BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
WORK INTEGRATED LEARNING PROGRAMMES
M. Tech Automotive Electronics
I Semester 2019-20

Course Title	**Automotive Vehicles**
Course No(s)	**AEL ZC441**
Credit Units	4
Credit Model	
Content Authors	**Dr. Kiran D. Mali**

Course Description:
Automotive Chassis Layout, Frame and body Construction, I.C. Engine Construction and Components. Engine Cooling and Lubrication System, Clutches, Transmission System, Drive Line System, Steering System, Suspension and Shock Absorber System, Braking System, Automotive Vehicle Performance.

Course Objectives

No	
CO1	To study of main components/systems of an automobile, such as an engine, transmission, drive-axle system, suspension system, brake system, etc.
CO2	Understanding the fundamental working principles of different systems.
CO3	To learn the performance analysis along with working, and important aspects of various components of automotive vehicles
CO4	To get acquainted with advanced concepts through projects, assignments which will be conducted during the semester

Text Book(s)

TB1	N. K. Giri, *Automotive Mechanics*, Khanna Publishers, Eighth edition
TB2	Kripal Singh, *Automobile Engineering*, - Vol. I & II, Standard Publishers & Distributors

Reference Book(s) & other resources

RBa	V. Ganeshan, *Internal Combustion Engines*, Tata McGraw-Hill Education
RBb	Joseph Heitner, *Automotive Mechanics – Principles and Practice*, - Affiliated East West Press, 2nd edition, 1980
RBc	K.K. Jain , R. B. Asthana, *Automobile Engineering TTTI Bhopal* - Tata McGraw-Hill
RBd	S. Srinivasan, *Automotive Mechanics*,- Tata McGraw-Hill Education
RBe	Sudhir Kumar Saxena, *Automobile Engineering*, University science Press,2009

Learning Outcomes:

No	Learning Outcomes
LO1	To be able to recognize and identify different vehicle systems and components.
LO2	To be able to analyze the functions and evaluate the performance of vehicle systems.
LO3	Understanding importance of each system and how it may affect safety, reliability and performance of vehicle.
LO4	Apply technical knowledge and skills necessary to remove, replace mechanical related small components.

Lect No.	Learning Objectives	Topics to be covered	Reference to Text
1-2	An introduction to automobiles	Overview of the course and evaluation scheme Development of automobiles, General classification, Basic structure and components of automobile	1TB1,1TB2
3	The chassis Construction and Body	Classification, Conventional construction, Sub frames, Frame less constructions, Classification of body, Numerical problems on chassis member bending.	11TB1, 1 TB2
4 to 5	Reciprocating Engine Construction and basics	Constructional details, Calculation of displacement velocity and acceleration of piston and connecting rod, Working of 2and 4 stroke engines. Numerical problems on the above topics	3TB1
6	Cooling systems	Need. Variation of gas temperature. Piston temperature distribution. Theory of engine heat transfer and correlation. Parameters affecting engine heat transfer. Air-cooled systems.	8TB1, 12RBa
7	Cooling systems	Types of water-cooling systems. Radiators. Fans. Correlation for the power required for engine cooling. Numerical problems on the above topics	8TB1, 12RBa
8	Lubrication systems	Causes of engine friction. Function of lubrication. Mechanism of lubrication. Journal bearing lubrication.	7TB1, 11RBa
9	Lubrication systems	Types of lubrication systems. Lubrication of engine components.	7TB1, 11RBa
10	Clutch	Definition of clutch, requirements, classification, principle of working of friction clutches, Driving system and Plate clutch (uniform pressure and uniform wear).	14TB1, 3TB2
11	Clutch	Comparison of spring and diaphragm clutch, Cone clutch (uniform pressure and uniform wear).	14TB1, 3TB2
12	Clutch	Energy lost by plate clutch during engagement. Centrifugal clutch. Frction	14TB1, 3TB2

		materials and properties, Numerical problems on the above topics	
13	Brakes	Fundamentals of brakes, Braking of vehicle. Heat generated due to braking operation. Theory of Internal expansion brake.	18TB1, 10,11TB2
14-15	Brakes	Hydraulic brakes. Hand or parking brakes. Braking of vehicle moving in a curved path. Numerical problems on the above topics	18TB1, 10,11TB2
16-17	Gear box	Fundamentals of gear train, need of gear box, types of gear boxes,Torque and tooth load in epicyclic gear trains. Sliding mesh and constant mesh gears.	15TB1, 4TB2
18-19	Gear box	Epicyclic gears and hydra-matic transmission. Numerical problems on the above topics	15TB1, 4TB2
20	Differential and rear axle	Differential. Rear axle. Axle shaft. Axle housing. Numerical Problems	16TB1, 6TB2
21	Propeller shaft, Universal joint	Types of driving shafts. Mechanics of Hotchkiss and torque tube drives. Slip joint. Hook's joint.	16TB1, 6TB2
22-23	Suspension System	Object and basic requirement, Functions and types of suspension spring, Shock absorber, Independent Suspension, Stabilizer, Interconnected suspension systems, Numerical Problems on spring design	12 TB1,7TB2
24-25	Front Axle and Steering system	Ackerman steering gear. Devis steering gear. Turning circle radii. Standard steering gears. Power steering. Numerical problems on the above topics	17TB1, 8TB2
26-27	Wheels and Tyres	Types of wheels. Design consideration of wheels. Wheel alignment.	13TB1, 9TB2
28-30	Vehicle Performance	Forces and couples on wheel, Vehicle drag, Power for propulsion, Traction and tractive efforts, Stability of vehicle on slope.	20TB1
31	Miscellaneous Topics	Accessories and vehicle safety	12,13,14 TB2
32	Revision and Review	Discussion on the topics studied	

ISM: Instructor Supplied Material

Evaluation Scheme:

Legend: EC = Evaluation Component; AN = After Noon Session; FN = Fore Noon Session

No	Name	Type	Duration	Weight	Day, Date, Session, Time
EC-1	Assignments/Quizzes	Online	-	20%	
EC-2	Mid-Semester Exam	Closed Book	2 hours	30%	
EC-4	Comprehensive Exam	Open Book	3 hours	50%	

Note:

Elearn portal: https://elearn.bits-pilani.ac.in.

Students are expected to visit the Elearn portal on a regular basis and stay up to date with the latest announcements and deadlines.

Evaluation Guidelines:

1. EC-1 consists of Quizzes, assignments, lab
2. For Closed Book tests: No books or reference material of any kind will be permitted.

3. For Open Book exams: Use of books and any printed / written reference material (filed or bound) is permitted. However, loose sheets of paper will not be allowed. Use of calculators is permitted in all exams. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.
4. If a student is unable to appear for the Regular Test/Exam due to genuine exigencies, the student should follow the procedure to apply for the Make-Up Test/Exam which will be made available on the Elearn portal. The Make-Up Test/Exam will be conducted only at selected exam centres on the dates to be announced later.
5. Syllabus for Mid-Semester Test (Closed Book): Contact Hours 1 to 8
6. Syllabus for Comprehensive Exam (Open Book): Contact Hours 1 to 16

It shall be the responsibility of the individual student to be regular in maintaining the self-study schedule as given in the course handout, attend the lectures, and take all the prescribed evaluation components such as Quizzes, Assignments, Lab, Mid-Semester Test and Comprehensive Examination according to the evaluation scheme provided in the handout.

Instructor-in-Charge
AEL ZC441

Birla Institute of Technology & Science, Pilani
Work Integrated Learning Programmes Division
M. Tech Automotive Electronics
I Semester 2019-20

Course Title	Automotive Control Systems
Course No(s)	AEL ZG510
Credit Units	5
Credit Model	Instruction + Student Preparation
Instructor-In-Charge	

Course Description
Introduction to vehicle electronics, semiconductor diodes, FETs, rectifiers, small signal amplifiers, circuit models, automotive applications and case studies, automotive micro controllers, auto sensors and actuators, vehicle electronics, feedback control, control strategy, analog and digital controllers, expert systems and neural networks, advanced topics in EMC, vehicle communication networks, automotive control system design, transmission and powertrain, brake, traction, suspension, active safety and supplementary restraint systems, intelligent vehicle systems and ADAS..

COURSE OBJECTIVES	
CO1	Learn the working of various components, sensors and actuators used by control systems
CO2	Educate about various automotive micro controllers, control systems and control strategy
CO3	Introduce the CAN network and various systems built around the CAN network

LEARNING OUTCOMES	
LO1	Comfortable selecting, designing and working with electronic components and systems
LO2	Able to design and develop simple control systems for automotive mechatronics
LO3	Understand the strategy and working of various automotive systems like ABS, EBD etc.,
LO4	Understand and analyze connected car technlogy and ADAS systems
LO5	Apply the concepts using Ricardo Ignite and MATLAB.

Text Book(s):

T1	U Kiencke, L Nielsen, “Automotive Control Systems for Engine, Driveline, and Vehicle”, Springer.
T2	Ronald K. Jurgen, “Automotive Electronics Handbook”, McGraw-Hill, Inc.

Reference Book(s) & other resources:

R1	Allan W.M. Bonnick, “Automotive Computer Controlled systems, Diagnostic tools and techniques”
R2	Bechfold, Understanding Automotive electronics, SAE, 1998.
R3	William, B. Ribbens, Understanding Automotive electronics, ButterWorth Heinemann 1998.
R4	Robert N. Brandy, Automotive computers and Digital Instrumentation, Prentice Hall Eaglewood Cliffs, New Jersey, 1988.

Content Structure: Current

Session	Area	Topic	Reference
1	**Vehicle Electronics1**	Semiconductor diodes, FETs, Rectifiers, Small signal amplifiers	
2		Circuit models, Automotive applications and case studies	
3	**Automotive Microcontrollers**	Introduction to modern computer logic Programming inputs and Outputs	
4		Interrupts and system design. Typical controllers used	
5	**Auto Sensors and Actuators**	Types of sensors, Sensors calibration	
6		Signal attenuation, Shielding	
7	**Vehicle Electronics2**	Feedback control, Control strategy	
8		Analog and digital controllers, Expert systems and neural networks	
9	**Advanced Topics in EMC**	Basics of EMC, Component segregation, cable routing, Grounding, Shielding, common impedance coupling	
10		Classification of EMC environments, EMC test methods	
11	**Vehicle Communication Networks**	Various networks used, topology, basic architecture of CAN	
12		Security protocols, Vulnerabilities	
13	**Automotive Control Systems**	Engine, Transmission, Powertrain, Brake control systems	
14		Traction, Suspension control systems, active safety systems	
15	**Intelligent Vehicle Systems and ADAS**	In vehicle electronic sensors, connected cars and application Collision avoidance systems	
16		Active cruise control, Self-driving applications	

Revised Objectives

COURSE OBJECTIVES	
CO1	Learn the fundamentals of control strategy development for automotive systems
CO2	Understand the various functional requirements of automotive applications
CO3	Introduce the concept of model based control development and testing

LEARNING OUTCOMES	
LO1	Develop control strategy for ICE and other automotive sub systems
LO2	Able to design and develop control systems for automotive applications
LO3	Develop plant models for evaluating control strategies
LO4	Develop MIL and HIL testing frameworks and analyse results
LO5	Gain proficiency in use tools like Ricardo Wave, Ricardo Ignite and Simulink

Content Structure: Revised

Mode – Class Room Discussions

Topic No	Topic Title	Reference
1.1	Introduction to control systems, examples and need. Concepts of control system design, development process	
1.2	Over-View of course structure, defining pre-requisites, supplementary study material and time lines	
1.3	Introduction to Automotive IC Engines and Electronic Fuel Control, Fundamentals of ICE control	

Topic No	Topic Title	Reference
2.1	SI Engine Modelling – Fundamental Equations and their significance	
2.2	Air-fuel Ratio & Flame Propagation	
2.3	Emissions Formation & Control	

Topic No	Topic Title	Reference
3.1	CI Engine Modelling – Comparison with SI Engine	
3.2	Direct Injection and Lean Burn – CI vs GDI	
3.3	Emissions Formation & Control	

Topic No	Topic Title	Reference
4.1	SI Engine Control Requirements	
4.2	Lambda Control Circuit & Engine Model for Lambda Control	
4.3	Adaptive Lambda Control	

Topic No	Topic Title	Reference
5.1	Knock Control in SI Engines	
5.2	Knock Sensor, Conditioning & Control	
5.3	Cylinder Balancing & Adaptation of injection map	

Topic No	Topic Title	Reference
6.1	Engine Mis-Fire Detection	
6.2	Kalman Filter Design	
6.3	Crankshaft Torque Balance	

Topic No	Topic Title	Reference
7.1	Power Train Modelling – Manual and Automatic Gearboxes	
7.2	Drive Cycles and Significance of Gear Ratios	
7.3	Testing methodology, statutory requirements and standards	

Topic No	Topic Title	Reference
8.1	Steer by Wire – EPS control development	
8.2	Drive by Wire – Electronic Throttle Control	
8.3	Brake by Wire – Electronic Brake Control	

Topic No	Topic Title	Reference
9.1	Plant Modelling, Requirements and Applications	
9.2	Plant Modelling using Simulink and Simscape	
9.3	Data Driven vs Mathematical Models	
9.4	Data Extraction Methods – Testing vs Simulation	

Topic No	Topic Title	Reference
10.1	1D Model using Ricardo Wave – Design of Experiments and Data Collection	
10.2	Full System simulation using Ricardo Ignite – MIL Testing	
10.3	Co-Simulation of Wave & Simulink Models – MIL Testing	

Topic No	Topic Title	Reference
11.1	HIL Testing fundamentals, applications and use cases	
11.2	Developing HIL testing frame-work for control strategy evaluation	
11.3	Automating HIL Test Scripts – Pass / Fail Scenarios	

Evaluation Scheme:

Legend: EC = Evaluation Component; AN = After Noon Session; FN = Fore Noon Session

No	Name	Type	Duration	Weight	Day, Date, Session, Time
EC-1	Quiz	online	2 weeks	10%	
	Assignments / Experiential lab	Virtual / Remote	2 weeks	20%	
EC-2	Mid-Semester Test	Closed Book	2 hours	30%	
EC-3	Comprehensive Exam	Open Book	3 hours	40%	

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Contact sessions: Students should attend the online contact sessions as per the schedule provided on the Elearn portal.

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6. Syllabus for Comprehensive Exam (Open Book): Contact Hours 1 to 16

It shall be the responsibility of the individual student to be regular in maintaining the self-study schedule as given in the course handout, attend the online lectures, and take all the prescribed evaluation components such as Quizzes, Assignments, Project, Mid-Semester Test and Comprehensive Examination according to the evaluation scheme provided in the handout.

Instructor-in-charge
(AEL ZG510)

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
WORK INTEGRATED LEARNING PROGRAMMES
M. Tech. Automotive Electronics
First Semester 2019-2020

Course Title	Autotronics
Course No(s)	AEL ZG511
Credit Units	5
Credit Model	1-1-2 (32 Hours of Class-room Instruction + 32 Hours of Case-studies/Tutorials/Laboratories + 64 Hours of Student Preparation)
Instructor In charge	

Course Objectives

No	Objective
CO1	An introduction to the applications of mechatronics in Automobile systems
CO2	Introduction to the various mechatronics building blocks like the System modelling, Signal sensing and conditioning, Control system engineering, Electrical and mechanical actuation systems etc.
CO3	Learning about Sensors and Transducers, Operational Amplifiers, Hydraulic and Pneumatics, Dynamic response of systems, System transfer function, Frequency response, Closed loop controllers.

Text Book(s)

T1	Automotive Mechatronics by Konrad Reif , Springer Vieweg Edition
T2	Mechatronics by W. Bolton, 4th Edition, Pearson

Reference Book(s) & other resources

R1	Understanding Automotive Electronics – 8th Edition, William B.Ribbens
R2	Control Systems by W. Bolton, Newnes

Learning Outcomes: Students will be able to

LO1	Apply mechatronics in the field of Automotive systems
LO2	Acquire concepts of signal sensing and conditioning, control and decision making and output actuation.
LO3	Illustrate working of various sensors and transducers, system modelling and dynamic response, open and closed loop controllers, electrical and mechanical actuators.
LO4	Develop hydraulic and pneumatic systems

Content Structure:

Session 1: Introduction

Topic No.	Topic Title	Reference
1.1	Introducing Mechatronics, Concepts of signal measurement, control and output actuation	T2- Chapter 1
1.2	Application examples	

Session 2: Electricity and Electronic fundamentals

Topic No.	Topic Title	Reference
2.1	Resistor, inductor, capacitor, Semiconductor devices	R1- Chapter
2.2	Diodes, transistors, Field effect transistors , Logic gates	

Session 3: Sensors

Topic No.	Topic Title	Reference
2.1	Automotive sensors – Basics and Overview	T1- Pages 144-234 /
2.2	Sensor measuring principles	

Session 4: Sensors type

Topic No.	Topic Title	Reference
3.1	Engine speed, Manifold air pressure, Accelerator pedal, Yaw rate sensors,	T1- Pages 246-289 / R1- Chapter 5
3.2	Temperature, Knock, acceleration, Lambda oxygen sensors	
3.3	Rain/Light , Torque sensors	

Session 5: Signal conditioning

Topic No.	Topic Title	Reference
4.1	Operational amplifiers basics	T2- Chapter 3
4.2	Summing, difference, integratring, differentiating, logarithmic type	

Session 6: Signal conditioning - Contd

Topic No.	Topic Title	Reference
5.1	Wheatstone bridge, Zener diode, Low and High pass filters	T2- Chapter 3
5.2	Analog to Digital (ADC) and Digital to Analog(DAC)	

Session 7: System modelling

Topic No.	Topic Title	Reference
6.1	Mechanical and Electrical systems	T2- Chapter 10
6.2	Hydraulic and Thermal systems	

Session 7: Dynamic response of systems

Topic No.	Topic Title	Reference
7.1	First and second order systems, their performance measures	T2- Chapter 12/13
7.2	Transfer functions - Basics	

Session 8: Review Session.

Session 9/10 : Feedback / Closed loop controllers

Topic No.	Topic Title	Reference
9.1	Feedback loops	T2- Chapter 13/15
9.2	Open and closed loop	
9.3	Closed loop controllers (PID strategies)	

Session 11/12: Electronic Engine controls

Topic No.	Topic Title	Reference
9.1	Engine performance terms	R1- Chapter 4
9.2	Electronic fuel control systems	

Session 13-14: Actuators:

Topic No.	Topic Title	Reference
10.1	Electric actuators, Electromechanical types	T1- Pages 290-304; R1- Chapter 247-270
10.2	Fuel Injectors, Exhaust gas recirculation	
10.3	Variable valve timing, Electric motor	
10.4	Brushless DC motor, Ignition systems	

Session 15: Hydraulics:

Topic No.	Topic Title	Reference
11.1	Basics of hydraulics, types of valves	T1- Pages 396-410
11.2	Automatic brake functions, Electronic braking force distribution	

Session 16: Review Session

Assignments

- Each student/ group of students will be given an individual assignment on any of the topics discussed in the class
- Assignments are take-home and deadline-driven (typically of 2 weeks duration) announced post Mid-semester examination
- Students to spend at least 16 hours of work in study, research, discussion and preparation of the report and presentation.
- As part of deliverables, the student is expected to prepare a report and make a short-presentation in the class

Evaluation Scheme

Evaluation Component	Name	Type	Weight	Duration	Schedule
EC - 1	Assignments	Individual and Take-home	10%	2 Weeks	Throughout
	Lab	Bootcamp / Online	20%	1 week	
EC - 2	Mid-Semester Examination	Closed Book	30%	2 Hrs	
EC - 3	End-Semester Examination	Open Book	40%	3 Hrs	

Lab Calendar

Contact Sessions		Practice (Slot booking and practicing tutorials)				Lab Exam (Remote proctored)	
No.	Date	Phases	Start Date	End Date		Type	Dates
1		Phase1 (30 days)				Regular	
2							
3							
4						Makeup	
Review		Phase2 (16 days)					

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6. Syllabus for Comprehensive Exam (Open Book): Contact Hours 1 to 16

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Instructor-in-Charge
AEL ZG511

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
WORK INTEGRATED LEARNING PROGRAMMES
M. Tech Automotive Electronics
I Semester 2019-20

Course Title	Embedded System Design
Course No(s)	AEL ZG512
Credit Units	4
Credit Model	1-1-2
Content Authors	

Course Description

Introduction to embedded systems; embedded architectures; Architectures and programming of microcontrollers and DSPs; Embedded applications and technologies; power issues in system design; introduction to software and hardware co-design.

Course Objectives

No	Course Objective
CO1	Introduce Hardware and Software Components of Embedded Systems
CO2	Introduce the challenges in system design and develop system design skills
CO3	Develop basic programming skills required for designing Embedded systems
CO4	Introduction to advanced topics of research in the field of Embedded Systems

Text Book(s)

T1	Wolf, Wayne, Computers as Components – Principles of Embedded Computing System Design, Second Edition, Morgan-Kaufmann, 2010.

Reference Book(s) & other resources

R1	James.K.Peckol, Embedded System Design – A Contemporary Design Tool, Wiley Student Edition, 2010
R2	Steve Furber, ARM System-on-chip Architecture, Second Edition, Pearson, 2007
R3	The Unified Modeling Language Reference Manual, by James Rumbaugh, Ivar Jacobson, Grady Booch, Addison-Wesley, 1999
R4	P. A. Laplante & S. J. Ovaska, Real-Time Systems Design and Analysis: Tools for the Practitioner, Wiley, 4th edition
R5	Kamal, Raj, Embedded Systems: Architecture, Programming & Design, Tata McGraw Hill, 2nd Ed., 2008
R6	The Definitive Guide to ARM Cortex M3/M4 Processors. Third Edition. Joseph Yiu
R7	Reference Manuals/ Published Papers a)8051 Microcontroller- Hardware Manual, b)8051RE2 Reference Manual, c)ARM CPU Reference Manual, d)LPC 23xx Reference Manual, e)TI DSP 64xx Manual Note : Required manual and reference papers will be uploaded on course website .

Content Structure

1. **Introduction to Embedded System**
   - 1.1. Introduction
     - 1.1.1. Characteristics and Embodiments of Embedded System
     - 1.1.2. Classification of Embedded Systems
     - 1.1.3. Introduction to Hardware and Software components of an Embedded System
   - 1.2. Hardware Components of Embedded System
     - 1.2.1. Introduction to Processor Architectures
     - 1.2.2. Memory Types Organization, Cache
     - 1.2.3. Interrupts
     - 1.2.4. Basic peripherals like Timers , ADC/DAC
   - 1.3. Software components of Embedded System
     - 1.3.1. RTOS & Tasks
     - 1.3.2. Introduction to SOC design, Embedded System Design Process/Flow

2. **Small Scale Embedded System Design**
   - 2.1. Problem Specification
     - 2.1.1. User and System Design Requirements
     - 2.1.2. System Block Diagram Development
     - 2.1.3. Selection of Hardware and Software – Considerations
     - 2.1.4. Hardware/Software design & Testing Considerations
     - 2.1.5. Final System Design
3. **Embedded Architecture 1 – RISC ARM Architecture**
   - 3.1. Introduction to ARM CPU Architecture
   - 3.2. Programmers Model of ARM CPU
     - 3.2.1. Register Organization
     - 3.2.2. Operating Modes
     - 3.2.3. Pipelining
     - 3.2.4. ARM Exception Handling
   - 3.3. ARM Instruction Set
4. **Embedded Architecture 2 –ARM Based Microcontrollers**
   - 4.1. Introduction to LPC23xx
     - 4.1.1. AMBA Bus Architecture
     - 4.1.2. GPIO, Timer, Watch dog
     - 4.1.3. Interrupt Handling -VIC , ADC/DAC
     - 4.1.4. DMAC
   - 4.2. Communication Peripherals- Synchronous & Asynchronous
     - 4.2.1. SPI , I2C , I2S , UART
     - 4.2.2. CAN
     - 4.2.3. USB
   - 4.3. Introduction to ARM Cortex Architectures
     - 4.3.1. ARM Cortex-M Architecture
     - 4.3.2. Board Design - System Booting related Concepts
5. **Embedded Architecture 3 –DSP Processors**
   - 5.1. Introduction to VLIW & DSP architectures
     - 5.1.1. Fixed and Floating point Datapath /DSP including Numeric Representation
     - 5.1.2. DSP Architectures - Characteristics
   - 5.2. TMS 64X+ CPU Architecture –Addressing Modes
     - 5.2.1. TMS 64X+ CPU Introduction
     - 5.2.2. Computational Unit
     - 5.2.3. Instruction Set
   - 5.3. TMS 6455 Programmers Model

5.3.1. Modes of Operation
5.3.2. Exceptions, Interrupts

6. Distributed and Multiprocessor based System Design

6.1. Introduction to Multiprocessor , Distributed and Networked Embedded Systems
6.2. Case Studies – Distributed and Multiprocessor Systems

7. Embedded Software Design

7.1. System Modeling
7.1.1. Hardware software partitioning
7.1.2. System Modeling using UML
7.2. Compilers, Assemblers and Debuggers for Embedded Sytems
7.3. Embedded C Programming
7.3.1. Memory Management , Shared Memory
7.3.2. System Initialization

8. Embedded Software

8.1. Tasks & Task management , Context Switching
8.2. RTS –Task Scheduling Concepts , Semaphore, Mutex, Deadlocks
8.3. Multitasking using ARM Cortex M Architectures – Introduction to RTOS Design

9. Advanced Embedded System Concepts

9.1. Performance Analysis and Optimization
9.2. Accelerated Embedded System
9.3. Fault Tolerance and Reliability

Evaluation Scheme:

Legend: EC = Evaluation Component; AN = After Noon Session; FN = Fore Noon Session

No	Name	Type	Duration	Weight	Day, Date, Session, Time
EC-1	Quiz-I/ Assignment-I	Online	-	5%	February 1 to 10, 2016
	Quiz-II			5%	March 1 to 10, 2016
	Quiz-III/ Assignment-II			5%	March 25 to April 3, 2016
EC-2	Mid-Semester Test	Closed Book	2 hours	35%	28/02/2016 (AN) 2 PM – 4 PM
EC-3	Comprehensive Exam	Open Book	3 hours	50%	10/04/2016 (AN) 2 PM – 5 PM

Syllabus for Mid-Semester Test (Closed Book): Topics in Session Nos. 1 TO 11
Syllabus for Comprehensive Exam (Open Book): All topics (Session Nos. 1 to 22)

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Evaluation Guidelines:

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2. For Closed Book tests: No books or reference material of any kind will be permitted.
3. For Open Book exams: Use of books and any printed / written reference material (filed or bound) is permitted. However, loose sheets of paper will not be allowed. Use of calculators is permitted in all exams. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.
4. If a student is unable to appear for the Regular Test/Exam due to genuine exigencies, the student should follow the procedure to apply for the Make-Up Test/Exam which will be made available on the Elearn portal. The Make-Up Test/Exam will be conducted only at selected exam centres on the dates to be announced later.

It shall be the responsibility of the individual student to be regular in maintaining the self study schedule as given in the course handout, attend the online lectures, and take all the prescribed evaluation components such as Assignment , Mid-Semester Test and Comprehensive Exam according to the evaluation scheme provided in the handout.

Instructor-in-Charge
AEL ZG512