OPEN ELECTIVES OFFERED FROM THE DEPARTMENT

V – VIII SEMESTER

MODERN CONSUMER ELECTRONICS

Course Code: ECOE01 **Credits: 3:0:0**
Prerequisites: Nil **Contact Hours: 42**
Course Coordinator: Flory Francis

UNIT – I

Audio and Acoustic Systems: Microphones, Headphones, Loudspeakers, Amplifiers, Stereo Multiplexing, Equalizers, Mixers, Portable stereo, Music synthesizers, Commercial sound systems

UNIT – II

Radio and TV: AM/FM tuners, Monochrome TV systems, Colour TV systems, Video disc recording and playback, Video systems, Set-top boxes, Video resolution

UNIT – III

Communication Systems: Telecommunication systems, Switching systems, Modulation techniques, Fiber optics, Data services, Mobile radio systems, Cellular telephone systems, 4G/5G

UNIT – IV

Computing Systems: Microprocessors, Microcomputers and Microcontrollers, Computer organization, Super computers, GPUs, Operating systems, Programming languages, Memory technology

UNIT – V

Future Trends: Autonomous vehicles, Drones, Robotics, Sensors, IoT, Smart homes, Smart cities, Virtual reality, Augmented reality, Sensors, MEMS, Nanotechnology, Digital health, Cyber security

Textbooks:

1. **B. R. Gupta,** V. Singhal, “Consumer Electronics”, S. K. Kataria & Sons, 2013.
2. S. P. Bali, “Consumer Electronics”, Pearson India, 2008.

References:

1. Philip Hoff, “Consumer Electronics for Engineers”, Cambridge University Press, 1998.

Course Outcomes (COs):

1. Identify and understand the operation of audio and acoustic systems and devices. (POs – 1, 6, 9, 10, PSO –3)
2. Understand the components and the operating details of modern radio and television systems. (POs – 1, 6, 9, 10, PSO –3)
3. Understand the operation of modern communication systems and mobile devices. (POs – 1, 6, 9, 10, PSO –3)
4. Estimate the performance of new and existing computing systems. (POs – 1, 6, 9, 10, PSO –3)
5. Predict the evolution of modern technological trends in the electronics industry. (POs – 1, 6, 9, 10,12, PSO – 3)

MICRO ELECTRO MECHANICAL SYSTEMS

Course Code: ECOE05 **Credits: 3:0:0**
Prerequisites: Nil **Contact Hours: 42**
Course Coordinator: S Lakshmi

UNIT – I

Introduction to MEMS: Historical background of Micro Electro Mechanical Systems, Feynman's vision, Nano technology and its applications, Multi-disciplinary aspects, Basic technologies, Application areas, Scaling laws in miniaturization, scaling in geometry, Electrostatics, Electromagnetics, Electricity and heat transfer.

UNIT – II

Micro and Smart Devices and Systems: Transduction principles in MEMS Sensors: Actuators: different actuation mechanisms - silicon capacitive accelerometer, Piezo-resistive pressure sensor, Blood analyzer, Conductometric gas sensor, Silicon micro-mirror arrays, Piezo-electric based inkjet print head, Electrostatic comb-driver

UNIT – III

Materials and Micromanufacturing: Semiconducting materials, Silicon, Silicon dioxide, Silicon Nitride, Packaging materials Silicon wafer processing, Lithography, Thin-film deposition, Etching (wet and dry), Wafer-bonding, Silicon micromachining: surface, bulk,

UNIT – IV

Electrical and Electronics Aspects: Electrostatics, Coupled electro mechanics, Stability and Pull-in phenomenon, Practical signal conditioning circuits for microsystems, RF MEMS. Switches, Varactors, Tuned filters,

UNIT – V

Integration and Packaging of Microelectromechanical Systems: Integration of microelectronics and micro devices at wafer and chip levels, Microelectronic packaging: wire and ball bonding, flipchip, Microsystem packaging examples

Textbooks:

1. G. K. Ananthasuresh, K.J.Vinoy, S.Gopalakrishnan, K.N.Bhat, V.K.Aatre, "Micro and Smart Systems", 1st Edition,Wiley India, 2010.
2. T R Hsu, "MEMS and Microsystems Design and Manufacturing", 2nd Edition, Tata McGraw Hill, 2008.

References:

1. Chang Liu, "Foundations of MEMS", Pearson International Edition, 2006.
2. S D Senturia, "Microsystem Design", Springer International Edition, 2001.

Course Outcomes (COs):

1. Analyze scaling laws and transduction principles as applied to MEMS. (POs – 1, 2, 12, PSO - 2)
2. Understand Micro Systems and their applications. (POs – 1, 2, 12)
3. Describe various fabrication techniques specific to MEMS devices. (POs – 2, 3, PSO – 2)
4. Analyze the electrical and electronics aspects of MEMS systems. (POs, 4, 3, PSO – 2)
5. Examine the various packaging methods for MEMS devices. (POs – 2, 3, PSO – 2)

BASICS OF MACHINE LEARNING

Course Code: ECOE06 **Credits: 3:0:0**

Prerequisites: Nil **Contact Hours: 42**

Course Coordinator: S Sethu Selvi

UNIT – I

Introduction: What is machine learning? Examples of machine learning applications – Learning associations, Classification, Regression, Unsupervised learning, Reinforcement learning

Supervised Learning: Learning a class from examples, Learning multiple classes, Regression, Model selection and generalization, Dimensions of a supervised machine learning algorithm

UNIT – II

Bayes Decision Theory: Introduction, Classification, Losses and risks, Discriminant functions, Association rules

UNIT – III

Dimensionality Reduction: Subset selection, Principal Component Analysis (PCA), Singular Value Decomposition (SVD) and matrix factorization, Linear Discriminant Analysis (LDA)

UNIT – IV

Clustering: k-means clustering, Hierarchical clustering

Decision Trees: Uni-variate trees, Pruning, Rule extraction from trees, Multivariate trees

UNIT – V

Multilayer Perceptrons: Introduction, Perceptron, training a perceptron, Learning Boolean functions, Multilayer perceptrons, MLP as a universal approximator, Backpropagation algorithm, Two class discrimination, Training procedures, Learning time, Deep learning

Textbook:

1. Ethem Alpaydin, “Introduction to Machine Learning”, 3rd Edition, PHI Learning Pvt. Ltd, 2015.

References:

1. Tom M Mitchell, “Machine Learning”, Indian Edition, McGraw-Hill Science, 2017.
2. Andreas C. Müller, Sarah Guido, “Introduction to Machine Learning with Python”, O'Reilly Media, Inc., 2016.

Course Outcomes (COs):

1. Appreciate the concepts and issues of various machine learning systems (POs – 1, 2, 3, 4, 5, 10, PSOs – 1, 3)
2. Employ Bayesian learning and discriminant functions for classification (POs – 1, 2, 3, 4, 5, 10, PSOs – 1, 3)
3. Examine various dimensionality reduction algorithms (POs – 1, 2, 3, 4, 5, 10, PSOs – 1, 3)
4. Evaluate different unsupervised learning algorithms (POs – 1, 2, 3, 4, 5, 10, PSOs – 1, 3)
5. Describe basics of multilayer perceptrons leading to deep learning algorithms. (POs – 1, 2, 3, 4, 5, 10, PSOs – 1, 3)

AUTOMOTIVE ELECTRONICS

Subject Code: ECOE-07 **Credits: 3:0:0**
Prerequisites: Nil **Contact Hours: 42**
Course Coordinator: Roshan Zameer Ahmed

UNIT – I

Automotive Fundamentals Overview: Ignition System, Spark plug, Spark pulse generation, Ignition Timing, Brakes, Steering System, Battery, Starting System.

UNIT – II

Sensors: Oxygen (O2/EGO) Sensors, Throttle Position Sensor (TPS), Engine Crankshaft Angular Position (CKP) Sensor, Magnetic Reluctance Position Sensor, Engine Speed Sensor, Ignition Timing Sensor, Hall effect Position Sensor, Knock Sensor, Optical Crankshaft, Manifold Absolute Pressure (MAP) Sensor

UNIT – III

Actuators: Fuel Metering Actuator, Fuel Injector, Ignition Actuator

Exhaust After-Treatment Systems: Catalytic Converter, Exhaust Gas Recirculation (EGR), Evaporative Emission Systems, electronic engine control systems and electronic ignition control systems

UNIT – IV

Vehicle Motion Control: Antilock Brake System (ABS), Electronic Steering Control, Power Steering, Traction Control, Electronically controlled suspension.
Integrated Body: Safety Systems.

UNIT – V

Automotive Diagnostics: Timing Light, Engine Analyzer, On-board diagnostics, Off-board diagnostics, Expert Systems.

Future Automotive Electronic Systems: Alternative Fuel Engines, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Radio navigation.

Text Books:

1. William B. Ribbens**, "**Understanding Automotive Electronics", 8th Edition, SAMS/Elsevier Publishing, 2017.

References:

1. Robert Bosch GmbH, "Automotive Electrics Automotive Electronics Systems and Components", 5th edition, John Wiley& Sons Ltd., 2007.

Course Outcomes (COs):

1. Explain fundamentals of automotive electronics systems for different applications. (POs - 1, 2, 5, PSO - 2)
2. Apply the knowledge of embedded systems in terms of sensor functioning to build subsystems for automotive electronics. (POs - 1, 2, 5, PSO - 2)
3. Analyze the functioning of actuator systems involved in the exhaust after-treatment system, engine control system and ignition control system using electronics. (POs - 1, 2, 5, PSO - 2)
4. Apply the knowledge of electronics in vehicle motion control systems, antilock braking systems, steering control systems suspension systems and communication system using electronics. (POs - 1, 2, 5, PSO - 2)
5. Identify defects in engine operation using automotive diagnostics and future automotive electronic systems. (POs - 1, 2, 5, PSO -2)

COMMUNICATION SYSTEMS AND MOBILE STANDARDS

Subject Code: ECOE08 **Credits: 3:0:0**
Prerequisites: Basic Electronics **Contact Hours: 42**
Course Coordinator: Sarala S M

UNIT – I

Introduction to Communication Systems: Introduction to Communication Systems, Elements of a Communication System, Modulation and its necessity, Types of Modulation, Binary Data Transmission, Multiplexing techniques.

UNIT – II

Introduction to Computer Networks: Data Communication, Networks, Protocols and Standards, Topology, Categories of Networks, OSI & TCP/IP Protocol suites.

UNIT – III

Optical Fiber Communication: Motivation for optical communications, Advantages of optical fibers Key elements of optical fiber communication link. Total Internal Reflection, fiber types, Attenuation in fibers

UNIT – IV

Wireless Communication: An Overview of Wireless System, Evolution of wireless networks, Wireless Network Architecture and Operation: The Cell concept, Cellular advantage, Cellular Hierarchy, Cell Fundamentals, Re-use Number, Capacity expansion Techniques - Cell splitting, Cell Sectoring

UNIT – V

Wireless standards: GSM: Architecture, Channels, Frame structure, UMTS, 3GPP, LTE and 4G features and difference

Textbooks:

1. Simon Haykins, "An Introduction to Analog and Digital Communications", John Wiley, 2010.
2. Andrew S. Tanembaum, "Computer Networks", 4th Edition, Pearson Education, 2003.

References:

1. Gerd Keiser, "Optical Fiber Communications", 4th Edition, Tata McGraw Hill, 2010
2. Gary J. Mullett "Wireless Telecommunications Systems and Networks", 1st Edition, Cengage Learning, 2013.

Course Outcomes (COs):

1. Understand the necessity of digital modulation schemes. (POs -1, 2, 4, 9, 10, 11, 12, PSOs- 1, 3)
2. Understand the different data communication networks, topologies, and components. (POs -1, 2, 4, 9, 10, 11, 12, PSOs - 1, 3)
3. Employ operational techniques of optical fiber to build optical Communication Systems. V (POs 1, 2, 4, 9, 10, 11, 12, PSOs - 1, 3)
4. Procure the idea of wireless communication and Study cellular technology. (POs - 1, 2, 4, 9, 10, 11, 12, PSOs - 1, 3)
5. Understanding various Wireless standards. (POs - 1, 2, 4, 9, 10, 11, 12, PSOs - 1, 3)