



भारतीय प्रौद्योगिकी संस्थान दिल्ली
Indian Institute of Technology Delhi



Advanced Programme in Electric Vehicle (EV) Technology

6 MONTHS

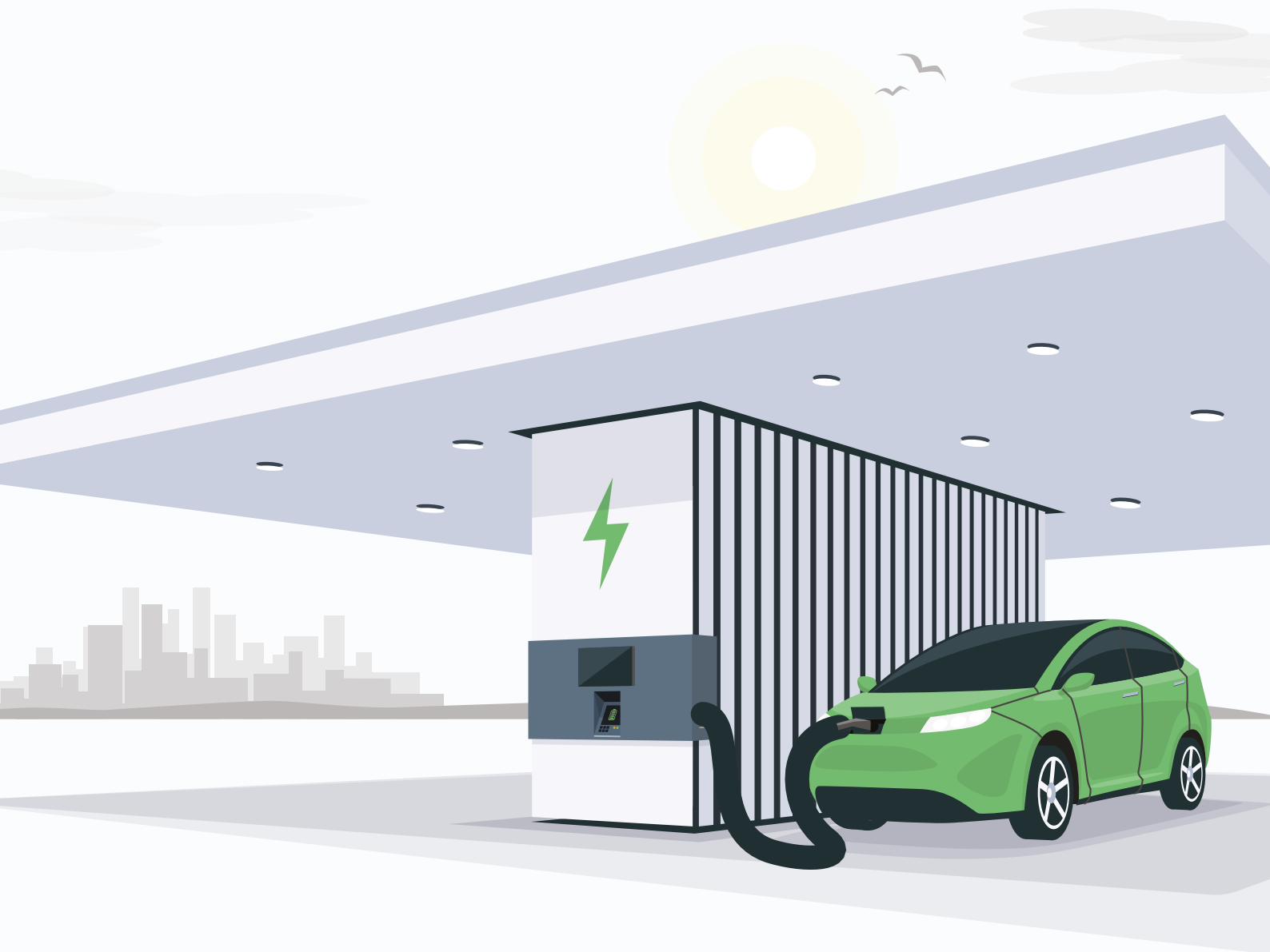
LIVE ONLINE LECTURES

3rd COHORT

Programme offered by Continuing Education Programme (CEP), IIT Delhi

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Programme is offered by IIT Delhi (IITD)



**2ND BEST UNIVERSITY IN INDIA
BY QS 2022**

ABOUT INDIAN INSTITUTE OF TECHNOLOGY DELHI

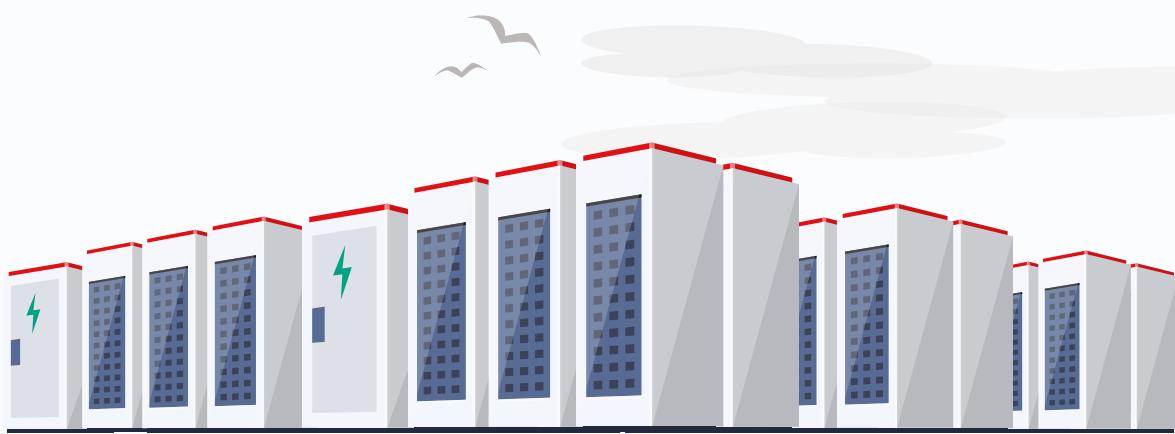
Indian Institute of Technology Delhi is one of the Twenty-Three IITs created to be Centres of Excellence for Training, Research and Development in Science, Engineering and Technology in India. Established as College of Engineering in 1961, the Institute was later declared as an Institution of National Importance under the “Institutes of Technology (Amendment) Act, 1963” and was renamed as “Indian Institute of Technology Delhi”. It was then accorded the status of a Deemed University with powers to decide its own academic policy, to conduct its own examinations, and to award its own degrees.

Since its inception, over 48000 have graduated from IIT Delhi in various disciplines including engineering,

physical sciences, management and humanities & social sciences of these, nearly 5070 received PhD Degrees. The number of students who graduated with B.Tech Degrees is over 15738. The rest obtained Master’s Degrees in engineering, sciences and business administration. These alumni today work as scientists, technologists, business managers and entrepreneurs. There are several alumni who have moved away from their original disciplines and have taken to administrative services, active politics or are with NGOs. In doing so, they have contributed significantly to building of this nation and to industrialisation around the world. For more details, please **visit: www.iitd.ac.in**



ABOUT CONTINUING EDUCATION PROGRAMME (CEP)

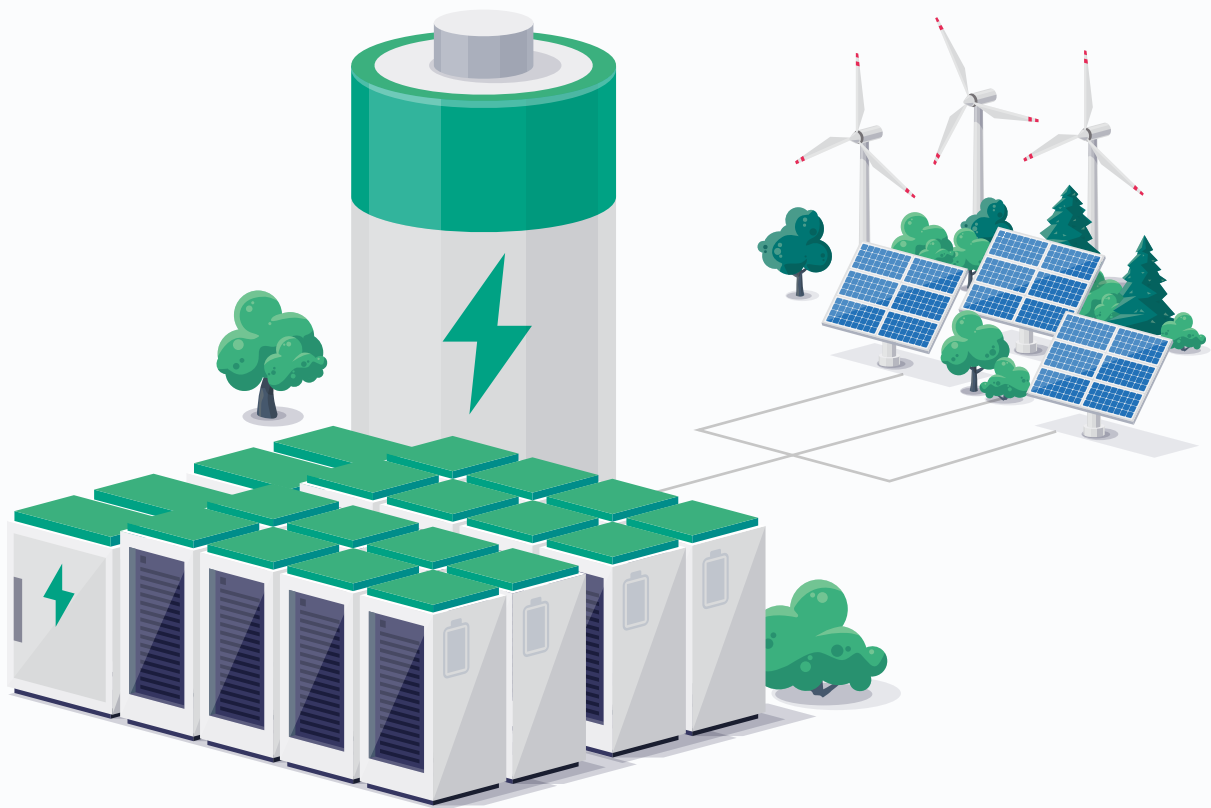


Executive education is a vital need for the companies to build a culture that promotes newer technologies, solutions and build a workforce that stays abreast of the rapidly transforming needs to the technological, business and regulatory landscape.

Committed to the cause of making quality education accessible to all, IITD has launched Online Certificate Programmes under eVIDYA@IITD ई-विद्या/आईआईटीडी enabling Virtual & Interactive-learning for Driving Youth Advancement@IITD for Indian as well as International participants. These outreach programmes offered by the

Indian Institute of Technology Delhi are designed to cater to the training and development needs of various organisations, industries, society and individual participants at National and International level with a vision to empower thousands of young learners by imparting high quality Online Certificate Programmes in cutting edge areas for their career advancement in different domains of engineering, technology, science, humanities and management. For more details, please visit: <http://cepqip.iitd.ac.in>

PROGRAMME OVERVIEW



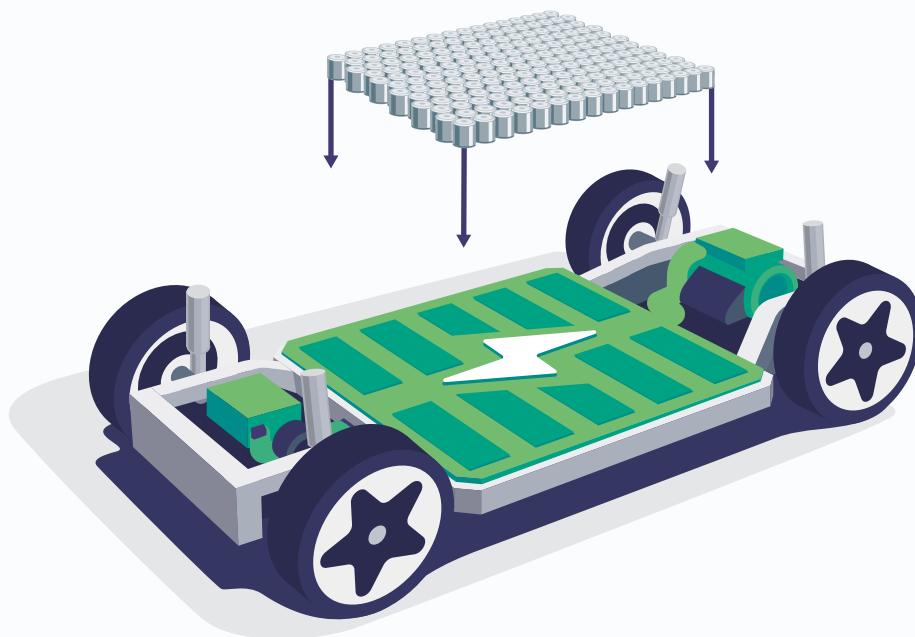
Electric vehicles are considered to be an important step towards mitigating dependency on crude oil, protecting the environment and improving transportation sustainability. Many manufacturers have made major investments in electric automobile technology opening up employment and growth opportunities for individuals with knowledge in the required field. The E-Mobility space encompasses several technologies:

the important one being electrochemical energy storage and conversion, electric drivetrain, power electronics, etc. The electrochemical energy storage and conversion devices used in Electric Vehicles (EV) are primarily batteries, fuel cells, and supercapacitors. These devices invariably require power electronic interface to couple with the vehicle drivetrain and charging stations.

PROGRAMME OVERVIEW

The programme will provide a basic understanding of the working of the storage devices from a single cell to pack level, duty cycles led sizing of storage, and basics of power electronics required for interfacing devices with drivetrains. The programme content will also include various aspects of charging from device to electrical grid level as well as an introduction to smart grids, net metering and system integration.

Thus the programme is designed to provide a comprehensive view of the Electric Vehicle (EV) Technology to individuals and working professionals. The programme will help to cater for the training and development need of industry 4.0 and enable the participants to build the required skill set, capabilities and knowledge in the e-mobility domain.



PROGRAMME HIGHLIGHTS



Provides a comprehensive understanding of the working storage devices from the single cell to pack level, duty cycles led to the sizing of storage devices and basics of power electronics required for interfacing with drivetrains and charging stations.



Provides different aspects of charging device to electric grid level, introduction to smart grid, net metering and system integration. Ecosystem required for e-mobility.



Exposes individuals and working professionals to the entire spectrum of technologies, economic and policy aspects of e-mobility space.



Caters to the training and development need of industry 4.0 and enables the participants to build the required skill set, capabilities and knowledge in the e-mobility domain.



Earn the prestigious IIT Delhi Completion Certification in Electric Vehicle (EV) Technology.



WHO IS THIS PROGRAMME FOR?



Fresh graduates who aspire to work in the sunrise sector of Electric Vehicle (EV) to get a comprehensive overview of the technology.



- **Working professionals in R&D** at entry level to get a thorough understanding of the fundamental principles behind the working of energy storage devices and the interface with power electronics thereby understanding the new possibilities and research directions.
- At mid and senior level to refresh the underpinning principles behind the energy storage technology and relate it to future trends in the technology.



- **Working professionals** at all levels in quality control to get an exposure on the relation between the quality specifications and working of the devices at the fundamental level.
- Production, sales & support to understand the terminologies related to rating, sizing and specifications of the relevant technologies such as energy storage devices, chargers, power electronic components, and powertrain drives.
- Management and decision making roles to familiarise with the jargons related to Electric Vehicle (EV) technology and get a comprehensive view of the possibilities and limitations of fast changing technologies in the Electric Vehicle (EV) domain.



PAST PARTICIPANTS PROFILE

Participants of the previous programme come from a wide range of industries, job functions and management levels.

Industries:



66%

Automotive



6%

Manufacturing



5%

Electric Vehicle (EV)



10%

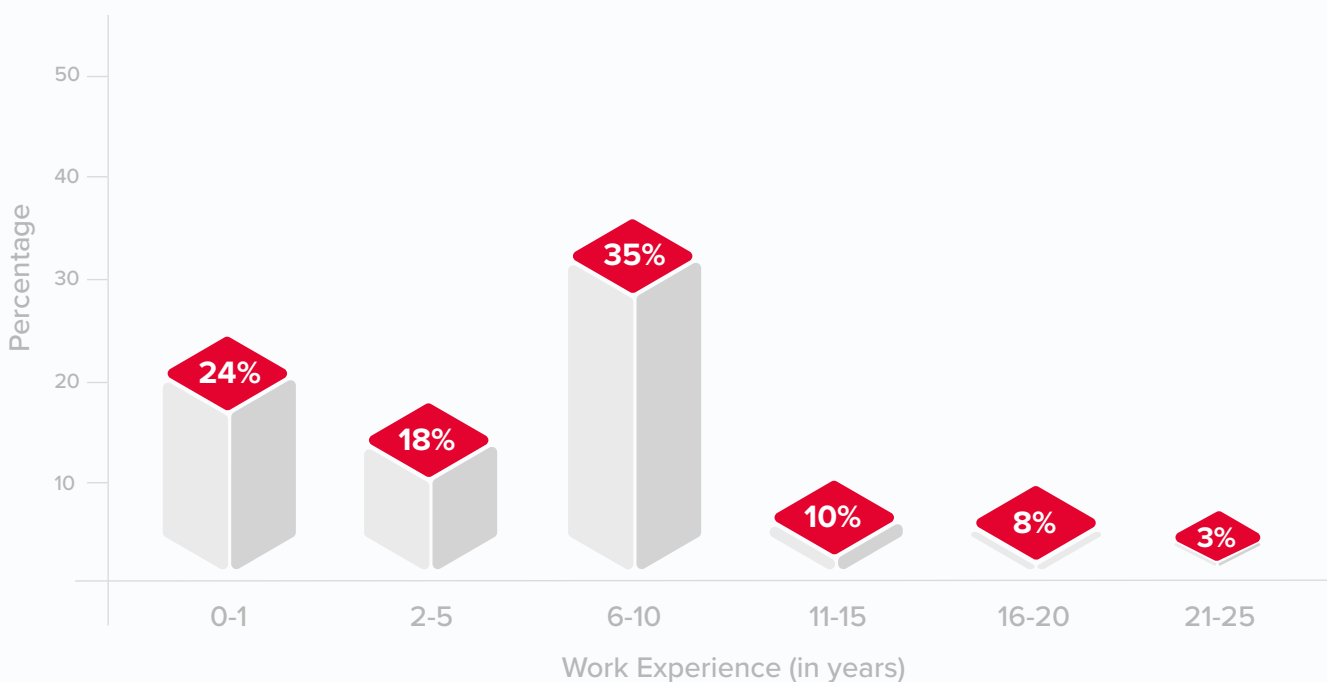
Information Services



13%

Others

Work Experience (in years)



PAST PARTICIPANTS PROFILE

Participants of previous programme work at:



PROGRAMME CURRICULUM



Curriculum Duration

6 Months



Total Exams

3



Total Content Hours

70+ Hours



Weekly Time Commitment

5 Hours



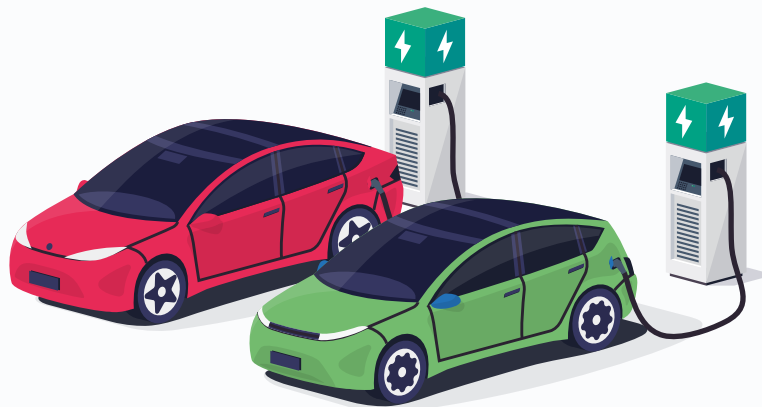
Number of Live Sessions

22+



Project Work

In small groups; case study/literature search; flipped and peer learning



Module 1- Overview of Electric Vehicle

This module will provide the background and overview of the programme learning. It will introduce the need for the electric vehicles, classification of the electric vehicles, understanding electric drivetrain, etc.

Outlook for EV and the Indian scenario

Basic scheme of EV drivetrain

Vehicle dynamics and concept of drive cycles

Range of EV and EV battery trends

Module 2- Electrochemical Cells

This module is designed to provide a relevant and holistic view of the various terminologies and fundamentals of any electrochemical device.



Electrochemical cell and battery



Type of batteries used in EV



Other electrochemical storage relevant to EV: fuel cell, supercap, flow batteries

Module 3- Battery Characteristics

Module will cover the battery types relevant to EV, their key performance indicators and present state-of-art as well as future direction.



Battery state and rate of discharge: SoC, SoH, C-rate, capacity versus C-rate



Key characteristics of Battery: Voltage, current-voltage characteristics



Li-ion battery: present state of art and future directions

Module 4- Building of Battery Module

The understanding gained from module 3 will be used for designing and building of module and packs from the cells for real application.



Battery modules and pack



Sizing of battery pack



Mechanical and thermal design of battery pack

Module 5- Power Electronics Interface

The charge discharge of battery pack require matching of its characteristics with the charger and drive train characteristics. This matching is through power electronics devices and this learning module will provide relevant background to power electronics required to understand the design and working of power electronics interface.

Power electronics interface – Basic devices and components

Convertors and invertors (buck and boost)

Battery management system

Traction motors

Module 6- Charging Infrastructure

The success of the electric vehicle will depend on the suitable charging infrastructure. The module will cover the relevant details related to chargers as well as smart and mini-grids etc.



Chargers for EV
– levels/ standards



Charger types and
Indian standard



Battery
management system

Module 7- Overview of Policies

This module will discuss various government policies relevant to electric vehicles.



EV Indian scenario and future projections



Total cost of ownership



Indian EV policies



YOUR PROGRAMME

FACULTY



Dr. Anil Verma

Professor
Department of Chemical Engineering
Indian Institute of Technology Delhi

Dr. Anil Verma is a Professor in the Department of Chemical Engineering, IIT Delhi. In addition, Prof. Verma was also a Visiting Professor at Energy, Environmental & Chemical Engineering, Washington University in St Louis, USA and Visiting Fellow at Department of Chemical Engineering, Newcastle University, Newcastle upon Tyne, UK. He is also Principal Investigator and Administrator of DST-IIT Delhi Centre for Energy Storage Platform on Batteries (ESPOB) funded by the Department of Science and Technology, Ministry of Science and Technology, Govt. of India. He is also an active Professorial Member in Centre for Automotive Research and Tribology (CART), IIT Delhi. Prof. Verma holds B.Tech. and M.Tech. (Silver Medal) from H.B.T.I. Kanpur. Prof. Verma served in industry also before doing Ph.D. from IIT Delhi. He is also associated with various IITs, NITs, State Engineering Colleges, IOCL, BIS, DST, etc. in various capacities. Prof. Verma has successfully completed several Projects and Consultancies for various National and International organisations such as DST; CSIR;

BRNS; ISRO; LG; Cenovus, Canada etc. He has also done many CEP programmes such as Electrochemical Energy Devices; Advanced Pedagogies: Electric Vehicle Theme. Prof. Verma mainly works in the area of Electrochemical systems like Fuel Cells for Portable Devices and Batteries for Energy Storage and Electric Vehicle Charging Station. His research group comprises Chemists, Physicists, Chemical Engineers, Mechanical Engineers, Electrical, Electronics, communication and Instrumentation Engineers. Prof. Verma has supervised 12 Ph.D. theses and presently 6 Ph.D. students are pursuing Ph.D. under him. He has filed 9 National and International patents, out of which 2 have been granted. He has published 3 Monographs, 6 Book Chapters and published 85 Research Papers in high quality International Peer Reviewed Journals. Moreover, he has presented his research work in more than 150 National and International Conferences.



Dr. Anupam Shukla

Professor
Department of Chemical Engineering
Indian Institute of Technology Delhi

Dr. Anupam Shukla is a Professor in the Department of Chemical Engineering, IIT Delhi and has been a faculty member of IIT Delhi for last 15 years. Prof. Shukla completed 5 Year Integrated M. Tech. in Chemical Engineering from IIT Bombay and Ph.D. from IIT Kanpur. He then worked as a faculty member at IIT Guwahati for a little more than 2 years before moving to IIT Delhi. Prof. Shukla works in the area of electrochemical systems with focus on electrochemical energy storage, mainly supercapacitors and batteries. The area of interest also includes membrane electrolysis, electrodialysis, electrochemical route to graphene synthesis, and ion exchange membranes. Prof. Shukla served as a member of curriculum development for

post-graduate programme on E-mobility hosted by Centre for Automobile Research (CART) at IIT Delhi and has also served in a few committees of funding agencies to review proposals for support funding for setting up plants on new electrochemical technologies. Prof. Shukla has completed more than 10 projects sponsored by Government funding agencies and Industries on materials and cells related to electrochemical systems and has several ongoing sponsored projects. Prof. Shukla has supervised 7 Ph.D. theses and currently have 5 Ph.D. students working in different areas of electrochemical energy storage. He has published 50 papers in international journals and several in conference proceedings.





Dr. Sumit Kumar Pramanick

Assistant Professor
Department of Electrical Engineering
Indian Institute of Technology Delhi

Dr. Sumit Kumar Pramanick is working as an Assistant Professor in the Department of Electrical Engineering, IIT Delhi. His area of expertise is in the field of design of power electronic converters and its control for applications like machine drives, renewable energy and e-mobility. His research group in IIT Delhi is currently working towards development of high power density power converters for EV battery charging using energy efficient power devices, high bandwidth embedded current sensors, high frequency magnetics design, and wireless power transfer technology. Dr. Pramanick is closely working with a few start-ups in NCR region to develop products related to power electronics. He has introduced concepts of adaptation of digital controllers in standalone power electronic converters as per industry practice. Separate hands on module has also been developed as a part of the M.Tech. curriculum with Power

Electronics and Machine Drives specialization in IIT Delhi. His contributions to this curriculum was recognized through Teaching Excellence Awards, 2018 in IIT Delhi. He is a recipient of INAE Young Engineer Award, 2020. He is a Member of IEEE, IEEE Industrial Electronics Society, and IEEE Power Electronics Society. He is a regular reviewer in reputed journals like IEEE Transactions on Industrial Electronics, IEEE Transactions on Power Electronics, IEEE Transactions on Industrial Applications and Sadhana. Prior to joining IIT Delhi, he was a Post-Doctoral Fellow in the Cullen College of Engineering at University of Houston, Texas, USA. He finished his doctoral research in Department of Electronic Systems Engineering, Indian Institute of Science, Bangalore. He completed B.E. in Electrical Engineering from Indian Institute of Engineering Science and Technology, Shibpur.



Dr.ing. Praveen Kumar

Professor

Department of Electronics and Electrical Engineering
Indian Institute of Technology Guwahati

Dr. Praveen Kumar is a Professor in the Department of Electronics and Electrical Engineering, IIT Guwahati. Professor Kumar did his B.Tech., M.Tech., and Ph.D. from REC Hamirpur, IIT Delhi, and TU Delft, respectively. He worked for a decade in the automobile industry in Germany and in 2009 joined IIT

Guwahati in the department of EEE. Currently, he is a Professor in the Department of EEE, IIT Guwahati, and heads the E-Mobility lab. His group research areas are high power density motor design, intelligent chargers and EV drivetrain architecture.



Dr. Akhil Garg

Assistant Professor

Centre for Automotive Research and Tribology (CART),
Indian Institute of Technology Delhi

Dr. Akhil Garg is an Assistant Professor in the Centre for Automotive Research and Tribology (CART), IIT Delhi. Dr. Garg has done B. Tech. in Mechanical Engineering from NIT Rourkela, and Ph.D. from NTU, Singapore. His main research

interests included Renewable Energy and Energy Storage Systems, Recycling of Battery Packs for EVs, Thermal Designs of Battery Packs, and Intelligent Optimization for Engineering Design.

PROGRAMME FEATURES



Coaching

Live discussion forum for peer-to-peer doubt resolution



Format

Live weekend classes: weekly live interactive lectures from IITD faculty on concept building, hands on exercises and doubt resolution



Mentorship

Live interactive sessions with leading faculty covering curriculum



Practical Learning

- Case studies based approach to ensure understanding of concepts through tangible problem statements
- Hands-on exercises and assessments at regular intervals to test concept understanding and retention



Student Support

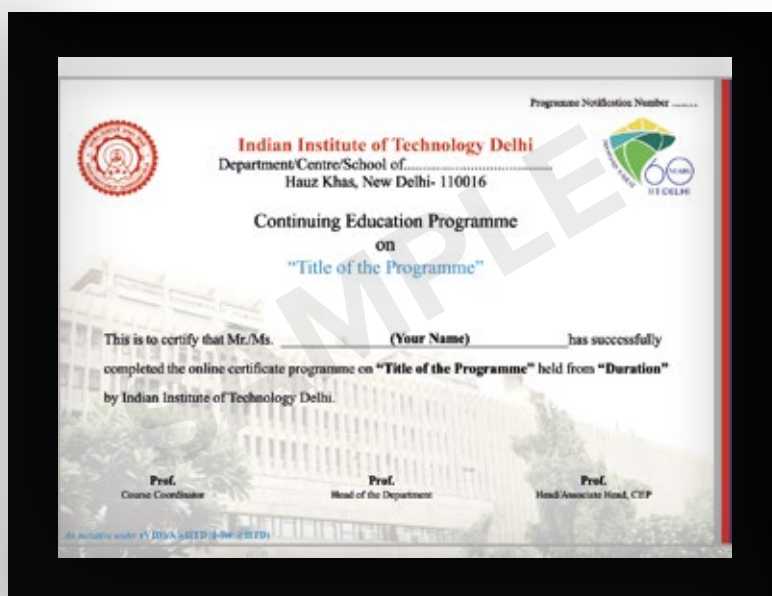
Your programme buddy will help personalise your learning experience by periodically engaging with you to ensure you are on track with upcoming deadlines, offer guidance, resolve non-academic queries and lend a helping hand wherever required. However, in case you need to approach us, you can contact our Student Support Team is available 7 days a week from 09 AM to 09 PM IST

SAMPLE CERTIFICATES

Completion Certificate

Complete all the courses successfully to obtain this prestigious recognition from IIT Delhi.

- You will be awarded a Completion Certificate if you obtain 50% aggregate marks in the evaluation components and maintain minimum attendance of 60% in lectures and tutorials.
- Participants who are unable to score 50% marks in the evaluation will be eligible for the Participation Certificate if their attendance is above 60%



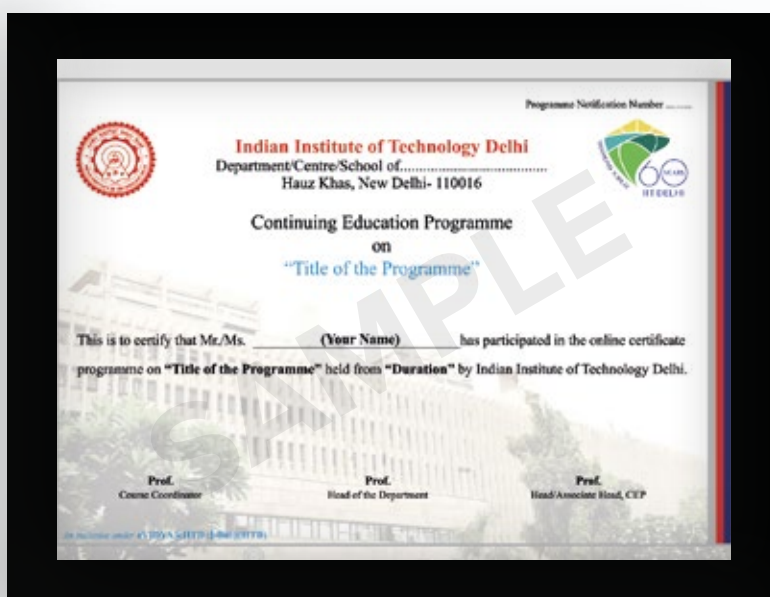
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- The above image of the e-certificate is for illustrative purposes only and the format of the certificate may be changed at the discretion of IIT Delhi.
- Only e-certificate will be provided and it will be issued by CEP IIT Delhi.
- The organising department of this programme is the Department of Chemical Engineering, IIT Delhi.

SAMPLE CERTIFICATES

Participation Certificate

Participants who are unable to score 50% marks in the evaluation will be eligible for the Participation Certificate if their attendance is above 60%



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Online Certificate Programmes are offered by Indian Institute of Technology, Delhi under the aegis of Continuing Education Programme (CEP) so that the Institute can realise its vision of serving as a valuable resource for industry and society, and fulfil its mission to develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

PROGRAMME DETAILS



Duration

6 months



Fees

₹1,18,000 (inclusive of taxes)

Booking Amount (For *EMI Applications): ₹11,800

Installment 1: ₹59,000 | Installment 2: ₹59,000

(For Self/Company Sponsored Applications)

*EMI is a service offered by upGrad and IIT-Delhi is not responsible for the same.

All fees should be submitted in the IIT Delhi CEP account only, and the receipt will be issued by IIT Delhi CEP account for your records.



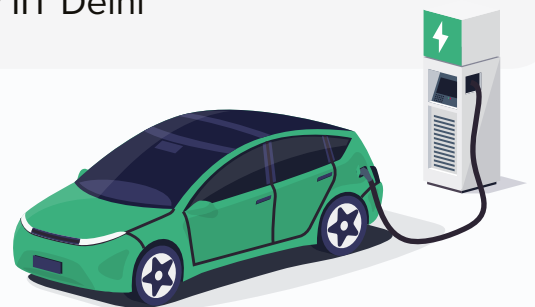
Eligibility

- For Indian Participants - Graduates or Diploma Holders from a recognised University/Institutes(UGC/AICTE/DEC/AIU/State Government) in any discipline.
- For International Participants - Graduation or equivalent degree from any recognised University or Institution in their respective country.



Selection Process

Screening and Selection will be done by IIT Delhi



IMPORTANT INFORMATION

Last date to apply

2nd January 2023

Last date to submit the instalment 1 fee

Within 3 days
of the issue of Offer Letter

Last date to pay booking amount for
EMI* applicants

Within 3 days
of the issue of Offer Letter

Last date to submit the instalment 2 fee

Within 10 days
of the issue of Offer Letter

Programme Start Date

08th January 2023

*EMI is a service offered by upGrad Education Pvt. Ltd. and IIT Delhi is not liable for the same.

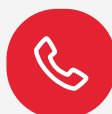
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