VIT Vidyalankar Institute of Technology
Accredited A+ by NAAC

Vidyalankar Institute of Technology

An Autonomous Institute affiliated to University of Mumbai

Bachelor of Technology

in

Electronics & Telecommunication Engineering

Second Year Scheme and Syllabus

(As per NEP GR, with effect from the Academic Year 2023-24)

Preamble

The National Education Policy (NEP) framework aims to break the mould from teacher centric to student centric educational practices. It empowers the students with flexibility in terms of choosing courses across different faculties and modes of learning.

This multidisciplinary approach will encourage learners to follow their passion and inherent interests. The learner is free to learn at a pace that he is comfortable with, and this enables lifelong learning. It also enhances the scope for holistic personality development.

This premise is truly reflected in preamble of the NEP document, "The future of nation is decided in the classrooms of the schools and colleges today".

Details of implementation:

NEP curriculum framework enables us to accelerate change, redesign systems with equity in mind, respond to feedback, encourage collaboration, catch and pollinate ideas and create a culture of research and development. It will allow us to offer the required academic flexibility which will focus on improving competency level of students with diverse strengths.

The curriculum planned by VIT has vertical Program Courses consisting of core courses (PCC) of branch of engineering positioned and sequenced to achieve sequential and integral learning of the entire breadth of the specific branch. This vertical also includes Professional elective courses (PEC) which offer flexibility and diversity to learners to choose specialization from a basket of recent developments in their field of technology. The selection of unique professional elective courses based on industrial requirements and organizing them into tracks is a special feature of this curricula ensuring employability.

The vertical Multidisciplinary Courses consists of Open Elective (OE) courses and multidisciplinary minor (MD M) courses. Special vocational and skill development courses are included as a part of Skill courses vertical that make student capable to work in industrial environment.

The student is expected to demonstrate their ability through courses in Experiential Learning Courses vertical like internships/On Job Training, Community Engagement Project, Real Industry Project/ research problem. Our curriculum also introduces Social Service Internship and Internship with institutes abroad along with courses like Design Thinking. This will lead to the creation of products and/ or patents through this program.

For holistic development of students, apart from technical courses, Ability Enhancement Courses, Entrepreneurship/Economics/Management Courses, Indian Knowledge System and Value Education courses from vertical Humanities and Social Science and Management develop the required soft-skills and attitude amongst learners.

In Liberal Learning vertical, courses like Various Dance Forms, Global citizenship Education, Facets of Astronomy etc. aim to create balance in brain hemispheres and hence improve learners' clarity in thoughts and responses.

In addition to core courses, professional and open electives; our framework offers honor degree in each programme of engineering. It includes specialized courses along with field/ domain study that make students capable of working on industry relevant problems.

Chairman, Board of Studies
Department of Electronics & Telecommunication Engineering
Vidyalankar Institute of Technology

Chairman, Academic Council
Vidyalankar Institute of Technology

Course Structure and Assessment Guidelines

for

S. Y. Bachelor of Technology

in

Electronics and Telecommunication Engineering

Second Year B. Tech. Electronics & Telecommunication Engineering Preferred Semester: III

Course Structure and Assessment Guidelines

	Course		Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
NEP-Vertical	Code	Name			ISA	MSE	ESE	
BSC	BS43	Engineering Mathematics-III	Theory	3	20	30	50	100
PC_PCC	ET102T	Microprocessor and Microcontroller	Theory	2	15	20	40	075
	ET102P	Microprocessor and Microcontroller Lab	Practical	1	25	-	25	050
	ET01T	Electronic Devices and Circuits	Theory	2	15	20	40	075
	ET01P	Electronic Devices and Circuits Lab	Practical	1	25	-	25	050
	ET02T	Principles of Communication Engineering	Theory	2	15	20	40	075
	ET02P	Principles of Communication Engineering Lab	Practical	1	25	-	25	050
	ET101T	Network Theory and Transmission lines	Theory	2	15	20	40	075
	ET101P	Network Theory and Transmission lines lab	Practical	1	25	-	25	050
SC-VSEC	ET08	Instrumentation and Control Systems lab	Practical	1	25	-	25	050
	ET17	Skill Based Lab	Practical	1	50	-	-	050
HSSM_AEC	HS07	Technical Communication	Practical	1	50	-	-	050
HSSM_IKS	GEXXX*	Any HSSM_IKS course	Theory	2	As per course			075
Total Credits				20				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESA= End Semester Examination

*Selection based on the subset of courses made available by the Institute for the semester.

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Second Year B. Tech. Electronics & Telecommunication Engineering Preferred Semester: IV

Course Structure and Assessment Guidelines

	Course		Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40% of total marks)
NEP-Vertical	**Code**	**Name**			**ISA**	**MSE**	**ESE**	
PC_PCC	ET106T	Mathematical theory of Communication	Theory	2	15	20	40	075
	ET106P	Mathematical theory of Communication Lab	Practical	1	25	-	25	050
	ET07T	Data Structures and Analysis of Algorithms	Theory	2	15	20	40	075
	ET07P	Data Structures and Analysis of Algorithms Lab	Practical	1	25	-	25	050
	ET06T	Integrated Circuits	Theory	2	15	20	40	075
	ET06P	Integrated Circuits Lab	Practical	1	25	-	25	050
	ET09T	Digital Communication	Theory	2	15	20	40	075
	ET09P	Digital Communication Lab	Practical	1	25	-	25	050
	ET100T	Signal and systems	Theory	2	15	20	40	075
	ET100P	Signal and systems Lab	Practical	1	25	-	25	050
ELC_INT/ OJ	ET45	Mini Project 1 (Hardware)	Practical	2	25	-	50	075
ELC-CEP	GEXXX*	CEP/FP course	As per course	2	As per course			
Total Credit				19				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESA= End Semester Examination

*Selection based on the subset of courses made available by the Institute for the semester.

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed syllabus of Second Year Semester - III

Course Name: Engineering Mathematics-III

Course Code: BS43

Category: Basic Science (BS)

Preamble:

The objective of the course is to impart the knowledge of Laplace Transform, Inverse Laplace Transform, Fourier Series, Fourier Transforms and Complex Variable. The course clarifies the concept of transforms and its applications. The course will enable students to learn different transforms of a function, Complex Variable and it will provide with a sound foundation in Mathematics to prepare them for graduate studies in Electronics and Telecommunication Engineering.

Pre-requisites:

Applied Mathematics-I(BS02), Applied Mathematics-II(BS04)

Course Objectives:

- To understand and apply Laplace and inverse Laplace transform to solve differential equations.
- Understanding the fundamental of Fourier series, Fourier transform, Eigen value and Eigen vectors and Complex Variable to solve real world problems.
- To create a strong foundation by studying the basics of Engineering Mathematics and interfacing to various peripherals which will lead to a well-designed based System.
- To provide students with the sound foundation of Mathematics, Science, and Engineering fundamentals necessary to formulate, solve and analyse engineering problems and prepare them for Graduate studies.
- To impart knowledge of interfacing techniques and educate the student in the domain of Electronics and Telecommunication Engineering.

Course Outcomes:

Student will be able to:

CO1: Compute Laplace Transform of a given function

CO2: Apply Inverse Laplace Transform to convert frequency domain into time domain.

CO3: Obtain Fourier series of a given periodic functions by decomposing it into sine and cosine series.

CO4: Apply Fourier transforms to solve problems involving periodic and non-periodic functions.

CO5: Solve problems involving eigenvalues and eigenvectors to understand their applications in different contexts.

CO6: Analyze complex functions to determine if they are analytic and apply C-R equations to verify their analyticity.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	-	3	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	20	30	50	100

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Laplace Transform	Definition of Laplace transform Laplace Transform (L) of Standard Functions, Properties of Laplace Transform: Linearity, First Shifting theorem, Second Shifting Theorem, change of scale Property, Multiplication by t, Division by t, Laplace Transform of derivatives and integrals (All Properties are without proofs). Evaluation of integral using Laplace Transform.	8
2	Inverse Laplace Transform	Formulae of Inverse Laplace Transform, Laplace Inverse using partial fraction, Properties of Inverse Laplace Transform, convolution Theorem (without proof).	6
3	Fourier Series	Fourier series of a periodic function in the interval of period 2π, 2L. Half range Sine and Cosine Fourier series, Complex form of Fourier series.	8
4	Fourier Transform	Fourier Transform, Fourier Sine & Cosine Transform. Inverse Fourier transforms.	6
5	Eigen Values and Eigen Vectors	Eigen values and Eigen vectors Properties, Cayley Hamilton theorem (without proof), examples based on verification of Cayley Hamilton Theorem and by using it to find inverse and power of given matrix.	8

6	Complex variable	Analytic function, C-R equations in polar & cartesian form (without proof), Harmonic function. Finding analytic function if $u\ or\ v\ or\ (u+v)\ or\ (u-v)$ is given, Milne-Thompson method, Orthogonal trajectories.	9
		Total	**45**

Textbooks:

1. Dr. B. V. Ramana "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, India 2006
2. P. N. Wartikar and J N Wartikar "Textbook of Applied Mathematics Volume I & II, Vidyarthi Ghriha Prakashan Pune 2005 9th Edition.
3. Kanti B Datta, "Mathematical methods for Science and Engineering", Cengage learning 2012.
4. N P Bali and Manish Goyal, "A textbook of Engineering Mathematics", Laxmi Publication 2006.

Reference Books:

1. Dr. B S Grewal, "Higher Engineering Mathematics", Khanna Publication, 44th Edition
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & sons, 10th Edition.
3. C. R. Wylie & L. C. Barrett, "Advanced Engineering Mathematics", Tata McGraw India, 6th Edition.
4. H K Das, "Advanced Engineering Mathematics", S Chand, 22nd Edition.
5. Murray R. Spiegel. "Schaum's Outline of Laplace Transform", Tata McGraw India, 1st Edition.
6. Murray R. Spiegel. "Schaum's Outline of Fourier analysis with applications", Tata McGraw India ,1stEdition.
7. Dr. B S Tyagi, "Function of a Complex variable", Kedar Nath & Ram Nath publication, 2021.

Course Name: Microprocessor and Microcontrollers

Course Code: ET102T

Category: Core

Preamble:

Microprocessor (MP) and microcontroller (MC) are fundamental building blocks in any smart application. To develop any application, it is important for the students to understand the hardware architecture and programming aspects of a microcontroller and interfacing of various types' devices with microcontroller. A microcontroller can be considered a self-contained system which is integrated with a processor, a memory and different peripheral devices like timers. Microcontrollers are widely used in the design of embedded systems like a temperature monitoring system. In contrast, the microprocessor is not a self-contained system and a device like memory is connected externally. Microprocessors are widely used in personal computers (PC's), laptops for general-purpose computing applications. This course prepares the students to gain fundamental knowledge of microprocessor and microcontroller architecture and develop skills for programming of microcontroller for application development.

Pre-requisites:

Logic Circuit

Course Objectives:

- To enable learners to gain knowledge of hardware organization of microprocessor-based system 8-bit microcontroller.
- To enable learners to gain knowledge for programming of 8-bit microcontroller.
- To enable learners to interface and programming of different types of peripheral devices with 8-bit microcontroller.
- To enable learners to develop applications based on 8-bit microcontrollers.

Course Outcomes:

Student will be able to:

CO1. Understand the organization of processor based system and memory.
CO2. Understand detailed architecture of 8051 microcontroller.
CO3. Develop assembly language program 8051 microcontroller.
CO4. Use different peripheral devices with 8 bit microcontroller.
CO5. Design simple applications based on 8 bit microcontrollers and their development boards.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	75

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Processor architecture	Overview of microcomputer systems, Steps taken by the microprocessor to executes an instruction. Components of microprocessor based system. Concept of bus, Program Counter, Stack. Introduction to processor architecture: Von Neumann and Harvard model.	05
2	Memory system	Classification of Memory: Primary and Secondary. Types of Semiconductor memories. Concept of Cache Memory.	03
3	8051 Microcontroller	Intel 8051 microcontroller, features, architecture and hardware pins, memory organization, IO Ports, Timers, Interrupt system and serial port.	06
4	Programming 8051 Microcontroller	Addressing modes, Assembly language instructions for 8051 microcontroller, assembly language programming using 8051 microcontroller for Arithmetic and Logic operations, Block manipulations, sorting, searching. Bit level and byte level IO operations, Delay subroutines using Timer.	05

5	Interfacing Devices with 8 bit Microcontroller	Sensors and Actuators, Switches, Relays, IO devices like LED, 7 Segment display, LCD, motors, and memory with 8 bit microcontroller.	05
6	Study 8 bit microcontroller Applications	Selecting a microcontroller for an application, Concept of RISC & CISC Architecture, Speed Control of DC Motor and stepper motor, Temperature monitoring with LCD display, Design of Clock using I2C RTC and display device. Study of development board: MSP 430 and Arudino UNO.	06
Total			**30**

Text Books:

1. Computer Organization- By Carl Hamacher, Zvonko Vranesic and Safwat Zaky, McGraw Hill, Second Edition.
2. The 8051 Microcontroller & Embedded system using assembly & 'C'- By C. Kenneth J. Ayala and D. V. Gadre, Cengage Learning, Edition 2010.
3. The 8051 Microcontroller & Embedded systems- By M. A. Mazidi, J. G. Mazidi and R. D. Mckinlay, Pearson Publications, Second Edition 2006
4. Douglas V Hall, SSSP Rao "Microprocessors & Interfacing", McGraw Hill

Reference Books:

1. Introduction to embedded systems- By Shibu K. V, McGraw Hill.
2. 8051 Microcontrollers MCS 51 Family and its variants - By Satish Shah, Oxford publication, first edition 2010.
3. Microcontrollers – Theory and Applications- By Dr. Ajay V. Deshmukh, Tata McGraw–Hill Companies – 2005.
4. Programming Customizing the Microcontroller- By McGraw Hill, 2001.

Course Name: Microprocessor and Microcontrollers Lab

Course Code: ET102P

Category: Core

Preamble:

This course introduces learners to understanding the concept of Integrated Development Environment (IDE), its use in development and simulation of assembly language. Interfacing the I/O devices with 8-bit microcontrollers, writing the program for problem statement and developing a simple microcontroller-based applications during practical.

Pre-requisites: Logic Circuits

Course Objectives:

- To understand the concept and use of IDE.
- To understand the development and simulation of assembly language program.
- To understand the use of various peripheral devices.
- To understand testing and verification of hardware interfacing and software written for.
- To understand development of simple embedded solution for the real life problem statement.

Course Outcomes:

Student will be able to:

CO1: Use Keil IDE in the development, simulation and execution of assembly language program of 8051 microcontroller.
CO2: Develop assembly language program for ALU operations for 8051 microcontrollers.
CO3: Develop assembly language program for data sorting, searching operations for 8051 microcontroller.
CO4: Implement interfacing of I/O devices with 8051 microcontroller.
CO5: Design simple application using 8-bit microcontrollers.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	25	-	25	50

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

- Develop 8051 assembly language program to implement ALU operations required in the data computations.
- Develop 8051 assembly language program to implement data search (smallest, largest) from the block of information like min temperature, max temperature, average temperature.
- Develop 8051 assembly language program for data sorting (odd values, even values, above or below certain value) from the block of information like marks above or below certain limit.
- Develop 8051 based system and write assembly language program for the interfacing of I/O devices like to read the number of events happening, display the result of certain operation.
- Develop 8051 based simple application like temperature monitoring system, speed control of DC motor according to change in temperature, design of clock using RTC to time window for certain task.

Text Books:

1. Computer Organization- By Carl Hamacher, Zvonko Vranesic and Safwat Zaky, McGraw Hill, Second Edition.
2. The 8051 Microcontroller & Embedded system using assembly & 'C'- By C. Kenneth J. Ayala and D. V. Gadre, Cengage Learning, Edition 2010.
3. The 8051 Microcontroller & Embedded systems- By M. A. Mazidi, J. G. Mazidi and R. D. Mckinlay, Pearson Publications, Second Edition 2006
4. Douglas V Hall, SSSP Rao "Microprocessors & Interfacing", McGraw Hill

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1. Introduction to embedded systems- By Shibu K. V, McGraw Hill.
2. 8051 Microcontrollers MCS 51 Family and its variants - By Satish Shah, Oxford publication, first edition 2010.
3. Microcontrollers – Theory and Applications- By Dr. Ajay V. Deshmukh, Tata McGraw–Hill Companies –2005.
4. Programming Customizing the Microcontroller- By McGraw Hill, 2001.

Course Name: Electronic Devices and Circuits

Course Code: ET01T

Category: Core

Preamble:

This course introduces students about Working and characteristics of various Active devices used to build various circuits. The course will offer in depth knowledge about modelling of devices and analysis and designing of various circuits used to develop the Electronics system.

Pre-requisites:

Nil

Course Objectives:

- Understanding, working, characteristics and biasing of BJT.
- Analyzing and designing various amplifiers using MOSFET
- To understand and evaluating various types of power amplifier circuits.
- Analyzing and designing various types of low and high frequency oscillator circuits.
- Understanding and Analysing MOSFET based differential amplifier circuits.

Course Outcomes:

Student will be able to:
CO1: Students will be able to Analyse various performance parameter of BJT & MOSFET Amplifier circuits.
CO2: Students will be able to Design Electronic circuits for given specification using BJT & MOSFET.
CO3: Students will be able to understand Operation of Power Amplifier.
CO4: Students will be able to understand Oscillator.
CO5: Students will be able to understand Differential Amplifier.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Bipolar Junction Transistor	Construction and working of B.J.T. CE Configuration of BJT and their characteristics. Biasing of BJT and its various circuits. BJT Modelling (hybrid-π model only). Introduction to CE Amplifier and Analysis of only CE Amplifier using only hybrid-π Model. Numerical based on BJT biasing and BJT Amplifier.	8
2	MOSFET	Construction working and characteristics of Enhancement MOSFET and depletion MOSFET. Dc load line and Biasing circuits for EMOSFET, DMOSFET. Numerical on Biasing circuits. Small Signal Equivalent circuits of MOSFET. Introduction and Analysis of CS Amplifier .	6
3	Power Amplifier:	Introduction to various types of power amplifier. Analysis of Class A, class B, Class AB power Amplifier using BJT. Heat sink and it's need. Study of Class C amplifier(study of transformer coupled and transformer less Push Pull qmplifiers)	5
4	Oscillator	Concept of feedback. Introduction to Positive and Negative Feedback [only block diagram and concept. No circuits and derivation] .Barkhauson's Criteria. RC phase shift and Wien bridge oscillator using BJT. General Topology of Tank circuits oscillator, Hartley, Colpitt and Clapp oscillator using BJT	6

5	Differential Amplifier.	Differential Amplifier: Need of Differential amplifier. Dc transfer characteristics of MOSFET passive load different amplifier DC & AC Analysis of MOS passive load Amplifier.	5
Total			**30**

Text Books:

1. Electronic Circuit Analysis and Design. D. A. Neamen, Tata McGraw Hill 2nd Edition, 2012
2. Microelectronics Circuits, Sedra and Smith OXFORD 7thEdition.

Reference Books:

1. Electronic Devices and Circuit. T. F. Bogart, Merrill 6thEdition. Reference Books
2. Electronic Devices and Circuits Salivahanan, N. Suresh Kumar, Tata McGraw Hill, 3rdEdition
3. Electronic Devices and Circuits J. Millman, Christos CHalkias, and Satyabratat Ajit, Millman's, Tata McGraw Hill, 3rdEdition
4. Microelectronics Circuits Analysis and Design Muhammad H. Rashid, Cengage Learning, 2nd Edition

Course Name: Electronic Devices and Circuits Lab

Course Code: ET01P

Category: Core

Preamble:

This course introduces students about Working and characteristics of various Active devices used to build various circuits. The course will offer in depth knowledge about modelling of devices and analysis and designing of various circuits used to develop the Electronics system.

Pre-requisites:

Nil

Course Objectives:

- Understanding, working, characteristics and biasing of BJT.
- Analyzing and designing various amplifiers using MOSFET
- To understand and evaluating various types of power amplifier circuits.
- Analyzing and designing various types of low and high frequency oscillator circuits.
- Understanding and Analysing MOSFET based differential amplifier circuits.

Course Outcomes:

Student will be able to:
CO1: Students will be able to Analyse various performance parameter of BJT & MOSFET Amplifier circuits.
CO2: Students will be able to Design Electronic circuits for given specification using BJT & MOSFET.
CO3: Students will be able to understand Operation of Power Amplifier.
CO4: Students will be able to understand Oscillator.
CO5: Students will be able to understand Differential Amplifier.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	25	50

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. Implementation and designing of various biasing circuits for BJT.
2. Implementation and designing of various biasing circuits for MOSFET.
3. Implementation and verifying the results of Common Emitter Amplifier.
4. Implementation and verifying the results of Common Source Amplifier
5. Frequency analysis of Common Emitter Amplifier.
6. Frequency analysis of Common source Amplifier.
7. Implementation of R-C Phase shift oscillator using BJT.
8. Implementation of Hartley oscillator using BJT
9. Implementation of Transformer coupled Class A Power Amplifier using BJT
10. Implementation of Transformer coupled Class B Power Amplifier using BJT
11. Implementation of Passive load Differential Amplifier using MOSFET.
12. V-I Characteristics of BJT using LT-SPICE.
13. V-I Characteristics of MOSFET using LT-SPICE
14. Simulation of Wien-Bridge Oscillator using BJT.
15. Simulation of Colpitt Oscillator using BJT

Suggested List of Mini-Project:

1. 5V DC Power supply.
2. Bugler Alarm
3. Light operated switch.
4. Auto door opening using sensors.
5. Pre Amplifier circuit.
6. Musical Siren.

Text Books:

1. Electronic Circuit Analysis and Design. D. A. Neamen, Tata McGraw Hill 2nd Edition, 2012
2. Microelectronics Circuits, Sedra and Smith OXFORD 7th Edition.

Reference Books:

1. Electronic Devices and Circuit. T. F. Bogart, Merrill 6thEdition. Reference Books
2. Electronic Devices and Circuits Salivahanan, N. Suresh Kumar, Tata McGraw Hill, 3rdEdition
3. Electronic Devices and Circuits J. Millman, Christos CHalkias, and Satyabratat Ajit, Millman's, Tata McGraw Hill, 3rdEdition
4. Microelectronics Circuits Analysis and Design Muhammad H. Rashid, Cengage Learning, 2ndEdition.

Course Name: Principles of Communication Engineering

Course Code: ET02T

Category: Core

Preamble:

This course introduces students to basics of Communication Engineering with detailed understanding of various analog, angle modulation and demodulation techniques and all the applications dealt in detail. The course also covers pulse analog and digital modulation and demodulation techniques

Pre-requisites:

Nil

Course Objectives:

- To illustrate fundamentals of basic communication system
- To enable learners to understand various analog modulation and demodulation techniques
- To focus on applications of analog modulation and demodulation techniques
- To explain the key concepts of analog and Digital Pulse modulation and demodulation techniques

Course Outcomes:

Student will be able to:

CO1: Understand the basic components of communication and noises in communication system.

CO2: Explain various modulation and demodulation techniques.

CO3: Compare the performance of Transmitters and Receivers.

CO4: Explain various analog and Digital Pulse Modulation & Demodulation techniques.

CO5: Understand Time Division and Frequency Division Multiplexing & De-multiplexing.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Basics of Communication System	Block diagram, electromagnetic spectrum, signal bandwidth and power, types of communication channels, Introduction to time and frequency domain. Basic concepts of wave propagation. Types of noise, signal to noise ratio, noise figure, noise temperature and Friss formula.	4
2	Amplitude Modulation and Demodulation	Basic concepts, need for modulation, waveforms (time domain and frequency domain), modulation index, bandwidth, voltage distribution and power calculations. DSBFC: Principles, low-level and high-level transmitters, DSB suppressed carrier, Balanced modulators with diode (Ring modulator and FET) and SSB systems. Amplitude demodulation: Diode detector, practical diode detector, Comparison of different AM techniques, Applications of AM and use of VSB in broadcast television.	7
3	Angle Modulation and Demodulation	Frequency and Phase modulation (FM and PM): Basic concepts, mathematical analysis, FM wave (time and frequency domain), sensitivity, phase and frequency deviation, modulation index, deviation ratio, bandwidth requirement of angle modulated waves, narrowband FM and wideband FM. Varactor diode modulator, FET reactance modulator, stabilized, AFC, Direct FM transmitter, indirect FM	7

		Transmitter, noise triangle, pre- emphasis and de-emphasis FM demodulation: Balanced slope detector, Foster-Seely discriminator, Ratio detector, FM demodulator using Phase lock loop, amplitude limiting and thresholding, Applications of FM and PM.	
4	Radio Receivers	Characteristics of radio receivers, TRF, Super - heterodyne receiver block diagram, tracking and choice of IF, AGC and its types and Communication receiver. FM receiver block diagram, comparison with AM receiver.	4
5	Analog and Digital Pulse Modulation & Demodulation	Sampling theorem for low pass signal, proof with spectrum, Nyquist criteria, Sampling techniques, aliasing error and aperture effect. PAM, PWM, PPM generation, detection and applications. Basics of PCM system and differential PCM system. Concepts of Delta modulation (DM) and Adaptive Delta Modulation (ADM).	6
6	Multiplexing & De-multiplexing	Frequency Division Multiplexing transmitter & receiver block diagram and applications. Time Division Multiplexing transmitter & receiver block diagram and applications	2
Total			**30**

Text Books:

1. Kennedy and Davis, "Electronics Communication System,Tata McGraw Hill publication
2. B.P Lathi, Zhi Ding, "Modern Digital and Analog Communication system, Oxford University press, Fourth Edition
3. Wayne Tomasi, "Electronics Communication System, Pearson education, Fifth Edition

Reference Books:

1. Taub,Schilling and Saha "Taub's Principles of communication Systems, Tata McGraw Hill,Third Edition
2. P.Sing and S.D Sapre, "Communication Systems: Analog and Digital", Tata McGraw Hill, Third edition
3. Dennis Roddy and John Coolen, Electronic Communication,Pearson, 4/e, 2011
4. Simon Haykin, Michel Moher, "Introduction to Analog and Digital Communication", Wiley, Second edition
5. Louis Frenzel, "Communication Electronics", Tata McGraw Hill, Third Edition

Course Name: Principles of Communication Engineering Lab

Course Code: ET02P

Category: Core

Preamble:

This course introduces students to basics of Communication Engineering with detailed understanding of various analog, angle modulation and demodulation techniques and all the applications dealt in detail. The course also covers pulse analog and digital modulation and demodulation techniques

Pre-requisites:

Nil

Course Objectives:

- To illustrate performance of different analog modulation and demodulation techniques using experimentation/simulation
- To enable learners to demonstrate sampling theorem and various sampling techniques using experimentation
- To focus on various pulse modulation schemes used for data transmission using experimentation/simulation
- To explain the key concepts of multiplexing techniques using experimentation/simulation

Course Outcomes:

Student will be able to:

CO1: Analyse performance of different analog modulation and demodulation techniques using experimentation/simulation.
CO2: Demonstrate Sampling theorem and various sampling techniques using experimentation.
CO3: Analyse analog and Digital Pulse Modulation & Demodulation techniques using experimentation/simulation
CO4: Understand the concept of Multiplexing & De-multiplexing using Experimentation/simulation.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. Generation of AM modulation and demodulation.
2. Generation of FM modulation and demodulation.
3. Design and implement Pre-emphasis and De-emphasis circuit.
4. SSB Generation and Detection
5. Verification of Sampling theorem.
6. Generation of PAM modulation and demodulation.
7. Generation of PWM and PPM modulation and demodulation.
8. Demonstrate Digital pulse transmission technique (DM,ADM)
9. Observation of TDM multiplexing and de-multiplexing signals.
10. Observation of FDM multiplexing and de-multiplexing signals.
11. Obtain Frequency Spectrum of AM and determine its BW
12. Performance analysis of AM and FM

Text Books:

1. Kennedy and Davis, “Electronics Communication System,Tata McGraw Hill publication
2. B.P. Lathi,Zhi Ding, “Modern Digital and Analog Communication system”,Oxford University press Fourth Edition
3. Wayne Tomasi, “Electronics Communication System, Pearson education, Fifth Edition

Reference Books:

1. Taub, Schilling and Saha “Taub’s Principles of communication Systems, Tata McGraw Hill, Third Edition
2. P. Sing and S.D Sapre, "Communication Systems: Analog and Digital”, Tata McGraw Hill, Third edition
3. Dennis Roddy and John Coolen, Electronic Communication, Pearson, 4/e, 2011
4. Simon Haykin, Michel Moher, "Introduction to Analog and Digital Communication”, Wiley, Second edition
5. Louis Frenzel, “Communication Electronics”, Tata McGraw Hill, Third Edition

Course Name: Network Theory and Transmission Lines

Course Code: ET101T

Category: Core

Preamble:

This course introduces students to the basics of Electrical Circuit Theory and its analysis using various network solving techniques in time and frequency domain for different input signals. Students are introduced to the different network synthesis techniques. This course also discusses transmission lines which are used to carry information and energy, and its analysis using distributed circuit theory.

Pre-requisites:

Basic Electrical & Electronics Engineering.

Course Objectives:

- To analyse electrical circuits by using circuit theory concepts and network theorems.
- To analyse the electrical circuits in time and frequency domain.
- To understand network functions, network parameters, inter relationship among various circuit parameters, and to solve more complex network using these parameters.
- To synthesize passive networks by various methods.
- To analyse transmission lines using distributed circuit theory.

Course Outcomes:

Student will be able to:

CO1: Analyse electrical circuits using network basic concepts and network theorems.
CO2: Analyse the circuits for various inputs in time domain and frequency domain.
CO3: Determine various network parameters and network functions of two port networks.
CO4: Synthesize different network functions using various synthesis techniques.
CO5: Analyse transmission line at RF frequencies.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	75

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Analysis of DC and AC Circuits	Dependent Sources circuit analysis using mesh and node analysis Network Theorems: Superposition, Thevenin's, Norton's, and Maximum power transfer.	6
2	Time and Frequency Domain Analysis of R-L-C Circuits	Time Domain Analysis: Initial and final conditions of R, L, & C components. Time domain analysis of first order R-L and R-C Circuits, and second order RLC circuits. Frequency Domain Analysis: Frequency domain representation of R, L, and C components, Laplace Transform in analysis of electrical circuits. initial and final value theorem of Laplace transform.	6
3	Network Functions and Two Port Networks	Network functions: One port and Two port network functions, Poles and Zeros of Network functions. Two port networks: Open Circuits, short Circuit, Transmission and Hybrid parameters, conditions for reciprocity and symmetry, relationship among the parameters. Interconnections of Two-Port Networks.	6
4	Synthesis of Networks	Tests for Hurwitz polynomial: Routh Array and continued fraction expansion method. Positive Real Functions: Concept of positive real function, testing for necessary and sufficient conditions for Positive Real Functions.	6

		Synthesis of LC, RC & RL Circuits: properties of LC, RC & RL driving point functions, LC, RC & RL network Synthesis in Foster-I &II forms, Cauer-I & II forms.	
5	Transmission Line Theory	Transmission Line parameters, equivalent circuit, transmission line equation and its solution. Parameters of radio frequency lines: Propagation constant, attenuation constant, phase constant, group velocity, input impedance, characteristic impedance, reflection coefficient, standing wave ratio, VSWR, ISWR, Introduction to Smith Chart.	6
Total			**30**

Text Books:

1. Franklin F Kuo, "Network Analysis and Synthesis", Wiley Toppan, 2nd.ed. 1966
2. D Roy Choudhury, "Networks and Systems", New Age International 1998
3. David M. Pozar, "Microwave Engineering", Wiley, Third Edition
4. Sudhakar, Shyammohan S. Palli, "Circuits and Networks", Tata McGraw Hill, Third Edition

Reference Books:

1. M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi, 26th Indian Reprint, 2000
2. A Chakrabarti, "Circuit Theory", Dhanpat Rai & Co., Delhi, 6th Edition
3. W L Everitt and G E Anner, "Communication Engineering", Mc-GrawHill, New York, 3rd Edition
4. Annapurna Das and S. K. Das, "Microwave Engineering", McGraw Hill, Third Edition

Course Name: Network Theory and Transmission Lines Lab

Course Code: ET101P

Category: Core

Preamble:

This course introduces students to the techniques, concepts of Electrical Circuit analysis using simulations and experimentations. It also discusses transmission line analysis for radio wave propagation.

Pre-requisites:
Basic Electrical & Electronics Engineering

Course Objectives:

- To analyse and verify electrical circuits concepts and network theorems using simulation and experimentation.
- To analyse the response of R-L, R-C and R-L-C circuits.
- To analyse two port networks using network parameters.
- To analyse transmission lines for radio wave propagation.

Course Outcomes:

Student will be able to:

CO1: Analyse electrical/electronic circuits with the help network analysis concepts and theorems using simulation and experimentation.
CO2: Analyse the R-C and R-L-C circuits in time and frequency domain.
CO3: Analyse and represent the network in terms of network parameters.
CO4: Analyse transmission lines using transmission line parameters.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	25	50

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. Dependent Sources implementation and analysis.
2. Thevenin's/Norton's Theorems verification/implementation and its applications.
3. Maximum power transfer theorem and its applications.
4. Transient analysis of network.
5. Charging and discharging of R-C circuit and its applications.
6. Second order R-L_C circuit analysis.
7. Two port networks parameters analysis and its interpretation.
8. Interconnections of two port networks and its analysis.
9. Transmission line parameters calculations and analysis.
10. Transmission line analysis.

Text Books:

1. Franklin F Kuo, "Network Analysis and Synthesis", Wiley Toppan, 2nd.ed. 1966
2. D Roy Choudhury, "Networks and Systems", New Age International 1998
3. David M. Pozar, "Microwave Engineering" , Wiley, Third Edition
4. A. Sudhakar, Shyammohan S. Palli, "Circuits and Networks", Tata McGraw Hill, Third Edition

Reference Books:

1. M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi, 26th Indian Reprint, 2000
2. A Chakrabarti, "Circuit Theory", Dhanpat Rai & Co., Delhi, 6th Edition
3. W L Everitt and G E Anner, "Communication Engineering", Mc-Graw Hill, New York, 3rd Edition
4. Annapurna Das and S. K. Das, "Microwave Engineering", McGraw Hill, Third Edition

Course Name: Instrumentation and Control Systems Lab

Course Code: ET08P

Category: Core

Preamble:

This course introduces students to the implementation of concepts of Instrumentation and Control using simulations and experimentations. Experiments on First and Second order Systems in time and frequency domain for different input will be performed and the results will be interpreted. Also, Basic theory of Transient and steady state analysis will be introduced. Furthermore, Stability analysis techniques in time and frequency domain will be introduced.

Pre-requisites:

Nil

Course Objectives:

- To theoretically understand basics of measurements, sensors and transducers and control theory
- To apply concepts of measurement in evaluating performance of Temperature, Displacement and Resistance sensors
- To analyse First and Second order systems using frequency response plots.
- To inspect stability of the system using simulations.

Course Outcomes:

Student will be able to:

CO1: Students will be able to theoretically understand basics of measurements, sensors and transducers and control theory.
CO2: Students will be able to apply concepts of measurement in evaluating performance of Temperature, Displacement and Resistance sensors.
CO3: Students will be able to analyse First and Second order systems using frequency response plots.
CO4: Student will be able to inspect stability of the system using simulations.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	25	50

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. To study various temperature, displacement, and resistance sensors.
2. To evaluate performance of thermistor and RTD Sensors.
3. Plot Time and Frequency response of first and second order system in MATLAB.
4. To Obtain pole, zero and gain values of a transfer function and draw its S-plane using MATLAB.
5. Analyse RLC Network and plot its response in MATLAB.
6. To determine stability of given equations using ROUTH Array method.
7. To study steady state and transient response analysis from theory and numerical point of view.
8. To inspect stability of System using Root Locus on MATLAB.
9. To inspect stability of System using Bode Plot on MATLAB.
10. To inspect stability of System using Polar Plot on MATLAB.

Text Books:

1. H.S. Kalsi, "Electronic Instrumentation", TMH, 2nd.ed.
2. M. Gopal, "Control System Engineering", TATA McGraw Hill 3rd Edition
3. David M. Pozar, "Microwave Engineering", Wiley, Third Edition
4. Norman Nise, "Control System Engineering", Tata McGraw Hill, Fourth Edition

Reference Books:

1. Helfrick and Copper, "Modern Electronic Instrumentation and Measuring techniques", PHI, 3rd Edition.
2. Benjamin C Kuo, "Automatic Control Systems", Pearson Education, 7th Edition.

Course Name: Skill Based Lab

Course Code: ET17

Category: Core

Preamble:

This course aims to provide fundamentals of Python Programming supplemented over the structural and object oriented programming. Student will learn the flexibility and comprehensiveness of Python programming and appreciate the application development through simple problem statements.

Pre-requisites: ES04: Structured Programming

Course Objectives:

- Describe the core syntax and semantics of Python programming language.
- Explore file handling in Python
- Infer the Object-oriented Programming concepts in Python
- Formulate GUI Programming operations in Python
- Develop applications using variety of libraries and functions

Course Outcomes:

After successful completion of the course student will be able to:
CO1: Create functions, modules and packages to develop different
CO2: Implement different file system objects.
CO3: Develop Python programs using Object Oriented Programming concepts.
CO4: Develop GUI
CO5: Preprocess & Visualize data using different Python libraries like Numpy, Pandas and Matplotlib.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	50	-	-	50

Detailed Syllabus:

Module no.	Module name	Topics	Hours
1	Object Oriented Programming	Classes and Objects, Public and Private Members, Class Declaration and Object Creation, Object Initialization, Class Variables and methods, Accessing Object and Class Attributes, Inheritance, Constructor in Inheritance	2
2	Introduction to Python	Introduction to Python, Installation and resources, Identifiers and Keywords, Comments, Indentation and Multi-lining, Variables (Local and Global), data types, Arithmetic, Comparative, Logical and Identity Operators, Bitwise Operators, Expressions, Print statement and Formats, Input Statements in python Strings, Lists, Tuples, Dictionaries, Sets, Accessing Elements, Properties, Operations and methods on these data structures. Decision Flow Control Statement: if and else statement, Nested If statement, Loop Statement: While Loop, do and while loop, for loop statement, Continue, Break and pass Statement, Conditional Statements	6
3	Functions & Modules	Functions: Built-in-functions, library functions, Defining and calling the functions, return statements, Passing the arguments, Recursive functions, Modules and importing packages in python code.	5
4	File I/O Handling	File Input/Output: Files I/O operations, Read / Write Operations, File Opening, Modes, with keywords, Moving within a file, pickling	5
5	Graphical User Interface	Graphical User Interface using Tkinter Library module, creating simple GUI, Buttons, Labels, entry fields, widget attributes.	6
6	Numpy, Pandas, Matplotlib, Seaborn, Scipy	Introduction to Numpy, Creating and Printing Ndarray, Class and Attributes of Ndarray, Basic operation, Copy and view, Mathematical Functions of Numpy. Introduction to Pandas, Understanding Data frame, View and Select Data, Missing Values, Data Operations, File read and write operation. Introduction to Matplotlib library, Line properties, Plots and subplots, Types of Plots	6
		Total	30

Text Books:

1. "Let us Python: Python is Future", Yashvant Kanetkar, BOB publication
2. "Core Python Programming", Nageshwar Rao
3. "Python & Tkinter Programming", John Grayson, Manning publications
4. Python 3 object oriented programming, Dusty Philips, PACKT Publisher
5. Introduction to coputing & problem solving using Python, E. Balguruswami, McGraw Hill Education.

Reference Books:

1. Python Cookbook:Receipes for Mastering Python 3, David Beazely, O'Reilly Media
2. "Head First Python", Paul Barry, O'Reilly
3. "Tkinter GUI Application Development Blueprints: Master GUI programming in Tkinter as you design, implement and deliver 10 real world application",Packt Publishing
4. "Python Crash Course A habds-on, Project Based Introduction to programming", Eric Matthes, No Starch Press.

Software Tools:

1. Python IDE: https://www.python.org/downloads/

2. Anaconda Environment: https://www.anaconda.com/distribution/

Online Repository:

1. Github
2. Python 3 Documentation: https://docs.python.org/3/
3. "The Python Tutorial", http://docs.python.org/release/3.0.1/tutorial/
4. http://spoken-tutorial.org
5. Python 3 Tkinter library Documentation: https://docs.python.org/3/library/tk.html
6. Numpy Documentation: https://numpy.org/doc/
7. Pandas Documentation: https://pandas.pydata.org/docs/
8. Matplotlib Documentation: https://matplotlib.org/3.2.1/contents.html
9. Scipy Documentation : https://www.scipy.org/docs.html
10. Machine Learning Algorithm Documentation: https://scikit-learn.org/stable/
11. https://nptel.ac.in/courses/106/106/106106182/

Course Name: Technical Communication

Course Code: HS07

Category: Humanities, Social Sciences and Management

Preamble:

This course introduces the participants gain an understanding and knowledge of genres such as reports, feasibility studies, proposals, and specifications. Participants will construct a logical outline of a technical document; write with awareness of expository techniques such as definition, classification, and causal analysis; and design an effective format and layout for a technical publication.

Pre-requisites:

Nil

Course Objectives:

- Demonstrate rhetorical knowledge to create effective technical writing documents for endusers.
- Apply and adapt flexible writing process strategies to produce clear, high-quality deliverables in a multitude of technical writing genres.

Course Outcomes:

Student will be able to:

CO1: Write effective reports and design documentation
CO2: Make effective presentations
CO3: Apply ethical practices in technical communication

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	50	-	-	50

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Fundamentals of Technical Communication	Technical Communication: Features; Distinction between General and Technical Communication; Language as a tool of Communication; Dimensions of Communication: Reading & comprehension; Technical writing: sentences; Paragraph	6
2	Forms of Technical Communication	White paper writing, Email writing, Technical report, Synopsis writing, Technical research Paper writing, Lab manual, Instruction manual, Reading datasheets	10
3	Technical Presentation: Strategies & Techniques	Presentation: Classroom presentation, Poster presentation Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear: Confident speaking; Audience Analysis & retention of audience interest. Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections Video making and presentation	10
4	Technical Communication Skills	Interview skills Group Discussion: Objective & Method; Features of Body Language Voice Modulation: Quality, Pitch; Rhythm; intonation; Pronunciation; Articulation; stress & accent Linguistic features of voice control: Vowel & Consonant Sounds	4
Total			**30**

Reference Books:

1. Technical Communication: Process and Product, MLA Update (9th Edition), by Sharon J. Gerson, Steven M. Gerson. Publisher: Pearson; 9 edition (February 9, 2017). ISBN-10: 0134678869. ISBN-13: 978-0134678863

2. The Elements of Style, Fourth Edition. Aug 2, 1999, by William Strunk Jr. and E. B. White. Publisher: Pearson. http://www.bartleby.com/141/
3. Technical Communication: A Practical Approach (8th Edition) Jan 7, 2012, by William S. Pfeiffer and Kaye A. Adkins, Publisher: Pearson.
4. Pocket Guide to Technical Communication (5th Edition) 5th Edition, by William S. Pfeiffer. Publisher: Pearson.
5. Engineering Communication (January 1, 2014). Knisely, Charles W., Knisely, Karin I. Publisher: Cengage

Detailed syllabus of Second Year Semester – IV

Course Name: Mathematical Theory of Communication

Course Code: BS106T

Category: Core

Preamble:

This course introduces students to Mathematical theory of Communication, with detailed Mathematical introduction to Complex Integration, Vector Spaces, Vector Integration, Probability Distributions and Statistical Techniques like, Correlation and Regression which are widely applicable in Electronics and Telecommunication Engineering. This Course will also offer in-depth understanding of fundamental and theoretical underpinnings, applications, best practices, and research activities.

Students will learn how to integrate complex variables by using Cauchy's theorems. This course is designed for students with a solid understanding of Linear Algebra in the form of vector Space, Vector Calculus, Probability with Discrete & continuous random variable's distribution functions and Statistical Techniques. By the end of the course, students will have a deep understanding of calculus and probability distributions and will be equipped with the various advanced mathematical tools and techniques which are necessary to solve wide range of computational problems in telecommunication fields.

Pre-requisites:

Engineering Mathematics-I (BS02), Engineering Mathematics-II (BS04)

Course Objectives:

- Understand the integration methods for complex variables in the annular regions and interpretation of their significances.
- Understand the concept of Linear Algebra especially Vector Spaces used in ML, AI & Data Science as optimization technique and their significances.
- Understand the concepts of Vector Differentiation and Integration to evaluate line integral and work done by Green's theorems.
- Apply various techniques of Probability Distributions for data analysis to solve discrete and continuous random variable problems.
- Understand the concept of statistical techniques like Correlation and Regression lines for the field of Data analytic, machine learning and other fields that require strong analytical and problem-solving abilities.

Course Outcomes:

Student will be able to:

CO1:- Apply the knowledge of integration methods for complex variables in the annular regions and interpretation of its significances.
CO2:- Apply various the concept of Linear Algebra- Vector Spaces used in ML, AI & Data Science as optimization technique and its significances.
CO3:- Understand the concepts of Vector Differentiation and Integration to evaluate line integral and work done by Green's theorems.
CO4:- Understand the concept of probability and distribution functions for data analysis.
CO5:- Understand & apply the concept of statistical techniques like Correlation and Regression lines for the field of Data analytic, machine learning and other fields that require strong analytical and problem-solving abilities.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	75

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	**Complex Integration**	1.1 Line Integral, Cauchy 's Integral theorem (without proof), 1.2 Cauchy 's Integral formula (without proof). 1.3 Taylor 's and Laurent 's series 1.4 Residues, Cauchy 's Residue Theorem (without proof)	6

		Self-learning Topics: Application of Residue Theorem to evaluate real integrations, Z- Transform of sequence in complex function.	
2	**Linear Algebra: Vector Spaces**	2.1 n-dimensional vector, angles norms, Inner dot product. 2.2 Cauchy-Schwarz inequality (with proof), 2.3 Vector Spaces over a real field, Subspaces. 2.4 Orthogonal projection, Orthonormal basis, Gram-Schmidt process for vectors. **Self-Learning Topics:** Linear combinations, linear Dependence, and Independence, QR decomposition, SVD Decomposition.	6
3	**Vector Differentiation and Integration**	3.1 Basics of Gradient, Divergence and Curl (Without Proof). 3.2 Properties of vector field: Solenoidal and Irrotational (conservative) vector field. 3.3 Line Integral, work done. 3.4 Green's theorem in a plane (Without Proof) only evaluation. **Self-learning Topics:** Surface Integral, Gauss divergence theorem and its applications.	6
4	**Probability Distributions**	4.1 Random Variable: Probability distribution for discrete and continuous random variable. 4.2 Bayes Theorem (without proof) 4.3 Expectation, Variance for discrete and continuous random variable. 4.4 Probability distributions: Poisson, and Normal distributions. **Self-learning Topics:** Mean & variance by Moment generating function, T-distribution (t-tests and regression coefficients), χ^2-distribution (chi-square test and loglinear analysis), F-distribution (ANOVA, Levene's test), Continuous uniform distribution in Engineering.	6
5	**Statistical Techniques**	6.1 Karl Pearson 's Coefficient of correlation (r). 6.2 Spearman 's Rank correlation coefficient (R) (repeated and non-repeated ranks) 6.3 Lines of regression: Fitting of first-degree curve. **Self-learning Topics:** Covariance, Fitting of second-degree and exponential curves.	6
Total			**30**

Textbooks:

1. Dr. B V Ramana "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, India 2006, ISBN 13: 9780070086241
2. P N Wartikar and J N Wartikar "*Textbook of Applied Mathematics Volume I & II, Vidyarthi* Ghriha Prakashan Pune 2005 9th Edition.
3. Kanti B Datta, "Mathematical methods for Science and Engineering", Cengage learning 2012.
4. N P Bali and Manish Goyal, "A textbook of Engineering Mathematics", Laxmi Publication 2006.

Reference Books:

1. Dr. B S Grewal, "Higher Engineering Mathematics", Khanna Publication, 44th Edition, ISBN 13: 9788193328491
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & sons, 10th Edition, ISBN 13: 9788126508273
3. C. R. Wylie & L. C. Barrett, "Advanced Engineering Mathematics", Tata McGraw India, 6th Edition.
4. H K Das, "Advanced Engineering Mathematics", S Chand, 22nd Edition, ISBN 13: 9788121903455
5. Murray R. Spiegel. "Schaum's Outline of Vector analysis", Tata McGraw India, 1st Edition.
6. Murray R. Spiegel. "Schaum's Outline of Complex analysis with applications", Tata McGraw India.
7. Kenneth Hoffman. "Linear Algebra", Pearson 2018.
8. Dr. B S Tyagi, "Function of a Complex variable", Kedar Nath & Ram Nath publication, 2021.

Course Name: Mathematical Theory of Communication Lab

Course Code: BS106P

Category: Core

Preamble:

This course introduces students to experimental implementation of Mathematical theory of Communication, with detailed Mathematical introduction to Complex Integration, Vector Spaces, Vector Integration and Statistical Techniques like Probability Distribution, Correlation and Regression using various software tools like python, MATLAB, sage etc. which are widely applicable in Electronics and Telecommunication Engineering. This Course will also offer hands on to code various mathematical problems.

Pre-requisites:

Engineering Mathematics-I (BS02), Engineering Mathematics-II (BS04)

Course Objectives:

- To understand and analyse the behaviour of functions defined in the complex plane and extends the integration of real valued function to complex valued functions.
- To develop fundamental understanding algebraic structure that underline the various areas of mathematics and its applications.
- To provide skills and knowledge to understand and apply vector integration techniques to solve problems involving vector fields, curves, surface and volumes.
- To provide students with a solid foundation in probability theory, including both discrete and continuous distributions and to develop analytical and problem-solving skills in applying probability distributions to real-world scenarios and to prepare students for further studies in statistics, data analysis, and related fields
- To provide students with solid foundation in the analysis and understanding of joint distribution marginal and conditional distributions.

Course Outcomes:

Student will be able to:

CO1: Evaluate complex integrals, compute residues & evaluate various contour integrals.
CO2: Understand the basics of Vector Spaces used in the field of Machine learning, AI, and Data science.
CO3: Evaluate problems on line integrals, green theorem and stokes theorem.
CO4: Illustrate the understanding of concept of probability distribution of various data.
CO5: Compute problems on joint distribution, marginal and conditional distributions.
CO6: Understand the basic statistical techniques like Correlation and Regression lines for the

field of Data analysis.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	25	-	25	50

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. Computing residue of integrand and residue theorem
2. Verification of Cauchy schwartz inequality
3. Finding Norm, angle, inner product between two vectors
4. Implementing Gram Smith Process for basis of vector space
5. Probability analysis of a random experiment. (E.g.Binary Communication Channel)
6. Probability density and distribution analysis for a random experiment.
7. Mean and variance analysis of random phenomenon using standard random variable distributions.
8. Simple data analysis using standard random variable distributions.

Textbooks:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & sons, 10th Edition.
2. Dr. B V Ramana "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, India 2006
3. P N Wartikar and J N Wartikar "Textbook of Applied Mathematics Volume I & II, Vidyarthi Ghriha Prakashan Pune 2005 9th Edition.
4. N P Bali and Manish Goyal, "A textbook of Engineering Mathematics", Laxmi Publication 2006.

Reference Books:

1. Dr. B S Grewal, "Higher Engineering Mathematics", Khanna Publication, 44th Edition.
2. C. R. Wylie & L. C. Barrett, "Advanced Engineering Mathematics", Tata McGraw India, 6th Edition.

3. H K Das, "Advanced Engineering Mathematics", S Chand, 22nd Edition.
4. Kenneth Hoffman. "Linear Algebra", Pearson 2018.
5. Seymour Lipschutz, "Schaum's Outline of Linear Algebra", Tata McGraw India, 6th Edition.
6. Seymour Lipschutz, Schaum's Outline of Probability and Statistics", Tata McGraw India ,1st Edition.
7. T. Veerarajan, "Probability, Statistics and Random processes", Tata McGraw India, 2nd Edition.
8. Robert Weinstock, "Calculus of variation with application to physics and Engineering", Dover
9. Publications, New York, 1st Edition.

Course Name: Data Structure & Analysis of Algorithms

Course Code: ET07T

Category: Core

Preamble:

This course deals with the various data structures we need to organize the data. It introduces the concept of data structures and presents various types of data structures along with the implementations of the various operations that can be performed on the data structure. It also further dives into comparison and implementation of various searching and sorting techniques.

Pre-requisites: ES04: Structured Programming and ES05: Object Oriented Programming

Course objective:

- To Introduce the fundamental knowledge & need of Data Structures for efficient storage mechanism of data.
- To understand the importance of Design and analysis of Algorithm for efficient programming.
- To Implement and perform different operation of Stack, Queue, Linked List, Trees, Graphs etc.
- To Understand the working of different Sorting, Searching & Hashing techniques.

Course Outcome:

After successful completion of the course the student will be able to:

CO1: Compare functions using asymptotic analysis and describe the relative merits of worst, average, and best-case analysis.
CO2: Implement various operations on Stack and Queue.
CO3: Demonstrate the operation of Linked list.
CO4: Implement and traverse nonlinear data structures like Trees & Graph data structures.
CO5: Implement various Sorting and Algorithms and compare their performance.
CO6: Apply different hashing and searching techniques to efficiently retrieve and manipulate data.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	75

Detailed Syllabus:

Module no.	Module name	Content	No. of Hours
1	**Introduction to Data Structure and Algorithms**	Concept of ADT, Types of Data Structures and Operations, Introduction to Data structure and its types. Introduction to Algorithms, Analysis of algorithms, Asymptotic Notations, Time complexity, space complexity	4
2	**Stack & Queues**	Introduction to Stack, ADT of Stack, Operations on Stack, Array Implementation of Stack, applications of Stack- Infix to Postfix Expression Conversion, Postfix Expression Evaluation Introduction to Queue, ADT of Queue, Operations on Queue, Array Implementation of Queue, Types of Queue-Circular Queue, Priority Queue, Introduction to Double Ended Queue Applications of various types of Queues	6
3	**Linked List**	Introduction, Linked List v/s Array, Representation of Linked List, Types of Linked List - Singly Linked List, Doubly Linked List Operations on Singly Linked List and Doubly Linked List, Singly Linked List Application-Polynomial Representation and Addition,	4
4	**Trees and Graphs**	Trees: Basic Tree Terminologies, Types of Binary Tree, Binary Search Tree Implementation, Tree Traversal algorithms In order, Pre order and Post order Applications – Expression Tree Introduction Graph : Terminology, Memory Representation of Graph, Operations Performed on Graph, Graph Traversal: Breadth First Search, Depth First Search, Applications of the Graph, Shortest Path, Minimum Spanning Tree.	6
5	**Searching**	Searching: Sequential search, Binary Search, Hashing-Concept, Hash Functions, Common hashing functions, Collision resolution Techniques: Linear Probing, Quadratic probing, double hashing	6
6	**Sorting**	Comparison and Analysis Internal Sorting: Insertion Sort, Selection, Bubble Sort, Quick Sort, Merge Sort	4
Total			**30**

Text Books:

1. Data Structures using C by Reema THereja, Oxford Press, 2014
2. Data Structures Using Java, Y. Langsam, M.J. Augenstein and A.M. Tanenbaum, Pearson Education
3. Data Structure: A Pseudocode Approach with C R.F. Gilberg, Behrouz A. Forouzan Thomson Edition
4. Introduction to Data Structure and its Applications, Jean Paul Tremblay, P. G. Sorenson, McGraw-Hill Higher Education

5. Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahani and Sanguthevar Rajasekaran, Universities Press (India) Pvt. Ltd.
6. "Learning with Python", Allen Downey, Jeffrey Elkner, Chris Meyers ,Dreamtech Press

Reference Books:

1. Data structures and algorithms in Java, Michael Goodrich & Roberto Tamassia, Wiley India
2. An introduction to data structures with Applications, Jean Paul Tremblay, Paul G. SorensonTata McGrawHill
3. "Algorithms", Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, Tata McGrawHill Edition.

Course Name: Data Structure & Analysis of Algorithms Lab

Course Code: ET07P

Category: Core

Preamble:

This course deals with the various data structures we need to organize the data. It introduces the concept of data structures and presents various types of data structures along with the implementations of the various operations that can be performed on the data structure. It also further dives into comparison and implementation of various searching and sorting techniques.

Pre-requisites: ES04: Structured Programming and ES05: Object Oriented Programming

Course objective:

- Design and construct simple programs by using the concepts of structures as abstract data types.
- To have a broad idea how to use pointers in the implement of data structure.
- To enhance programming skills while improving their practical knowledge in data structures.
- To strengthen the practical ability to apply suitable data structure for real time applications.

Course Outcome:

Student will be able to:

CO1: Implement the abstract data type and reusability of a particular data structure.
CO2: Implement the linear data structures like stack, queues using array and linked list.
CO3: Understand and implement non-linear data structure like trees and graphs.
CO4: Implement various sorting and searching techniques.
CO5: Understand and implement Hashing technique.
CO6: Choose the appropriate data structure for solving the given problem.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	25	50

Suggested List of Practical:

Sr. No.	Suggested Experiment
1	Write a program to implement a stack ADT using array.
2	Write a program to accept an infix expression from user and convert it into postfix expression.
3	Write a program to evaluate given postfix expression using stack.
4	Write a program to implement Circular Queue using array.
5	Write a program to implement Priority Queue using arrays.
6	Write a program to implement Linked List with the following functions. i) insertbeg ii) insertend iii) delete iv) display v) reverse vi) count vii) search
7	Write a program to implement Priority Queue using linked list.
8	Write a program to implement binary search tree with the following function. (i) insert (ii) delete (iii) search (iv) inorder (v) preorder (vi) postorder
9	Write a program to construct expression tree using postfix expression.
10	Write a program to implement modified bubble sort and insertion sort.
11	Write a program to implement merge sort.
12	Write a program to implement quick sort.
13	Write a program to implement binary search.
14	Write a program to implement hashing.

Text Books:

1. Data Structures using C by Reema THereja, Oxford Press, 2014
2. Data Structures Using Java, Y. Langsam, M.J. Augenstein and A.M. Tanenbaum, Pearson Education
3. Data Structure: A Pseudocode Approach with C R.F. Gilberg, Behrouz A. Forouzan Thomson Edition
4. Introduction to Data Structure and its Applications, Jean Paul Tremblay, P. G. Sorenson, McGraw-Hill Higher Education

5. Fundamentals of Computer Algorithms, Ellis Horowitz, Sartaj Sahani and Sanguthevar Rajasekaran, Universities Press (India) Pvt. Ltd.
6. "Learning with Python", Allen Downey, Jeffrey Elkner, Chris Meyers ,Dreamtech Press

Reference Books:

1. Data structures and algorithms in Java, Michael Goodrich & Roberto Tamassia, Wiley India
2. An introduction to data structures with Applications, Jean Paul Tremblay, Paul G. SorensonTata McGrawHill
3. "Algorithms", Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, Tata McGrawHill Edition.

Course Name: Integrated Circuits

Course Code: ET06T

Category: Core

Preamble:

This course introduces the Linear Integrated circuits which are used to design basic building blocks of electronic system. This course introduces designing the linear circuit for given mathematical equations. This course also consists of Analysis and designing of various linear and non-linear applications using Operational Amplifier ICS. This course also includes special integrated circuits used to design various communication circuits.

Pre-requisites:

Electronics Devices and circuits.

Course Objectives:

Students will be able to

- Understand the Concept, working and Key Application of Various Linear Integrated circuits.
- To perform analysis of circuits based on linear integrated circuits.
- To Design circuits and systems for applications using linear integrated circuits.
- To Create DC Power supply for given Application and Specifications.
- Outline and classify all types of integrated circuits.

Course Outcomes:

Student will be able to:

CO1: Describe the Ideal and Practical characteristics of various Integrated circuits.

CO2: Design circuits for Various Linear and Non-Linear applications.

CO3: Identify the appropriate integrated circuit modules for designing engineering applications.

CO4: Demonstrate the application of Voltage regulator, Timer and PLL.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencementof the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Differential and Operational Amplifier.	1.1 Block diagram and working of Operational Amplifier. Various parameters of Operational Amplifier. Typical values for IC741. 1.2 Inverting, Non-Inverting amplifier using op-amp (Both open and close loop). Arithmetic circuits like Adder, Subtractor. Numerical based on op-amp circuits.	4
2	Linear applications of Operational Amplifier.	2.1 Need of Instrumentation amplifier analysis of 3 op-amp Instrumentation Amplifier. Basic and Practical Integrator and Differentiator circuits. Voltage to current and current to voltage converter circuits. 2.2 Filters using op-amp. Analysis and designing of 1st Order Butterworth Filter using op-amp. Working and designing of 2nd order filter using op-amp (No derivation for 2nd order filter)	7
3	Non-Linear Application of Operational amplifier	3.1 Comparator using op-amp, Working, analysis, designing and application of Schmitt-Trigger using op-amp. Precision half wave and full wave rectifier using op-amp. Sample and hold circuit, peak detector circuit using op-amp.	5

4	Voltage Regulator.	4.1 Functional Block diagram of voltage regulator. Working and designing of three terminal fixed voltage regulators(78XX,79XX). 4.2Functional block diagram, working and designing of general-purpose IC 723 Regulator. 4.32Functional block diagram, working and designing of general-purpose IC LM317 Regulator 4.4 Block diagram of SMPS, comparison between Switching and linear regulator.	5
5	Timer IC 555	5.1 Functional block diagram, specification and working of IC555.Design and working of Astable and Monostable Multivibrator using 555. 5.2 Application of 555 like VCO, PWM.	5
6	Special Purpose Integrated circuits	6.1 Functional block diagram and working of VCO IC 566. 6.2 Functional block diagram and working of PLL IC 565.	4
Total			**30**

Textbooks:

1. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, Pearson 4th Edition 2015
2. DESIGN WITH OP-AMP AND ANALOG INTEGRATED CIRCUITS By Sergio Franko, Tata McGraw Hill, 3rdEdition.
3. Linear Integrated circuits by Roy Choudhary, New age International Publishers,4th Edition

Reference Books:

1. Operational Amplifiers and Linear ICs, David A. Bell, Oxford,3rd Edition 2011
2. Linear Integrated Circuits S. Saliva Hanan, et al McGraw Hill 2nd Edition,2014

Course Name: Integrated Circuits Lab

Course Code: ET06P

Category: Core

Preamble:

This course introduces the Linear Integrated circuits which are used to design basic building blocks of electronic system. This course introduces designing the linear circuit for given mathematical equations. This course also consists of Analysis and designing of various linear and non-linear applications using Operational Amplifier ICS. This course also includes special integrated circuits used to design various communication circuits.

Pre-requisites:

Electronics Devices and circuits.

Course Objectives:

Students will be able to

- Understand the Concept, working and Key Application of Various Linear Integrated circuits.
- To perform analysis of circuits based on linear integrated circuits.
- To Design circuits and systems for applications using linear integrated circuits.
- To Create DC Power supply for given Application and Specifications.
- Outline and classify all types of integrated circuits.

Course Outcomes:

Student will be able to:

CO1: Describe the Ideal and Practical characteristics of various Integrated circuits.

CO2: Design circuits for Various Linear and Non-Linear applications.

CO3: Identify the appropriate integrated circuit modules for designing engineering applications.

CO4: Demonstrate the application of Voltage regulator, Timer and PLL.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	25	-	25	50

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall beapproved by a panel constituted at Institute level and published to the learners before the commencementof the semester.

Suggested List of Practicals:

1. Design and implementation of Inverting and Non-inverting amplifier using IC741.
2. Frequency response of Operational Amplifier using IC741.
3. Design and Implementation of 1st and 2nd order Filter using IC 741.
4. Design and Implementation of Practical Integrator circuit using IC741.
5. Design and Implementation of Practical Differentiator circuit using IC741.
6. Design and Implementation of various Arithmetic circuits using IC741.
7. Design and Implementation of Instrumentation amplifier using IC741.
8. Design and Implementation of Schmitt -trigger circuit using IC741.
9. Design and Implementation of Precision rectifier using IC741.
10. Design and Implementation of voltage regulator circuit using IC723.
11. Design and Implementation of Astable Multivibrator circuit using IC555.
12. Design and Implementation of Monostable Multivibrator circuit using IC555.

Textbooks:

1. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, Pearson 4th Edition 2015
2. DESIGN WITH OP-AMP AND ANALOG INTEGRATED CIRCUITS By Sergio Franko, Tata McGraw Hill, 3rdEdition.
3. Linear Integrated circuits by Roy Choudhary, New age International Publishers,4th Edition

Reference Books:

1. Operational Amplifiers and Linear ICs, David A. Bell, Oxford,3rd Edition 2011
2. Linear Integrated Circuits S. Saliva Hanan, et al McGraw Hill 2nd Edition,2014

Course Name: Digital Communication

Course Code: ET09T

Category: Core

Preamble:

The course intends to identify the signals and functions of its various components, to learn about theoretical features of digital communication system and draw signal space diagrams, compute spectra of modulated signals, to learn about error detection and correction to produce optimum receiver. The objective is to equip the students with basic knowledge for analyzing analog and digital communication systems ranging from data networks and internet to mobile data communication systems such as cellular and WiFi systems. Specifically, the students will learn how to manage communication system resources including bandwidth and power by selecting a proper signaling and/or analog/pulse/digital modulation scheme.

Pre-requisites:

Principles of Communication Engineering

Course Objectives:

- To describe the basics of information theory and source coding.
- To illustrate various error control codes.
- To describe baseband system.
- To learn different digital modulation and demodulation techniques

Course Outcomes:

Student will be able to:

CO1: Apply the concepts of Information Theory in source coding
CO2: Apply various error detection codes & Analyze different error correction codes.
CO3: Compare various baseband transmission methods for digital signals
CO4: Compare the performances of different digital modulation techniques
CO5: Evaluate the performance of optimum baseband detection in the presence of white noise.
CO6: Understand the principles of spread spectrum communications.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	75

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Information Theory & Source Coding	Block diagram and sub-system description of a digital communication system, Proability, Information Theory ,measure of information and properties, entropy and it's properties Mini Source Coding, Shannon 's Source Coding Theorem, Shannon-Fano Source Coding, Huffman Source Coding ,mutual information and channel capacity, channel coding theorem, channel capacity theorem	4
2	Error Correction & detection Codes	Error detection codes: Vertical Redundancy Check (VRC) code, Longitudinal Redundancy Check (VRC) code, Cyclic Redundancy Check (CRC) code and Checksum code	3
3	Error Control systems	Error Correction Codes : Types of error control, error control codes, linear block codes, systematic linear block L4 codes, generator matrix, parity check matrix, syndrome testing, error correction, and decoder implementation Systematic and Non-systematic Cyclic codes: encoding with shift register and error detection and correction Convolution Codes: Time domain and transform domain approach, graphical representation, code tree, trellis, state diagram, decoding methods	8

4	Baseband Modulation & Transmission	Discrete PAM signals and it's power spectra Inter-symbol interference, Nyquist criterion for zero ISI, sinusoidal roll-off filtering, correlative coding, equalizers, and eye pattern	4
5	Bandpass Modulation & Demodulation	Generation, detection, signal space diagram, spectrum, bandwidth efficiency, and probability of error analysis of: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK)Modulations, Binary Phase Shift Keying (BPSK) Modulation, Quaternary Phase Shift Keying QPSK), M-ary PSK Modulations, Quadrature Amplitude Modulation (QAM), Minimum Shift Keying (MSK)	8
6	Optimum Reception of Digital Signal	Baseband receiver, Probability of Error, Optimum Receiver and Filter, Matched Filter and its probability of error, Coherent Reception.	3
Total			**30**

Text Books:

1. H. Taub, D. Schlling, and G. Saha-Principles of Communication Systems, Tata Mc- Graw Hill, New Delhi, Third Edition, 2012.
2. Lathi B P, and Ding Z-Modern Digital and Analog Communication Systems, Oxford University Press, Fourth Edition, 2017.
3. Haykin Simon-Digital Communications, John Wiley and Sons, New Delhi, Fourth Edition,2014.
4. John G. Proakis-Digital Communications, McGraw-Hill, Fourth Edition

Reference Books:

1. Sklar B, and Ray P. K.-Digital Communication: Fundamentals and applications, Pearson,Dorling Kindersley (India), Delhi, Second Edition, 2009.
2. T L Singal-Analog and Digital Communication, Tata Mc-Graw Hill, New Delhi, First Edition,2012.
3. P Ramakrishna Rao-Digital Communication, Tata Mc-Graw Hill, New Delhi, First Edition,2011.
4. K. Sam Shanmugam-Digital and analog communication Systems, John Wiley and sons.
5. Upamanyu Madhow- Fundamentals of Digital Communication- Cambridge University Press
6. W.C. Huffman, Vera Pless- Fundamentals of Error Correcting Codes, Cambridge University Press
7. Graham Wade-Coding Techniques, Palgrave, New York

Course Name: Digital Communication Lab

Course Code: ET09P

Category: Core

Preamble:

The course intends to identify the signals and functions of its various components, to learn about theoretical features of digital communication system and draw signal space diagrams, compute spectra of modulated signals, to learn about error detection and correction to produce optimum receiver. The objective is to equip the students with basic knowledge for analyzing analog and digital communication systems ranging from data networks and internet to mobile data communication systems such as cellular and WiFi systems. Specifically, the students will learn how to manage communication system resources including bandwidth and power by selecting a proper signaling and/or analog/pulse/digital modulation scheme.

Pre-requisites:

Engineering Mathematics III, Principles of Communication Engineering

Course Objectives:

- To describe the basics of information theory and source coding.
- To illustrate various error control codes.
- To describe baseband system.
- To learn different digital modulation and demodulation techniques

Course Outcomes:

Student will be able to:

CO1: Apply the concepts of Information Theory in source coding.
CO2: Apply various error detection codes & Analyze different error correction codes.
CO3: Compare various baseband transmission methods for digital signals.
CO4: Compare the performances of different digital modulation techniques.
CO5: Evaluate the performance of optimum baseband detection in the presence of white noise.
CO6: Understand the principles of spread spectrum communications.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	25	50

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical's:

1. To understand Various line codes
2. Modulation and Demodulation of Binary Amplitude Shift Keying
3. Modulation and Demodulation of Binary Frequency Shift Keying.
4. Modulation and Demodulation of Phase Shift Keying
5. Modulation and Demodulation of Quadrature Phase Shift Keying
6. To Study and Perform Linear Block Codes
7. To Study and perform Cyclic codes.
8. Error detection and correction using Hamming code
9. Performance Analysis of Digital Modulation techniques using BERTOOL

Text Books:

1. H. Taub, D. Schlling, and G. Saha-Principles of Communication Systems, Tata Mc- Graw Hill, New Delhi,Third Edition, 2012.
2. Lathi B P, and Ding Z-Modern Digital and Analog Communication Systems, Oxford University Press, Fourth Edition, 2017.
3. Haykin Simon-Digital Communications, John Wiley and Sons, New Delhi, Fourth Edition,2014.
4. John G. Proakis-Digital Communications, McGraw-Hill, Fourth Edition

Reference Books:

1. Sklar B, and Ray P. K.-Digital Communication: Fundamentals and applications, Pearson,Dorling, Kindersley (India), Delhi, Second Edition, 2009.
2. T L Singal-Analog and Digital Communication, Tata Mc-Graw Hill, New Delhi, First Edition,2012.
3. P Ramakrishna Rao-Digital Communication, Tata Mc-Graw Hill, New Delhi, First Edition,2011.
4. K. Sam Shanmugam-Digital and analog communication Systems, John Wiley and sons.
5. Upamanyu Madhow- Fundamentals of Digital Communication- Cambridge University Press
6. W.C. Huffman, Vera Pless- Fundamentals of Error Correcting Codes, Cambridge University Press
7. Graham Wade-Coding Techniques, Palgrave, New York

Course Name: Signals and Systems

Course Code: ET100T

Category: Core

Preamble:

This course introduces students to the basics of signals and systems and its classification, operations and analysis in time domain. Analysis of signals and systems in frequency domain and analysis of LTI continuous and discrete systems in frequency domain using Laplace, Fourier and Z-transforms. Introduction to FIR and IIR systems and its realization in different forms.

Pre-requisites:

Nil

Course Objectives:

- To introduce to the basics of signals and systems, and its classification, operations and analysis in time domain.
- To analyse the signals and systems in frequency domain and analysis of LTI continuous and discrete systems in frequency domain.
- To provide foundation of signal and system concepts to areas like communication, control and comprehend applications of signal processing in communication systems.

Course Outcomes:

Student will be able to:

CO1: Classify and analyse different types of signals and systems.
CO2: Analyse continuous time and discrete time LTI systems time domain.
CO3: Analyse continuous time signals and systems and LTI systems in frequency domain using Laplace transform.
CO4: Analyse continuous time signals and systems and LTI systems in frequency domain using Fourier transform.
CO5: Analyse discrete time signals and systems and LTI systems in frequency domain using Z-transform.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to signals and systems	**Introduction to Signals:** Basic Elementary signals: exponential, sine, step, impulse, ramp, rectangular, triangular. Classification of Signals: analog and discrete time signals, even and odd signals, periodic and non-periodic signals, deterministic and non-deterministic signals, energy and power signals. Operations on signals. **Systems and Classification of systems:** System Representation, continuous time and discrete systems, system with and without memory, causal and non-causal system, linear and nonlinear system, time invariant and time variant system, stable system.	6
2	Time domain analysis of Continuous Time and Discrete Time systems	Linear Time Invariant (LTI) systems: Representation of systems using differential /difference equation, Impulse, step and exponential response, System Stability and Causality. Use of convolution integral and convolution sum for analysis of LTI systems, properties of convolution integral/sum, Correlation, auto-correlation, cross correlation, and spectral Density.	6
3	Laplace Transform and Continuous time LTI systems	Need of Laplace Transform, Concept of Region of Convergence, Properties of Laplace Transform, Relation between continuous time Fourier Transform and Laplace Transform, unilateral Laplace Transform, inverse Laplace Transform. Analysis of continuous time LTI systems using Laplace Transform: Causality and stability of systems in s-domain, Total response of a system	6

4	Fourier Analysis of Continuous and Discrete Time Signals and Systems	Fourier transform of periodic and non-periodic functions, Properties of Fourier Transform, Inverse Fourier Transform, Frequency Response: computation of Magnitude and Phase Response, LTI system analysis using Fourier transform, Introduction to discrete time Fourier transform.	5
5	z-Transform and Discrete time LTI systems	Need of z-Transform, z-Transform of finite and infinite duration sequences, Concept of Region of Convergence, z-Transform properties, Standard z-transform pairs, relation between Z-transform and discrete time Fourier Transform, one sided Z-Transform. Inverse z-Transform: Partial Fraction method only. Analysis of discrete time LTI systems using Z-Transform: Systems characterized by Linear constant coefficient difference equation, Transfer Function, plotting Poles and Zeros of a transfer function, causality and stability of systems, Total response of a system.	7
Total			**30**

Text Books:

1. Nagoor Kani, Signals and Systems, Tata McGraw Hill, Third Edition, 2011.
2. Rodger E Ziemer, William H. Tranter and D. Ronald Fannin, Signals and Systems, Pearson Education,
3. Fourth Edition 2009.
4. Alan V. Oppenhiem, Alan S. Willsky and S. Hamid Nawab, Signals and Systems, Prentice-Hall of India, Second Edition, 2002.
5. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley and Sons, Second Edition, 2004.

Reference Books:

1. Hwei. P Hsu, Signals and Systems, Tata McGraw Hill, Third edition, 2010
2. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley and Sons, Second Edition, 2004. 3) V. Krishnaveni and A. Rajeshwari, Signals and Systems, Wiley-India, First Edition 2012.
3. Michael J Roberts, Fundamentals of Signals and systems, Tata McGraw Hill, special Indian Economy edition, 2009.
4. Luis F. Chaparro, Signals and Systems Using MATLAB, Academic Press
5. Rangaraj M. Rangayyan, "Biomedical Signal Analysis- A Case Study Approach", Wiley 2002.
6. Signals and Systems Laboratory: Virtual Laboratory http://ssl-iitg.vlabs.ac.in/

Course Name: Signals and Systems Lab

Course Code: ET100P

Category: Core

Preamble:

This course introduces students to the basics of signals and systems and its classification, operations and analysis in time domain. Analysis of signals and systems in frequency domain and analysis of LTI continuous and discrete systems in frequency domain using Laplace, Fourier and Z-transforms. Introduction to FIR and IIR systems and its realization in different forms.

Pre-requisites:

Engineering Mathematics-I, II, & III, Network Theory and Transmission lines, Signals and Systems, Matlab Basics

Course Objectives:

- To introduce to the analysis in time domain of signals and systems.
- To analyse the signals and systems in frequency domain and analysis of LTI continuous and discrete systems in frequency domain.
- To provide applications of signal and system concepts to areas like communication, control and comprehend applications of signal processing in communication systems.
- To analyse FIR and IIR systems.

Course Outcomes:

Student will be able to:

CO1: Analyse different types of continuous and discrete signals and systems.
CO2: Analyse continuous time and discrete time LTI systems in time domain.
CO3: Analyse continuous time signals and systems and LTI systems in frequency domain using Laplace Transform.
CO4: Analyse continuous time signals and systems and LTI systems in frequency domain using Fourier Transform.
CO5: Analyse discrete time signals and systems and LTI systems in frequency domain.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	25	50

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. Generation of various continuous and discrete time signals.
2. Operations on signals and discrete time signals.
3. Convolution between signals and discrete time signals.
4. Auto correlation and cross correlation.
5. Continuous time signals and systems analysis using Laplace transform.
6. Continuous time signals and systems analysis using Fourier transforms and inverse Fourier transform.
7. Discrete time signals and systems analysis using Z-transform.
8. Noise analysis in systems.
9. Synthesis of sound signal.
10. Stability analysis of LTI systems.

Text Books:

1. Nagoor Kani, Signals and Systems, Tata McGraw Hill, Third Edition, 2011.
2. Rodger E Ziemer, William H. Tranter and D. Ronald Fannin, Signals and Systems, Pearson Education, Fourth Edition 2009.
3. Alan V. Oppenhiem, Alan S. Willsky and S. Hamid Nawab, Signals and Systems, Prentice-Hall of India, Second Edition, 2002.
4. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley and Sons, Second Edition, 2004.

Reference Books:

1. Hwei. P Hsu, Signals and Systems, Tata McGraw Hill, Third edition, 2010
2. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley and Sons, Second Edition, 2004.
3. V. Krishnaveni and A. Rajeshwari, Signals and Systems, Wiley-India, First Edition 2012.
4. Michael J Roberts, Fundamentals of Signals and systems, Tata McGraw Hill, special Indian Economy edition, 2009.
5. Luis F. Chaparro, Signals and Systems Using MATLAB, Academic Press
6. Rangaraj M. Rangayyan, "Biomedical Signal Analysis- A Case Study Approach", Wiley 2002.
7. Signals and Systems Laboratory: Virtual Laboratory http://ssl-iitg.vlabs.ac.in/

Course Name: Mini Project-I

Course Code: ET45

Category: Project and Internship

Preamble:

This course introduces students to the implementation of concepts of Electrical and electronics domain. Students can develop basic projects based on analog and or digital electronics-based subjects.

Pre-requisites:

Nil

Course Objectives:

- To make students familiar with the basics of electronic devices and circuits, electrical circuits and digital systems.
- To familiarize the students with the designing and making of Printed circuit boards(PCB).
- To improve the knowledge of electronics hardware among students.

Course Outcomes:

Student will be able to:

CO1: Create the electronics circuit for particular application/experiment.
CO2: Design and simulate the circuits by putting together the analog and digital components.
CO3: Learn the technique of soldering and circuit implementation on general purpose printed circuit board (GPP).
CO4: Realize the PCB design process and gain up-to-date knowledge of PCB design software.
CO5: Utilize the basic electronic tools and equipment's (like DMM, CRO, DSO etc.)
CO6: Analysis of hardware fault (Fault detection and correction).

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	2

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	50	75

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Unit No.	Topics	Hrs.
1.0		**Identification and Designing of Circuit**	**04**
	1.1	Identification of application with understanding of its detail operation. Study of necessary components and devices required to implement the application.	
	1.2	Designing the circuit for particular application (either analog, digital, electrical, analog and digital, etc)	
2.0		**Software simulation and Implementation on GPP**	**06**
	2.1	Simulation of circuit for particular application using software's to verify the expected results	
	2.2	Implementation of verified circuit on general purpose printed circuit board (GPP). Now Verify the hardware results by using electronic tools and equipment's like millimeter, CRO, DSO etc.	
3.0		**PCB design and optimization**	**06**
	3.1	Design the circuit by placing components using PCB design softwares.	
	3.2	Reduce the size of PCB by varying the position of components or devices for optimize use of copper clad material.	
4.0		**Implementation of PCB**	**04**
	4.1	Transfer the designed PCB on Copper clad either by using dark room or taking printout on glossy paper, etc (use available suitable method).	
	4.2	Perform Etching and then Soldering.	
5.0		**Detection of Hardware faults and Result verification**	**05**
	5.1	Identify the hardware faults in designed circuit and subsequently rectify it	
	5.2	Now again verify the hardware results by using electronic tools and equipment's like multimeter, CRO, DSO etc.	
6.0		**Understanding the Troubleshooting**	**05**
	6.1	Understand the trouble shooting by removing some wired connection.	
	6.2	Understand the trouble shooting of track. Troubleshoot the faculty components or devices	
		Total	**30**

Text Books:

1. Electronics Project Book, Varun Bansal, Hobby Electronics, 1st Edition.
2. Electronics Project for Dummies E. Boysen, N., Muir John Wiley 1st Edition.
3. 30 Arduino Projects for Evil Genius Simon Monk Mc Graw Hill Professional, 2nd Edition
4. Raspberry Pi Electronics projects for Evil Genius Donald Norris Mc Graw Hill Professional, 1st Edition.
5. Electronics Project for Beginners A K Maini Pustak Mahal 1st Edition.

Reference Books:

1. Printed circuit board R S Khandpur McGraw-Hill Education 1st Edition
2. Complete PCB Design Using OrCAD Capture and PCB Editor Kraig Mitzner Academic Press 2nd Edition.