Bachelor of Technology

(Electronics and Telecommunication)

Curriculum

S.Y. B.Tech

(With Effect from academic year 2019-20 onwards)

Department of Electronics and Telecommunication Engineering

Government College of Engineering,

Aurangabad M.S. 431005 India

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.

Programme Outcomes Engineering Graduates will be able to:

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

Program specific outcomes

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

Electronics & Telecommunication Engineering Department

Mapping of PEOs and POs

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

GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD

(An Autonomous Institute of Government of Maharashtra)

Department of Electronics & Telecommunication Engineering

Teaching and Evaluation Scheme

Bachelor of Technology (Electronics & Telecommunication)

S.Y.B.Tech SEMESTER-I

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		TestI	TestII	TA	ESE			
	THEORY COURSES													
1	MA2001	Engineering Mathematics-III	1,2,3,9,11	4	-	-	4	15	15	10	60	-	-	100
2	HS2001	Environmental Studies		4	-	-	4	15	15	10	60	-	-	100
3	**Any one** from ET2001/ ET2002													
	ET2001	Electrical Fundamentals	1,2,3,9,10,12	2	-	-	2	10	-	10	30	-	-	50
	ET2002	Programming Language	1,2,3,5,9,10,12	2	-	-	2	10	-	10	30	-	-	50
4	ET2003	Electronics Devices & Circuits	2,3,4,5	3	-	-	3	15	15	10	60	-	-	100
5	ET2005	Digital Electronics	1,2,3,4,9,10,12	3	-	-	3	15	15	10	60	-	-	100
6	ET2007	Signals & Systems	1,2,3,4,5,9,10, 12	3	-	-	3	15	15	10	60	-	-	100
	LABORATORY COURSES													
7	ET2004	Lab-Electronics Devices & Circuits	4,5	-	-	2	1	-	-	-	-	25	25	50
8	ET2006	Lab- Digital Electronics	2,3,4,5,12	-	-	2	1	-	-	-	-	25	25	50
9	ET2008	Lab- Signals & Systems	1,2,3,4,5,10,12	-	-	2	1	-	-	-	-	25	25	50
10	**MANDATORY COURSES (Only ONE Course during four year Program)**													
			Total	**19**	**0**	**6**	**22**	**85**	**75**	**60**	**330**	**75**	**75**	**700**

SEMESTER-II

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		TestI	TestII	TA	ESE			
	THEORY COURSES													
1	HS1004	Any one from Humanity Group		3	-	-	3	15	15	10	60	-	-	100
2	ET2009	Instrumentation & Measurement	1,2,5,6,7	2	-	-	2	10	-	10	30	-	-	50
3	ET2011	Network Theory	1,2,3,9,11,12	3	2	-	4	15	15	10	60	-	-	100
4	ET2013	Linear Integrated Circuits	1,2,3,4,5,6,7, 8,9,10,11,12	3	-	-	3	15	15	10	60	-	-	100
5	ET 2015	Analog Communication	1,2,3,11	3	-	-	3	15	15	10	60	-	-	100
6	ET 2017	Mathematics- IV	1,2,3,11	4	-	-	4	15	15	10	60	-	-	100
	LABORATORY COURSES													
7	ET2010	Lab- Instrumentation & Measurement	1,2,4,9,10,12	-	-	2	1	-	-	-	-	25	25	50
8	ET2012	Lab- Network Theory	1,,4,5,9,10,12	-	-	2	1	-	-	-	-	25	25	50
9	ET2014	Lab- Linear Integrated Circuits	1,2,3,4,5,6,7, 8,9,11,12	-	-	2	1	-	-	-	-	25	25	50
10	ET2016	Lab-Analog Communication	4,5,11	-	-	2	1	-	-	-	-	25	25	50
11	**MANDATORY COURSES (Only ONE Course during four year Program)**													
			Total	**18**	**2**	**8**	**23**	**85**	**75**	**60**	**330**	**100**	**100**	**750**
			Grand Total	**37**	**2**	**14**	**45**	**170**	**150**	**120**	**660**	**175**	**175**	**1450**

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

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MA2001: Engineering Mathematics-III (Basic Science)	
Teaching Scheme **Lectures: 4 Hrs/Week** **Total Credits : 3+1+0**	**Examination Scheme** **Class Test-I : 15 Marks** **Class Test-II : 15 Marks** **Teachers Assessment : 10Marks** **End Semester Exam : 60 Marks**

Course description:

Engineering Mathematics-III (MA 2001) is a compulsory course to all second year engineering students of the institute in the Semester –III and is a continuation of previous year courses viz. Engineering Mathematics-I (MA1001) and Engineering Mathematics-II (MA1002). This course intends to provide engineering students a coherent and balanced account of major mathematical techniques and tools.

Course Objective:

This course intends to provide an overview of analytical and numerical techniques to solve ordinary and partial differential equations, which we apply to solve many engineering problems of mechanical, civil electrical Engineering.

Course Outcomes:

After completing the course, students will be able to:

CO1	Determine the solution of second and higher order linear differential equation and apply knowledge of LDE to solve the problems in Engineering
CO2	Classify, formulate and solve the first order and second order linear, non-linear partial differential equations and apply the knowledge of partial differential equations to solve the problems in Engineering
CO3	Find approximate solution of ordinary differential equations of first order and find the convergence and stability of the approximate solutions

Detailed syllabus:

Unit-I	**Linear Differential Equations (LDE):** Linear Differential Equations **(LDE)** with constant coefficients, Differential equations reducible to LDE with constant coefficients, Simultaneous LDE with constant coefficients	08 Hrs
Unit-II	**Applications of Linear Differential Equations (LDE):** L-C-R Circuit, Coupled Electrical Circuits, Bending of beams, Spring-Mass system	08 Hrs
Unit-III	**Partial Differential Equations (PDE):** First order linear/ nonlinear Partial Differential Equation Formation **(PDE)**, Lagrange's equation, Linear Partial Differential Equations **(PDE)** of second and higher order with constant coefficients, Linear non-homogeneous PDE.	08 Hrs
Unit-IV	**Applications of Partial Differential Equations:** Solutions of one-dimensional wave equation, one-dimensional heat equation, Steady state solution of two-dimensional heat equation, Fourier series solutions in Cartesian coordinates.	08 Hrs

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Unit-V	**The approximation for the solution of first order Ordinary Differential Equations:** Taylor series method, Euler's method, Euler's modified Method, Runge-Kutta Fourth order Method, Milne's Predictor-Corrector Method, Solution of system of ordinary differential equations by Runge-Kutta methods.	08 Hrs

Text and Reference Books

1. A Text Book of engineering Mathematics (Vol.1 &2) by P.N.Wartikar & J.N.Wartikar, Pune Vidhyarthi Griha Prakashan, Pune.
2. Advanced Engineering Mathematics by Erwin Kreyszig, Willey Eastern Ltd. Mumbai.
3. Engineering Mathematics-A Tutorial Approach by Ravish R Singh, Mukul Bhatt.
4. Higher Engineering Mathematics by B. S. Grewal, Khanna publication, New Delhi.
5. Advanced Engineering Mathematics by H. K. Dass, S. Chand and Sons.
6. Calculus by G. B. Thomas and R. L. Finney, Addison- Wesley, 1996
7. Elements of Partial Differential Equations by I.N. Sneddon

Mapping of Course outcome with Program Outcomes (Civil Engineering)

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

Mapping of Course outcome with Program Outcomes (Mechanical Engineering)

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

Mapping of Course outcome with Program Outcomes (Electrical Engineering)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14
CO1	1													
CO2	1													
CO3	1													

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Mapping of Course outcome with Program Outcomes (Electronics and Telecommunication Engineering)

Course Outcome	PO 1	PO2	PO 3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO1 1	PO12
CO1	2	3	3						3		3	
CO2	2	3	3						3		3	
CO3	2	3	3						3		3	

Mapping of Course outcome with Program Outcomes (Computer Science Engineering)

Course Outcome	PO 1	PO2	PO 3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO1 1	PO12
CO1	1	1										3
CO2	1	1										3
CO3	1	1										3

Mapping of Course outcome with Program Outcomes (Information Technology)

Course Outcome	PO 1	PO2	PO 3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO1 1	PO12
CO1	1	1								3		
CO2	1	1								3		
CO3	1	1								3		

1 – High, 2 – Medium, 3 - Low

Teaching Strategies:

The teaching strategy planned through the lectures, and team based home works. Exercises assigned weekly to stimulate the students to actively use and revise the learned concepts, which also help the students to express their way of solving the problems fluently in written form. Most critical concepts and mistakes emphasized

Teacher's Assessment: Teacher's assessment of 10 marks based on the following.

1) Home assignments
2) Surprise tests with multiple choice questions

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ET2001 : Electrical Fundamentals	
Teaching Scheme **Lectures: 2 Hrs/Week** **Credits: 02**	**Examination Scheme** **Test 1 : 10 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 30 Marks**

Course description: On completion of this course, students will have a knowledge of fundamentals of electronics Engineering. It includes the Kirchhoff's voltage law, current law, source transformation, network analysis methods and AC circuits.

Course Objectives:

- To offer basic understanding for solving circuits using KCL, KVL and network theorems.
- To explain DC circuits, magnetic circuits and AC circuits.

Course Outcomes

After completing the course, students will be able to

CO1	K1	Define the terms related to network theorems, magnetic induction and AC circuits.
CO2	K2	Understand DC/AC circuits and magnetic circuits.
CO3	K3	Apply concepts of AC/DC circuits for network analysis.

Detailed Syllabus:

Unit 1	**DC Circuits:** Kirchoff's laws, Source conversion, series and parallel circuit, current and voltage division rule, Delta-star and star-delta conversion, Node voltage and Mesh current methods, Superposition theorem, Thevenin's and Norton's theorems, Maximum power transfer theorem. Charging and discharging of capacitor, Time constant for RC circuit
Unit 2	**Electromagnetic Induction**: Faraday's laws, statically and dynamically induced emf, self and mutual inductance, coefficients of coupling, dot convention, inductance in series and parallel, principle of operation, constructional details, types and applications of single phase Transformer, Induction motors, DC motors.
Unit 3	**Single phase AC Circuits**: Concept of single phase supply, Terms related with A.C. quantities, pure resistive, inductive and capacitive circuits, Complex and phasor representation of AC quantities, series and parallel circuits, introduction to resonance

TEXT AND REFERENCE BOOKS

1. Leonard Bobrow ''Fundamentals of Electrical Engineering" ,Oxford University press
2. Vincent Del Toro, "Principles of Electrical Engineering ", Prentice Hall.
3. D.P. Kothari, I.J Nagrath ,"Basic Electrical Engineering "Tata McGraw Hill
4. M.S.Naidu, S.Kamakshaiah ,"Introduction to Electrical Engineering" Tata McGraw Hill
5. J.P.Tiwari,"Basic Electrical Engineering "New Age Publication
6. Joseph Administer,"Schaum's outline of Electric circuits", Tata McGraw Hill

Mapping of Course outcome with Program Outcomes (PO) and Program Specific Outcomes (PSO)

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

3 – High, 2 – Medium , 1 - Low

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

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

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ET2002 : Programming Language (Engineering Science Elective)	
Teaching Scheme **Lectures: 2 Hrs/Week** **Total Credits : 02**	**Examination Scheme** **Class Test : 10 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 30 Marks**

Prerequisites: Nil

Course description: This course covers fundamentals of Programming. It mainly emphasizes on programming language C. It deals with introduction of C language along with applications development using it.

Course Objectives:

- To learn and acquire art of computer programming
- To know about concepts of popular programming language C
- To develop simple applications using C programming concepts

Course Outcomes

After completing the course, students will able to:

CO1	To learn basics of C Programming Language	K1
CO2	To Write & Debug C Programs using basic C constructs	K2
CO3	Solve real time problems using C programming Language	K3

Detailed Syllabus:

Unit 1	**Introduction to C Language fundamentals**, The C character set, variables and constants, data types, keywords, expressions, statements, operators- arithmetic operators , unary operators, relational & logical operators, conditional operators, type conversions , type casting.
Unit 2	**C Programming: Control Structures-** Conditional and Unconditional Branching Using if, nested if, if else, switch, break, continue, go to statement, and return statements. **Loop structures** - For loop, While loop, Do while loop. **Functions** – Creating subprograms using Functions, Parameter passing by value, parameter passing by reference, returning values from functions, recursion, Local and Global variables concepts, main function with argv, argc[].
Unit 3	**Arrays-** definition, passing array to the function, Multidimensional array, String operation- String copy, String length, String concatenation, String compare. Introduction to structure and union. Array of structure, Passing structure as an object to function. Structure as an return type of function. **Pointers**- pointer as a variable, pointer to array, pointer as argument to function. String operations using pointers.

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Text and Reference Books

1. E. Balgurusamy, "Programming in ANSIC C", Third Edition, Tata McGraw Hill.
2. Kernighan Ritchie, "The C Programming Language", Prentice Hall of India.
3. Yashvant Kanetkar, "Let Us C", Seventh Edition, BPB Publications.
4. Behrouz A. Forouzan, Richard F. Gilberg, "Computer Science- A Structured Programming approach using C", Indian Edition,Thomson, 3rd Edition.

Mapping of Course outcome with Program Outcomes (PO) and Program Specific Outcomes (PSO)

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PS O 1	PSO 2	PS O 3
CO1	1	1							1	1		1	1	1	3
CO2	2	1			2				1	1		1	2	1	2
CO3	3	2	1		3				1	1		1	2	1	2

1 – Low **2 – Medium** **3 - High**

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

1) Application development using C
2) Power point presentation of case studies
3) Question & answer
4) Mini projects

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ET 2003 : Electronics Devices and Circuits	
Teaching Scheme **Lectures: 3 Hrs/Week** **Credits: 03**	**Examination Scheme** **Class Test I :15 Marks** **Class Test II :15 Marks** **Teachers Assessment :10 Marks** **End Semester Exam :60 Marks**

Prerequisites: Knowledge of Physics and Mathematics

Course description: After the completion of this course, students will be able to understand working principles of the semiconductor devices and their applications with frequency analysis response. This will help students in learning dependent core courses.

Course Objectives:

- To acquaint the students with construction, theory and characteristics of various Semiconductor devices
- To lay a strong fundamental base of electronics.
- To develop capacity to interpret and analyze different electronics circuits

Course Outcomes

After completing the course, students will able to:

CO1	Know the basics principles and construction of the semiconductor devices.	K1
CO2	Understand the working of semiconductor devices and their characteristics	K2
CO3	Describe various applications of semiconductor devices	K2
CO4	Explain the working of different types of power amplifiers	K2
CO5	Analyze the types of feedback amplifiers	K3
CO6	Illustrate the types of oscillators	K3

Detailed Syllabus:

Unit 1	**Diodes and Circuits** Review of the device construction, operation, characteristics and voltage and current equations for – PN junction diode, Schottky diode, Light Emitting Diode, Laser Diode, Zener Diode, GUNN diode etc. Design of the circuits based on the diodes- Full Wave, Half Wave and Bridge Rectifiers, Detectors, Single and Balanced Mixers, Clippers and Clampers, Over-voltage protection circuits.Various uses of the diodes- for device isolation in semiconductor process, voltage dependent capacitor in Voltage Controlled Oscillator, voltage reference
Unit 2	**BJT (Bipolar Junction Transistor)** Device structure and symbol, basic operation, Input and Output Characteristics, Transistor configurations, BJT biasing, Stability factor, h-parameters, transistor amplifier, Hybrid – π parameter.
Unit 3	**FET (Field Effect Transistor)** Structure, symbol, basic operation, drain and transfer characteristics, biasing arrangements for JFET, MOSFET, UJT, IGFET. Review of device construction, operation, characteristics and voltage and current equations for MOSFET, UJT, IGFET. Applications of MOSFET, UJT, IGBT
Unit 4	**Feedback Amplifiers and Oscillators** Introduction, The Basic concepts of Feedback, Effect of Negative Feedback, Types of Negative Feedback Connections, Method of Identifying Feedback Topology and Feedback

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	Factor, Stability of Feedback Amplifier. Conditions for oscillations, types of oscillators -Wien bridge, Hartley, Colpitts and Crystal oscillators. Characteristics-Source Degeneration, Barkhausen criteria of stability, etc.
Unit 5	**Power Amplifiers** Non-switching Amplifiers- Class A, Class B, Class C, Class AB, Class B Push-pull, Cross-over distortion in Class B Push-pull. etc.

Text and Reference Books

1. Boylestad & Nashelsky, Electronics Devices & Circuits, Pearson Education
2. Millman & Halkias, Electronic Devices & Circuits, TMH
3. D. A. Neamen, Electronic circuit analysis and design, TMH, (Second edition)
4. S.Salivahanan, N Sureshkumar, "Electronic Devices and Circuits", McGraw Hill Publication(Third Edition)
5. J.B. Gupta, "Electronic Devices and Circuits", Katson Education Series(6th Edition)

Mapping of Course outcome with Program Outcomes

Course Outcome	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	2		-	-	-	-		-	-			2	1	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	1	1	-
CO4	1	2	2										2		1
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
CO6	3	2	2										2	1	1

3 – High 2 – Medium 1 - Low

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

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

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ET2004: Lab-Electronics Devices and Circuits	
Teaching Scheme **Practical: 2Hrs/Week** **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 able to:

CO1	Know the testing of components
CO2	understanding of electrical circuits in practical applications
CO3	to analyze and design amplifier circuits, oscillators and filter circuits employing BJT, FET devices
CO4	Implement hardwired circuit to test performance and application for what it is being designed.

List of Experiments

Sr. No.	Details
1	To calculate Efficiency and Ripple Factor in case of Half Wave, Full Wave & Bridge Rectifier and to observe the effect of load and filters.
2	Study of Series Positive Clipper and Series Negative Clipper Circuits and Shunt Positive Clipper and Shunt Negative Clipper Circuits
3	To analyze the Drain and Transfer Characteristics of N- channel MOSFET
4	To evaluate Input resistance, Output resistance and Current gain of NPN and PNP Transistor in CB, CC and CE Configuration and plot their characteristics
5	Evaluation of following parameters of JFET: DC Drain resistance, Transconductance, Amplification factor and plot the V-I characteristics of JFET
6	To plot the Frequency response of RC–Coupled amplifier
7	To plot the Frequency response of a FET amplifier.
8	Study of design and functioning of Hartley Oscillator ,Colpitt Oscillator and Wein Bridge Oscillator
9	Study of the working principle of Class A, Class B and Class AB Push-pull Amplifier
10	Study of the working principle of class C Amplifier , Differential amplifier and its operation at tuned frequency

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		3										
CO3		3	2									
CO4				3	2							

3 – High 2 – Medium 1 - Low

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ET2005 : Digital Electronics (Professional Core)	
Teaching Scheme **Lectures: 03 Hrs/Week** **Total Credits :03**	**Examination Scheme** **Class Test I :15 Marks** **Class Test II :15 Marks** **Teachers Assessment :10 Marks** **End Semester Exam :60 Marks**

Prerequisites: Nil

Course description: After completing this course, students will have a clear and fundamental understanding of Digital systems. Topics range from an overview of Basics of Digital Electronics, Types of digital logics, different logic families and Finite State Machine

Course Objectives:

- To introduce basic postulates of Boolean algebra and show the correlation between Boolean expressions. To introduce the methods for simplifying Boolean expressions.
- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To learn the procedures for the analysis and design of combinational circuits.
- To outline the formal procedures for the analysis and design of sequential circuits.
- To introduce the concept of memories and programmable logic devices.
- To introduce the concept of synchronous and asynchronous sequential circuits and to design Combinational and Sequential circuits to solve real world problem

Course Outcomes:

Students will be able to:

CO1	Apply the knowledge of digital circuit concepts to optimize a digital circuit.	K1.K2,K3
CO2	Develop a digital logic and apply it to solve real life problems.	K1.K2,K3
CO3	Design and implement Combinational circuits that solve binary logical tasks	K1,K2
CO4	Design and implement synchronous and asynchronous sequential circuits.	K1,K2
CO5	Conduct experiments using digital ICs to demonstrate a given application / problem statement	K1,K2,K3
CO6	Work in a team to demonstrate an application of digital circuits by engaging in self-learning	K3

Detailled Syllabus

UNIT 1	**Minimization Techniques and Logic Gates** **Minimization Techniques**: Boolean postulates and laws, De-Morgan's Theorem, Principle of Duality, Boolean expression, Minimization of Boolean expressions, Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS), Karnaugh map Minimization, Don't care conditions, Quine-McCluskey method of minimization. **Logic Gates:** AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR Implementations of Logic Functions using gates, NAND–NOR implementations, Multi level gate implementations, Multi output gate implementations. TTL and CMOS Logic and their characteristics, Tristate gates,Introduction to CAD tools and VHDL

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UNIT 2	**Combinational Circuits** Design procedure, Half adder, Full Adder, Half subtractor, Full subtractor, Parallel binary adder, parallel binary Subtractor, Fast Adder, Carry Look Ahead adder, Serial Adder/Subtractor, BCD adder, Binary Multiplier, Binary Divider, Multiplexer/ Demultiplexer, decoder, encoder, parity checker, parity generators, code converters, Magnitude Comparator.
UNIT 3	**Sequential Circuits** Latches, Flip-flops, SR, JK, D, T, and Master-Slave, Characteristic table and equation, Application table, Edge triggering, Level Triggering, Realization of one flip flop using other flip flops, serial adder/subtractor, Counters, Asynchronous and Synchronous counters, Ring Counter, Johnson counter,Registers, shift registers, VHDL code for Flipflop and counter.
UNIT 4	**Memory Devices And Digital Integrated Circuits** **Memory Devices** Basic memory structure: ROM,PROM, EPROM, EEPROM, EAPROM, RAM, Static and dynamic RAM, Programmable Logic Devices, PLA, PAL, FPGA,combinational logic circuits using PLA, PAL. Digital integrated circuits: Logic levels, propagation delay, power dissipation, fan-out and fanin, noise margin, logic families and their characteristics-RTL, TTL, ECL, CMOS
UNIT 5	**Sequential Circuits Design** **Synchronous Sequential Circuits:** Basic design steps. Mealy and Moore state models, state minimization. Design of counter using sequential circuit approach. Algorithmic State Machine (ASM) charts. **Asynchronous Sequential Circuits:** Behavior, Analysis, Synthesis, State reduction, state assignments, Examples. Hazards

TEXT BOOK:

M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

REFERENCES:

- A.P. Malvino, Digital Electronics, Mc-Graw Hill
- W.H. Gothman, Digital Electronics-An introduction to theory and practice, PHI
- Douglas V. Hall, Digital Circuits and Systems, McGraw Hill
- R.P.Jain, Digital Electronics, Tata McGraw Hill
- William I Fleatcher, An Engineering approach to digital design, PHI
- J.F.Wakerly: Digital Design, Principles and Practices,4thEdition,Pearson Education, 2005
- Charles H Roth: Digital Systems Design using VHDL, Thomson Learning, 1998
- H.Taub and D. Schilling, Digital Integrated Electronics, McGraw Hill, 1977
- D.A. Hodges and H.G. Jackson, Analysis and Design of Digital Integrated Circuits, International Student Edition, McGraw Hill, 1983

Mapping of Course Outcome with PO and PSO

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3												1	2	
CO2		3										2			
CO3		2	3										1		1
CO4		2	3										1	2	1
CO5				3						3			1	2	
CO6				3					2	3		2	1	2	1

3 – High 2 – Medium 1 – Low

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

1) Simulation
2) Application development
3) Power point presentation of case studies
4) Question & answer / Logic problem solving
5) Mini projects

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ET2006 : Lab Digital Electronics (Professional Core)	
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 able to:

CO1	Implement logical operations using basic and universal logic gates
CO2	Perform and realize arithmetic, logic circuits using ICs
CO3	Execute and realize the combinational logic circuits using gates and ICs
CO4	Perform and realize sequential logic, circuits using ICs.

List of Experiments Note: At least 10 Practicals should be performed

Sr. No.	Details
1	To verify of logic gates such as AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR
2	To realize logic operations using NAND /NOR
3	To reduce Karnaugh Map (SOP/POS) • Realize a code converter binary to gray • Realize a circuit to detect prime numbers in a 4-bit binary numbers • Realize a circuit to detect the numbers divisible by 03 in 4-bit binary numbers
4	To develop Adder/ Subtractor Study of 4-bit adder using IC7483
5	Multiplexer- Demultiplexer Study of 4-bit Adder using 4:1 MUX
6	To study Encoder 8:3, 16:4, Decoder 3:8, 4:16
7	To study comparators Ic 7485
8	To study Flip-flops D, R-S, J-K Realize conversion of JK to T, JK to D flip flop
9	To design Asynchronous counter using J-K Flip-flops
10	To study Shift Register and their application using ICs 7476,7495
11	To study Decade counter/Ring counter
12	To design Synchronous Counter using J-K Flip –flops
13	Realization of 3 bit counter as sequencial circuit and Mod-N counter design (7476,7490,74192,74193)
14	To study A.L.U. such as 74181
15	Introduction to Hardware Description Language

Mapping of Course outcome with Program Outcomes and Program Specfic Outcomes

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

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ET2007: Signals and Systems	
Teaching Scheme **Lectures: 3 Hrs/Week** **Credits: 3**	**Examination Scheme** **Class Test I : 15 Marks** **Class Test II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Inclination to learn mathematics, basic knowledge of differential equations and difference equations, electrical circuits and networks.

Course Description:

The course will provide strong foundation on signals and systems which will be useful for creating foundation of communication and signal processing. The students will learn basic continuous time and discrete time signals and systems. Student will understand application of various transforms for analysis of signals and systems both continuous time and discrete time. Students will also explore to power and energy signals and spectrum.

Course Outcomes

After completing the course, students will be able to:

CO1	Identify different signals, systems and transforms	K1
CO2	Understand the types of signals and systems	K2
CO3	Understand continuous and discrete domains for signals and sampling	K2
CO4	Demonstrate time domain signal into frequency domain through various transforms	K2
CO5	Interpret the properties of transforms	K2
CO6	Apply transforms on signals	K3

Detailed Syllabus:

Unit 1	Basic definitions, Classification of signals and systems. Signal operations and properties, Basic continuous time signals, signal sampling and reconstruction, Basic system properties
Unit 2	Continuous and discrete time: Impulse response characterization and convolution integral for LTI system, signal responses to LTI system, properties of convolution, LTI system response properties
Unit 3	Laplace Transform and its properties, Inverse Laplace Transform Application of Laplace transforms

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Unit 4	Fourier Analysis of Continuous Time Signals and Systems, Fourier Series, Fourier Transform and properties, Fourier Analysis of Discrete Time Signals and Systems, Discrete Time Fourier series, Discrete Fourier Transform and properties. Frequency response of LTI systems
Unit 5	The Z-Transform, Convergence of Z-Transform, Basic Z-Transform, Properties of Z-Transform, Inverse Z-Transform and Solving difference equation using Z-Transform

TEXT AND REFERENCE BOOKS

1. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall
2. Signals and Systems by K. Gopalan, Cengage Learning (India Edition)
3. Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications
4. Signals and Systems by Simon Haykin and Bary Van Veen, Wiley- India Publications
5. Linear Systems and Signals by B.P.Lathi, Oxford University Press
6. Signal, Systems and Transforms by Charles L. Philips, J. M. Parr and E. A. Riskin, Pearson Education
7. Digital Signal Processing Fundamentals and Applications by Li Tan, Elsevier, Academic Press
8. Signal and Systems By Anand Kumar, 3rd Edition, PHI

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	2	2	-	1	2	2	3
CO2	2	2	1	-	-	-	-	-	2	2	-	1	2	3	3
CO3	2	2	1	1	-	-	-	-	2	2	-	1	-	3	3
CO4	2	2	1	-	-	-	-	-	2	2	-	1	2	3	3
CO5	2	1	1	1	1	-	-	-	2	2	-	1	-	2	3
CO6	3	2	1	1	1	-	-	-	2	2	-	1	-	2	-
1 – Low 2 – Medium 3 - High															

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

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

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ET2008: Lab-Signals and Systems	
Teaching Scheme **Practical: 2 Hrs/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 using MATLAB/CCS/IDE, students will able to:

CO1	Write the programs for signal generation, operations, transformation	S2
CO2	Use simulation tool	S2
CO3	Understand the time and frequency domain representation of discrete time signals through simulation	S2
CO4	Prove properties of transforms	S2

Lists of Experiments

1	Understand basic Matlab functions and its IDE and learn and understand Simulink toolbox.
2	Write a program to generate the discrete sequences (i) unit step (ii) unit impulse (iii) ramp (iv)periodic sinusoidal sequences. Plot all the sequences. Using Function generators and CRO observe these signals in continuous time domain. Also vary and measure their amplitude and frequency. Generate these signals using Simulink toolbox.
3	Generate a discrete time sequence by sampling a continuous time signal. Show that with sampling rates less than Nyquist rate, aliasing occurs while reconstructing the signal.
4	Perform basic operations like addition, subtraction, folding, shifting on signals.
5	Extraction of odd and even parts of 5 different signals and compare with the theoretical results.
6	Write a program to convolve any two discrete time sequences. Plot all the sequences. Verify the result by analytical calculation. Convolve the two x1(n), x2(n) signals. Convolve x1(n) with x3(n), x4(n) and compare the results of each convolution. Try the same for x2(n) also.
7	Find the Fourier transform of a square pulse, sinusoidal signal, exponential signal Plot their amplitude and phase spectrum. Compare the results with mathematical solutions. Also find the inverse Fourier transform.
8	Find the Laplace and inverse Laplace transform of the given functions. Verify the result by analytical calculation. Plot the characteristics. Find the Z transform and inverse Z transform of the given functions. Verify the result by analytical calculation.
9	Write a program to prove the time shifting property of Laplace, Z and Fourier transform.
10	Implement signal transforms using Simulink.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

CO No.	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
01	1	-	-	1	2	-	-	-	-	1		-	1	2	2
02	1	1	1	1	2	-	-	-	-	1		3	2	2	2
03	1	1	1	1	2	-	-	-	-	1		3	2	2	2
04	1	-	-	1	2	-	-	-	-	1		3	2	2	2

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ET2009: Instrumentation and Measurement (Engineering Sciences)	
Teaching Scheme **Lectures: 2 Hrs /Week**	**Examination Scheme** **Test I : 10 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 30 Marks**

Prerequisites: Knowledge of basic Electronics

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, 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 elements of setup for measurement of physical quantities and parameter.	K1
CO2	Understand the various techniques for parameter measurement & study of signals.	K2
CO3	Apply the complete knowledge of various electronics instruments/transducers to measure thephysical quantities in the field of science, engineering and technology.	K3

Detailed Syllabus:

Unit 1	**Instrumentation Basics and bridge measurement** Introduction to measurements, Units and standards of measurement and their classification, Sensing and Transduction, Block diagram of Instrumentation system, Errors in measurements, Probability of errors, Static and Dynamic performance characteristics of measuring Transducer. Bridge measurement: Measurement of Voltage, Current, AC /DC Bridges such as Wheatstone, Kelvin, Maxwell, Hay, Schering, Wein bridge and their application.
Unit 2	**Transducer** Definition, classification, selection criterion, Resistive, Capacitive and Inductive Transducers, Hall Effect Transducer, Thermocouple ,strain gauge, Transducers for measurement of Flow, Viscosity, Humidity, Pressure and necessary signal conditioning.

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Unit 3	**Basic Parameter Measurement and analysis by Electronic Instrumentation** AC voltmeters using rectifiers, True RMS voltmeter, Vector voltmeter, Digital voltmeter, Q-meter, Electronic multimeter, Sound level meter, RF Voltage/ power measurement, Recorders. Wave analyzers, Harmonic distortion analyzer, DSO, Spectrum analyzer, logic analyzer, Network Analyzer.

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

3 – High **2 – Medium** **1 - Low**

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

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

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ET2010: Lab Instrumentation & Measurement	
Teaching Scheme **Practical: 2 Hrs/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	Implement the setup for obtaining characteristics of various transducer.
CO2	Perform experiments for parameter measurements by different instruments.
CO3	To learn how to visualize and work on multidisciplinary tasks.
CO4	Use simulation tools.

List of Experiments

1	Study of Error measurement.
2	Measurement of a. resistance using Wheatstone bridge b. capacitance using Schering bridge c. inductance using Maxwell bridge
3	Measurement of Temperature using a. Thermocouple b. RTD(PT100)
4	Study of Strain measurement a. using strain gauges b. determine linear range of operation c. sensitivity
5	Characteristics of a. Photovoltaic cell b. Photoconductive cell **c.** PIN photodiode **d.** Phototransistor
6	Study of a. input output characteristics of LVDT b. linear range of operation c. sensitivity
7	Study Pressure transducer characteristics
8	Measurement of Signal Frequency using Digital Oscilloscope
9	Study of Flow Measurement
10	Study of spectrum analyzer

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Mapping of Course outcome with Program Outcomes

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

3 – High 2 – Medium 1- Low

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ET2011 : Network Theory (Professional Core)	
Teaching Scheme **Lectures: 3Hrs/Week** **Tutorial: 2Hr/Week** **Credits: 04**	**Examination Scheme** **ClassTest I : 15Marks** **ClassTest II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60Marks**

Prerequisites:

- Basic knowledge of Fundamentals Electrical Engineering
- Course description: On completion of this course, students will have a basic and comprehensive

understanding of network analysis and synthesis methods. It includes the network analysis methods,

resonance, transient analysis, properties of symmetric and asymmetric network, passive filter design,

attenuator, network functions and two port parameters.

Course Objectives:

- To offer basic understanding for solving circuits using network theorems.
- To explain resonance circuits, properties of symmetric and asymmetric passive network, passive filters and attenuators.
- To give knowledge about two port parameters, network functions, stability and transient analysis of basic circuits.

Course Outcomes

After completing the course, students will able to:

CO1	Define basic terms in concern with different networks.	K1
CO2	Understand network analysis concepts.	K2
CO3	Perform transient analysis of networks.	K2
CO4	Perform AC analysis of networks.	K2
CO5	Understand two port network parameters and functions	K2
CO6	Apply the knowledge of network analysis concepts to solve given problem.	K3

Detailed Syllabus:

Unit 1	**Network Analysis:** Mesh, Super mesh, Node and Super Node analysis, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems, Millers Theorem and its dual.(AC circuit analysis for all above topics of thisunit) **Graph Theory:** Network graph, tree, co-tree, and loops. Incidence matrix, tie-set, cut-set matrix. Formulation of equilibrium equations in matrix form

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Unit 2	**Transient Analysis of Basic RC, RL and RLC Circuits** Initial conditions, source free RL and RC circuits, properties of exponential response, Driven RL and RC circuits, Natural and Forced response of RL and RC circuits. Introduction to Source free and driven series RLC circuit. Over damped and Under damped series RLC circuit.
Unit 3	**Resonance** **Series Resonance:** Impedance, Phase angle variations with frequency, Voltage and current variation with frequency, Bandwidth, Selectivity. **Parallel resonance:** Resonant frequency and admittance variation with frequency,
	Bandwidth and selectivity. General case: Resistance present in both branches. Comparison and applications of series and parallel resonant circuits.
Unit 4	**Filters and Attenuators** **Classifications:** Symmetrical networks, asymmetrical networks, properties of symmetrical and asymmetrical networks. **Filters:** Filter fundamentals, Constant K-LPF, HPF, BPF and BSF, introduction to concept of m derived LPF and HPF, Terminating half sections, and composite filters. **Attenuators:** Introduction to Neper and Decibel. Symmetrical T and type attenuators.
Unit 5	**Two Port Network Parameters and Functions** Terminal characteristics of network: Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions, Applications of the parameters. Application of Laplace Transforms to circuit analysis. Network functions for one port and two port networks, Pole-zeros of network functions and network stability.

TEXT AND REFERENCE BOOKS

1. Franklin F. Kuo, Network Analysis and Synthesis, Wiley Publications
   M.E. Van Valkanburg, Network Analysis, PHI Publications
2. M.E. Van Valkanburg, Introduction to Modern Network Synthesis, Wiley Publicatio
3. L. Wadhawa, Network Analysis and Synthesis, New Age InternationalPublications
   Roy Chaudhary, Networks and Systems, New Age International Publications Network
4. Lines and Fields by John D Ryder; PHI, NewDelhi.
   Network Filters and Transmission Lines by AK Chakarvorty; Dhanpat Rai and Co. Publication

Mapping of Course outcome with Program Outcomes

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

3 – High 2 – Medium 1 - Low

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

1) Simulation
2) Prototypedevelopment
3) Power point presentation of casestudies
4) Question & answer / Numericalsolution

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ET2012 : Lab-Network Theory	
Teaching Scheme **Practical: 2 Hrs/Week** **Credits: 01**	**Examination Scheme** **TermWork : 25 Marks** **PracticalExamination &Viva Voce: : 25Marks**

Laboratory Course Outcomes

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

CO1	Experiment for verification of network theorems.
CO2	Plot transient response of RL and RC circuits.
CO3	Measurement of two port parameters for a given circuit.
CO4	Plot frequency response of passive networks.

List of Experiments

Sr. No.	List of Experiments
1	To verify i. Thevenin'stheorem. ii. Maximum power transfertheorem iii. Superposition theorem.
2	To find transient response of RL and RC circuits
3	To measure the 'Z' and 'Y' parameters of two port network.
4	To measure the 'h' and ABCD parameters of two port network.
5	i. To find resonance frequency and bandwidth of series and parallel RLCcircuit. ii. Simulate parallel resonance circuit in which resistance present in bothbranches
6	To plot frequency response of low pass and high pass filter. Also find out cutoff frequency.
7	To plot frequency response of band pass and band stops filter.
8	To plot frequency response of m derived low pass and high pass filter.
9	Design of symmetrical T and pi attenuator

Mapping of Course outcome with Program Outcomes

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

3 –High 2 –Medium 1 - Low

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ET2013 : Linear Integrated Circuits (Professional Core)	
Teaching Scheme **Lectures: 3 Hrs/Week** **Total Credits : 03**	**Examination Scheme** **Class Test I : 15 Marks** **Class Test II : 15Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Electronic Devices and Circuits

Course description: This course covers fundamentals of Linear Integrated Circuits. It deals with characteristics of Operational amplifiers. It covers applications such as summing, precision rectifying, filtering as well as timer, PLL *etc.*

Course Objectives:

To impart knowledge of working principles of Op-Amp & its applications
To emphasize the features and advantages of integrated circuits
To introduce the theoretical concepts and applications of analog multipliers & PLL
To design simple filter circuits for particular application

Course Outcomes

After completing the course, students will able :

CO1	To learn about the basic concepts, configurations and parameters of op-amp	K1
CO2	To understand and analyze frequency response of op-amp and its compensation	K2
CO3	To comprehend op-amp applications in linear and non-linear domains	K2
CO4	To implement linear/non-linear circuits for signal processing and communications	K3
CO5	To attain design skills for op-amp based specific circuits like ADC/DAC, Active filters	K2
CO6	To develop design skills for interfacing analog opamp circuits to digital circuits.	K2

Detailed Syllabus:

Unit 1	**Op-Amp Fundamentals** Block diagram of Op-Amp. An overview of different types of OPAMP, their peculiarities and application areas. Op-Amp parameters, Frequency response, inverting, and non-inverting configurations.
Unit 2	**Op-Amp Applications** Summing amplifier, Difference amplifier, Instrumentation amplifier and applications, Integrator, Differentiator and applications. V to I and I to V converter, Comparators, Limitations of Op-amp as Comparator, Schmitt trigger, Comparator IC LM339, Precision rectifiers, Peak detector.
Unit 3	**Signal Generators** Sine wave generators, Triangular wave generators, Saw tooth generators, V to F and F to V converters, function generator IC 8038 , Multi vibrators using IC 555, D-A and A-D converters.
Unit 4	**Active Filter Design** All types of filter responses, First and second order active filters LP and HP, BPF, band reject and bi quad filters, sensitivity analysis.
Unit 5	**Non-linear Applications and Phase Locked Loops**

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	Log and Antilog amplifiers, Analog multipliers, Block diagram of PLL, free running frequency, lock range, capture range, Transfer characteristics of PLL, Block diagram of PLL IC 565, Applications of PLL - Frequency synthesizer, FM demodulator, AM demodulator, FSK demodulator

Text and Reference Books

1. D. Roy Choudhary, Shail Jain, Linear Integrated Circuits, New Age International
2. MilimanHykin, Integrated Circuits, TMH.
3. GovindDaryanani, Principles of Active Network Synthesis and Design, John Wiley and Sons
4. Ramakant A. Gaikwad, "Op-Amps and Linear Integrated Circuits",PHI.
5. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", TMH, Third Edition

Mapping of Course outcome with Program Outcomes

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

3 – High 2 – Medium 1 - Low

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

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

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ET2014 : Lab Linear Integrated Circuits	
Teaching Scheme **Practical: 2 Hrs/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 able to:

CO1	Conduct the measurement process for Op-Amp parameters.
CO2	Implement wave generator circuits.
CO3	Implement signal processing and wave shaping circuits.
CO4	Demonstrate the linear/nonlinear applications using Op-Amp like filters ADC,DAC.

List of Experiments

Sr. No.	List of Experiments
1	To measure operational amplifiers parameters.
2	To implement non inverting amplifier and to study Op-Amp as unity gain buffer.
3	To implement inverting amplifier and to study Op-Amp as inverter (sign changer).
4	To implement adder/ subtractor amplifier circuit.
5	To plot output response of Integrator for square and sinusoidal inputs.
6	To plot output response of Differentiator for square and sinusoidal inputs.
7	To plot Frequency response of low pass Butterworth's 2^{nd} order active filter.
8	To plot Frequency response of high pass Butterworth's 2^{nd} order active filter.
9	To implement Voltage to current converter and Current to Voltage converter.
10	To simulate waveform generator using function generator IC 8038.
11	To implement and plot the output waveform for astable multivibrator using IC 555.
12	To assemble Zero crossing detector and observe the input-output waveforms.
13	To study PLL 565 and its transfer characteristics.

Mapping of Course outcome with Program Outcomes

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

3 – High 2 – Medium 1 - Low

Approved in XXI Academic Council, Dated 12 Feb 2020

ET2015 : Analog Communication (Professional Core)	
Teaching Scheme **Lectures : 03Hrs/Week** **Total Credits : 03**	**Examination Scheme** **Class Test I : 15 Marks** **Class Test II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Nil

Course description: After completing this course, students will have a clear and fundamental understanding of Communication theory. Topics range from an overview of types of modulation. Effect of noise in communication is also covered. Subject develops the understanding of students to treat the modulation in time and frequency domain.

Course Objectives:

- To provide students with basics of Analog Communication principles
- To emphasize Analog modulation and demodulation techniques.
- To emphasize Performance of communication circuits in presence of noise
- To emphasize Modern trends in communication systems and transmitter/receiver circuits.

Course Outcomes

After completing the course, students will able to:

CO1	State basic concepts in electronic communication	K1
CO2	Understand various modulation and demodulation techniques and noise	K2
CO3	Solve numericals on different types of modulation and demodulation	K2
CO4	Explain effect of noise and different applications of various modulations	K2
CO5	Comprehend modulations in time and frequency domain	K2
CO6	Compare different techniques of modulation and demodulation	K2

Detailed Syllabus:

Unit 1	**Amplitude Modulation** Introduction to communication system, Need for modulation, Frequency Division Multiplexing, Amplitude Modulation, Definition, Time domain and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves, Switching modulator, Detection of AM Waves; Square law detector, Envelope detector, Double side band suppressed carrier modulators, time domain and frequency domain description, Generation of DSBSC Waves, Balanced Modulators, Ring Modulator
Unit 2	**SSB Modulation** Frequency domain description, Frequency discrimination method for generation of AM SSB Modulated Wave, Time domain description, Phase discrimination method for generating AM SSB Modulated waves. Demodulation of SSB Waves, Vestigial side band modulation: Frequency description, Generation of VSB Modulated wave, Time domain description, Envelope detection of a VSB Wave pulse Carrier, Comparison of AM Techniques.

Unit 3	**Angle Modulations** Basic concepts, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Direct FM, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Comparison of FM and AM.
Unit 4	**Noise in Analog Modulation** Definition, classification, Noise in Analog communication System, Noise in DSB and SSB System, Noise in AM System, Noise in Angle Modulation System, Threshold effect in Angle Modulation System, Pre-emphasis and de-emphasis.
Unit 5	**Pulse Modulation and Radio Transmitters & Receivers** Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation and demodulation of PWM, PPM, Generation and demodulation of PPM, Time Division Multiplexing. Receiver Types - Tuned radio frequency receiver, Super-heterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Comparison with AM Receiver, Amplitude limiting.

Text and Reference Books

1. Simon Haykin, Analog and Digital Communications, John Wiley, 2005
2. George F. Kennedy, Electronic Communication System, Tata McGraw Hill.
3. F.E.Terman, Electronics and Radio Engg, Mc- Graw Hill.
4. R. Coolen, Electronic Communications, PHI
5. K. Sam Shanmugam ,Analog and Digital Communication, Willey ,2005
6. Wayne Tomasi, Electronics Communication Systems-Fundamentals through Advanced, PHI, 5th Edition, 2009

Mapping of Course outcome with Program Outcomes

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

3 – High, 2 – Medium, 1 - Low

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

1) 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

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ET2016: Lab-Analog Communication (Professional Core)	
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 able to:

CO1	Implement and realize circuits for different modulation techniques
CO2	Implement and realize circuits for different demodulation techniques
CO3	Build and test the basic digital communication circuits
CO4	Write programs for generation and detection of different modulations and demodulation

List of Experiments

Sr. No.	Details
1	Implement the circuit for Amplitude Modulation and Demodulation. Perform this using simulation software (Proteus or similar)
2	Determine modulation index with trapezoidal method and the observed results with the theoretical values
3	Perform the experiment for DSB SC Modulation and Demodulation. Observe the waveforms
4	Perform the experiment for SSB SC Modulation and Demodulation. Observe the waveforms
5	Using the setup for Diode Detector observe the detection of modulated signals
6	Perform the experiment for Frequency Modulation and Demodulation
7	Perform the experiment for PAM generation and Reconstruction
8	Study the setup and output of PWM and PPM: Generation and Reconstruction
9	Build the circuits for Pre Emphasis - De Emphasis Circuits and perform the experiment
10	Perform the experiment AGC Characteristics

Mapping of Course outcome with Program Outcomes

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

3 – High 2 – Medium 1 – Low

ET2017 : Engineering Mathematics IV	
Teaching Scheme **Lectures: 4 Hrs /Week** **Credits: 04**	**Examination Scheme** **Test 1 : 15 Marks** **Test 2 : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of basic mathematics

Course description: This course will give exposure on vector spaces, linear mapping, correlation, regression and queuing theory. The contents are creating basis for mathematics involved in higher level and research oriented courses.

Course Objectives:

- Understand vector spaces
- Understand concepts of linear mapping
- Impart knowledge of orthogonality concepts
- Expose basics of Queuing theory

Course Outcomes

After completing the course, students will able to:

CO1	Examine a system of vectors for linear dependence and for being a basis	K2
CO2	Understand linear transformations and orthogonality	K2
CO3	Find best fit curve by using least square method and regression analysis	K2
CO4	Solve Wave equations using numerical approach	K3

Detailed Syllabus:

Unit 1	**Vector Spaces** Introduction , Vector Spaces, Examples of vector spaces, linear combinations, Spanning Sets, Subspaces, Linear spans, Row space of a matrix, Linear dependence and independence, Basis and dimensions, Application to matrices, rank of matrix, Sums and direct sums, coordinates Introduction to linear transformation and vector spaces
Unit 2	**Linear Mapping and Matrices** Introduction, Mapping, functions, Linear mapping (Linear transformations), Kernel and image of linear mapping, singular and Non-singular linear mapping, Isomorphism, Operations with linear mappings, Algebra A(V) of linear operators. Introduction, Matrix Representation of a Linear Operator, Change of basis, Similarity, Matrix and general linear mappings.
Unit 3	**Inner Product Spaces, Orthogonality** Introduction, Inner product spaces, example of inner product spaces, Cauchy-Schwarz Inequality, Applications, Orthogonality, Orthogonal Sets and Bases, Gram-Schmidt Orthogonalization Process, Orthogonal and positive definite matrices, Complex inner product spaces, Normed vector spaces.

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Unit 4	**Correlation and Regression & Probability theory** Correlation and regression analysis, Linear regression, multivariable regression Analysis of variance, Least square curve fitting The notion of probability and basic properties, Random variables: Basic definition and properties, Transformations for random variables, Methods for generation of random variables
Unit 5	**Numerical Solution of Partial Differential Equations** Introduction, Laplace's equation, solution of Laplace equation by Jacobi's method and Gauss-Seidel method, Numerical solution of Wave equation
Text and Reference Books 1. Introductory Methods of Numerical Analysis, S. S. Sastry, PHI Publication 2. Linear Algebra, Schaum Outline Series, Seymour Lipschutz, Marc Lipson, McGraw Hill Publication 3. Elementary Statistical Methods, S. P. Gupta, S. Chand Publication 4. Linear Algebra and Vector Calculus, Rajesh R. Singh, Mukul Bhatt, McGraw Hill Publication	

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										
CO3	2	2	2								1	
CO4	3	2	1								1	

3 – High 2 – Medium 1 - Low

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

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