Micro Electro Mechanical Systems

B.E., VIII Semester, Electronics &Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC831	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03
CREDITS – 03			

Course Objectives: This course will enable students to:

- Understand overview of microsystems, their fabrication and application areas.
- Working principles of several MEMS devices.
- Develop mathematical and analytical models of MEMS devices.
- Know methods to fabricate MEMS devices.
- Various application areas where MEMS devices can be used.

Module 1	**RBT Level**
Overview of MEMS and Microsystems: MEMS and Microsystem, Typical MEMS and Microsystems Products, Evolution of Microfabrication, Microsystems and Microelectronics, Multidisciplinary Nature of Microsystems, Miniaturization. Applications and Markets.	L1, L2
Module 2	
Working Principles of Microsystems: Introduction, Microsensors, Microactuation, MEMS with Microactuators, Microaccelerometers, Microfluidics. **Engineering Science for Microsystems Design and Fabrication:** Introduction, Molecular Theory of Matter and Inter-molecular Forces, Plasma Physics, Electrochemistry.	L1, L2
Module 3	
Engineering Mechanics for Microsystems Design: Introduction, Static Bending of Thin Plates, Mechanical Vibration, Thermomechanics, Fracture Mechanics, Thin Film Mechanics, Overview on Finite Element Stress Analysis.	L1,L2,L3
Module 4	

Scaling Laws in Miniaturization: Introduction, Scaling in Geometry, Scaling in Rigid-Body Dynamics, Scaling in Electrostatic Forces, Scaling in Fluid Mechanics, Scaling in Heat Transfer.	L1,L2,L3
Module 5	
Overview of Micromanufacturing: Introduction, Bulk Micromanufacturing, Surface Micromachining, The LIGA Process, Summary on Micromanufacturing.	L1,L2

Course Outcomes: After studying this course, students will be able to:

- Appreciate the technologies related to Micro Electro Mechanical Systems.
- Understand design and fabrication processes involved with MEMS devices.
- Analyse the MEMS devices and develop suitable mathematical models
- Know various application areas for MEMS device

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of Three sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Tai-Ran Hsu, MEMS and Micro systems: Design, Manufacture and Nanoscale Engineering, 2nd Ed, Wiley.

Reference Books:

1. Hans H. Gatzen, Volker Saile, JurgLeuthold, Micro and Nano Fabrication: Tools and Processes, Springer, 2015.
2. Dilip Kumar Bhattacharya, Brajesh Kumar Kaushik, Microelectromechanical Systems (MEMS), Cenage Learning.

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SPEECH PROCESSING

B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC832	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03

CREDITS – 03

Course Objectives: This course enables students to:

- Introduce the models for speech production
- Develop time and frequency domain techniques for estimating speech parameters
- Introduce a predictive technique for speech compression
- Provide fundamental knowledge required to understand and analyse speech recognition, synthesis and speaker identification systems.

Modules

Module-1	**RBT Level**
Fundamentals of Human Speech Production: The Process of Speech Production, Short-Time Fourier Representation of Speech, The Acoustic Theory of Speech Production, Lossless Tube Models of the Vocal Tract, Digital Models for Sampled Speech Signals	L1, L2
Module-2	
Time-Domain Methods for Speech Processing: Introduction to Short-Time Analysis of Speech, Short-Time Energy and Short-Time Magnitude, Short-Time Zero-Crossing Rate, The Short-Time Autocorrelation Function, The Modified Short-Time Autocorrelation Function, The Short-Time Average Magnitude Difference Function.	L1, L2
Module-3	
Frequency Domain Representations: Discrete-Time Fourier Analysis, Short-Time Fourier Analysis, Spectrographic Displays, Overlap Addition(OLA),Method of Synthesis, Filter Bank Summation(FBS) Method of Synthesis, Time-Decimated Filter Banks, Two-Channel Filter Banks, Implementation of the FBS Method Using the FFT, OLA Revisited, Modifications of the STFT.	L1, L2
Module-4	
The Cepstrum and Homomorphic Speech Processing: Homomorphic Systems for Convolution, Homomorphic Analysis of the Speech Model, Computing the Short-Time Cepstrum and Complex Cepstrum of Speech, Homomorphic Filtering of Natural Speech, Cepstrum Analysis of All-Pole Models, Cepstrum Distance Measures.	L1, L2, L3
Module-5	
Linear Predictive Analysis of Speech Signals: Basic Principles of Linear	L1, L2,

Predictive Analysis, Computation of the Gain for the Model, Frequency Domain Interpretations of Linear Predictive Analysis, Solution of the LPC Equations, The Prediction Error Signal, Some Properties of the LPC Polynomial A(z), Relation of Linear Predictive Analysis to Lossless Tube Models, Alternative Representations of the LP Parameters.	L3

Course outcomes: Upon completion of the course, students will be able to:

- Model speech production system and describe the fundamentals of speech.
- Extract and compare different speech parameters.
- Choose an appropriate speech model for a given application.
- Analyse speech recognition, synthesis and speaker identification systems

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Theory and Applications of Digital Speech Processing-Rabiner and Schafer, Pearson Education 2011

Reference Books:

3. **Fundamentals of Speech Recognition**- Lawrence Rabiner and Biing-Hwang Juang, Pearson Education, 2003.

4. **Speech and Language Processing–An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition**- Daniel Jurafsky and James H Martin, Pearson Prentice Hall 2009.

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Radar Engineering

B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC833	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to:

- Understand the Radar fundamentals and analyze the radar signals.
- Understand various technologies involved in the design of radar transmitters and receivers.
- Learn various radars like MTI, Doppler and tracking radars and their comparison

Modules	**RBT Level**
Module-1	
Basics of Radar: Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitions with respect to pulse waveform - PRF, PRI, Duty Cycle, Peak Transmitter Power, Average transmitter Power. **Simple form of the Radar Equation**, Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar, Illustrative Problems. **(Chapter 1 of Text)**	L1, L2, L3
Module-2	
The Radar Equation: Prediction of Range Performance, Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, Envelope Detector — False Alarm Time and Probability, Probability of Detection, **Radar Cross Section of Targets:** simple targets – sphere, cone-sphere, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems. **(Chapter 2 of Text, Except 2.4, 2.6, 2.8 & 2.11)**	L1, L2, L3
Module-3	
MTI and Pulse Doppler Radar: Introduction, Principle, Doppler Frequency Shift, Simple CW Radar, Sweep to Sweep subtraction and Delay Line Canceler, MTI Radar with – Power Amplifier Transmitter, Delay Line Cancelers — Frequency Response of Single Delay- Line Canceler, Blind Speeds, Clutter Attenuation, MTI Improvement Factor, N- Pulse Delay-Line Canceler, **Digital MTI Processing** – Blind phases, I and Q Channels, Digital MTI Doppler signal processor, Moving Target Detector- Original MTD. **(Chapter 3: 3.1, 3.2, 3.5, 3.6 of Text)**	L1, L2, L3
Module-4	
Tracking Radar: Tracking with Radar- Types of Tracking Radar Systems, Monopulse Tracking- Amplitude Comparison Monopulse (one-and two-coordinates), Phase Comparison Monopulse. **Sequential Lobing**, Conical Scan Tracking, Block Diagram of Conical Scan	L1, L2, L3

Tracking Radar, Tracking in Range, Comparison of Trackers. **(Chapter 4: 4.1, 4.2, 4.3 of Text)**	
Module-5	
The Radar Antenna: Functions of The Radar Antenna, Antenna Parameters, Reflector Antennas and Electronically Steered Phased array Antennas. **(Chapter 9: 9.1, 9.2 9.4, 9.5 of Text)** **Radar Receiver:** The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver, Duplexers and Receivers Protectors, Radar Displays. **(Chapter 11 of Text)**	L1, L2, L3

Course outcomes: At the end of the course, students will be able to:

- Understand the radar fundamentals and radar signals.
- Explain the working principle of pulse Doppler radars, their applications and limitations
- Describe the working of various radar transmitters and receivers.
- Analyze the range parameters of pulse radar system which affect the system performance

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 16 marks
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Introduction to Radar Systems- Merrill I Skolink, 3e, TMH, 2001.

Reference Books:

1. Radar Principles, Technology, Applications — Byron Edde, Pearson Education, 2004.
2. Radar Principles – Peebles. Jr, P.Z. Wiley. New York, 1998.
3. Principles of Modem Radar: Basic Principles – Mark A. Rkhards, James A. Scheer, William A. HoIm. Yesdee, 2013

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MACHINE LEARNING

B.E., VIII Semester, Electronics & Communication Engineering/ Telecommunication Engineering

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC834	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (8 Hours / Module)	Exam Hours	03

CREDITS – 03

Course Objectives: This course will enable students to:

- Introduce some concepts and techniques that are core to Machine Learning.
- Understand learning and decision trees.
- Acquire knowledge of neural networks, Bayesian techniques and instant based learning.
- Understand analytical learning and reinforced learning.

Modules	
Module-1	**RBT Level**
Learning: Designing Learning systems, Perspectives and Issues, Concept Learning, Version Spaces and Candidate Elimination Algorithm, Inductive bias.	L1, L2
Module-2	
Decision Tree and ANN: Decision Tree Representation, Hypothesis Space Search, Inductive bias in decision tree, issues in Decision tree. Neural Network Representation, Perceptrons, Multilayer Networks and Back Propagation Algorithms.	L1, L2
Module-3	
Bayesian and Computational Learning: Bayes Theorem, Bayes Theorem Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier.	L1, L2
Module-4	
Instant Based Learning and Learning set of rules: K- Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning. Sequential Covering Algorithms, Learning Rule Sets, Learning First Order Rules, Learning Sets of First Order Rules.	L1, L2
Module-5	
Analytical Learning and Reinforced Learning: Perfect Domain Theories, Explanation Based Learning, Inductive-Analytical Approaches, FOCL Algorithm, Reinforcement Learning.	L1, L2
Course outcomes: At the end of the course, students should be able to:	

- Understand the core concepts of Machine learning.
- Appreciate the underlying mathematical relationships within and across Machine Learning algorithms.
- Explain paradigms of supervised and un-supervised learning.
- Recognize a real world problem and apply the learned techniques of Machine Learning to solve the problem.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Machine Learning-Tom M. Mitchell, McGraw-Hill Education, (INDIAN EDITION), 2013.

Reference Books:

1. **Introduction to Machine Learning-** Ethem Alpaydin, 2nd Ed., PHI Learning Pvt. Ltd., 2013.
2. **The Elements of Statistical Learning-**T. Hastie, R. Tibshirani, J. H. Friedman, Springer; 1st edition, 2001.

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NETWORK AND CYBER SECURITY

B.E., VIII Semester, Electronics & Communication Engineering

[As per Choice Based credit System (CBCS) Scheme

Subject Code	15EC835	IA Marks	20
Number of Lecture Hours/Week	03	Exam marks	80
Total Number of Lecture Hours	40 (8 Hours per Module)	Exam Hours	03

CREDITS – 03

Course Objectives: This course will enable students to:

- Know about security concerns in Email and Internet Protocol.
- Understand cyber security concepts.
- List the problems that can arise in cyber security.
- Discuss the various cyber security frame work.

Module-1	RBT Level
Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH) (Text 1: Chapter 15)	L1, L2
Module-2	
E-mail Security: Pretty Good Privacy, S/MIME, Domain keys identified mail (Text 1: Chapter 17)	L1, L2
Module-3	
IP Security: IP Security Overview, IP Security Policy, Encapsulation Security Payload (ESP), Combining security Associations Internet Key Exchange. Cryptographic Suites(Text 1: Chapter 18)	L1, L2
Module-4	
Cyber network security concepts: Security Architecture, antipattern: signature based malware detection versus polymorphic threads, document driven certification and accreditation, policy driven security certifications. Refactored solution: reputational, behavioural and entropy based malware detection. **The problems:** cyber antipatterns concept, forces in cyber antipatterns, cyber anti pattern templates, cyber security antipattern catalog (Text-2: Chapter1 & 2)	L1, L2, L3
Module-5	
Cyber network security concepts contd. : **Enterprise security using Zachman framework** Zachman framework for enterprise architecture, primitive models versus composite models, architectural problem solving patterns, enterprise workshop, matrix mining, mini patterns for problem solving meetings. **Case study:** cyber security hands on – managing administrations	L1, L2, L3

and root accounts, installing hardware, reimaging OS, installing system protection/ antimalware, configuring firewalls (Text-2: Chapter 3 & 4).	

Course Outcomes: After studying this course, students will be able to:

- Explain network security protocols
- Understand the basic concepts of cyber security
- Discuss the cyber security problems
- Explain Enterprise Security Framework
- Apply concept of cyber security framework in computer system administration

Question paper pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of Three sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Education Inc., 6th Edition, 2014, ISBN: 978-93-325-1877-3.
2. Thomas J. Mowbray, "Cyber Security – Managing Systems, Conducting Testing, and Investigating Intrusions", Wiley.

Reference Books:

1. Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.
2. Cryptography and Network Security, Atul Kahate, TMH, 2003.

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VISVESVARAYA TECHNOLOGICAL UNIVERSTY, BELAGAVI

B.E (CBCS) Open Electives List offered by EC/TC Board

5th Semester Open Electives List:

SL No	Course Code	Course Title	Teaching Department(s)	Offering Department
1	15EC561	Automotive Electronics	EC/TC	EC/TC
2	15EC562	Object Oriented Programming Using C++	CS/IS/EC/TC/EE	EC/TC
3	15EC563	8051 Microcontroller	EC/TC	EC/TC

6th Semester Open Electives List:

SL No	Course Code	Course Title	Teaching Department(s)	Offering Department
1	15EC661	Data Structures Using C++	CS/IS/EC/TC	EC/TC
2	15EC662	Power Electronics	EC/TC/EE	EC/TC
3	15EC663	Digital System Design using Verilog	EC/TC	EC/TC

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5th Semester Open Electives Syllabus for the Courses offered by EC/TC Board

Automotive Electronics
B.E V Semester (Open Elective)
[As per Choice Based Credit System (CBCS) scheme

Subject Code	15EC561	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40(08 Hrs per Module)	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to:

- Understand the basics of automobile dynamics and design electronics to complement those features.
- Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts.

Module-1	**RBT Level**
Automotive Fundamentals Overview – Evolution of Automotive Electronics, Automobile Physical Configuration, Survey of Major Automotive Systems, The Engine – Engine Block, Cylinder Head, Four Stroke Cycle, Engine Control, Ignition System - Spark plug, High voltage circuit and distribution, Spark pulse generation, Ignition Timing, Diesel Engine, Drive Train - Transmission, Drive Shaft, Differential, Suspension, Brakes, Steering System (Text 1: Chapter1), Starter Battery –Operating principle: (Text 2: Pg. 407-410) (4 hours) **The Basics of Electronic Engine Control** – Motivation for Electronic Engine Control – Exhaust Emissions, Fuel Economy,Conceptof an Electronic Engine control system, Definition of General terms, Definition of Engine performance terms, Engine mapping, Effect of Air/Fuel ratio, spark timing and EGR on performance, Control Strategy, Electronic Fuel control system, Analysis of intake manifold pressure, Electronic Ignition. (Text 1: Chapter 5) (4 hours)	L1, L2
Module-2	

Automotive Control System applications of Sensors and Actuators – Typical Electronic Engine Control System, Variables to be measured (Text 1: Chapter 6) (1 hour) **Automotive Sensors** – Airflow rate sensor, Strain Gauge MAP sensor, Engine Crankshaft Angular Position Sensor, Magnetic Reluctance Position Sensor, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Throttle Angle Sensor (TAS), Engine Coolant Temperature (ECT) Sensor, Exhaust Gas Oxygen (O2/EGO) Lambda Sensors, Piezoelectric Knock Sensor. (Text 1: Chapter 6) (5 hours) **Automotive Actuators** – Solenoid,Fuel Injector, EGR Actuator, Ignition System (Text 1: Chapter 6) (2 hours)	L1, L2
Module-3	
Digital Engine Control Systems – Digital Engine control features, Control modes for fuel Control (Seven Modes), EGR Control, Electronic Ignition Control - Closed loop Ignition timing, Spark Advance Correction Scheme, Integrated Engine Control System - Secondary Air Management, Evaporative Emissions Canister Purge, Automatic System Adjustment, System Diagnostics. (Text 1: Chapter 7) (6 hours) **Control Units** – Operating conditions, Design, Data processing, Programming, Digital modules in the Control unit, Control unit software. (Text 2: Pg. 196-207) (2 hours)	L1, L2
Module-4	
Automotive Networking –Bus Systems – Classification, Applications in the vehicle, Coupling of networks, Examples of networked vehicles (Text 2: Pg. 85-91), Buses - CAN Bus, LIN Bus, MOST Bus, Bluetooth, FlexRay, Diagnostic Interfaces. (Text 2: Pg. 92-151) (6 hours) **Vehicle Motion Control** – Typical Cruise Control System, Digital Cruise Control System, Digital Speed Sensor, Throttle Actuator, Digital Cruise Control configuration, Cruise Control Electronics (Digital only), Antilock Brake System (ABS) (Text 1: Chapter 8) (2 hours)	L1, L2
Module-5	
Automotive Diagnostics–Timing Light, Engine Analyzer, On-board diagnostics, Off-board diagnostics, Expert Systems, Occupant Protection Systems – Accelerometer based Air Bag systems. (Text 1: Chapter 10) (2 hours)	L1, L2, L3

Future Automotive Electronic Systems – Alternative Fuel Engines, Electric and Hybrid vehicles, Fuel cell powered cars, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Heads Up display, Speech Synthesis, Navigation – Navigation Sensors - Radio Navigation, Signpost navigation, dead reckoning navigation, Voice Recognition Cell Phone dialing, Advanced Cruise Control, Stability Augmentation, Automatic driving Control (Text 1: Chapter 11) (6 hours)	

Course Outcomes: At the end of the course, students will be able to:

- Acquire an overview of automotive components, subsystems, and basics of Electronic Engine Control in today's automotive industry.
- Use available automotive sensors and actuators while interfacing with microcontrollers / microprocessors during automotive system design.
- Understand the networking of various modules in automotive systems, communication protocols and diagnostics of the sub systems.
- Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts and get fair idea on future Automotive Electronic Systems.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 16 marks
- There will be 2 full questions (with a maximum of three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, Elsevier Publishing.

2. Robert Bosch Gmbh (Ed.) Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th edition, John Wiley& Sons Inc., 2007.

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Object Oriented Programming Using C++

B.E. V Semester (Open Elective)

[As per Choice Based Credit System (CBCS)scheme]

Subject Code	15EC562	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hrs/ Module	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to:

- Define Encapsulation, Inheritance and Polymorphism.
- Solve the problem with object oriented approach.
- Analyze the problem statement and build object oriented system model.
- Describe the characters and behavior of the objects that comprise a system.
- Explain function overloading, operator overloading and virtual functions.
- Discuss the advantages of object oriented programming over procedure oriented programming.

Module -1	**RBT Level**
Beginning with C++ and its features: What is C++?, Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading and control structures in C++ (Topics from Ch -2,3 of Text).	L1, L2
Module -2	
Functions, classes and Objects: Functions, Inline function, function overloading, friend and virtual functions, Specifying a class, C++ program with a class, arrays within a class, memory allocation to objects, array of objects, members, pointers to members and member functions (Selected Topics from Chap-4,5 of Text).	L1, L2, L3
Module -3	
Constructors, Destructors and Operator overloading: Constructors, Multiple constructors in a class, Copy constructor, Dynamic constructor, Destructors, Defining operator overloading, Overloading Unary and binary operators, Manipulation of strings using operators (Selected topics from Chap-6, 7 of Text).	L1, L2, L3
Module -4	
Inheritance, Pointers, Virtual Functions, Polymorphism: Derived Classes, Single, multilevel, multiple inheritance,	L1, L2, L3

Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions (Selected topics from Chap-8,9 of Text).	
Module -5	
Streams and Working with files: C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF (Selected topics from Chap-10, 11 of Text).	L1, L2, L3

Course Outcomes: At the end of the course, students will be able to:

- Explain the basics of Object Oriented Programming concepts.
- Apply the object initialization and destroy concept using constructors and destructors.
- Apply the concept of polymorphism to implement compile time polymorphism in programs by using overloading methods and operators.
- Use the concept of inheritance to reduce the length of code and evaluate the usefulness.
- Apply the concept of run time polymorphism by using virtual functions, overriding functions and abstract class in programs.
- Use I/O operations and file streams in programs.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 16 marks
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

ObjectOriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013.

Reference Book:

Object Oriented Programming using C++, Robert Lafore, Galgotia publication 2010.

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8051 MICROCONTROLLER

B.E., V Semester (Open Elective)

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC563	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hrs/ Module)	Exam Hours	03

CREDITS – 03

Course objectives: This course will enable students to:

- Understand the difference between a Microprocessor and a Microcontroller and embedded microcontrollers.
- Familiarize the basic architecture of 8051 microcontroller.
- Program 8051microprocessor using AssemblyLevel Language and C.
- Understand the interrupt system of 8051 and the use of interrupts.
- Understand the operation and use of inbuilt Timers/Counters and Serial port of 8051.
- Interface 8051 to external memory and I/O devices using its I/O ports.

Module -1	**RBT Level**
8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.	L1, L2
Module -2	
8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.	L1, L2
Module -3	
8051 Stack, I/O Port Interfacing and Programming: 8051 Stack, Stack and Subroutine instructions. Assembly language program examples on subroutine and involving loops - Delay subroutine, Factorial of an 8 bit number (result maximum 8 bit), Block move without overlap, Addition of N 8 bit numbers, Picking smallest/largest of N 8 bit numbers. Interfacing simple switch and LED to I/O ports to switch on/off LED with respect to switch status.	L1, L2, L3
Module -4	
8051 Timers and Serial Port: 8051 Timers and Counters – Operation and Assembly language programming to generate a	L1, L2, L3

pulse using Mode-1 and a square wave using Mode-2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS-232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.	
Module -5	
8051 Interrupts and Interfacing Applications: 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, LCD and Stepper motor and their 8051 Assembly language interfacing programming.	L1, L2, L3
Evaluation of Internal Assessment Marks: It is suggested that at least a few simple programs to be executed by students using a simulation software or an 8051 microcontroller kit for better understanding of the course. This activity can be considered for the evaluation of 5 marks out of 20 Internal assessment marks, reserved for the other activities.	
Course outcomes: At the end of the course, students will be able to: • Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and Instruction set of 8051. • Write 8051 Assembly level programs using 8051 instruction set. • Explain the Interrupt system, operation of Timers/Counters and Serial port of 8051. • Write 8051 Assembly language program to generate timings and waveforms using 8051 timers, to send & receive serial data using 8051 serial port and to generate an external interrupt using a switch. • Write 8051 C programs to generate square wave on 8051 I/O port pin using interrupt and to send & receive serial data using 8051 serial port. • Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051 using 8051 I/O ports.	
Question paper pattern: • The question paper will have ten questions. • Each full Question consisting of 16 marks • There will be 2 full questions (with a maximum of Three sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module.	

TEXT BOOKS:

1. **"The 8051 Microcontroller and Embedded Systems – using assembly and C",** Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. **"The 8051 Microcontroller",** Kenneth J. Ayala, 3rd Edition, Thomson/Cengage Learning.

REFERENCE BOOKS:

1. **"The 8051 Microcontroller Based Embedded Systems",** Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. **"Microcontrollers: Architecture, Programming, Interfacing and System Design",** Raj Kamal, Pearson Education, 2005.

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6th Semester Open Electives Syllabus for the courses offered by EC/TC Board:

DATA STRUCTURE USING C++
B.E VI Semester (Open Elective)
[As per Choice Based Credit System (CBCS) Scheme]

Course Code	**15EC661**	**IA Marks**	**20**
Number of Lecture Hours/Week	**03**	**Exam Marks**	**80**
Total Number of Lecture Hours	**40 (08 Hrs per Module)**	**Exam Hours**	**03**

CREDITS – 03

Course objectives: This course will enable students to

- Explain fundamentals of data structures and their applications essential for programming/problem solving
- Analyze Linear Data Structures: Stack, Queues, Lists
- Analyze Non Linear Data Structures: Trees
- Assess appropriate data structure during program development/Problem Solving

Module -1

INTRODUCTION: Functions and parameters, Dynamic memory allocation, Recursion.
LINEAR LISTS: Data objects and structures, Linear list data structures, Array Representation, Vector Representation, Singly Linked lists and chains. **L1, L2**

Module -2

ARRAYS AND MATRICS: Arrays, Matrices, Special matrices, Sparse matrices.

STACKS: The abstract data types, Array Representation, Linked Representation, Applications-Parenthesis Matching & Towers of Hanoi. **L1, L2, L3**

Module -3

QUEUES: The abstract data types, Array Representation, Linked Representation, Applications-Railroad car arrangement.

HASHING: Dictionaries, Linear representation, Hash table representation. **L1, L2, L3**

Module -4

BINARY AND OTHER TREES: Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT binary tree and the class linked binary tree. **L1, L2, L3**

Module -5

Priority Queues: Linear lists, Heaps, Applications-Heap Sorting.
Search Trees: Binary search trees operations and implementation, Binary Search trees with duplicates. **L1, L2, L3**

Course outcomes: After studying this course, students will be able to:

- Acquire knowledge of Dynamic memory allocation, Various types of data structures, operations and algorithms and Sparse matrices and Hashing
- Understand non Linear data structures trees and their applications
- Design appropriate data structures for solving computing problems
- Analyze the operations of Linear Data structures: Stack, Queue and Linked List and their applications

Text Book:

Data structures, Algorithms, and applications in C++, Sartaj Sahni, Universities Press, 2nd Edition, 2005.

Reference Books:

1. **Data structures, Algorithms, and applications in C++,** Sartaj Sahni, Mc. Graw Hill, 2000.
2. **Object Oriented Programming with C++,** E.Balaguruswamy, TMH, 6th Edition, 2013.
3. **Programming in C++,** E.Balaguruswamy. TMH, 4th, 2010.

D. V. [illegible]

POWER ELECTRONICS

B.E., VI Semester (Open Elective)

[As per Choice Based Credit System (CBCS) scheme]

Subject Code	15EC662	IA Marks	20
Number of Lecture Hours/Week	03	Exam Marks	80
Total Number of Lecture Hours	40 (08 Hours / Module)	Exam Hours	03
CREDITS – 03			

Course Objectives: This course will enable students to

- Understand the working of various power devices.
- Study and analysis of thyristor circuits with different triggering techniques.
- Learn the applications of power devices in controlled rectifiers, converters and inverters.
- Study of power electronics circuits under different load conditions.

Module-1	RBT Level
Introduction - Applications of Power Electronics, Power Semiconductor Devices, Control Characteristics of Power Devices, types of Power Electronic Circuits. Power Transistors: Power BJTs: Steady state characteristics. Power MOSFETs: device operation, switching characteristics, IGBTs: device operation, output and transfer characteristics. (Text 1)	L1, L2
Module-2	
Thyristors - Introduction, Principle of Operation of SCR, Static Anode-Cathode Characteristics of SCR, Two transistor model of SCR, Gate Characteristics of SCR, Turn-ON Methods, Turn-OFF Mechanism, Turn-OFF Methods: Natural and Forced Commutation – Class A and Class B types, Gate Trigger Circuit: Resistance Firing Circuit, Resistance capacitance firing circuit. (Text 2)	L1, L2, L3
Module-3	
Controlled Rectifiers - Introduction, principle of phase controlled converter operation, Single phase full converters, Single phase dual converters. AC Voltage Controllers - Introduction, Principles of ON-OFF Control, Principle of Phase Control, Single phase control with resistive and inductive loads. (Text 1)	L1, L2, L3
Module-4	
DC-DC Converters - Introduction, principle of step-down operation and it's analysis with RL load, principle of step-up operation, Step-up converter with a resistive load, Performance parameters, Converter classification, Switching mode regulators: Buck regulator, Boost regulator, Buck-Boost Regulators. (Text 1)	L1, L2
Module-5	
Pulse Width Modulated Inverters- Introduction, principle of operation, performance parameters, Single phase bridge inverters, voltage control of single phase inverters, current source inverters, Variable DC-link inverter, Boost inverter. (Text 1)	L1, L2

Course outcomes: After studying this course, students will be able to:

- Describe the characteristics of different power devices and identify the applications.
- Illustrate the working of DC-DC converter and inverter circuit.
- Determine the output response of a thyristor circuit with various triggering options.
- Determine the response of controlled rectifier with resistive and inductive loads.

Evaluation of Internal Assessment Marks:

It is suggested that at least a few experiments of Power Electronics are conducted by the students for better understanding of the course. This activity can be considered for the evaluation of 5 marks out of 20 Internal assessment marks, reserved for the other activities.

Question paper pattern:

- The question paper will have ten questions
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of Three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module
- The students will have to answer 5 full questions, selecting one full question from each module

Text Book:

1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4thEdition, Pearson Education Inc, 2014, ISBN: 978-93-325-1844-5.
2. M.D Singh and K B Khanchandani, Power Electronics, 2nd Edition, Tata Mc-Graw Hill, 2009, ISBN: 0070583897.

Reference Books:

1. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
2. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi, 2012.
3. P.C. Sen, "Modern Power Electronics", S Chand & Co New Delhi, 2005.

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DIGITAL SYSTEM DESIGN USING VERILOG

B.E., VI Semester (Open Elective)

[As per Choice Based Credit System (CBCS) scheme]

Subject Code:	15EC663	IA Marks: 20
Number of Lecture Hours/Week:	03	Exam Marks: 80
Total Number of Lecture Hours:	40 (08 Hrs per module)	Exam Hours: 03
CREDITS – 03		

Course objectives: Thiscourse will enable students to:

- Understand the concepts of Verilog Language.
- Design the digital systems as an activity in a larger systems design context.
- Study the design and operation of semiconductor memories frequently used in application specific digital system.
- Inspect how effectively IC's are embedded in package and assembled in PCB's for different application.
- Design and diagnosis of processors and I/O controllers used in embedded systems.

Module -1	RBT Level
Introduction and Methodology: Digital Systems and Embedded Systems, Real-World Circuits, Models, Design Methodology (1.1, 1.3 to 1.5 of Text). **Combinational Basics:**Combinational Components and Circuits, Verification of Combinational Circuits.(2.3 and 2.4 of Text) **Sequential Basics**:Sequential Datapaths and ControlClocked Synchronous Timing Methodology (4.3 up to 4.3.1,4.4 up to 4.4.1 of Text).	L1, L2, L3
Module -2	
Memories: Concepts, Memory Types, Error Detection and Correction (Chap 5 of Text).	L1, L2, L3
Module -3	
Implementation Fabrics: Integrated Circuits, Programmable Logic Devices, Packaging and Circuit boards, Interconnection and Signal integrity (Chap 6 of Text).	L1, L2, L3
Module -4	
I/O interfacing: I/O devices, I/O controllers, Parallel Buses, Serial Transmission, I/O software (Chap 8 of Text).	L1, L2, L3
Module -5	
Design Methodology: Design flow, Design optimization, Design for test, Nontechnical Issues (Chap 10 of Text).	L1, L2, L3, L4

Course outcomes: After studying this course, students will be able to:

- Construct the combinational circuits, using discrete gates and programmable logic devices.
- Describe Verilog model for sequential circuits and test pattern generation.
- Design a semiconductor memory for specific chip design.

- Design embedded systems using small microcontrollers, larger CPUs/DSPs, or hard or soft processor cores.
- Synthesize different types of processor and I/O controllers that are used in embedded system.

Question paper pattern:

- The question paper will have ten questions.
- Each full Question consisting of 16 marks. There will be 2 full questions (with a maximum of Three sub questions from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

Peter J. Ashenden, "Digital Design: An Embedded Systems Approach Using VERILOG", Elesvier, 2010.

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