# DAYANANDA SAGAR UNIVERSITY

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## SCHOOL OF ENGINEERING

# SCHEME & SYLLABUS
# FOR
# MASTER OF TECHNOLOGY ( M.Tech) – 2020
# ELECTRONICS & COMMUNICATION ENGINEERING
## SPECIALIZATION: EMBEDDED SYSTEMS

**(With Effect from 2020-21)**

**SEMESTER I**

| SL | PROGRAM CODE | COURSE CODE | COURSE TITLE | $\frac{CR}{AU}$ | SCHEME OF TEACHING | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | S/P | C |
| 1 | 201 | 20ESE5101 | LINEAR ALGEBRA AND OPTIMIZATION TECHNIQUES | CR | 03 | 01 | - | - | 04 |
| 2 | 201 | 20ESE5102 | MODERN AUTOMOTIVE SYSTEMS | CR | 03 | - | - | - | 03 |
| 3 | 201 | 20ESE5103 | AUTOMOTIVE EMBEDDED SYSTEM | CR | 03 | - | - | - | 03 |
| 4 | 201 | 20ESE5XXX | DEPARTMENT ELECTIVE – I | CR | 03 | - | 02 | - | 04 |
| 5 | 201 | 20ESE5XXX | DEPARTMENT ELECTIVE – II | CR | 03 | - | 02 | - | 04 |
| 6 | 201 | 20ESE5104 | AUTOMOTIVE SYSTEM LAB | CR | - | - | 04 | - | 02 |
| 7 | 201 | 20ESE5105 | AUTOMOTIVE EMBEDDED SYSTEMS LAB | CR | - | - | 04 | - | 02 |
| | | | | | **15** | **01** | **12** | - | **22** |

**SEMESTER II**

| SL | PROGRAM CODE | COURSE CODE | COURSE TITLE | $\frac{CR}{AU}$ | SCHEME OF TEACHING | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | S/P | C |
| 1 | 201 | 20ESE5201 | AUTOMOTIVE CONTROL AND SIMULATION | CR | 03 | - | - | - | 03 |
| 2 | 201 | 20ESE5202 | AUTOMOTIVE POWER ELECTRONICS AND DRIVES | CR | 03 | - | - | - | 04 |
| 3 | 201 | 20ESE5203 | AUTOMOTIVE SOFTWARE ARCHITECTURE | CR | 03 | - | 02 | - | 03 |
| 4 | 201 | 20ESE5XXX | DEPARTMENT ELECTIVE – III | CR | 03 | - | 02 | - | 04 |
| 5 | 201 | 20ESE5XXX | DEPARTMENT ELECTIVE – IV | CR | 03 | - | 02 | - | 04 |
| 6 | 201 | 20ESE5204 | CONTROL AND SIMULATION LAB | CR | - | - | 04 | - | 02 |
| 7 | 201 | 20ESE5205 | AUTOMOTIVE POWER ELECTRONICS LAB | CR | - | - | 04 | - | 02 |
| | | | | | **15** | - | **14** | - | **22** |

CR – CREDIT, AU – AUDIT, L – LECTURE, T – TUTORIAL, P – PRACTICAL, S/P – SEMINAR/PROJECT, C – NO. OF CREDITS,

**SEMESTER III**

| SL | PROGRAM CODE | COURSE CODE | COURSE TITLE | $\frac{CR}{AU}$ | SCHEME OF TEACHING | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | S/P | C |
| 1 | 201 | 20ESE5XXX | DEPARTMENT ELECTIVE – V | CR | 03 | - | 02 | - | 04 |
| 2 | 201 | 20MOE53XX | OPEN ELECTIVE | CR | 03 | - | - | - | 03 |
| 3 | 201 | 20ESE5301 | DISSERTATION PHASE 1 | CR | - | - | 06 | - | 03 |
| | | | | | **06** | - | **08** | **-** | **10** |

**SEMESTER IV**

| SL | PROGRAM CODE | COURSE CODE | COURSE TITLE | $\frac{CR}{AU}$ | SCHEME OF TEACHING | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | S/P | C |
| 1 | 201 | 20ESE5XXX | DEPARTMENT ELECTIVE – VI | CR | 03 | - | 02 | - | 04 |
| 2 | 201 | 20ESE5401 | DISSERTATION PHASE 2 | CR | - | - | 12 | - | 06 |
| | | | | | **03** | - | **14** | **-** | **10** |

CR – CREDIT, AU – AUDIT, L – LECTURE, T – TUTORIAL, P – PRACTICAL, S/P – SEMINAR/PROJECT, C – NO. OF CREDITS,

## DEPARTMENTAL ELECTIVES

### I SEM

| SL | COURSE CODES | COURSE TITLE |
|---|---|---|
| 1 | 20ESE5131 | AUTOMOTIVE VEHICLE NETWORK |
| 2 | 20ESE5132 | REAL TIME EMBEDDED SYSTEMS |

### II SEM

| SL | COURSE CODES | COURSE TITLE |
|---|---|---|
| 1 | 20ESE5231 | EMBEDDED ARCHITECTURE AND TECHNOLOGY |
| 2 | 20ESE5232 | ADVANCED EMBEDDED SYSTEMS |

### III SEM

| SL | COURSE CODES | COURSE TITLE |
|---|---|---|
| 1 | 20ESE5331 | SAFETY CRITICAL SYSTEMS |
| 2 | 20ESE5332 | INSTRUMENT CLUSTER AND INFOTAINMENT SYSTEMS |
| 3 | 20ESE5333 | ENGINE MANAGEMENT SYSTEMS |

### IV SEM

| SL | COURSE CODES | COURSE TITLE |
|---|---|---|
| 1 | 20ESE5431 | PROTOCOL NETWORKS AND WIRELESS COMMUNICATION |
| 2 | 20ESE5432 | PRODUCT MANAGEMENT |
| 3 | 20ESE5433 | INTERNET OF THING AND SMART VEHICLE |
| 4 | 20ESE5434 | WEB AND MOBILE APPLICATIONS |

## OPEN ELECTIVES

| SL | COURSE CODE | COURSE TITLE | OFFERING DEPARTMENT |
|---|---|---|---|
| 1 | 20MOE5301 | DIGITAL MARKETING | COMPUTER SCIENCE & ENGINEERING |
| 2 | 20MOE5302 | PRODUCT LIFECYCLE MANAGEMENT | MECHANICAL ENGINEERING |
| 3 | 20MOE5303 | PROJECT MANAGEMENT | ELECTRONICS & COMMUNICATION ENGINEERING |

**SEMESTER/YEAR : I SEM**
**COURSE CODE : 20ESE5101**
**TITLE OF THE COURSE : LINEAR ALGEBRA AND OPTIMIZATION TECHNIQUES**
**L: T/A: P: C : 3: 1: 0: 4**

**COURSE OBJECTIVE:**
1. To disseminate knowledge on matrix algebra and determinants.
2. To familiarize about vector spaces, Orthonormal sets.
3. To master concepts of graph theory and optimization problems.

**COURSE OUTCOME:**
1. To solve problems on matrix algebra.
2. Gain in-depth knowledge of vector spaces and Gram Schmidt orthogonalization procedure.
3. Get insight OS graph theory and application of optimization techniques.

**MATRICES AND SYSTEMS OF EQUATIONS, DETERMINANTS (09 Hours)**
Systems of linear equations – Row echelon form – Matrix algebra – Elementary matrices Partitioned matrices – The Determinant of a Matrix – Properties of Determinants – Cramer's rule.

**VECTOR SPACES AND LINEAR TRANSFORMATIONS (09 Hours)**
Definition and examples – Subspaces – Linear independence – Basis and dimensions – Change of basis – Row space and Column space – Linear transformations: Definition – Matrix representations.

**ORTHOGONALITY AND EIGENVALUES (12 Hours)**
The Scalar product in R – Orthogonal subspace – Least squares problem – Inner product space – Orthonormal sets – The Gram-Schmidt Orthogonalization procedure – Orthogonal polynomials – Eigenvalues and Eigenvectors – Systems of Linear differential equations – Diagonalization–Hermitianmatrices–TheSingularValueDecomposition–Quadraticforms – Positive definite matrices – Non-negative matrices.

**GRAPH THEORY (10 Hours)**
Vertex cover, matching, path cover, connectivity, hamiltonicity, edge colouring, vertex colouring, list colouring; Planarity, Perfect graphs; other special classes of graphs; Random graphs, Network flows, Introduction to Graph minor theory.

**INTRODUCTION TO OPTIMIZATION (10 Hours)**
Statement of an optimization problem, Classification of optimization problem. Classical optimization techniques- single variable optimization, multivariable optimization with no constraints, with equality constraints, with inequality constraints and convex programming problem.

**TEXT BOOKS:**

1. Gilbert Strang, Introduction to Linear Algebra, 4th Edition Wellesley-Cambridge Press.

2. Reinhard Diestel, "Graph Theory", Springer (2010).

**REFERENCES:**


1. Artin,M., Algebra, Prentice-Hall ofIndia,1994.
2. S.S Rao, Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.

**SEMESTER/YEAR : I SEM**
**COURSE CODE : 20ESE5102**
**TITLE OF THE COURSE : MODERN AUTOMOTIVE SYSTEMS**
**L: T/A: P: C : 3: 0: 0: 3**

**COURSE OBJECTIVE**

1. To prepare the students to critically evaluate the challenges and identify the role of electronics and software systems in a modern automobile.
2. To realise the principles ,construction and working of automotive systems, limitations of the conventional systems, the needs for electronic controls to improve the performance, safety and meet regulatory requirements.
3. To explore potential new functions and applications by studying the physical systems, interacting with experts and users.

**COURSE OUTCOME**

1. Explain and specify the function of electronic systems in modern automobiles.
2. Evaluate the use of modern electronics technology to improve the performance, safety, comfort and related issues.
3. Synthesize and specify the addition of new features in existing electronic automotive subsystems for enhanced functionality.

**INTRODUCTION TO MODERN AUTOMOTIVE SYSTEMS AND INDUSTRY (08 Hours)**

Automotive systems - Automotive Tools and Technology - Model Based Software Engineering -A novel approach -Key drivers of growth and Trend

**AUTOMOTIVE SENSORS AND ACTUATORS (10 Hours)**

Basic and Overview – Automotive applications Details of the sensor market - Feature of the vehicle sensors- Sensor classification - Error types and tolerance - Automotive Electrical Architecture

**VEHICLE NETWORK (12 Hours)**

CAN –LIN – FlexRay –MOST - In Vehicle Network Diagnostics: Process of Automotive Fault Diagnostics - Fault Codes - Vehicle Systems (open-loop and closed-loop) - On- and Off- Board Diagnostics - OBD-I - OBD-II – Engine -Steps taken to diagnose a fault - Diagnostics Protocol-KWP2000 - SAE-J1587 - SAE-J1708.

**AUTOMOTIVE APPLICATION (10 Hours)**

Comfort and Convenience -Power train and Hybrid Systems -Safety systems –Infotainment: Instrument cluster -Advance Driver Assistant systems (ADAS) and Autonomous driving - Smart vehicle

**AUTOMOTIVE ORGANIZATION** **(10 Hours)**

SAE -SAE India –AUTOSAR -ISO26262- FISITA -Automotive Technology Organization

**TEXT BOOK:**


1. Denton., *Automotive Electrical and Electronic Systems*, Elsevier Butterworth-Heinemann (2004)
2. Jack Erjavec., *Automotive Technology – A System Approach*, 3rd edition. (2004)


**REFERENCES:**


1. http:// www.sae.org
2. http://www.delphi.com
3. http://www.bosch.com

**SEMESTER/YEAR : I SEM**
**COURSE CODE : 20ESE5103**
**TITLE OF THE COURSE : AUTOMOTIVE EMBEDDED SYSTEM**
**L: T/A: P: C : 3: 0: 0: 3**

**COURSE OBJECTIVE**

1. Inculcation the requisite skill to design and implement automotive embedded applications using micro-controllers.
2. To develop automotive applications using microcontrollers.
3. To master typical embedded microcontroller used in automotive industries, hardware interfacing and microcontroller programming in C and assembly languages are taught in detail.

**COURSE OUTCOME**

1. Demonstrate real-time system principles, issues involved in the development of real-time.
2. Analyse different features, architecture, peripheral interfacing and programming of embedded microcontrollers for automotive applications.

**INTRODUCTION TO AUTOMOTIVE ECU SOFTWARE DEVELOPMENT USING ADVANCE MICROCONTROLLER (03 Hours)**

Basics of ECU HW -Microcontroller/microprocessor -Signal conditioning circuits (input/output circuits) - Memory Layouts (RAM/ROM/Flash) -Understanding schematics of an ECU

**ARCHITECTURE OF 16-BIT EMBEDDED MICRO-CONTROLLERS (12 Hours)**

Introduction to 68HC12 Family of Micro controllers -68HC12 in automotive applications – Architecture – Registers - 68HC12/68HCS12 - assembly language programming - 16-bit HCS12 CPU -SIM (System Integration module) -Clocks and Reset Generator (CRG) -Memory, Peripheral -On-chip Voltage Regulator

**PERIPHERAL INTERFACING WITH 16-BIT MICRO-CONTROLLER (16 Hours)**

Timer -parallel port programming -Stepper motors – LCD – Keyboard - Serial Port – ADC – DAC - Sensor Interfacing - Interrupt handling - PWM generation - DC motor control - automotive embedded system Application development using IO and related programming –UART – SPI - I2C - Various ways to use the CAN module in HCS12 - Micro-controller based system development using IO related programming

**TIMERS, ALARMS, COUNTERS, EVENTS, INTERRUPTS, EXCEPTIONS (06 Hours)**
Implementation of Timer – Alarms – Counters – Events - Interrupts and Exceptions in a Microcontroller

**EMBEDDED SOFTWARE DEVELOPMENT LIFE CYCLE (SDLC) (13 Hours)**
**V** Model Water fall - Requirement Engineering - Requirement gathering - Requirement analysis - Software Architecture - Software Prototyping - Software design - High level - Low level -Software Implementation - Software verification and validation -Software Development Practices - Basics of Project/Product Management -Software estimation - Resource planning and management - Risk Management - Software Quality processes - Requirement change management - Software Configuration management.

**TEXT BOOK:**


1. Frank Vahid and Tony Givargis, Embedded System Design: A Unified hardware/Software Introduction, John Wiley & Sons. (2002)
2. Muhammad Ali Mazidi, Danny Causey and Janice Mazidi. HCS12 Microcontrollers and Embedded Systems, Prentice Hall. (2008)


**REFERENCES:**


1. International Journal for Automotive Technology
2. IEEE Transactions on Vehicular Technologies
3. David E. Simon, (1999), an Embedded Software Primer, Pearson Education

**SEMESTER/YEAR : II SEM**
**COURSE CODE : 20ESE5201**
**TITLE OF THE COURSE : AUTOMOTIVE CONTROL AND SIMULATION**
**L: T/A: P: C : 3: 0: 0: 3**

**COURSE OBJECTIVE**

1. To design controllers for controlling the dynamic behaviour of automotive systems.
2. To introduce control systems engineering terminology and learn modelling of physical systems.
3. To attain expertise in control theory and digital control systems.

**COURSE OUTCOME**

1. Develop mathematical models for automotive subsystems.
2. Ability to solve problems on time response, frequency response and stability analysis of control systems.
3. Proficiently use Matlab / Simulink software and perform time response and frequency response analysis of systems.

**INTRODUCTION TO AUTOMOTIVE CONTROL AND SIMULATION (05 Hours)**

Introduction to Control Systems and its classification, Control system applications in automotive engineering

**MATHEMATICAL MODELLING OF PHYSICAL SYSTEMS (17 Hours)**

Fundamentals of modelling using transfer function approach, Modelling of Suspension System, Power steering System, Fuel injection system and Antilock braking system, Introduction to Block Diagrams &Signal Flow Graphs, Time domain analysis, First Order, second Order, higher order control system response for typical inputs like Step, Ramp and Impulse inputs, Time response specifications, Error Analysis - Type number, Characteristic Equation, Poles and Zeroes concept, Error Analysis and Performance criterion, Controllers and their characteristics, Demonstration on the use of Simulink tools for solving mathematical models for time response of analysis

**STABILITY ANALYSIS AND COMPENSATION TECHNIQUES (10 Hours)**

Routh -Hurwitz stability criteria, Root Locus Method, Frequency response analysis, Types of compensators and compensator design, State Space Analysis of Control Systems, State variables, State Space representation, State Models, Solution of time invariant state equations

**DISCRETE TIME SYSTEMS AND Z - TRANSFORM METHOD (10 Hours)**

Introduction to z-transformation, Solving difference equations by the z-transform method, Inverse z transformation, Pulse transfer function and Stability analysis in the z-plane, Digital control systems, Introduction, Controllers, Modelling of digital control systems and implementation on controllers

**HARDWARE IN-THE-LOOP TESTING (08 Hours)**

Experimental setup for HIL, HIL testing, Introduction to LabCar, building scenarios and vehicle analysis using Labcar.

**TEXT BOOK:**


1. Norman S. Nise. *Control Systems Engineering,* 6th Edition, Wiley.(2010)

2. Richard C. Dorf and Robert H. Bishop. *Modern Control Systems*, 12th Edition, Prentice Hall.(2010)


**REFERENCES**:


1. www.engin.umich.edu/group/ctm

2. Uwe Kiencke and Lars Nielsen. *Automotive Control Systems: For Engine, Driveline, and Vehicle*, 2nd Edition, Springer.(2010)

3. Farid Golnaraghi and Benjamin C. Kuo. *Automatic Control Systems,* 9th Edition, Wiley.(2009)

**SEMESTER/YEAR : II SEM**
**COURSE CODE : 20ESE5202**
**TITLE OF THE COURSE : AUTOMOTIVE POWER ELECTRONICS AND DRIVES**
**L: T/A: P: C : 3: 0: 0: 3**

**COURSE OBJECTIVE**

1. To develop maximum power point algorithms.
2. To analyze, design and simulate different power converters and dynamics of electrical machine.

**COURSE OUTCOME**

1. Able to realize and design power electronics and drive systems for different applications and conduct experiments, analyze and interpret data.
2. To integrate new technology and use of modern engineering tools.

**INTRODUCTION AUTOMOTIVE POWER ELECTRONICS AND DRIVES (03 Hours)**

Need for Automotive Power Electronics, Power Electronic Vehicle Architecture, Future Trends.

**AUTOMOTIVE POWER SEMICONDUCTOR DEVICES (08 Hours)**

Introduction, Diodes, Power MOSFET's, IGBT, Power Integrated Circuits, Emerging Device Technologies: Super-Junction and SIC Devices, Power Losses and Thermal Management

**AUTOMOTIVE POWER ELECTRONIC CONVERTERS (08 Hours)**

DC-DC Converters, AC-DC Rectifiers, DC-AC Inverters, Alternators, Electrical power generation in the Vehicle, voltage protection, Power losses, EMC, EMC Ranges

**AUTOMOTIVE MOTOR DRIVES (19 Hours)**

Brushed-DC Electric Machinery for Automotive Applications, Induction Motor Drives, Power Electronics and Control for Hybrid and Fuel Cell Vehicles, Introduction, Power Electronics Requirements, Propulsion Motor Control Strategies-Slip Frequency Control Vector Control of Propulsion Motion, Sensor less Operation, APU Control System in Series Hybrid Vehicles, Fuel Cell for APU Applications

**POWER ELECTRONICS APPLICATIONS IN-VEHICLE AND PASSENGER SAFETY (12 Hours)**

Introduction, Power Electronics in Vehicle Safety, Power Electronics in Passenger Safety, Thermal Management, Introduction, Thermal Model of Electronic Devices, Maximum Power Ratings of Semiconductor Devices, Extruded Heat Sinks, and Multiple Devices on a Common Heat sink

**TEXT BOOK:**


1. Randall Shaffer. *Fundamentals of Power Electronics with MATLAB*, River Media.(2007)
2. Ali Emadi. *Handbook of Automotive Power Electronics and Motor Drives*, Taylor and Francis.(2005)


**REFERENCES**:


1. M. H. Rashid. *Power Electronics*, 3rd Edition, Prentice Hall.(2004)
2. N. Mohan, J. M. Undelan and W. Robbins. *Power Electronics: Converters, Applications and Design*, 3rd Edition, John Wiley and Sons.(2002)
3. Billings. *Switched Mode Power Supply Handbook*, 2nd Edition, McGraw Hill.(1999)

**SEMESTER/YEAR : II SEM**
**COURSE CODE : 20ESE5203**
**TITLE OF THE COURSE : AUTOMOTIVE SOFTWARE ARCHITECTURE**
**L: T/A: P: C : 3: 0: 2: 4**

**COURSE OBJECTIVE**

1. To realise the challenges of advanced software design and the issues associated with large-scale software architectures, frameworks, patterns and components.
2. To develop an expertise of the tools and techniques that may be used for the automatic analysis and evaluation of software.

**COURSE OUTCOME**

1. Realise the principles behind software patterns and be able to apply a number of the fundamental patterns.
2. To apply the major approaches for automated software analysis achievable through static and dynamic analysis.

**INTRODUCTION AUTOMOTIVE SW ARCHITECTURE (10 Hours)**

Introduction to Automotive architecture and layered architecture, Need of open architecture, Introduction to AUTOSAR & history.

**AUTOSAR Architecture Overview (10 Hours)**

MicrocontrollerAbstractionlayer,ECUabstractionlayer,Servicelayer,AUTOSARlibraries.

**AUTOSAR Interfaces and Interaction layers (10 Hours)**

Type of Interfaces in AUTOSAR, General Interfacing Rules, Interfacing with Complex Drivers, Implementation of Memory Abstraction Interface, Communication, Data Transformation.

**AUTOSAR Configuration (12 Hours)**

Overview, Pre-compile time, Post-build time, variants.

**AUTOSAR Integration and Runtime Aspects (08 Hours)**

Mapping of Runnable, Partitioning, Scheduling, Mode Management, Error Handling, Reporting and Diagnostic, Debugging, Measurement and Calibration.

**TEXT BOOK:**


1. Tammy Noergaard, Embedded System Architecture, Second Edition, 2014
2. Kevin Roebuck, AUTOSAR, Emereo Pty Ltd, 2011


**REFERENCES**:


1. **http://www.autosar.org**

**SEMESTER/YEAR : I SEM**
**COURSE CODE : 20ESE5131**
**TITLE OF THE COURSE : AUTOMOTIVE VEHICLE NETWORK**
**L: T/A: P: C : 3: 0: 2: 4**

**COURSE OBJECTIVE**

1. To enable the students to interface sensors in modern automotive electronic systems.
2. To disseminate the terminologies on automotive sensors, characterization, sensor selection, interfacing, sensing, data logging.
3. Apply Data processing for specified applications.

**COURSE OUTCOME**

1. To disseminate the automotive sensors and interfacing techniques
2. To Design, model and simulate interfacing systems with sensors
3. To Develop and demonstrate interfacing systems

**INTRODUCTION TO AUTOMOTIVE VEHICLE NETWORK (10 Hours)**

Networks, Need for networks, Types of networks, Need for standards, TCP/IP model, Topologies, Error detection and correction mechanisms, Encoding schemes, Serial/parallel transmission, Bits, Baud and bandwidth Synchronous and asynchronous, Need and benefits of IVN, Classes of IVN protocols, Multiplexed electrical systems, Vehicle multiplexing, Bitwise contention, Network elasticity, Error processing and management

**CONTROLLED AREA NETWORK (CAN) PROTOCOL (10 Hours)**

Controller Area Network (CAN) Protocol, Main characteristics of CAN, CAN Applications, CAN in OSI Reference Model, CAN Data Link Layer, Principles of data exchange in CAN, Arbitration, Data Frame, Remote Frame, Error detection and management in CAN, CAN physical Layer, Bit encoding, Bit timing and synchronization, Relationship between data rate and bus length, Single wire and twin wire media, CAN repeaters, Medium-to-medium gateway, Protocol handlers, Micro-controllers and line drivers, Time-Triggered CAN (TTCAN), Comparison with other IVN protocols.

**LOCAL INTERCONNECT NETWORK (LIN) PROTOCOL (05 Hours)**

LIN consortium, LIN specification, LIN features, Technical overview, LIN operation, LIN frame format, Scheduling table, Network management of LIN cluster, IN Transport Layer, LIN node configuration and identification, LIN diagnostics, LIN physical layer, Comparison with other IVN protocols and Case Study

**FLEXRAY PROTOCOL (13 Hours)**

Future on board systems, Need for FlexRay, Origin of FlexRay, FlexRay consortium, FlexRay Objectives, FlexRay Features, Application requirements, Working of FlexRay, Network topologies, ECU architecture, Segment Configuration, Communication Cycles, FlexRay frame format, Timing of configuration protocol, Error control, and FlexRay core mechanisms, Coding and Decoding, Medium Access Control, Frame and Symbol Processing, Clock Synchronization, FlexRay Components, Comparison with other IVN protocols.

**MEDIA ORIENTED SYSTEM TRANSPORT (MOST) PROTOCOL (12 Hours)**

Emerging in car systems, Introduction to MOST, MOST goals, Features, Cables and Connectors, Data Types, Topology, Frame Format, Application Areas, System Description, Specification, Device Model, Device Implementation, Diagnostics and Comparison with other IVN.

**TEXT BOOK:**


1. Aswin Goel., *Fleet Management*, Springer.(2008)
2. Gilbert Held., *Inter- and Intra-Vehicle Communications*, CRC Press.. (2007)


**REFERENCES**:


1. Ronald W. Cox, Local Area Network Technology Applied to Automotive Electronics Communications, IEEE Transactions on Industrial Electronics, VOL. IE-32, No. 4, November 1985.
2. http://cache.freescale.com/files/microcontrollers/doc/brochure/BRINVEHICLENET.pdf
3. BehrouzForouzan., *Data Communications and Networking*, McGraw-Hill.(2003)
4. Dennis Foy., *Automotive Telematics*, Red Hat.(2002)
5. Ronald k. Jurgen. *Automotive Electronics Handbook*, McGraw-Hill.(1999)

**SEMESTER/YEAR : I SEM**
**COURSE CODE : 20ESE5132**
**TITLE OF THE COURSE : REAL TIME EMBEDDED SYSTEMS**
**L: T/A: P: C : 3: 0: 2: 4**

**COURSE OBJECTIVE**

1. To utilize the principles of real time systems, concepts of RTOS and OSEK Standards.
2. To apply OSEK RTOS for developing real-time software for automotive applications.
3. To porting OSEK RTOS on embedded target and fault tolerance will be discussed.

**COURSE OUTCOME**

1. Design and implement time critical applications using OSEK RTOS.

**INTRODUCTION TO REAL TIME EMBEDDED SYSTEMS (15 Hours)**

Soft and Hard Real Time Systems, Real Time Operating Systems, Difference between general purpose and Real Time Operating System, Introduction to RTOS, Need of Embedded Systems, Need for RTOS in embedded applications, RTOS in automotive applications, Study of ECU using RTOS

**OSEK STANDARD SPECIFICATIONS (07 Hours)**

Introduction to OSEK Standards, OSEK OS, OSEK COM, OSEK NM, OSEK Implementation Language (OIL), OSEK/VDX time triggered operating system, OSEK/VDX fault tolerant communication

**MULTITASKING, INTER PROCESS COMMUNICATION, TASK, THREAD, PROCESS, NEEDS, PURPOSE, ADVANTAGES AGAINST EACH OTHER, PCB, STATES, FLOW OF PROGRAM EXECUTIONS (20 Hours)**

Implementation of Multitasking , Inter Process communication in an Airbag ECU using, OSEK RTOS, programming concepts, efficient software development for ECUs, Implementation of multitasking, flow of executions, different states realization, Binary Semaphore, Mutex semaphores, Shared memory, Pipe, Message Queues, Mail Box, sockets

**OSEK NM (06 Hours)**

Scope of NM,-Direct Network Management-Indirect Network Management, Booting, Board Support Packages (BSP) for RTOS and Reconfiguration-making kernel-image & porting OSEK RTOS on the embedded target with an automotive application

**RTOS INITIALIZATION AND STARTING (08 Hours)**

Booting, Board Support Packages (BSP) for RTOS and Reconfiguration, making kernel Using OSEK RTOS, demonstration of RTOS for various applications

**TEXT BOOK:**


1. Frank Vahid and Tony Givargis. Embedded System Design(2002)
2. Lemieux Joseph. *Programming in the OSEK/VDX Environment*, R & D.(2001)


**REFERENCES**:


1. Phillip A. Laplante.*Real-Time Systems Design and Analysis- An Engineers Handbook*, IEEE Press, PHI.(2001)
2. Alan C. Shaw. *Real-Time Systems and Software*, John Wiley.(2001)
3. Jane W.S. Liu. *Real – Time Systems*, Prentice-Hall.(2000)
4. Gordon Doughman. *Programming the Motorola M68HC12 Family*, Anna books/Rtc.(2000)

**SEMESTER/YEAR : II SEM**
**COURSE CODE : 20ESE5231**
**TITLE OF THE COURSE : EMBEDDED ARCHITECTURES AND TECHNOLOGY**
**L: T/A: P: C : 3: 0: 2: 4**

**COURSE OBJECTIVE**

1. Realize the Hardware and software architecture in detail.
2. Provide exposure to operating system based design.
3. Utilize embedded concepts to Real world design, Application -level techniques.

**COURSE OUTCOME**

1. Mastering embedded processor architecture and programming, I/O and device driver interfaces to embedded processor, OS primitives.
2. Ability to design hardware and software layers of a typical embedded system.

**INTRODUCTION TO EMBEDDED SYSTEMS ARCHITECTURE**: **(06 Hours)**

The Embedded Systems Model, An Overview of Programming Languages and Examples of Their Standards, Standards and Networking, Multiple Standards-Based Device Examples: Digital Television (DTV)

**EMBEDDED HARDWARE ARCHITECTURE**: **(12 Hours)**

ISAs for Embedded Systems, Board Memory, Board I/O and Board Buses, GPP Microarchitectures, ARM ISA, FPGA Architectures, Reconfigurable Logic, DSP Microarchitectures, Networks-on-Chips.

**EMBEDDED SOFTWARE ARCHITECTURE**: **(14 Hours)**

Device Drivers: Device drivers for interrupt handling, Memory device drivers, on-board bus device drivers, Middleware and Application Software: Middleware examples, Application layer software examples.

**EMBEDDED OPERATING SYSTEM**: **(09 Hours)**

Introduction, multitasking and process management, memory management, I/O and file system management, IoT OS examples: TinyOS, contikiOS, Programming model, Memory management, communication protocol stack.

**DESIGN AND DEVELOPMENT**: **(09 Hours)**

Creating an Embedded System Architecture, Implementing the Design, Quality Assurance and Testing of the Design.

**TEXT BOOKS:**

1. Tammy Noergaard, "Embedded Systems Architecture, A Comprehensive Guide for Engineers and Programmers ",Second Edition,2012

**REFERENCES:**


1. www.arm.com
2. C. Maxfield, "The Design Warrior's Guide to FPGAs: Devices, Tools and flows", Newnes, 2004.
3. Phil Lapsley, Jeff Bier, Amit Shoham, Edward A. Lee, "DSP Processor Fundamentals: Architectures and Features" , Wiley India Pvt Ltd, 2009

**SEMESTER/YEAR : II SEM**
**COURSE CODE : 20ESE5232**
**TITLE OF THE COURSE : ADVANCED EMBEDDED SYSTEMS**
**L: T/A: P: C : 3: 0: 2: 4**

**COURSE OBJECTIVE**

1. Provide an overview of Advanced Embedded system
2. Provide the knowledge and hands-on ARM cortex based microcontrollers, Raspberry PI and Arduino Platforms.
3. To inculcate the concepts of Linux environment and Python Programming language

**COURSE OUTCOME**

1. Able to prototype Embedded system Applications on Arduino, Raspberry Pi.
2. Able to use ARM Cortex M based microcontrollers for Application Design and development
3. Familiarity with Linux environment and able to develop simple web applications using Python.

**ARM CORTEX PROCESSORS: (10 Hours)**

Introduction to ARM CORTEX series, improvement over classical series and advantages for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, versions, features and applications. Need of operating system in embedded system, desired features of operating system & hardware support from processor, Firmware development using CMSIS standard for ARM Cortex. Survey of CORTEX based controllers, its features, comparison.

**REAL TIME INTERFACING WITH ARM CORTEX BASED MICROCONTROLLER: (12 Hours)**

Features, Architecture, System control block (PLL and VPB divider), Memory Map, GPIO, Pin Connect Block, timer, interfacing with LED, LCD, GLCD, KEYPAD. Interfacing the peripherals to microcontroller: UART Applications, on-chip ADC using Interrupt (VIC), EEPROM using I2C, SDCARD using SPI

**RAPID PROTOTYPING FOR EMBEDDED SYSTEM WITH RASPBERRY PI: (07 Hours)**

Introduction to Rapid Prototyping using Raspberry Pi, Configuration of Raspberry Pi, Linux on Raspberry Pi: Using the Command Line, Files and the Filesystem, More Linux Commands.

**SCRIPTING LANGUAGE FOR EMBEDDED SYSTEMS: (09 Hours)**

Python-basic: Basic Syntax, variable types, basic operators, decision making, loops, tuples, dictionary, modules, files I/O, Exceptions. Python-Advanced: Classes/Objects, Regular expressions, CGI Programming, Database access, Networking, Multithreading, XML processing, GUI programming, Flask: Introduction, Creating folders, database schema, Creating the database, the View functions, The Templates, Testing the application.

**REAL TIME INTERFACING WITH RASPBERRY PI AND ARDUINO: (12 Hours)**

Basic interfacing With Pi: Interfacing of Sensors and Actuators, Remote Access using Putty. Basic Interfacing with Arduino Uno: Control LEDS from GPIO Pins, Input-Switch Buttons, DC Motor, Servo Motor, Stepper motor, GSM Interface, IOT/Web Development using Raspberry pi: Introduction to Web Framework: GPIO-Control, Webcam Installation, Custom Webpage on Raspberry Pi, Integrating Webcam+ Custom Page.

**TEXT BOOKS:**


1. Shibu K V. "Introduction to Embedded systems", 2009 McGraw Hill Education
2. Matt Rachidson "Getting started with Raspberry Pi " 2013, O'Reilly publisher
3. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide – Designing and Optimizing System Software", 2004, Morgan Kaufmann Publishers


**REFERENCES:**


1. https://www.raspberrypi.org/,
2. http://www.arduino.cc/
3. ARM architecture reference manual
4. www.arm.com,
5. http://www.freescale.com

**SEMESTER/YEAR : III SEM**
**COURSE CODE : 20ESE5331**
**TITLE OF THE COURSE : SAFETY CRITICAL SYSTEMS**
**L: T/A: P: C : 3: 0: 2: 4**

**COURSE OBJECTIVE**

1. Equipping the terminologies of various phases of the safety life cycles in a schematic manner
2. Analyse risk based approaches to the development of the safety requirements

**COURSE OUTCOME**

1. Able to take project management responsibility and wish to ensure that they are aware of most recent developments in safety systems
2. Attain expertise in specific areas of safety related systems, technology

**INTRODUCTION TO SAFTEY SYSTEMS (12 Hours)**

ASIL, Functional Safety Management, why Functional Safety Management-Basic standard of Functional Safety-management of Functional Safety- Functional Safety plan,-concept phase- Risk analysis and Hazard analysis, Product Development system level

**ACTIVE SAFETY SYSTEMS (13 Hours)**

Antilock Braking systems (ABS), Traction Control Systems (TCS), Electronic Stability Program (ESP) of Bosch, Adaptive Cruise Control (ACC),Radar Systems, Vision Systems, Night Vision Systems, Brake Controller

**PASSIVE SAFETY SYSTEMS (13 Hours)**

Airbag systems, Seat belt tensioners, Pedestrian Protection, Intelligent Speed Adaptation (ISA),Intelligent Speed Adaptation (ISA),Crash Testing

**SAFTEY STANDARDS (12 Hours)**

Introduction to ISO26262, ISO26262 and challenges, ISI26262 adaptation, IEC61508, ISO26262 principles, ISO26262 safety life cycle, SO26262 Structure, Vocabulary Important ,ISO analysis

**TEXT BOOK:**

1. Developing Safety-Critical Software: A Practical Guide By Leanna Rierson
2. Embedded Systems Security: Practical Methods for Safe and Secure Software By David Kleidermacher

**REFERENCES:**

1. "ISO 26262 Software Compliance: Achieving Functional Safety in the Automotive Industry" white paper by Parasoft
2. "Automated Defect Prevention for Embedded Software Quality" white paper by VDC Research

**SEMESTER/YEAR : III SEM**
**COURSE CODE : 20ESE5332**
**TITLE OF THE COURSE : INSTRUMENT CLUSTER AND INFOTAINMENT SYSTEMS**
**L: T/A: P: C : 3: 0: 2: 4**

**COURSE OBJECTIVE**

1. Integration of our digital life into cars due to customer demand and integrate some of the best ergonomically best designed visual and audio components to give you the feel of home.
2. To give highly dynamic innovations that can ensure various applications on the road.

**COURSE OUTCOME**

1. Understand the User experience critically realistically and are able to deliver great looking solutions.

**INTRODUCTION TO INFOTAINMENT SYSTEMS (10 Hours)**

Introduction to Infotainment Systems, In-car entertainment (ICE), or in-vehicle infotainment (IVI), Car audio, Carputers, Internet, Safety concerns, HMI

**INSTRUMENT CLUSTER SYSTEMS (10 Hours)**

Display systems, Personalized screen, Electronic instrument cluster, Digital instrument panel, Automotive, LCD, Speedometer, Tachometer, lamp, High

**NAVIGATION SYSTEMS (10 Hours)**

Global Positioning Systems (GPS), Inertial Navigation Systems (INS), Vehicle Location and Navigation

**INFOTAINMENT SYSTEMS (08 Hours)**

Real-time management and planning of commercial vehicle operation, Satellite Radio (XM-Radio and SIRIUS), Fleet Management

**MOBILE APPLICATIONS (12 Hours)**

Mobile communication antennas (cellular antennas) for the automotive and commercial vehicle industry as well as for M2M markets, Types of Cellular antennas: - External Cellular Antennas, Integrated Cellular Antennas, and Future.

**TEXT BOOK:**

1. Embedded Android: Porting, Extending, By Karim Yaghmour
2. Clusters in Automotive and Information & Communication Technology: Innovation, Multinationalization and Networking Dynamics By Paul J.J. Welfens (Editor)

**REFERENCES:**

1. Embedded Security in Cars: Securing Current and Future Automotive IT Applications Hardcover – Import, by Kerstin Lemke (Editor), Christof Paar (Editor) , Marko Wolf (Editor) (2005)

**SEMESTER/YEAR : III SEM**
**COURSE CODE : 20ESE5333**
**TITLE OF THE COURSE : ENGINE MANAGEMENT SYSTEMS**
**L: T/A: P: C : 3: 0: 2: 4**

**COURSE OBJECTIVE**

1. To realize the fundamentals, operation, function of various systems and their major components in various engine systems.
2. To measure and test sensors, actuators, wiring circuits and control units

**COURSE OUTCOME**

1. Able to identify directional control, Pressure control, flow controls relative to on and off engine systems.
2. Able to summarize maintenance procedures related to steering system, brake system, maintenance, adjustment and testing.

**INTRODUCTION TO ENGINE MANAGEMENT SYSTEMS (10 Hours)**

History of automobile engine system, History of diesel engine, Area of diesel engine, Basic principle of Diesel engine- basic principal of fuel engine-Basics of gasoline

**COMPUTERIZED ELECTRONIC FUEL INJECTION (22 Hours)**

Theory of Operation: Analog & Digital Signals, Binary Numbers & Memories, Data Links & Multiplex Communication, Types of Fuel Injection, Common Component, Engine Input Sensors: Coolant & Intake Temperature, Crankshaft Position, Camshaft Position, Manifold Absolute Pressure, Throttle Position, Oxygen, Air/Fuel Ratio, Knock, Speed & Distance , Battery & Switches, Output Devices: Relays, Injector Sequencing & Management, Ignition Operation, Idle Air Controller, EVAP, Wastegate Solenoids, Torque Converter & Speed Control, Malfunction Indicator Light, Speed Density/Mass Air Flow Fuel Management Strategies: Key ON Mode, Crank Mode, Open & Closed Loop, Wide-Open Throttle, Adaptive Memory Cells, Cruise & Decel, Wide-Open Throttle , Key OFF Mode

**FUEL INJECTION SYSTEMS (18 Hours)**

Electronic Fuel Systems, Computer Self-Diagnostic Circuits, Electronic Throttle Actuator Control Systems, Fuel Control, Fuel Supply System Control, Injection System Inspection and Maintenance, Engine Diagnostic Procedures: Fuel System testing, On Board Diagnostics, Monitored & Non Monitored Circuits, Diagnostic Trouble Codes

**TEXT BOOK:**

1. Halderman,J.&Linder,J.*Automotive Fuel and Emissions Control Systems (3rd Edition)* Upper Saddle River, NJ: Pearson Education.(2012)
2. Fundamentals of Automotive and Engine Technology Robert Bosch Gmbh Ed

**REFERENCES**:

1. Halderman, J. D. *Diagnosis &Troubleshooting of Automotive Electrical, Electronic, & Computer Systems (6th Edition)* Upper Saddle River, NJ: Pearson Education. (2011)

**SEMESTER/YEAR : IV SEM**
**COURSE CODE : 20ESE5431**
**TITLE OF THE COURSE : PROTOCOL NETWORKS AND WIRELESS COMMUNICATION**
**L: T/A: P: C : 3: 0: 2: 4**

**COURSE OBJECTIVE**

1. Detailed discussion of communication in wired and wireless embedded system.
2. Understand the wireless network communication stack, protocols and sensor network applications.

**COURSE OUTCOME**

1. Gain in-depth knowledge of packet flow in the wireless communication network
2. Gain insight into various concepts of wireless and embedded networks

**EMBEDDED COMMUNICATION PROTOCOLS: (07 Hours)**

Embedded Networking: Introduction, Serial/Parallel Communication, Serial communication protocols, RS232 standard, RS485, Synchronous Serial Protocols-Serial Peripheral Interface (SPI), Inter Integrated Circuits (I2C), PC Parallel port programming, ISA/PCI Bus protocols, Fire wire.

**ETHERNET BASICS: (13 Hours)**

Elements of a network, Inside Ethernet, Building a Network: Hardware options: Cables, Connections and network speed, Design choices: Selecting components, Ethernet Controllers. Using the internet in local and internet communications, Internet protocol, UDP and TCP concepts, Serving web pages with Dynamic Data, Serving web pages that respond to user Input, Email for Embedded Systems, Using FTP, Keeping Devices and Networks ecure.

**WIRELESS EMBEDDED NETWORKING: (12 Hours)**

Wireless sensor networks: Introduction, Applications, Network Topology, Localization ,Time Synchronization , Energy efficient MAC protocols , SMAC, Energy efficient and robust routing , Data Centric routing, Wireless LAN – IEEE 802.11 Standard-Architecture, Services – AdHoc Network , Hiper LAN, Blue Tooth.

**MOBILE NETWORKS: (08 Hours)**

Cellular Wireless Networks, GSM Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Handover, Security GPRA

**ROUTING, TRANSPORT AND APPLICATION LAYERS: (10 Hours)**

Mobile IP , DHCP, AdHoc Networks , Proactive and Reactive Routing Protocols, Multicast Routing, TCP over Adhoc Networks, WAP Architecture ,WWW Programming Model , WDP ,WTLS , WTP , WSP ,WAE , WTA Architecture ,WML , WML scripts.

**TEXT BOOKS:**


1. FrankVahid,Givargis'EmbeddedSystemsDesign:AUnifiedHardware/Software Introduction', Wiley Publications, 2002
2. Bhaskar Krishnamachari, 'Networking wireless sensors', Cambridge press 2005
3. KavehPahlavan, Prasanth Krishnamoorthy, " Principles of Wireless Networks' PHI/Pearson Education,2003


**REFERENCES:**


1. Jan Axelson, 'Parallel Port Complete', Penram publications, 2006
2. Dogan Ibrahim, 'Advanced PIC microcontroller projects in C', Elsevier 2008

**SEMESTER/YEAR : IV SEM**
**COURSE CODE : 20ESE5432**
**TITLE OF THE COURSE : PRODUCT MANAGEMENT**
**L: T/A: P: C : 3: 0: 2: 4**

**COURSE OBJECTIVE**

1. To make students learn management issues relevant to product design and development
2. To comprehend the information's on product development process, design management, analysis of customers and competitors, cost management and value analysis, quality processes, total quality management, PLM and PDM with suitable case studies.

**COURSE OUTCOME**

1. To inculcate the concepts management issues relevant to product design and development
2. To develop benchmarking/QFD/PDS for products
3. To realize the importance of TQM, PLM and PDM and apply for suitable applications.

**INTRODUCTION TO PRODUCT DEVELOPMENT MANAGEMENT (07 Hours)**

Overview, New product development process, Concept and best practice, Organizational structures, Marketing organizations, Role of sales forces, Global marketing, Product Management - Fact versus fiction, Factors affecting product management

**DESIGN MANAGEMENT (13 Hours)**

Design management systems, Legal implications, Phases of design process, Production planning and feasibility, Design specification, Conceptual design, Embodiment design, Detailed design Post-design release, Role of the corporate design manager, Customer and Competitor Analysis, Understanding customers and market, Need to know about customers, Response of customers to a marketing program, Creation of product feature matrix, Assessment of competitor's current product, Comparison of value chain, Assessment of strategies, Differential advantage analysis

**QUALITY PRODUCTS AND PROCESSES (08 Hours)**

Design process in concurrent engineering, Quality function deployment and its process, Quality inspection and statistical sampling, Statistical process control Systems for eliminating defects, Fundamentals of TQM, Some important philosophies and their impact on quality (Deming, Juran, Crossby), Features of Malcolm Baldridge quality award, Identification and measurement of quality costs, Issues related to products, Processes, Organization, Leadership, and Commitment for total quality achievement

**TOOLS AND TECHNIQUES USED IN TQM (12 Hours)**

Seven tools, essential features of QCC, ZD, Kaizen and JIT programmes, Fundamental concepts about Quality Function Deployment (QFD), Components of Total Quality System

(TQS) in organizations, Quality Auditing - Introduction to ISO 9000 and 14000 standards, case studies, Product Life cycle Management (PLM), Different phases of product lifecycle and corresponding technologies, Product development processes and methodologies, Foundation technologies and standards (e.g. visualisation, collaboration and enterprise application integration), Information authoring tools (e.g., MCAD, ECAD, and technical publishing), Core functions (e.g., data vaults, document and content management, workflow and program management), Functional applications (e.g., configuration management)

**PRODUCT DATA MANAGEMENT (PDM) (10 Hours)**

Introduction to PDM, Advantages and disadvantages of PDM, Engineering data, Engineering workflow, PDM implementation, Cost Management and Value Analysis, Basics of project cost management, Introduction to estimating and budgeting, Procurement management processes, Principles and skills to the management of a project, Planning and scheduling in the pre-phase of a project, Worth and value, current day customer needs, Data collection, FAST diagram, Case studies

**TEXT BOOK:**


1. Brigitte Borja De Mozota. *Design Management: Using Design to Build Brand Value and Corporate Innovation*, Allworth Press (2004)

2. S. Thomas Foster and Jr., Prentice. *Managing Quality – An Integrative Approach* 2nd edition, Hall Publishing Co. (2003)


**REFERENCES:**


1. Karl Ulrich and Steven Eppinger. *Product Design and Development* 4th edition, McGraw-Hill/Irwin (2004)

2. Stephen C. Armstrong. *Engineering and Product Development Management,* Cambridge University Press (2005)

3. Donald R. Lehmann and Russell S. Winer. *Product Management* 4th edition, Tata McGraw-Hill Publishing Company Limited (2007)

**SEMESTER/YEAR : IV SEM**
**COURSE CODE : 20ESE5433**
**TITLE OF THE COURSE : INTERNET OF THINGS AND SMART VEHICLE**
**L: T/A: P: C : 3: 0: 2: 4**

**COURSE OBJECTIVE**

1. To provide better realisation of Societal, Business Perspective and Technical knowledge of IOT domain
2. Learning of IOT characteristics, IOT use cases
3. Applying IOT in different domains

**COURSE OUTCOME**

1. Realise Societal, Business Perspective and Technical knowledge of IOT domain
2. Able to Perform concept design, product design and development of embedded systems in IOT domain

**INTRODUCTION TO IOT: (09 Hours)**

Introduction, IOT Messages, History of IOT, IOT domains, landscape, ecosystem, business models

**IOT CHARACTERISTICS: (08 Hours)**

IOT use cases – consumer and enterprise, Consumer Electronics

**IOT APPLICATIONS: (10 Hours)**

IOT in Telecommunications, Smart Manufacturing, Smart Vehicles, IOT in Enterprises, Smart Transportation, Smart Energy, Smart Retail and logistics

**IOT AUTOMOTIVE APPLICATIONS: (15 Hours)**

Run apps in the in-vehicle entertainment systems, Use a link to a Smartphone, Remote access to the vehicle through an API, Access to data through the On Board Diagnostics port called OBD-II, New and emerging initiatives

**SMART VEHICLE: (08 Hours)**

Origins, History, Models: Production Models, Future Models, Concept and Unproduced Models, Electric Versions: Smart Electric Drive and Electric Vehicle Conversions, Safety, Modifications, Marketing

**TEXT BOOK:**


1. S. S. Manvi, M. S. Kakkasageri, "Wireless and Mobile Network concepts and protocols", Wiley, First edition, (2010)

2. P. Kaveh, Krishnamurthy, "Principles of wireless networks: A unified approach", PHI, (2006)

**REFERENCES:**

1. ItiSahaMishra,"Wirelesscommunicationandnetworks3Gandbeyond",MGH (2009)

**SEMESTER/YEAR : IV SEM**
**COURSE CODE : 20ESE5434**
**TITLE OF THE COURSE : WEB AND MOBILE APPLICATIONS**
**L: T/A: P: C : 3: 0: 2: 4**

**COURSE OBJECTIVE**

1. The course harnesses the skills of student in developing mobile application development using the Android platform.

**COURSE OUTCOME**

1. Mastering object-oriented concepts,
2. Design user interfaces for mobile devices,
3. Develop mobile applications, and create and consume web services.

**WEB BASICS: (15 Hours)**

Basic anatomy of Web, Embedded Web Server and Thin Clients, Differences between Embedded System and large Web Sites, Web Contents: Static, Dynamic, Common Web Content Types: Plain text, Images, XML, JSON, HTML, JavaScript, CSS, Web Technologies: Service-oriented Architecture, REST Services, SOAP and WSDL, Node.js

**JAVA AND SPRING: (17 Hours)**

Basic Java: Overview, Environment setup, syntax, Objects, Classes, data-types, Variable types, Modifier types, operators, loop control, decision making, numbers, characters, strings, arrays, regular expressions, methods, Files I/O, exceptions. Advanced Java: Object oriented properties, Interfaces, Packages, data structure, collection, generics, serialization, networking, multithreading, applet basics. Spring: Overview, architecture, environment setup, IoC containers, Bean definition, Bean scopes, Bean life-cycle, Bean post-processors, Bean definition inheritance, Dependency injection, Event handling, JDBC Framework, Transaction management.

**CONTROLLING EMBEDDED SYSTEM THROUGH SMART PHONE: (12 Hours)**

Smart Phone technology, Smart Phone Interaction Models: As a Remote Control (Connecting through Bluetooth), Dual Connectivity (Bluetooth and Internet), Gateway Connectivity, Ad- hoc mobile phone networks (peer-to-peer), System Architecture Related tools and frameworks

**BUILDING THE SMARTPHONE APPLICATION USING ANDROID: (06 Hours)**

Android architecture, Adapters and Widgets, UI design, Application components, Different security levels, Create Android application.

**TEXT BOOKS:**


1. HerbertSchildt:JavaTheCompleteReference,7thEdition,TataMcGrawHill,2007
2. Wei-MengLee,"BeginningAndroid4ApplicationDevelopment"WroxPublications, 2012.
3. Paul Deital and Harvey Deital, "Android How to Program" , Detial associates publishers, 2013


**REFERENCES:**


1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.
2. http://developer.android.com
3. ZigurdMednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, "Programming Android Java Programming for the New Generation of Mobile Devices", O'Reilly Media, July 2011.

**SEMESTER/YEAR : I SEM**
**COURSE CODE : 20ESE5104**
**TITLE OF THE COURSE : AUTOMOTIVE SYSTEM LAB**
**L: T/A: P: C : 0: 0: 4: 2**

1. Demonstration and discussion on the following physical automotive systems to understand the Construction, working and integration with other systems:
    - Comfort and Convenience System
    - Engine Management Systems
    - Safety
    - Infotainment and Cluster
    - Autonomous Driving Vehicle
2. Demonstration and discussion on the following automotive electronic systems and components:
    - Automotive sensors and actuators
        - Pressure sensor module
        - Speed sensor module
        - Temperature sensor module
        - Injectors, solenoids, DC and Stepper motors
        - CAN demo module
    - Fuel injection system demo setup
    - Connect Engine Test Bench with EFI
3. Group tasks

**SEMESTER/YEAR : I SEM**
**COURSE CODE : 20ESE5105**
**TITLE OF THE COURSE : AUTOMOTIVE EMBEDDED SYSTEMS LAB**
**L: T/A: P: C : 0: 0: 4: 2**

- Learning IDE for embedded micro-controller (Freescale codewarrior)
- Simple C/assembly language programming using IDE for micro-controller
- Switches, LED, seven segment, LCD and key pad interfacing with micro-controller
- Motor control (PWM) & sensor (ADC) interfacing and Serial communication with microcontroller
- Embedded programming by using Freescale codewarrior for HCS12
- Parallel port interfacing for HCS12
- Configuring the timers/counter and interrupt handling
- Configuring PWM module for DC motor control
- Use of ADC for sensor interfacing
- Working with SCI, SPI and I2C module
- Configuring HCS12 for CAN and LIN communication

**SEMESTER/YEAR : II SEM**
**COURSE CODE : 20ESE5204**
**TITLE OF THE COURSE : CONTROL AND SIMULATION LAB**
**L: T/A: P: C : 0: 0: 4: 2**

- Mathematical Modeling in Simulink
- I/O Modeling in Simulink-PWM
- Mathematical model of DC electric motor in Simulink
- Development of a speed control application
- HIL simulation of plant and controller
- Vehicle analysis using labcar

**SEMESTER/YEAR : II SEM**
**COURSE CODE : 20ESE5205**
**TITLE OF THE COURSE : AUTOMOTIVE POWER ELECTRONICS LAB**
**L: T/A: P: C : 0: 0: 4: 2**

- Introduction to MATLAB
- Modeling and Simulation of DC-DC converters
- Modeling and Simulation of AC-DC Rectifiers
- Modeling and Simulation of DC-AC Inverters
- Building and testing of power converter circuits
- Modeling and Simulation of DC Motor Drives
- Modeling and Simulation of Induction Motor Drives
- Building and testing of power electronic control circuits for DC motors for speed control
- Study of power electronics in hybrid and electrical vehicles

## OPEN ELECTIVES

**SEMESTER/YEAR : III SEM**
**COURSE CODE :20MOE5301**
**TITLE OF THE COURSE : DIGITAL MARKETING**

**L: T/A: P: C : 3: 0: 0: 3**

**COURSE OBJECTIVE:**
To learn how to do marketing online- Boost website traffic, generate potential leads & increase sales revenue with better brand awareness using internet platforms like Social Media, Email Marketing, Mobile Marketing, Ecommerce Marketing and Affiliate Marketing.
**COURSE OUTCOME:**
After completion of the program the students will be able to plan, conceptualize and implement Digital Marketing strategy for client requirements.

**UNIT-1**

**Digital Marketing Overview 7 hrs**

Introduction, Key terms and concepts, what is marketing? What is digital marketing? Why Digital Marketing wins over traditional Marketing,Understanding marketing strategy, the building blocks of marketing,

Understanding Digital Marketing Process: Increasing Visibility, Visitors engagement

**UNIT-2**

**Search Engine Optimization and Search Markets 10 hrs**

Stakeholders inSearch, CustomerInsights, O n &off-page Optimization, Meta Tags, Layout, ContentUpdates, Inbound Links &LinkBuilding, Goal Configuration&Funnels, IntelligenceReporting, Conversions, BounceRate, Traffic Sources, Scheduling etc.

**UNIT-3**

**Social Media 10 hrs**

What is Social MediaMarketing? Overview of Facebook,Twitter, LinkedIn, Blogging, YouTube and Flickr, building Brand Awareness Using SocialMedia, Social MediaManagement, Insights andAnalytics, Best Practice Examples &caseStudies.

**UNIT-4**

**Website Analytics** **9 hrs**

Goal Configuration&Funnels, IntelligenceReporting, Conversions, BounceRate, Traffic Sources, Scheduling etc

**UNIT-5**

**Email and Mobile Marketing** **8 hrs**

UserBehaviour, Segmentation, KeyMetrics, Best Practice CaseStudies, SplitTesting, Campaign ProcessOptimisation, SMSStrategy, MobileAdvertising, Mobile OptimizedWebsites, 7 Step Process for MobileApps, ProximityMarketing, StrategicSteps, Review &Testing.

**TEXT BOOKS:**


1. Digital Marketing, Vandana Ahuja, Oxford University Press

2. The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns, Ian Dodson, Wiley 2016

**SEMESTER/YEAR : III SEM**
**COURSE CODE :20MOE5302**
**TITLE OF THE COURSE : PRODUCT LIFE CYCLE MANAGEMENT**

**L: T/A: P: C : 3: 0: 0: 3**

**COURSE OBJECTIVE:**

1. To realise the various aspects of Product Life Cycle Management.
2. To realise the Digital Manufacturing.

**COURSE OUTCOME:**

1. Students should be able to use methods, tools and technique taught in the Product Life Cycle Management.

**UNIT-1**

Introduction to Product Life Cycle Management (PLM) **10 hrs**

Definition, PLM Lifecycle model, Threads of PLM, Need for PLM, Opportunities and benefits of PLM, Views, Components and Phases of PLM, PLM feasibility study, PLM visioning.

PLM Concepts, Processes and Workflow -Characteristics of PLM, Environment driving PLM,PLM Elements, Drivers of PLM, Conceptualization, Design, Development, Validation, Production, Support of PLM.

**UNIT-2**

**Product Data Management (PDM) Process and Workflow 10 hrs**

PDM systems and importance, reason for implementing a PDM system, financial justification of PDM implementation. Versioning, check-in and checkout, views, Metadata, Lifecycle, and workflow. Applied problems and solution on PDM processes and workflow.

**UNIT-3**

**Tools of Communication for collaborative work 10 hrs**

Creation of 3DXML and CAD drawing using CAD software. Creation of an animation for assembly instructions on 3D via composer, creation of an acrobat 3D document. Applied problems and solutions on tools of communication for collaborative work.

Collaborative Product Development-Digital mock-up and prototype development, design for environment, virtual testing and validation, marketing collateral

**UNIT-4**

**Developing a PLM strategy and conducting a PLM assessment** **7 hrs**

Strategy, Impact of strategy, implementing a PLM strategy, PLM initiatives to support corporate objectives. Infrastructure assessment, assessment of current systems and applications.

**UNIT-5**

**Digital Manufacturing – PLM** **8 hrs**

Digital manufacturing, benefits manufacturing, manufacturing the first-one, Ramp up, virtual learning curve, manufacturing the rest, production planning.

**TEXT BOOKS:**


1. Product Lifecycle Management: Grieves, Michael, McGraw-Hill Edition 2006
2. Product Data Management: Burden,Rodger, Resource Pub,2003


**REFERENCE BOOKS:**


1. Fabio Guidice, Guido La Rosa, Product Design for the environment-A lifecycle approach, Taylor and Francis
2. Hartman, Product Lifecycle Management with SAP,2006
3. Robert J Thomas, NDP: Managing and forecasting for strategic processes

**SEMESTER/YEAR : III SEM**
**COURSE CODE :20MOE5303**
**TITLE OF THE COURSE : PROJECT MANAGEMENT**

**L: T/A: P: C : 3: 0: 0: 3**

**COURSE OBJECTIVE:**

1. To disseminate the conceptual knowledge on various aspects of project management

2. To realise the role of project manager

**COURSE OUTCOME:**

1. Students should be able to use project management methods, tools and technique

**UNIT I**

**THE PROJECT MANAGEMENT FRAMEWORK –INTRODUCTION 8 Hrs**

What is a Project? What is project Management? Relationship among Project management, Program management and Portfolio Management, Project Management and Operations Management, Role of a Project Manager.

**UNIT II**

**THE PROJECT MANAGEMENT FRAMEWORK-PROJECT LIFE CYCLE AND ORGANISATION 6 Hrs**

The project Life Cycle Overview, Project vs. Operational work, Stakeholders, Organizational Influences on Project Management.

**UNITIII**

**THE STANDARD FOR PROJECT MANAGEMENT OF A PROJECT: 11Hrs**

Project Management Process for a Project: Common Project Management Process Interactions, Project Management Process Groups, Initiating Process Group, Planning Process Group, Executing Process Group, Monitoring and Controlling Process Group, and Closing Process Group.

**UNIT IV**

**THE PROJECT MANAGEMENT KNOWLEDGE AREAS: PART I 10Hrs**

Project Integration Management, Project Scope Management, Project Time ManagementProject Cost Management, Project Quality Management.

**UNIT V:**

**THE PROJECT MANAGEMENT KNOWLEDGE AREAS: PART II 10Hrs**

Project Human Resource Management, Project Communications Management, Project Risk Management, Project Procurement Management.

**TEXT BOOK:**

1. A Guide to the Project Management Body of Knowledge ( PMBOK® Guide )—Fifth Edition (ENGLISH)

**REFERENCES:**

2. http://www.pmi.org/

**SEMESTER/YEAR : III SEM**
**COURSE CODE :20ESE5301**
**TITLE OF THE COURSE : DISSERTATION PHASE 1**

**L: T/A: P: C : 0: 0: 0: 3**

**COURSE OBJECTIVES:**

1. To develop the work practice in students to apply theoretical and practical tools/techniques
2. To improve the professional competency
3. To improve research aptitude by touching the areas which otherwise not covered by theory or laboratory classes.
4. To solve real life problems related to industry and current research.

**COURSE OUTCOMES:**

1. Solving of real time problems not necessarily new line of enquiry, but shows that student has mastered research and synthesizing skills in producing a contribution to knowledge.
2. Builds competency and research aptitude.

The thesis shall consist of research work done by the candidate or a comprehensive and critical review of any recent development in the subject of specialization or a detailed report of project work consisting of experimentation/numerical work, design and or development work that the candidate has executed.

**SEMESTER/YEAR : IV SEM**
**COURSE CODE :20ESE5401**
**TITLE OF THE COURSE : DISSERTATION PHASE 2**

**L: T/A: P: C : 0: 0: 0: 6**

**COURSE OBJECTIVES:**

The dissertation demonstrates the student's mastery of relevant resources and methods.

1. An ordered, critical exposition of knowledge gained through student's own effort.
2. Demonstrates sound under-standing of research process.
3. Demonstrates knowledge of appropriate methodology.
4. Demonstrates ability to present study in a disciplined way in scholarly conventions of the discipline.
5. Ability to make critical use of published work.

**COURSE OUTCOMES:**

1. Improves the professional competency and research.
2. Develops the work to apply theoretical and practical tools/techniques
3. Solve problems related to industry and current research.
4. Possible publication in journal or conferences.

**THE REPORT GENERALLY CONTAINS:**

1. Cover
2. Title page
3. Certificate(s)
4. Acknowledgements
5. Abstract
6. Contents page
7. List of figures or Tables
8. Introduction
9. Literature survey
10. Methodology
11. Results and Discussion
12. Conclusion and scope of future work.
13. Reference list / Bibliography
14. Appendices.

## AVOIDING PLAGIARISM

1. Plagiarism is taking the words, theories, or ideas of another person and passing them off as your own.
2. Plagiarism can be copying **inadvertently/advertently** a passage from a book or journal or pasting something from the internet into report without referencing the original source.
3. Plagiarism can also result from wrong **referencing.**

**Avoiding plagiarism**

The guide/supervisor shall certify that the report is checked for plagiarism and is within 25% of the content.

The thesis shall consist of research work done by the candidate or a comprehensive and critical review of any recent development in the subject of specialization or a detailed report of project work consisting of experimentation/numerical work, design and or development work that the candidate has executed. It is expected that students should refer national and international journals, proceedings of national and international seminars. Emphasis should be given to the introduction to the topic, literature review, and scope of the proposed work along with some preliminary work/experimentation carried out on the thesis topic. Student should submit the thesis covering the content discussed above and highlighting the features of work to be carried out in the thesis. Student should follow standard practice of thesis writing. At the end of successfully finishing the work he/she has to submit a detailed report and has to present for a viva–voce.