

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

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

5th Semester Open Electives List:

S L N o	Course Code	Course Title	Teaching Department(s)	Offering Departme nt
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:

S L N o	Course Code	Course Title	Teaching Department(s)	Offering Departme nt
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

**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			
<p>Course objectives: This course will enable students to:</p> <ul style="list-style-type: none"> • 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
<p>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)</p> <p>The Basics of Electronic Engine Control – Motivation for Electronic Engine Control – Exhaust Emissions, Fuel Economy, Concept of 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)</p>			L1, L2
Module-2			

<p>Automotive Control System applications of Sensors and Actuators – Typical Electronic Engine Control System, Variables to be measured (Text 1: Chapter 6) (1 hour)</p> <p>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)</p> <p>Automotive Actuators – Solenoid, Fuel Injector, EGR Actuator, Ignition System (Text 1: Chapter 6) (2 hours)</p>	L1, L2
Module-3	
<p>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)</p> <p>Control Units – Operating conditions, Design, Data processing, Programming, Digital modules in the Control unit, Control unit software. (Text 2: Pg. 196-207) (2 hours)</p>	L1, L2
Module-4	
<p>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, Flex Ray, Diagnostic Interfaces. (Text 2: Pg. 92-151) (6 hours)</p> <p>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)</p>	L1, L2
Module-5	
<p>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)</p>	L1, L2, L3

<p>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)</p>	
<p>Course Outcomes: At the end of the course, students will be able to:</p> <ul style="list-style-type: none"> • 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. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • 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. 	
<p>Text Books:</p> <ol style="list-style-type: none"> 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. 	

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: <ul style="list-style-type: none">• 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:			L1,

Derived Classes, Single, multilevel, multiple inheritance, Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions (Selected topics from Chap-8,9 of Text).	L2, L3
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
<p>Course Outcomes: At the end of the course, students will be able to:</p> <ul style="list-style-type: none"> • 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. 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • 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. 	
<p>Text Book: Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013.</p> <p>Reference Book: Object Oriented Programming using C++, Robert Lafore, Galgotia publication 2010.</p>	

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: <ul style="list-style-type: none">• Understand the difference between a Microprocessor and a Microcontroller and embedded microcontrollers.• Familiarize the basic architecture of 8051 microcontroller.• Program 8051 microprocessor using Assembly Level 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			

<p>8051 Timers and Serial Port: 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode-2 on a port pin.</p> <p>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.</p>	L1, L2, L3
Module -5	
<p>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.</p> <p>Interfacing 8051 to ADC-0804, LCD and Stepper motor and their 8051 Assembly language interfacing programming.</p>	L1, L2, L3
<p>Evaluation of Internal Assessment Marks:</p> <p>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.</p>	
<p>Course outcomes: At the end of the course, students will be able to:</p> <ul style="list-style-type: none"> • 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.

**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]			
Subject 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			
<ul style="list-style-type: none"> • 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 			
Module -1			RBT
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 MATRICES: Arrays, Matrices, Special matrices, Sparse matrices. STACKS: The abstract data types, Array Representation, Linked Representation, Applications-Paranthesis 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			

<p>Priority Queues: Linear lists, Heaps, Applications-Heap Sorting. Search Trees: Binary search trees operations and implementation, Binary Search trees with duplicates.</p>	<p>L1, L2, L3</p>
<p>Course outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • 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 	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • 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. 	
<p>Text Book: Data structures, Algorithms, and applications in C++, Sartaj Sahni, McGraw Hill, 2nd Edition, 2005.</p>	
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013. 2. Programming in C++, E.Balaguruswamy. TMH, 4th, 2010. 	

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 <ul style="list-style-type: none">• 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
<p>Course outcomes: After studying this course, students will be able to:</p> <ul style="list-style-type: none"> • 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. 	
<p>Evaluation of Internal Assessment Marks:</p> <p>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.</p>	
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • 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 	
<p>Text Book:</p> <ol style="list-style-type: none"> 1. Mohammad H Rashid, Power Electronics, Circuits, Devices and Applications, 3rd/4th Edition, 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. 	
<p>Reference Books:</p> <ol style="list-style-type: none"> 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. 	

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: This course will enable students to: <ul style="list-style-type: none">• 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 Control Clocked 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: <ul style="list-style-type: none">• 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", Elsevier, 2010.