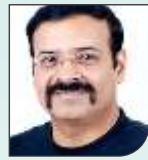


**SPEAKERS**



**Mr. Tejas Kshatriya**  
Associate Vice President,  
KPIT.



**Mr. Abhay Patwardhan**  
Principal Solution Architect,  
KPIT.



**Dr. Raja Munusamy**  
Head, Advanced Technology,  
Engineering Research Centre,  
Tata Motors Ltd., Pune



**Mr. S. S. Ramdasi**  
General Manager,  
Powertrain Engineering,  
ARAI, Pune.



**Dr. Philip Jose**  
Asst. General Manager,  
Advanced Technology,  
Engineering Research Centre,  
Tata Motors Ltd., Pune.



**Mr. Chandrakant M Awate**  
Asst. General Manager,  
TATA Motors, ERC, Pune.



**Mr. M. M. Desai**  
Dy. General Manager,  
Automotive Electronics Department,  
ARAI, Pune.



**Dr. S. A. Patil**  
Dy. General Manager,  
Academy, ARAI, Pune.



**Mr. Manas Vora**  
Sr. Electronics Engineer,  
Devise Electronics



**Mr. M. T. Ingale**  
Dy. Manager, Learning Center,  
Academy, ARAI, Pune.

**Besides, speakers from ARAI & other Industries are expected**

5 Day Proficiency Improvement Programme on  
**Hybrid Drives, Traction & Controls**  
at ARAI, Kothrud, Pune

**3<sup>rd</sup> to 7<sup>th</sup> April 2017**

**REGISTRATION FORM**

Name, Designation, Dept., Office No., Mobile No. & Email ID :	
Delegate - 1	
Delegate - 2	
Delegate - 3	
Company Name & Address	
Co-ordinator's Name, Designation, Contact No., Email ID	
100% Advance Payment Details	

Please fax/email/post duly filled-in registration form on or before 1<sup>st</sup> April 2017 to :  
Dr. K. C. Vora, Sr. Dy. Director & Head, ARAI Academy  
ARAI Post Box 832, Pune 411 004 / S. No. 102, Vetel Hill, Off Paud Road, Kothrud, Pune 411 038.  
Tel: 020-3023 1248 / 1245 / 1239, Fax : 020-3023 1104.  
Email: [training.pga@araiindia.com](mailto:training.pga@araiindia.com); [morgaonkar.pga@araiindia.com](mailto:morgaonkar.pga@araiindia.com); [patil.pga@araiindia.com](mailto:patil.pga@araiindia.com)

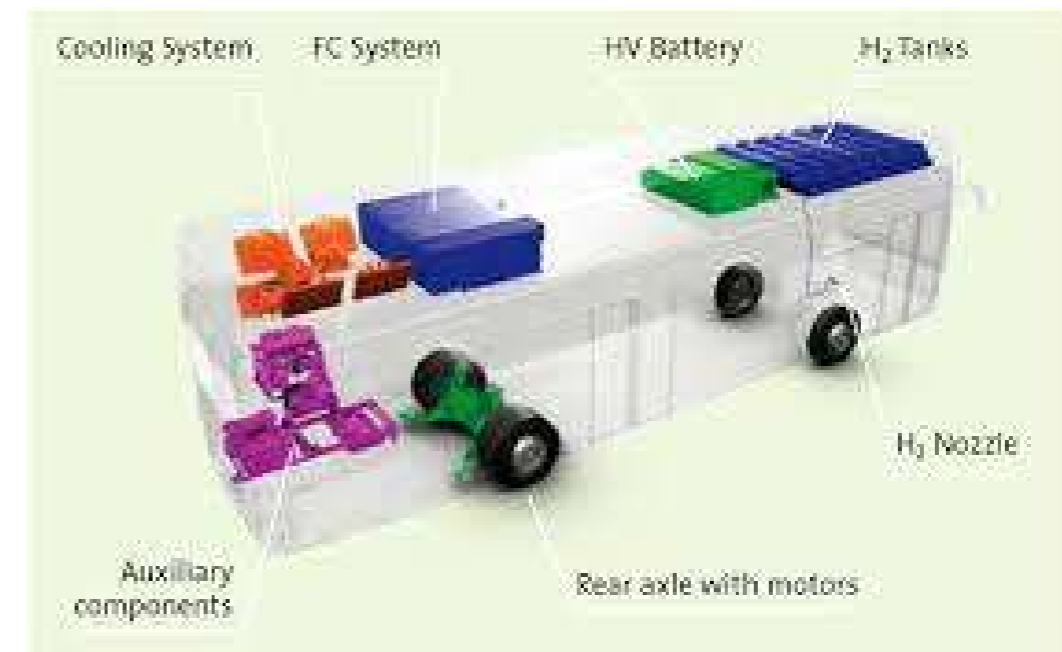


2015



2011

5 Day Proficiency Improvement Programme on  
**Hybrid Drives,  
Traction & Controls**



at  
**ARAI, Kothrud, Pune**  
(The Automotive Research Association of India)

**3<sup>rd</sup> to 7<sup>th</sup> April 2017**

Organized by



## BACKGROUND & OBJECTIVES

The evolution of vehicle has been phenomenal in the past two decades. The fossil fuels have been dominating the research on automotive technologies. It has been established fact that stocks of fossil fuels are limited and diminishing; and hence, cannot be depended upon for a long time. Alternate technologies such as battery and fuel cell as the power source will be the norm in the coming days.

Study of battery technologies, different electric motors and their control approaches, various architectures based on fuel cells and other propulsion power sources is the need of the hour.

This course will take you through the basics of hybrid vehicle technologies, types of motors for electric vehicles, various speed control strategies and architectures for hybrid traction. Demonstration of the demo vehicle is also planned during the session.

## INTENDED LEARNING OUTCOMES

On completion of the module, the delegates should be able to:

- Understand basics of Hybrid Drives.
- Understand Hybrid Vehicle Configuration.
- Get familiar with Energy Storage devices & its application.
- Understand Fuel Cell Technology.
- Understand various types of Motors for EV & HV applications.
- Understand design of EV Motors.
- Understand various Motor Controllers Design & Options.
- To know about Power Split devices for Hybrid Transmission.
- To know the Control Strategies for Electrification in HEV.
- Become self-disciplined and self-motivated, demonstrating personal responsibility in the pursuit of studies and professional practice.
- Lead Multi-disciplinary teams.
- Demonstrate independent learning ability necessary for conducting professional development.

Note : ARAI reserves the right to change the dates, schedule, contents, speakers, venue etc. for the programme without any notice.

## PROGRAMME

### Day One

- 08.30 - Registration
- 09.00 - Inauguration & Quiz
- 09.30 - Typical Real World Challenges & Research Direction in Hybrid Drive, Traction & Controls
- 11.00 - Tea Break
- 11.15 - Introduction to Electric & Hybrid Electric Vehicles
- 13.00 - Lunch
- 14.00 - Battery Technology
- 15.30 - Battery Management System (BMS) & Algorithms for SOC, SOH estimation
- 17.00 - Conclusion

### Day Two

- 09.00 - Requirement of electric motor for EV/Hybrid Application – Road load equation, Parameters to decide motor requirement & Size
- 10.30 - Types of Electric Motor
- 11.00 - Tea
- 11.15 - Types of Electric Motor (Contd.)
- 11.45 - Motor Control System
- 13.00 - Lunch
- 14.00 - EV/HEV Testing Demo
- 17.00 - Conclusion

### Day Three

- 09.00 - Design of Power Electronics
- 11.00 - Tea
- 11.15 - Design of Power Electronics (Contd.)
- 13.00 - Lunch
- 14.00 - Control Strategy for Integration of Battery, Motor & System
- 17.00 - Conclusion

### Day Four

- 09.00 - Overview of Micro Controller Architecture for HEV & FCV
- 10.00 - Charging & Regenerative Breaking
- 11.00 - Electric Vehicle Architecture for Electric Bus
- 12.00 - Fuel Cell Technology
- 13.00 - Lunch
- 14.00 - Success Story of Fuel Cell Technology
- 17.00 - Conclusion

### Day Five

- 09.00 - Developing a sustainable ecosystem for Hybrid & Electric mobility in India
- 10.00 - Testing & Validation of EV HV : Indian & Global Scenario along with Demo
- 11.30 - Demo of EV testing
- 13.00 - Lunch
- 14.00 - Written Test
- 15.00 - Summary, Discussions and Feedback
- 16.00 - Certificate Distribution
- 17.00 - Conclusion

## WHO SHOULD ATTEND ?

- Organizations involved in R&D, design, manufacturing, testing, and product development teams specializing in
- Transmission / Gears/ Clutches/ Engine
- Automotive component manufacturers and suppliers of critical components
- Engineers working in the areas of Transmission
- Engineers who are interested in pursuing further studies on part time / full time basis
- Engineering / consulting companies
- Professors / engineering college students

## MODE OF PAYMENT

At Par / Multicity cheque or demand draft in favour of  
**The Automotive Research Association of India**  
 payable at Pune.

ARAI, over five decades, has provided its design and development expertise to the Indian automotive industry, focusing on the testing and evaluation of components and systems to meet national and international standards. ARAI strives to achieve international recognition in these areas. In keeping with the globalization of economy and business, ARAI continues to enlarge its scope of services to meet the requirements of automotive industries around the world. In addition to utilizing state-of-the-art technology, laboratories and highly-trained personnel, ARAI recognizes the need to develop a new generation of engineers to meet the demands of the automotive industry, not just in India but across the globe.

ARAI ACADEMY is classified into three divisions:

**LEARNING CENTRE** has embarked upon a programme of building up human resources by commencing educational programme (Graduate, Post graduate & Doctoral) with specialization in Automotive Engineering. It has tied up with VIT University (Vellore), Veltech University (Chennai), College of Engineering (Pune), Christ University (Bangalore), University of Alabama (USA), Tennessee Tech University (USA), Loughborough University (UK) and University of Braunschweig (Germany).

**TRAINING CENTRE**, In line with Post Graduate and Doctoral Programs conducted by various universities abroad, ARAI Academy has devised various Proficiency Improvement Programmes (PIPs), to be taught by ARAI, Academia & Industry Experts. PIP gives engineers, faculty and student's knowledge and technical expertise in a wide range of automotive disciplines. It helps in understanding system's view point for automotive design and manufacture, with specific skills in formulating automotive engineering solutions in terms of their function and performance, through optional modules.

## REGISTRATION FEES

Category	Registration Fees (Rs.) (per participant)	Total Fees including Tax of 15% (Rs.)* (per participant)
Engineers & Professionals	25000.00	28750.00
Teaching Faculty	15000.00	17250.00
Engineering College Students	10000.00	11500.00

\*Service Tax is as applicable at the time of program.

Registration fees include:

- Breakfast
- Lunch
- Delegate Kit

Based on the present system in universities, credits are proposed for each module, so that the graduate engineers can attend various modules and sum-up the credits required for Master's or Doctoral Programs. Participants also get chance to visit related laboratories of ARAI and get hands on experience. Certificates are issued on the basis of attendance & written test conducted at the end of the programme. We also conduct Training Programmes through WEBEX and Domain Training Programmes for Automotive Industry.

**KNOWLEDGE CENTRE** It has collection of around 23,000 books, standards, project reports, seminar/conference proceedings and around 75,000 SAE technical papers. It also has 237 eBooks. It subscribes to 40 national and international journals. It regularly publishes a monthly magazine 'Automotive Abstracts'. It also conducts literature / patent search for customer's projects.

Please visit [www.araiindia.com](http://www.araiindia.com) for more information.



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