Electronics & Telecommunication Engineering Department

Curriculum: TE (E&TC)

Approved in 13th Academic Council held on 01/07/2016

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

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

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**	**TA**	**ESE**			
1	ET341	Instrumentation & Measurement	1,2,5	3	-	-	3	20	20	60	-	-	100
2	ET342	Microprocessor & Peripherals	1,2,3,4,5	3	-	-	3	20	20	60	-	-	100
3	ET343	Digital Signal Processing	1,2,3,5,6,7,12	3	1		4	20	20	60	-	-	100
4	ET344	Digital Communication	1,2,3,5	4	-	-	4	20	20	60	-	-	100
5	ET345	Object Oriented Programming	1,2,3,5,9	3	1	-	4	20	20	60	-	-	100
		LABORATORY COURSES											
6	ET346	Lab Instrumentation and Measurement & Object Oriented Programming	1,4,5	-	-	4	2	-	-	-	25	25	50
7	ET347	Lab Microprocessor & Peripherals	1,2,3,4,5	-	-	2	1	-	-	-	25	25	50
8	ET348	Lab Digital Signal Processing	1,2,4,6,11	-	-	2	1	-	-	-	25	25	50
9	ET349	Lab Digital Communication	1,3,4,5	-	-	2	1	-	-	-	25	25	50
10	ET350	Electronics Workshop - II	1,2,3,4,5	-	-	2	1	-	-	-	25	25	50
				16	**2**	**12**	**24**	**100**	**100**	**300**	**125**	**125**	**750**

SEMESTER-II

	THEORY COURSES												
Sr. No.	**Course Code**	**Subject**	**Programme Outcome**	**Scheme of Teaching (Hrs /Week)**			**Total Credits**	**Scheme of Evaluation (Marks)**					
								Theory			**Term Work**	**Practical/Viva-voce**	**Total**
				L	**T**	**P**		**Test**	**TA**	**ESE**			
1	ET351	Microcontroller Systems	1,2,3,4,5,11,12	3	-	-	3	20	20	60	-	-	100
2	ET352	Control Systems	1,2,3,5	4	-	-	4	20	20	60	-	-	100
3	ET353	Electronics Design Technology	1,2,3,9,11,12	3	1	-	4	20	20	60	-	-	100
4	ET354	Electromagnetic Engineering	1,2,3	3	1	-	4	20	20	60	-	-	100
5		Elective I											
	ET355	Introduction to VLSI Design	1,2,3,4,5,6,10	3	-	-	3	20	20	60	-	-	100
	ET356	Telematics	2,3,5	3	-	-	3	20	20	60	-	-	100
	ET357	CA & OS	1,2,3,6	3	-	-	3	20	20	60	-	-	100
	LABORATORY COURSES												
6	ET358	Lab Microcontroller Systems	1,2,3,4,5	-	-	2	1	-	-	-	25	25	50
7	ET359	Lab Control Systems	1,3,4,5,9,12	-	-	2	1	-	-	-	25	25	50
8	ET360	Lab Electronics Design Technology	1,3,4,5,9,10,12	-	-	2	1	-	-	-	25	25	50
9		Lab Elective I											
	ET361	Lab Introduction to VLSI Design	4,5,11,12	-	-	2	1	-	-	-	25	25	50
	ET362	Lab Telematics	4,5	-	-	2	1	-	-	-	25	25	50
	ET363	Lab CA & OS	2,3,4,5,6	-	-	2	1	-	-	-	25	25	50
10	ET364	Open Source Software	1,2,4,5,9	-	-	4	2	-	-	-	25	25	50
				16	**2**	**12**	**24**	**100**	**100**	**300**	**125**	**125**	**750**

Approved in 13th Academic Council held on 01/07/2016

GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD

(An Autonomous Institute of Government of Maharashtra)

Department of Electronics & Telecommunication Engineering

Teaching and Evaluation Scheme

TE (Part-Time) in Electronics & Telecommunication Engineering

THEORY COURSES													
Sr. No.	**Course Code**	**Subject**	**Programme Outcome**	**Scheme of Teaching (Hrs/Week)**			**Total Credits**	**Scheme of Evaluation (Marks)**					
								Theory			**Term Work**	**Practical/ Viva-voce**	**Total**
				L	**T**	**P**		**Test**	**TA**	**ESE**			
Semester I													
1	ET342	Microprocessor & Peripherals	1,2,3,4,5	3	-	-	3	20	20	60	-	-	100
2	ET343	Digital Signal Processing	1,2,3,5,6,7,12	3	1		4	20	20	60	-	-	100
3	ET344	Digital Communication	1,2,3,5	4	-	-	4	20	20	60	-	-	100
		LABORATORY COURSES											
4	ET347	Lab Microprocessor & Peripherals	1,2,3,4,5	-	-	2	1	-	-	-	25	25	50
5	ET348	Lab Digital Signal Processing	1,2,4,6,11	-	-	2	1	-	-	-	25	25	50
6	ET349	Lab Digital Communication	1,3,4,5	-	-	2	1	-	-	-	25	25	50
7	ET350	Electronics Workshop - II	1,2,3,4,5			2	1	-	-	-	25	25	50
		Total for Sem I		**10**	**1**	**08**	**15**	**60**	**60**	**180**	**100**	**100**	**500**
Semester II													
1	ET341	Instrumentation & Measurement	1,2,5	3	-	-	3	20	20	60	-	-	100
2	ET345	Object Oriented Programming	1,2,3,5,9	3	1	-	4	20	20	60	-	-	100
3	ET351	Microcontroller Systems	1,2,3,4,5,11,12	3	-	-	3	20	20	60	-	-	100
4	ET354	Electromagnetic Engineering	1,2,3	3	1	-	4	20	20	60	-	-	100
		LABORATORY COURSES											
5	ET346	Lab Instrumentation & Measurement and Object Oriented Programming	1,4,5	-	-	4	2	-	-	-	25	25	50
6	ET358	Lab Microcontroller Systems	1,2,3,4,5	-	-	2	1	-	-	-	25	25	50
		Total for Sem II		**12**	**2**	**06**	**17**	**80**	**80**	**240**	**50**	**50**	**500**
Semester III													
1	ET352	Control Systems	1,2,3,5	4	-	-	4	20	20	60	-	-	100
2	ET353	Electronics Design Technology	1,2,3,9,11,12	3	1	-	4	20	20	60	-	-	100
3		Elective I											
	ET355	Introduction to VLSI Design	1,2,3,4,5,6,10	3	-	-	3	20	20	60	-	-	100
	ET356	Telematics	2,3,5	3	-	-	3	20	20	60	-	-	100
	ET357	CA & OS	1,2,3,6	3	-	-	3	20	20	60	-	-	100
		LABORATORY COURSES											
4	ET359	Lab Control Systems	1,3,4,5,9,12	-	-	2	1	-	-	-	25	25	50
5	ET360	Lab Electronics Design Technology	1,3,4,5,9,10,12	-	-	2	1	-	-	-	25	25	50
6		Lab Elective I											
	ET361	Lab Introduction to VLSI Design	4,5,11,12	-	-	2	1	-	-	-	25	25	50
	ET362	Lab Telematics	4,5	-	-	2	1	-	-	-	25	25	50
	ET363	Lab CA & OS	2,3,4,5,6	-	-	2	1	-	-	-	25	25	50
7	ET364	Open Source Software	1,2,4,5,9	-	-	4	2	-	-	-	25	25	50

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		Total for Sem III		**10**	**1**	**10**	**16**	**60**	**60**	**180**	**100**	**100**	**500**

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

ET341: Instrumentation and Measurement Compulsory	
Teaching Scheme **Lectures: 3 Hrs /Week**	**Examination Scheme** **Test : 20 Marks** **Teachers Assessment : 20 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Physics, Basics of Electrical Engineering

Course description:

This course is electronics based course dealing with measurements and instrumentation designed for students in Electronics Engineering. It is a theory course based on the use of electrical and electronics instruments for measurements. The course deals with topics such as Principle of measurements, Errors, Accuracy, Units of measurements and electrical standards, Q- meters, Watt-meters, Digital voltmeters, recorders, Temperature controllers, the principles of operation of transducers used for measurement.

Course Objectives:

- To understand the operation of different instruments
- To familiarize with various measurement methods and electronic measurement equipment's
- To analyze the signals using different analyzers
- To introduce transduction methods

Course Outcomes

After completing the course, students will be able to:

CO1	Identify transducer, measuring method & electronic instruments for specific purpose.
CO2	Understand the various types of transducers, characteristics, their applications.
CO3	Explain different types of signal generators & signal analyzing instrument.
CO4	Illustrate various techniques for parameter measurement.

Detailed Syllabus:

Unit 1	**Instrumentation Basics** Introduction to measurements: Units and standards of measurement and their classification, Sensing and Transduction, Measurement system, Functional elements of instruments, Errors in measurements, Probability of errors, Static performance characteristics of measuring instruments, Classification of Instruments, IEEE standards of measurement.
Unit 2	**Electrical and Electronic Measurement** Measurement of Voltage, Current, AC /DC Bridges and their applications such as Wheatstone, Kelvin, Maxwell, Hay, Schering, Wein bridge measurement. Resistance, Inductance, Capacitance, Power, Energy, Phase, Frequency measurement.
Unit 3	**Transducer** Transducer elements: Definition, classification, selection criterion. Signal conditioning, Photo devices, Piezoelectric transducers, RTD, Thermocouple, Thermistor, LVDT, Resistive, Capacitive and Inductive Transducers, Hall Effect transducer. Flow, Viscosity, Humidity, Pressure measurement, strain gauge.

Unit 4	**Basic Parameter Measurement by Electronic Instrumentation** Sampling and vector voltmeter, Sync. detector, Sound level measurement, AC voltmeters using rectifiers, True RMS voltmeters, Digital voltmeter, Vector voltmeter, Q-meter, Electronic multi meter, RF power/Voltage measurement, Recorders.
Unit 5	**Signal Analysis Instrumentation** Signal generators, CRO- principle and its working, Dual trace CRO, DSO, Specifications of generator, CRO, Wave analyzers, Harmonic distortion analyzer, Spectrum analyzer logic & signature analyzer, Network Analyzer, Automated measurement system.

Text and Reference Books

1. Cooper and Helfrick, Modern Electronic Instrumentation and Measurements, Prentice-Hall of India
2. Kalsi, Electronic Instrumentation and Measurements, TMH
3. Oliver & Cage, Electronic Measurements and Instrumentation, McGraw Hill
4. J.J. Carr, Elements of Electronics Instrumentation and Measurement Handbook, Pearson Education, 3rd Edition
5. B.C. Nakra and K.K. Chaudhary, Instrumentation Measurement and Analysis, Tata McGraw Hill, 2nd Edition

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	2	2										
CO3	2	2			2							
CO4	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) Simulation
2) Power point presentation of case studies
3) Question & answer / Numerical solution
4) Study of Industry processes and its presentation

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	00	10
K2	Understand	15	20	50
K3	Apply	00	00	00
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 100		20	20	60

Assessment table

Assessment Tool	**K1**	**K2**	**K2**	**K2**

	CO1	CO2	CO3	CO4
Class Test (20 Marks)	05	15	00	00
Teachers Assessment (20 Marks)	00	05	10	05
ESE Assessment (60 Marks)	10	15	15	20

Designed by - Prof. S.B. Gundre

ET346: Lab Instrumentation & Measurement and OOP	
Teaching Scheme **Practical: 4 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 simple programs in C++ language using classes, constructor and destructor, static, new and delete.
CO2	Clarify the use of features of object oriented programing using C++.
CO3	Implement the characteristics of transducers.
CO4	Perform experiments for parameter measurements by different instruments.

List of Experiments

Instrumentation and Measurement	
1	Identify unknown resistance with Wheatstone bridge
2	Measure the values of various inductors, capacitors and resistors
3	Plot LVDT characteristics
4	Plot Temperature , Pressure Transducer characteristics
5	Study Flow measurement
6	Study Strain measurement
7	Study DC voltmeter
8	Study of CRO and measurements
9	Study of signal generators
10	Measurements using digital storage Oscilloscope
11	Study of spectrum analyzer and measurements
Object Oriented Programming	
1	Program using Class definition
2	Program using the concept of accessing member functions defined in private section of class
3	Program using Constructors
4	Program using Destructors
5	Program using static data members and static member functions

6	Program using friend function
7	Program using new and delete operator
8	Program using friend class
9	Program using function overloading
10	Program using operator overloading
11	Program using single Inheritance
12	Program to demonstrate how ambiguity is avoided using scope resolution operator in the following inheritance (a) single inheritance (b) multiple inheritances
13	Program using virtual functions
14	Program using file handling functions

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S2	S2	S2	S2
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	06	06	06	07
Practical Examination & Viva Voce (25 Marks)	06	06	06	07

Assessment Pattern

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

ET342: Microprocessor& Peripherals Compulsory	
Teaching Scheme **Lectures: 3 Hrs/Week**	**Examination Scheme** **Test : 20 Marks** **Teachers Assessment : 20 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Digital Electronics

Course Objectives:

- To get acquainted with architecture of 8085 & 8086
- To understand the addressing modes & instruction set of 8085 & 8086 and concepts of Assembly Language Programming.
- To develop understanding of interrupt structure and serial I/O section.
- To understand interfacing of different peripherals to 8085 based system.

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

CO1	Describe the architecture and instruction set of microprocessors.
CO2	Write structured, well-commented, understandable programs in assembly language and also debug them.
CO3	Use interrupts for handshaking and data transfer protocols.
CO4	Interface I/O devices and memory to microprocessor.
CO5	Distinguish between single processor and multiprocessing modes.

Detailed Syllabus:

Unit 1	**Introduction** Overview of Microprocessor System, Microprocessor basic architecture, Harvard and Von Neumann architecture, Organization of microprocessor based system, 8085 architecture, pin diagram, functional block diagram, Address & Data Bus, de-multiplexing, generation of control signals. Memory Interfacing: classification of memories, Interface design, Design of decoder, Memory map, I/O Interfacing using Buffers & Latches, I/O Mapped I/O and Memory mapped I/O
Unit 2	**Assembly Language Programming** Instruction classification, Addressing modes, Data transfer operations, Arithmetic & Logic operations, Branch operations, writing of simple assembly language programs, Instruction cycles, machine cycles and T states. Instruction classification, Addressing modes, Data transfer operations, Arithmetic & Logic operations, Branch operations, writing of simple assembly language programs, Instruction cycles, machine cycles and T states.
Unit 3	**Interrupts** Interrupt and Interrupt Structure, Interrupt related instructions, stacks, subroutines, CALL & RET instructions, Basics concepts in serial I/O, 8085 serial I/O lines.
Unit 4	**Peripheral Devices** Features, operating modes and working of 8255 programmable peripheral interface, 8253 programmable interval timer, 8259 programmable interrupt controller, 8251 USART, ADC 0809 and DAC 0808. Interfacing to LED, key, optocoupler, relay and stepper motor
Unit 5	**Introduction to 8086** Functional block diagram, architecture, pin configuration, segmentation, minimum mode, maximum, addressing modes and Introduction to 8086 assembly language programming

Text and Reference Books

1. Ramesh Gaonkar, Microprocessor Architecture, Programming and Applications, Wiley Eastern Publication
2. B. Ram, Fundamentals of Microprocessors And Microcomputers, Tata McGraw Hill Publication
3. K.L. Short, Microprocessor And Programmed Logic, Pearson Education, 2nd Edition
4. Microcomputer systems: The 8086 Family Yu-Cheng Liu & Glenn A Gibson.
5. The Intel Microprocessor by Berry B Brey Pearson

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3										
CO2			2	2								
CO3	2	2			3							
CO4	3	2		2								
CO5	3	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) Simulation
2) Application development
3) Power point presentation of case studies
4) Question & answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini projects

Assessment Pattern

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

Assessment table

Assessment Tool	**K1**	**K1**	**K3**	**K3**	**K2**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Class Test (20 Marks)	05	05	03	02	05
Teachers Assessment (20 Marks)	03	02	05	05	05
ESE Assessment (60 Marks)	10	10	08	07	25

Designed by: Prof. R.P. Chaudhari

ET347: Lab Microprocessor & Peripherals	
Teaching Scheme **Practical: 2Hrs/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	Program Programming 8085 using assembly language programming for arithmetic and logical functions
CO2	Program 8085 to interface ADC & DAC signal conversion
CO3	Use of 8085 microprocessor for process control
CO4	Use of 8085 for data communication through parallel and serial port

List of Experiments

No.	**List of Experiments**
1	Study of 8085 microprocessor system
2	Write and execute ALP to sort given number in ascending and descending order
3	Write and execute ALP for transfer of memory block
4	Write and execute ALP for addition, subtraction, multiplication and division
5	Write and execute ALP for generate decimal counter
6	Study of ADC & DAC interface to 8085 microprocessor, write and execute ALP for ADC, DAC
7	Study of Stepper motor interface to 8085 microprocessor, write and execute
8	Study of interrupt structure of 8085, write and execute ALP to initialize 8259 PIC and execute interrupt subroutine
9	Study of 8255 PPI, write and execute ALP to study 8255 in different modes

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S2	S3	S3	S2
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	05	10	05	05

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Practical Examination & Viva Voce (25 Marks)	10	05	05	05

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**
S1	Imitation	--
S2	Manipulation	10
S3	Precision	15
S4	Articulation	--
S5	Naturalization	--
Total		**25**

Preparation (S1)	--
Conduct of Experiment (S2)	10
Observation and Analysis of Results (S3)	05
Record(S2)	05
Viva-Voce (S3)	05
Total	**25**

ET343: Digital Signal Processing Compulsory	
Teaching Scheme **Lectures: 3 Hrs/Week** **Tutorials : 1Hr/Week**	**Examination Scheme** **Test : 20 Marks** **Teachers Assessment : 20 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

Course Objectives:

- To introduce the concept of analyzing discrete time signals and systems in time and frequency domain
- To gain experience in design and implementation of digital filters and spectral analyzers and in their application to real signals (e.g. Speech, images)

Course Outcomes

After completing the course, students will be able to:

CO1	Analyze and implement digital signal processing systems in time domain and frequency domain
CO2	Compute the Fourier transform ,the discrete Fourier transform (DFT) , Fast Fourier Transform (FFT) of discrete-time signals , Multi Rate signal Processing
CO3	Design and implementation of IIR and FIR filters and in their application to real signals (e.g. Speech, images)
CO4	Understand various transform in discrete domain
CO5	Demonstrate applications on Digital Signal Processors

Detailed Syllabus:

Unit 1	**Fourier Analysis:** Distinguishing Fourier transform of discrete singular & discrete Fourier transform, Discrete Fourier series, Phase and amplitude spectra, Properties of Discrete Fourier Transform, Linear Convolution of sequence using DFT, Frequency domain representation of discrete time system DTFT and DFT, Computation of DFT. Fast Fourier transform: Radix- 2 decimation in time and decimation in frequency FFT algorithms, Inverse FFT. Introduction to signal space, orthogonal basis and signal representation using unitary transforms like DFT,DCT, Haar and Walsh transform
Unit 2	**IIR FILTER** Design of Butterworth Chebyshev filters, IIR filter design by impulse invariant bilinear transformation, impulse invariance method, step invariance method
Unit 3	**FIR FILTERS**

	Characteristics of FIR Digital Filters. Frequency response, comparison of FIR, IIR filters -Window techniques, Design of these filters, using -Rectangular, Hamming, Bart let, Kaiser windows
Unit 4	**Multirate DSP** Introduction, Decimation, Interpolation, Sampling rate conversion: Filter Design and implementation, Multistage Implementation, Band Pass Signal, Arbitrary factor Application of Multirate Signal Processing, Introduction to Wavelet Transforms
Unit 5	**Digital Signal Processors** Introduction, Architecture, Features, Addressing Formats, Functional modes, Introduction to Commercial Processors Architecture and features of TMS 320F/2047 and ADSP signal processing chips, Applications of DSP

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,J 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							
CO4						2	3					3
CO5			2		1	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) 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	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	00	00	12
K2	Understand	10	05	18
K3	Apply	05	05	12
K4	Analyze	05	10	18
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 100		20	20	60

Assessment table

Assessment Tool	K4	K2	K3	K2	K2
	C01	C02	C03	CO4	CO5
Class Test (20 Marks)	05	10	05	00	00
Teachers Assessment (20 Marks)	03	07	08	02	00
ESE Assessment (60 Marks)	18	08	18	06	10

Special Instructions if any: Nil

Designed by: N. R. Kolhare

ET348: Lab-Digital Signal Processing	
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 using MATLAB/CCS/IDE, students will be able to:

CO1	Compute and demonstrate convolution and correlation
CO2	Implement and test FIR filters, IIR filters and DFT, FFT based frequency response
CO3	Use MATLAB and CCS software for DSP system analysis and design
CO4	Demonstrate application using DSP processor in real time

List of Experiments

Sr. No.	Details
1	Program for linear convolution
2	Program for Circular convolution
3	Program for Autocorrelation, Cross correlation
4	Program for DFT, IDFT, FFT
5	Design and implement of FIR filter
6	Design and implement of III filter
8	Program for Sampling and waveform generation
9	Program for Voice codec
10	Program for Adaptive filtering
11	Program for Wavelet Transform

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	

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S2	S1	S4	S3
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	05	08	02	10
Practical Examination & Viva Voce (25 Marks)	05	08	02	10

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

ET344: Digital Communication Compulsory	
Teaching Scheme **Lectures: 4 Hrs/Week**	**Examination Scheme** **Test : 20 Marks** **Teachers Assessment : 20 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. Information theory 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 information theory

Course Outcomes:

After completing the course, students will be able to:

CO1	Define basic concepts of information theory, pulse and digital communication system
CO2	Understand the fundamentals of digital communication link
CO3	Illustrate pulse modulation, digital modulation techniques
CO4	Interpret the significance of noise in transmission and error in received signal
CO5	Analyze the performance of pulse and digital modulation techniques

Detailed Syllabus:

Unit 1	Pulse amplitude modulation and Time division multiplexing, Pulse width and Pulse position modulation, Quantization, Pulse code modulation: 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	Baseband signal receiver, probability of error, optimum receiver for both, baseband and pass band, optimal coherent reception: PSK, FSK, QPSK. Signal space representation and probability of error, comparison of modulation system.
Unit 4	PCM transmission, DM transmission, comparison of PCM, DM and Space Shuttle ADM
Unit 5	Discrete messages and information content, Source coding, Shannon's theorem, Mutual Information and channel capacity

Text and Reference Books

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

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	2	2	2		3							
CO4	1	2	2									
CO5	1	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. Question & answer / Numerical solution
2. Simulation
3. Power point presentation of advanced topics
4. Visit to manufacturing processes plants and BSNL
5. Mini projects
6. Survey

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	04	00	06
K2	Understand	16	10	30
K3	Apply	00	10	24
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 100		20	20	60

Assessment table

Assessment Tool	K1	K2	K2	K3	K3
	CO1	CO2	CO3	CO4	CO6
Class Test (20 Marks)	04	08	08	00	00
Teachers Assessment (20 Marks)	00	05	05	05	05
ESE Assessment (60 Marks)	06	12	18	12	12

Special Instructions if any: Nil

Designed by: Dr. A. S. Bhalchandra

ET349 : 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	Calculate BER for digital modulation technique
CO2	Perform various digital modulation and demodulation techniques
CO3	Perform various pulse modulation and demodulation techniques
CO4	Use modern tools for simulation of modulation

List of Experiments

Sr. No.	Details
1	To generate Pulse Amplitude Modulated signals
2	To generate Pulse Width Modulated signals
3	To generate Pulse Position Modulated signals
4	To generate and receive Time Division Multiplexed signals
5	To generate and receive Pulse Code Modulated signals
6	To generate and receive Delta Modulated signals
7	To generate and receive Adaptive Delta Modulated signals
8	To generate and receive Amplitude Shift Keying
9	To generate and receive Frequency Shift Keying
10	To generate and receive Phase Shift Keying
11	Study of source coding, Shannons 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)	03	09	09	04

Assessment Pattern

Assessment Pattern Level No.	Skill Level	Term Work	Practical Exam and Viva-Voce
S1	Imitation	02	03
S2	Manipulation	12	11
S3	Precision	11	11
S4	Articulation	00	00
S5	Naturalization	00	00
Total		25	25

Preparation (S1)	02	03
Conduct of Experiment (S2)	10	09
Observation and Analysis of Results (S3)	02	02
Record (S2)	06	05
Mini-Project / Presentation/ Viva-Voce (S3)	05	06
Total	**25**	**25**

ET345: Object Oriented Programming Compulsory	
Teaching Scheme **Lectures: 3 Hrs/Week** **Tutorial: 1 Hr/ Week**	**Examination Scheme** **Test : 20 Marks** **Teachers Assessment : 20 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Basic knowledge of C programming

Course description:
After completion of this course student will have broad knowledge of object oriented programming. The course fully covers the basics of programming in the C++ programming language and presents the fundamental notions and techniques used in object-oriented programming. Topics covered include fundamentals of C++ programming, classes and objects, inheritance, polymorphism and file handling.

Course Objectives:

- To provide platform for design and implementation of simple computer programs in C++.
- To present the syntax of the C++ language as well as basic data types offered by the language.
- To discuss the features of the object-oriented language and its implementation in C++.
- To demonstrate the use of C++ language in solving engineering problems.

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

CO1	Define principles of modularity, encapsulation, information hiding, abstraction, Polymorphism, inheritance and file handling.
CO2	Familiarize C++ language for writing and executing of programs.
CO3	Explain object-oriented concepts and features of the C++ programming language.
CO4	Apply object oriented programming concepts in design and implementation of programs for a given problem.
CO5	Develop algorithms for engineering problems.

Detailed Syllabus:

Unit 1	**Object Oriented Paradigm:** Structured versus Object oriented development, Elements of OOP, Objects, Classes, Encapsulation, Inheritance, Polymorphism, Message communication
Unit 2	**Classes and Objects:** Class specification, Class objects, Member access, Defining member functions, Constructors and Destructors, Copy Constructor, Nested classes, array of an object, Passing and returning objects as arguments, Static data members, Static member functions, Friend functions
Unit 3	**Inheritance :** Definition of inheritance, protected data, private data, public data, inheriting constructors and destructors, constructors and destructors of derived classes, types of inheritance, single inheritance, hierarchical inheritance, multiple inheritance, hybrid inheritance
Unit 4	**Polymorphism:** Function overloading, Overloading unary operators, Overloading binary operators, New, Delete operator, this pointer, virtual and pure virtual functions

Unit 5	**File Handling:** Components of a file, different operation of the file, creation of file streams, updating of file, opening and closing a file, file pointers and their manipulations, functions manipulation of file pointers

TEXT AND REFERENCE BOOKS

1. B. Stroustrup, "C++ Programming Language", 3rd Edition, Pearson Education.
2. Herbert Schildt: *The Complete Reference C++*, 4th Edition, Tata McGraw Hill, 2003.
3. Paul J De i t e l, Harvey M Deitel: *C++ for Programmers*, Pearson Education, 2009.
4. Stanley B. Lippmann, Josee Lajore: *C++ Primer*, 4th Edition, Pearson Education, 2005
5. Cohoon and Davidson, "C++ Program Design: An introduction to Programming and Object-Oriented Design" 3rd Edition, Tata McGraw Hill. 2003.
6. K.R. Venugopal et al., "*Mastering C++",* Tata McGraw Hill Pub.
7. Resources available on "http://www.e-gecaect.com "e-learning environnement.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	2											
CO3	2											
CO4	1	3	3		1							
CO5	1	3			1				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) Simulation
2) Application development
3) Power point presentation of case studies
4) Question & answer / Numerical solution
5) Mini projects

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	00	12
K2	Understand	10	00	36
K3	Apply	05	20	12
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 100		20	20	60

Assessment table

Assessment Tool	K1	K2	K2	K3	K3
	CO1	CO2	CO3	CO4	CO5
Class Test (20 Marks)	05	05	05	05	00
Teachers Assessment (20 Marks)	00	00	00	10	10
ESE Assessment (60 Marks)	12	18	18	06	06

Special Instructions if any: Nil

Designed by: Prof. S.D. Bharkad

Approved in 13th Academic Council held on 01/07/2016

ET350 : Electronics Workshop II Compulsory	
Teaching Scheme **Lectures: 2 Hrs/Week**	**Examination Scheme** **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

Course Outcome	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

Assessment Pattern Level No.	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
Total Marks 25		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**

Designed by - Prof. P. H. Bhagat

ET351: Microcontroller Systems Compulsory	
Teaching Scheme **Lectures: 3 Hrs/Week**	**Examination Scheme** **Test : 20 Marks** **Teachers Assessment : 20 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Digital Electronics, Microprocessor & Peripherals

Course Objectives:

- To get acquainted with architecture of 8051& ARM architecture
- To understand the addressing modes & instruction set of 8051 and concepts of Assembly Language Programming and Embedded 'C'.
- To develop understanding of timer, interrupt structure and serial I/O section.
- To understand interfacing of different peripherals to 8051 based system.
- To develop insight into ARM architecture and derivatives of 8051

Course Outcomes

After completing the course, students will be able to:

CO1	Describe the architecture and instruction set of microcontrollers.
CO2	Write structured, well-commented, understandable programs in assembly language & embedded 'C' and also debug them.
CO3	Use I/O, interrupts, timer and serial section of microcontroller
CO4	Interface I/O devices and memory to microcontroller
CO5	Use derivatives of 8051

Detailed Syllabus:

Unit 1	**Introduction** Comparison of microprocessor and microcontroller, Different types of microcontrollers: Embedded microcontrollers, Processor Architectures: Harvard v/a Von Neumann, CISC v/s RISC, Architecture and pin functions of 8051, CPU timing and machine cycles, Internal Memory Organization, Program Counter and stack, Input / Output ports.
Unit 2	**Assembly and Embedded 'C' Language Programming** Instruction set of 8051, instruction format, classification of instructions, addressing modes-Groups of instructions, data transfer, arithmetic, logical, branch ,Boolean instructions. Difference between assembly and C language programming, C compiler for 8051,Simple programs using assembly and 'C', I/O ports Programming, Time delay generation using C.
Unit 3	**Peripherals of 8051** Counters and Timers, Serial data input and output, Interrupts, Power saving modes, Interfacing keyboard and display devices, LED, 7-segment LED, LCD, relay, optocoupler, stepper motor, ADC, DAC
Unit 4	**Introduction to ARM Processor** ARM family architecture, Register architecture, Memory access and addressing modes, Arithmetic and Logical instructions, Branching instructions, Thumb instruction set
Unit 5	**Derivatives of 8051** Comparative study of salient features of 8051 02and its derivatives like 89C51, 89C52, 89C2051 AND 89C2052 Current processor and controller survey. (cost, availability, popularity)

TEXT AND REFERENCE BOOKS

1. Mazidi and Mazidi, 8051 Micro controller,PHI
2. Kenneth J.Ayala, 8051 Micro controller, West Publishing Company
3. MykePredko, Programming customizing the 8051 Microcontroller, TMH
4. Udayashankara V, Mallikarjunaswamy, 8051 Microcontroller, TMH
5. Steve Ferber, ARM system-on-chip architecture, 2e, Pearson education.
6. Andrew Sloss, Dominic Symes, ARM system Developer's Guide: Designing and Optimizing System Software, Morgan Kaufmann Publishers

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Teacher's Assessment: Teachers Assessment of 50 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Question & answer / Numerical solution
4) Study of Industry processes and its presentation
5) Mini projects

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	10	04	06
K2	Understand	10	06	36
K3	Apply	00	10	18
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 100		20	20	60

Assessment table

Assessment Tool	K1	K2	K3	K2	K2
	CO1	CO2	CO3	CO4	CO5
Class Test (20 Marks)	10	10	00	00	00
Teachers Assessment (20 Marks)	04	03	10	03	00

ESE Assessment (60 Marks)	06	12	18	12	12

Special Instructions if any: Nil

Designed By: R.P. Chaudhari

ET358: 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 be 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

List of Experiments

1	Arithmetic, logical and other programs using assembly language
2	Array manipulation programs using assembly language
3	LED & 7-segment interface
4	Keyboard, relay and optocoupler interface
5	ADC interface
6	DAC interface
7	Stepper Motor interface
8	Basic Programs using Embedded 'C'
9	Program the peripherals of 8051 using Embedded 'C'

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S2	S3	S3	S2
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	05	10	05	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	00	00
S2	Manipulation	10	15
S3	Precision	15	10

S4	Articulation	00	00
S5	Naturalization	00	00
Total		25	25

ET352: Control Systems Compulsory	
Teaching Scheme Lectures: 4 Hrs/Week	**Examination Scheme Test : 20 Marks Teachers Assessment : 20 Marks End Semester Exam : 60 Marks**

Prerequisites: Basic knowledge of signals and systems, mathematical basics like Laplace transform

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 Observability of the Systems.

Course Outcomes

After completing the course, students will be able to:

CO1	Identify time and frequency response of first order and second order systems.
CO2	Describe control system fundamentals.
CO3	Explain compensating circuits.
CO4	Apply concept of stability and its various methods.
CO5	Analyze circuits in state space.

Detailed Syllabus:

Unit 1	**Introduction** Mathematical models of physical system, 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, servomotor control.
Unit 2	**Time response analysis** Standard test signals, time response of second order system, steady state Error constants, design specifications of second order system, preliminary design considerations of compensators need of compensation, lead compensations, lag compensation, lag-lead compensation.
Unit 3	**Stability Analysis** Concept of stability, condition of stability, characteristic equation, relative stability, Routh-Hurrwitz 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 zero's 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, observability.

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		3			3							
CO4	1		2									
CO5		1	2		2							

1 – High **2 – Medium** **3 - Low**

Teacher's Assessment: Teachers Assessment of 20 marks is based on

1) Assignment of 20 Marks is based on state space, stability, system characteristics, and analysis of given electronic circuits.
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

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	00	05
K2	Understand	15	05	30
K3	Apply	00	05	20
K4	Analyze	00	10	05
K5	Evaluate	00	00	00

K6	Create	00	00	00
Total Marks 100		20	20	60

Assessment table

Assessment Tool	**K1**	**K2**	**K2**	**K3**	**K4**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Class Test (20 Marks)	05	10	05	00	00
Teachers Assessment (20 Marks)	00	05	00	05	10
ESE Assessment (60 Marks)	05	15	15	20	05

Designed by: Prof. S.R. Kulkarni

ET359: Lab Control Systems	
Teaching Scheme **Practical: 2Hrs/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	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/ LabVIEW** 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/LabVIEW**

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**

ET353: Electronic Design Technology Compulsory	
Teaching Scheme **Lectures: 3 Hrs /Week** **Tutorials: 1 Hr /Week**	**Examination Scheme** **Test : 20 Marks** **Teachers Assessment : 20 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Electronic Devices and Circuits, Digital Electronics, Instrumentation.

Course description: This course covers the designing of various analog and digital electronic systems and its application with available components in the market.

Course Objectives:

- To provide an overview of the fundamentals and designing of the analog and digital systems.
- To provide an overview of designing of preamplifiers, power amplifier and various signal generator circuits using IC.

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand the fundamentals of criteria for selection of components, PCB design, Heat Dissipation and Electronics Design.
CO2	Design regulated power supply, analog systems, instrumentation systems and digital circuits using IC.
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, study of their ratings, characteristic parameters, commercial nomenclatures and criteria for selection (Like R, L, C, transformers, diodes, transistors etc.), Components mounting, Heat sinks, Heat sink design, PCB selection and design criteria.
UNIT 2	**Regulated Power Supply Design** Regulated power supply design using half wave and full wave rectifier, L and π filter design, Series regulator design using transistor, Regulator design using IC78XX, 79XX, IC LM317 series, Switched mode power supply design using IC78S40 etc.
UNIT 3	**Design of Analog systems** Design of amplifiers, preamplifiers, power amplifiers using IC, Design of low pass, High pass and band pass filters using op-amp and IC's for audio and instrumentation purpose, Design of signal generators for generating square wave, sinusoidal wave and triangular wave using IC's.
UNIT 4	**Design of Instrumentation Systems:** Design of Instrumentation amplifier, signal transmitter circuits. Design of industrial data acquisition system, ADC/DAC using IC, Design of Timers, temperature controllers using P,PI and PID controller, Design of driver circuits for relays, stepper motors.
UNIT 5	**Design of Digital systems** Design of digital circuits using IC's like counters, MUX, DEMUX, Parity generator and detector.

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. Bowans, "Digital Instrumentation", TMH Publications
4. William Fletcher, "An Engineering Approach to Digital Design", PHI
5. Monogram by CEDT, IISc Bangalore, "Thermal Design of Electronic Equipment"
6. Waller C. Bosshart , "PCB Design & Technology", TMH
7. Bert Haskell, "Portable Electronics Product Design and Development", MGH Publication
8. Mohammed H. Rashid, "Spice for circuits & Electronics using Pspice",PHI

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	1	3	2								3	
CO3	1	2	2						3		2	3

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) Simulation
2) Application development
3) Power point presentation of case studies
4) Question & answer / Numerical solution
5) Study of Industry processes and its presentation
6) Design Project
7) Quizzes
8) Laboratory Work
9) Tutorials

Recommended Assessment Pattern:

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

Assessment table:

Assessment Tool	**K1**	**K2**	**K3**	**K3**
	CO1	**CO2**	**CO2**	**CO3**
Class Test (20 Marks)	05	05	05	05

Teachers Assessment (20 Marks)	00	05	10	05
ESE Assessment (60 Marks)	10	25	15	10

Designed by: Prof. A.S. Kalambe

ET360- Lab Electronics Design Technology	
Teaching Scheme **Practical: 2Hrs/Week**	**Examination Scheme** **Term Work : 25 Marks** **Practical/Viva-Voce : 25 Marks**

Laboratory Course Outcomes:

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

CO1	Implement and analyze various electronics circuits.
CO2	Communicate technical information by means of written and oral reports.
CO3	Apply theory to implement various circuits.
CO4	Demonstrate the practical.

List of Experiments:

Sr. No.	**Details**
1	To design Regulated Power Supply
2	To design Dual Tracking Regulator
3	To design Filters(Low pass filter, Band pass filter, High pass filter)
4	To design signal generator circuit using IC
5	To design power amplifier using IC
6	To design IC based Counter circuit
7	To design parity generator and detector using IC
8	To design Preamplifier circuit
9	To design of Active tone control using Op-amp
10	Study of ADC and DAC
11	Study of Data Acquisition System for parameters like : Temperature, Pressure, Humidity, Light

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S2	S2	S3
	CO2	CO1	CO3	CO4

Term Work (25 Marks)	10	05	05	05
Practical/Viva-voce(25 Marks)	05	05	05	10

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
S5	Naturalization	00	00
Total		25	25

Preparation (S1)	04	04
Conduct of Experiment (S2)	06	06
Observation and Analysis of Results (S3)	06	06
Record (S2)	04	04
Mini-Project / Presentation/ Viva-Voce (S3)	05	05
Total	**25**	**25**

Designed by: Prof. A.S. Kalambe

ET354: Electromagnetic Engineering Compulsory	
Teaching Scheme **Lectures: 3 Hrs/Week** **Tutorial: 1 Hrs/Week**	**Examination Scheme** **Test : 20 Marks** **Teachers Assessment : 20 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 analyze
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	**Magnetostatics** 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 20 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
6) Mini projects

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	15	10	45
K2	Understand	05	10	15
K3	Apply	00	00	00
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 100		20	20	60

Assessment table

Assessment Tool	K1	K1	K1	K1	K2
	CO1	CO2	CO3	CO5	CO4
Class Test (20 Marks)	3	4	4	4	5
Teachers Assessment (20 Marks)	2	2	3	3	10
ESE Assessment (60 Marks)	10	10	12	13	15

ET355: Introduction to VLSI Design **Elective**	
Teaching Scheme **Lectures: 3 Hrs/Week**	**Examination Scheme** **Test : 20 Marks** **Teachers Assessment : 20 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Digital Electronics

Course description: This course introduces the concept of hardware design and implementation using Hardware Description Languages like VHDL. Students also learn about the architectures of different Programmable Logic Devices like PAL, PLA, PLD, FPGA etc. An introduction to CMOS design is provided by giving an exposure to quality metrics and static and dynamic behavior of CMOS inverter and gate.

Course Educational Objectives:

- To introduce the fundamental principles of VLSI circuit design
- To acquaint them with integrated circuit designing using CAD tools and Hardware Description Languages
- To explain architectures of different programmable devices.
- To elaborate behavior of CMOS gate and CMOS inverter**.**
- To give exposure for designing combinational logic gates in CMOS

Course Outcomes

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

CO1	Identify the different process steps in HDL design flow.
CO2	Develop dataflow, behavioral and structural models for digital circuits using hardware description like VHDL and simulate them
CO3	Understand architectures of programmable devices, quality metrics of a digital design and operation of CMOS device.
CO4	Model the static and dynamic behavior of CMOS gate and inverter
CO5	Implement, synthesize and simulate digital systems on programmable devices like FPGA, CPLD *etc* / CMOS design

Detailed Syllabus

Unit 1	Introduction to HDL, VHDL, Levels of Abstraction, Language Constructs, Library, Entity, Architecture, Modeling styles, Signals and variables, Sequential and concurrent statements, Process Statement, Assertion Statement, Sequential Wait Statements, Synthesis and simulation concept
Unit 2	Combinational and Sequential Circuit Design: VHDL implementation of full adders, carry look ahead adder, Subtractor, ALU, Decoder, Encoder, Multiplier, Comparator, Barrel Shifter, code converters, registers, shift registers and counters.
Unit 3	Introduction to Programmable Logic Devices: PAL, PLA, PLD, Architecture of CPLD and FPGA. Case Studies: Xilinx XC9500 CPLD series and XC4000 FPGA , Review of SPARTAN and VIRTEX FPGA Series
Unit 4	Issues in digital IC design; Quality metrics of a digital design, CMOS inverter: static CMOS

	inverter, Robustness of CMOS inverter; Static and Dynamic performance of CMOS inverter
Unit 5	Designing combinational logic gates in CMOS: Static CMOS design; Dynamic CMOS design, Perspectives.

TEXT AND REFERENCE BOOKS

1. Charles Roth, "Digital Design with VHDL", Thomson Learning, India Edition
2. John Wakerly, "Digital Design: Principal and Practices", Pearson Education
3. Douglus Perry, "VHDL", TMH
4. J. Bhasker, "VHDL Primer", PHI
5. J. Bhasker, "A VHDL synthesis Primer", BSP, New Delhi
6. J.M. Rabaey, A. P. Chandrakasan and B. Nikolic, Digital Integrated Circuits: A Design Perspective, Second Edition, PH/Pearson

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	3		2	2	2				2		
CO3	2	2								2		
CO4	1	2										
CO5	1	2	2	2	1	1				1		

1 – High 2 – Medium 3 – Low

Teacher Assessment:

Teachers Assessment of 20 marks will consist of synthesis, simulation and presentation of few VHDL programs along with one of the or combination of few of following

1) Simulation
2) Application development
3) Power point presentation of case studies
4) Implementation of digital systems
5) Mini projects

Recommended Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	00	06
K2	Understand	15	05	42
K3	Apply	00	05	12
K4	Analyze	00	10	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 100		20	20	60

Assessment table

Assessment Tool	K1	K2	K2	K3	K4
	CO1	CO2	CO3	CO4	CO5
Class Test (20 Marks)	05	15	00	00	00
Teachers Assessment (20 Marks)	00	05	00	05	10
ESE Assessment (60 Marks)	06	24	18	12	00

Special Instructions if any: Nil

Designed by- Prof. S. S. Agrawal

ET361: Lab Introduction to VLSI Design	
Teaching Scheme **Practical: 2Hrs/Week**	**Examination Scheme** **Term Work : 25 Marks** **Practical Examination & Viva Voce: 25 Marks**

Term Work: Term work will consist of record of experiments/assignments based on the syllabus. The experiments will comprise of Modeling, Simulation, Synthesis and Hardware verification using PLD Target boards and CMOS layout Software Platforms

• Xilinx ISE/ ModelSim / Xilinx Simulator/ Xilinx XST / Tanner / Microwind

Course Outcomes

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

CO1	Demonstrate HDL design flow with the help of CAD design tool
CO2	Execute programs using VHDL with different modeling techniques
CO3	Synthesize, simulate and download modules on FPGA platforms
CO4	Model simple CMOS gates and digital systems using suitable software

List of Experiments

Sr. No.	**Details**
1	Design of simple circuits using data flow modeling
2	Design of Mux/ Demux
3	Design of Comparator
4	Design of Sequence detectors
5	Design of Synchronous & Asynchronous Counters
6	Design of Shift registers
7	Design of ALU
8	Design of Code Converters
9	Download programs on FPGA platform
10	Layout of BJT and MOSFET using suitable software
11	Design of CMOS gates using suitable software

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	**S1**	**S2**	**S2**	**S3**
	CO1	**CO2**	**CO3**	**CO4**
Term Work (25 Marks)	05	12	04	04

Approved in 13th Academic Council held on 01/07/2016

Practical Examination & Viva Voce (25 Marks)	05	10	05	05

Recommended Assessment Pattern

Assessment Pattern Level No.	Skill Level	Term Work	Practical Examination & viva voce
S1	Imitation	05	05
S2	Manipulation	16	15
S3	Precision	04	05
S4	Articulation	00	00
S5	Naturalization	00	00
Total		**25**	**25**

Preparation (S1)	05	05
Conduct of Experiment & Record(S2)	16	10
Observation and Analysis of Results (S3)	04	05
Mini-Project / Presentation/ Viva-Voce (S3)	00	05
Total	**25**	**25**

ET356 : Telematics Elective	
Teaching Scheme **Lectures: 3 Hrs/Week**	**Examination Scheme** **Test : 20 Marks** **Teachers Assessment : 20 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Analog communication theory, Communication System Theory

Course description: The subject Telematics shall lay strong basics of switching fundamentals and detail study of telephone and cable networks. It also includes different protocols used for flow, congestion and error control. Real time services and day-to-day applications are also included in the syllabus.

Course Objectives:

- To understand fundamentals of telephone cables
- To study various telephone networks for data transmission
- To learn flow and congestion control
- To get awareness about error detection, correction, error control rate.
- To impart concepts of Telematics applications

Course Outcomes

After completing the course, students will be able to:

CO1	Empowered to learn switching fundamentals and technology used in today's communication field
CO2	Use tools and measuring equipment for telematics networks.
CO3	Describe the general functioning of a complex network.

Detailed Syllabus:

Unit 1	**Telephone Network Overview:** Switching strategies like Circuit switching ,message switching and packet switching, Basic architecture of automatic electronics exchange, STS and TST type switching, Signalling and coding, Various telephone circuits, Line interfacing and automatic terminating equipment, Principal of store and forward exchange.
Unit 2	**Telephone and Cable networks for Data Transmission:** Telephone networks major components LATAs, Signalling and services provided by Telephone networks, Dialup modems, Modem standards, Digital subscriber line ADSL,HDSL,SDSL,VDSL, Cable TV networks, Traditional cable networks, Hybrid fibre coaxial networks
Unit 3	**Flow and Congestion Control:** Flow control, justification, stop-and-wait protocol, sequence number, sliding window, Round-trip time and efficiency, Congestion control, protocol types
Unit 4	**Error Control:** Bit error rate, simple errors and runs. Bit rate control, detection and correction codes, packet rate control, packet recognition, timers and re-transmitters, basic protocols.
Unit 5	**Telematics Applications and Services**: Classification of telematics services, real-time services, characterization of traffic sources, service-level agreement (SLA), quality of Service (QoS), call admission control (CAC), police control applications.

TEXT AND REFERENCE BOOKS

1. Behrouz Forouzan "Data Communication and Networking", TMH 4th Edition
2. William Stallings, "Data Communication", Tata McGrawHill Publication.

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Teacher's Assessment:

Teachers Assessment of 20 marks is based on one of the / or combination of following

1) Power point presentation of case studies
2) Question & answer / Numerical solution

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	10	10	24
K2	Understand	10	10	36
K3	Apply	00	00	00
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 100		20	20	60

Assessment table

Assessment Tool	K1	K2	K2
	CO1	CO2	CO3
Class Test (20 Marks)	10	05	05
Teachers Assessment (20 Marks)	00	10	10
ESE Assessment (60 Marks)	24	18	18

Special Instructions if any: Nil

Designed by: Prof. P.H. Bhagat

ET362: Lab Telematics	
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	Obtain an overview of Electronics Exchange, modems, Cable TV networks, network protocols, telematics services
CO2	Use modern tools for Congestion and Error control systems
CO3	Use the various equipment's for telecommunication systems

List of Experiments

Sr. No.	Details
1	Study of Electronic Exchange
2	Study of modems
3	Study of Cable TV networks
4	Study of Congestion control
5	Study of Error control system
6	Study of Algorithms of Error control and detection system
7	Study of Network protocols
8	Study of various equipment's used in telecommunications
9	Case study of Telematics Services

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	2							
CO3				2	2							

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S2	S2
	CO1	CO2	CO3
Term Work (25 Marks)	10	7	8
Practical Examination & Viva Voce (25 Marks)	10	07	08

Assessment Pattern

Assessment Pattern Level No.	Skill Level	Term Work	Practical Examination & viva voce
S1	Imitation	10	15
S2	Manipulation	15	10
S3	Precision	00	00

S4	Articulation	00	00
S5	Naturalization	00	00
Total		25	25

ET357: Computer Architecture and Operating Systems Elective	
Teaching Scheme **Lectures: 3 Hrs/Week**	**Examination Scheme** **Test : 20 Marks** **Teachers Assessment : 20 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Microprocessor & Microcontroller

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 Educational 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 be able to:

CO1	Express parallel processing and pipelining concept
CO2	To explain different parallel processors, pipeline architecture and superscalar architecture
CO3	Discuss system software, thread and memory management
CO4	To implement different scheduling algorithms, page replacement algorithms and pipelining architecture
CO5	Understand the design principles on various operating systems and memory management

Unit 1	**Overview of Parallel Processing and Pipelining Processing** : Necessity of high performance, Constraints of conventional architecture, Parallelism in uniprocessor system, Evolution of parallel processors, Future trends, Architectural classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism, Explicitly Parallel Instruction Computing (EPIC) Architecture, Case study of Intel Itanium Processor, Principles of scalable performance: Performance metrics and measures, Speedup performance laws**.**
Unit 2	**Pipeline Architecture:** Principles and implementation of pipelining, Classification of pipelining processors, General pipelining reservation table, Design aspect of arithmetic and instruction pipelining, Pipelining hazards and resolving techniques, Data buffering techniques, Job sequencing and collision, Advanced pipelining techniques, Loop unrolling techniques, Out of order execution, Software scheduling, Trace scheduling, Predicated execution, Speculative loading, Register Stack Engine, Software pipelining, VLIW (Very Long Instruction Word) processor, Case Study: Superscalar Architecture: Pentium, Ultra SPARC, Dual core
Unit 3	**System Software** Overview of all system software, Operating system, I/O manager, Assembler, Compiler, inker, Loader, OS services and Components, Multitasking, Multiprogramming, Timesharing, Buffering, Spooling
Unit 4	**Process and Thread Management** Concept of process and threads, Process states, Process management, Context switching, Interaction between processes and OS, Multithreading
Unit 5	**Memory Management**

	Memory partitioning, Swapping, Paging, Virtual Memory, Page replacement algorithms, Segmentation

TEXT AND REFERENCE BOOKS

1. Kai Hwang, Faye A. Briggs, " Computer Architecture and Parallel Processing " McGraw Hill International Edition
2. Kai Hwang, " Advanced Computer Architecture ", Tata McGraw hill Edition
3. V. Rajaraman, L Sivaram Murthy, "Parallel Computers", PHI.
4. William Stallings, " Computer Organization and Architecture, Designing for Performance " 6th Ed. PHI
5. Harrold Stone " High Performance Computer Architecture "
6. Richard Y. Kain " Advanced Computer Architecture "
7. Achyut S. Godbole, Operating Systems, Tata McGraw Hill 2nd edition.
8. D.M. Dhamdhere, Operating Systems, Tata McGraw Hill 2nd edition.
9. Operating Systems Design & implementation Andrew S. Tanenbaum, Albert S. Woodhull Pearson.

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	3	3										
CO3		2				2						
CO4		2	2									
CO5			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) Application development
2) Power point presentation of case studies
3) Question & answer / Numerical solution
4) Laboratory Work
5) Tutorials
6) Survey of systems

Recommended Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	00	06
K2	Understand	15	05	36
K3	Apply	00	15	18
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 100		20	20	60

Assessment table

Assessment Tool	K2	K2	K3	K3	K2
	CO1	CO2	CO3	CO4	CO5
Class Test (20 Marks)	10	10	00	00	00
Teachers Assessment (20 Marks)	00	05	05	05	05
ESE Assessment (60 Marks)	12	18	12	06	12

Approved in 13th Academic Council held on 01/07/2016

Special Instructions if any: Nil

Designed by- Prof. M.H. Nerkar

ET363: Lab Computer Architecture and Operating Systems	
Teaching Scheme **Practical: 2Hrs/Week**	**Examination Scheme** **Term Work : 25 Marks** **Practical Examination & Viva Voce: 25 Marks**

Term Work: The term work shall consist of record of experiments based on the syllabus.
Turbo C ++/ Microsoft Visual C/C++/ Microsoft Visual Basic / Microsoft Visual Basic.Net / LINUX development system/MATLAB

Course Outcomes

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

CO1	Follow the architectures for different processors
CO2	Simulation of parallel and pipelined processes
CO3	Execute programs for device drivers
CO4	Implementation of different algorithms for CPU, memory and paging

List of Experiments

Sr. No.	**Details**
1	Simulation and development of applications of parallel processing using MATLAB
2	Practical study of Ultra SPARC, Dual core processors
3	Design aspect of arithmetic and instruction pipelining
4	Program to control USB and COM devices
5	Program to access PCI devices and LPT devices
6	Shell programming for Operating System
7	Thread synchronization using semaphores
8	Implementation of CPU scheduling algorithms
9	Implementation of memory allocation algorithms
10	Demand paging implementation-using algorithms

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	2	2							
CO3			2	2	2							
CO4				1	1							

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	**S1**	**S2**	**S2**	**S3**
	CO1	**CO2**	**CO3**	**CO4**
Term Work (25 Marks)	04	08	08	05
Practical Examination & Viva Voce (25 Marks)	03	08	07	07

Recommended Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	04	03
S2	Manipulation	16	15
S3	Precision	05	07
S4	Articulation	00	00
S5	Naturalization	00	00
Total		**25**	**25**

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

ET364: Open Source Software Compulsory	
Teaching Scheme **Practical: 4 Hrs/Week**	**Examination Scheme** **Term Work : 25 Marks** **Practical/Viva Voce : 25 Marks**

Students shall perform practical based on following:

Course Outcomes

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

CO1	Select, install and use open source software as per specific needs of Engineering.
CO2	Demonstrate use of open source software for creating and managing database and queries.
CO3	Select install and use open source software for solution of engineering problems.

Unit 1	Introduction to Open sources, Need of Open Sources, Open source operating systems: LINUX: Introduction, Development with any one Linux distributions Ubuntu, Fedora, opens USE, Enterprise Desktop & Server Practical will be based on 1. Installation 2. Basic Commands and Utilities 3. Features of Operating system
Unit 2	Open Source Programming Languages Java, PHP: Introduction, PHP and SQL database, Python Practical will be based on 1. PHP and Python operators, Statements, Functions and Scripts 2. PHP and SQL database connectivity 3. Small programs in PHP/Python 4. Java Eclipse IDE and Net beans
Unit 3	Open Source Application Packages: SciLab, Open office, Latex , GCC, NASM, Android SDK Practical will be based on 1. SciLab 2. Open office, Latex 3. GCC, NASM 4. Android SDK

TEXT AND REFERENCE BOOKS

1. Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", Wiley Publications,2003
2. Steve Suchring, "MySQL Bible", John Wiley, 2002
3. Rasmus Lerdorf and Levin Tatroe, "Programming PHP", O'Reilly, 2002
4. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2001
5. Martin C. Brown, "JAVA: The Complete Reference" 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009
6. Steven Holzner, "PHP: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009
7. Vikram Vaswani, "MYSQL: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009

Mapping of Course outcome with Program Outcomes

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

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	**S2**	**S3**	**S3**
	CO1	**CO2**	**CO3**
Term Work (25 Marks)	07	08	10
Practical Examination & Viva Voce (25 Marks)	07	08	10

Recommended Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	00	00
S2	Manipulation	15	15
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
Total		**25**	**25**