Electronics & Telecommunication Engineering Department

Curriculum: TE (E&TC)

Electronics & Telecommunication Engineering Department

Program Educational Objective(s)	
After graduation and few years of graduation, the Electronics & Telecommunication Engineering graduates would	
PEO 1	Core Competency: Graduates will provide engineering solutions with strong base of science and mathematics, subject domain knowledge for challenging problems in Electronics and allied disciplines.
PEO 2	Career Building: Graduates will fulfill professional responsibilities effectively by synergizing theoretical and practical skills.
PEO 3	Technical Proficiency: Graduates will practice analytical, creative, innovative skills for higher education, research, industrial development.
PEO 4	Managerial Skills: Graduates will perform cohesively in group using moral, ethical practice, managerial, entrepreneurial skills for welfare of society with global outlook.

Electronics & Telecommunication Engineering Department

Programme Outcomes Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program specific outcomes.

1. Graduates will be able to apply subject domain knowledge to design and develop Electronics Circuits and Systems for Industrial Solutions
2. Graduates will be able to design and analyses various types of Communication Systems
3. Graduates will be able to apply concepts of Signal Processing and algorithm to develop diversified application

Electronics & Telecommunication Engineering Department

Mapping of PEOs and POs

Program Educational Objective(s)		Mapped Programme Outcomes
PEO 1	Core Competency: Graduates will provide engineering solutions with strong base of science and mathematics, subject domain knowledge for challenging problems in Electronics and allied disciplines.	1,2,3,4,5,6
PEO 2	Career Building: Graduates will fulfill professional responsibilities effectively by synergizing theoretical and practical skills.	6,7,8,9,10,11,12
PEO 3	Technical Proficiency: Graduates will practice analytical, creative, innovative skills for higher education, research, industrial development.	1,2,3,4,5,6,9,11
PEO 4	Managerial Skills: Graduates will perform cohesively in group using moral, ethical practice, managerial, entrepreneurial skills for welfare of society with global outlook.	7,8,9,10,11,12

GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD

(An Autonomous Institute of Government of Maharashtra)

Department of Electronics & Telecommunication Engineering

Teaching and Evaluation Scheme

TE (Full-Time) in Electronics & Telecommunication Engineering

SEMESTER-I

Sr. No	Course Code	Subject	Programme Outcomes	Scheme of Teaching (Hrs /Week)			Total Credits	Scheme of Evaluation (Marks)						
				L	T	P		Theory				Term Work	Practical/ Viva-voce	Total
								Test I	Test II	TA	ESE			
THEORY COURSES														
1	ET3001	Digital Communication	1,2,3,5,6,7,8,10	3	-	-	3	15	15	10	60	-	-	100
2	ET3103	Microprocessor & Microcontroller	1,2,3,4,5,9,10,11,12	4	-	-	4	15	15	10	60	-	-	100
3	ET3005	Electronics Design Technology	1,3,4,5,8,9,10,11,12	3	2	-	4	15	15	10	60	-	-	100
4	ET3007	Control System	1,2,3,5,9,11	3	-	-	3	15	15	10	60	-	-	100
5		Any ONE from Professional Elective Group		3	-	-	3	15	15	10	60	-	-	100
6		Any ONE From Open Elective Group		3	-	-	3	15	15	10	60	-	-	100
LABORATORY COURSES														
7	ET3002	Lab- Digital Communication	1,3,4,5,10	-	-	2	1	-	-	-	-	25	25	50
8	ET3104	Lab- Microprocessor & Microcontroller	1,2,4,5,10	-	-	2	1	-	-	-	-	25	25	50
9	ET3006	Lab- Electronics Design Technology	1,2,3,4,9,11	-	-	2	1	-	-	-	-	25	25	50
10	ET3008	Lab- Control System	1,3,4,5,9,12	-	-	2	1	-	-	-	-	25	25	50
		Lab- Professional Elective Group		-	-	2	1	-	-	-	-	25	-	25
11	**MANDATORY COURSES (Only ONE Course during four year Program)**													
			Total	**19**	**2**	**10**	**25**	**90**	**90**	**60**	**360**	**125**	**100**	**825**

Approved in XXI Academic Council, Dated 12.[illegible].2020

SEMESTER-II

THEORY COURSES															
Sr. No.	Course Code	Subject	Programme Outcomes	Scheme of Teaching (Hrs /Week)			Total Credits	Scheme of Evaluation (Marks)						
				L	T	P		Theory				Term Work	Practical/ Viva-voce	Total
								Test I	Test II	TA	ESE			
1	ET3009	Digital Signal Processing	1,2,3,5,6, 7,12	3	2	-	4	15	15	10	60	-	-	100
2	ET3111	Computer Architecture and Organization	1,2,3,5,11 ,12	3	-	-	3	15	15	10	60	-	-	100
3	ET3013	Embedded Systems	1,3,5,12	3		-	3	15	15	10	60	-	-	100
4	ET3015	Electromagnetic Engineering	1,2,3	3	2	-	4	15	15	10	60	-	-	100
5		Any ONE from Professional Elective Group		3	-	-	3	15	15	10	60	-	-	100
	LABORATORY COURSES													
6	ET3010	Lab- Digital Signal Processing	1,2,3,4,5,6, 7,11	-	-	2	1	-	-	-	-	25	25	50
7	ET3012	Lab- Computer Architecture		-	-	2	1	-	-	-	-	25	25	50
8	ET3014	Lab- Embedded Systems	4,5,6,9,11, 12	-	-	2	1	-	-	-	-	25	25	50
9		Lab- Professional Elective		-	-	2	1	-	-	-	-	25	-	25
10	ET3016	e-skill workshop	1,2,3,4,5	-	-	2	1	-	-	-	-	25	25	50
11	MANDATORY COURSES (Only ONE Course during four year Program)													
		Total		**15**	**4**	**10**	**22**	**75**	**75**	**50**	**300**	**125**	**100**	**725**
		Grand Total		**34**	**6**	**20**	**47**	**165**	**165**	**110**	**660**	**250**	**200**	**1550**

L-Lectures, T-Tutorials, P-Practical, TA-Teacher Assessment, ESE-End-Semester Examination

Mandatory Courses: Group Discussion/ Seminar/ Implant Training/ NSS/ NCC/ Yoga/ Talent Hour

Approved in XXI Academic Council, Dated 12 Feb 2020

ET3001: Digital Communication Professional Core	
Teaching Scheme Lectures : 3 Hrs/Week **Total Credits: 03**	**Examination Scheme** **Test I : 15 Marks** **Test II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Communication Engineering

Course description: This course covers the fundamentals of digital communication. It deals with pulse modulation and digital modulation techniques. It also covers interference in transmission and probability of error in received signal. Spread Spectrum Modulation is dealt appropriately

Course Objectives:

- Understand the fundamentals of digital communication
- To explain about the pulse modulation and digital modulation techniques
- To make students aware of interference in digital modulated signal
- To give exposure to Spread Spectrum Modulation

Course Outcomes:

After completing the course, students will be able to:

CO1	Define basic concepts of pulse modulation, digital modulation, spread spectrum modulation	K1
CO2	Explain various types of pulse and digital modulation and demodulation techniques	K2
CO3	Formulate mathematical representation of pulse ,digital modulation -demodulation	K3
CO4	Describe the significance of noise in digital communication systems	K2
CO5	Understand the spread spectrum of modulated signal	K2
CO6	Interpret the performance of pulse and digital modulation techniques	K3

Detailed Syllabus:

Unit 1	Pulse modulation: Sampling, Quantization, Pulse code modulation, line coding, T1 Digital System, DPCM, DM, ADM, Voice coder (Vocoders)
Unit 2	Digital Modulation Techniques: Phase shift keying, Quadrature Amplitude shift keying, Frequency shift keying, Pulse shaping, reduction of inter channel and inter symbol interference, regenerative repeaters.
Unit 3	Optimal Reception of Digital Signal Baseband signal receiver, probability of error, optimum receiver for both, baseband and pass band, optimal coherent reception: PSK, FSK, QPSK. Signal space representation and Comparison of modulation system.
Unit 4	Noise in PCM and DM, PCM Transmission, Delta Modulation Transmission, Comparison of PCM and DM , The space shuttle ADM
Unit 5	Spread Spectrum Modulation Spread Spectrum, Pseudo noise Sequences, DSSS, FHSS and Code Division Multiple Access Ranging

Approved in XXI Academic Council, Dated 12 Feb 20..

Text books and Reference books

1.	H. Taub and D. L. Schilling, " Principles of Communication Systems", 3rd Ed, McGraw-Hill 2012
2.	Simon Haykin , "Digital Communications", John-Wiley, 4th Ed , 2006
3.	B. Carlson, "Communication Systems: An Introduction to Signals and Noise in Electrical Communication", 5th Ed, McGraw-Hill,2010
4.	K S Shanmugam, "Digital and Analog Communication Systems", John-Wiley & Son,2006
5.	R P Singh and S D Sapre, " Communication Systems ",2nd Ed, McGraw-Hill,2007

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	1	1											3	
CO2	2	2	1		1					2				3	
CO3	3	3	2		2									3	1
CO4	2	2	2		1					2				3	
CO5	2	2	2			1	1	2		2				3	
CO6	3	2	2		2									3	1

3 –High **2 –Medium** **1 – Low**

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Question & answer / Numerical solution
2. Simulation
3. Power point presentations
4. Mini projects

Approved in XXII Academic Council, Dated 12 Feb 2020

ET3002 : Lab Digital Communication	
Teaching Scheme **Practical: 2 Hrs/Week**	**Examination Scheme** **Term Work: 25 Marks** **Practical Examination & Viva Voce: 25 Marks**

As an outcome of completing the Laboratory course, students will be able to:

CO1	Perform various pulse modulation and demodulation techniques	S1
CO2	Perform various digital modulation and demodulation techniques	S2
CO3	Interpret the performance of modulation techniques in presence of noise	S2
CO4	Use modern tools for simulation for modulation	S2

List of Experiments

1.	Study various Line coding techniques
2.	Perform PAM,PWM,PPM
3.	Perform Time Division Modulation and demonstrate interlacing of at least three waveforms
4.	Perform Pulse Code Modulation and Demodulation and recover original signal
5.	Perform Delta and Adaptive Modulation and Demodulation. Observe change of step size in ADM
6.	Perform Amplitude Shift Keying transmission and reception
7.	Perform Frequency Shift Keying transmission and reception. Find out bandwidth of modulated signal
8.	Perform Phase Shift Keying transmission and reception. Find out bandwidth of modulated signal
9.	Compare performance of digital modulation techniques by EYE diagram
10	Simulate Spread Spectrum modulation technique

Mapping of Course outcome with Program Outcomes

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	1		3	2					1				3	
CO2	1	1		2	2					1				3	
CO3	2	2		2	2					1				3	
CO4				2	3					1				3	

3 – High 2 – Medium 1 - Low

Approved in XXI Academic Council held 12 Feb 2020

ET3103: Microprocessor & Microcontroller		
Teaching Scheme	**Examination Scheme**	
Lectures: 4hrs / week	**Test I**	**15 Marks**
Total Credits :4	**Test II**	**15 Marks**
	Teacher's Assessment	**10 Marks**
	End Semester Exam	**60 Marks**

Prerequisites: Knowledge of Digital Electronics

Course description: This course introduces students to Microprocessors and Microcontrollers and their applications.

Course Objectives:

- To get acquainted with architecture of microprocessors and microcontrollers.
- To understand the addressing modes & instruction set of 8085 & 8051 and concepts of Assembly and 'C' Language Programming.
- To develop understanding of interrupt structure and serial I/O section.
- To understand interfacing of different peripherals and develop systems using the same
- To study various microcontrollers such as PIC, Raspberry Pi, Arduino

Course Outcomes:

After completing the course, students will be able to:

CO1	State functions of different microprocessors, microcontrollers, individual blocks and peripherals	K1
CO2	Describe the architecture, instruction sets and peripheral interfacing	K2
CO3	Write programs in assembly language and embedded 'C'.	K2
CO4	Understand timers, interrupts and serial interface and their applications	K2
CO5	Interface and program different peripherals	K3
CO6	Design systems using microcontrollers.	K3

Detailed Syllabus:

Unit 1	8085 Microprocessor and its peripherals Differentiation between Microprocessors and Microcontrollers, 8085 Architecture, Memory Interface, Memory Mapped IO, Addressing Modes, Instruction Set, Assembly Programming, Interrupt Handling, Interfacing to Peripherals 8255, 8253
Unit 2	Introduction to 8051 Functional block diagram, architecture, pin configuration, SFRs special function registers, stack and stack pointer, Internal memory Organization, I/O ports, addressing modes, instruction set and simple programs using Assembly Language.
Unit 3	Peripherals of 8051 Counters and Timers, Serial data input and output, Interrupts, Power saving modes, Interfacing LED, 7-segment LED, LCD, relay, optocoupler, ADC, DAC, Applications of

	8051 using assembly language and embedded C.
Unit 4	Introduction to Open Source Microcontroller Hardware Introduction to PIC and Arduino family, features, architecture and to Open Source hardware boards like Raspberry Pi.
Unit 5	Design of microcontroller based systems Design of industrial projects based on real time problems using microcontroller from 8051 family, PIC, Raspberry Pi, Arduino or suitable controllers

Text Books

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085/8085A", Penram International Publishing
2. B. Ram, "Fundamentals of Microprocessors And Microcomputers", Dhanpat Rai and Sons, Eighth Edition, New Delhi
3. K.L. Short, "Microprocessor And Programmed Logic", Prentice Hall, 2nd Edition
4. Muhammad Ali Mazidi, Janice G. Mazidi and Rolin D. McKinlay, "The Microcontroller and Embedded Systems", Second Edition, Prentice Hall
5. Ayala K. J., "8051 Microcontroller: Architecture, Programming and applications" Second Edition, West Publishing Company.
6. Myke Predko, Programming customizing the 8051 Microcontroller, Tata McGraw Hill

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO 1	PO2	PO 3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1							1	1	1		3		
CO2	2	2	1						1	1	1	1	3	1	1
CO3	2	2	1	1	1				1	1	1	1	3	1	1
CO4	2	2	1	1	1				1	1	1	1	3	1	1
CO5	2	2	2	2	2				1	1	2	1	3	1	1
CO6	2	2	2	2	2				2	2	3	2	3	2	2

3 – High **2 – Medium** **1 - Low**

Teacher's Assessment: Teachers Assessment of 10 marks is based on a mini project/application developed by students.

Approved in XXI Academic Council [illegible] 12 Feb 2020

ET 3104 : Lab Microprocessor & Microcontroller	
Teaching Scheme **Practical: 2 Hrs/Week**	**Examination Scheme** **Term Work : 25 Marks** **Practical Examination & Viva Voce: 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Write assembly language programs.	S1
CO2	Write Programs using Embedded 'C'.	S2
CO3	Interface I/O ports, serial ports, timers and program them.	S2
CO4	Implement the interfacing of various peripherals using 8051.	S3

List of Experiments

Sr. No.	List of Experiments
1	Study of 8085 microprocessor trainer system to enter, edit and execute program.
2	Write and execute ALP for- a. 8 bit addition b. 16 bit addition c. 8 bit subtraction d. BCD addition e. Multiplication (8 bit by 8 bit) f. Division (16 bit divide by 8 bit number)
3	Write and execute ALP for- a. Block transfer of N bytes of data b. Add ' N' 8 bit numbers c. Count '0s' in a byte d. Count even umbers in an array
4	Write and execute ALP to study 8255 in different modes. a. Flashing of LEDs b. Ring counter c. 3/4 bit counter d. Input data from Key and display on LEDs
5	Practice IDE software and universal programmer to program 8051.
6	Write and execute ALP for a. Addition of two 8-bit nos stored in internal RAM b. Subtraction of two 8-bit nos stored in external RAM c. Block transfer of N bytes of data d. Bit manipulation programs
7	Write an embedded 'C' program to interface LED, keys and relay and execute a. Generate various patterns on LEDs b. Display status of keys on LEDs c. Relay interface d. Buzzer interface
8	Write programs and execute to interface stepper motor and rotate it in clockwise, anticlockwise directions, rotate motor by 'N' steps
9	Write program and execute to interface DAC to generate various waveforms like square, ramp, staircase, triangular waveforms

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1		1	2					1			2		
CO2	1	1		1	2					1			3		
CO3	2	2		2	2					2			3	1	1
CO4	2	2		2	2					2			3	1	1

3 – High 2 – Medium 1-Low

Approved in XXI Academic Council, Dated [illegible] Feb 2020

ET 3005 : Electronics Design Technology	
Teaching Scheme **Lectures: 3 Hrs/Week** **Tutorial: 02 Hrs/Week** **Total Credits: 04**	**Examination Scheme** **Test I : 15 Marks** **Test II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Electronic Devices and Circuits.

Course description: This course covers the designing of various electronic systems and its applications.

Course Objectives:

- To provide an overview of the fundamentals and designing of the electronic circuits
- To provide an overview of designing of circuits using different ICs
- The capability to design and construct circuits, analysis of performance

Course Outcomes:

After completing the course, students will able to:

CO1	Understand the fundamentals of criteria for selection of active and passive components	K2
CO2	Design electronic systems using discrete components and ICs	K2
CO3	Analyze and evaluate the performance of designed circuit/system	K3
CO4	Develop the problem specific prototype using electronic design resources	K2
CO5	Compare and create competent design solution	K1
CO6	Develop performance skills as an individual and as a team member as well	K2

Detailed Syllabus:

UNIT 1	**Fundamentals of Electronics Design** Review of various active and passive components used in electronic circuit, PCB selection and design criteria
UNIT 2	**Design of Regulators.** Design aspects of regulators: Linear Design aspects of integrated regulators LM78XX, LM79XX, LM317, LM337, LM723, Protection circuits, Switching Regulator using IC 78S40
UNIT 3	**Design of Small Signal Amplifier** Design of biasing circuits, Bias stabilization, Design and evaluation of Common Emitter Amplifier circuits, Multistage Amplifier, Design of RC and LC oscillator circuits
UNIT 4	**Design of Power Amplifier** Classification, performance parameter, Design of Class A, B, C, AB, Complementary symmetry, IC based Audio Power Amplifier, Design of Heat Sinks
UNIT 5	**Design and Implementation of circuits for specific applications** A mini-project activity based on above syllabus to impart hands-on-expertise

Approved in XXI Academic Council, Dated 12 Feb 2020

Text and Reference Books:

1. Ramakant Gaikwad, "OPAMPS and Linear Integrated Circuits", PHI/Pearson Education.
2. K. R. Botkar, "Linear Integrated Circuits", Khanna Publication, New Delhi
3. Monogram by CEDT, IISc Bangalore, "Thermal Design of Electronic Equipment"
4. Waller C. Bosshart , "PCB Design & Technology", TMH
5. Bert Haskell, "Portable Electronics Product Design and Development", MGH Publication
6. D.S.Mantri, G.P.Jain "A practical approach to Electronic Circuit Design".

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2		2										2		
CO2	2		2								3				2
CO3	2		2								3			3	
CO4		2	2										2		
CO5		1	1						3	2	2	1		3	
CO6					2			2		3					1

1 – Low 2 – Medium 3 - High

Teacher's Assessment: Teachers Assessment of 10 marks is based on

1) Simulation
2) Application development
3) Power point presentation of case studies
4) Question & answer / Numerical solution
5) Design Project
6) Laboratory Work
9) Tutorials

Approved in XXI Academic Council, Dated 12 Feb 2020

ET3006 : Lab Electronics Design Technology	
Teaching Scheme **Practical: 2Hrs/Week** **Total Credits: 01**	**Examination Scheme** **Term Work : 25 Marks** **Practical/Viva-Voce : 25 Marks**

Laboratory Course Outcomes:

As an outcome of completing the Laboratory course, students will able to:

CO1	Develop ability to interpret specifications and build basic design block schematic.
CO2	Design and implement schematic using discrete components / ICs
CO3	Evaluate and analyze the performance of circuit / system
CO4	Develop performance skills as an individual and as a team member as well

List of Experiments:

Sr. No.	Details
1	To design Regulated Power Supply using 3 terminal regulator ICs / other ICs and evaluate performance parameters like r.f. and % R
2	Design and implement dual tracking regulated power supply using 3 terminal regulator ICs
3	To design CE amplifier with Fixation of Q point, Evaluate S factor and analyze performance
4	To design two-stage Common Emitter Amplifier with RC coupling
5	To design Class A power amplifier and simulate the performance
6	To design Class B power amplifier and simulate the performance
7	To design Wein-bridge Oscillator and observe resonant frequency
8	To design Colpit's and Hartley Oscillator with relevant design equations
9	To develop applications on Copper clad PCB using Electronic components
10	Report on mini-project

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

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

1 – Low 2 – Medium
3 - High

Approved in XXI Academic Council, Dated 12 Feb 2020

ET3007: Control Systems	
Teaching Scheme **Lectures: 3 Hrs/Week** **Total Credits: 03**	**Examination Scheme** **Test I :15 Marks** **Test II :15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Basic knowledge of Signals and Systems

Course description: After completing this course, students will have a broad and fundamental understanding of Control System. Topics range from an overview of Basics of Control System, State Space Analysis, Overview of Stability analysis, Frequency and Time Response of System.

Course Objectives:

- To provide a clear view of Control System.
- To get accustomed with Frequency and Time domain Analysis methods for industrial applications.
- To get familiarize with state space analysis with its Controllability and Observe ability of the Systems.

Course Outcomes

After completing the course, students will be able to:

CO1	K1	Identify the types of systems, transfer function and stability criteria and concept.
CO2	K2	Understand Transfer function, Stability and State Space representation of system.
CO3	K3	Apply concepts of time domain and frequency domain to systems
CO4	K2	Understand the Compensatory circuit, controllability and observability of control system
CO5	K2	Understand the concept of controllers and its applications
CO6	K3	Apply models of physical systems for analyzing and designing of control systems

Detailed Syllabus:

Unit 1	**Introduction** History of control system, Laplace transform review, open loop and closed loop systems, introduction of linear and nonlinear control systems, regenerative feedback, transfer function, block diagrams and reduction techniques including signal flow graphs, deriving transfer function of physical system like electrical networks, Mechanical system.
Unit 2	**Time response analysis** Standard test signals, time response of first order and second order system, steady state Error constants, design specifications of second order system, control system compensators: lead compensations, lag compensation, lag-lead compensation. Basic concept of state, state variable, and state models, state models for linear continuous time function, transfer matrix, diagonalization of transfer function, controllability, observe ability.

Approved in XXI Academic Council, Dated 12 Feb 2020

Unit 3	**Stability Analysis** Concept of stability, condition of stability, characteristic equation, relative stability, Routh-Hurwitz criterion, Nyquist stability criterion, Basic Concept of Root Locus, rules of root locus, application of root locus technique for control system.
Unit 4	**Frequency response Analysis** Bode plots, gain margin, phase margin, effect of addition of poles and zeros on bode plots, performance specifications in frequency domain, compensation and their realization in time and frequency domain.
Unit 5	**Industrial controllers** P,PI,PD,PID, Introduction to PLC,PLC programming and its application development.

Text and Reference Books

1. I.J. Nagrath and M. Gopal, Control Systems Engineering, Third Edition, New age International Publishers, India, 2001
2. Norman S. Nise, Control systems Engineering, Third Edition, John Wiley and Sons Inc., Singapore, 2001
3. K. Ogata, Modern Control Engineering, Fourth edition, Pearson Education India, 2002.
4. M Gopal, Control System Principle & Design, T.M.H., Fourth Edition, 2012
5. B.C. Kuo, Automatic Control Systems, Seventh Edition, Prentice–Hall of India, 2000
6. R.C. Dorf and R.H. Bishop, Modern Control Systems, Eighth edition, Addison- Wesley, 1999.
7. Smarajit Ghosh, "Control Systems-Theory and Applications", Second Edition, Pearson.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1		2			1								2		
CO2	2	2											2		
CO3	3	1			1				1		1		3		
CO4	2		2										1		
CO5	2		2										1		
CO6	3	1			1				1		1		2		

1 – Low 2 – Medium 3 - High

Teacher's Assessment: Teachers Assessment of 10 marks is based on

1) State space, stability, system characteristics, and analysis of given electronic circuits.
   AND/ OR
2) One or combination of few of following
   a. Simulation
   b. Application development
   c. Study of Industry processes and its presentation

Approved in XXI Academic Council, Dated ... Feb 2020

ET3008: Lab Control Systems	
Teaching Scheme **Practical: 2Hrs/Week** **Total Credits : 01**	**Examination Scheme** **Term Work : 25 Marks** **Practical Examination** **& Viva Voce: 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will be able to:

CO1	Imitate the basic time and frequency responses of system.
CO2	Execute different applications using PLC Trainer Kit.
CO3	Demonstrate industrial applications using MATLAB/LABVIEW/PLC Trainer Kit.
CO4	Implement hardware for basic control systems.

List of Experiments

Sr. No.	Details
1.	Transient response of a) Step, ramp and Impulse response of first order systems. b) Step, ramp and Impulse response of second order systems
2.	Determination of a)step & impulse response for a type '0', type '1', type '2' systems b)Steady state Errors for a type '0', type '1', type '2' systems
3.	a)Study the effect of addition of zeros and poles to the forward path transfer function of a closed loop system b)Determination of characteristics of closed loop control system
4.	State space representation using, a) Controllable Canonical Form b)Observable Controllable Form
5.	Stability Analysis Using a)Root Locus, b)Bode Plot, c) Nyquist plot
6.	To design a passive RC lead compensating network, (a) the maximum phase lead and the frequency at which it occurs and to obtain its frequency response. (b) To determine experimentally the transfer function of the lead compensating network.
7.	Analyzed the First order and second order System for step input using RC and RLC network.
8.	Study of DC Motor Speed Control System.
9.	Determination of PI, PD and PID controller of first order
10	Study of Synchro transmitter-receiver
11	Experiments based on PLC trainer Kit

Approved in XXI Academic Council held 12 Feb 2020

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2				2								1		
CO2				2	1								2		
CO3			1	2					3					1	
CO4				1	2										1

1 – Low 2 – Medium 3 - High

Approved in XXI Academic Council, Dated 12 Feb 2020

ET3009 : Digital Signal Processing	
Teaching Scheme **Lectures: 3 Hrs/Week** **Tutorial: 2 Hr/Week** **Credits: 04**	**Examination Scheme** **Test I + Test II : 15 +15 Marks** **Teachers Assessment: 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Signals and Systems, Engineering Mathematics

Course description:

- The primary objective of this course is to provide a thorough understanding and working knowledge of design, implementation and analysis DSP systems.
- This course in digital signal processing develops essential analysis and design techniques required for a broad range of disciplines.
- Student familiar with most important methods in DSP, including digital filter design, transform domain processing and importance of signal processor
- After completion of the subject, the student should be able to understand the design principles and the implementation of digital filters and DFT/FFT, and
- be able to make use of signal processing concepts and wavelets to perform some simple applications.

Course Outcomes

After completing the course, students will able to:

CO1	Interpret, represent and process discrete/digital signals and systems (k1)
CO2	Implement frequency domain analysis of discrete time signals of DSP system (k2)
CO3	Understand transforms of signals and systems. (k2)
CO4	Design and implement digital filters for processing of discrete time signals. (k3)
CO5	Develop creative and innovative design that achieves desirable performance criteria within specified objectives and constraints for lifelong learning and continuing professional education. (k2)
CO6	Understand the basic theory of wavelet transform and the concepts of using simple wavelets for simple applications (K2)

Detailed Syllabus:

Unit 1	**Discrete-time Systems and General Realization Techniques** Concept of discrete-time signal. Sampling and reconstruction of signal. Time invariance, causality, linearity, periodic, energy, power convolution. LTI systems: Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercise, properties of convolution, interconnection of LTI systems with physical interpretations, stability and causality conditions, recursive and non recursive systems
Unit 2	**Discrete Time Fourier Transform (DTFT):** Concept of frequency in discrete and continuous domain and their relationship (radian and radian/sec), freq. response in the discrete domain. Discrete system's response to sinusoidal/complex inputs (DTFT), Representation of LTI systems in complex frequency domain. **Z-Transforms:** Definition, mapping between s-plane & z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequences with examples & exercises, characteristic families of signals along with ROC, convolution, correlation and multiplication using Z-transform, initial value theorem,

Approved in XXI Academic Council, Dated 12 F

	Perseval's relation, inverse Z-transform by contour integration, power series & partial-fraction expansions with examples and exercises. **Discrete Fourier Transform:** Concept and relations for DFT/IDFT, Relation between DTFT & DFT. Twiddle factors and their properties, computational burden on direct DFT, DFT/DFT as linear transformation, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circulation convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences-Overlap-Save and Overlap-Add methods with examples and exercises. **Fast Fourier Transforms:** Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithm, signal flow graph, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises.
Unit 3	**Design of Infinite Impulse Response Filters** Revision of analog systems, Butterworth filters and Chebyshev filters. Types of digital filters: IIR and FIR. IIR filter design, bilinear transformation, frequency scaling, transformation from prototype low-pass filter to high-pass filter and band-pass filter. Impulse-invariant and/or step-invariant approaches CO3,6
Unit 4	**Design of Finite Impulse Response Filters** FIR filter analysis, Fourier series approach, windowing, Gibbs phenomenon, commonly used windows, concept of linear phase, frequency transformation, low-pass, band-pass, high-pass filters and filter band design.
Unit 5	**Digital Signal Processors and Applications** 1. Architectures and importance instruction sets of TMS320c 5416/6713 of digital signal processors and DSP chips. Writing program in c and asm. 2. FPGA: Architecture, different subsystem, design flow of dsp system design, mapping into dsp algorithm into FPGA.
	TEXT AND REFERENCE BOOKS 1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989. 2. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall, 1997. 3. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992. 4. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992. 5. D. J. DeFatta, J. G. Lucas and W. S. Hodgkis, Digital Signal Processing Wiley and Sons, Singapore, 1988. 6. G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applicatios', Pearson Education, New Delhi, 2003 / PHI. **7.** K. Mitra, 'Digital Signal Processing – A Computer Based Approach, Tata McGraw Hill, New Delhi, 2001

Approved in XXI Academic Council, Dated 12 Feb 2020

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	1	2	2	-	-	2	2	2	-	-		-	3
CO2	2	1	1	2	2	1	1	2	2	2	-	-		1	3
CO3	2	1	1	1	-	-	1	2	2	1	-	-		1	3
CO4	1	1	1	1	1	1	-	1	1	1	-	1		1	3
CO5	1	2	3	2	1	2	2	1		1	1	1	1	1	3
CO6	2	2	2	1	-	2	1	1		1	1	3	1	1	3

1 – Low 2 – Medium 3 - High

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Prototype development
3) Power point presentation of case studies
4) Question & answer / Numerical solution

Approved in XXI Academic Council, Dated 12 Feb 2020

ET3010 : Lab-Digital Signal Processing	
Teaching Scheme **Practical: 2 Hrs/Week** **Total Credits: 01**	**Examination Scheme** **Term Work: 25 Marks** **Practical Examination & Viva Voce: 25 Marks**

Laboratory Course Outcomes

Practical part of the work consists of minimum eight tasks that should be performed on the RPi /DSP starter board /or MATLAB simulations.

Purpose:

The Digital Signal Processing Lab (DSPLAB) provides all the required equipment to implement real-time digital signal processing solutions supporting experimental research, applied research, and industrial projects conducted at the Communication Systems Division.

The laboratory has Licensed MATLAB software with various Tool boxes and Simulink. Students simulate here number of experiments in MATLAB. Students also use TMS 320C5416 fixed-point DSP. Programing of the DSP chip is done in C(and some assembly) language using the Code Composer Studio integrated development environment.

Some examples of developments at the DSPLAB are multi-standard modems, wireless sensor networks, GNSS receivers, smart antennas, software-defined radio solutions and indoor location systems, among others.

Equipment: DSP prototype board or FPGA development tools and platforms

Texas Instruments C6727 Floating Point DSP developer kit
As an outcome of completing the Laboratory course using MATLAB/CCS/IDE, students will able to:

CO1	The student will be able to carry out simulation of DSP systems.
CO2	Develop and Implement DSP algorithms in software using a computer language such as C/MATLAB /TMS320C6713 floating point Processor.
CO3	Analyze and Observe Magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filters.
CO4	Analyze and Observe Magnitude and phase characteristics (Frequency response Characteristics) of digital IIR filters.
CO5	Demonstrate the applications of FFT to DSP.
CO6	Produce and process signals in time domain i.e. Sampling, quantization, convolution, correlation in MATLAB and model FIR and IIR filters to meet specific requirements

Approved in XXI Academic Council, Dated 12 Feb 2020

List of Experiments

Sr. No.	Details
1	Program for Discrete-time signals and systems, linear coefficients difference equations and realization structures, convolution and correlation
2	*Introduction to Hardware and Software Tools for the TMS320C6748 Board* 1. C6000 instruction set architecture or 2. Developer Kit (LCDK) 3. Or FPGA /Raspberry Pi 3 4. TI Code Composer Studio software tools 5. TI DSP BIOS (operating system) 6. LabVIEW 7. Matlab
3	Generating a Sine Wave Using the Hardware and Software Tools for the TI TMS320C6711 DSP
4	Program for DTFT and DFT Spectral Analysis
5	Program for FFT and Bit reversal
6	Design and implement of FIR filter, FIR filtering interfacing MATLAB and Code Composer Studio
8	Design discrete-time digital filters and implement them in real time.
9	Design and implement of III filter
10	Program for Multirate Signal Processing Basic Sampling Rate Alteration Devices • Decimator and Interpolator Design and Implementation • Design of Filter Banks • Design of Nyquist Filters
11	Program for STFT Implementation

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	2	3		3											3
CO2		3		2										1	3
CO3	2	2		1										1	3
CO4				1		1					1			1	3
CO5	2	1			1								1	1	3
CO6			1			2	2						1	1	3

1 – High 2 – Medium 3 - Low

Approved in XXI Academic Council, Dated 12 Feb 2020

ET3111: Computer Architecture and Organization	
Teaching Scheme **Lectures: 3Hrs/Week** **Total Credits: 03**	**Examination Scheme** **Class Test – I : 15 Marks** **Class Test – II : 15 Marks** **Teachers Assessment :10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Microprocessors fundamentals

Course Description: This course aims to provide foundation for students to understand modern computer system architecture and operating systems. It covers parallel processing and pipeline architecture including advance pipelining techniques, software scheduling, job sequencing and collision. Operating system includes concepts of compiler, assembler, threads, CPU scheduling, memory management, paging and segmentation.

Course Objectives:

- To state necessity of parallel processing
- To explain principles of pipelining architecture to improve throughput
- To describe fundamentals of Operating System
- To elaborate concepts of multitasking, multiprogramming, timesharing, buffering & spooling

Course Outcomes

As an outcome of completing the course, students will able to:

CO1	Be familiar with the basics of systems topics: single-cycle (MIPS), multi-cycle (MIPS), parallel, pipelined, superscalar, and RISC/CISC architectures.
CO2	Ability to understand the concept of cache mapping techniques.
CO3	Analyze the concept of I/O organization.
CO4	Ability to conceptualize instruction level parallelism.

Detailed Syllabus:

UnitI	**Introduction** Computer Types, Function and structure of a computer, Functional components of a computer, Interconnection of components, Performance of a computer. Representation of Instruction, Machine instructions, Operands, Addressing modes, Instruction formats, Instruction sets and Instruction set architectures - CISC and RISC architectures.
Unit II	**Central Processing Unit:** Organization of a processor - Registers, ALU and Control Unit, Interger Arithmetic and Floating point arithmetic, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardware control unit, Microprogrammed control unit, Hardwired Implementation, Micro instruction operations, Microinstruction sequencing, Reduced Instruction Set Computers: Instruction execution

Approved in ... Academic Council, Dated 12 Feb 2020

	characteristics, Compiler baaed register organization, RISC Pipelining
Unit III	**Memory Subsystem: Computer Memory System overview,** Semiconductor main memory, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Address translation, Hardware support for memory management
Unit IV	**Input/output Subsystem** Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces – Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infiniband, I/O peripherals - Input devices, Output devices.
Unit V	**Operating System Support:** Operating system overview, Scheduling, Memory Management, Introduction of Linux operating system

Recommended Books:

1. W. Stallings, "Computer Organization and Architecture - Designing for Performance", Prentice Hall of India
2. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization", McGraw-Hill
3. D. A. Patterson and J. L. Hennessy, "Computer Organization and Design - The Hardware/Software Interface", Morgan Kaufmann
4. J .P. Hayes, "Computer Architecture and Organization", McGraw-Hill

Resources available on e-learning site http://www.e-gecaect.com

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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

3 – High 2 – Medium 1 – Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2)Application development
3) Power point presentation of case studies
4) Question & answer / Numerical solution
5) Study of Industry processes and its presentation

Approved in XXI Academic

ET 3012: Lab Computer Architecture and Organization	
Teaching Scheme **Practical: 2 Hrs/Week**	**Examination Scheme** **Term Work : 25 Marks** **Practical Examination & Viva Voce: : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will be able to:

CO1	Write and execute the programs for 8085 micro-processor.
CO2	Develop code for simple applications based on 8051 micro-controller
CO3	Install Linux and execute commands
CO4	Write c-programs for memory management and task scheduling

List of Experiments

Sr. No.	Details
1	Write & execute following programs for 8085 processor- a. Addition of two 8-bit numbers stored in memory, also store result in a memory. b. To Count no. Of 1's and 0's in a given byte. c. To obtain division of two 8-bit nos. d. To obtain fibonacci series. e. To obtain factorial of a no.
2	Write and execute following programs for 8051 micro-controller- a. To blink LED using 8051 in timer mode. b. Generate four random patterns on LED.
3	Write and execute a program for generation of sawtooth and triangular waveform for 8051.
4	Write and execute a program for interfacing of LCD or seven segment using 8051.
5	Write a C program for CPU scheduling algorithm- (Any TWO) a. FCFS b. SJF c. Round Robin d. Priority
6	Write a C program for memory management algorithm- (Any ONE) a. First fit b. Best fit c. Worst fit
7	Installation of LINUX operating systems
8	Linux operating basic commands- Write a C program to illustrate Linux file system calls and process management system calls- File system calls- open(0, close(), create(), read(), write(), dup(), lseek() Process management system calls- fork(), exec(), exit(), wait(), signal(), kill(), alarm().

Approved in XYZ Academic Council, Dated 15 Feb 2020

Mapping of Course outcome with Program Outcomes

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

3 – High 2 – Medium 1 – Low

Approved in XXI Academic Council, Dated 12 Feb 2020

ET3013: Embedded Systems	
Teaching Scheme Lectures : 3Hrs/week Total credits: 03	**Examination Scheme** Test 1 : 15 Marks Test 2 : 15 Marks Teachers' Assessments: 10 Marks End Semester Exam : 60 Marks

Prerequisites: Basic knowledge of Digital Electronics, Microprocessor & Microcontroller

Course description: This course introduces the concept of Embedded System, Embedded Microprocessor and its peripherals, interrupts and exceptions, C/ Assembly Programming, Tool Chains, Emulation and Debugging. The course focuses on ARM RISC processors for embedded applications.

Course Objectives:

- To develop understanding about requirements and general design methodology of Embedded Systems.
- To apply hardware and software knowledge for developing Embedded Systems as per requirements, specifications and constraints.
- To impart knowledge of serial communication protocols, ARM architecture and Real Time Operating Systems.
- To expose the students to development cycle of Embedded System.

Course Outcomes: After completing the course, the students will able to:

CO1	Understand classification, design issues & metrics of embedded systems and development cycle.	K2
CO2	Understand serial communication protocols, RTOS concepts	K2
CO3	Understand ARM Basics, Assembly language , ARM architecture	K2
CO4	Interface different peripherals to ARM processor for engineering solutions and write RTOS routines.	K3
CO5	Understand System-on chip concepts, embedded SOC, Zync SOC	K2
CO6	Design Embedded systems for various applications	K3

Detailed Syllabus:

Unit 1	**Introduction to Embedded Systems** Definition of Embedded System, Components of a typical Embedded System- Processor, Memory, Peripherals, Software, Microcontroller. Overview of Embedded Processors, Introduction to RISC processors- Berkeley/ Stanford RISC model, Introduction to Memory Systems-SRAM, DRAM. Introduction to Real Time non-OS and RTOS systems
Unit 2	**ARM as Embedded Processor** Overview of ARM based Embedded Systems, ARM Architecture and differentiation in Cortex Series (A, M, R), ARM Assembly Language, Thumb Instruction Set, ARM Basics-Register, Stack, RAM Cache, Memory Management Unit, Memory Protection Unit, Interrupt and Exception Handling, Introduction to Floating Point Unit, NEON Coprocessor

Approved in XXI Academic Council, Dated 12 Feb 2020

Unit 3	**Basic Peripherals** Introduction to Parallel and Serial I/O, Timers/counters, Real Time Clocks, SPI, I2C, RS232 Serial Port, UART, DMA Controllers, USB, Introduction to PCI Express and AXI Bus.
Unit 4	**Embedded System Development**
	ARM Assembly Language Programming using Keil, Assembly programming using Raspberry Pi, Introduction to Embedded C Programming, C Programming for Raspberry Pi
Unit 5	**System on Chip** Introduction to Zynq SoC, Anatomy of Embedded SoC, IP block design, High Level Synthesis, Embedded Processing with ARM Cortex-A9 using High Level Synthesis, Linux and RTOS on Zynq, Case Study- Video Processing and Computer Vision on Zynq

Text and Reference Books

1. ARM System Developer's Guide, Andrew N. Sloss, Dominic Symes, Chris Wright, ELSEVIER, 2005, ISBN 8181476468, 9788181476463
2. ARM System-On-Chip Architecture, 2ND ED, Steve Furber, Pearson Education, 2007, ISBN 8131708403
3. Embedded Systems Design, 2ND ED, Steve Heath, Newnes, 2003, ISBN 0750655461
4. Professional Embedded ARM Development, James A. Langbridge, John Wiley & Sons, Inc., 2014, ISBN 9781118788943
5. The Zynq Book, 1ST ED, Louise H. Crockett, Ross A. Elliot, Martin A. Enderwitz, Robert W. Stewart, Strathclyde Academic Media, 2014
6. ARM Assembly Language Fundamentals and Techniques, 2ND ED, William Hohl, Christopher Hinds, CRC Press, 2015, ISBN 9781482229868
7. ARM Assembly Language with Hardware Experiments, Ata Elahi, Trevor Arjeski, Springer, 2014, ISBN 9783319117034
8. PCI System Architecture, 4TH ED, Tom Shanley, Don Anderson, MindShare Inc. PEARSON Education, 2006, ISBN 813170100X

Mapping of Course Outcome with Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1												1		
CO2	2		3											2	
CO3	3		1										2		
CO4	2		2		2							2			2
CO5					2								2		
CO6			2		2							2	2		2

3- High **2-Medium** **1-Low**

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Quiz
2) Surprise Test
3) Power point presentation of advanced topic in detail
4) Question & answer / Numerical solution

Approved in XXI Academic Council

ET3014: Lab Embedded Systems	
Teaching Scheme **Practical: 2 Hrs/Week**	**Examination Scheme** **Term Work : 25 Marks** **Practical Examination & Viva Voce: : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Use modern engineering tools necessary for integrating software and hardware components in Embedded system designs.
CO2	Program the basic interfacing of ARM processor with peripherals using Embedded C
CO3	Demonstrate the data communication using SPI/ I2C and exception handling with ARM processor
CO4	Demonstrate the programming using timers/counters, Real time clock
CO5	Demonstrate the programming of embedded SoC
CO6	Program the basic interfacing of Raspberry pi boards

List of Experiments

Sr. No.	List of Experiments
1	Practice IDE software and universal programmer to program microcontrollers.
2	Program to Interface LEDs to LPC2148
3	Program to Interface Seven Segment display
4	Program to Interface keys/ key matrix
5	Program to Interface LCD and Graphics LCD
6	Program to Interface Stepper motor
7	Program to Interface Buzzer, relay, ADC/DAC
8	Use external interrupt to carry out ISR
9	Understand free RTOS tutorial
10	Write RTOS routine using free RTOS

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1					3										
CO2				3	2				2		1				
CO3				3	2				2		1				
CO4													1		
CO5													2		
CO6				2	2	2					1	1	2		2

3 – High 2 – Medium 1 - Low

Approved in XXI Academic Council, Dated 12 Feb 2020

ET 3015 : Electromagnetic Engineering	
Teaching Scheme **Lectures: 3 Hrs/Week** **Tutorial: 2 Hrs/Week** **Total Credits: 04**	**Examination Scheme** **Test I : 15 Marks** **Test II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Engineering Mathematics I, Engineering Mathematics II, Engineering Mathematics III, Engineering Mathematics IV.

Course Objectives:

- To understand the three dimensional representation of vector fields and vector calculus.
- To understand the fundamental principal of electrostatic and magnetic fields and their nature and understand the principals behind the practical laws.
- To understand the Maxwell's equations as applied to static and time varying fields.
- To understand complex electromagnetic phenomenon of wave propagation and electromagnetic radiation.

Course Outcomes: After completing the course, students will be able to:

CO1	Gain knowledge of coordinate systems and will be effective use it to three dimensional field problems
CO2	Understand the fundamentals of electrostatic and steady magnetic fields
CO3	Understand the Maxwell's equations
CO4	Model static and time varying electromagnetic field problem and analyse
CO5	Understand the phenomenon of wave propagation and electromagnetic radiation.
CO6	Understand Antenna fundamentals.

Detailed Syllabus:

Unit 1	**Electrostatics** Brief overview of coordinate systems and vector calculus, Coulomb's law and electric field intensity, Experimental law of Coulomb, Electric field intensity, Field due to a continuous volume charge distribution, Field of a line charge, Field of a sheet of charge, Streamlines and sketches of fields, Electric flux density, Gauss's law, and Divergence, Electric flux density, Gauss's law, Application of Gauss's Law: Some symmetrical charge distributions. , Differential volume element, Divergence, Maxwell's first equation (Electrostatics), Vector operator V and the Divergence theorem.
Unit 2	**Energy and Potential** Energy expended in moving a point charges in an electric field, Line integral, Definition of potential difference and potential, Potential field of a system of charges : Conservative property, Potential gradient, Dipole, Energy density in the electrostatic field, Conductors, Dielectrics and Capacitance, Current and current density, Continuity of current, Metallic of current, Conductor properties and boundary conditions.
Unit 3	**Magneto statics** Steady magnetic field, Biot-Savart law, Ampere's Circuital law, Curl, Stokes' Theorem, Magnetic flux and magnetic potentials, Derivation of steady-magnetic-field laws, Magnetic forces, Materials, and inductance. Force on a moving charge, Force on a differential current element, Force between differential current elements, Force and Torque on a closed circuit, Nature of magnetic materials, Magnetization and Permeability, Magnetic boundary conditions, Magnetic Circuit, Potential energy and forces on magnetic materials, Inductance and Mutual inductance.

Approved in XXI Academic Council, Dated 12 Feb 2020

Unit 4	**Time Varying Fields and Maxwell's Equations** Faraday's law, Displacement current, Maxwell's equations in point form, Maxwell's equations in integral form, Retarded potentials. Uniform Plane Wave: Wave motion in free space, Wave motion in perfect dielectrics, Plane waves in lossy dielectrics, Poynting vector and Power considerations, Propagation in Good Conductors: Skin effect, Reflection of uniform plane waves, Standing wave ratio.
Unit 5	**Antenna Fundamentals** Antenna parameters, Isotropic radiators, Radiation power density, Radiation intensity, Directivity (D), Directive Gain, Radiation resistance, Front to back ratio, Antenna band-width and Antenna beam width.

Text and Reference Books

1. W.H. Hayt, J.A. Buck, "Electromagnetic Engineering", 6th edition TMH.
2. Jordon & Balmain, Mortise, "Electromagnetic Waves & Radiating System", PHI.
3. Kraus & Fleisch, "Electromagnetic with Applications", Mcgraw Hill.
4. M.A. WazedMIAH, "Fundamentals of Electromagnetic", McGraw Hill.
5. K.D. Prasad, "Electromagnetic Fields and Waves", Satya Prakashan.
6. D. N. Vasudeva, "Fundamentals of Magnetism & Electricity", S & C Publication.
7. J. D. Kraus, R J Marhefka, "Antennas for All Applications", TMH.

Mapping of Course outcome with Program Outcomes and Program Specific Outcome

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	1	3										
CO3	1											
CO4	2	2										
CO5	2		1									
CO6	2		2									

3 – High **2 – Medium** **1 - Low**

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Power point presentation of case studies
4) Question & answer / Numerical solution

Approved in XXI Academic Council, Dated 12 Feb 2020

ET3016 : e-skill Workshop Compulsory	
Teaching Scheme	**Examination Scheme**
Lectures: 2 Hrs/Week	**Term-work:25 marks**
	Practical /Viva-voce:25 marks

Prerequisites: Knowledge of Electronics Workshop I

Course description: The aim of this course is to enable the student to comprehend the principles of modern manufacturing processes and to acquire competency in the design, construction and documentation of electronic equipment.

Course Objectives:

Elaborate the design processes and production methods
Explain the use of software techniques and thermal analysis techniques
Explain the use and application of surface mount technology
Build capacity amongst students to design a PCB, assemble and test an electronic circuit

Course Outcomes

After completing the course, students will be able to:

CO1	Identify task and required circuit diagram / system for it.
CO2	Build a project model, simulate and test it through software.
CO3	Demonstrate working of the project.

Detailed Syllabus:

A group of three or four students shall select a topic from the field of Electronics and Telecommunication engineering. They have to build a system / mini project and test it.

Term Work: It will consist of a report based on the study and actual work done on the selected topic, which will cover theoretical and analytical study of the system, specifications, applications, results etc.

Students are expected to design an IC based project of analogue / digital circuit/system

Approved in XXI Academic Council, Dated 12 Feb 2020

(This can be used as experimental set-up in the laboratory). PCB design, fabrication, testing and implementation should be done. Students may use the software simulation for verification of hardware implementation. Documentation of the project is to be in standard IEEE format. Project report should include abstract in 100 words (max), key words, introduction, design, simulation, implementation, results/ results comparison, conclusion and references.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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

3 – High 2 – Medium 1 - Low

Approved in XXI Academic Council, Dated 12 Feb 2020

Approved in XXX Academic
Council, Dated 27 Feb 2020