Bharatiya Vidya Bhavan's

Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai)

Revision: SPIT-2-18

Bachelor of Technology (B.Tech)
in
Electronics and Telecommunication Engineering
(Program Code: UET)

Second Year Engineering
(Sem. III and Sem. IV)
Effective from Academic Year 2018 -19

Board of Studies Approval: 13/12/2017

Academic Council Approval: 20/01/2018

Dr. Y. S. Rao	*Dr. Surendra Rathod*	*Dr. Prachi Gharpure*
Head of Department	*Dean Academics*	*Principal*

Principal
Sardar Patel Institute of Technology
Bhavans Andheri Campus
Munshi Nagar, Andheri (West).
Mumbai - 400 058.

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Scheme for B.Tech Electronics and Telecommunication Engineering						
SEM III						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	**T**	**P**	**Total**
BS31	Applied Mathematics I*	BS	3	1	--	4
ET31	Electronics Devices and Circuits	PC	3	--	--	3
ET32	Circuit Theory*	PC	3	1	--	4
ET33	Digital Circuits*	PC	3	1	--	4
ET34	Electromagnetic Wave Propagation	PC	3	1	--	4
ETL31	Electronics Devices and Circuits Lab	PC	--	--	2	1
ETL32	Digital Circuits Lab	PC	--	--	2	1
ETL33	HDL Programming Lab	PC	--	--	2	1
ETL34	Object Oriented Programming Lab	PC	--	1	2	2
BS32	Human Health Systems Approach	BS	2	--	--	2
SDX	SCOPE Course	SD	--	--	--	--
ABL1	Building Automation, Fire Safety and Electronic Security (Noncredit)	ABL	--	--	--	--
CEP1	Introduction to CEP (Optional)	CEP	--	--	--	--
BC	Fundamentals of Mathematics (Noncredit) (only for direct second year students) &	BC	2	--	--	--
	Total		**19**	**5**	**8**	**26**

*** Common courses with Electronics Engineering**

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Scheme for B.Tech. Electronics and Telecommunication Engineering						
SEM IV						
Course Code	**Course Name**	**Group**	**Teaching Scheme (Hrs/week)**			**Credits**
			L	**T**	**P**	**Total**
BS 41	Applied Mathematics II*	BS	3	1	--	4
ET41	Fundamentals of Communication Engineering*	PC	3	-	--	3
ET42	Signals & Systems	PC	3	1	--	4
ET43	Principles of Control Systems*	PC	3	1	--	4
ET44	Integrated Circuits	PC	3	1	--	4
ETL41	Fundamentals of Communication Engineering Lab	PC	--	-	2	1
ETL43	Principles of Control Systems Lab	PC	--	--	2	1
ETL44	Integrated Circuits Lab	PC	--	--	2	1
ETL45	Computer Methods for Circuit Simulation Lab*	PC	--	--	2	1
LA^	Liberal Arts (Non credit) LA1: Yoga Vidya LA2: Music Appreciation LA3: Dramatics	LA	1	--	--	--
SDX	SCOPE Course	SD	--	--	--	--
ABL2	Occupational Safety and Legal Studies for Engineer (Noncredit)	ABL	--	--	--	--
CEP2	Problem solving module-I (Optional)	CEP	--	--	--	--
	Total		16	4	8	23

*** Common courses with Electronics Engineering**

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Evaluation Scheme

B.Tech Electronics and Telecommunication Engineering (SEM III)					
Course Code	**Course Name**	**Marks**			
		ISE	**MSE**	**ESE**	**Total**
BS31	Applied Mathematics I*	20	20	60	100
ET31	Electronics Devices and Circuits	20	20	60	100
ET32	Circuit Theory*	20	20	60	100
ET33	Digital Circuits*	20	20	60	100
ET34	Electromagnetic Wave Propagation	20	20	60	100
ETL31	Electronics Devices and Circuits Lab	40	--	--	40
ETL32	Digital Circuits Lab	40	--	--	40
ETL33	HDL Programming Lab	40	--	20	60
ETL34	Object Oriented Programming Lab	40	--	20	60
BS32	Human Health Systems Approach	ISE1= 20	ISE2= 20	Attendance= 10	50
ABL1	Building Automation, Fire Safety and Electronic Security (Noncredit)	--	--	--	--
BC	Fundamentals of Mathematics (Noncredit)	ISE1= 20	ISE2= 20	Attendance= 10	50&
	Total				**750**
B.Tech Electronics and Telecommunication Engineering (SEM IV)					
Course Code	**Course Name**	**Marks**			
		ISE	**MSE**	**ESE**	**Total**
BS 41	Applied Mathematics II*	20	20	60	100
ET41	Fundamentals of Communication Engineering*	20	20	60	100
ET42	Signals & Systems	20	20	60	100
ET43	Principles of Control Systems*	20	20	60	100
ET44	Integrated Circuits	20	20	60	100
ETL41	Fundamentals of Communication Engineering Lab	40	--	--	40
ETL43	Principles of Control Systems Lab	40	--	--	40
ETL44	Integrated Circuits Lab	40	--	20	60
ETL45	Computer Methods for Circuit Simulation Lab	40	--	20	60
LA^	Liberal Arts (Non credit) LA1: Yoga Vidya LA2: Music Appreciation LA3: Dramatics	ISE1= 20	ISE2= 20	Attendance= 10	50
ABL2	Occupational Safety & Legal Studies for Engineers (Noncredit)	--	--	--	--
	Total				**750**

*** Common courses with Electronics**

& only for direct second year students (Since it is non-credit course it will not be counted in total marks)

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SEMESTER - III

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
BS31	Applied Mathematics-I	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite course codes		BS11 (Engineering Mathematics I) BS21 (Engineering Mathematics II)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Evaluate Laplace and Inverse Laplace transform of functions using various properties.
	CO2	Solve differential equations with given initial conditions using Laplace and Laplace Inverse.
	CO3	Expand functions in terms of sine and cosine series on the given interval.
	CO4	Find Fourier transforms by applying its various properties
	CO5	Check for a function being analytic using Cauchy-Reimann equations and construct analytic functions.
	CO6	Construct Bilinear Transformations and find images under Conformal mappings

Module No	Module Name	Unit No	Topics	Ref	Hours
1	**Laplace Transform**	**1.1**	Definition of Laplace Transform, LT of **Error! Reference source not found.**,*sin(at), cos(at), sinh(at), cosh(at), erf(t).*	1,2,3,4	03
		1.2	Properties of Laplace Transform: Linearity, change of scale, first shifting theorem, second shifting theorem, multiplication by t, division by t, Laplace Transform of derivatives and integrals.		06
2	**Inverse Laplace Transform, Special Functions and Applications of Laplace**	**2.1**	Inverse Laplace Transform using Partial fraction method, Convolution theorem (without proof), differentiation and integration property.	1,2,3,4	04
		2.2	Laplace of Heavi-side unit step, dirac-delta function, LT of periodic function		03
		2.3	Applications of Laplace Transforms to find solution of ordinary differential equations and simultaneous differential equations.		03

3	**Fourier Series and Fourier Transforms**	**3.1**	Introduction to Fourier Series, Dirichlet's condition of convergences, Euler's formulae	1,2,3,4	02
		3.2	Fourier series of algebraic, exponential, trigonometric functions ,half range sine and cosine series, Parsevals Identity. Complex form of Fourier series. Differentiation and Integration of Fourier Series.		05
		3.3	Fourier Transforms, Inverse Fourier Transforms and its applications		06
4	**Complex Variable**	**4.1**	Definition of analytic function, Cauchy Reiman equations in Cartesian and polar form. Constructing analytic function by Milne Thompson and analytic method.	1,2,3,4	05
		4.2	Harmonic functions, orthogonal trajectories		02
		4.3	Conformal Mappings		03
				Total	**42Hrs**

NOTE: ISE component will be evaluated through assignments and quizzes conducted in the tutorial sessions (tutorials will be conducted class wise)

References:

1. Kreyszig, "Advanced Engineering Mathematics, 9th edition", John Wiley
2. H.K.Dass, "Advanced Engineering Mathematics", 28th edition, S.Chand, 2010
3. Grewal B.S., "Higher Engineering Mathematics", 38th edition, Khanna Publication
4. Jain and Iyengar, "Advanced Engineering Mathematics", 4th edition, Narosa Publishing House, Pvt. Ltd, 2014

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET31	Electronic Devices and Circuits	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE	Total	
		20		20		60	100	

Pre-requisite Course Codes		BS12(Applied Physics I) BS22 (Applied Physics II) ES21 (Basic Electrical Technology)
After successful completion of the course, students will able to		
Course Outcomes	CO1	Apply the concept of basic diodes.
	CO2	Analyze BJT circuits and carry out the small signal analysis of BJT amplifiers.
	CO3	Describe the working and carry out the small signal analysis of JFET & MOSFET amplifiers.
	CO4	Analyze and design single and multistage JFET and MOSFET amplifiers.
	CO5	Differentiate between discrete and integrated biasing techniques.
	CO6	Understand the concept of feedback amplifiers.

Module No.	Unit No.	Topics	Ref.	Hrs
1	1.1	**PN Junction diode:** **Clippers and Clampers**: series and shunt clippers, single diode series and shunt clamper circuits.	2,3,4	4
2	2.1	**DC Analysis of transistor circuits :** **Bipolar Junction Transistor :** Review of BJT characteristics,DC load line and regions of operation, transistor as switch, DC analysis of CE amplifier - voltage divider bias, stability factor analysis.	1, 2	6
	2.2	**Small Signal Analysis of BJT amplifiers:** AC load line analysis, amplifier parameters Zi, Zo, Av, Ai, hybrid pi model, Early effect.		
3	3.1	**Junction Field Effect Transistor (JFET):** Construction, working, regions of operation, transfer (VGS Vs ID) and output (VDS Vs ID) characteristics, Schockly equation.	2,3,5	14
	3.2	**Junction Field Effect Transistor:** Analysis and design of self bias and voltage divider bias.		
	3.3	**Small Signal Analysis of JFET CS Amplifier:** Small signal equivalent circuit and analysis (mid-frequency) (Zi, Zo and Av)		
	3.4	**Metal-Oxide Semiconductor Field Effect Transistor (MOSFET):** **MOSFET:** DC load line and region of operation, common		

		MOSFETs configurations, analysis of biasing circuits.		
	3.5	**E-MOSFET:** MOS capacitor, depletion and inversion region, concept of threshold voltage, operation of MOSFET, derivation of threshold voltage and drain current, body effect, channel length modulation. Graphical analysis to evaluate parameters, AC load line, small signal model, small signal (mid-frequency) analysis.		
4	**4.1**	**Frequency Response of amplifiers :** Single Stage Amplifiers - Effect of capacitors (coupling, bypass, load) on frequency response of single stage MOSFET amplifiers, low and high frequency response of MOSFET amplifiers, miller effect and Miller capacitance, gain bandwidth product.	**1, 2,4**	**8**
	4.2	**Multistage Amplifier:** Low and high frequency response and mid – frequency analysis of multistage / cascade (CS-CS), design of two stage FET amplifiers.		
5	**5.1**	**MOSFET Differential Amplifiers :** MOSFET Differential Amplifiers**:** DC transfer characteristics, small signal analysis, differential and common mode gain, CMRR, differential and common mode input impedance.	**3**	**6**
	5.2	**Integrated Circuit biasing:** **Current Mirror:** Two transistor (MOSFET) current source, current relationship, output resistance. **Improved Current Source:** Three transistor (MOSFET) current source. **Special Current Source:** Cascode (MOSFET) current source, Wilson and Widlar current sources.		
6	**6.1**	**Concept of feedback:** Classification of feedback on amplifier characteristics, Barkhausen criteria, general characteristics of negative feedback amplifiers, effect of feedback on amplifier characteristics, feedback topologies - voltage series, voltage shunt, current series and current shunt feedback, Illustrative problems.	**1, 2,3**	**4**
			Total	**42**

References:

[1] A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, Edition IV.
[2] B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995.
[3] D. A. Neamen, Semiconductor Physics and Devices (IRWIN), Times Mirror High Education Group, Chicago) 1997.
[4] Electronics Devices and Circuits by Salivahanan, McGraw Hill Education; 3 edition (23 June 2012).
[5] Mahesh B. Patil, Basic Electronic Devices and Circuits, Prentice Hall India Learning Private Limited (2013).

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET32	Circuit Theory	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes		ES21 (Basic Electrical Technology)
After successful completion of the course, students will able to		
Course Outcomes	CO1	Analyse the given circuits using theorems and transformation techniques
	CO2	Analyse the given circuit using Graph Theory
	CO3	Analyse the given RL, RC and RLC circuits in time domain
	CO4	Analyse the given RL, RC and RLC circuits in frequency domain
	CO5	Predict the circuits using Foster and Cauer realization methods
	CO6	Explain the concept of two port network, relation between the parameters and their interconnection

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Analysis of DC circuits: Analysis of circuits with and without controlled sources using generalized loop, node matrix, Superposition, Thevenin, Norton, Maximum Power transfer, Millman theorems	3	10
	1.2	Analysis of coupled circuits: Self and mutual inductances, coefficient of coupling, Dot convention, equivalent circuit, solution using loop analysis	1	
2	2.1	Graph Theory: Concept of loop, tree, co-tree, incidence matrix, cut set matrix and tie set matrix	3	6
	2.2	Tellegen's theorem, Planar and Non planar graphs, Duality principle	3	
3	3.1	Time domain analysis of R-L and R-C circuits: Forced and natural response, time constant, initial and final values Solution using first order equation for standard input signals: Transient and steady state time response, solution using universal formula	1,3	12

	3.2	Time domain analysis of R-L-C circuits: Forced and natural response, effect of damping Solution using second order equation for standard input signals: Transient and steady state time response	1,3	
	3.3	Frequency domain analysis of RLC circuits: S-domain representation, applications of Laplace Transform in solving electrical networks	1,3	
4	4.1	Network Function: driving point and transfer function, Poles and Zeros, calculation of residues by analytical and graphical method, frequency response	2	6
	4.2	Positive real functions: Concept of positive real function, testing for Hurwitz polynomials, testing for necessary and sufficient conditions for positive real functions	2	
	4.3	Synthesis of RC, RL, LC circuits: Concepts of synthesis of RC, RL, LC driving point functions.	2	
5	5.1	Parameters: Open Circuit, Short Circuit, Transmission and Hybrid parameters, relationships among parameters, reciprocity and symmetry conditions	1	8
	5.2	Series/parallel connection: T and Pi representations, interconnection of Two-Port networks	1	
Total				42

References:

[1] A. Chakrabarti, "Circuit Theory", Dhanpat Rai and Co.,New Delhi

[2] Franklin F Kuo, "Network Analysis and Synthesis", Wiley Toppan

[3] M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi

[4] D. Roy Choudhury, "Networks and Systems", New Age International Pvt Ltd, Wiley

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET33	Digital Circuits	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE	Total	
		20		20		60	100	

Pre-requisite Course Codes		ES21 (Basic Electrical Technology)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Explain various logic gates, SOP, POS forms and their minimization with k-map for given combinational circuits.
	CO2	Construct combinational circuits using given MSI devices.
	CO3	Discuss different types of programmable logic devices like PAL, PLA, CPLD and FPGA.
	CO4	Apply the knowledge of flip-flops and MSI to design counters
	CO5	Design state machines for given state diagrams after state reduction
	CO6	Discuss fault models and testing methods for digital circuits

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Logic Gates:** Basic gates, Universal gates, Sum of products and products of sum, minimization with Karnaugh Map (upto four variables) and realization.	1,2,3	12
	1.2	**Logic Families:** Types of logic families (TTL and CMOS), characteristic parameters (propagation delays, power dissipation, Noise Margin, Fan-out and Fan-in), transfer characteristics of TTL NAND, Interfacing CMOS to TTL and TTL to CMOS.	1,2,3	
	1.3	**Combinational Circuits using basic gates as well as MSI devices:** Half adder, Full adder, Half Subtractor, Full Subtractor, Multiplexer, Demultiplexer, Decoder, Comparator (Multiplexer and Demultiplexer gate level upto 4:1).	1,2,3	

		MSI devices IC7483, IC74151, IC74138, IC7485.		
2	**2.1**	**Sequential Logic:** Latches and Flip-Flops. Conversions of Flip-Flops, Timing Considerations and Metastability	1,2,3	12
	2.2	**Counters:** Asynchronous, Synchronous Counters, Up Down Counters, Mod Counters, Ring Counters Shift Registers, Universal Shift Register	1,2,3	
3	**3.1**	Mealy and Moore Machines, Clocked synchronous state machine analysis, State reduction techniques and state assignment, Clocked synchronous state machine design.	4,5	12
	3.2	MSI counters (7490, 7492, 7493, 74160, 74163, 74169) and applications, MSI Shift registers (74194) and their applications	4,5	
4	**4.1**	Concepts of PAL and PLA. Introduction to CPLD and FPGA architectures.	4,5	05
5	**5.1**	Fault Models, Stuck at faults, Bridging faults, Controllability and Observability	6	05
	5.2	Path sensitization, ATPG, Design for Testability, Boundary Scan Logic, JTAG and Built in self test.	6	
			Total	**42**

References:

[1] William I. Fletcher, 'An Engineering Approach to Digital Design', PHI.

[2] R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill

[3] Morris Mano, Digital Design, Pearson Education, Asia 2002.

[4] John F. Wakerley, Digital Design Principles And Practices, third Edition Updated,Pearson Education, Singapore, 2002

[5] Stephen Brown and ZvonkoVranesic, Fundamentals of digital logic design with VHDL, McGraw Hill, 2nd Edition.

[6] B. Holdsworth and R. C. Woods, 'Digital Logic Design', Newnes, 4th Edition

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET34	Electromagnetic Wave Propagation	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE		Total
		20		20		60		100

Pre-requisite Course	BS11 (Engineering Mathematics I) BS21 (Engineering Mathematics II) BS31 (Applied Mathematics I)
After successful completion of the course, student will be able to	

Course Outcomes	CO1	Ability to comprehend the physical significance of static and dynamic field theory.
	CO2	Ability to interpret the behaviour of Electromagnetic wave in various media and Interfaces by applying Maxwell's Equation
	CO3	Ability to determine the energy flow and Polarization by applying the maxwell's equation.
	CO4	Ability to calculate and analyse the parameters for wave propagation in Transmission Line through theoretical calculations and Smith Chart
	CO5	Ability to evaluate the degradation in the performance of a device and system or subsystem compatibility based on radiated emission.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Static and Dynamic theory before Maxwell:** Coulomb's law, Gauss's law, Bio-Savart's law, Ampere's law, Poisson's and Laplace's equations.	1-5	12
	1.2	**Maxwell's Equations**: Integral and Diffrential form, Time Harmonic Fields and Maxwell's Equation in Phasor Form.	1-5	
	1.3	**Electromagnetic Boundary Conditions:** Electric Boundary condition and Magnetic Boundary Condition	1-5	
2	2.1	**Wave equation:** Derivation and its solution in Cartesian coordinates	1-5	8
	2.2	**Plane Waves in Various Media:** Lossless Media, Lossy conducting media, good dielectric and Good Conductor, Concept of Skin Depth	1-5	
	2.3	**Power flow in EM Fields:** Poynting Vector		

3	**3.1**	**Plane wave Reflection from Media Interface at Normal Incidence:** Lossless Media, Lossy conducting media, good conductor and Perfect Conductor	1-5	8
	3.2	**Plane wave Reflection and Polarization from Media Interface at Oblique Incidence:** Perpendicular Polarization, Parallel Polarization, Total Internal Reflection, Wave Polarization.	1-5	
4	**4.1**	**Transmission Lines:** Transmission Line Parameters ,Transmission Line Equations,Input Impedance, SWR, and Power, The Smith Chart.	1-5	10
5	**5.1**	**Introduction to Electromagnetic Interference and Compatibility:**Source and Characteristics of EMI,EMI Control Techniques, EMC Consideration and Regulation.	2,6,7	04
			Total	**42**

References:

[1] R.K. Shevgaonkar, Electromagnetic Waves, TATA McGraw Hill Companies, 3 rd Edition, 2009

[2] Matthew N.D. Sadiku, Principles of Electromagnetics, Oxford International Student 4 th Edition, 2007

[3] D K Cheng, Fundamentals of Eleectromagnetics, Addison Wesley, MA 1993.

[4] Edward C. Jordan, Keth G. Balmin, Electromagnetic Waves & Radiating Systems, Pearson Publications, 2 nd Edition, 2006

[5] W.H. Hayt, J.A. Buck, Engineering Electromagnetics, McGraw Hill Publications, 7 th Edition, 2006.

[6] Henry W. Ott, Electromagnetic Compatibility Engineering, Wiley Publications, 2009.

[7] David Morgan, A Handbook for EMC Testing and Measurement, IET, 1994.

Weblinks:

http://nptel.ac.in/, by Prof R.K. Shevgaonkar, Department of Electrical Engineering Indian Institute of Technology, Bombay.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL 31	Electronic Devices and Circuits Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE	Total	
		40		--		--	40	

Pre-requisite Course Codes		ET 31 (Electronic Devices and Circuits)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	To analyse wave shaping circuits.
	CO2	To demonstrate the working of BJT amplifier.
	CO3	To verify the working, biasing and small signal analysis of JFET amplifiers.
	CO4	To analyze and design single and multistage JFET amplifiers.
	CO5	To analyze current mirror circuits through simulation.
	CO6	To design and simulate feedback amplifiers.

Exp. No.	Experiment Details	Ref	Marks
1	To design, set up & study various shunt and series clipping circuits using diodes.	4	5
2	To design, set up & study various clamping circuits using diodes.	4	5
3	To design a single stage BJT amplifier for a given gain.	1	5
4	Analyze, design and simulate MOSFET biasing circuit for given conditions.	3, 5	5
5	Design of single stage RC coupled CS amplifier and plot its frequency response.	5	5
6	Design of cascade CS-CS amplifier and study of its frequency response.	3	5
7	Implementation of any one current mirror circuit using any circuit simulation software.	3,5	5
8	To design and analyze the voltage-series feedback amplifier and to calculate the following parameters with and without feedback- 1. Mid band gain. 2. Bandwidth and cut-off frequencies. 3. Gain Bandwidth Product.	2	5
		Total Marks	40

References:

[1] A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, Edition IV.

[2] B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995.

[3] D. A. Neamen, Semiconductor Physics and Devices (IRWIN), Times Mirror High Education Group, Chicago) 1997.

[4] Electronics Devices and Circuits by Salivahanan, McGraw Hill Education; 3 edition (23 June 2012).

[5] Mahesh B. Patil, Basic Electronic Devices and Circuits, Prentice Hall India Learning Private Limited (2013).

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL32	Digital Circuits Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE			MSE		ESE	Total
		40			--		--	40

Pre-requisite Course Codes		ET33 (Digital Circuits)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Follow the given instructions for performing an experiment on the breadboard
	CO2	Construct logic circuits using gate to realize given function
	CO3	Construct logic circuits using MSI ICs to realize given function
	CO4	Validate the design of combinational and sequential logic circuits by hardware implementation
	CO5	Test and troubleshoot given logic circuits using testing instruments
	CO6	Develop an application using concepts of digital circuits

Exp. No.	Experiment Details	Ref.	Marks
1	To implement the combinational logic for given function using basic gates/MSI ICs.	1,2	5
2	To study TTL and CMOS logic family	1,2	5
3	To study 4-bit, 5-bit and 8 bit comparator using IC7485	1,2	5
4	To study of gate level multiplexers and MSI multiplexers	1,2	5
5	To study the gate level implementation and MSI circuits of flip-flops	1,2	5
6	To design mod 4 synchronous up/down counter using JK flip-flop	1,2	5

7	To study IC7490, IC7492 and IC7493 as asynchronous counter, IC74160, IC74163, IC74169 as synchronous counters and IC74194 as universal shift register.	1,2	**5**
8	**Mini-Project:** Design and implement an application using digital circuit concepts.	1,2	**5**
		Total Marks	**40**

References:

[1] Datasheets and application notes of LSI and MSI circuits.

[2] R. P. Jain and M. M. S. Anand "Digital Electronics Practice Using Integrated Circuits," TataMc Graw Hill Education

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL33	HDL Programming Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE			MSE		ESE	Total
		40			--		20	60

Pre-requisite Course Codes		ET33 (Digital Circuits)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Write VHDL code to build the given hardware
	CO2	Verify the behavior of given hardware with VHDL simulation tool
	CO3	Write synthesizable VHDL code and perform physical verification on FPGA and CPLD device
	CO4	Write, simulate, synthesize and implement VHDL code with behavioral, dataflow and structural modeling style
	CO5	Interface the external peripherals with FPGA and design a hardware to create an application.
	CO6	Interpret the RTL, synthesis, Floorplan report and optimally utilize the internal resources of given FPGA

Exp. No.	Experiment Details	Ref.	Marks
1	Design, simulate and synthesize 9 bit parity generator using dataflow modeling and carry out physical verification on given FPGA.	1,2,3	5
2	Design, simulate and synthesize ripple carry adder and carry-look ahead adder using structural modeling and carry out physical verification on given FPGA	1,2,3	5
3	Design, simulate and synthesize a stepper motor control hardware using Johnson counter. Use behavioral modeling for designing this hardware.	1,2,3	5

	Carry out physical verification on given FPGA		
4	Write the testbench to verify the given IP.	1,2,3	**5**
5	Interface ADC/ DAC with FPGA. Give input signal to ADC, digitally amplify the input signal, give amplified data to DAC and observe the amplified output on DSO.	1,2,3	**5**
6	FPGA implementation of Traffic light controller in VHDL using Finite State Machine	4	**5**
7	Design of Microcomputer using existing IP. Use instantiation for designing the hardware.	2	**5**
8	Mini project as an application of HDL	4	**5**
		Total Marks	**40**

References:

[1] J. Bhaskar, "VHDL Primer", Pearson Education.

[2] Gaganpreet Kaur, "VHDL Basic to Programming", Pearson

[3] Douglas Perry, "VHDL: Programming by Example" McGraw Hill

[4] Application notes by Xilinx and Altera

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL34	Object Oriented Programming Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE			MSE		ESE	Total
		40			--		20	60

Pre-requisite Course Codes		ES4(Programming Methodology and Data Structures)
After successful completion of the course, student will be able to		
Course Outcomes for Tutorials	CO1	Write programs using object oriented programming paradigm.
	CO2	Solve programs using inheritance and polymorphism
	CO3	Use abstract classes, interface and package to solve problems
	CO4	Apply concepts of multithreading and exception handling to create efficient program.
	CO5	Demonstrate use of string classes

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**BASIC OF JAVA**	2	
	1.1	History & features, Difference between JDK,JRE,JVM, Unicode system, Advantages of OOP		3
	1.2	I/O using Scanner class & Command line argument, Object, Class, Constructor , Static Variable, Method & block		
	1.3	Branching & looping		
2		**OOP CONCEPTS**	1,2,4	
	2.1	Inheritance (IS – A), Aggregation & Composition (Has – A)		4
	2.2	Method overloading & overriding, Constructor overloading & overriding, this, super, final keyword		
	2.3	Runtime polymorphism, Static and Dynamic Binding		
3		**ABSTRACT CLASS, INTERFACE, PACKAGE**	1,2	
	3.1	Abstract class & interface, instanceof operator		3
	3.2	Package and access modifier		
	3.3	Object class, Nested class		
4		**STRING HANDLING**	1,2	
	4.1	Immutable string ,Methods of String class,		1
	4.2	String comparison, concatenation, substring, toString method		

5		**EXCEPTION HANDLING**	1,2	
	5.1	What & why? Try & catch block, Multiple catch block, Nested try, Finally block		1
	5.2	Throw, Throws keywords, Exception propagation		
	5.3	Custom exception		
6		**MULTITHREADING**	1,2	
	6.1	Life cycle of a – thread, Create thread using, Thread & Runnable class		2
	6.2	Thread methods, schedule, sleep, join, Thread priority, Thread group, Perform multiple task using multiple thread		
	6.3	Thread synchronization		
			Total	**14**

References:

[1] Ralph Bravaco , Shai Simoson , "Java Programing From the Group Up" ,Tata McGraw-Hill.

[2] Herbert Schildt, "Java The Complete Reference", Tata McGraw-Hill.

[3] Jaime Nino, Frederick A. Hosch, 'An introduction to Programming and Object Oriented Design using Java', Wiley Student Edition.

[4] C Xavier, "Java Programming A Practical Approach",Tata McGraw-Hill.

[5] James Holmes "Struts: The Complete Reference" Tata McGraw-Hill.

[6] Jim Keogh, "J2EE: The Complete Reference" Tata McGraw-Hill.

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Pre-requisite Course Codes		ES4(Programming Methodology and Data Structures)
After successful completion of the course, student will be able to		
Course Outcomes for Laboratory	CO1	Use object oriented programming concepts for a scenario.
	CO2	Apply concept of input output and string handling
	CO3	Demonstrate polymorphism, static and dynamic binding.
	CO4	Apply Inheritance, Abstract Class and Interface to implement scenario.
	CO5	Apply concept of multithreading and exception handling for a scenario.

Exp. No.	**Experiment Details**	**Ref.**	**Marks**
1	Program on I/O using command line arguments, scanner class, BufferedReader etc.	**1,2**	**5**
2	Program on Constructor.	**1,2,3**	**5**
3	Program on Polymorphism, Run time polymorphism.	**1,2**	**5**
4	Program on Inheritance, Abstract Class, Interface.	**1,2**	**5**
5	Program on Nested Class, Aggregation, Composition.	**1,2,3**	**5**
6	Program on Multithreading.	**2,3,4**	**5**
7	Program on String and Exception Handling.	**1,2**	**5**
8	Program on Package and access modifiers.	**1,2**	**5**
		Total Marks	**40**

References:

[1] Ralph Bravaco , Shai Simoson , "Java Programing From the Group Up" ,Tata McGraw-Hill.

[2] Herbert Schildt, "Java The Complete Reference", Tata McGraw-Hill.

[3] Jaime Nino, Frederick A. Hosch, 'An introduction to Programming and Object Oriented Design using Java', Wiley Student Edition.

[4] C Xavier, "Java Programming A Practical Approach",Tata McGraw-Hill.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
BS32	Human Health Systems Approach	2	-	-	2	--	--	2
		Examination Scheme						
		ISE1		ISE2	Attendance			Total
		20		20	10			50

Student will be evaluated after completion of 50% syllabus for 20 Marks (ISE1) and at the end of course for 20 Marks (ISE2). Grade equivalent to 'D' (50%-59.99% Marks) or above is considered as 'Satisfactory'. If any of the tasks given is not completed/submitted/shown/evaluated then the corresponding lower grade will be given. Although the grades are given they will not mentioned in final grade card but they are necessary to declare the successful completion of the Non-Credit course.

Pre-requisite Course Codes		--- Student will be able to understand
Course Outcomes	CO1	Physiology as integrated interdisciplinary Science
	CO2	Physiological significance of balanced diet and exercise in health
	CO3	Significance of cleanliness and hygiene in daily routine
	CO4	Dynamics and homeostasis of human health

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Levels of Organizational Systems**		1	2
	1.1	Molecular, Cellular and Organ Systems		2
	1.2	Biological Molecules		
	1.3	Biochemistry, Biophysics, Molecular Biology and Bioengineering	1	
2	**Energy and Molecular Supply Chain Management**			**7**
	2.1	Digestive System: Nutrient supply and Balanced Diet		2
	2.2	Respiratory System and effects of Pollution		2
	2.3	Cardiovascular System, Blood Pressure, ECG and Blood Report		2
	2.4	Musculo-skeletal System and exercise Physiology		1
3	**Body Fluid Dynamics**		1	**4**
	3.1	Body fluids		2
	3.2	Kidneys as Filtration Units and their Physiological Functions		
	3.3	Urinary System		1
	3.4	Kidney and Urinary Stones, and Dialysis		1
4	**Control, Coordination and Regulatory Systems**		1	**4**
	4.1	Sense Organs		1
	4.2	Nervous systems		2
	4.3	Endocrine Systems (Pancreas and Diabetes, Thyroid and its functions)		1
5	**Defense Systems**		1	**3**
	5.1	Integumentary System		1
	5.2	Immune System		2

6	**Molecular Biology and Genetical Information**		2	**6**
	6.1	Hereditary Molecules: DNA RNA		2
	6.2	Horizontal flow of Genetic Information		2
	6.3	Vertical flow of Genetic Information		2
			Total	**26**

References:

1. Text book of Anatomy and Physiology for Nurses and allied a health Sciences by Indu Khurana & Arushi.
2. Simplified Courses in Molecular Biology by V.K Agarwal- S.Chand Publications.

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Course Code	Course Name	Teaching Scheme			Credits Assigned			
		L	T	P	L	T	P	Total
BC	Fundamental of Mathematics	2	-	-	Non-Credits			
		Examination Scheme						
		ISE1		ISE2		Attendance		Total
		20		20		10		50

Student wi3ll be evaluated after completion of 50% syllabus for 20 Marks (ISE1) and at the end of course for 20 Marks (ISE2). Grade equivalent to 'D' (50%-59.99% Marks) or above is considered as 'Satisfactory'. If any of the tasks given is not completed/submitted/shown/evaluated then the corresponding lower grade will be given. Although the grades are given they will not mentioned in final grade card but they are necessary to declare the successful completion of the Non-Credit course.

Course Objectives: To improve the basic mathematical skills for solving engineering problems.

Course Outcomes:

	Learners will be able	
Course Outcomes	**CO1**	To find basic derivatives, Integration and limits.
	CO2	To find rank of a matrix and solve system of linear equations using rank.
	CO3	To find partial derivative of a function and apply it to extremise functions.
	CO4	To solve differential equations of first and higher order.
	CO5	To find roots & logarithm of a complex number.

Module No	Module name	Unit No.	Topics	Ref.	Hrs.
1.	**Derivatives**	1.1	Derivative of functions which are expressed in one of the following form a) product of functions, b) quotient of functions, c) derivatives of trigonometric function	1,2,5,6,7	1
		1.2	**Application of Derivatives:** Rolls theorem and Mean value theorem	1,2,5,6,7	1
2.	**Integration**	2.1	Indefinite integrals-methods of integration, substitution method.	1,2,5,6,7	1
		2.2	Evaluation of definite integral 1) bysubstitution, 2) integration by parts,	1,2,5,6,7	1
3.	**Basic of Matrices**	3.1	Rank of Matrix, Normal form	1,2,3,4,6	1
		3.2	Consistency and solution of simultaneous linear homogeneous and	1,2,3,4,6	1

			Non-homogeneous equations. Linear Dependence & independence vectors		
4.	**Partial Differentiation**	4.1	Partial derivatives of first and higher order, Chain Rule & Composite function	1,2,3,4,7	1
		4.2	Euler's theorem on homogeneous functions with two and three independent variables	1,2,3,4,7	1
		4.3	Application of partial derivatives: Maxima and Minima of functions of two variables.	1,2,3,4,7	1
5.	**Differential Equations of first & higher order**	5.1	Exact Differential Equation,	1,2,3,4,	3
		5.2	Linear Differential Equation with constant coefficient- complementary function, particular integrals of differential equation of the type f(D)y = X where X is **Error! Reference source not found.**sin(ax+b),		
		5.3	cos(ax+b), **Error! Reference source not found.** xV.		
6.	**Indeterminate forms**	6.1	Indeterminate forms, L- Hospital Rule	7	1
7.	**Basics of Complex Numbers**	7.1	Roots of complex numbers by De'moivre's Theorem	1,2,3,4	1
		7.2	Relation between circular and hyperbolic function		1
		7.3	Logarithm of complex numbers.		1
				Total	16

References:-

1. Dr.B.S.Grewal," Higher Engineering Mathematics" by Khanna Publication, New Delhi, 42ndEdition.
2. H.K. Das, " Advanced Engineering Mathematics,"by S.ChandPublication.New DelhiTwelfth Revised Edition, 2004
3. Erwin Kreyszig," Advanced Engineering Mathematics,"by John Wiley Eastern Limited, UK Ninth Edition,
4. Shanti Narayan, P. K. Mittal," A Text book of Matrices," by S. Chand publication, New Delhi, Eleventh Edition.
5. Maharashtra state board of secondary and higher secondary education,Pune, Edition 2017.
6. George B. Thomas, Ross L Finney," Calculus and Analytical Geometry by Narosa Publishing House, Mumbai,Ninth Edition.
7. P.N.Wartikar and J.N.Wartikar," A text book of Applied Mathematics, Vol – I and II by

Vidyarthi Griha Prakashan, Pune. Ninth Revised Edition,2004.

SEMESTER - IV

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
BS41	Applied Mathematics-II	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes		BS11 (Engineering Mathematics I) BS21 (Engineering Mathematics II)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	To diagonalise a given matrix and calculate functions of a square matrix
	CO2	To reduce a given quadratic form to simpler forms
	CO3	To apply the concept of complex analysis to evaluate integrals
	CO4	To evaluate line integrals and surface integrals.
	CO5	To calculate expectation, variance and moments of a random variable
	CO6	To apply the concepts of matrices to real life problems

Module No	Module Name	Unit No	Topics	Ref	Hours
1.	**Linear Algebra: Matrix Theory**	**1.1**	Eigenvalues and Eigenvectors, properties of Eigenvalues and Eigenvectors	1,2,3,7	03
		1.2	Cayley-Hamilton theorem and its applications.		01
		1.3	Similarity of matrices, Diagonalisation of matrix		02
		1.4	Application of diagonalisation of matrices to find functions of a square matrix and to solve a system of ODE		02
		1.5	Quadratic forms over real field, Singular Value Decomposition		05
		1.6	Application to find google page rank		02
2.	**Complex Variables: Integration**	**2.1**	Line Integral, Cauchy's Integral theorem for simply connected regions, Cauchy's Integral formula	1,2,3,4	05

		2.2	Region of Convergence, Taylor's and Laurent's series		02
		2.3	Zeros, singularities, poles of f(z), residues, Cauchy's Residue theorem		04
		2.4	Applications of Residue theorem to evaluate real Integrals of different types		03
3.	**Vector Integration: Line and Surface Integrals**	**3.1**	Line and Surface Integrals, Circulation of a vector, Greens theorem in a plane, Gauss divergence theorem, Stokes theorem	1,2,3,4	06
4.	**Probability: Random Variables**	**4.1**	Discrete and continuous random variables (Single and Joint), probability density function, cumulative density function, expectation, variance. Moments and Moment generating function.	1,2,3,4,5,6	07
				Total	42 Hrs

NOTE: ISE component will be evaluated through assignments and quizzes conducted in the tutorial sessions (tutorials will be conducted class wise)

References:

1. Kreyszig, "Advanced Engineering Mathematics, 9th edition", John Wiley
2. H.K.Dass, "Advanced Engineering Mathematics", 28th edition, S.Chand, 2010
3. Grewal B.S., "Higher Engineering Mathematics", 38th edition, Khanna Publication
4. Thomas & Finney,"Calculus& Analytic Geometry", 9th edition, Addison Wesley.
5. Kishor S. Trivedi, "Probability & Statistics with reliability", 2nd edition, Wiley India
6. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists"
7. H Anton and C Rorres," Elementary Linear Algebra Application Version", 6th edition, John Wiley & Sons, 2010

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET41	Fundamentals of Communication Engineering	3	--	--	3	--	--	3
		Examination Scheme						
		ISE		MSE		ESE	Total	
		20		20		60	100	

Pre-requisite Course Codes	EL31 (Analog Electronics - I) EL32 (Circuit Theory)	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Infer principle of working of various sub systems of analog communication
	CO2	Analyze the performance parameters of analog and pulse modulations
	CO3	Apply concepts of Signals and systems to Analog Communication
	CO4	Analyze principle of working of receivers.
	CO5	Characterize noise and interpret effect of noise on modulations
	CO6	Compare the different analog communication systems.

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Amplitude Modulation Introduction to communication system, Need for modulation, , Amplitude Modulation, Definition, Time domain and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves, square law Modulator, Switching modulator, DSB-SC, time domain and frequency domain description, Generation of DSB-SC Modulated waves, Frequency Division Multiplexing Detection of AM Waves: Square law detector, Envelop detector	1	10
	1.2	Single Side Band (SSB):-Principle, Filter method, phase shift method and third method Independent side band (ISB) and Vestigial Side Band (VSB) principles and transmitters	1	

	1.3	Comparison and Applications of different AM Systems	1	
2	2.1	Angle Modulation Frequency modulation (FM): Basic concepts, Mathematical analysis of FM, Time and frequency domain Representation, FM generation-Varactor diode modulator, FET reactance modulator, stabilized reactance modulator- AFC, Direct FM transmitter, indirect FM Transmitter	4	10
	2.2	FM demodulation: Balance slope detector, Foster-Seely discriminator, ratio detector, Phase lock loop(PLL) FM demodulator		
	2.3	Comparison of AM, FM , Applications of FM	4	
3	3.1	Noise Resistive (Thermal) Noise Source, White Noise, Narrowband Noise-In phase and quadrature phase components and its Properties, noise figure, and noise temperature, Noise Figure of cascaded networks.	2	06
	3.2	Effect of noise on AM and FM, Pre Emphasis and De-Emphasis	2	
4	4.1	Radio Receivers Types of receivers, TRF, Super heterodyne receiver, AM and FM receivers	3	08
	4.2	Receiver parameters, and choice of IF, Simple AGC, delayed AGC	3	
5	5.1	Pulse Modulation Review of Sampling theory, Generation Detection and applications: PAM, PWM, PPM	5	06
	5.2	Generation, Detection and applications : PCM, Delta modulation, adaptive delta modulation, TDM	5	
		Total		42

References:

1.Wayne Tomasi, "Electronics Communication Systems", Pearson education, Fifth edition.

2.Kennedy and Davis, "Electronics Communication System", Tata Mc Graw Hill, Fourth edition.

3.B.P. Lathi, Zhi Ding,"Modern Digital and Analog Communication system", Oxford University Press, Fourth edition

4.Taub, Schilling and Saha, "Taub's Principles of Communication systems", Tata Mc Graw Hill,Third edition.

5.P. Sing and S.D. Sapre, "Communication Systems: Analog and Digital", Tata McGraw Hill,Third edition.

6.Simon Haykin, Michel Moher, "Introduction to Analog and Digital Communication", Wiley, Second edition.

7.Dennis Roddy and John Coolen, "Electronic Communication", Prentice Hall, Third Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET42	Signals & Systems	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE	ESE		Total	
		20		20	60		100	

Pre-requisite Course Codes		BS31 (Applied Mathematics I)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Classify and illustrate various operations on signals and systems.
	CO2	Interpret and analyze LTI systems and report results.
	CO3	Analyze the properties of a continuous and discrete time signal in frequency domain and observe the spectrum.
	CO4	Analyze the system characteristics and evaluate the system response using Z - Transform
	CO5	Evaluate system response using Laplace - Transform which is useful in understanding behavior of Electronics circuits and communication systems.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Overview of Signal and Systems**	1,2, 3,4	08
	1.1	**Introduction:** Signals, systems, elementary signals, exponential, sine, step, impulse, ramp, rectangular, triangular and operations on signals		
	1.2	**Classification of signals:** Continuous and discrete time, deterministic and non deterministic, periodic and aperiodic, symmetric (even) and asymmetric (odd), energy and power, causal and anti-causal signals.		
	1.3	**Classification of systems:** Static and dynamic, time variant and time invariant, linear and nonlinear, causal and noncausal, stable and unstable systems.		
2		**Time domain analysis of Continuous Time and Discrete Time**	1,3,	08

		systems	4,6	
	2.1	**Linear Time Invariant (LTI) systems**: Representation of systems using differential /difference equation, Impulse, step and exponential response, total response of a system, system stability, convolution, impulse response of interconnected systems, auto-correlation, cross correlation, properties of correlation, analogy between correlation and convolution, examples on applications of LTI systems		
3		**Signals in Frequency Domain**	1,2, 5	12
	3.1	**Fourier series**: Orthogonal representation of signals, magnitude and phase spectra, Gibbs phenomenon, Parsevel's relation, analogy between Continuous Time Fourier Series (CTFS) and Discrete Time Fourier Series (DTFS), Sampling theorem, sampling of continuous time signals.		
	3.2	**Fourier Transform**: Fourier Transform and Inverse Fourier Transform on periodic and non-periodic signals, limitations of Fourier Transform and need for Laplace and z-Transform, Properties of Fourier Transform, Parsevel,s relation, Energy and power spectral density and bandwidth. definition and problems on DTFT.		
4		**Z-Transform Analysis**	1,6, 7	08
	4.1	**Z-Transform:** z-Transform of finite and infinite duration sequences, properties, relation between discrete time Fourier Transform and z-Transform, Inverse z-Transform, one sided z–Transform.		
	4.2	**Analysis of LTI Systems with Z- Transform:** Transfer Function,causality and stability of systems, frequency response, Solution of difference equation using z- Transform		
5		**Analysis of Systems with Laplace Transform and State Space Model**	1,5, 6	06
	5.1	**Analysis of LTI Systems with Laplace Transform:** Transfer Function,causality and stability of systems, frequency response, relation between Laplace Transform and z–Transform, Solution of differential equation using Laplace Transform		
	5.2	**State Space Model:** Procedure to determine state equations, State equations from transfer function, Laplace transform solution of state equations		
			Total	**42**

References:

[7] B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2005

[8] Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems", Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002

[9] Simon Haykin and Barry Van Veen "Signals and Systems", John Wiley & Sons, 2001.Reprint 2002

[10] Nagoor Kani, Signals and Systems, Tata McGraw Hill, Third Edition, 2011.

[11] C.L. Phillips et al., (2003) Signals, Systems and Transforms, (3rd Edition), Prentice Hall

[12] Ganesh Rao and SatishTunga, "Signals and Systems", Sanguine Technical Publishers, 2004

[13] H. P Hsu, R. Ranjan, "Signals and Systems", Scham‟ s outlines, TMH, 2006

E Books/signals and systems video links

1. NPTEL lecture Video on Signals and Systems by Prof. S.C.Dutta Roy, http://www.satishkashyap.com/2012/04/iit-video-lectures-on-signals-and.html
2. NPTEL lecture Video on Signals and Systems by Prof. T.K. Basu, IIT Kharagpur
3. MIT Open Course video lectures

   https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video- lectures/

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET43	Principles of Control Systems	3	1	--	3	1	--	3
		Examination Scheme						
		ISE		MSE	ESE			Total
		20		20	60			100

Pre-requisite Course Codes		BS11 (Engineering Mathematics I) BS21 (Engineering Mathematics II) BS31 (Applied Mathematics I)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Classify different types of Control systems and formulate mathematical modeling of the given system.
	CO2	Illustrate the Transient and steady state behavior of given system for standard test inputs..
	CO3	Analyze the stability of systems in time domain and frequency domain.
	CO4	Justify the concept of Controllability and observability using State variable model
	CO5	Apply the control theory to design the compensators to enhance stability of system
	CO6	Evaluate the system performance with the use of Compensators & Controllers

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	**Introduction to control system:** Definition of system, Notion of feedback, Open loop and closed loop systems; feedback and feedforward control structure; Examples of control systems.	1,2	10
	1.2	**Dynamic Response:** Standard test signals; Transient and steady state behavior of first and second order systems; Generalized error coefficients, steady state errors in feedback control systems and their types.	1,2	
	1.3	**Control System Modeling:** Types of models Impulse response model, State variable model, Transfer function model , Modeling of electrical systems, translational and rotational mechanical systems.	1,2	
2	2.1	**Representation of Control System :**Block diagram representation of systems, Block diagram reduction methods, Closed loop transfer function, signal flow graph. Mason's gain rule	1,2	10

	2.2	**State Space Analysis:** Concepts of state space,State equations ,State transition matrix, properties of state transition matrix ,Solution of homogeneous systems.	1,2	
	2.3	**Controllability and Observalibity:** Concept of controllability, Controllability analysis of LTI systems, Concept of observability, Observability analysis of LTI systems using Kalman approach, pole placement using state feedback PBH test	3,4	
3	**3.1**	**Time Domain System Stability Analysis :** Concepts of Stability Concept of absolute, relative and robust stability	1,2	08
	3.2	Routh-Hurwitz stability criteria	1,2	
	3.3	**Root Locus Analysis:** Root-locus concepts; General rules for constructing root-locus; Root-locus analysis of control systems.	1,2	
4	**4.1**	**Frequency Domain System Stability Analysis:** Relation between time and frequency response	1,2	08
	4.2	**Bode Plot:** Magnitude and phase plot,Method of plotting Bode plot; Stability analysis by using Gain and phase margins on the Bode plots	1,2	
	4.3	Polar plots, Nyquist stability criterions; Nyquist plot; Gain and phase margins.	1,2	
5	**5.1**	**Compensators & Controllers:** Types of compensators, Realization of basic compensators –cascade compensation in time domain and frequency domain, Design of lag, lead, lag-lead compensator using Bode plot and Root locus.	1,2	06
	5.2	**Controllers**: Concept of ON/OFF controllers; Concept of P, PI, PD and PID Controllers.	1,2	
	5.3	**Advanced Control Systems:** Introduction to Robust Control, Adaptive control and Model predictive control, Neuro- fuzzy controllers, Design of Real life applications of control system	3,4	
			Total	**42**

References:

[1] I. J. Nagrath, M. Gopal, Control Systems Engineering, New Age International, Fifth Edition, 2012.

[2] M. Gopal, Control Systems: Principle and design, Tata McGraw Hill, First Edition, 1998.

[3] Ogata.K, Modern Control Engineering, 5th edition, Prentice Hall of India, 2010

[4] Richard C. Dorf and Robert H. Bishop, Modern Control System, Pearson, Eleventh Edition, 2013.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ET44	Integrated Circuit	3	1	--	3	1	--	4
		Examination Scheme						
		ISE		MSE		ESE	Total	
		20		20		60	100	

Pre-requisite Course Codes	ET31(Electronics Devices and Circuits) ET33 (Digital Circuits)	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Describe the fundamentals of Op-Amp.
	CO2	Analyse and design applications of Op-Amp.
	CO3	Design different applications using IC 555.
	CO4	Illustrate the function of Special Purpose ICs such as VCO, PLL, Power amplifier and DAC/ADC conversion technique.
	CO5	Design DC power supply like LVLC, LVHC, HVLC and HVHC using Regulator ICs.

Module No.	Unit No.	Topics	Ref.	Hrs.
Module 1		**Operational Amplifier Overview**	1,2,3, 4	04
	1.1	Op-Amp symbol and Terminals, Ideal Op-Amp and Practical Op-Amp characteristics, Op-Amp Parameters, open loop and closed loop configurations, Virtual ground concept.		
	1.2	Inverting and Non-inverting modes, Feedback in Op-Amp Circuits (Positive and Negative).		
Module 2		**Applications of Operational Amplifier**	1,2,3, 4	10
	2.1	**Amplifiers:** Current amplifier, difference amplifier, instrumentation amplifier and programmable gain amplifier.		
	2.2	**Converters:** Current to voltage converters, voltage to current converters, voltage to frequency converter, frequency to voltage converter, logarithmic converters and antilog converters.		
	2.3	**Active Filters:** Low pass, high pass, band pass and band reject filters.		
	2.4	**Sine Wave Oscillators:** RC phase shift oscillator, Wien bridge oscillator, Quadrature oscillator.		
Module 3		**Non-Linear Applications of Operational Amplifier**	1,2,3,	10

	3.1	**Comparators:** Inverting comparator, non-inverting comparator, zero crossing detector, window detector and level detector.	4	
	3.2	**Schmitt Triggers:** Inverting Schmitt trigger, non-inverting Schmitt trigger, and adjustable threshold levels.		
	3.3	**Waveform Generators:** Square wave generator, triangular wave generator, and duty cycle modulation.		
	3.4	**Precision Rectifiers:** Half wave, full wave and applications.		
	3.5	Peak detectors, sample and hold circuits.		
		Special Purpose Integrated Circuits		
Module 4	**4.1**	**Functional block diagram, working, design and applications:** Timer 555.	1,4	08
	4.2	**Functional block diagram, working and applications:** VCO 566, PLL 565, multiplier 534, waveform generator XR 2206, Power amplifier LM380.		
Module 5		**Voltage Regulators**	1,4	06
	5.1	**Functional block diagram, working and design** of three terminal fixed (78XX, 79XX series) and three terminal adjustable (LM 317, LM 337) voltage regulators.		
	5.2	**Functional block diagram, working and design** of general purpose 723 (LVLC, LVHC, HVLC and HVHC) with current limit and current fold-back protection.		
Module 6		**ADC and DAC Conversion**		
	6.1	D to A Conversion Techniques, R - 2R ladder, Multiplying DAC with Applications, A to D Conversion Techniques, Dual slope ADC, Ramp ADC, Successive approximation ADC.	1,4	04
Total				**42**

References:

1. Sergio Franco, Design with Operational Amplifiers and analog integrated circuits, Third edition, McGraw Hill International edition, 2002.
2. D. Roy Choudhury and S. B. Jain, "*Linear Integrated Circuits*", New Age International Publishers, 4th Edition
3. Ramakant A. Gayakwad, "*Op-Amps and Linear Integrated Circuits*", Pearson Prentice Hall, 4th Edition
4. Robert Coughlin, Frederick F. Driscoll, Operational Amplifiers and Linear Integrated circuits, PHI Learning, sixth edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL41	Fundamentals of Communication Engineering Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE		Total
		40		--		--		40

Pre-requisite Course Codes	ET41 (Fundamentals of Communication Engineering)	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Students will able to implement in hardware various modulation and demodulation techniques
	CO2	Students will able to measure parameters in analog communication
	CO3	Students will able analyze parameters of radio receiver
	CO4	Students will able to generate PAM, PWM &PPM
	CO5	Students will able to develop skill to debug circuits
	CO6	Students will able to analyze and document results

Exp. No.	Experiment Details	Ref.	Marks
1	A)To generate amplitude modulated wave and determine the percentage modulation. B)To Demodulate the modulated wave using envelope detector.		5
2	A)To generate AM-Double Side Band Suppressed Carrier (DSB-SC) signal. B)To generate the SSB modulated wave.		5
3	A) To generate frequency modulated signal and determine the modulation index and bandwidth for various values of amplitude and frequency of modulating signal. B) To demodulate a Frequency Modulated signal using FM detector.		5
4	A) To observe the effects of pre-emphasis on given input signal. B) To observe the effects of De-emphasis on given input signal.		5
5	A)To generate the Pulse Amplitude modulated and demodulated signals B)To generate the pulse width modulated and demodulated signals		5

6	To generate pulse position modulation and demodulation signals and to study the effect of amplitude of the modulating signal on output.		5
7	To design and obtain the characteristics of a mixer circuit. B)To obtain diode detector characteristics		5
8	To study the AGC Characteristics of radio receivers		5
		Total Marks	40

References:

[1] Lab manuals

[2] www.mathworks.com

[3] www.scilab.org

[4] www.ni.com/labview

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL43	Principles of Control Systems Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		MSE		ESE	Total	
		40		--		--	40	

Pre-requisite Course Codes		ET43(Principles of Control Systems)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Examine working principle and application of given control system components.
	CO2	Develop a program using suitable programming language for time and frequency domain analysis of a given system.
	CO3	Demonstrate the dynamic behavior of the system in time domain and frequency domain.
	CO4	Experiment the effect of compensator on the performance of control system.
	CO5	Identify and demonstrate any control system for real life application.

Exp. No.	Experiment Details	Ref.	Marks
1	To plot the Synchro transmitter characteristics and Synchro transmitter and receiver as an error detector.	1	5
2	To plot Speed torque characteristic of DC servo motor.	1	5
3	To plot characteristics of Potentiometer and its loading effect for different conditions of load.	1	5
4	To determine the line and load regulation characteristics of AC servo voltage stabilizer at different line and load conditions and observe the mechanism of AC voltage stabilization as an example of closed control system.	1	5
5	Using Liner System I Trainer Kit obtain the frequency response of first order and second order system.	1	5
6	Using Liner System II Trainer Kit obtain the time response of closed loop RLC circuit with integrator circuit and study the effect of Lead, Lag Compensator on its time response. Compare these results with mathematical expressions derived for the system.	1	5
7	Some of the experiments can be combined based on the theme like i. fundamental of control system (Laplace and State Transition) ii. time response iii. stability a) Develop a program in Matlab/Scilab/LabVIEW to define the given closed loop transfer function of system and plot their poles	2,3,4	5

	& zeros on s-plane. b) Develop a program in Matlab/Scilab/LabVIEW to find the step response of a given second order control system and obtain its time domain parameters from this step response. Compare these results with mathematical calculations. c) Develop a program in Matlab/Scilab/LabVIEW for a given control system described by its state space equation to find solution in terms of state transition matrix, zero input response, zero state response, complete response. d) Develop a program in Matlab/Scilab/LabVIEW for a given control system described by its state space equation to find system is controllable or not, observable or not, to find rank of matrix and using rank comment on system controllability and observability e) Develop a program in Matlab/Scilab/LabVIEW to obtain the root locus of a system described by its Transfer Function with unity feedback, Comment on the stability of this given control system. Compare these results with mathematical calculations. f) Develop a program in Matlab/Scilab/LabVIEW to find gain margin and phase margin of the system described by its Transfer Function with unity feedback. Comment on the stability of this given control system. Compare these results with mathematical calculations.		
8	**Mini-Project:** Identify the model of control system for real life application and demonstrate controlling action for the same. Use appropriate software platform.	1,2,3,4	**5**
Total Marks			**40**

References:

[5] Lab manuals

[6] www.mathworks.com

[7] www.scilab.org

[8] www.ni.com/labview

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Course Code	Course Name :	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
		--	--	2	--	--	1	1
ETL44	Integrated Circuits Lab	Examination Scheme						
		ISE	MSE		ESE		Total	
		40	--		20		60	

Pre-requisite Course Codes	ET44 : Integrated Circuits	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	To measure different parameters of Op-Amp.
	CO2	Identify, Analyze and design applications of Op-Amp.
	CO3	Implement different applications using special purpose ICs.
	CO4	Design DC power supply for given specification/s.
	CO5	Design, simulate and implement different applications using integrated circuits.

Exp. No.	Suggested list of Experiments	Ref.	Marks
1	To measure different parameters of Op-Amp.	1,2,3	5
2	Design and test a Schmitt trigger circuit for the given values of UTP and LTP using Op-Amp.	1,2,3	5
3	Design and test the following circuits using IC555 A) Astable multivibrator for given frequency and duty cycle. B) Monostable multivibrator for given pulse width-W.	1,2,3	5
4	Design a circuit in which the frequency of oscillations can be controlled by an externally applied voltage using VCO (IC566).	1,2,3	5
5	Design DC power supply LVLC, LVHC, HVLC and HVHC using Regulator ICs.	1,3	5
6	Design and simulate the given circuit using circuit simulation software like SEQUEL, TINA, Multisim. (A group activity with different problem statements.)	1,3	5
7	**Mini Project:**Design, Develop and analyze the given application using ICs like Op-Amp, Multiplier, DAC, MOSFET and also other required ICs using Analog System Trainer Kit by Texas Instruments. Before implementation simulation using circuit software like SEQUEL, TINA and Multisim.	6	10
		Total Marks	**40**

References:

1. Sergio Franco, Design with Operational Amplifiers and analog integrated circuits, Third edition, McGraw Hill International edition, 2002.
2. Ramakant A. Gayakwad, "*Op-Amps and Linear Integrated Circuits*", Pearson Prentice Hall, 4th Edition
3. Robert Coughlin, Frederick F. Driscoll, Operational Amplifiers and Linear Integrated circuits, PHI Learning, sixth edition.
4. Datasheets for Op-Amp., regulator ICs, IC555.
5. Circuit Simulation software/s like SEQUEL, TINA, Multisim etc.
6. Analog System Trainer Kit Manual (Texas Instruments).

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ETL45	Computer Methods for Circuit Simulation Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE			MSE		ESE	Total
		40			--		20	60

Pre-requisite Course Codes		Programming in C BS31 (Applied Mathematics I) ET32 (Circuit theory)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Illustrate a network in terms algebraic equations
	CO2	Apply Numerical techniques to solve linear and non linear algebraic equations
	CO3	Perform DC and Transient analysis on Electrical networks
	CO4	Analyze the given circuit using Monte Carlo

Exp. No.	Experiment Details	Ref.	Marks
1	Formulation of Linear algebraic Equations for Network using Modified Nodal Analysis and Apply Gaussian Elimination and L U decomposition methods for Solution	1,3,4	5
2	Apply Indirect methods (Gauss-Seidel and Gauss Jacobi) to find Solution of Linear algebraic Circuit Equation	1,3,4	5
3	Formulation of Non-Linear algebraic Equations for Network and Applying Newton – Raphson method to solve them	2,3,4	5
4	Applying Newton – Raphson method for solving a MOSFET based Non-Linear algebraic Circuit Equations	1,3,4	5
5	Transient simulation using Forward Eular, Backward Eular and Trapezoidal method. Verification of Stability in each method.	2,3,4	5
6	Solution of differential circuit equations using linear multistep methods	1,3,4	5
7	Solution of differential circuit equations using trapezoidal ringing	1,3,4	5
8	Perform Monte-Carlo Analysis on given circuit	1,2,3,4	5
		Total Marks	40

References:

[1] F. N. Najm, *Circuit Simulation*, Wiley-IEEE Press, 2010

[2] M.B. Patil, V. Ramanarayanan, V. T. Ranganathan, *Simulation of Power Electronic Circuits*, Narosa

[3] E. Balagurusamy, *Numerical Methods*, TATA McGRAW HILL

[4] R. Raghuram, *Computer Simulation of Electronic Circuits*, New Age International

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
LA1	Yoga-Vidya	1	-	-	Non-Credits			
		Examination Scheme						
		ISE1		ISE2	Attendance			Total
		20		20	10			50

Student will be evaluated after six sessions for 20 Marks (ISE1) and at the end of last session for 20 Marks (ISE2). Grade equivalent to 'D' (50%-59.99% Marks) or above is considered as 'Satisfactory'. If any of the tasks given is not completed/submitted/shown/evaluated then the corresponding lower grade will be given. Although the grades are given they will not mentioned in final grade card but they are necessary to declare the successful completion of the Non-Credit course.

Pre-requisite Course Codes	---	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Student will be able to perform various techniques of Yoga
	CO2	Student will be able to follow healthy habits to improve immune system
	CO3	Student will be able to describe the importance of Yoga in one's life
	CO4	Student will be able to make resolution to practice techniques of Yoga

Through this course, students will get an all-round experience of how Yoga can benefit their body, breath, emotions along with relaxation techniques to maintain a calm and balanced state of mind.

Day No.	Topics	Hrs.
1	What is Yoga, why Yoga? Techniques: warm up stretches for hands, legs, neck; Sukhasana, Padmasana	1
2	Introduction to Ashtanga Yoga Techniques: Talasana, Utkatasana, Konasana 2	1
3	Asana classification and importance of different types of Asanas Techniques: Sthita-prarthanasana, Ekpadasana, Garudasana	1
4	Yogendra rhythm- breathing pattern Techniques: Parvatasana, Yashtikasana	1
5	Forward bending and abdominal compression Techniques: Konasana 3, Yogamudra	1
6	Shuddhi Kriyas- Prevention of diseases by improving immune system Techniques: Jalaneti, Kapalabhati	1

7	Yogic Aahar Techniques: Vajrasana, Pavanmuktasana	1
8	Relaxation and it's importance Techniques: Shavasana	1
9	Spine and it's importance in Yoga Techniques: Bhujangasana, Makarasana, Vakrasana	1
10	Pranayama Techniques: Basic techniques	1
11	Attitude training Techniques: connecting techniques to concepts.	1
12	Pranayama Techniques: Traditional Pranayama	1
13	Yogachara- The Yoga way of living Techniques: Games	1
14	Revision	1

References:

[1] Sadashiv Nimbalkar, "Yoga for Health & Practices", Yoga Vidya Niketan,Mumbai.

[2] Swami Satyananda Saraswati, "Asana Pranayama Mudra Bandha", Yoga Publications Trust, Munger, Bihar, 2008

[3] Dr.H.R.Nagendra, Dr.R.Nagarathna, "New Perspectives in Stress Management", Vivekananda Yoga Research Foundation, Bangaluru

[4] Books from The Yoga Institute, Santacruz:
a) Yoga Cyclopedia Vol 11
b) Yoga of caring
c) Insights through Yoga
d) Growing with Yoga

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
LA2	Music Appreciation	1	-	-	Non-Credits			
		Examination Scheme						
		ISE1		ISE2	Attendance			Total
		20		20	10			50

Student will be evaluated after six sessions for 20 Marks (ISE1) and at the end of last session for 20 Marks (ISE2). Grade equivalent to 'D' (50%-59.99% Marks) or above is considered as 'Satisfactory'. If any of the tasks given is not completed/submitted/shown/evaluated then the corresponding lower grade will be given. Although the grades are given they will not mentioned in final grade card but they are necessary to declare the successful completion of the Non-Credit course.

Pre-requisite Course Codes		---
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Appreciate various processes of Music composition
	CO2	Appreciate the role of engineers in sound recording

S.N.	Topics	Hrs.
1	Introduction to audio and digital audio	2 hr
2	Types of Mics and Speakers	1 hr
3	Introduction to instruments	2 hr
4	Introduction to Audio Console	2 hr
5	Audio Production Process	2 hr
6	Effects	2 hr
7	Mixing aesthetics	2 hr
8	Make your song	2 hr

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
LA3	Dramatics	1	-	-	Non-Credits			
		Examination Scheme						
		ISE1		ISE2	Attendance			Total
		20		20	10			50

Student will be evaluated after six sessions for 20 Marks (ISE1) and at the end of last session for 20 Marks (ISE2). Grade equivalent to 'D' (50%-59.99% Marks) or above is considered as 'Satisfactory'. If any of the tasks given is not completed/submitted/shown/evaluated then the corresponding lower grade will be given. Although the grades are given they will not mentioned in final grade card but they are necessary to declare the successful completion of the Non-Credit course.

Pre-requisite Course Codes	---	
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Student will be able to Understand an Art of Theatre.
	CO2	Student will be able to Express their thoughts.
	CO3	Student will be able to Create and visualize new ideas.
	CO4	Student will be able to Perform impressively.

Day No.	Topics	Hrs.
1	Lalitkala (Forms of Art)	1
2	Drama – Show and Text	1
3	Techniques – Abhinay (Acting)	1
4	1. Vachik Abhinay (Reading)	1
5	2. Angik Abhinay (Expressions)	1
6	3. Satvik Abhinay	1
7	Digdarshan (Direction)	1
8	Nepathya (Settings)	1
9	Veshbhusha (Drapery)	1
10	Natyabhasha (Dialogs and Language)	1
11	Kaal and Avakash (Time and Space)	1
12	Natya Rasa (Theory of Rasa)	1
13	Natya Rasa (Theory of Rasa)	1
14	Aswad prakriya	1
	Total	14

References:

[1] An Actors prepare – Stanislavsky (English)

[2] A building a Character – Stanislavsky(English)

[3] Natyashastra – Bharatmuni (English And Marathi)

[4] Abhinaysadhana- K. Narayan Kale (Marathi)

[5] Natyavimarsh-K. Narayan Kale (Marathi)

[6] Jagatik Rangabhumicha Itihas – Kru. Ra. Sawant (Marathi)

[7] Marathi Rangabhumicha Itihas - Shri. Na. Banahatti (Marathi)

[8] Lalitkalamimansa- Go. Chi. Bhate(Marathi)

[9] Sahitya Adhyapan Ani Prakar- va. la. Kulakarni Gauravgranth(Marathi)

[10] Vachik Abhinay- Dr. Shriram Lagoo (Marathi)

[11] Rangnayak- Arwind Deshpande

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'Activity Based Learning'

ABL1: Building Automation, Fire Safety and Electronic Security

This is non-credit activity conducted in semester III for all the branches of engineering. It is compulsory for all the students to appear for this activity.

This is one day event involving following activities:

1. Invited Talks on the related topics
2. Poster Presentation
3. Fire/Safety Drills
4. Design competition in building automation, fire safety and security.

This event shall be conducted in association with Fire and Security Association of India (FSAI).

ABL2: OCCUPATIONAL SAFETY & LEGAL STUDIES FOR ENGINEERS

Engineering is the branch of science and technology concerned with design, building and the use of engine, machines and structures. In this fast moving world scenario, it is seen that the field of Engineering has travelled a very long distance of time space. In the modern parlance, this field must be properly knitted with the other two important dimensions—SAFETY & LAW. An Engineer must have adequate knowledge of these vital subject if he ever wishes to establish himself in this Industrial world.

The following activities have been designed to meet up with the growing expectations with the concerned topic. Students are requested to actively participate in those activities based learning to catch up with the realities of the industrial world.

Hence, the activities are divided into 5 parts—MOOT COURT, DEBATE, ELOCUTION, PRESENTATION & ROLE PLAY

1) ***MOOT COURT:***

It is a process in which participants take part in simulated court proceedings, usually involving drafting memorials or memoranda and participating in oral argument. It is just a dummy presentation of the actual court proceedings. It will have a pair of counsel from the defendant as well as the prosecution side. The case write up will be given to both the sides well in advance. They need to study the case along the lines of actual law pertaining to the case which will be more or less company law, intellectual property laws, banking laws, insurance laws or negotiable instrument laws. Both sides will have a researcher who will work along with his respective team to unearth any backdated supportive cases. The sides has to come in common consensus to work on issues which should not be more than five. Based on those issues both sides will present their case turn by turn with the permission of the judge. Judge can consist of persons ranging from 1 to 3. The issues should be dealt with in the book called memorial which should be prepared by both the sides. The prosecution will start the case followed by the defendants. Nobody can criss-cross each other's time of presentation. The judge/s have to control the whole proceedings properly. The judge has the power to give permission for rebuttal as per his own whims. In the end he will pass the judgment based on law.

2) ***DEBATE:***

Debates will have topics based on safety and law based and the pair of participants need to stand for or against the motion.

3) ***ELOCUTION:***

Same will be the case with elocution but it will be extempore and the participants will have to present their insights on the topic given on the spot.

4) ***PRESENTATION:***

A PPT presentation will have topics based on legal laws and students need to prepare the same.
The list of topics are:

Sale deed, WILL, Gift Deed, Agreement, Power of attorney, MOU(Memorandum of Understanding), Non-Disclosure agreements, Affidavit, Charter, Partnership deed, Copyrights Transfer Agreement, Franchise Termination, Lease purchase contract, Letters Patent, Legal Threat, Promissory Note, Share Certificate, Share transmission, PIL (Public Interest Litigation).

5) ***ROLE PLAY:***

This activity is a group activity whereby they have to work as a team and enact some situation pertaining to law or safety in the Industrial premises. It's a fun activity whereby they camouflage themselves stepping into the shoes of the role that they will be performing to create an awareness amongst the audience of what to do in case they find themselves in same situations in near future.

6) ***Client Counseling***

The Client Counseling addresses fundamental skill of ability to interview, counsel, and support a client through their legal issue. Competitors conduct an initial interview with a person playing the role of the client and then address both the client's legal and non-legal needs.

7) ***Negotiation***

Negotiation provides a means for students to practice and improve their negotiating skills. The activity simulates legal negotiations in which students, acting as lawyers, negotiate a series of legal problems. The simulations consist of a common set of facts known by all participants and confidential information known only to the participants representing a particular side.

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Competitive Examinations Preparation (CEP): (Extra credits=2)

Salient Features of CEP:

- It is optional module
- Motivation, mentoring and preparation of students to pursue higher education
- Modules as per national level technical competitive examination **GATE**
- Motivation, mentoring and preparation of students to join public sector or government organizations like BARC, DRDO etc.
- Motivation, mentoring and preparation of students to join top ranking technical institutes in country like IISc and IIT.
- Module design as per the courses studies in that semester or prior semester by considering syllabus of GATE examination
- Help to sharpen the problem solving skills of students and concerned teachers
- Course mentors will be allotted at the start of academic year
- Two (2) extra credits will be given if
    1. Student submit **Valid Gate Score card**.
    2. Must pass CEP1 to CEP6 in modal question papers given by the faculty
    3. Maintains regular contact with CEP course teachers

CEP Courses:

Semester III:
CEP1: Introduction to CEP

One hour introduction session to entire class about CEP.

Student shall be assigned as 'Teaching Assistant' to Engineering Mathematics Course –I.
Student shall maintain regular contact with the semester III course teachers (once in a week per course). Teacher shall maintain the attendance of the student. Teacher shall mentor student and give assignments with GATE level problems to solve. At least TWO assignments per course shall be submitted by the student.

After End Semester Examination student shall appear for the Model Test paper based on the pattern of the actual GATE Examination. This paper shall be based on the contents of Semester-I and Semester-III courses. The negative marking is applicable as per GATE pattern.
The student shall obtain minimum 10 marks to continue registration in CEP module for next semester onwards.

Semester IV:
CEP2: Problem solving module-I

Student shall be assigned as 'Teaching Assistant' to Engineering Mathematics Course–II and Basics of electrical Engineering.
Student shall maintain regular contact with the semester IV course teachers (once in a week per course). Teacher shall maintain the attendance of the student. Teacher shall mentor student and give assignments with GATE level problems to solve. At least TWO assignments per course shall be submitted by the student.

After End Semester Examination student shall appear for the Model Test paper based on the pattern of the actual GATE Examination. This paper shall be based on the contents of Semester-II and Semester-IV courses. The negative marking is applicable as per GATE pattern.
The student shall obtain minimum 10 marks to continue registration in CEP module for next semester onwards.

Semester V:
CEP3: Problem solving module-II

Student shall be assigned as 'Teaching Assistant' to Semester III courses.
Student shall maintain regular contact with the semester V course teachers (once in a week per course). Teacher shall maintain the attendance of the student. Teacher shall mentor student and give assignments with GATE level problems to solve. At least TWO assignments per course shall be submitted by the student.

After End Semester Examination student shall appear for the Model Test paper based on the pattern of the actual GATE Examination. This paper shall be based on the contents of Semester-V courses. The negative marking is applicable as per GATE pattern.
The student shall obtain minimum 10 marks to continue registration in CEP module for next semester onwards.

Semester VI:
CEP4: Problem solving module –III

Student shall be assigned as 'Teaching Assistant' to Semester IV courses.

Self Learning: Numerical Ability and Verbal Ability

Student shall maintain regular contact with the semester VI course teachers (once in a week per course). Teacher shall maintain the attendance of the student. Teacher shall mentor student and give assignments with GATE level problems to solve. At least TWO assignments per course shall be submitted by the student.

After End Semester Examination student shall appear for the Model Test paper based on the pattern of the actual GATE Examination. This paper shall be based on the contents of Semester VI courses and self learning module on numerical ability and verbal ability. The negative marking is applicable as per GATE pattern.
The student shall obtain minimum 10 marks to continue registration in CEP module for next semester onwards.

Semester VII:
CEP5: Problem solving module-IV

Student shall be assigned as 'Teaching Assistant' to Semester V courses.

Self Learning: Contents not covered in any semester of study

Student shall maintain regular contact with the semester VII course teachers (once in a week per course).Teacher shall maintain the attendance of the student. Teacher shall mentor student and give assignments with GATE level problems to solve.
At least TWO assignments per course shall be submitted by the student.

After End Semester Examination student shall appear for the Model Test paper based on the pattern of the actual GATE Examination. This paper shall be based on the contents of entire syllabus of GATE Examination. The negative marking is applicable as per GATE pattern.
The student shall obtain minimum 10 marks to continue registration in CEP module for next semester onwards.

Semester VIII:
CEP6: Problem solving module-V

At the start of the semester student shall appear for the TWO Model Test papers based on the pattern of the actual GATE Examination. This paper shall be based on the contents of entire syllabus of GATE Examination. The negative marking is applicable as per GATE pattern.

Student shall submit 'Valid GATE Score Card' after declaration of GATE result.

Mapping with Syllabus for GATE Exam (Semester wise)

Semester - I

Engineering Mathematics-I : basis, linear dependence and independence, matrix algebra, eigen values and eigen vectors, rank, solution of linear equations – existence and uniqueness. partial derivatives, maxima and minima, Taylor series, Vectors in plane and space, vector operations, gradient, divergence and curl,
Semester-II
Engineering mathematics –II: multiple integrals, Differential Equations: First order equations (linear and nonlinear), higher order linear differential equations, Cauchy's and Euler's equations, methods of solution using variation of parameters, complementary function and particular integral, partial differential equations, variable separable method, initial and boundary value problems. single and multi-step methods for differential equations
Basics of Electrical Engineering : Network solution methods: nodal and mesh analysis; Network theorems: superposition, Thevenin and Norton's, maximum power transfer; Wye- Delta transformation; Steady state sinusoidal analysis using phasors
Semester-III
Applied Mathematics-I: Gauss's, Green's and Stoke's theorems, Cauchy's integral theorem, Cauchy's integral formula; Taylor's and Laurent's series, residue theorem.
Circuit Theory: Network solution methods: nodal and mesh analysis; Network theorems: superposition, Thevenin and Norton's, maximum power transfer; Wye- Delta transformation; Steady state sinusoidal analysis using phasors; Time domain analysis of simple linear circuits; Solution of network equations using Laplace transform; Frequency domain analysis of RLC circuits; Linear 2- port network parameters: driving point and transfer functions; State equations for networks
Electronics Devices and Circuits: Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations; P-N junction, Zener diode, BJT, MOS capacitor, MOSFET. Small signal equivalent circuits of diodes, BJTs and MOSFETs; Simple diode circuits: clipping, clamping and rectifiers; Single-stage BJT amplifiers, MOSFET amplifiers: biasing, bias stability, mid-frequency small signal analysis and frequency response; BJT and MOSFET amplifiers: multi-stage, differential, feedback.
Digital Circuits: Number systems; Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders and PLAs; Sequential circuits: latches and flip- flops, counters, shift- registers and finite state machines;
Signals and Systems: Fourier series and Fourier transform representations, sampling theorem and applications; Discrete-time signals: discrete-time Fourier transform (DTFT), DFT, FFT, Z-transform, interpolation of discrete-time signals; LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay.

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Semester-IV
Applied Mathematics-II: line, surface and volume integrals, Analytic functions, Mean, median, mode and standard deviation, probability distribution functions - binomial, Poisson, exponential and normal; Joint and conditional probability
Fundamentals of Communication Engineering: Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, superheterodyne receivers, circuits for analog communications;
Electromagnetic Wave Propagation: Electrostatics; Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector; Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth; Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart;
Principles of Control System: Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems.
Integrated Circuits: power circuits, Sinusoidal oscillators: criterion for oscillation, Simple op-amp circuits; Active filters; single-transistor and op-amp configurations; Function generators, wave-shaping circuits and 555 timers; Voltage reference circuits; Power supplies: ripple removal and regulation. Data converters: sample and hold circuits, ADCs and DACs;
Semester V:
Microcontroller and Applications: 8-bit microprocessor (8085): architecture, programming, memory and I/O interfacing. Data converters: sample and hold circuits, ADCs and DACs;
Random Signal Analysis: Random processes: autocorrelation and power spectral density, properties of white noise; Information theory: entropy, mutual information and channel capacity theorem;
Semester VI:
Digital Communication: Random processes: autocorrelation and power spectral density, properties of white noise; Information theory: entropy, mutual information and channel capacity theorem; Digital communications: PCM, DPCM, digital modulation schemes, amplitude, phase and frequency shift keying (ASK, PSK, FSK), QAM, MAP and ML decoding, matched filter receiver, calculation of bandwidth, SNR and BER for digital modulation; Fundamentals of error correction, Hamming codes; inter-symbol interference and its mitigation; Basics of TDMA, FDMA and CDMA, filtering of random signals through LTI systems;

Discrete Time Signal Processing: Discrete-time signals: discrete-time Fourier transform (DTFT), DFT, FFT, Z-transform, interpolation of discrete-time signals , digital filter design techniques.
VLSI Design: Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process.
Semester VII:
Microwave and Radar Engineering : Waveguides: modes, boundary conditions, cut-off frequencies, dispersion relations; Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar; Light propagation in optical fibers.
Not covered in any Semester
Engineering Mathematics: Linear Algebra: Vector space Calculus: Mean value theorems, theorems of integral calculus, evaluation of definite and improper integrals Solution of nonlinear equations, convergence criteria. Combinatorial probability Correlation and regression analysis
Semiconductor memories: ROM, SRAM, DRAM;
Timing and frequency synchronization.

Self Learning Module: General Aptitude

I. Verbal Ability

1. Grammar

2. Nouns, Pronouns, Articles
3. Verbs, Auxiliaries, Modals
4. Adjectives, Adverbs
5. Prepositions, Conjunctions
6. Active/ Passive Voice, Direct/ Indirect Speech
7. Verbal phrases
8. Sentence Completion
9. Vocabulary
10. Synonyms
11. Antonyms
12. Analogy
13. Reverse Analogy
14. Verbal Reasoning
15. Critical Reasoning
16. Logical Reasoning

II. Numerical Ability

I. Quantitative Aptitude:

1. Simple Equations
2. Ratio-proportion-variation
3. Numbers
4. Percentage, Profit and Loss
5. Simple Interest and Compound Interest
6. Average, mixtures and Alligations
7. Time and Work
8. Time and Distance
9. Indices, Surds, Logarithms
10. Quadratic Equations
11. Inequalities
12. Progressions
13. Permutations and Combinations
14. Data Interpretation

II. Reasoning

1. Number and Letter Series
2. Analogies
3. Odd man out (Classification)
4. Coding and Decoding
5. Blood relations
6. Venn Diagrams
7. Seating Arrangements
8. Puzzles
9. Clocks and Calendars