High competition and large market size are characteristic of the automotive industry. The Automotive Industry is poised to emerge as the most important economic sector for the next ten years and automotive electronics is expected to play a major role in mitigating industry challenges. The cost of the electronic embedded system in an automobile has increase from a mere one percent in 1980 to twenty percent in 2005 and would be forty percent by 2015. Microcontrollers, embedded systems, a variety of sensors, and many challenging on-line processing techniques contribute substantially to improve engine performance, redefine engine safety, passenger comfort, driver interface, navigation and environmental pollution. India, with its emerging market and competent professionals – has become a hub of development activity in the area.

The need to train and evolve professionals with expertise in digital electronics and allied areas has become a challenging task. The proposed course here is expected to fill the gap. It is expected to offer subjects in electrical sciences with a judicious mix of those in automotive systems. Those completing the course are expected to be well suited to take up the R & D challenges in the area in the decades to come and would be equipped to work effectively in collaboration with a multidisciplinary team.
# CURRICULUM
## First Semester

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Credits 15

*Non Credit Course

## Second Semester

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**Credits** 20

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**Credits** 10

**Total Credits: 64**
## List of Courses

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### Subject Core

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## Project Work

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AS601 APPLIED MATHEMATICS 3-0-0-3


Wave Equation: Solution of initial and boundary value problems – Characteristics – D’Alembert’s solution – Significance of characteristic curves – Laplace transform solutions for displacement in a long string, in a long string under its weight – a bar with prescribed force on one end – Free vibrations of a string.


Queuing theory: Single and Multiple server Markovian Queuing Models with finite and infinite system capacity – Priority queues – Queuing applications.

TEXT BOOKS/REFERENCES:


AS602 OBJECT-ORIENTED SOFTWARE ANALYSIS 3-0-0-3
AND DESIGN WITH UML


TEXT BOOKS/REFERENCES:


Kernel: Configuring and building a kernel - booting- debugging embedded systems - DDD debugger. Device driver: Introduction to device driver - Design and building a device driver into a kernel - Device structures, operations - kernel tables and dispatching.


Embedded networking: Sockets - embedded web servers - resource virtualization and other application level protocols - Emerging operating systems: Eclipse IDE for C - Embedded Linux Pthreads - Gnu Tool chain - UML design tool.

TEXT BOOKS/REFERENCES:

Review of signals and systems: Commonly used signals in DSP- unit step and Impulse, sinusoids, complex exponentials, classification of signals, periodicity, energy vs power signals.
Discrete time systems – classification of discrete systems, Characterization of LTI systems - Impulse response, convolution, difference equation, FIR/IIR systems. Basic concepts of sampling.
Review of Fourier analysis: Continuous time periodic Fourier series; discrete time periodic Fourier series; Continuous time A periodic Fourier transform; discrete time A periodic Fourier transforms; Discrete Fourier Transform and Fast Fourier transforms.
Definition of DFT; Properties and relationships among various Fourier transforms. The discrete Fourier transforms; definition of the DFT and its inverse; transform relationships; cyclic convolution and correlation; Fast Fourier transform algorithms, Linear filtering of long sequences using the FFT.
Z-Transforms: Definition, ROC, properties relationships to DTFT and D FT, concepts of poles and zeros of a system, inverse Z-transforms.

TEXT BOOKS/REFERENCES:

Drive train – drive train elements – Multi-speed gearbox – Manual Transmission- Automatic transmissions – continuously variable transmissions- all wheel drive
Chassis systems – Basic principles – Suspension – shock absorbers – Wheels – wheel suspensions – Tires – Steering, system requirements - power assisted steering systems
Vehicle dynamics – dynamics of linear motion – accelerating and braking –dynamics of lateral motion –operating dynamics – Aerodynamic parameters
Vehicle acoustics – exterior noise measurement and statutory limits – engineering acoustics

**TEXT BOOKS/REFERENCES:**

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**AS612 EMERGING COMPUTER ARCHITECTURES 3-0-0-3**


**TEXT BOOKS/REFERENCES:**

TEXT BOOKS/REFERENCES:


AS614 INTRODUCTION TO MULTIMEDIA SYSTEMS 3-0-0-3


TEXT BOOKS/REFERENCES:

Overview of basic principles in computer networks and wireless networks - power aware computing - integration of these principles into embedded systems - basic security principles as applied to this context - Computer Networks review - Wireless networks review - Power-aware computing - Sensor networks - Applications in embedded systems - Integration of wireless, sensors and embedded hardware/software - Security.

**TEXT BOOKS/REFERENCES:**


**AS616 EMBEDDED PROCESSORS AND INTERFACING WITH FOCUS ON ARM PROCESSORS**


**TEXT BOOKS/REFERENCES:**


**AS617 EMERGING APPLICATIONS AND PLATFORMS IN EMBEDDED SYSTEMS**

Introduction to mobile phone programming: Building effective interfaces for mobile devices with 3D - SVG and games API - Mobile phone programming languages - Internationalizing API. Creating end to end mobile applications: payment API - Python for Symbian phones - C++ for Symbian phones.

TEXT BOOKS/REFERENCES:


AS618 EMBEDDED SYSTEMS ON CHIP (SOC), FAULT TOLERANCE, 3-0-0-3 VERIFICATION AND TESTING

Design, verification and testing of today’s system on chips. System design challenges, design verification, test and debug standards. Both hardware and software issues related to design, test and fault tolerance will be covered with special emphasis on power management. Projects - hardware or software systems.
Introduction to Embedded hardware - Processors, Chipsets, Cores - System on Chip basic concepts - System level design and integration with emphasis - power, performance - test and verification - Hardware/Software Co Design - Verification methodologies - Application driven embedded SoC systems - SoC test and test scheduling - Fault Tolerance and IP protection.

TEXT BOOKS/REFERENCES:

AS701 AUTOMOTIVE CHASSIS AND SUSPENSION SYSTEM 3-0-0-3


TEXT BOOKS/REFERENCES:


AT701 AUTOMOTIVE STANDARDS AND REGULATIONS 3-0-0-3


TEXT BOOKS/REFERENCES:

AS702 PROGRAMMING MULTI-CORE ARCHITECTURES 3-0-0-3

Introduction - Technology trends leading to prevalence of multi-core architectures - General purpose multi-core architectures - Shared memory architecture - Synchronization primitives - Vector processing (SIMD).


Graphics processor programming – nVidia CUDA - nVidia CUDA architecture - programming - Power-aware computing.

TEXT BOOKS/REFERENCES:


AT705 AUTOMOTIVE SAFETY 3-0-0-3

TEXT BOOKS/REFERENCES:


AS703 INTRODUCTION TO AUTOMOTIVE EMBEDDED SYSTEMS 3-0-0-3


TEXT BOOKS/REFERENCES:

Introduction to modern hardware and computing systems- Networking. Visualization- digital mockup – Virtual reality centers – styling. Finite element methods and their applications to automotive applications. Modeling and simulation of automotive systems such as braking, suspension, hydraulics, fuel, transmission, electrical harness, tubing etc.CAD/CAM/CAE CFD. Vehicle dynamics and simulation. Vehicle crash and occupant protection simulation.
Simulation of engine and subsystems as well as combustion/ Simulation of various control systems/NVH simulation, Vehicle performance simulation. Optimization of the various systems and multi attribute optimization. Meshless computing, Simultaneous and concurrent engineering.

TEXT BOOKS/REFERENCES:


**TEXT BOOKS/REFERENCES:**


**AS704 ADVANCED AUTOMOTIVE EMBEDDED SYSTEMS 3-0-0-3**


**TEXT BOOKS/REFERENCES:**

AT710 AUTOMOTIVE HVAC, CABIN COMFORT AND ERGONOMICS 3-0-0-3


Applications of HVAC fundamentals to analysis and design of automotive air conditioning systems. Psychometrics, passenger thermal comfort, refrigeration cycles and system design, central and Unitary systems, heating system design, air flow circuits, Air cleaning, ventilation, air space diffusion, compact heat exchanger design, controls and instrumentation. Cabin comfort - In-car air conditioning - overall energy efficiency - air management.

TEXT BOOKS/REFERENCES:

5. ASHRAE Handbooks.

AS705 NVH AND REFINEMENT FOR AUTOMOTIVE APPLICATION 3-0-0-3


TEXT BOOKS/REFERENCES:


AT614 AUTOMOTIVE EMISSIONS AND CONTROL 3-0-0-3


TEXT BOOKS/REFERENCES:


TEXT BOOKS/REFERENCES: