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 (PO's)

Programme Outcomes describe what students are expected to know or be able to do by the time of graduation from the programme. The POs for Under Graduate Course in Electronics and Telecommunication Engineering are able to

1. Apply knowledge of mathematics, science and technical fundamentals for solutions of domain problems
2. Identify, formulate, review the literature, analyze the complex engineering problems
3. Design and implement the systems' components and processes serving the needs of safety, environment and society
4. Perform experiment, analyze and interpret results
5. Use modern tools and technical skills necessary for electronic system development
6. Understand the impact of electronics in modern era
7. Explore the needs of society for sustainable development and human values
8. Understand professional, ethical and legal responsibilities
9. Work effectively in diverse and multidisciplinary tasks, to accomplish common goal
10. Communicate effectively
11. Engage in continuing educational / professional, entrepreneurship development
12. Apply electronics engineering and management principles / skills, as a member and leader in a team to solve social and industrial problems

Electronics & Telecommunication Engineering Department

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

Mapping of PEOs and POs

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	3	-	-	3	15	15	10	60	-	-	100
2	ET3003	Microprocessor & Microcontroller	1,2,3,4,5	4	-	-	4	15	15	10	60	-	-	100
3	ET3005	Electronics Design Technology	1,3,11	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	-	-	2	1	-	-	-	-	25	25	50
8	ET3004	Lab- Microprocessor & Microcontroller	1,2,3,4,5	-	-	2	1	-	-	-	-	25	25	50
9	ET3006	Lab- Electronics Design Technology	1,3,4,9	-	-	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**

SEMESTER-II

THEORY COURSES															
Sr. No.	**Course Code**	**Subject**	**Programme Outcomes**	**Scheme of Teaching (Hrs /Week)**			**Total Credits**	**Scheme of Evaluation (Marks)**						
								Theory				**Term Work**	**Practical/ Viva-voce**	**Total**
				L	**T**	**P**		**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	ET3011	Computer Architecture and Organization	1,2,3,5,11 ,12	4	-	-	4	15	15	10	60	-	-	100
3	ET3013	Embedded Systems	1,2,3,5,9, 11	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	1,2,4,6,11	-	-	2	1	-	-	-	-	25	25	50
7	ET3012	Lab- Computer Architecture		-	-	2	1	-	-	-	-	25	25	50
8	ET3014	Lab- Embedded Systems	4,5,9,11	-	-	2	1	-	-	-	-	25	25	50
9		Lab- Professional Elective		-	-	2	1	-	-	-	-	25	-	25
10	ET3016	e-skill workshop	4,5	-	-	2	1	-	-	-	-	25	25	50
11	**MANDATORY COURSES (Only ONE Course during four year Program)**													
		Total		**16**	**4**	**10**	**23**	**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

ET3001: Digital Communication **Compulsory**	
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:

- To 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 pulse modulation, digital modulation, spread spectrum modulation techniques k2
CO3	Describe the significance of noise in transmission and error in received signal k2
CO4	Formulate mathematical representation of pulse ,digital modulation techniques k3
CO5	Interpret the performance of pulse and digital modulation techniques k3

Detailed Syllabus:

Unit 1	Pulse modulation, Quantization, Pulse code modulation, line coding, T1 Digital System, DPCM, DM, ADM, Voice coder (Vocoders)
Unit 2	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	Mathematical representation of noise ,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, Direct Sequence Spread Spectrum, Spread Spectrum and Code Division Multiple Access Ranging using DS Spread Spectrum Synchronization in Spread Spectrum Systems

Text and Reference Books

1. John G Proakis, "Digital communications", Fourth edition, McGraw Hill.
2. Simon Haykin , "Digital Communications", John-Wiley, 1998
3. H. Taub and D. L. Schilling, " Principles of Communication Systems", 2nd Ed, McGraw-Hill
4. B. Carlson, "Communication Systems: An Introduction to Signals and Noise in Electrical Communication", 3rd Ed, McGraw-Hill, 1986.
5. K S Shanmugam, "Digital and Analog Communication Systems", John-Wiley & Son, 1979

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 – 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 presentation of advanced topics
4. Visits
5. Mini projects

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test I	Test II	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	05	00	06
K2	Understand	10	10	05	36
K3	Apply	00	00	05	18
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K2	K3	K3
	CO1	CO2	CO3	CO4	CO5
Class Test I (15) Marks)	05	10	00	00	00
Class Test II (15 Marks)	05	10	00	00	00
Teachers Assessment (20 Marks)	00	05	00	05	00
ESE Assessment (60 Marks)	06	24	12	12	06

ET3002 : Lab Digital Communication	
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	Perform various pulse modulation and demodulation techniques
CO2	Perform various digital modulation and demodulation techniques
CO3	Use modern tools for simulation of modulation

List of Experiments

1.	Perform Pulse Amplitude Modulation
2.	Perform Pulse Width Modulation
3.	Perform Pulse Position Modulation
4.	Perform Time Division Modulation
5.	Perform Pulse Code Modulation and Demodulation
6.	Perform Delta Modulation and Demodulation
7.	Perform Adaptive Delta Modulation and Demodulation
8.	Perform Amplitude Shift Keying transmission and reception
9.	Perform Frequency Shift Keying transmission and reception
10.	Perform Phase Shift Keying transmission and reception
11.	Calculate BER for Digital Modulation Techniques
12.	Study of source coding and Shannon's Theorem

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S2	S2	S3
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	02	09	09	05
Practical Examination & Viva Voce (25 Marks)	02	09	09	05

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Exam and Viva-Voce**
S1	Imitation	02	02
S2	Manipulation	18	18
S3	Precision	05	05
S4	Articulation	00	00
S5	Naturalization	00	00
Total		25	25

Preparation (S1)	02	02
Conduct of Experiment (S2)	09	09
Observation and Analysis of Results (S3)	02	02
Record (S2)	09	09
Mini-Project / Presentation/ Viva-Voce (S3)	03	03
Total	**25**	**25**

ET3003: 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, addressing modes & instruction set of 8085 and 8051.
- To be proficient in Assembly and C Programming for Microprocessors
- To understand peripheral interface in microcontroller system
- To understand timing, interrupt control and exception handling

Course Outcomes:

After completing the course, students will be able to:

CO1	Describe the architecture, instruction set of microprocessors and microcontroller and peripheral interfacing concepts.	K1
CO2	Write programs in assembly language and embedded 'c'.	K3
CO3	Understand timers, interrupts and serial interfaces.	K2
CO4	Understanding AVR Microcontroller using Arduino	K3

Detailed Syllabus:

Unit 1	Differentiation between Microprocessors and Microcontrollers, Harvard and Von Neumann Architecture of Microprocessor, Typical Architecture of a Microprocessor- ALU, Accumulator, Register File, Address/ Data Bus, Program Counter, Stack, Stack Pointer, Instruction Register, Instruction Decoder, Memory Interface, Memory Mapped IO, Overview of 8085 Architecture, Address Modes, Timing Diagram, Instruction Set, Assembly Programming, Interrupt Handling, 8255 Programmable Peripheral Interface, 8253 Timer, Interface to Peripheral. RISC Vs. CISC Architecture
Unit 2	8051 and its peripherals, Intel 80X86 overview, Berkeley/ Stanford RISC Model, PIC Microcontroller Architecture, PIC Assembly Language Programming, PIC Program and Application Development using Embedded C

Unit 3	Introduction to Arduino Family, Understanding the Board, Serial Communication, Interface with sensors and actuators, Memory, LED Display and VGA Interface
Unit 4	Software Architecture, Introduction to C and Programming Basics, Arduino Drivers, Arduino Native Library, Functions, Math and Timing, Digital and Analog Interface, Serial Communication, LEDs, LCDs, Audio Input and Output, Networking using Ethernet, Bluetooth and Wi-Fi, External Memory Interface
Unit 5	Instruction level parallelism- Pipelining, Superscalar Architectures, Threading, Data Level Parallelism- Single Instruction Multiple Data (SIMD), Introduction to Snapdragon 802 SOCs- GPU, Audio Codec

Text Books

1. Microprocessor Architecture, Programming and Applications, Ramesh Gaonkar, Wiley Eastern Publication
2. The 8051 Microcontroller and Embedded Systems, M. A. Mazidi, Janice Gillispie Mazidi, PEARSON Education, ISBN 8178085747
3. PIC Microcontrollers- An Introduction to Microelectronics, 2ND ED, ELSEVIER, 2004, ISBN 0750662670
4. Embedded C Programming- Techniques and Applications of C and PIC MCU, Mark Siegesmund, ELSEVIER, 2014, ISBN 9780128013144
5. C Programming for Arduino, Julien Bayle, PACKT open source, 2013, ISBN 9781849517584

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Teacher's Assessment: Teachers Assessment of 20 marks is based on one of the / or combination of few of following

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

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test 1	Test 2	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	00	00	10
K2	Understand	10	05	05	30
K3	Apply	00	10	05	12
K4	Analyze	00	00	00	08
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	**K2**	**K2**	**K2**	**K4**
	C01	**C02**	**C03**	**CO4**
Class Test 1 (15 Marks)	05	10	00	00
Class Test 2(15 Marks)	00	05	10	00
Teachers Assessment (10 Marks)	00	05	05	00
ESE Assessment (60 Marks)	10	30	12	08

ET 3004 : Lab Microcontroller 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	Program 8051 using assembly language and Embedded "C" for arithmetic and logical Functions.
CO2	Program 8051 to interface ADC & DAC signal conversion
CO3	Implement the interfacing of various peripherals using 8051
CO4	Use of 8051 for data communication through parallel and serial port
CO5	Exploring AVR Microcontroller using Arduino

List of Experiments

Sr. No.	List of Experiments
1	Write and execute ALP for addition, subtraction, multiplication.
2	Write and execute ALP for transfer of memory block, sort numbers in ascending and descending order.
3	Study of 8255 PPI, write and execute ALP to study 8255 in different modes.
4	Interface peripherals to 8085(LED, Keyboard).
5	Practice IDE software and universal programmer to program 8051.
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
11	Experimenting with Arduino

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S2	S2	S2	S2
	CO1	CO2	CO3	CO4	CO5
Term Work (25 Marks)	03	06	04	06	06
Practical Examination & Viva Voce (25 Marks)	05	08	04	04	04

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	05	05
S2	Manipulation	20	20
S3	Precision	00	00
S4	Articulation	00	00
S5	Naturalization	00	00
Total		25	25

ET 3005 : Electronics Design Technology	
Teaching Scheme **Lectures: 3 Hrs/Week** **Total Credits: 04** **Tutorial: 02**	**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, take measurements of circuit behavior and performance.

Course Outcomes:

After completing the course, students will able to:

CO1	Understand the fundamentals of criteria for selection of components.
CO2	Design analog systems using ICs.
CO3	Develop the given application using Electronics Design concepts.

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 of Common Emitter Amplifier, CC Amplifier, Multistage Amplifier, Feedback Amplifier.
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 of Oscillators.** Principle, Classification, Design of Phase-shift, Wein-bridge, Colpit's, Hartley, Crystal Oscillators.

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:

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

1- High 2-Medium 3- 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) Design Project
6) Laboratory Work
9) Tutorials

Recommended Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**Test I**	**Test II**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	04	04	00	10
K2	Understand	05	05	03	25
K3	Apply	06	06	05	25
K4	Analyze	00	00	02	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1**	**K2**	**K3**
	C01	**C02**	**C03**
Class Test I (15 Marks)	04	05	06
Class Test II (15 Marks)	04	05	06
Teachers Assessment (10 Marks)	00	05	05
ESE Assessment (60 Marks)	10	25	25

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	Implement various electronics circuits.
CO2	Design and conduct simulation and experiments

List of Experiments:

Sr. No.	Details
1	To design Regulated Power Supply
2	To design Dual Tracking Regulator
3	To design Common Emitter Amplifier
4	To design two-stage Common Emitter Amplifier with RC coupling
5	To design Class A power amplifier
6	To design Class B power amplifier
7	To design Phase-shift and Wein-bridge Oscillator
8	To design Colpit's and Hartley Oscillator
9	To develop applications on Copper clad PCB using Electronic components.

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Recommended Assessment Pattern

Assessment Pattern Level No.	Skill Level	Term Work	Practical/Viva-voce
S1	Imitation	10	05
S2	Manipulation	10	10
S3	Precision	05	10
S4	Articulation	00	00
55	Naturalization	00	00
Total		25	25

Assessment Table

Assessment Tool	S2	S3
	CO1	CO2
Term Work (25 Marks)	10	15
Practical/Viva-voce(25 Marks)	10	15

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	Remember control system concepts
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, industry controllers, controllability and observability of control system.

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. Industrial controllers: P,PI,PD,PID
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	**State Space Analysis** 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.

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.

Mapping of Course outcome with Program Outcomes

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

1 – High **2 – Medium** **3 - Low**

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. Power point presentation of case studies
   d. Study of Industry processes and its presentation
3)

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test I	Test II	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	05	00	12
K2	Understand	10	10	05	30
K3	Apply	00	00	05	18
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
	Total	15	15	10	60

Assessment Table				
Assessment Tool	**K1**	**K2**	**K3**	**K2**
	CO1	**CO2**	**CO3**	**CO4**
Class Test I	05	05	00	05

Class Test II	05	05	00	05
Teachers Assessment	00	00	05	05
ESE Assessment	12	15	18	15

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
A	**Experiments based on MATLAB/ Lab VIEW** 1. Transient response of second order system. 2. Frequency response analysis control systems 3. Determination of characteristics of closed loop control system 4. State space representation of continuous time systems. 5. Stability Analysis Using Root Locus, Bode Plot, Nyquist plot
B	**Hardware implementation** 1. Design lead lag compensator using RC Network. 2. Analyzed the First order and second order System for step input using RC and RLC network. 3. Study of DC Motor Speed Control System.
C	**Experiments based on PLC Trainer Kit (BENIX Model-10, Allen-Bradly 1760-pico controller)** 1. Implement the water level control with ladder diagram 2. Implement logical functions with ladder diagram a. AND, OR, NAND, XOR, XNOR b. Output Latching 3. Implement logic for a warning light flashes when the counter reaches 10
D	**Application based on MATLAB/PLC Trainer Kit/Lab VIEW**

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S2	S3	S2
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	05	05	10	05
Practical Examination & Viva Voce (25 Marks)	10	05	05	05

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	05	10
S2	Manipulation	10	10
S3	Precision	10	05
S4	Articulation	00	00
S5	Naturalization	00	00
Total		25	25

Preparation (S1)	05	10
Conduct of Experiment (S2)	10	10
Observation and Analysis of Results (S3)	05	05
Mini-Project / Presentation/ Viva-Voce (S3)	05	00
Total	**25**	**25**

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 III, Engineering Mathematics IV

Course description:
This course in digital signal processing develops essential analysis and design techniques required for a broad range of disciplines. This course is an introduction to graduate-level courses in communications and signal processing. 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	Understand the basic theories behind and to be able to realize filter equations and DFT/FFT for practical applications (k1)
CO2	Learn to apply the linear systems approach to signal processing problems using high-level programming language; (k2)
CO3	Design digital filters on paper by using MATLAB, and implement the design using some simulation techniques. Apply their application to real implementation signal challenges (e.g. Speech, images) (k3)
CO4	Ability to program digital signal processing algorithms in C and MATLAB, including the design, implementation, and real-time operation of digital filters, and applications of the fast Fourier transform.(k2)
CO5	Understand the importance of signal processing is DSP processor architecture and its application in real time domain in communication, computer network, speech, image;(k2)
CO6	Understand the basic theory of wavelet transform and the concepts of using simple wavelets for simple applications

Detailed Syllabus:

Unit 1	**<u>Revision on the Discrete-time Systems and General Realization Techniques</u>** Basic definition of discrete-time signal. Sampling of continuous-time signal. Time invariance, causality, linearity, convolution. The z-transform and its inverse, delay property and its meaning in the time domain, frequency response and stability.

	Realization of digital filter structures, direct realization, canonic form, cascade and parallel realization of digital systems.
Unit 2	**Discrete Fourier Transform and Convolution** Convolutions and its applications, circular convolution, convolution by section, overlap-add method and overlap-save method. Fourier series and continuous-time Fourier transform. Discrete Fourier series and discrete Fourier transform (DFT), properties of the DFT, Fourier analysis using the DFT, convolution theorem, the fast Fourier transform (FFT) algorithm and implementation of the FFT. Wavelet Transform: Short-time Fourier transform, continuous wavelet theory, dyadic structure, discrete wavelet transform, wavelet and scaling functions, multi-resolution analysis, sample applications of wavelet transform.
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
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 of digital signal processors and DSP chips. 2. Adaptive digital filters: Concepts of adaptive filtering, basic Wiener filter theory, basic LMS adaptive algorithm. Application example. 3. Multirate digital signal processing: Concepts of multirate signal processing, design of practical sampling rate converters. Application examples.

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

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	2	1										3
CO2	2	2										
CO3		2	1		1							2
CO4						2	3					3
CO5			2		1	2						
CO6	3	2				2						

1 – High2 – Medium3 - Low

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

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test I**	**Test II**	**Teachers Assessment / Assignment**	**End Semester Examination**
K1	Remember	05	00	00	06
K2	Understand	10	10	05	42
K3	Apply	00	05	05	12
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K2	K2	K2
	C01	C02	C03	CO4	CO 5	CO 6
Class Test I (15 Marks)	05	10	00	00	00	00
Class Test II (15 Marks)	00	00	05	10	00	00
Teachers Assessment (10 Marks)	00	00	05	05	00	00
ESE Assessment (60 Marks)	06	12	10	12	12	08

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

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 /Rasberri 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	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3		3								
CO2		3		2								
CO3	2	2		1								
CO4				1		1					1	
CO5	2	1			1							
CO6			1			2	2					

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S2	S1	S4	S3	S2	S3
	CO 1	CO 2	CO3	C04	CO5	CO6
Term Work (25 Marks)	05	04	02	05	05	04
Practical Examination & Viva Voce (25 Marks)	05	02	02	10	03	03

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	08	08
S2	Manipulation	05	05
S3	Precision	10	10
S4	Articulation	02	02
S5	Naturalization	00	00
Total		25	25

ET3011: Computer Architecture and Organization	
Teaching Scheme **Lectures: 4Hrs/Week** **Total Credits: 04**	**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

	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

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

1 – High 2 – Medium 3 – 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

Recommended Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test-I**	**Test-II**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	05	00	10
K2	Understand	10	10	00	20
K3	Apply	00	00	05	25
K4	Analyze	00	00	05	05
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K2	K3
	CO1	CO2	CO3	CO4
Class Test – I (15 Marks)	05	10	00	00
Class Test – II (15 Marks)	00	00	10	05
Teachers Assessment (10 Marks)	00	00	05	05
ESE Assessment (60 Marks)	10	25	10	15

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 ARM architecture, serial communication protocols and RTOS concepts	K2
CO3	Interface different peripherals to ARM processor for engineering solutions and write RTOS routines.	K2
CO4	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
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:

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

1-High 2-Medium 3-Low

Teacher's Assessment: Teachers Assessment of 20 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

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test 1	Test 2	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	00	00	10
K2	Understand	10	05	05	30
K3	Apply	00	10	05	12
K4	Analyze	00	00	00	08
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment Table

Assessment Tool	K2	K2	K2	K4
	C01	C02	C03	CO4
Class Test 1 (15 Marks)	05	10	00	00
Class Test 2(15 Marks)	00	05	10	00
Teachers Assessment (10 Marks)	00	05	05	00
ESE Assessment (60 Marks)	10	30	12	08

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

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

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

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S2	S2
	CO1	CO2	CO3
Term Work (25 Marks)	03	18	04
Practical Examination & Viva Voce (25 Marks)	05	16	04

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	05	05
S2	Manipulation	20	20
S3	Precision	00	00
S4	Articulation	00	00
S5	Naturalization	00	00
Total		25	25

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.

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.

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

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

1 – High 2 – Medium 3 - 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

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test I	Test II	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	10	00	00	45
K2	Understand	05	05	10	15
K3	Apply	00	10	00	00
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K1	K1	K3	K2
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Class Test I (15 Marks)	03	03	04	00	05
Class Test II (15 Marks)	00	00	00	10	05
Teachers Assessment (10 Marks)	00	00	00	00	10
ESE Assessment (60 Marks)	10	10	12	13	15

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

(which 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

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

1 – High 2 – Medium 3 - Low

Assessment Pattern Level	**Knowledge Level**	Term Work	**Practical Viva – Voce**
S1	Imitation	05	05
S2	Manipulation	15	15
S3	Precision	05	05
S4	Articulation	00	00
S5	Naturalization	00	00
S1	Imitation	25	25

Assessment table:

Assessment Tool	**S1**	**S2**	**S3**
	CO1	**CO2**	**CO3**
Term work	05	05	15
Practical / Viva-voce	05	05	15

Preparation (S1)	05	05
Conduct of Experiment (S2)	10	11
Observation and Analysis of Results (S3)	03	03
Record (S2)	05	04
Mini-Project / Presentation/ Viva-Voce (S3)	02	02
Total	**25**	**25**