Program Details

MS Program in Automotive Engineering comprises of 3 Terms

I²IT, India in collaboration with Lawrence Technological University, USA offers the Post Graduate MS Program in Automotive Engineering. The program comprises of 3 Terms.

Term I will be conducted at I²IT, India, where students will be prepared through Pre-core subjects. The expert faculty of I²IT will train the students. Students will also be taught at I²IT's satellite campus at Ratnagiri in Maharashtra, where they will have access to high-tech infrastructure. Students will have hands-on knowledge of Thermal Systems, Mechanical Systems and Electronics amongst others, by working in 22 well-equipped laboratories and a full-fledged workshop.

Term II will be conducted at Lawrence Technological University in USA for the duration of 12 months. Seven Core subjects will be taught at Lawrence Tech. The faculty is made up of highly qualified industry experts and Doctorate level professors, involved in applied research and consulting themselves. The University has state-of-the-art facilities, such as the unique 4 x 4 vehicle chassis dynamometer.

Term III of the course will be conducted back at I²IT, India. The students now get a chance to select three electives that best suit their strengths. They will also have to undertake and complete a project that will test their understanding of the subjects and competence in solving real-world problems using knowledge gained during the program.

Students will gain expertise from the learned faculty of both I²IT and Lawrence Tech. Industry experts and professionals will be actively involved in the program so that students have an exposure to the real-world scenario of automotive engineering.

During the program students will learn about a range of subjects such as:

- Vehicle Dynamics
- Body and Chassis Systems
- Automotive Control Systems
- Automotive Mechanical Systems
- Automotive Electrical Systems
- Power-train Systems
- Advanced Quality Control
- Engineering Management
- Emission Control Systems
- Hybrid Electric Vehicles
- Automotive Driveline Systems
- Noise Vibration and Harshness
- Embedded Systems

Program Structure

	Duration	Number of subjects	Credits	Center for learning
Term I	3 months	2	6	I'IT, India
Term II	12 months	7	21	Lawrence Tech, USA
Term III	6 months	4	18	I'IT, India / Lawrence Tech*

The total duration of the program will be of 21 months. Students will cover a total of 13 subjects for 45 credits to successfully complete the program.

[1] Should some students fail to get the US visa, they will continue Term III at I'IT.

*Students have the option of continuing the program at Lawrence Tech, USA. This is subject to visa compliance and additional fees for studying at Lawrence Tech.

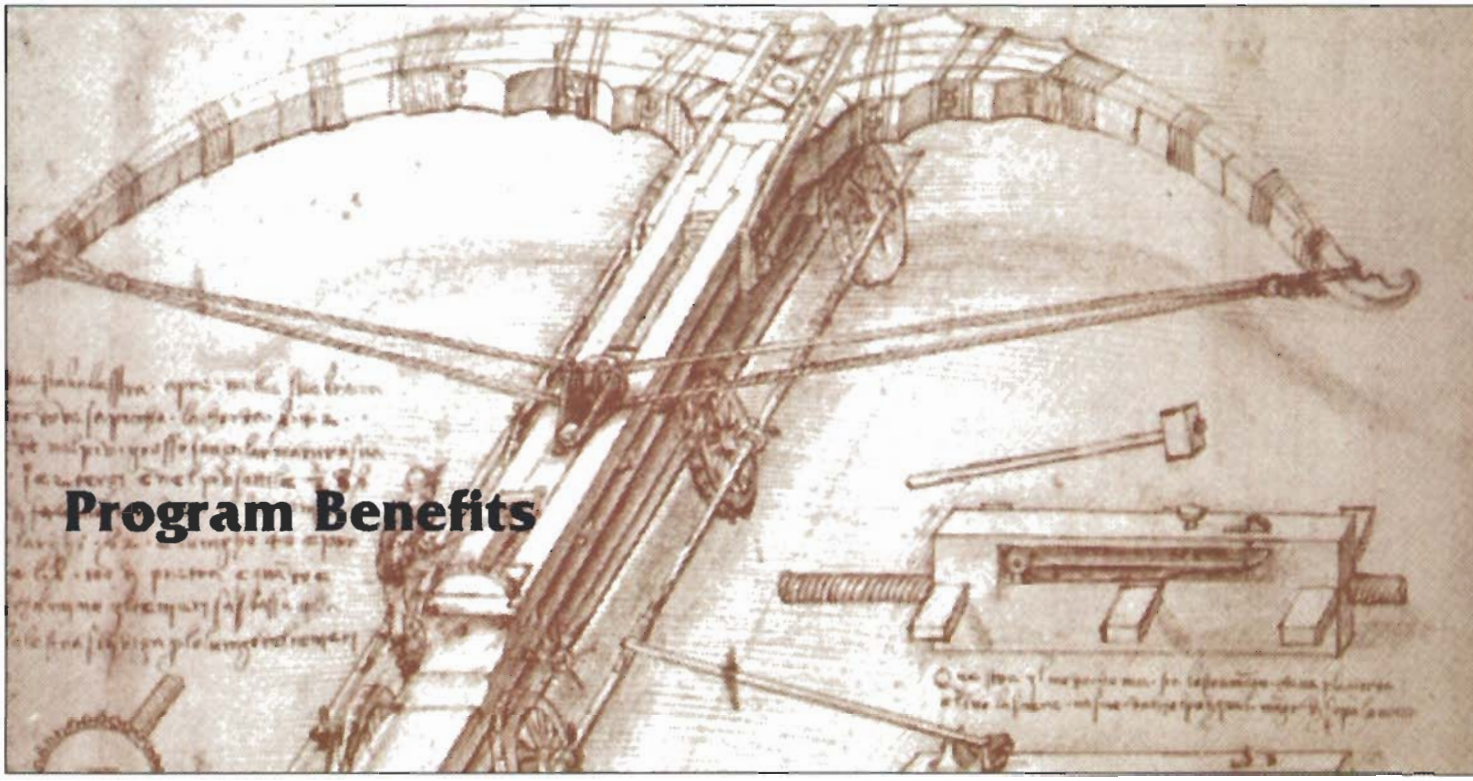
Program Aims

- To introduce students from engineering discipline to modern developments in automotive engineering and highlight the importance of information technology in today's industry.

- To produce industry-ready graduates with specialized training in automotive engineering who will be prepared for employment in the national and international automobile and auto-component manufacturing sectors.

- To impart appropriate training in various aspects of theoretical, computational and practical hands-on knowledge in automotive engineering so that engineers have industry-relevant experience.

- To create designers, researchers and innovators for the next generation automotive technologies that will have high integration of electronics, control and software.



Program Benefits

The program is designed to address the key areas like theoretical foundation, practical relevance with the 'real-life' problem solving approach. The courses will be delivered using collaborative learning process through class room lectures, laboratory sessions, assignments, student seminars, lectures by industry experts, case studies, relevant industry visits and research / industry projects.

On successful completion of the course, the students will:

- Be familiar with a range of subjects that will prepare them to solve a real-world problem by approaching it with a 360-degree view.
- Be familiar with the use of simulation tools for automotive engineering design.
- Have learnt a variety of computational techniques involving code writing as well as using packages that solve automotive engineering problems.
- Have learnt experimental techniques and methodologies and be able to perform experiments.
- Gain exposure to shop floor practices, lean manufacturing processes and flexible manufacturing systems, cutting-edge technologies such as minimizing noise vibrations, programming languoges, IT packages, software engineering methodologies, software development techniques and training in personal skills.

Curriculum Structure

Term I: I²IT, India

Course Code	Course Name	Type	Credits
AME 2123	Circuits & Electronics	Precore	3
AME 3153	Electronic Machines & Controls	Precore	3
AME 4603	Introduction to Mechanics	Precore	3
AME 4613	Introduction to Thermal Systems	Precore	3

Students have to choose two Pre-core subjects for a total of 6 credits.

AME 2123 Circuits and Electronics

Credits: 3

Fundamental laws. Circuit parameters, elementary network theory. Forced and transient response, semi-conductor devices, electronic circuits, digital logic and counting circuits.

AME 3153 Electrical Machines and Controls

Credits: 3

Magnetic circuits, DC and AC machines, transformers, linear systems, models and equations. Time and frequency response of control systems, root locus, Bode plots, stability, control system design methods, sinusoidal steady state, three phase systems.

AME 4603 Introduction to Mechanical Systems

Credits: 3

Exposes non-mechanical engineering students to the principles of engineering mechanics. Dynamics, strength of materials, gears, and vibrations.

AME 4613 Introduction to Thermal Systems

Credits: 3

The principles of engineering thermodynamics, fluid mechanics, and heat transfer. Conservation of mass and energy, brief topical coverage of the second law of thermodynamics, thermodynamic cycles, hydraulics, flow losses, coefficients of drag, and heat exchanges.

Curriculum Structure

Term II: Lawrence Tech, USA

Course No.	Course Name	Type	Credits
EME 6333	Body & Chassis Systems	Core	3
EME 6343	Automotive Manufacturing	Core	3
EME 6353	Automotive Mechanical Systems	Core	3
EME 6363	Automotive Electrical Systems	Core	3
EME 6373	Powertrain Systems I	Core	3
EME 6383	Powertrain Systems II	Core	3
EME 6403	Quality Control	Core	3

EME 6333 - Body and Chassis Systems

Credits: 3

Introduction to body and chassis systems. Taught as a series of seminars resented by industry experts and coordinated by the MAE program director. Includes body-in-white, safety design, design of hardware, dimensioning and tolerances, noise-vibration harshness (NVH), seats and restraints, interior systems, electrical distributions. Standards and federal regulations. Strategic product planning, and next generation vehicles are also included.

EME 6343 - Automotive Manufacturing

Credits: 3

Manufacturing processes for metals, polymers, automotive manufacturing and assembly, including major sub-assemblies, engine, transmissions, stampings, body construction, paint systems, trim, electrical, powertrain, chassis. The need for new organizations and business processes, such as concurrent engineering, computer-aided manufacturing, introduction to robotics, etc. A semester field trip to a vehicle assembly plant is included.

EME 6353 - Automotive Mechanical Systems

Credits: 3

Must have a B.S.M.E or graduate standing with approval of MAE program director. Basic mechanical systems of the automobile; axles; drive shafts; C.V. joint/half shafts; 4X4 driveline systems; steering columns; manual/power steering; brakes; suspension; heating, ventilating, and air conditioning (HVAC). Taught as a series of seminars presented by industry experts and coordinated by the MAE program director. Includes hands-on introduction to the associated hardware.

EME 6363 - Automotive Electrical Systems

Credits: 3

Must have a B.S.E.E or gradate standing with approval of MAE program director. Basic electrical systems of the automobile; power train control, transmission control, charging and voltage regulation, storage, ignition, braking control (ABS), traction control, and electrical distribution with a hand-on introduction to associated hardware.

EME 6373 - Powertrain Systems - 1 (Engines)

Credits: 3

Must have a B.S.M.E or graduate standing with approval of MAE program director. Powertrain systems from a thermodynamic point-of-view. Thermodynamic analysis of the combustion and gas exchange processes in compression-ignition and spark-ignition.

EME 6383 - Powertrain Systems - 2 (Transmissions)
Credits: 3
Must have a B.S.M.E. or graduate standing with approval of MAE program director. Introduces powertrain systems from a mechanical point-of-view; manual and automatic transmissions systems, clutches, gears, flywheels, engines accessories, exhaust system, powertrain control systems, powertrain matching, and vehicle performance systems. Taught as a series of seminars presented by industry experts and coordinated by the MAE program director. A semester field trip to a transmission manufacturing/engineering facility is included.

EME 6403 - Quality Control
Credits: 3
Quality policies and objectives, management of quality, new product quality, production of quality. Statistical process quality control. Computers and SPQC. Methods for process improvements, preventive maintenance. Quality measure and control in several manufacturing industries.

Curriculum Structure

Term III: I²IT, India / Lawrence Technological University, USA

Course	Credits
Elective I	3
Elective II	3
Elective II	3
Project	9

List of elective subjects offered at Lawrence Technological University, USA.

FME 5103 - Fasteners and Bolted Joints
Credits: 3
Introduction and the analysis behavior and design of fasteners and bolted joints for static and cyclic loading. Assembly and in service issues and parameters as well as the reliability of bolted assemblies.

EME 5113 - Polymer Materials And Processes
Credits: 3
Behavior, processing and applications of plastics; how fundamental characteristics of polymers influence the properties of plastics. Emphasis on the design and manufacture of plastic parts.

EME 5203 - Design of Mechanical Joints
Credits: 3
Design and performance of mechanical and structural joints and interface. Description and analysis of mechanical joints, threaded fastener joints, riveted joints, welded joints and adhesive joints. Flanges and stiffeners; coupling and pin connections; and the design of hub and tubular joints.

EME 5433 - Vehicle Dynamics - 1
Credits: 3
Fundamentals of vehicle dynamics with focus on acceleration, braking, aerodynamics, oxle loading, ride and steady state handling principles, steering and instability (e.g., roll over)

EME 6103 - Engineering Materials
Credits: 3
An advanced course in engineering materials including metals, ceramics, plastics, and composites. Thermodynamics of materials, phase transformations, solidification, elastic and plastic deformation, strengthening mechanisms, fracture, fatigue, and embrittlement. Case studies in engineering materials selection for manufacturing fabrication.

EME 6343 - Automotive Manufacturing
Credits: 3
Manufacturing processes for metals, polymers, automotive manufacturing and assembly, including major sub-assemblies, engine, transmissions, stampings, body construction, paint systems, trim, electrical, powertrain, chassis. The need for new organizations and business processes, such as concurrent engineering, computer-aided manufacturing, introduction to robotics, etc.

EME 6443 - Emission Control Systems
Credits: 3
Further exploration and engineering considerations of the thermodynamic combustion processes of conventional internal combustion engines, the chemical products of the combustion process, and the engineering of the engine, control systems, and components to control vehicle emissions below the regulated levels.

EME 6473 - Hybrid Electric Vehicles
Credits: 3
The engineering requirements to optimize hybrid and alternative fuel vehicles to achieve satisfactory customer acceptance. Major vehicle considerations such as weight, aerodynamics, mechanical power losses, which in turn involve new materials, new manufacturing techniques, etc.

EME 6513 Advanced Driveline System Design -
Credits: 3
Automotive course is proposed to give detailing understanding, to gain mathematically grounded knowledge and engineering experience in design and testing vehicle driveline systems. This is course-I in a (2) course series. The course links vehicle dynamics and vehicle performance study with driveline systems design, and then develops analytical and design skills in these fields of Automotive Engineering. Topics include analysis and synthesis of driveline systems layouts. Design of parallel algorithms for mechantronic driveline systems based on the optimization of vehicle operational properties, engineering design and experimental study of driveline subsystems and mechanisms.

EME 7513 - Advanced Driveline System Design-2
Credits: 3
This course is proposed to gain advanced knowledge, research and engineering experience in automotive driveline systems. Theoretically grounded on applied mathematics and adaptive mechanics, it develops analytical skills in research, design, and experimental study of driveline systems. This course-II in a (2) course series. Topics cover a general theory and engineering methods of analysis of driveline systems as multi-structural bodies dynamics. The course gives wide vision and knowledge in dynamics, noises, and vibration of drivelines and their components. Interaction between drivelines, suspension systems, and vehicle bodies is also covered. Regular classes are accommodated with computer labs (ADAMS/Driveline) and experimental labs (NVH instrumentation).

EME 7433 - Vehicle Dynamics - 2

Credits: 3

Advanced study of vehicle dynamics with focus on pneumatic tire behavior, suspension and steering characteristics for ride and handling, including steady state and unsteady state handling. Dynamics of vehicles including passenger automobiles, trucks, tractors, trailers and non-highway trucks.

EME 7623 - Automotive Control Systems 2

Credits: 3

Project oriented course focusing on the development of modern control systems for complex automotive vehicle systems. Emphasis on sampled data and digital control systems. This is Course 2 in a (2) course series where student applies the analytical knowledge gained in EME6623 and independently completes an automotive controls systems project. Brief review of analog control systems, discussion of hardware-in the loop concepts, and an introduction to sampled data systems and digital controls, including z-transforms. Control system project selection will be in the areas of vehicle dynamics, steering, suspension, engine, transmission, driveline, or any other vehicle system of special interest to the student. Modern simulation, modeling and control system software such as Matlab®, Simulink®, Stateflow®, dSPACE® software and hardware used for project implementation. Use of the LTU 4WD vehicle chassis dynamometer for vehicle controls is included.

EME 5243 - Finite Element Analysisl

Credits: 3

A course in FEA that introduces higher order elements and focuses on using existing software packages to do class projects. Linear strain triangle, axisymmetric solid elements. Isoparametric formulation, dynamic analysis.

EME6533 Noise Vibration and Harshness

Credits: 3

Free and forced multi-degree-of-freedom systems. Eigenvectors and Eigenvalues and orthogonality of normal modes. Mode summation method. Lagrange's Equations. solutions of forced vibrationd by Laplace Transforms and numerical methods. Rayleigh's principle and approximate numeral techniques. Vibration of continuous systems: longitudinal and transverse vibration of beams; torsional vibrations, vibrating string.

List of electives offered at I²IT, India.

AME 8001 - Automotive Embedded System I *

Credits: 3

Introduction to Unified Modeling Language (UML), UML RT + State Driven Modeling 4+1 views of a software system. Concurrency view, Finite State Machines. CASE tools IBM Rose Real Time, iLogix Rhapsody etc. Embedded Programming (Programming subject) Communication Protocols and Telematics CANBUS and Flex-Ray Protocol.

AME 8002 - Automotive Embedded System II *

Credits: 3

Introduction to hard real-time systems. Pre-emption, worst Case performance vs Avg. case performance and mathematical guarantees for real timeness. Programming for RTOS. Porting onto other processor. Rate Monotonic Analysis. Analysis of Engine Control System. Multi-processor system architecture. Case Study of Survivable Software Systems and Graceful Degradation. Study of common embedded automotive sub-systems. Airbag subsystem, Antilock Braking System, Drive by wire systems.

AME 6983-02 - Micro Controllers and PLD's in Automotive Systems *
Credits: 3
Covers various micro controller architectures and their roles in automotive segment. Discussion of various communication protocols used in automotive architecture. It further discusses the need for latest CPLD's and FPGA's in design of automotive electronic systems along with their architecture and design around them.

AME 8008 Automotive Area Networks *
Credits: 3
Understanding of communication technologies involved in automotive engineering. Wireline and wireless technologies for communication within the vehicles and in between the vehicle and base stations. Discussion and analysis of conventional wireline LAN technologies such as Ethernet, Token Ring, and Token Bus. Wireless technologies such as Wi-Fi, Blue tooth, Zig Bee, UWB, Wi-Max, GPS along with the communication sensors.

AME 8009 High-performance Computing Applications
Credits: 3
High-performance Computing Applications in automotive industry. Introduction to standard packages in finite element analysis, computational fluid dynamics, IC engine design, crash simulation, aerodynamics amongst others.

EME 6803 - Engineering Management
Credits: 3
Global manufacturing and the new challenges. Manufacturing and engineering business systems and organizations. Management responsibilities and contributions to strategic planning. Management of resource in a manufacturing enterprise. Industrial relations and collective bargaining. Management of technology. How to reward achievers. Manufacturing organization for the future.

Project
Credits: 9
Students can undertake an industry-sponsored project or a research-based project leading to Master's level competency. For industry-sponsored projects, the Career Management Center facilitates interaction between students and the industry. Students are encouraged to work on projects, which will enhance their understanding in certain technology domains within a real-life scenario. The research project includes researching on the given/chosen seminar topic, which will generally be state-of-the-art in the field and then delivering the seminar to peers and faculty along with its documentation in the prescribed IEEE format. Following the seminar, the student has to undertake a research project under the guidance of tenure track/visiting faculty/and industry experts. The research project has to be submitted in the form of a dissertation, which will be examined by experts nominated by the institute. The research project is the culmination of the student's learning in the institute and is expected to be of high standards as demanded by the industry.

* Students opting for these electives will have to undertake pre-requisite courses in Analog and Digital Electronics, Introduction to Analog and Digital Systems and Control, Introduction to C and Java.

Note: Electives offered are representative and maybe added or dropped depending upon minimum number of students opting and availability of faculty.