Title of the Course: Antenna & Wave Propagation **Course Code:** UETC0501	**L**	**T**	**P**	**Credit**
	3	**-**	**-**	**3**

Course Pre-Requisite: Analog Communication Systems, Network Analysis, Electromagnetic Engineering.

Course Description:

Antenna & wave propagation is core subject & it has six units. In order to cover antenna fundamentals

Chapters are arranged. As the antenna is integral part of the communication system parameters, array, measurement & micro strip antenna are covered in the subject. Propagation depends upon the type of media so types are covered. At the end one application which covers use of antenna.

Antenna & wave Propagation course intends to build the competency in the students to understand basics. The subject is useful to understand the courses like RADAR & Navigation , Microwave Engineering.

In addition, syllabus of the course is included in GATE.

Course Objectives:

1. To define different terminologies of antenna & classify.
2. To explain measurement schemes of antenna parameters.
3. To distinguish among different types of wave propagation.
4. To explain different types of RADAR system.

Course Learning Outcomes:

Student will able to:

1. Apply different terminologies of antenna & classify.
2. Explain measurement schemes of antenna parameters.
3. Distinguish among different types of wave propagation.
4. Explain different types of RADAR system.

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy level	Descriptor
CO1	Apply different terminologies of antenna & classify.	Cognitive (Knowledge	**Apply**
CO2	**Explain** measurement schemes of antenna parameters.	Cognitive (Knowledge	**Understanding**
CO3	**Distinguish** among different types of wave propagation.	Psychomotor (Skill)	**Analyzing**
CO4	**Explain** different types of RADAR system.	Cognitive (Knowledge	**Understanding**

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1			2									
CO2					3							
CO3									2			
CO4										1		

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weight age for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- Fundamentals of Antenna Basic antenna radiation mechanism (single & double wire), parameters- radiation resistance, pattern , beam area, radiation intensity, beam efficiency, directivity, gain and resolution, antenna aperture, effective height, radio communication link, field from oscillating dipole, field zones, shape impedance consideration. Introduction to antenna array	05 **Hrs.**
Unit 2:--- Broadband & Frequency Independent Antenna Broadband & Frequency Independent Antenna: Broadband basics, infinite and finite biconical antennas, directional biconicals, conical, disk cones and bowties, the frequency-independent concept: Rumsey's principle ,the Illinois story, the frequency independent planner log-spiral antenna, frequency independent conical-spiral antenna, the log periodic antenna, the composite yagi-uda corner-log-periodic array	05 **Hrs.**
Unit 3:--- Antenna Measurements & Microstrip Antenna Antenna measurement: Antenna ranges, Radiation pattern, Gain measurements, Directivity measurements, Radiation efficiency, Impedance measurements, MICROSTRIP Antenna - Introduction, Basic characteristics, Feeding methods, basic types – rectangular, circular & transmission line model.	08 **Hrs.**
Unit 4:--- Ground Wave Propagation Plane earth reflection, space wave and the surface wave, elevated dipole antennas above a plane earth, wave tilt of the surface wave, spherical earth propagation, troposphere wave.	05 **Hrs.**
Unit 5:--- Ionospheric Propagation The ionosphere, effective permittivity and conductivity of an ionized gas, reflection and refraction of the waves by the ionosphere, regular and irregular variations of ionosphere, attenuation factor, sky wave transmission calculations, effect of earth magnetic field, wave propagation in ionosphere, Faraday rotation and measurement of total electron content, other ionosphere phenomena.	08 **Hrs.**
Unit 6:--- Radar System Fundamentals, RADAR performance factors, basic pulsed radar system, antennas and scanning, display methods, pulsed radar systems, moving target indication, radar beacons, CW Doppler radar, frequency modulated CW radar, phase array radars, planar array radars	07 **Hrs.**

Textbooks:

1. Antenna for all Application-John D Kraus, third edition-TMH publication
2. Antenna Theory-Constantine A. Balanis -Third edition-Wiley Publication
3. Electromagnetic Waves and Radiation Systems- Jordan and Balmain PHI publication
4. Electronics Communication System – Kennedy Davis- 4thedition TMH publication

References:

1] Antennas and Wave Propagation–G. S. N. Raju (Pearson)
2] Foundations of Antenna Theory and Techniques – Vincent F. Fusco(Pearson)

Unit wise Measurable students Learning Outcomes: Student will be able to

1 Describe antenna parameters.
2 Enumerate all details about broadband Antenna.
3 Demonstrate measurement techniques of antenna & design microstrip antenna.
4 Explain ground wave propagation.
5 Explain Ionospheric propagation.
6 Differentiate among different RADAR systems.

Title of the Course: Control System	**L**	**T**	**P**	**Credit**
Course Code: UETC0502	**3**	**1**	**-**	**4**

Course Pre-Requisite: Student should have clear understanding of Linear differential equations, Differential equations and its solution, and Laplace transform, Signals & Systems, basic Electrical circuits

Course Description:

Control system is offered as the core course at the fifth semester of E&TC Engineering undergraduate programmer. This course intends to build the competency in the students to design mathematical model of mechanical & Electrical system & check the stability of system in time domain and frequency domain.

In addition, syllabus of this course is included in competitive exams like GATE.

Course Objectives:

1. To provide an introduction and basic understanding of different control system components.
2. To develop time & frequency domain analysis.
3. To analyze & compare different control systems.
4. To understand the concept of stability & state space variables.

Course Learning Outcomes:

Upon successful completion of this course, a student will be able to:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		level	Descriptor
CO1	Apply knowledge of mathematics, science, and engineering to design, analyze and control the different systems	Cognitive (Application)	Apply
CO2	Analyze the systems in time domain and frequency domain.	Cognitive (Analysis)	Analyze
CO3	Analyze the behavior of closed loop systems using root locus, Routh Hurwitz, Bode and Nyquist.	Cognitive (Analysis)	Analyze
CO4	Describe state variables	Cognitive (Comprehension)	Describe
CO5	Design compensators in frequency domain	Cognitive (Synthesis)	Design

CO-PO Mapping:

CO	**PO**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	**3**	**-**	**1**		**3**	**3**	**1**	**-**	**3**	**3**	**-**	**3**
2	**3**	**2**	**-**		**-**	**-**	**1**	**-**	**3**	**-**	**-**	**3**
3	**3**	**2**	**3**		**3**	**3**	**1**	**-**	**3**	**3**	**-**	**3**
4	**2**	**1**	**-**		**-**	**-**	**-**	**-**	**1**	**-**	**-**	**3**
5	**3**	**3**	**2**		**3**	**3**		**-**	**2**	**3**	**2**	**3**

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10

ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

UNIT-I Introduction Need & classification of control system, Effects of feedback, Mathematical models – (Mechanical & Electrical systems) Differential equations, Transfer function – Armature & field control of DC servo motor, Block diagram algebra – Block diagram reduction, Representation by Signal flow graph – Reduction using Mason's gain Formula..	7 Hrs
UNIT-II Time Response Analysis Standard test signals – Time response of first & second order systems –Design specifications of 2nd order system & error compensation, Characteristic Equation of Feedback control systems, Transient response of second order systems – Time domain specifications, Steady state response – Steady state errors and error constants.	6 Hrs
UNIT-III Stability Analysis In S-Domain The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability. Root Locus Technique**:** The root locus concept – construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root locus..	6 Hrs
UNIT-IV Frequency Response Analysis Introduction, Frequency domain specifications-Bode plots, Determination of Frequency domain specifications and transfer function from the Bode Plot – Phase margin and Gain margin-Stability Analysis from Bode Plots, Polar Plots, Nyquist Stability Criterion, Nyquist plot & stability analysis.	7 Hrs
UNIT-V Classical Control Design Techniques Compensation techniques –Lag, Lead, Lead-Lag Controllers design in frequency Domain, Design of PID control system.	6 Hrs
UNIT- VI State Variable Analysis and Design Concept of state, state variable & state model, state model for linear continuous time systems, state variable & linear discrete time system.	6 Hrs

Textbooks:

1. Control Systems Engineering, I .J. Nagrath and M. Gopal, 5thEdition, Anshan Publishers.
2. Control System Engineering, Dr. Rajeev Gupta, Wiley Precise Publication
3. Modern Control Engineering, Eastern Economy, K. Ogata, 4thEdition.
4. R. Anandha Natarajan and B. Ramesh Babu, "Control System Engineering", 3rd Edition, Scitech Publication, 2009.

References:

1. Control System Principles and Design, M. Gopal, Tata McGraw Hill 3rdEdition
2. Automatic Control Systems, S. Palani, Anoop K. jairath, Ane books pvt. Ltd.

Unit wise Measurable students Learning Outcomes: Upon successful completion students will be able to

1. Apply knowledge of mathematics, science, and engineering to design, analyze and control the different systems
2. Analyze the systems in time domain.
3. Analyze the behavior of closed loop systems using root locus, Routh Hurwitz, Bode and Nyquist.
4. Analyze the systems in frequency domain
5. Design compensators in frequency domain
6. Describe state variables

Title of the Course: Microcontroller	**L**	**T**	**P**	**Credit**
Course Code: UETC0503	**4**	**-**	**-**	**4**

Course Pre-Requisite:
Elements of Electronics Engineering ,Digital Electronics

Course Description:
The course has been designed to introduce fundamentals 8051 microcontroller especially designed for embedded systems. It aims understand the concepts and basic architecture of 8051, and the programming of 8051.

Course Objectives:
1. To learn and understand architecture and programming of 8051 microcontroller.
2. To learn and understand generation of time delay, serial communication and interrupts.
3. To learn and understand the development of microcontroller based system
4. To developing of assembly level programs and providing the basics of the microcontroller.
5. To provide solid foundation on interfacing the external devices to the controller according to the user requirements.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		Level	Descriptor
CO1	Ability to understand and explain computer based and memory based architecture, microcontroller, pipelining, addressing modes, data types in Embedded C, basics of serial communication, timer configuration and interrupt handling	Analysis	Analyze
CO2	Ability to calculate instruction execution time, delay, baud rate, and write assembly and C Code, identify the timer mode, serial communication mode and interrupt priorities	Application	Apply
CO3	Ability to debug/ analyze the code in assembly as well as Embedded C	Application	Apply
CO4	Ability to engage in independent study on "Applications of Microcontrollers for health, safety, environment and society"	Comprehension	Describe
CO5	Ability to work as an individual and as a team-member to design, formulate and implement experiments using microcontroller through conduction of an Open-Ended experiments	Synthesis	Design

CO-PO Mapping:

CO	**PO**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	**3**	**1**	**1**	**1**	**3**	**3**	**1**	1	3	**3**	**1**	**3**
2	**3**	**2**	**1**	**1**	1	1	1	**1**	**3**	**1**	**1**	**3**
3	**3**	**2**	**3**	**1**	**3**	**3**	**1**	**1**	**3**	**3**	**1**	**3**
4	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**
5	**3**	**3**	**2**	**1**	**3**	**3**	**1**	**1**	**2**	**2**	**2**	**3**

Assessments :

Teacher Assessment:
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10

ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- **INTRODUCTION TO MICROCONTROLLER**: CPU architecture, The 8051 Architecture: Introduction, 8051 Microcontroller Hardware, Input / Output Pins,	06 **Hrs.**
Unit 2:--- **MICROCONTROLLER INSTRUCTION SET & PROGRAMMING** :Instruction set architecture-RISC & CISC CPU Architectures, Execution of an instruction, Instruction Timing, Addressing Modes and Instruction set. : Example Demonstration using 8051 instruction set, Data transfer instructions, Arithmetic instructions, Logical instructions, Branching and Subroutines, Example programs.	10 **Hrs.**
Unit 3:--- **CONCEPTS OF EMBEDDED 'C' PROGRAMMING.:** Data types, examples in 8051 C, program structures, logical operations, Memory and I/O access, Programming peripherals (Examples: Timer / Counter), Programming serial communication (serial data input/output) - example programs using 8051.	08 **Hrs.**
Unit 4:--- **INTERRUPTS AND INTERRUPT PROGRAMMING:** Concept of Interrupts Interrupts in 8051. Programming Timer Interrupts, Programming External Hardware Interrupts, Programming Serial Communication Interrupts	08 **Hrs.**
Unit 5:--- **INTERFACING AND APPLICATIONS**: External Memory Interface, Interfacing 8051 to LCD, DAC, ADC Stepper motor interfacing. Applications of microcontrollers.	08 **Hrs.**
Unit 6:--- **Microcontrollers in IOT:** Role of microcontroller in Embedded System and Internet of Things (IoT), Microcontrollers used in IoT open source environment, design issues, operating conditions and requirements, platform details.	08 **Hrs.**

Textbooks:

1. "The 8051 Microcontroller Architecture, Programming & Applications", Kenneth J. Ayala 2e, Thomson Learning 2005.
2. "The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006
3. Internet of Things with Arduino Blueprints, by Pradeeka Seneviratne, Packt Publishing• Limited , 27 October 2015

References:

1] "Computer Organization and Architecture", Carl Hamacher, McGrawHill, 5th Edition.
2] T. D Morton, Embedded Microcontrollers, Pearson Education, India, 2003.
E Books:nptel.ac.in/courses/Webcourse-contents/IIT.../microcontrollers

Unit wise Measurable students Learning Outcomes:

1. CO1: Ability to understand and explain computer based and memory based architecture, microcontroller, pipelining, addressing modes, data types in Embedded C, basics of serial communication, timer configuration and interrupt handling
2. CO2: Ability to calculate instruction execution time, delay, baud rate, and write assembly and C Code, identify the timer mode, serial communication mode and interrupt priorities
3. CO3: Ability to debug/ analyze the code in assembly as well as Embedded C
4. CO5: Ability to engage in independent study on "Applications of Microcontrollers for health, safety, environment and society"
5. CO6: Ability to work as an individual and as a team-member to design, formulate and

implement experiments using microcontroller through conduction of an Open-Ended experiments

Title of the Course: Signals and Systems	**L**	**T**	**P**	**Credit**
Course Code: UETC0504	**3**	**1**	**-**	**4**

Course Pre-Requisite: Engineering Mathematics - III ,Basic Electrical Engineering

Course Description: In modern age of technology, signals and systems play vital roles. It is core subject in electronics and telecommunication field with diverse applications in area of science and technology such as signal and image processing, communications, control systems, circuit design etc. This course focus on analyze signals and systems using various transforms.

Course Objectives :

On completion of the course, students should be sufficiently familiar with the theoretical structure, formal representation, computational methods, notation, and vocabulary of linear models to be able to apply them to the analysis and design of digital and analog communications and control systems. The students will be able to perform signal analysis with reference to spectrum analysis of deterministic signals.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		Level	Descriptor
CO1	To describe basic signals mathematically and understand how to perform mathematical operations on signals.	Cognitive	Explain(II)
CO2	To apply skills to solve problems related to system classification & its properties	Psychomotor	Applying(III)
CO3	To know the Fourier series & Transforms for representation of periodic and a periodic signals	Cognitive	Knowing(IV)
CO4	To analyze the systems in time & frequency domain by applying knowledge of Fourier & Z Transforms	Cognitive	Analyzing (IV)

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	3	**1**	**2**	**2**	**1**	**1**	**1**	**1**			**1**
CO2	3	3	**1**	**2**	**3**	**1**	**1**	**1**	**1**			**1**
CO3	3	3	**1**	**2**	**3**	**1**	**1**	**1**	**1**			**2**
CO4	3	3	**1**	**2**	**2**	**1**	**1**	**1**	**1**			**1**

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1: Introduction to Signals and Systems	**6Hrs**

Introduction, standard signals, signal representation, classification of signals, System Representation, continuous & discrete systems, properties of system.	
Unit 2: Linear time invariant Systems: The representation of signals in term of impulses, discrete time LTI systems, continuous time LTI systems, properties of CT-LTI and DT-LTI systems, Convolution integral and convolution sum, graphical representation of convolution.	**8 Hrs**
Unit 3: Sampling : Representation of continuous time signals by it's samples, The sampling theorem, Reconstruction of signals from its samples using interpolation, The effect of under sampling, aliasing, Discrete time processing of continuous time signals, Sampling in the frequency domain.	**5Hrs**
Unit 4: Z Transform : Introduction of Z transform, ROC, properties of ROC, Unilateral Z-transform, properties of Z transform, Inverse Z transform : long division method, PFE method, residue method, Transfer function (Poles & Zeros).	**6Hrs**
Unit 5: Fourier Domain Analysis of Continuous and Discrete time Signals: **Continuous time Fourier Series :** Trigonometric Fourier series, Exponential Fourier series, relation between trigonometric and exponential Fourier series, Discrete time Fourier series, properties of Fourier series.	**6Hrs**
Unit 6 : Continuous Time Fourier Transform : Fourier series to Fourier transform, Fourier transform pair, Fourier spectra, Convergence of FT, properties of Fourier transform..	**5 Hrs**
Textbooks: 1 A.V. Oppenheim, A.S. Willsky, S.H. Nawab, *Signals* and *Systems*, Prentice Hall, 1997. Supplemental: Ashok Ambardar, *Analog and Digital Signal Processing,* CL Engineering, 1999	
References: 1. B. P. Lathi, *Linear systems and signals* ,Oxford University press, 2005 2. M. J. Roberts , *Signals and systems*, Tata Macgraw Hill,2005 3. Simon Haykin, Barry Van Veen, *Signals and systems* ,Wiley, 2003 4. Hwei P Hsu, *Schaum's Outline Signals and Systems*, Tata Macgraw Hill, 1995	
Measurable Students Learning Outcomes : 1. Understand fundamental characteristics of Signals and Systems. 2. Analyze response of linear continuous-time and discrete-time signals and systems. 3. Apply time-domain and frequency-domain analysis tools to linear continuous systems. 4. Analyze continuous-time signals and system responses using the concepts of transfer function representation by use of Laplace and inverse Laplace transforms. 5. Apply time-domain and frequency-domain analysis tools to linear discrete systems. Explore sampling concepts that link continuous-time and discrete-time signals and systems. 6. Analyze discrete-time signals and system responses using the concepts of transfer function representation by use of Z and inverse-Z transforms.	

Title of the Course: Antenna & Wave Propagation Lab	**L**	**T**	**P**	**Credit**
Course Code: UETC0531	**0**	**0**	**2**	**1**

Course Pre-Requisite: Electromagnetic Engineering,

Course Description: Course covers antenna parameters measurement, transmission line parameters measurement & RADAR applications.

Course Objectives:

1. To measure the parameters of the antenna & specify application.
2. To measure the different parameters of the transmission line.
3. To perform the practical on RADAR for the measurement.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		level	Descriptor
CO1	Compare the Antenna parameters of the different types of antenna	Cognitive	Compare
CO2	Use transmission line parameters to match the antenna with transmission line.	Cognitive	Use
CO3	Distinguish the RADAR measurement for different applications.	Psychomotor	Distinguish

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1			3		1				2			
CO2			3		1				2			
CO3			3		1				2			

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 25%, and 50% weights respectively.

Assessment	Marks
ISE	25
ESE-POE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1:--- Antenna Trainer kit **Aim and Objectives:** To know about the antenna trainer kit **Outcomes:** Perform the experiment using the antenna trainer kit. **Theoretical Background:** Antenna Trainer kit manual **Experimentation:** Connect the antenna trainer system Transmitter & Receiver **Results and Discussions:** **Conclusion:**	**02Hrs.**
Experiment No. 2:--- Proof of Theorems 1) Inverse Square law 2) Reciprocity Theorem	
Experiment No. 3:--- To measure parameters of Aperture type of Antenna(Horn & open ended wave guide Antenna)	02 **Hrs.**
Experiment No. 4:--- To measure parameters of Microstrip Antennas	02 **Hrs.**
Experiment No. 5:--- To measure parameters of Circularly Polarized Antennas	02 **Hrs.**
Experiment No. 6:--- To measure parameters of log periodic antenna	02 **Hrs.**
Experiment No. 7:--- To measure parameters of Phase Array(Broadside & End fire array)	02 **Hrs.**
Experiment No. 8:--- To calculate the attenuation of the transmission line	01 **Hrs.**

Experiment No. 9:--- To calculate the input impedance of the transmission line	01 **Hrs.**
Experiment No. 10:--- SWR measurement of the transmission line	01 **Hrs.**
Experiment No. 11:-- Fault localization on the transmission line	01 **Hrs.**
Experiment No. 12 :--- To measure velocity of the object.	01 **Hrs.**
Experiment No. 13 :--- To measure frequency of the tuning fork.	01 **Hrs.**
Experiment No. 14 :--- To measure the time period of the pendulum	01 **Hrs.**
Experiment No. 15 :--- To measure the speed of the fan	01 **Hrs.**
Textbooks: 1. Antenna trainer kit manual - Academia 2. Transmission Line trainer kit Manual- Scitech 3. RADAR Trainer kit manual- Scitech	
References: 1] "Antenna & Wave Propagation" By GSN Raju ,Pearson Publication.	

Title of the Course: Microcontroller Lab	**L**	**T**	**P**	**Credit**
Course Code: UETC0532	**0**	**0**	**2**	**1**

Course Pre-Requisite: Digital Electronics

Course Description:

Microcontroller Lab consists of minimum twelve experiments. It consists of Assembly language, Embedded C and Interfacing Programs

Course Objectives:

1. To understand assembly language programming.
2. To understand embedded C programming.
3. To Design & simulate microcontroller interfaces.
4. To implement interfacing of microcontroller with peripherals.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive level	Descriptor
CO1	Write assembly language programs	Cognitive	Explain
CO2	Write embedded C programs	Cognitive	Explain
CO3	Simulate and debug programs	Psychomotor	Implement
CO4	Interface peripherals to microcontroller	Psychomotor	Construct

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	1	3	3	2	3	3	1	1	3	2	2	1
CO2	1	3	3	3	3	3	1	1	3	3	2	1
CO3	1	2	2	2	2	3	1	1	2	3	2	1
CO4	1	2	2	2	2	2	1	1	2	2	2	1

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50
ESE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination.

Note: Any 10 Experiments from bellow list

Course Contents:

Experiment No. 1:--- **Aim and Objectives: perform arithmetic operations using assembly language** **Outcomes:** Write assembly language programs **Theoretical Background: Instruction set of microcontroller** **Experimentation: Addition/subtraction/multiplication/division/bcd to hex conversion** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Experiment No. 2:--- **Aim and Objectives: perform data transfer operations using assembly language** **Outcomes:** Write assembly language programs	02 **Hrs.**

Theoretical Background: Instruction set of microcontroller **Experimentation: Block Transfer/ Exchange operation** **Results and Discussions:** **Conclusion:**	
Experiment No. 3:--- **Aim and Objectives: perform memory organization using assembly language** **Outcomes:** Write assembly language programs **Theoretical Background: Instruction set of microcontroller** **Experimentation: Ascending order/descending order** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Experiment No. 4:--- **Aim and Objectives: perform memory organization using assembly language** **Outcomes:** Write assembly language programs **Theoretical Background: Instruction set of microcontroller** **Experimentation: Separation of Positive/Negative No. from memory** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Experiment No. 5:--- **Aim and Objectives: perform memory organization using assembly language** **Outcomes:** Write assembly language programs **Theoretical Background: Instruction set of microcontroller** **Experimentation: Separation of Even/odd No. from memory** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Experiment No. 6:--- **Aim and Objectives: perform memory organization using assembly language** **Outcomes:** Write assembly language programs **Theoretical Background: Instruction set of microcontroller** **Experimentation: Finding smallest/largest no. from memory** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Experiment No. 7:--- **Aim and Objectives: perform port operations using assembly language** **Outcomes:** Simulate and debug programs **Theoretical Background: Embedded C Programming** **Experimentation: Port toggling/ square wave generation** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Experiment No. 8:--- **Aim and Objectives: perform timer /counter operations using assembly language** **Outcomes:** Simulate and debug programs **Theoretical Background: Embedded C Programming** **Experimentation: Delay generation/Event count** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Experiment No. 9:--- **Aim and Objectives: perform Serial communication operations using Embedded C** **Outcomes:** Simulate and debug programs **Theoretical Background: Embedded C Programming** **Experimentation:** **Results and Discussions:**	02 **Hrs.**

Conclusion:	
Experiment No. 10:--- **Aim and Objectives: perform operations on interrupts using embedded C** **Outcomes:** Write embedded C programs **Theoretical Background: Embedded C Programming** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 11:--- **Aim and Objectives: perform interfacing of peripherals using embedded C** **Outcomes:** Interface peripherals to microcontroller **Theoretical Background: Embedded C Programming** **Experimentation: LED/LCD/Seven Segment Display interfacing** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Experiment No. 12:--- **Aim and Objectives: perform interfacing of peripherals using embedded C** **Outcomes:** Interface peripherals to microcontroller **Theoretical Background: Embedded C Programming** **Experimentation: Stepper motor/ADC/DAC Interfacing.** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Textbooks: 1. "The 8051 Microcontroller Architecture, Programming & Applications", Kenneth J. Ayala 2e, Thomson Learning 2005. 2. "The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006	
References: 1] "Computer Organization and Architecture", Carl Hamacher, McGrawHill, 5th Edition. 2] T. D Morton, Embedded Microcontrollers, Pearson Education, India, 2003. **E Books:** nptel.ac.in/courses/Webcourse-contents/IIT.../microcontrollers	
Experiment wise Measurable students Learning Outcomes: **1** Write assembly language programs for arithmetic operations **2** Write assembly language programs for data transfer operations **3** Write assembly language programs for memory organization **4** Simulate and debug programs for microcontroller port operations **5** Write embedded C programs for microcontroller **6** Interface peripherals to microcontroller	

Title of the Course: Programming Lab	**L**	**T**	**P**	**Credit**
Course Code: UETC0533	**0**	**0**	**2**	**1**

Course Pre-Requisite: Basics of C programming

Course Description: Learning MATLAB, different data types, looping & control structures, functions, and other tools and their practical use, in order to provide the ability to solve mathematical problems.

Course Objectives:

1. To understand matrix manipulation in MATLAB.
2. To Use different MATLAB inbuilt functions and tool box.
3. To do effective programming using different functions and commands.
4. To develop GUI based applications using MATLAB.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		level	Descriptor
CO1	Identify suitable commands & functions required for programming in MATLAB	Cognitive	Identify
CO2	Solve technical problems in engineering, math and science using MATLAB	Psychomotor	Solve
CO3	Create Apps with Graphical User Interface in MATLAB	Cognitive	Create
CO4	Carry out simulation of various Engineering systems models using SIMULINK	Cognitive	Carry out

CO-PO Mapping:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	1	2			3	1						
CO2	2	3			3	3						1
CO3		1			3					2		
CO4	3	3			3	3						

Strength of Correlation:
High : 3 Medium : 2 Low : 1

Assessments :

Teacher Assessment:

Assessment	Marks
ISE-TW	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

List of Experiments:

Experiment No. 1:-- Program based on, Arrays, Multidimensional array, displaying output data, scalar, and array operations, Hierarchy of operations built-in Matlab functions.	02 **Hrs.**
Experiment No. 2:-- Program based on, Introduction to different plotting functions, Defining and Plotting of standard signals	02 **Hrs.**
Experiment No. 3:-- Program based on, Branching Statements and logical data type, while & for loop, logical arrays and vectorization.	02 **Hrs.**
Experiment No. 4:-- Program based on, User-defined & i/o functions, sub functions, Private functions, Nested functions	02 **Hrs.**
Experiment No. 5:-- Program based on, handling complex data, Plotting of	02 **Hrs.**

complex data	
Experiment No. 6:-- Program based on, string manipulation, text read function, load and save commands	02 **Hrs.**
Experiment No. 7:-- Program based on, Matlab file processing, file opening and closing, binary i/o functions, formatted i/o functions	02 **Hrs.**
Experiment No. 8:-- Program based on, Creating and displaying a graphical user interface, object properties, graphical user interface components, dialog boxes, menus.	02 **Hrs.**
Experiment No. 9:-- Program based on, Simulink, modeling, solvers, and simulating model using variables from matlab.	02 **Hrs.**
Experiment No. 10:-- Program based on, Data import/export in SIMULINK, state space modeling & simulation, creation of subsystems.	02 **Hrs.**

Textbooks:

1. MATLAB programming for engineers
2. MATLAB & its application in engineering Rajkumar Bansal, Ashok kumar Good, Manoj kumar Sharma
3. MATLAB & Introduction with application Amos Gilt

References:

1. MasterinMATLAB-7 Duane Hanselman, Bruce Littlefiele, Person Education
2. MATLAB programming manual by Mathworks Inc
3. MATLAB & Simulink Introduction to applications – Partha S. Mallick, Scitech publications
4. C.B. Moler, Numerical Computing with MATLAB, SIAM, 2004. Available online at http://www.mathworks.com/moler/index_ncm.html.

Title of the Course: Mini Project – II **Course Code:** UETC0541	**L**	**T**	**P**	**Credit**
	-	**-**	**2**	**1**

Course Pre-Requisite: Analog Circuits, Digital Design, Linear integrated circuits, Network Analysis, Microcontroller.

Course Description: Course will cover all the implementation of theoretical design & its practical implementation.

Course Objectives:

- Design working, reliable and electronic circuits to meet specifications.
- Inculcate circuit designing skills and ability and to use modern design tools.
- Enhance employability based on knowledge and understandings Arduino programming with C++ & python programming with Raspberry Pi
- To create an interest in the field of electronic design as a prospective career option.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		level	Descriptor
CO1	Apply the fundamental concepts and working principles of electronics devices to design electronics circuits.	Cognitive	Apply(III)
CO2	Interpret datasheets and select appropriate components and devices	Cognitive	Interpret (II)
CO3	Develop software using Python or C programming Language	Cognitive	Develop(VI)
CO4	Demonstrate project based on Arduino or Raspberry Pi platform	Cognitive	Demonstrate (II)

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	3	-	3	-	-	-	2	-	-	-
CO2	-	-	3	-	1	-	-	-	2	-	-	-
CO3	-	-	3	-	1	-	-	-	2	-	-	-
CO4	-	-	3	-	1	-	-	-	2	-	-	-

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50
ESE	50

ISE are based on practical performed Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination

Guidelines:

Using the Arduino system essential skills for creating a simple sensor-driven physical computing system, and the second portion will reinforce those skills by making a simple interactive project.

OR

Setup and operate the Raspberry Pi using Linux OS or X Windows, program the Pi using Python for GPIO pins interfacing & simple GUI-based applications.

Prepare the document which consist of :

1. Problem statement (Different for each group)

2. Specifications 3.Block Diagram
4. Component Selection
5. Design Calculations
6. Program Simulation
7. Bill of Material
8. Conclusion
9. Datasheets

Textbooks:

1. Measurement, Instrumentation, and Sensors Handbook‖, John G. Webster, CRC Press,1999 .
2. Exploring Arduino: Tools and Techniques for Engineering Wizardry **book by Jeremy Blum**
3. Raspberry Pi 3: Beginner to Pro - Step by Step Guide **book by Timothy Short**
4. The 8051 Microcontroller and Embedded Systems Book by Muhammad Ali Mazidi

References:

1. http://www.electronicwings.com/
2. The Circuit Designer‘s Companion‖, Peter Wilson, Elsevier Ltd, 2012
3. Printed Circuits Handbook, 7th Edition, Clyde Coombs, Happy Holden, McGraw-Hill ,2016
4. Data sheets of microcontrollers

Program Elective I	
Course Code	**Course Name**
UETC0521	Optical Fiber communication
UETC0522	Operating System
UETC0523	Multimedia Engineering.

Title of the Course: Optical Fibre Communication **Course Code:** UETC0521	**L**	**T**	**P**	**Credit**
	3	**-**	**-**	**3**

Course Pre-Requisite:

physics and electromagnetic engineering background with good understanding in digital and analog communications

- Ray theory of light
- Snell's law
- Nature of light
- Distribution of Electric field and magnetic field in light
- Representation of light
- Basics of semiconductor
- Analog and digital modulation system with transmitter and receiver

Course Description:

To introduce the students to various optical fiber modes, configurations and various signal degradation factors associated with optical fiber and to study about various optical sources and optical detectors and their use in the optical communication system

Course Objectives:

1. Describe the basics optical communication
2. Optical fiber structure and light propagating mechanisms in detail.
3. Analyze the signal degradation mechanisms and the methods of limiting the same.
4. Explain the construction and working of optical sources and detectors.
5. Describe the optical receiver operation in detail.
6. Describe the wavelength division multiplexing and optical network in

Course Learning Outcomes:

1. Elaborate the basics of optical communication.
2. Differentiate the different types of optical fiber structures, fabrication methods and light propagating mechanisms.
3. Acquire knowledge of signal degradation mechanism in optical fiber.
4. Understand the construction of and working of optical sources and detectors.
5. Describe the optical receiver operation, WDM and optical network in detail

CO	**After the completion of the course the student should be able to**	Bloom's taxonomy	
		level	Descriptor
CO1	Tell advantages , disadvantages and basics of optical communication System	1	Tell
CO2	Compare different types of optical fibers- structure, fabrication methods and light propagating mechanisms	5	Compare
CO3	Predict signal degradation in optical fibers	6	Predict
CO4	Choose required optical sources and detectors	3	Choose
CO5	Explain the optical receiver operation, WDM and optical network in detail	2	Explain

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2			3				3			

CO2		3										
CO3			3		3							
CO4			3									
CO5		3		3							2	

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- **INTRODUCTION OF OPTICAL FIBERS** The evolution of Optic System, Elements of Optical Fiber Transmission Link, optical spectral band, The nature of Light, Basic Optical Laws and Definitions, Single Mode Fibers, Graded Index fiber structures. Mode theory for waveguides, Fiber Materials and fabrication methods.	**7 Hrs.**
Unit 2:--- **TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS** Attenuation, material absorption losses, scattering losses, bending losses, dispersion, polarization, nonlinear effects.	**6- Hrs.**
Unit 3:--- **OPTICAL SOURCES** Light source materials - LED -Structure - Quantum efficiency -Modulation. Laser Diode - Modes and threshold condition - Structures and Radiation Pattern. Light Source Linearity, Modal, Partition and Reflection Noise, Reliability considerations.	**7Hrs.**
Unit 4:--- **OPTICAL DETECTORS AND RECEIVERS** Physical Principal of Photodiodes, Photodetector Noise, Detectors Response Time, Avalanche Multiplication Noise, Structure for InGaAs APDs, Temperature effect of Avalanche Gain, Comparison of Photodetectors , Fundamental Receiver Operation, Digital Receiver Performance	6 **Hrs.**
Unit 5:--- **WDM CONCEPTS AND COMPONENTS** Operational Principles of WDM , couplers, Isolators, Circulators, Fabry Perot	**4Hrs.**

Filters, Mach-Zehnder Interferometer, tunable filters and sources, Semiconductor Optical Amplifier and Transceivers.	
Unit 6:--- **OPTICAL NETWORKS** Basic Network , SONET/SDH: - Optical specifications - SONET frame structure – SONET layers - SONET/SDH networks. Operational principles of WDM - Broadcast and Select WDM networks - Single hop networks - Wavelength routed networks - Performance of WDM+EDFA Systems	**6Hrs.**

Textbooks:

1. Gerd Keiser, "*Optical Fiber Communication*" McGraw -Hill International, Singapore, 3rd edition, 2000
2. John M. Senior , "Optical Fiber Communication", Second Edition, Pearson Education, 2007
3. Rajiv Ramaswami, Kumar N. Sivaranjan, "*Optical Networks A practical perspective*", 2nd edition, Elsevier, 2004

References:

1. Djafar K. Mynbaev, Lowell L. Scheiner, "*Fiber-Optic Communications Technology*", 1st edition, Pearson Education, 2001
2. John Powers, "*An Introduction to Fiber optic Systems*", 2nd edition, Irwin-McGraw Hill, 1999
3. J.Gowar, "*Optical Communication System*", 2nd edition, Prentice Hall of India, 2001

Unit wise Measurable students Learning Outcomes:

ULO1: : To understand the nature of light and its propagation in fiber cables and also about different types of optical fibers
ULO2: To understand fiber materials and fabrication methods
ULO3: To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.
ULO4: To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes structures.
ULO5: To understand noises, linearity and reliability of sources
ULO6: To understand different structures, working and properties of photodetectors.
ULO7: To learn the fiber optical receivers, noise performance, receiver operation and configuration
ULO8: To learn, the basic optical network and also different types of network topologies, WDM and configuration

Title of the Course: Operating System	**L**	**T**	**P**	**Credit**
Course Code: UETC0522	**3**	**-**	**-**	**3**

Course Pre-Requisite:

1. Computer Organization and Architecture.
2. Fundamentals of Data Structures

Course Description: In this course we will explore the core principles of operating systems design, including basic operating system structure; process and thread synchronization and concurrency; file systems and storage servers; memory management techniques; process scheduling and resource management.

Course Objectives:

1. To introduce basic concepts and functions of modern operating systems.
2. To understand the concept of process and thread management.
3. To understand the scheduling of processes and threads.
4. To understand the concept of concurrency control.
5. To understand the concept of I/O and File management.
6. To understand various Memory Management techniques.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		Level	Descriptor
CO1	Define the basic components of an operating system and their role in implementations for general purpose, real-time, and embedded applications.	Cognitive Level I- Remembering	Define
CO2	Analyze role of Process synchronization towards increasing throughput of system.	Cognitive Level IV- Analyzing	Analyze
CO3	Explain the basic concepts related to the concurrency such as race conditions, OS concerns and mutual exclusion requirements.	Cognitive Level V- Evaluating	Explain
CO4	Summarize the key issues related to the memory management.	Cognitive Level II- Understanding	Summarize
CO5	List the characteristics of Embedded OS.	Cognitive Level I- Remembering	List

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	2	3	3	-	-	1	-	-	-	-	-	-
CO2	2	3	3	-	-	1	-	-	-	-	-	-
CO3	1	3	3	-	-	1	-	-	-	-	-	-
CO4	1	3	3	-	-	1	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10

ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

UNIT I : FUNDAMENTALS OF OS AND SYSTEM SOFTWARE Overview of all system software Operating system- I/O Manager- Assembler-Compiler-Linker- Loader, OS services and components, multitasking, multiprogramming, time sharing, buffering, spooling	**06Hrs.**
UNIT II : PROCESS AND THREAD MANAGEMENT Concept of process and threads , process states process management context switching , interaction between processes and OS , multithreading	**08 Hrs.**
UNIT III : CONCURRENCY CONTROL Concurrency and race conditions, mutual exclusion requirements , s/w and h/w solutions, semaphores, monitors, classical IPC problem and solutions, Dead locks - characterization , detection ,recovery, avoidance and prevention.	**05 Hrs.**
UNIT IV : MEMORY MANAGEMENT Memory partitioning , swapping, paging, segmentation, virtual memory - Concepts, Overlays, Demand paging, Performance of demand paging , page replacement algorithm, Allocation algorithms	**05Hrs.**
UNIT V : I/O SYSTEMS Principles of I/O hardware - I/O devices - device controller - direct memory access Principles of I/O software – Goals - interrupt handlers - device drivers- device independent I/O software secondary-storage structure - Disk structure - Disk scheduling - Disk Management - Swap-space management - Disk reliability - Stable storage implementation File concept File support- Access methods- Allocation methods- Directory systems- File Protection	**06Hrs.**
UNIT VI : EMBEDDED OPERATING SYSTEMS Characteristics of embedded operating systems, Real time operations, Reactive operations, configurability, I/O device flexibility, protection mechanism, direct use of interrupts.	**06 Hrs.**

TEXT / REFERENCE BOOKS :

1. Achyut S. Godbole,**" Operating Systems"**IIndEdition,Tata Mc Graw Hill .
2. William Stallings ,**"Operating System: Internals & Design Principles'**, Prentice Hall of India.
3. Flynn & Metioes ,**"Understanding Operating System"**IVth Edition, Thomsan publication.
4. Silberschatz& Galvin,**" Operating System Concepts",**VIIth Wiley 2000 .
5. MilmanMilenkovic," **Operating systems, concept &design"**
6. P.balkrishna Prasad," Operating Systems" II ndEdition,Scitech Publication
7. Flynn /McHoes," Operating Ststems" Cengage Learning (India Edition)

Title of the Course: Multimedia Engineering **Course Code:** UETC0523	**L** **3**	**T** **-**	**P** **-**	**Credit** **3**

Course Pre-Requisite: Literacy includes being proficient in using the basic computer interface (Windows), being able to perform basic file management operations (formatting a disk, saving files, retrieving files, copying files and printing).

Course Description: Multimedia is the combined use of text, graphics, sound, animation, and video. A primary objective of this subject is to teach student how to develop multimedia programs. Another objective is to demonstrate how still images, sound, and video can be digitized on the computer. An authoring tool allows to develop an electronic stack of cards that contain buttons, graphics, and text.

Course Objectives:

1. To understand technical aspect of Multimedia Systems.
2. To understand and evaluate the process of development of Multimedia Systems.
3. To understand the framework and standards available for different Multimedia applications.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive level	Descriptor
CO1	To explain the relevance and underlying infrastructure of multimedia systems.	2.Understanding	Explain
CO2	To apply their multimedia knowledge to understand the current requirements of multimedia products.	3.Applying	Apply
CO3	To develop the multimedia systems as per industry standards using the standards and Frameworks learnt.	3.Applying	develop

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2			1							2
CO2				3		2						
CO3						3			2		3	2

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- Introduction to Multimedia	**5 hrs**

What is multimedia, Components of multimedia, Web and Internet multimedia applications, Transition from conventional media to digital media	
Unit 2:--- Computer Fonts and Hypertext Usage of text in Multimedia, Families and faces of fonts, outline fonts, bitmap font's International character sets and hypertext, Digital font's techniques.	**6 hrs**
Unit 3:--- Audio fundamentals and representations Digitization of sound, frequency and bandwidth, decibel system, data rate, audio file format, Sound synthesis, MIDI, wavetable, Compression and transmission of audio on Internet, Adding sound to your multimedia project, Audio software and hardware.	**6 hrs**
Unit 4:--- Multimedia Information Systems Workstation OS, New OS support, Real Time Mach, Multimedia system service architecture, Media Stream Protocol, service and window system, client control of continuous media, Hyper applications. Multimedia Information systems, File system support, Data Models.	**5 hrs**
Unit 5:--- Video and Animation Video Basics, How Video Works, Broadcast Video Standards, Analog video, Digital video, Video Recording and Tape formats, Shooting and Editing Video (Use Adobe Premier for editing), Video Compression and File Formats. Video compression based on motion compensation, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21, Animation: Cell Animation, Computer Animation, Morphing.	**6 hrs**
Unit 6:---Multimedia Authoring Multimedia Authoring Basics, Some Authoring Tools, Macromedia Director & Flash**.**	**7 hrs**
Textbooks: 1. Tay Vaughan, "Multimedia making it works", Tata McGraw-Hill, 2008. 2. Rajneesh Aggarwal & B. B Tiwari, "Multimedia Systems", Excel Publication, New Delhi, 2007. 3. Li & Drew, "Fundamentals of Multimedia", Pearson Education, 2009.	
References: 1. Parekh Ranjan, "Principles of Multimedia", Tata McGraw-Hill, 2007. 2. Anirban Mukhopadhyay and Arup Chattopadhyay, "Introduction to Computer Graphics and Multimedia", Second Edition, Vikas Publishing House.	

Audit Course-III

Title of the Course: Industrial Management Course Code:UETC0561	L	T	P	Credit
	2	-	-	2

Course Pre-Requisite: A working knowledge of Mathematics is sufficient**.**

Course Description:

To develop competencies and abilities to work in an industrial organization by studying of the concepts like planning, organizing, directing, controlling and operation research methodologies. Idea is to change their view from job seeker to job provider by changing their abilities to plan and formulate for the entrepreneurship.

Course Objectives:

1. To understand various functions of Management.
2. To study and understand the actual predictions made in organization in profit making process and various activities to be performed.
3. To study operation research methodologies.
4. To use the OR model to solve the case studies related to project management.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Explain functions of management.	Understanding	Explain
CO2	Illustrate marketing and selling concepts	Understanding	Illustrate
CO3	Apply the models of OR in industrial management	Applying	Apply

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1											2	
CO2											2	
CO3						2					3	
CO4			2	2		1					2	

Assessments :

Teacher Assessment:

End Semester Examination (ESE) having 100%.

Assessment	Marks
ESE	100

ESE: Assessment is based on 100% course content.

Course Contents:

Unit 1:Management	5Hrs.
Concept, functions, importance, levels of management, forecasting-concept and importance, Organization Importance and Principles, Staffing Procedure of staffing, performance appraisal. Directing, Leadership –definition and concept,	

qualities of leader.	
Unit 2:Marketing Marketing and selling concept, marketing mix, Advertising- concept, need, types, advantages and limitations. Material Management– concept, function, Purchase management-concept, objectives, functions, importance, policies and procedure.	5Hrs.
Unit 3: Costing Elements of cost, cost estimation procedure, Entrepreneurship-importance, Qualities, function of entrepreneur, small scale industries procedure of starting SSI unit, Difference Schemes for SSI. Forms of Business Organization -Single, partnership.	5 Hrs.
Unit 4:Linear Programming Operation Research definition ,methodologies, Scope and limitations, Linear Programming concept, Linear Programming by graphical method, Linear Programming by simplex method	4 Hrs.
Unit 5: Assignment and Transportation Assignment Problems Introduction Balanced, Unbalanced, Prohibitivetype of assignments, Transportation Problems for finding basic feasible solution by Northwest corner method, and Least cost method.	5Hrs.
Textbooks: 1. O.P. Khanna, Indusrial Engineering and Management, DhanpatRai Publication. 2. Anand Sharma, Operation Research, Himalaya Publishing House. 3. Nandkumar K. Hukeri, Industrial Management, Electrotech Publications	
References: 1. N. V. S.Raju, Industrial Engineering and Management, Cengage Learning. 2. Dr.D S Hira,Problems in Operation Research,S Chand publication 3. R.Panneerselvam, Operation Research, PHI Learning	

Title of the Course: Embedded System	**L**	**T**	**P**	**Credit**
Course Code: UETC0601	**3**	**-**	**-**	**3**

Course Pre-Requisite: Digital electronics , microcontrollers

Course Description:

This course makes the students aware of the fundamentals of embedded system and the family of controllers used to design embedded system.

Course Objectives:

1. Students have knowledge about the basic functions of embedded systems.
2. Students have knowledge about the basic structure of embedded systems.
3. Students have knowledge about the basic structure of ARM.
4. Students have knowledge about the applications of embedded systems
5. Students have knowledge about the development of embedded software

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive level	Descriptor
CO1	Understand Embedded system	Analysis	Analyze
CO2	Exhibit the knowledge of design metrics of embedded system	Application	Apply
CO3	Identify ARM Architecture and its operation	Analysis	Analyze
CO4	Program different embedded systems ARM controller	Synthesis	Design
CO5	Describe different embedded system architecture.	Comprehension	Describe

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	1	3	3	2	3	3	1	1	3	2	2	1
CO2	1	3	3	3	3	3	1	1	3	3	2	1
CO3	1	2	2	2	2	3	1	1	2	3	2	1
CO4	1	2	2	2	2	2	1	1	2	2	2	1
CO5	1	3	3	2	3	3	1	1	3	2	2	1

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:---	**06 Hrs.**
Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.	

Unit 2:--- ARM Architecture: ARM Design Philosophy, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families.	**06 Hrs.**
Unit 3:--- ARM Programming Model : Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.	**08 Hrs.**
Unit 4:--- ARM Programming: Simple C Programs using Function Calls, Pointers, Structures, Integer and Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation, Conditional Execution and Loops.	**06 Hrs.**
Unit 5:--- EMBEDDED SYSTEM APPLICATION DEVELOPMENT: Objectives, different Phases & Modeling of the Embedded product Development Life Cycle (EDLC), Case studies	**06Hrs.**
Unit 6:--- REAL TIME OPERATING SYSTEM (RTOS): Introduction to RTOS concept, Round robin, round robin with interrupts, Function queue scheduling, Tasks and task states, Task scheduling, shared data and reentrancy, semaphores and shared data using semaphores, protecting shared data.	**04 Hrs.**
Textbooks: 1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill. 2. ARM Systems Developer's Guides- Designing & Optimizing System Software – Andrew N. Sloss, Dominic Symes, Chris Wright, 2008, Elsevier. 3. Embedded/ Real-Time Systems: Concepts, Design & Programming By Dr. K V K K Prasad, Dreamtech Press	
References: 1] Embedded Systems - Raj Kamal, TMH 2] Embedded System Design - Frank Vahid, Tony Givargis, John Wiley. 3] Embedded Microcomputer Systems, Real Time Interfacing – Jonathan W. Valvano – Brookes / Cole, 1999, Thomas Learning.	
Unit wise Measurable students Learning Outcomes: **1** Understand Embedded system **2** Exhibit the knowledge of design metrics of embedded system **3** Identify ARM Architecture and its operation **4** Program different embedded systems ARM controller **5** Describe different embedded system architecture. 6 Understand Real time Operating System.	

Title of the Course: VLSI Design	**L**	**T**	**P**	**Credit**
Course Code: UETC0602	**4**	**-**	**-**	**4**

Course Pre-Requisite: Digital Electronics

Course Description:

This lab-oriented course covers the design of digital systems using VHSIC Hardware Description Language (VHDL) and Verilog and its implementation in Field Programmable Gate Arrays (FPGAs). This technology allows cost-effective unique system realizations by enabling design reuse and simplifying custom circuit design. The design tools are first introduced and used to implement basic circuits. In this ***course***, we will also study the fundamental concepts and structures of designing digital *VLSI* systems include CMOS devices and circuits. This course forms the base for more advanced designs flow, focusing on integrating the FPGA with external peripherals, simple signal processing applications.

Course Objectives:

1. To study HDL based design approach using VHDL and Verilog.
2. To learn VLSI design flow for implementing Behavioral /RTL/gate level architectures on FPGA.
3. To explain features and capabilities of HDL to simulate, synthesize and test digital logic modules.
4. To develop FSM design skills using HDL and verify their performance by using EDA tool.
5. To realize importance of testability in logic circuit design.
6. To learn digital CMOS logic design.

Course Learning Outcomes:

Upon successful completion of this course, the student will be able to:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		Level	Descriptor
CO1	Model digital circuit with HDL, simulate, synthesis and prototype in FPGA/CPLD.	Cognitive (Level III-Applying)	Model
CO2	Construct FSM for sequential logic circuits and simulate it for functional verification.	Cognitive (Level VI-Creating)	Construct
CO3	Determine the test vector by making use of various testing techniques for FPGA based designs.	Cognitive (Level V-Evaluating)	Determine
CO4	Examine the basic building blocks of CMOS VLSI design	Cognitive (Level IV-Analyzing)	Examine

CO-PO Mapping:

CO	**PO**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	3	2	3	2	3	-	-	2	1	-	1
CO2	2	2	2	3	1	1	-	-	-	-	-	1
CO3	2	1	1	2	-	-	-	-	-	-	-	1
CO4	2	1	-	-	-	-	-	-	-	-	-	1

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with60-70% weightage for course content

(normally last three modules) covered after MSE and consists of 30% Code and 70% Theory

Course Contents:

Unit 1:--- Introduction to VHDL: Introduction to VHDL, Level of abstraction, Need of HDL, VLSI Design flow, Features and capabilities of VHDL, Elements of VHDL [Entity, Architecture (Structural, Data flow and Behavioral), Library, Package, Configuration], Identifiers, literals, data types, Operators & Attributes.	10 **Hrs.**
Unit 2:--- VHDL Modeling: VHDL Test bench, Concurrent & Sequential constructs , Combinational logic using data flow and behavioural modeling (Adder, subtractor, Encoder, Decoder, multiplexer, De multiplexer, Tristate buffer, Parity generator & checker, Comparator) sequential logic (flip flops, shift registers and counters)	08 **Hrs.**
Unit 3:--- FSM Design Using VHDL: FSM, Meta-stability, Wait statement, delays- Inertial delay & Transport delay, Sequence detector, VHDL implementation of counter using FSM	06 **Hrs.**
Unit 4:--- Introduction to Verilog: Introduction to Verilog, Basic Verilog naming conventions, Verilog operators, data types, Assignment statements, control statements, Behavioral modeling in Verilog HDL, Combinational and sequential logic design using Verilog.	08**Hrs.**
Unit 5:--- PLD and Testing: Programmable Logic Devices: Introduction, Evolution: PROM, PLA, PAL, GAL, CPLD, FPGA, Testing : Fault models, Path sensitizing, Sequential circuit test, design for testability, Built-in self test(BIST), Test pattern generation, JTAG & Boundary scan	08 **Hrs.**
Unit 6:--- Introduction To MOS Circuits: MOS Transistors, MOS Transistor Switches, CMOS Logic Circuit and System Representations, MOS Transistor Theory**:** Introduction MOS Device Design Equations, The Complementary CMOS Inverter : DC Characteristics, Static Load MOS Inverters	08**Hrs.**

Textbooks:

1. Fundamentals of Digital Logic with VHDL design,Tata–Mcgraw Hill-Stephen Brown and ZvonkoVranesic.
2. "Digital integrated circuits- A design perspective", Jan Rabaey, Anantha C, 2nd edition, PHI.
3. "VLSI Design", Debaprasad Das, Oxford University press.
4. Neil H. E. Weste, David Money Harris, "CMOS VLSI Design: A Circuit & System Perspective", Pearson Publication.

References:

1. "Design through Verilog HDL", TR Padmanabhan, B. Bala Tripura Sundari, Wiley Publications.
2. "Introduction to VLSI Systems", Carver Mead – Lynn Conway, BS Publications.
3. "VLSI Design- Black Book", Dr. KVKK Prasad, Kattula Shyamala, Wiley-Dreamtech Press.
4. Principals of Digital System Design using VHDL, Cengage Learning-Roth John.
5. Charles H. Roth, "Digital systems design using VHDL", PWS.

Unit wise Measurable students Learning Outcomes:

UNIT-I:

UO1: Students will understand basic language construct of VHDL.

UO2: Students will explain the VLSI design flow from design specification to programming IC.

UNIT-II:

UO1: Students will be able to implement and simulate digital circuits using VHDL.

UNIT-III:

U01: Students will be able to introduce delay models in circuits.

U02: Students will be able to derive state diagram for given sequence and write VHDL description for the same.

UNIT –IV:

UO1: Students will be able to explain basic language constructs of Verilog.
UO2: Students will be able to simulate and implement combinational digital circuits using Verilog.

UNIT –V:

UO1: Students will be able to describe Xilinx CPLD XC9572 and Spartan III FPGA.
UO2: Students will be able to derive the test vectors for stuck-at-fault model for combinational circuits using fault coverage and path sensitization approach.
UO3: Students will be able to explain the technique for testing sequential logic.
UO4: Students will be able to explain the significance of BIST and boundary scan.

UNIT –VI:

UO1: Students will be able to explain basic structure of MOS transistor and its VI Characteristics.
UO1: Students will be able to analyze the performance of CMOS Inverter circuits on the basis of their operation and working.

Title of the Course: Digital Signal Processing	**L**	**T**	**P**	**Credit**
Course Code: UETC0603	**3**	**-**	**-**	**3**

Course Pre-Requisite: Signals and System

Course Description: This course provides an introduction to digital signal processing. In this course, a detailed examination of basic digital signal processing operations including sampling/reconstruction of continuous time signals, Fourier transforms will be given. The discrete Fourier transform (DFT) and fast Fourier transform (FFT) will be studied. Finally, we will examine time and frequency domain techniques for designing and applying infinite impulse response (IIR) and finite impulse response (FIR) digital filters. Concepts Of Multirate Digital Signal Processing will also be discussed.

Course Objectives: The course aims to

1. Apply the concept of FFT algorithms to compute DFT
2. Design FIR filter using various window method, frequency sampling.
3. Design IIR filter using impulse invariant, bilinear transform
4.Uunderstand Concepts Of Multirate Digital Signal Processing

Course Learning Outcomes: Upon successful completion of this course, the student will be able to

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive	
		Level	Descriptor
CO1	Analyze LTI Systems using FFT algorithms.	Analysis	Analyze
CO2	Design FIR and IIR systems.	Synthesis	Design
CO3	Analyze FIR and IIR systems.	Analysis	Analyze
CO4	Describe Concepts Of Multirate Digital Signal Processing	Comprehension	Describe

CO-PO Mapping:

CO	**PO**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	3	2	2	1	1	-	-	-	-	-	-
2	2	3	3	3	3	3	-	-	-	-	-	-
3	1	2	2	2	3	3	-	-	-	-	-	-
4	2	2	3	3	1	1	-	-	-	-	-	-

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- Discrete Time Fourier Transform. DTFT, Properties and symmetrical properties of DTFT, Introduction to DSP Systems [BD], Convergence of DTFT: Gibb's Phenomenon.	4 **Hrs.**
Unit 2:--- Discrete Fourier Transform DFT, Properties of DFT, Circular Convolution and Circular Co-relation using DFT	10 **Hrs.**

and IDFT , Linear Convolution using Circular Convolution, Fast Convolution. Overlap Save and Overlap add algorithm. Relationship between DTFT, DFT and ZT. FFT Algorithms – Radix 2: DIT-FFT and Radix 2: DIF.- FFT	
Unit 3:--- FIR Filter Design. Characteristics of FIR Filters. Properties of FIR Filters.FIR Design using Windowing Technique [Rectangular Window, Hamming Window and Hamming Window]FIR Design using Kaiser Window.FIR Design using Frequency Sampling Technique.	6 **Hrs.**
Unit 4:--- IIR Filter Design. Introduction to IIR Filters, IIR Filter Designing using Impulse Invariant method and Bilinear Transformation method, Characterstics of Butterworth filters, Chebyshev filters and elliptic filters, Butterworth filter design.	6 **Hrs.**
Unit 5:--- Realization of FIR and IIR Filters. Introduction, Basic realization blocksdiagram.FIR realization- Direct Form (Non-linear phase and Linear phase), Cascade and Parallel realization.IIR realization- Direct form I and II, Cascade and parallel realization.)	6 **Hrs.**
Unit 6:--- Multirate DSP Concept of Multirate DSP, Sampling rate conversion by a non integer factor, Design of two stage sampling rate converter	4 **Hrs.**
Textbooks: Text Books 1] Digital Signal Processing Principles, Algorithms and Application – By John G Prokis, Manolakis, Pearson Education publication 2.] Ifeachor, Jervis, "Digital Signal Processing ", Pearson Education.	
References: 1] Digital Signal Processing P. Ramesh Babu, Scitech publication 2] Digital Signal Processing Sanjeet Mitra, MGH 3]Dr. Shaila Apte Digital Signal Processing, Wiely India Publication, Second Edition	
Unit wise Measurable students Learning Outcomes: 1. Apply the concept of FFT algorithms to compute DFT 2. Design FIR filter using various window method, frequency sampling and FIR differentiator 3. Design IIR filter using impulse invariant, bilinear transform 4.Understand Concepts Of Multirate Digital Signal Processing	

Title of the Course: VLSI Design – Lab	**L**	**T**	**P**	**Credit**
Course Code: UETC0631	**0**	**0**	**2**	**1**

Course Pre-Requisite: Digital Electronics

Course Description:

This lab-oriented course covers the design of digital systems using VHSIC Hardware Description Language (VHDL), Verilog and its implementation on Field Programmable Gate Arrays (FPGAs).

Course Objectives:

5. To understand working of Xilinx ISE 14.2 and Digilent NEXYS 3 board.
6. To understand working of ModelSim simulator.
7. To Design & implement digital circuits using VHDL & Verilog.
8. To implement combinational, sequential and FSM design using VHDL & Verilog.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		Level	Descriptor
CO1	Explain working of Xilinx ISE 14.2 and Digilent NEXYS 3 board.	Cognitive	Explain
CO2	Explain working of ModelSim simulator.	Cognitive	Explain
CO3	Implement digital system design using FPGA.	Psychomotor	Implement
CO4	Construct FSM, sequential logic circuits and simulate for functional verification.	Psychomotor	Construct

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	H	H	H	H	H	-	-	-	-	-	-
CO2	-	H	-	-	H	-	-	-	-	-	-	-
CO3	-	L	H	H	H	H	-	-		-	-	-
CO4	-	L	H	H	H	H	M	-	-	-	-	-

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	25
ESE-POE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1:--- **Aim:** Study of Xilinx ISE 14.2 and Digilent NEXYS 3 board. **Objectives:** To understand working of Xilinx ISE 14.2 and Digilent NEXYS 3 board. **Outcomes:** Explanation of **working** of Xilinx ISE 14.2 and Digilent NEXYS 3 board. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 2:--- **Aim:** Study of ModelSim simulator. **Objectives:** To understand working of ModelSim simulator. **Outcomes:** Explanation of **working** of ModelSim simulator. **Theoretical Background:**	**02 Hrs.**

Experimentation: **Results and Discussions:** **Conclusion:**	
Experiment No. 3:--- **A**im: Write VHDL code to realize All Logic Gates. **Objectives:** To implement logic gates using VHDL. **Outcomes:** Functional verification of logic gates. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 4:--- **Aim:** Write a VHDL code to describe the functions of full adder and full subtractor using (Structural/Data flow / Behavioral Modeling). **Objectives:** To implement the functions of full adder and full subtractor. **Outcomes:** Functional verification of full adder and full subtractor. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 5:--- **Aim:** Write a VHDL program for the following combinational logic designs. **Objectives:** To implement combinational logic designs using VHDL. **Outcomes:** Functional verification of combinational logic designs. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 6:--- **Aim:** Write a VHDL code for 4-bit Binary up down counter (Asynchronous counter with clear and synchronous set). **Objectives:** To implement 4-bit Binary up down counter on FPGA. **Outcomes:** Functional verification of 4-bit Binary up down counter. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 7:--- **Aim:** Write a Verilog code for 4-bit Binary up or down counter. **Objectives:** To implement 4-bit Binary up down counter on FPGA **Outcomes:** Functional verification of 4-bit Binary up down counter using Verilog. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 8:--- **Aim:** Write a VHDL code for 4-Bit BCD up-down Counter with asyn. reset and synchronous clock enable. **Objectives:** To implement 4-Bit BCD up-down Counter on FPGA. **Outcomes:** Functional verification of 4-Bit BCD up-down Counter. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	02 **Hrs.**

Experiment No. 9:--- **Aim:** Write VHDL code to display messages on the given seven-segment display interface. **Objectives:** To implement seven-segment display interface. **Outcomes:** Functional verification of seven-segment display interface. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 10:--- **Aim:** Write a VHDL code for universal shift register. **Objectives:** To implement universal shift register on FPGA. **Outcomes:** Functional verification of universal shift register on FPGA. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 11:--- **Aim:** Write a VHDL code for sequence detector and arbiter. **Objectives:** To implement sequence detector and arbiter. **Outcomes:** Functional verification of sequence detector and arbiter. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 12:--- **Aim:** Write a VHDL code for LFSR. **Objectives:** To implement LFSR on FPGA. **Outcomes:** Functional verification of LFSR. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 13:--- **Aim:** Write a VHDL code to implement FIFO. **Objectives:** To implement FIFO on FPGA. **Outcomes:** Functional verification of FIFO. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 14:--- **Aim**: Write a VHDL code for 8 bit general purpose ALU. **Objectives:** To implement 8 bit general purpose ALU. **Outcomes:** Functional verification of ALU. **Theoretical Background:** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Textbooks: 1. Fundamentals of Digital Logic with VHDL design,Tata–Mcgraw Hill-Stephen Brown and ZvonkoVranesic.	

References:

1. Principals of Digital System Design using VHDL, Cengage Learning-Roth John.
2. Principals of Digital System Design using VHDL, Cengage Learning-Roth John.
3. Charles H. Roth, "Digital systems design using VHDL", PWS.

Experiment wise Measurable students Learning Outcomes:

1. Explanation of working of Xilinx ISE 14.2 and Digilent NEXYS 3 board.
2. Explanation of working of ModelSim simulator.
3. Functional verification of logic gates.
4. Functional verification of full adder and full subtractor.
5. Functional verification of combinational logic designs.
6. Functional verification of 4-bit Binary up down counter.
7. Functional verification of 4-bit Binary up down counter using Verilog.
8. Functional verification of 4-Bit BCD up-down Counter.
9. Functional verification of seven-segment display interface.
10. Functional verification of universal shift register on FPGA.
11. Functional verification of sequence detector and arbiter.
12. Functional verification of LFSR.
13. Functional verification of FIFO.
14. Functional verification of ALU.

Title of the Course: Embedded System Lab	L	T	P	Credit
Course Code: UETC0632	0	0	2	1

Course Pre-Requisite:
Digital electronics , microcontrollers

Course Description:
This course makes the students aware of the fundamentals of embedded system and the family of controllers used to design embedded system.

Course Objectives:

1. To understand assembly language programming for ARM.
2. To understand embedded C programming for ARM.
3. To Design & simulate ARM interfaces.
4. To implement interfacing of ARM with peripherals.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	Write assembly language programs	Cognitive	Explain
CO2	Write embedded C programs	Cognitive	Explain
CO3	Simulate and debug programs	Psychomotor	Implement
CO4	Interface peripherals to ARM	Psychomotor	Construct

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	1	3	3	2	3	3	1	1	3	2	2	1
CO2	1	3	3	3	3	3	1	1	3	3	2	1
CO3	1	2	2	2	2	3	1	1	2	3	2	1
CO4	1	2	2	2	2	2	1	1	2	2	2	1

Assessments :
Teacher Assessment:
One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50
ESE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.
ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1:--- **Aim and Objectives: perform arithmetic operations using assembly language** **Outcomes:** Write assembly language programs **Theoretical Background: Instruction set of ARM** **Experimentation: Addition/subtraction/multiplication/division/BCD to Hex** **Results and Discussions:** **Conclusion:**	**02 Hrs.**

Experiment No. 2:--- **Aim and Objectives: perform data transfer operations using assembly language** **Outcomes:** Write assembly language programs **Theoretical Background: Instruction set of ARM** **Experimentation: Block Transfer/ Exchange operation** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Experiment No. 3:--- **Aim and Objectives: perform memory organization using assembly language** **Outcomes:** Write assembly language programs **Theoretical Background: Instruction set of ARM** **Experimentation: Ascending order/descending order** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Experiment No. 4:--- **Aim and Objectives: perform memory organization using assembly language** **Outcomes:** Write assembly language programs **Theoretical Background: Instruction set of ARM** **Experimentation: Separation of Positive/Negative No. from memory** **Results and Discussions:** **Conclusion:**	
Experiment No. 5:--- **Aim and Objectives: perform memory organization using assembly language** **Outcomes:** Write assembly language programs **Theoretical Background: Instruction set of ARM** **Experimentation: Separation of Even/odd No. from memory** **Results and Discussions:** **Conclusion:**	
Experiment No. 6:--- **Aim and Objectives: perform memory organization using assembly language** **Outcomes:** Write assembly language programs **Theoretical Background: Instruction set of ARM** **Experimentation: Finding smallest/largest no. from memory** **Results and Discussions:** **Conclusion:**	
Experiment No. 7:--- **Aim and Objectives: perform port operations using embedded C** **Outcomes:** Simulate and debug programs **Theoretical Background: Embedded C Programming** **Experimentation: Port toggling/ square wave generation** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Experiment No. 8:--- **Aim and Objectives: perform operations on interrupts using embedded C** **Outcomes:** Write embedded C programs **Theoretical Background: Embedded C Programming** **Experimentation:** **Results and Discussions:** **Conclusion:**	**02 Hrs.**
Experiment No. 9:--- **Aim and Objectives: perform Serial communication operations using Embedded C**	

Outcomes: Simulate and debug programs **Theoretical Background: Embedded C Programming** **Experimentation:** **Results and Discussions:** **Conclusion:**	
Experiment No. 10:--- **Aim and Objectives: perform interfacing of peripherals using embedded C** **Outcomes:** Interface peripherals to ARM **Theoretical Background: Embedded C Programming** **Experimentation: LED/LCD/Seven Segment Display interfacing** **Results and Discussions:** **Conclusion:**	02 **Hrs.**
Experiment No. 11:--- **Aim and Objectives: perform interfacing of peripherals using embedded C** **Outcomes:** Interface peripherals to ARM **Theoretical Background: Embedded C Programming** **Experimentation: Stepper motor/ADC/DAC Interfacing.** **Results and Discussions:** **Conclusion:**	

Textbooks:

1. Introduction to Embedded Systems - Shibu K.V, McGraw Hill.
2. ARM Systems Developer's Guides- Designing & Optimizing System Software – Andrew N. Sloss, Dominic Symes, Chris Wright, 2008, Elsevier.

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References:

1] Embedded Systems - Raj Kamal, TMH

2] Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.

3] Embedded Microcomputer Systems, Real Time Interfacing – Jonathan W. Valvano – Brookes / Cole, 1999, Thomas Learning..

Experiment wise Measurable students Learning Outcomes:

1 Write assembly language programs for arithmetic operations
2 Write assembly language programs for data transfer operations
3 Write assembly language programs for memory organization
4 Simulate and debug programs for ARM port operations
5 Write embedded C programs for ARM
6 Interface peripherals to ARM

Title of the Course: Electronics System Design	**L**	**T**	**P**	**Credit**
Course Code:	**0**	**0**	**4**	**2**

Course Pre-Requisite: Analog Circuits, Digital Design, Linear integrated circuits, Network Analysis, and Microcontroller.

Course Description: Course will cover all the implementation of theoretical design in course.

Course Objectives:

1. To design & implement the signal conditioning circuit.
2. To design & implement the SMPS.
3. To design & implement communication system block.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		level	Descriptor
CO1	Design SMPS using LM3524 ,simulate & implement the same	Cognitive	Design
CO2	Design a signal conditioning circuit & implement.	Cognitive	Design
CO3	Design a communication system block(Modulator & Amplifier)	Cognitive	Design

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	-	3	-	1	-	-	-	2	-	-	-
CO2	-	-	3	-	1	-	-	-	2	-	-	-
CO3	-	-	3	-	1	-	-	-	2	-	-	-
CO4	-	-	3	-	1	-	-	-	2	-	-	-

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having 50%, and 50% weights respectively.

Assessment	Marks
ISE	50
ESE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1:--- Design and Implementation of SMPS **Aim and Objectives:** Design and simulate buck converter using ICs like LM3842 / LM 3524 and measure performance parameters like load regulation, line regulation, ripple rejection, output impedance, dropout voltage.	02Hrs.
Experiment No. 2:--- Digital Voltmeter: **Aim and Objectives:** Design of 4-digit numeric display circuit, Design of 3½ digit DVM, Study of IC7107/7106.	02Hrs
Experiment No. 3:--- Design of Communication System – **Aim and Objectives:** Design & Implement Modulator – Demodulator Design(AM / FM / FSK) using PLL 4046 or 565	02 Hrs.
Experiment No. 4:--- Design of Communication System – **Aim and Objectives:** Design & Implement Mixer or Audio / Power Amplifier (Any Chip)	02Hrs.
Experiment No. 5:--- Sensors & Signal Conditioning	02 Hrs.

Aim and Objectives: Design & Implement Signal Conditioning Circuit.	
Experiment No. 6:--- Design of Data Acquisition Systems (DAS) **Aim and Objectives:** Selection Criteria of Microcontrollers, PC Interfacing using serial communication like RS-232, USB, Overview of storage interface (like SD-Card, Serial EEPROM), Display interfaces, GUI Development.	02 Hrs.

Textbooks:

1. Switching Power Supply Design,‖3E, Abraham I. Pressman et. al, The McGraw-Hill Companies, 2009
2. ―Measurement, Instrumentation, and Sensors Handbook‖, John G. Webster, CRC Press, 1999
3. Roger L. Freeman,‖ Fundamentals of Telecommunications‖, John Wiley & Sons

References:

1. Practical design of power supplies‖ , Ron Lenk, John Wiley & Sons, 2005
2. The Circuit Designer‘s Companion‖, Peter Wilson, Elsevier Ltd, 2012
3. Printed Circuits Handbook, 7th Edition, Clyde Coombs, Happy Holden, McGraw-Hill ,2016
4. Printed Circuit Boards: Design, Fabrication, and Assembly‖, R. Khandpur, McGraw-Hill ,05
5. Mazidi, PIC microcontroller & embedded system, 3rd Edition ,Pearson
6. Henry Korth, "Data base system Concepts", 6th Edition, Mc-Graw Hill Education

Title of the Course: Digital Signal Processing Lab **Course Code:** UETC0634	**L**	**T**	**P**	**Credit**
	-	**-**	**2**	**1**

Course Pre-Requisite: Signals and Systems

Course Description:

This lab-oriented course provides the basics of DFT and it's properties, Design of digital filters(FIR & IIR)

Course Objectives:

1. To understand signal representation using MATLAB.
2. To understand working of FFT algorithm.
3. To implement DFT properties.
4. To implement FIR and IIR filters.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		Level	Descriptor
CO1	Explain signal representation using MATLAB.	Cognitive	Explain
CO2	Explain working of FFT and IFFT algorithms.	Cognitive	Explain
CO3	Implement LTI system using MATLAB functions.	Psychomotor	Implement
CO4	Implement digital filters using MATLAB functions	Psychomotor	Construct

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	-	3	3	3	3	3	-	-	-	-	-	-
CO2	-	3	-	-	3	-	-	-	-	-	-	-
CO3	-	1	3	3	3	3	-	-		-	-	-
CO4	-	1	3	3	3	3	2	-	-	-	-	-

Assessments :

Teacher Assessment:

One component of In Semester Evaluation (ISE) and one End Semester Examination (ESE) having25%, and 50% weights respectively.

Assessment	Marks
ISE	25
ESE-POE	50

ISE are based on practical performed/ Quiz/ Mini-Project assigned/ Presentation/ Group Discussion/ Internal oral etc.

ESE: Assessment is based on oral examination

Course Contents:

Experiment No. 1:--- **Aim:** Generation of discrete time sequence.	**02 Hrs.**
Experiment No. 2:--- **Aim:** Study of Convolution and correlation of signals.	**02 Hrs.**
Experiment No. 3:--- **A**im: Computation of DFT & IDFT using standard formula	**02 Hrs.**
Experiment No. 4:--- **Aim:** Computation of circular convolution	**02 Hrs.**
Experiment No. 5:--- **Aim:** Analysis of LTI System using FFT and IFFT.	**02 Hrs.**
Experiment No. 6:--- **Aim:** Design of FIR filter using windowing method	**02 Hrs.**
Experiment No. 7:- Design of FIR filter using frequency sampling method	**02 Hrs.**

Experiment No. 8:--- **Aim:** Design of IIR filter using impulse invariance method.	02 **Hrs.**
Experiment No. 9:--- **Aim:** Design of IIR filter using bilinear transformation method	**02 Hrs.**
Experiment No. 10:--- **Aim:** Experiment on DSP Processor TMS320C67XX .	**02 Hrs.**

Program Elective II	
Course Code	**Course Name**
UETC0621	Information Theory & coding
UETC0622	Mechatronics
UETC0623	Automotive Electronics

Title of the Course: INFORMATION THEORY AND CODING	**L**	**T**	**P**	**Credit**
Course Code: UETC0621	**3**	**1**	**-**	**4**

Course Pre-Requisite:
Probability, Fundamentals of digital communication.

Course Description:
The course introduces information theory, the fundamentals of error control coding techniques and their applications.

Course Objectives:

1. To understand information theory, estimate information content of a random variable from its probability distribution.
2. To understand the types of communication channels, their capacities and construct efficient codes for data on imperfect communication channels.
3. To understand the need & objective of error control coding with encoding & decoding procedure to analyze error detecting & correcting capability of different codes.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive level	Descriptor
CO1	Explain basic concepts of information theory and entropy coding.	Comprehension	Describe
CO2	Mathematically analyze communication channel models.	Application	Apply
CO3	Analyze the error detecting and correcting capability of coding scheme.	Application	Apply
CO4	Design encoder and decoder for various coding techniques as per the need and specification.	Application	Apply

CO-PO Mapping:

CO	**PO**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	2	1	1	1	1						
2	3	2	1	1	1	1						
3	3	2	2	2	3	1						
4	2	3	2	2	3	2						
5	2	3	2	2	3	2						

Assessments :

Teacher Assessment:
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one End Semester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:---	06 **Hrs.**
UNIT I: INFORMATION THEORY: Introduction, Concept of information: Unit, Properties, Entropy (Average Information) :	

Definition, Mathematical expression, Entropy of Binary Source, Information Rate, Joint Entropy, Conditional entropy, relation between Joint & Conditional Entropy, Mutual Information: Average Mutual Information, Mathematical expression, Relation between Mutual Information & Entropy.	
Unit 2:--- **CHANNEL CAPACITY AND CODING**: Channel Capacity, Redundancy and Efficiency of channel, Discrete memory less channel – Channel Matrix, Classification of channels: lossless Channel, Deterministic Channel, Noise free channel, Binary Symmetric Channel (BSC), Cascaded Channels and Binary Erasure Channel (BEC), Calculation of channel capacity of all cha theorem, Capacity of a band limited Gaussian channel, Shannon-Hartley Theorem, Trade of between Bandwidth and Signal to Noise ratio. Entropy Coding: Shannon Fano Coding, Huffman Coding.	06 **Hrs.**
Unit 3:--- **LINEAR BLOCK CODES:** Introduction: Error Control Coding: Need, Objectives & Approaches of Error Control Coding Classification, Error Detection and Error Correction Techniques, Linear Block Code: Structure, Terms Related to Block Code, Matrix Description of Linear Block Code, Generator and Parity Check Matrices, Hamming Codes, Encoder and Syndrome decoder for (n, k) block Code.	06 **Hrs.**
Unit 4:--- **CYCLIC CODES:** Algebraic structure, Properties, Polynomial representation of Codeword, Generator Polynomial, Generation of Code Vector in Non-systematic and Systematic form, Generator and Parity check matrices in Systematic form, Encoding of Cyclic Code, Syndrome decoding for Cyclic code, Hardware Representation of (n, k) cyclic code. Cyclic Redundancy Check Code.	06 **Hrs.**
Unit 5:--- **CONVOLUTIONAL CODE**: Introduction, Encoding of Convolutional Codes, Generation of Output code sequence : Time Domain Approach, Transform Domain Approach, Graphical Approach –Code Tree, State diagram and Trellis Diagram, Decoding of Codes : Maximum Likelihood Decoding - Viterbi Algorithm, Sequential Decoding .	06 **Hrs.**
Unit 6:--- **BCH & RS CODE:** Binary Field Arithmetic, BCH Code: Properties, Primitive element and primitive polynomial, Primitive BCH Code, Construction of Galois Field GF (2^m), Addition & Multiplication of GF (2^m), Minimal & Generator Polynomial for BCH Code, Decoding of BCH Code, Reed-Solomon code**:** Introduction, Error correction capability of RS code, RS code in Non-systematic & Systematic form, Decoding of RS & Non binary BCH code.	06 **Hrs.**

Textbooks:

1. R.P Singh &S.D.Sapre ,Analog Communication Systems,Mc-Graw Hill, &IInd Edition, 2001.
2. Muralidhar Kulkarni, K.S. Shivprakasha,Information Theory,& Coding Wiley (India) Publication 2014
3. ArijitSaha,Surajit Mandal, Information Theory Coding& Cryptography Pearson Education, Ist Edition, 2013.
4. Salvatore Gravano,"Introductionto Error Control Codes", Oxford University Press, Ist Edition, 2001

References:

1.Simon Haykin, "Communication Systems" John Wiley&Sons,Inc, IVth Edition
2. Sam Shanmugam, "Digital and Analog CommunicationSystems JohnWileyPublication , 2005.
3. Martin Roden, " Analog Digital& CommunicationSystems",Prentice Hall

India,IIIrd Edition.

4. Ranjan Bose, "Information Theory Coding &Cryptography",TataMcGraw-Hill Publishing Company Ltd, IInd Edition 2008.

Unit wise Measurable students Learning Outcomes:

6. Demonstrate knowledge of Information Theory
7. Explain basic concepts of communication channel and entropy coding.
8. Analyze the Linear block code error detecting and correcting capability.
9. Analyze the cyclic code error detecting and correcting capability.
10. Analyze the convolution code error detecting and correcting capability.
11. Analyze the BCH code error detecting and correcting capability.

Title of the Course: Mechatronics	**L**	**T**	**P**	**Credit**
Course Code: UETC0622	**3**	**1**	**-**	**4**

Course Pre-Requisite: Sensors, Control system,

Course Description:

Course Objectives:

1. Study of different Mechanical operations & Processes
2. To study different Actuators
3. To study PLC & Its applications
4. To study different types of CNC, NC machines.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Cognitive level	Descriptor
CO1	Understand Basic mechanical operations & Processes	Analysis	Analyze
CO2	Implement actuators according to need	Analysis	Analyze
CO3	Compare different Process controllers	Comprehension	Describe
CO4	Analyze the different case studies.	Analysis	Analyze

CO-PO Mapping:

CO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
1	3	-	1		3	3	1	-	3	3	-	3
2	3	2	-		-	-	1	-	3	-	-	3
3	3	2	3		3	3	1	-	3	3	-	3
4	2	1	-		-	-	-	-	1	-	-	3
5	3	3	2		3	3		-	2	3	2	3

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc. MSE: Assessment is based on 50% of course content (Normally first three modules) ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:---	06 **Hrs.**
Introduction to mechatronics: What is mechtronics, design of process, systems, measurement of system, Control system, Programmable logic	

controllers.	
Unit 2:--- **Actuators and Mechanisms:** Introduction, Actuators Types and Application Areas, ,Electro- mechanical Actuators ,DC motor, AC motor, Piezoelectric Actuators, Chemical Actuator, Bearings, Gears.	**07 Hrs.**
Unit 3:--- **Process Controllers :** Controller Principles, Two position controller(ON/OFF controller), Proportional controller ,Integral controller, Derivative controller,Pneumatic controllers ,PID controller tuning	**06 Hrs.**
Unit 4:--- **Programmable Logic Controllers:** Introduction to PLC, Basic structure of a PLC, Principle of Operation ,PLCs versus computer ,PLC programming.	06 **Hrs.**
Unit 5:--- **Introduction to CNC machines:** CNC machines, NC machines, CNC machines, DNC machines, machine structure,, Robotics.	**06 Hrs.**
Unit 6:--- Design of Mechatronics system: Introduction, Mechtronics approach into design, Case Examples, Future Trends-smart homes. .	**05 Hrs.**
Textbooks: 1 Mechatronics Integrated mechanical electronic system,K.P Ramachandan,G.K Vijayaraghavan Willey India. 2. Mechtronics principles,Concepts and application Nitaigour Preamchand Mahalik MCGraw hill 2nd edition 3. Mechatronics-W Bolton,Pearson	
References: 1. Programmable logical controller, Reis Webb, Prentice Hall 2. Mechatronics – Appu Kuttam, Oxford publications	
Unit wise Measurable students Learning Outcomes: **1** Fundamentals of Mechatronics system **2** Compare various sensors & Actuators. **3** understand Different process controllers. **4** Compare CNC, NC machines **5** Analyze the different case studies.	

Title of the Course: Automotive Electronics	L	T	P	Credit
Course Code: UETC0623	3	1	-	4

Course Pre-Requisite:
Transducers , microcontrollers

Course Description:
This course makes the students aware of the the fundamentals of Automotive Electronics and design of Automotive Electronics system.

Course Objectives:

1. To understand the concepts of Automotive Electronics and its evolution and trends
2. To understand sensors and sensor monitoring mechanisms aligned to Automotive systems,
3. To understand, design and model various automotive control systems using Model based development technique
4. To understand role of Microcontrollers in ECU design and choice of appropriate Hardware and Software
5. To describe various communication systems, wired and wireless protocols used in vehicle networking ,and safety standards

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Cognitive level	Descriptor
CO1	To understand the concepts of Automotive Electronics and it's evolution and trends	Analysis	Analyze
CO2	To understand sensors and sensor monitoring mechanisms aligned to Automotive systems	Application	Apply
CO3	To understand, design and model various automotive control systems using Model based development technique	Application	Analyze
CO4	To understand role of Microcontrollers in ECU design and choice of appropriate Hardware and Software	Synthesis	Design
CO5	To describe various communication systems, wired and wireless protocols used in vehicle networking ,and safety standards.	Comprehension	Describe

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	1	3	3	2	3	3	1	1	3	2	2	1
CO2	1	3	3	3	3	3	1	1	3	3	2	1
CO3	1	2	2	2	2	3	1	1	2	3	2	1
CO4	1	2	2	2	2	2	1	1	2	2	2	1
CO5	1	3	3	2	3	3	1	1	3	2	2	1

Assessments :
Teacher Assessment:
Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE)

and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- **Automotive Systems**: Overview of Automotive industry, Role of technology in Automotive Electronics. Tools and Processes. Introduction to modern automotive systems and need for electronics in automobiles and application areas of electronic systems in modern automobiles **ECU Design Cycle :** V-Model development cycle , Components of ECU, Examples of ECU on Chassis, Infotainment, Body Electronics and cluster	**07 Hrs.**
Unit 2:--- **sensors :** Accelerometers, wheel speed sensors, brake pressure sensors, Seat occupancy sensor, Engine speed, Steering wheel angle, Vehicle speed sensor, Throttle position sensor, Turbine speed sensor, Temperature sensor, Mass air flow (MAF) rate sensor, Exhaust gas oxygen concentration sensor, Throttle plate angular position sensor, Crankshaft angular position/RPM sensor, Manifold Absolute Pressure (MAP) sensor, Differential exhaust gas pressure sensor, **Actuators:** Solenoids, various types of electric motors, and piezoelectric force generators, Examples for actuators: Relays, solenoids and motors. Sensors in Airbag system, Chassis Control systems, Automatic transmission control system	07 **Hrs.**
Unit 3:--- **Microcontrollers/Microprocessors in Automotive domain** a. Criteria to choose the right microcontroller/processor for various automotive applications c. Understanding various architectural attributes relevant to automotive applications d. Automotive grade processors e. Development of control algorithm for different automotive subsystems Look-up tables and maps, Need of maps, Procedure to generate maps, Fuel maps/tables, Ignition maps/tables, Engine calibration, Torque table, Dynamometer testing	10 **Hrs.**
Unit 4:--- A) **Automotive Control System** : Control system approach in Automotive: Analog and Digital control methods, modelling of linear systems, System responses. Modeling of Automotive Systems simple examples.	06 **Hrs.**
Unit 5:--- **Safety Systems in Automobiles and Diagnostic Systems** A) Active Safety Systems: ABS, TCS, ESP, Brake assist etc B) Passive Safety Systems: Airbag systems, Advanced Driver Assistance Systems (ADAS), Examples of assistance applications: Lane Departure Warning, Collision Warning, Automatic Cruise Control, Pedestrian Protection, Headlights Control, Connected Cars technology and trends towards Autonomous vehicles C) Functional Safety: Need for safety systems, safety concept, safety process for product life cycle, safety by design, validation	**10 Hrs.**
Unit 6:--- **Diagnostic Systems** Fundamentals of Diagnostics: Basic wiring system and Multiplex wiring system,	8 **Hrs.**

Preliminary checks and adjustments, Self-diagnostic system. Fault finding and corrective measures, Electronic transmission checks and Diagnosis, Diagnostic procedures and sequence, On board and off board diagnostics in Automobiles, OBDII.	

Textbooks:

1. Ronald K Jurgen: "Automotive Electronics Handbook, 2nd Edition, McGraw-Hill, 1999
2. James D Halderman: -Automotive electricity and Electronics", PHI Publication
3. Terence Rybak. Mark Stefika: Automotive Electromagnetic Compatibility (EMC), Springer. 2004
4. Allan Bonnick.: "Automotive Computer Controlled Systems" Diagnostic Tools and Techniques". Elsevier Science, 2001.

References:

1. Uwe Kieneke and Lars Nielsen: Automotive Control Systems Engine, Driveline and Vehicle, 2nd Edition Springer Verlag, 2005
2. David Alciatore, Michael Histand: "Introduction to Mechatronics and Measurement Systems (SIE) TMH, 2007
3. Iqbal Husain: "Electric and Hybrid Vehicles: Design fundamentals" CRC Press, 2003.
4. Tom Denton: "Advanced Automotive Diagnosis, 2nd Edition, Elsevier, 2006.
5. G. Meyer, J. Valldorf and W. Gessner: "Advanced Microsystems for Automotive Applications", Springer. 2009
6. Tracy Martin: "How to Diagnose and Repair Automotive Electrical Systems" Motor Books/MBl Publishing Company. 2005.
7. Mehrdad Ebsani. Ali Emadi, Yimin Gao: - "Modern electronic. Hybrid Electric and Fuel Cell Vehicles: Fundamentals. Theory and Design". 2nd CRC Press. 2009 12. Marc Herniter: "Introduction to Model Based System Design – Rose Hulman Institute of Technology.

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Unit wise Measurable students Learning Outcomes:

1 Understand Automotive Electronics
2 Understand system approach and instrumentation
2 Exhibit the knowledge of design metrics of Automotive system
3 Understand Model based design
4 Understand Safety system in automobiles
5 Understand Diagnostic system in automobiles

Open Elective I		Offered by Department
Course Code	**Course Name**	
UOEL0616	Basics of communication systems	Electronics & Telecommunication Engineering
UOEL0617	Basics of Instrumentation	Electronics & Telecommunication Engineering

Title of the Course: Basics of Communication system	**L**	**T**	**P**	**Credit**
Course Code: UOEL0616	**3**	**-**	**-**	**3**

Course pre-requisite: Basic knowledge of working of diode, transistor, and amplifiers etc.

Course Description: Course deals with different types of Analog, Pulse and digital communication systems. Also it explains cellular, mobile and wireless systems.

Course Objectives:

1. Introduce the students to modulation and various analog and digital modulation schemes.
2. They can have a broad understanding of cellular, wireless and telecom concepts.

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's Taxonomy	
		Level	Descriptor
CO1	Explain various types of modulation and demodulation systems.	Cognitive	Explain
CO2	Distinguish various technologies like cellular,mobile and wireless.	Psychomotor	Distinguish

CO-PO Mapping:

CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.
MSE: Assessment is based on 50% of course content (Normally first three modules)
ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- Introduction: Introduction to Communication Process, Basic block diagram of communication system, Modulation, Information Theory, Analog vs Digital, Review of Signals and Systems. Electromagnetic spectrum, Need for Modulation.	**06Hrs.**
Unit 2:--- Simple description on Analog and Pulse Communication: Simple description on Analog and Pulse Communication: AM, FM, PM, PAM, PWM, PPM, PCM.	**08 Hrs.**
Unit 3:--- Simple description on Digital Communication: Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.	**08 Hrs.**
Unit 4 Cellular and Mobile Communications: The Cellular Engineering Fundamentals : Introduction, Cell, Frequency Re-use, Channel Assignment Strategies, Fixed and Dynamic Channel Assignment Strategies, Handoff Process, Factors affecting Handoff Process, Handoff Strategies, Few practical cases of Handoff Scenario, Interference and System Capacity, Co-channel Interference (CCI), Adjacent Channel Interference (ACI), Cell Splitting, Sectoring, Microcell Zone concept, Repeaters, Trunked Radio System. Cellular telephone systems, AMPS, GSM, CDMA.	**07Hrs.**
UNIT – V **Wireless Technologies:** Wireless LAN, PANs, MANs, and Bluetooth, Zig Bee	

and Mesh Wireless networks, Wimax, WiFi, Infrared wireless, RFID communication, UWB.	**07Hrs.**

Textbooks:

1 Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications, 2008.

2. Electronic Communications systems, Kennedy, Davis 4e, MC GRAW HILL EDUCATION, 1999.

References:

1) Theodore Rapp port, Wireless Communications - Principles and practice, Prentice Hall, 2002.

2. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.

3) R P Singh, S D Sapre 'Communication System-Analog & Digital' IInd Edition –Tata McGraw Hill Publication.

4) Blake"Electronic Communication Systems",2nd Edition CENGAGE learning.

5) Louis E. Frenzel, "Principals of electronic communication system", IIIrd Ed., TMH Pub.

6) Introduction to data communications and networking, Wayne Tomasi, Pearson Education, 2005.

Unit wise Measurable students Learning Outcomes:

After the completion of the course the student should be able to

1) Understand basics required for communication system.

2) Describe & demonstrate different types of Analog and Pulse systems.

3) Describe & demonstrate different types of Digital systems.

4) Explain different concepts in cellular and mobile communication system.

5) Explain different concepts in wireless technologies.

Course Name : Basics of Instrumentation	**L**	**T**	**P**	**Credit**
Course Code: UOEL0617	**3**	**-**	**-**	**3**

Course Objectives:

This course aims to

1. Provide introduction of different types of Transducers & sensors
2. Provide knowledge of different parts of Measurement system
3. Provide basic knowledge of measurement system
4. Provide basic understanding of different Electronic instruments
5. Provide knowledge of different types of bridges

Course Learning Outcomes:

CO	**After the completion of the course the student should be able to**	Bloom's taxonomy	
		level	Descriptor
CO1	Select appropriate passive or active transducers for measurement of physical phenomenon.	1	Select
CO2	Discuss various types of errors in measurements	6	Discuss
CO3	Develop an understanding of construction and working of different measuring instruments	3	Develop
CO4	Measure electrical quantities such as voltage, frequency and phase difference by using oscilloscope	5	Measure
CO5	Develop an ability to use measuring instruments and AC and DC bridges for measurement	3	Develop

CO-PO Mapping:

CO-PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	2	2							3	
CO2				2								
CO3			2	2							2	
CO4			3		3	2					3	
CO5	3	2		2								

Assessments :

Teacher Assessment:

Two components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one EndSemester Examination (ESE) having 20%, 30% and 50% weights respectively.

Assessment	Marks
ISE 1	10
MSE	30
ISE 2	10
ESE	50

ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar/Group Discussions etc.

MSE: Assessment is based on 50% of course content (Normally first three modules)

ESE: Assessment is based on 100% course content with60-70% weightage for course content (normally last three modules) covered after MSE.

Course Contents:

Unit 1:--- Transducers & Sensors: Definition, Various Types of Transducers, Classification of Transducers, Selection Factors and General Applications of Transducers, Detailed Study of Transducers: (i) Motion, (ii) Flow, (iii) Pressure, (iv) Temperature, (v) Force , (vi) Sound Transducer, Hall Effect Transducers, Digital Transducers, Proximity Devices, optical Sensors, Piezo – electric sensors	6 **Hrs.**
Unit 2:--- Introduction to Measurement: Introduction of measurement system, Performance Characteristics, Static Characteristics, Error in Measurement, Types of Static Error, Sources of Error, Dynamic Characteristics, Statistical Analysis, Electrical Standards	6 **Hrs.**
Unit 3:--- Signal Conditioning & Data Acquisition System: Introduction, analog DAS, digital DAS, multi channel DAS, data converters- ADC integrating type ADC, dual slope integrating type ADC, successive approximation type ADC, flash type ADC. DAC	6 **Hrs.**
Unit 4:--- Measuring Instruments: Analog Instruments-, PMMC, MI, ohmmeter. Digital voltmeters- Introduction, Types of DVM , general specifications of DVM, digital multimeter, digital measurements of time, digital frequency meter	6 Hrs
Unit 5:--- Oscilloscope: CRO: Dual Beam, Dual Trace, Digital storage, Measurement of phase and frequency using Lissajous pattern, CRO probes: active, passive, current, attenuators, LED, LCD, Graphics Display, function generator	6 **Hrs.**
Unit 6:--- Bridges: DC Bridges- Introduction, Wheatstone bridge, Kelvin's bridge. AC Bridges- Introduction, measurement of inductance-Maxwell's bridge, Hay's bridge, Andersons bridge, measurement of capacitance- Schering bridge, wein bridge	6Hrs
Textbooks: 1] A course in Electrical, Electronics measurement and Instrumentation, A.K. Sawhney 2]Electronic Instrumentation, H. S. Kalsi, MGH, 3rd Edition	
References: 1] Electronic Instrumentation and Measurement Techniques, Helfrick Cooper. 2] Instrumentation for Engineers And Scientists , John Turner ,II Edition , Wiley 3] Electronic Instrumentation and Measurements, David A Bell, Third Edition, Oxford 4]Instrumentation for Engineering Measurements, James W Dally, II Edition , Wiley	
Unit wise Measurable students Learning Outcomes: Upon successful completion of this course students will be able to: 1] Identify and classify error sources and explain how their effects can be minimized in Measurement 2] Analyze different systems used in data acquisition 3] Explain operating principle of measuring instruments like DVM, DMM. 4] Apply knowledge of lissajous pattern to determine frequency of a signal 5] Understand principle of operation of transducers & Apply knowledge of transducer and sensor for various applications 6] Design bridge circuits	

Audit Course-IV

Title of the Course: Engineering Economics Course Code: UETC0661	L	T	P	Credit
	2	-	-	2

Course Pre-Requisite: Industrial Management

Course Description: In modern age of technology, signals and systems play vital roles. It is audit course in electronics and telecommunication field with diverse applications in area of entrepreneurship. These courses focus on all aspects about Engineering Economics.

Course Objectives :

- Train the student to cost estimation of component.
- To Provide Knowledge about value Engineering.
- To know about cash flow.
- To solve problem on depreciation.

Course Learning Outcomes:

CO	After the completion of the course the student should be able to	Bloom's Taxonomy	
		Level	Descriptor
CO1	To describe basic of Economics for Engineering	Cognitive	Describing
CO2	To Know value Engineering for Engineering Economics	Psychomotor	Applying
CO3	To provide Knowledge of cash flow	Cognitive	Knowing
CO4	To analyze the problem of Replacement, maintenance and depreciation	Cognitive	Analyzing

CO-PO Mapping:

CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	-	-	-	3	-	-	-	-	3	-
CO2	3	3	-	-	-	3	-	-	-	-	3	-
CO3	3	3	-	-	-	3	-	-	-	-	3	-
CO4	3	3	-	-	-	2	-	-	-	-	3	-

Assessments :

Teacher Assessment:

End Semester Examination (ESE) 100% weights.

Assessment	Marks
ESE	100

ESE: Assessment is based on 100% course content.

Course Contents:

Unit 1: Introduction to Economics: Introduction to economics, flow in an Economy, law of supply and demand, scope of engineering economics, element of costs, marginal costs, marginal revenue, sunk cost, opportunity cost, elementary economic analysis.	**5Hrs**
Unit 2: Value Engineering: Make or buy decision, value engineering functions and aims, value engineering procedure, Interest formulae and their applications, single payment compound amount factor, equal payment series sinking fund and worth factor with examples	**5 Hrs**
Unit 3: Cash Flow : Methods of comparison of alternatives, present worth method (Revenue dominated cash flow diagram), future worth method (Revenue dominated cash flow diagram, cash dominated cash flow diagram), Annual equivalent method, Rate of return method –Examples all methods.	**5Hrs**
Unit 4: Replacement and maintenance Analysis : Introduction, Types of Maintenance, Types of replacement problem, Determination of economic life of an asset, Replacement of an asset with a new asset, Capital Recovery with return and concept of challenger and defender.	**5Hrs**
Unit 5: Depreciation : Introduction, Straight line method of depreciation, Declining balance method of depreciation, Sum of the year digits method of depreciation, Sinking fund method of depreciation, Service output method of depreciation.	**5Hrs**

Textbooks:

1.Panneer Selvam R. “Engineering Economics”, Prentice Hall of India Ltd, 2001.

2. Smith, G.W. “Engineering Economics”,Lowa State Press 1973.

References:

1. Park C.S., “Contemporary Engineering Economics”, Prentice Hall of India Ltd, 2002.
2. Newman, D.G. and Lavelle, J.P., Engineering Economics”and Analysis”, Engineering Press,2002.

Measurable Students Learning Outcomes :

- Ability to perform cost analysis.
- Ability to Demonstrate the effects of depreciation, on price.