

22.04.2021

SESSION 1

EXPERT LECTURE

09:30

Expert: Dr.R.Jayashri, Professor, School of
Electrical
Engineering and Telecommunications,
UNSW SYDNEY, AUSTRALIA.

AM

SESSION 2

EXPERT LECTURE

11:15

Expert: Dr.A.Deepak, EM Design Engineer,
ePropelled
systems Pvt Ltd.

AM

SESSION 3

EXPERT LECTURE

02:00

Expert:Mr.Rathnakumar Devaraj,
Industrial &Systems, Development
Engineer,
CE+T Power, Wandre, Belgium.

PM



PHASE 3 SCHEDULE: APRIL 19TH TO 24TH 2021

23.04.2021

SESSION 1 EXPERT LECTURE

09:30
AM

Expert : Dr.V.Gomathi,
Asso. Prof., EEE Dept,
Anna University,Chennai.

SESSION 2 EXPERT LECTURE

11:15
AM

Expert: Dr.N.Sivakumar, Global Technical
lead, Rolls-Royce,
Singapore.

SESSION 3 EXPERT LECTURE

02:00
PM

Dr.D.Maharajan,
Asso. Prof.,
EEE Dept., SRM University



PHASE 3 SCHEDULE: APRIL 19TH TO 24TH 2021

24.04.2021

SESSION 1

EXPERT LECTURE

Expert: Mr.S.Jayakrishnan,
General Manager, Hyundai Motor
India Ltd

09:30
AM

SESSION 2

EXPERT LECTURE

Expert: Dr.R.P.Kumudini Devi, Professor,
College of Engineering,
Guindy.Anna University,Chennai-25

11:15
AM

SESSION 3

EXPERT LECTURE

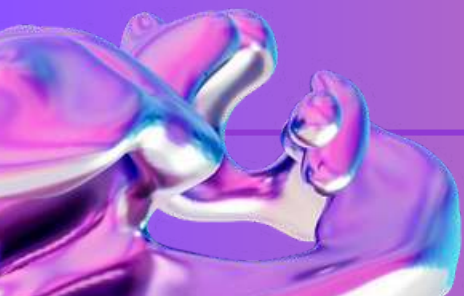
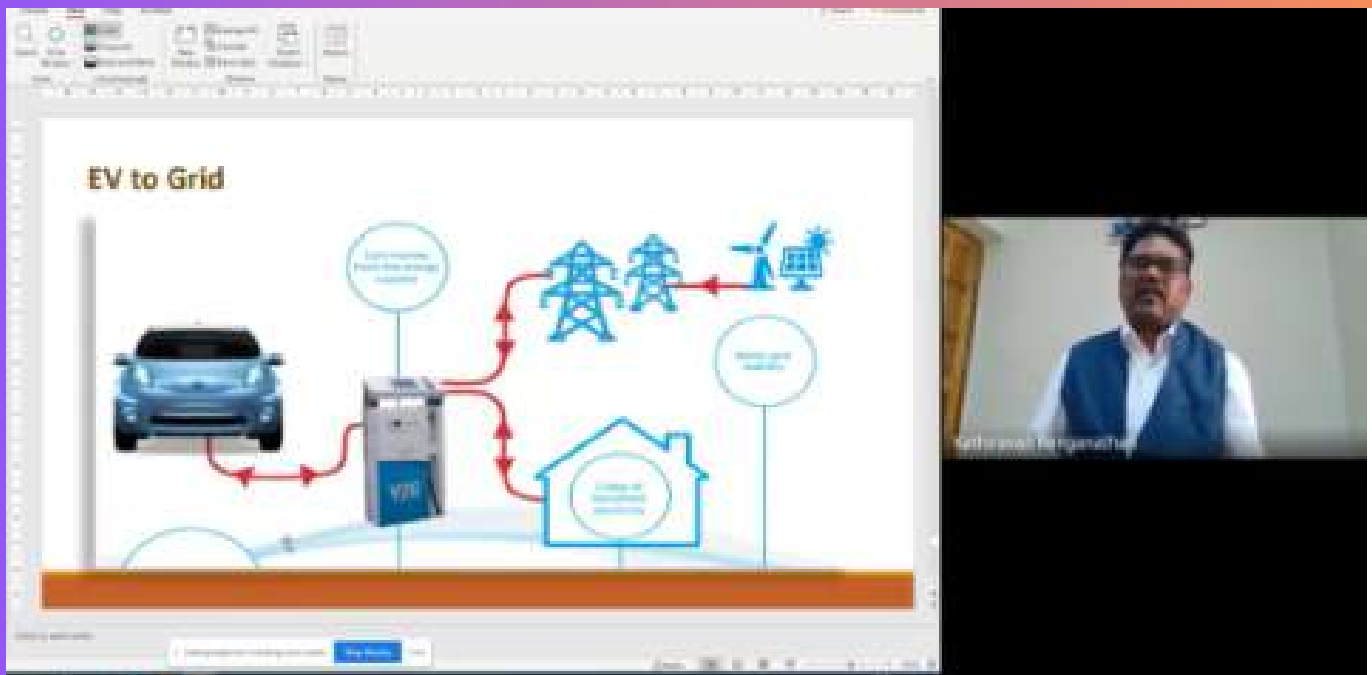
Expert: Dr.V.P.Boopathi
Sr. Appn. Engineer, PWSIM Engg. Solns Pvt
Ltd

02:00
PM

SESSION DETAILS PHASE - III

**DAY - 1
(19.04.2021)**

**Session-1:
Inauguration and
session-1 expert lecture by
Dr.R.Kathiravan,
Executive Engineer,
TANGEDCO**



DAY - 4
(22.04.2021)

Session-3:
Expert lecture by
Mr.Rathnakumar Devaraj,
Industrial & Systems,
Development Engineer, CE+T Power,
Wandre,
Belgium

Recommendation-Smart Charging

SUPPLY

Smart charging enables your electric vehicle to:

- 1. Take the grid load by following supply and demand.
- 2. Avoid the grid when there is a lack of renewable energy supply.
- 3. Charge when there is excess renewable energy supply.

DEMAND

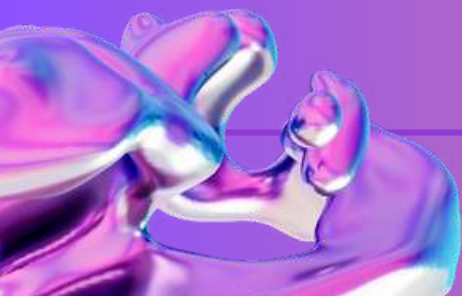
Thanks to smart charging, your electric vehicle can:

- 1. Store solar energy produced throughout the day and use it when needed.
- 2. Integrate with your smart home and appliances.

CE+T POWER

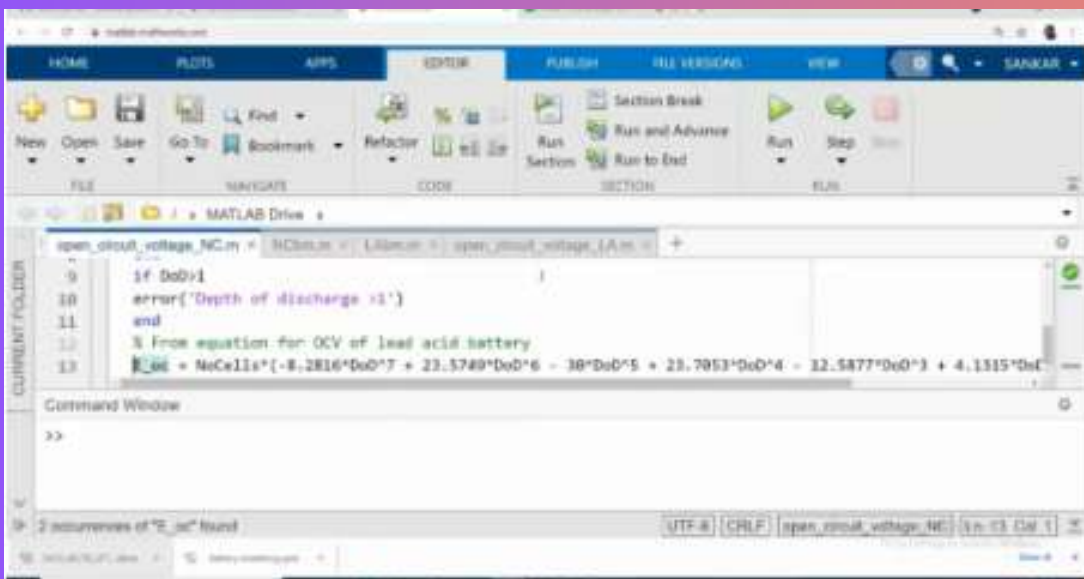
Leading Conversion Technology for Power Resilience

Rathna Kumar



DAY - 6 (24.04.2021)


Session-2: Expert lecture by Dr.M.Sankar, Asst. Prof./EEE, SVCE



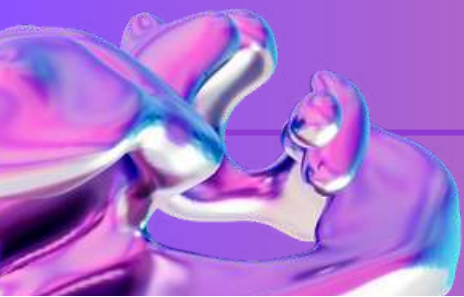
The screenshot displays the MATLAB R2020a environment. The main window shows a script named 'open_circuit_voltage_OC.m'. The code includes a function definition, a comment, and a polynomial equation for the open-circuit voltage (V_OC) based on the depth of discharge (DoD).

```
function V_OC = open_circuit_voltage_OC(DoD)
% Free equation for OCV of lead acid battery
V_OC = NeCells*(-8.2816*DoD^7 + 23.5749*DoD^6 - 30*DoD^5 + 23.7053*DoD^4 - 12.5877*DoD^3 + 4.1315*DoD^2 - 0.0001*DoD + 12.7);
```

The Command Window is empty, showing the prompt '»'. The status bar at the bottom indicates the file encoding is UTF-8 and the current line is 13 of 13.

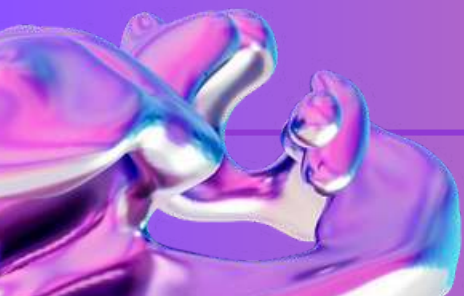


SANKAR M EEE



CONCLUDING REMARKS

The AICTE sponsored STTP on “Electric Vehicle Evolution – Impact on Power Grid” was organized in online mode in three phases with 18 sessions per phase. The STTP phases were inaugurated by dignitaries from Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO). The sessions were handled by expert speakers from industry and academia. The sessions were of expert lectures and hands-on training that facilitated the participants from industry and academia to expertise in concepts related to EV configuration/ components and its interaction with power grid, impact of EV evolution on operation and control of Electrical Power System, charging/discharging of aggregated EV and its impact on micro grid and hands-on training in design and analysis of EV drive motor using MAGNET, simulation of EV with battery energy storage (BES) using DlgSILENT. The participants attended a MCQ test at the end of the STTP. The qualified participants as per the AICTE norms were awarded with the Participation Certificates. The feedback from the participants were overwhelming in terms the session topics & expert speakers, the session flow, hands-on training and coordination and organizing of the STTP.



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has attended Six days online Short Term Training Programme - Phase I on **"Electric Vehicle Evolution - Impact on Power Grid"** Organised by Department of Electrical and Electronics Engineering,
Sri Venkateswara College of Engineering during February 8th - 13th, 2021.

Dr. K R. Santha
Vice Principal, Prof & Head / EEE
Co-ordinator

Prof. Dr. S Ganesh Vaidyanathan
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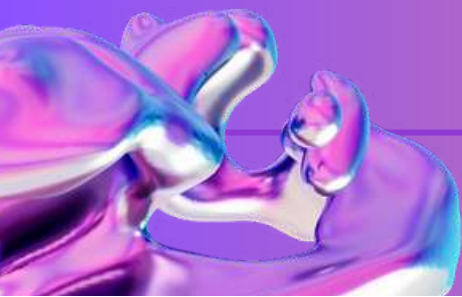
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