

Course Code	Course Title	Core/Elective	Prerequisite	Contact Hours			Total Hrs / Sessions
				L	T	P	
BEC714C	Automotive Electronics	Elective	Basics of IC Engine & ECU	3	0	0	40
Objectives	Course objectives: This course will enable students to: <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 automobile, providing add – on comforts 						
Topics to be Covered as per the VTU Syllabus							
Module-1 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, starter battery-operating principle. (Text1: Chapter1, Text 2: Pg. 407-410) 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 ration, spark timing and EGR on performance, control strategy, electronic fuel control system, analysis of intake manifold pressure, electronic ignition. (Text1: Chapter 5)							
Module-2 Automotive Sensors – Automotive control system applications of sensors and Actuators – Variables to be measured, airflow rate sensor, strain gauge MAP sensor, Hall Effect position sensor, Magnetic Reluctance Crankshaft position sensor, Throttle angle sensor, Engine coolant Temperature (ECT) Sensor, Exhaust Gas Oxygen (O2 /EGO) Lambda sensors, piezoelectric Knock sensor (Text 1: Chapter 6) Automotive Engine Control Actuators – Solenoid, Fuel Injector, EGR actuator, Ignition system (Text 1: Chapter 6)							
Module-3 Digital Engine Control System - 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) Control Units – Operating conditions, Design, Data Processing, Programming, Digital modules in the Control Unit, Control Unit Software (Text 2: Pg. 196-207)							
Module-4							

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Automotive Networking – Bus Stem- 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**)

Vehicle Motion Control – Typical Cruise control system, Digital Cruise Control System, Digital Speed Sensor, Throttle Actuator, Cruise Control Configuration, Cruise Control Electronics (Digital Only), Antilock Brake System (ABS) (**Text 1: Chapter 8**)

Module-5

Automotive Diagnostics – Timing Light, Engine Analyzer, On-Board diagnostics, Off-Board diagnostics, Expert Systems, Occupant Protection Systems – Accelerometer based Air Bag Systems (**Text1: Chapter10**)

Future Automotive Electronic Systems – Alternative Fuel Engines, Electric and Hybrid Vehicles, Fuel Cell Power Cars, Collision Avoidance Radar Warning Systems, Low tire pressure warning systems, Head 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**)

List of 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.

List of Reference Books

- 1.
- 2.

List of URLs, Text Books, Notes, Multimedia Content, etc

Related NPTEL Courses

Course Outcomes

At the end of the course the student will be able to:

CO1: Summarize an overview of automotive components, subsystems and basics of Electronic Engine Control in today’s automotive industry.

CO2: Identify the available automotive sensors and actuators while interfacing with microcontrollers / microprocessors during automotive system design.

CO3: Observe the operation of Digital Engine Control Systems & Secondary air management in automobiles.

CO4: Describe the vehicle motion control using digital speed sensor & ABS and automobile networking.

CO5: Illustrate On-board diagnostics, Off-board diagnostics, & Future Automotive Electronic Systems.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks.
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two



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assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks).

- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Course Code:	BEC714C	Course Title: Automotive Electronics												
List of Course Outcomes	Program Outcomes												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3	2	-	-	-	-	-	-	-	-	-	2	1	-
CO-2	3	2	-	-	-	1	1	-	-	-	-	2	1	-
CO-3	3	2	-	-	-	1	1	-	-	-	-	2	1	-
CO-4	3	2	-	-	-	1	-	-	-	-	-	2	1	-
CO-5	3	2	-	-	-	1	-	-	-	-	-	2	1	-

Note: 3 = Strong Contribution 2= Average Contribution 1 = Weak Contribution - = No Contribution