Department of EXTC

Semester III									
No	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	BSC	MA201	Linear Algebra	2	0	2	5	09	3
1	BSC*	MA202	Foundation of Mathematics-I*	2	1	0	6	09	3
2	PC	EC201	Computer Architecture & Organization	3	0	2	4	09	4
3	PC	EC202	Electronic Devices	3	0	2	4	09	4
4	PC	EC203	Network Theory	3	0	2	4	09	4
5	SBC	EC204	Electronic Instruments and Measurement Lab	0	1	2	2	05	2
6	SBC	AS201	Communication Skills	1	0	2	2	05	2
7	ABL	SVXX/ STXX	SEVA II or III /SATVA II or III	0	0	0	0	03	1
8	HSSE	HSEXX	HSS-I	2	0	0	3	05	2
TOTAL				**16**	**2**	**12**	**30**	**63**	**25**

**Only for Lateral Entry Students*

Semester IV									
No.	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	BSC	MA203	Probability and Stochastic Processes	3	0	0	5	08	3
1	BSC*	MA204	Foundation of Mathematics-II	2	1	0	6	09	3
2	PC	EC205	Analog Circuits	3	0	2	6	11	4
3	PC	EC206	Microcontrollers	3	0	2	6	11	4
4	PC	EC207	Signals and Systems	3	0	2	6	11	4
5	SBC	EC208	Mini Project-I	0	0	0	4	04	2
6	ABL	SVXX/STXX	SEVA II or III /SATVA II or III	0	0	0	3	01	1
7	HSSE	HSEX2	HSS-II	2	0	0	3	05	2
8	S/M	SCX1/MNX1	SCOPE-I/Minor-I						3
TOTAL				**16**	**1**	**6**	**39**	**60**	**26**

**Only for Lateral Entry Students*

Second Summer for HSC students									
No.	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	MLC	AS202	Constitution of India	1	0	0	05	06	NC

Second Summer (For Lateral Entry Students)									
No.	**Type**	**Code**	**Course**	**L**	**T**	**P**	**O**	**E**	**C**
1	BSC	MA201	Linear Algebra	2	0	2	5	09	3
1	BSC	MA203	Probability and Stochastic Processes	3	0	0	5	08	3
2	MLC	AS202	Constitution of India	1	0	0	05	06	NC

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Department of EXTC

Semester-III

Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Linear Algebra	2	0	2	5	9	2	0	1	3
		Examination Scheme								
MA201		Component	ISE		MSE		ESE		Total	
		Theory	50		50		100		200	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	MA101, MA102
Course Objective: To develop mathematical skills for solving engineering problems.	
Course Outcomes (CO): At *the End of the course students will be able to:*	
MA201.1	Solve a homogeneous and non-homogeneous system of linear equations using rank of amatrix.
MA201.2	Solve system of linear equations by Numerical Methods.
MA201.3	Solve equations in real life problems and to encode and decode messages using the concept of matrices.
MA201.4	Identify whether given structures are vector spaces and subspaces and construct a basis for them.
MA201.5	Show if a given matrix is diagonalizable or not.
MA201.6	Apply concepts of Eigenvalues and eigenvectors to calculate functions of a square matrix, Google page rank vector and solve systems of differential equations using diagonalization of matrices.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA201.1	3											
MA201.2	3											
MA201.3	3	1										
MA201.4	3											
MA201.5	3											
MA201.6	3	1										

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA201.1							
MA201.2							
MA201.3							
MA201.4							
MA201.5							
MA201.6							

Department of EXTC

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember√	Understand√	Apply√	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	Title	**Basics of matrices**	3,5	03
	1.1	Revision of basic matrices and types of matrices.		01
	1.2	Row echelon form, Reduced Row Echelon form, Rank of a matrix.		02
2	Title	**Linear equations & its solutions**	1,2,3,5	07
	2.1	Consistency and solution of simultaneous linear homogeneous and non-homogeneous equations.		02
	2.2	Application of solving systems of equations in traffic control.		01
	2.3	Solution of system of linear algebraic equations, by (1) Gauss Elimination Method (2) Gauss Jordan method (3) Gauss Jacobi Iteration method (4) Gauss Seidel Method. (5) LU Decomposition -Crout's method		04
3	Title	**Vector spaces (over field of real numbers)**	1,2,5	08
	3.1	Vector space, subspace, span, linear dependence and independence of vectors, basis, dimension, orthogonal projection & gram-Schmidt process. Null space, row space, column space, Rank-Nullity theorem (only statement). Least square method.		08
4	Title	**Encoding & decoding using Matrices.**	4	02
	4.1	Application of matrices to Coding and Decoding		02
5	Title	**Eigenvalues and Eigenvectors**	1,2,3,5	08
	5.1	Eigenvalues, Eigenvectors and its properties. Cayley Hamilton theorem and its applications. Diagonalization of matrices. Derogatory and Non-derogatory matrices.		04
	5.2	Application to find google page rank. Functions of a square matrix. Solving system of differential equations using diagonalization.		04
6	Self-Study	1.2 Normal form. 2.2 Forming equations using KVL for circuits and solving them using matrices. 3.1 Singular Value Decomposition. 5.1 Additional properties with proofs of eigenvalues and eigenvectors.	1,2,3,5	05*
			Total (*Not included)	**28**

Department of EXTC

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Introduction to Scilab (getting started) and its benefits to use as a mathematics tool.
2	Basic commands of scilab and vectors & matrix operations.
3	Conditional branching and iterations using Scilab.
4	Solution of linear equations using row-echelon and inverse of a matrix.
5	Solutions of linear equations using Gauss Elimination method.
6	Solutions of linear equations using Gauss Jordan method.
7	Solutions of linear equations using Gauss-Jacobi method.
8	Solutions of linear equations using Gauss-Seidel method.
9	Solutions of linear equations using Crout's method.
10	To find Eigen values and Eigenvectors using Scilab

Textbooks

Sr. No.	Title	Edition	Authors	Publisher	Year
1.	Linear Algebra and its applications	4th	Gilbert Strang	Cengage	2014
2.	Higher Engineering Mathematics	44th	Dr. B. S. Grewal	Khanna Publications	2020

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1.	Linear Algebra and its applications	3rd	David. C. Lay	Pearson Education	2006
2.	Elementary Linear Algebra Application Version	6th	H Anton and Crorres	John Wiley & Sons	2010
3.	Advanced Engineering Mathematics	28th	H. K Das	S. Chand	2014
4.	Hill Ciphers	1st	Jonaki B Ghosh	At Right Angles	2015
5.	Advanced Engineering Mathematics	10th	Erwin Kreysizg	John Wiley & Sons	2011

Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Foundations of Mathematics-I	2	1	0	6	9	2	1	0	3
MA202		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300

Pre-requisite Course Codes, if any.	-
Course Objective: To develop foundation of mathematical skills.	
Course Outcomes (CO): At *the End of the course students will be able to: -*	
MA202.1	Differentiate a function of one variable and partially differentiate a function of more than one variable.
MA202.2	Apply the concept of partial differentiation to find extreme values of a given function.
MA202.3	Find nth order derivative of a given function.
MA202.4	Expand a given function as a power series.
MA202.5	Perform operations on matrices and find inverses and determinants of them.
MA202.6	Perform vector operations and compute dot products and cross products between them.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA202.1	2											
MA202.2	2											
MA202.3	2											
MA202.4	1											
MA202.5	1											
MA202.6	1											

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA202.1							
MA202.2							
MA202.3							
MA202.4							
MA202.5							
MA202.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember√	Understand√	Apply	Analyze	Evaluate	Create

Department of EXTC

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	Title	**Differential Calculus**	1,2	**18**
	1.1	Partial fractions. Derivatives of standard functions, product and quotient rule for differentiation.		04
	1.2	Partial derivatives of first and higher order, composite differentiation		03
	1.3	Application of partial derivatives: Local Maxima and Minima of functions of two variables.		02
	1.4	Successive Differentiation: Proofs of nth derivatives of standard functions. Use of partial fractions to calculate nth derivatives of given functions. Leibnitz theorem for nth derivative of product of two functions.		05
	1.5	Infinite series: expansion of functions in powers of x using maclaurin series. Taylor's series.		04
2	Title	**Matrices**	1,2	**07**
	2.1	Addition and scalar multiplication of matrices. Matrix multiplication, types of matrices.		03
	2.2	Elementary row transformations, finding inverses using matrices, determinants and its properties		04
3	Title	**Vectors**	1,2	**03**
	3.1	Vector definition, addition, scalar multiplication, dot product of two vectors, angle between two vectors, cross product.		03
			Total	**28**

Textbooks

Sr. No	Title	Edition	Authors	Publisher	Year
1	**Higher Engineering Mathematics**	**44th**	**Dr. B. S. Grewal**	**Khanna Publications**	**2020**

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	**Advanced Engineering Mathematics**	**10th**	**Erwin Kreysizg**	**John Wiley & Sons**	**2011**
2	**Advanced Engineering Mathematics**	**28th**	**H. K. Dass**	**S. Chand Publications**	**2014**

Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Computer Architecture & Organization	3	0	2	4	9	3	0	1	4
EC201		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	EC101, Any Programming Language
Course Objective: Imparting concepts of each component of computer architecture thoroughly with practical aspects including memory systems and I/O communications with interfacing	
Course Outcomes (CO): *At the End of the course students will be able to*	
EC201.1	Describe basic computer structure and compare computer architecture models
EC201.2	Design algorithms to solve ALU operations and memory mapping techniques
EC201.3	Comprehend processor architecture with various design methods of CPU with comparative analysis
EC201.4	Describe memory systems with design and analysis of mapping techniques for cache and virtual memory
EC201.5	Analyze different parallel processing and pipelining concepts with pipelining hazards
EC201.6	Comprehend different types of I/O buses, compare and contrast different types of data transfer methods and arbitration techniques

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC201.1	3											
EC201.2		2		2								
EC201.3	2			2								
EC201.4		2		2								
EC201.5	2											
EC201.6	2											

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
EC201.1							
EC201.2							
EC201.3							
EC201.4							
EC201.5							
EC201.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze √	Evaluate	Create

Department of EXTC

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Overview of Computer Architecture and Organization**		**5**
	1.1	Introduction of Computer Organization and Architecture, Basic organization of computer and block level description of the functional units, Evolution of x86 Computers, Von Neumann model, Harvard Model, Embedded system	1	
	1.2	Performance Issues: Designing for performance, Amdahl's Law, Multi-core, GPGPU	1	
2	**Title**	**Data Representation and Arithmetic Algorithms**		**6**
	2.1	Number representation: Floating-point representation, Floating point arithmetic, IEEE 754 floating point number representation	2,3	
	2.2	Integer Data computation: Addition, Subtraction. Multiplication: Signed multiplication, Booth's algorithm.	2,3	
	2.3	Division of integers: Restoring and non-restoring division	2,3	
3	**Title**	**Processor Organization and Control Unit**		**9**
	3.1	CPU Architecture, Register Organization Instruction formats, basic instruction cycle. Instruction interpretation and sequencing, Case Study of 8086 Architecture and Register Organization.	1,2,4	
	3.2	Control Unit: Soft wired (Micro-programmed) and hardwired control unit design methods. Microinstruction sequencing and execution. Micro operations	2,4	
	3.3	RISC and CISC: Introduction to RISC and CISC architectures and design issues.	2,4	
4	**Title**	**Memory Organization**		**11**
	4.1	Introduction to Memory and Memory parameters. Classifications of primary and secondary memories. Types of RAMS and ROM, Allocation policies, Memory hierarchy and characteristics.	1,2	
	4.2	Cache memory: Concept, architecture (L1, L2, L3), mapping techniques. Cache Coherency, Interleaved and Associative memory.	1,2	
	4.3	Virtual Memory: Concept, Segmentation and Paging, Page replacement policies	1,2,4	
5	**Title**	**I/O Organization and Introduction to Parallel Processing**		**11**
	5.1	Buses: Types of Buses, Bus Arbitration, BUS standards	2	
	5.2	I/O Interface, I/O channels, I/O modules and IO processor, Types of data transfer techniques: Programmed I/O, Interrupt driven I/O and DMA.	1,2	
	5,3	Introduction to parallel processing concepts, Flynn's classifications, pipeline processing, Pipeline stages, Pipeline Hazards	1,2,4	
6	**Self Study**	Comparative Study of microprocessors and micro architectures with respect to their important features.8086 instructions and assembler directives with addressing modes with memory interfacing techniques. Cache memory protocol and virtual memory concepts in Pentium processors. Vector and Array Processors with VLIW architecture		**4***
			Total (*Not included)	**42**

Department of EXTC

Laboratory Component, if any: (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Implementation of various Arithmetic Operations through Assembly Language Programming for microprocessor 8086 (MASM)
2	Simulate the operation of COPY and PASTE in 8086 (MASM)
3	Implement various String Operations in 8086 through the utilities provided by DOS interrupts (MASM)
4	Generation of alphabetic arrangement of a given string in 8086 (MASM)
5	Design password application (generation and detection) in 8086 (MASM)
6	Design of Carry Look Ahead Adder
7	Implementation and programming of Booth's Multiplication Algorithm
8	Implementation and programming of Division Algorithm (Non-Restoring and Restoring)
9	Implementation of Mapping techniques of Cache memory
10	Implementation of Page Replacement Policies

Textbooks

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Computer Organization	**Fifth**	Carl Hamacher, Zvonko Vranesic and Safwat Zaky	**Tata McGraw-Hill**	**2002**
2	Computer Organization and Architecture: Designing for Performance	**Eighth**	William Stallings	**Pearson**	**2010**
3	Computer System Architecture	**Third**	M, Morris Mano	**Pearson**	**1993 Reprinted 2007**
4	Computer Architecture & Organization	**Third**	John P. Hayes	**McGraw-Hill**	**1998**

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Structured Computer Organization	**Sixth**	Andrew S. Tanenbaum	**Pearson**	**2013**
2	Microprocessor and Interfacing: Programming & Hardware	**Third**	Douglas V Hall	**Tata-McGraw Hill**	**2012**
3	Computer Architecture and Organization: Design Principles and Applications	**Second**	B. Govindarajulu	**McGraw Hill**	**Paperback -2017**

Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Electronic Devices	3	0	2	4	9	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
EC202		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	ES13 (Basic Electrical Technology)
Course Objective: To teach fundamentals of electronic devices	
Course Outcomes (CO): At *the End of the course students will be able to*	
EC202.1	Discuss device physics and characteristics of semiconductor devices.
EC202.2	Discuss working principle and characteristics of BJT
EC202.3	Discuss working principle and characteristics of FET
EC202.4	Analyze single stage BJT and FET amplifier circuits
EC202.5	Discuss semiconductor device fabrication process
EC202.6	Discuss construction, working principle and characteristics of advance semiconductor devices HEMT, MESFET and HBT

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC202.1	2	1			2							
EC202.2	2	1			2							
EC202.3	2	1			2							
EC202.4	2	3			2							
EC202.5	2	1			2							
EC202.6	2	1			2							3

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

CO	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
EC202.1							
EC202.2							
EC202.3							
EC202.4							
EC202.5							
EC202.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember√	**Understand√**	**Apply√**	**Analyze√**	**Evaluate**	**Create**

Department of EXTC

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Diode**	1	**6**
	1.1	Review of PN Junction Analysis		
	1.2	Applications of Diode: Simple diode model, Limiter circuits, Rectifiers, Clamper Circuits, Peak Detector and Voltage Doubler		
	1.3	Zener diode and Schottky diode		
2	**Title**	**Bipolar Devices**	1,2	**11**
	2.1	BJT: The bipolar transistor action, minority carrier distribution, low-frequency common-base current gain, non-ideal effects, Ebers-Moll Model and Hybrid-Pi Model		
	2.2	Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT amplifiers, bias stability, various configurations (such as CE, CB, CC) and their features, small signal analysis, low frequency models, estimation of voltage gain, input resistance, output resistance etc., design procedure for specifications, frequency analysis of multistage amplifiers.		
3	**Title**	**Field Effect Devices: JFET**	1,2	**11**
	3.1	Construction, operation, and device characteristics		
	3.2	Biasing schemes for FET amplifiers, bias stability, various configurations (such as CS, CG, CD) and their features, small signal analysis, low frequency models, estimation of voltage gain, input resistance, output resistance etc., design procedure for specifications, frequency analysis of multistage amplifiers.		
4	**Title**	**Field Effect Devices: MOSFET**	2	**10**
	4.1	Two terminal MOS structure, MOSFET construction, Band diagrams under equilibrium and external bias, Threshold Voltage		
	4.2	V-I and CV characteristics, Channel length modulation, Short Channel effects, MOSFET Model		
5	**Title**	**Integrated circuit fabrication process**	R-3	**4**
	5.1	Oxidation, diffusion, ion implantation, photolithography		
	5.2	Etching, chemical vapor deposition, sputtering, twin-tub CMOS process.		
6	**Self-Study**	Device structure, principle of operation and V-I characteristics of MODFET (i.e. HEMT), MESFET and HBT		**4***
			Total (*Not included)	**42**

Department of EXTC

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To plot forward and reverse characteristics of semiconductor diode
2	Implement clipper and clamper circuits using diode
3	Implement half-wave and full-wave rectifier circuits
4	To plot characteristics of Zener diode and observe Zener as voltage regulator
5	Finding characteristics of BJT configurations (CE/CB/CC) using simulation and hardware implementation.
6	Obtain the operating point for different biasing circuits
7	Design and implement single stage BJT based amplifier for the required specifications.
8	Obtain frequency response of single stage BJT based amplifier
9	Finding characteristics of FET (CG/CS/CD) using Simulation and Hardware Implementation
10	Design and implement single stage FET based amplifier for the required specifications.
11	Obtain frequency response of single stage FET based amplifier
12	Obtain Input-Output Characteristics of MOSFET using circuit simulator

Textbooks:

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Electronic Devices and Circuits	Eleventh	RL Boylestad and Lous Nashelsky	Prentice Hall	2013
2	Electronic Circuit Analysis and Design	Third	Donald A. Neamen	Tata McGraw Hill	2006

Reference Books:

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Semiconductor Physics and Devices	Fourth	Donald A. Neamen and Dhrubes Biswas	Tata McGraw Hill	2017
2	CMOS Digital Integrated Circuits	Fourth	Sung-Mo Kang, Yusuf Leblebici and Chulwoo Kim	Tata McGraw Hill	2019
R-3	Semiconductor Devices: Physics and Technology	Third	S. M. Sze and Ming-Kwei Lee	Wiley	2015

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Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Network Theory	3	0	2	4	09	3	0	1	4
EC203		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	ET101
Course Objective: To teach fundamental theorems for circuit analysis.	
Course Outcomes (CO): At *the End of the course students will be able to*	
EC203.1	Analyze the given circuits using theorems and transformation techniques
EC203.2	Analyze the given circuit using Graph Theory
EC203.3	Analyze the given RL, RC and RLC circuits in time domain
EC203.4	Analyze the given RL, RC and RLC circuits in frequency domain
EC203.5	Predict the circuits using Foster and Cauer realization methods
EC203.6	Explain the concept of two port network, relation between the parameters and their interconnection

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC203.1		3										
EC203.2		3										
EC203.3		3										
EC203.4		3										
EC203.5	3											
EC203.6	3											

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
EC203.1					3	2	
EC203.2					3	2	
EC203.3					3	2	
EC203.4					3	2	
EC203.5					3	2	
EC203.6					3	2	

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze√	Evaluate	Create

Department of EXTC

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Analysis of DC circuits** and **coupled circuits:**		12
	1.1	Analysis of circuits with and without controlled sources using generalized loop, node matrix, Superposition, Thevenin, Norton, Maximum Power transfer.	3	
	1.2	Self and mutual inductances, coefficient of coupling, Dot convention, equivalent circuit, solution using loop analysis	1	
2	Title	**Graph Theory:**		4
	2.1	Concept of loop, tree, co-tree, incidence matrix, cut set matrix and tie set matrix	4	
	2.2	Duality principle and its application	4	
3	Title	**Transient Analysis:**		12
	3.1	**Time domain analysis of R-L and R-C circuits:** Forced and natural response, time constant, initial and final values	1,3	
	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 insolving electrical networks	1,3	
4	Title	**Network Synthesis:**		6
	4.1	**Network Function:** driving point and transfer function, Poles and Zeros, calculation of residues by analytical and graphical method, frequency response	2	
	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	
	Title	**Two Port Network:**		8
	5.1	**Parameters:** Open Circuit, Short Circuit, Transmission and Hybrid parameters, relationships among parameters, reciprocity and symmetry conditions	1	
	5.2	**Series/parallel connection:** T and Pi representations, interconnection of Two-Port networks	1	
6	Self-Study	**Millman's theorem, Telogen's theorem, Nonplanar graphs, Solution using first order equation for standard input signals, Transient and steady state time response, solution using universal formula, Terminated Two-Port networks**		4*
			Total (*Not included)	42

Department of EXTC

Laboratory Component

Sr. No.	Title of the Experiment
1	To measure and calculate currents and voltages for a given resistive circuit and verify KCL and KVL.
2	To verify superposition theorem experimentally for a given resistive circuit consisting of two independent sources.
3	To verify Thevenin's theorem experimentally for a given circuit.
4	To verify maximum power transfer theorem experimentally for a given circuit.
5	To verify reciprocity theorem experimentally for a given circuit.
6	To measure and calculate RC time constant for a given RC circuit.
7	To measure and calculate RC time constant for a given RL circuit.
8	To measure and analyze (settling time, overshoot, undershoot, etc.) step response of for a given series RLC circuit for following cases: (1) $\zeta = 1$ (critically damped system), (2) $\zeta > 1$(over damped system), (3) $\zeta < 1$ (under damped system). Choose appropriate values of R, L, and C to obtain each of above cases one at a time.
9	To measure and calculate Z-parameters for a given two-port system.
10	To measure and calculate Y-parameters for a given two-port system.
11	To measure and calculate h-parameters for a given two-port system.
12	To measure and calculate ABCD-parameters for a given two-port system.

Design based Problems (DP)/Open Ended Problem:

1. Write a 'c' program to obtain RC time constant from a given step response of RC circuit.
2. Write a 'c' program to plot frequency response of RC circuit for different values of R and C.
3. Write a 'c' program to obtain 3-dB bandwidth and RC time constant from a given frequency response of RC circuit.
4. Write a 'c' program to plot impedance of a given series RLC circuit as a function of frequency. Also obtain minimum value of impedance and series resonance frequency using 'c' program.
5. Write a 'c' program to obtain following parameters from step response of series RLC circuit for different values of R, L and C.
    a. Propagation delay
    b. Overshoot
    c. Undershoot
    d. Damping factor
    e. Natural frequency
    f. Settling time

Department of EXTC

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Circuit Theory	Seventh Revised Edition	A. Chakrabarti	Dhanpat Rai and Co., New Delhi	**2018**
2	Network Analysis	Third Edition	M E Van Valkenburg	Prentice-Hall of India Pvt. Ltd.	**2018**

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
3	Network Analysis and Synthesis	Second Edition	Franklin F Kuo	Wiley	**2006**
4	Networks and Systems	Second Edition	D. Roy Choudhury	New Age International Pvt. Ltd, Wiley	**2009**

Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(SBC)	Electronics Instruments and Measurement Lab	0	1	2	2	5	0	1	1	2
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
EC204		Theory		--		--		--		--
		Laboratory		150		--		50		200

Pre-requisite Course Codes, if any.	ET101
Course Objective: To teach principle of working and application of various measuring instruments used in Electronics Laboratories	
Course Outcomes (CO): At *the End of the course students will be able to*	
EC204.1	Describe the working of measuring instruments available in the lab
EC204.2	Find out and verify the manufacturers, make, models, market cost and specifications of the given instrument
EC204.3	Select the suitable test and measuring instrument for the given circuit
EC204.4	Operate the instrument for observing and recording the given signal in time domain and frequency domain
EC204.5	Recognize the importance of calibration of instruments
EC204.6	Design signal conditioning circuit for measurement of various parameters

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC204.1	2	1			3							
EC204.2	2	1			3							2
EC204.3	2	2			3							
EC204.4	2	1			3							
EC204.5	2	1			3							
EC204.6	2	1	3		3							

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
EC204.1							
EC204.2							
EC204.3							
EC204.4							
EC204.5							
EC204.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember√	Understand√	Apply√	Analyze	Evaluate	Create

Department of EXTC

Sr. No.	Title of the Experiment
1	Measurement of static parameters using analog ammeter, voltmeter, and galvanometer.
2	Exploring controls of CRO/DSO and measurement of various parameters in the given circuit using CRO/DSO
3	Study of working principle and exploring controls of function generator, signal generator and arbitrary function generator
4	Study of working principle of tachometer, lux meter, clamp meter and thermal camera and demonstrate its use.
5	Study of working principle of multimeter, wattmeter & energy meter and demonstrate its use.
6	Designing DC bridge for Resistance Measurement (Quarter, Half and Full bridge)
7	Designing signal Conditioning circuit for Strain Measurement
8	Designing AC bridge Circuit for capacitance measurement and verification using Q-meter
9	Designing signal Conditioning circuit for Temperature Measurement
10	Designing signal Conditioning circuit for Distance Measurement

Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
SBC	Professional Communication Skills	1	0	2	2	5	1	0	1	2
AS201		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory			--		--			
		Laboratory	200		--		--			200

Pre-requisite Course Codes, if any.	
Course Objective: To demonstrate the desired spoken and written communication skills required in early professional life, with focus on job placements.	
Course Outcomes (CO): At *the End of the course students will be able to*	
AS201.1	Demonstrate the spoken and written skills for job placements.
AS201.2	Draft professional documents.
AS201.3	Design written communication for social media.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS201.1										2		
AS201.2										2		
AS201.3										2		

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS201.1							
AS201.2							
AS201.3							

BLOOM'S Levels Targeted (Pl. appropriate)

Remember	Understand	Apply√	Analyze√	Evaluate	Create

Department of EXTC

Theory Component

Module No.	Unit No.	Topics	Ref.	L Hrs.	P Hrs
1.	**Title**	**Placement Skills**		**6**	**12**
	1.1	Resume Writing & Cover Letter			
	1.2	Group Discussion			
	1.3	Case Studies/Pitching a startup			
	1.4	Team Building Skills/Work			
	1.5	Interview Skills			
2	**Title**	**Corporate Communication**		**6**	**12**
	2.1	Presentation Skills			
	2.2	Meeting: Notice, Agenda, Minutes			
	2.3	Proposal Writing			
	2.4	Report Writing: Informative, Analytical report			
3	**Title**	**Research Writing**		**2**	**4**
	3.1	Sourcing information through digital media			
	3.2	Written communication using social media: Blog			
4	**Self Study**	Research Paper, News Analysis			**6***
			Total(*Not included)	**42 hrs**	

List of ISEs

Sr. No.	Title of the Experiment	Marks
1	Resume	20
2	Cover Letter	20
3	GD	40
4	Mock Interview	20
5	Presentation	20
6	Blog Writing	20
7	Team Building Activity	--
8	Minutes of the Meeting/Notice & Agenda	20
9	Proposal Writing	20
10	Report Writing	20
Total		**200**

Textbooks

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Interpersonal Skills at Work	2002	John Hayes	McGraw Hill Education	2002
2	Campus Placement: A Comprehensive Guide	2016	Ankur Malhotra	McGraw Hill Education	2016

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	If I Understood You, Would I Have This Look on My Face? My Adventures in the Art and Science of Relating and Communicating	2017	Alan Alda	Random House	2017
2	Handbook for Writing Proposals	2010	Robert J. Hamper, Sue Baugh	McGraw Hill Education	2010
3	Effective Communication Skills for Scientific and Technical Professionals	2000	Harry Chambers	Paperback Basic Books	2000
4	The Art of Writing Together	2008	William Issac	Crown Business	2008
5	Communication Skills	2011	Meenakshi Raman, Sangeeta Sharma	Oxford, India	2011

Bharatiya Vidya Bhavan's
Sardar Patel Institute of Technology
(Autonomous Institute Affiliated to University of Mumbai)
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

Department of EXTC

Semester-IV

Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Probability and Stochastic Processes	3	0	0	5	8	3	0	0	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
MA203		Theory		75		75		150		300
		Laboratory		-		--		-		-

Pre-requisite Course Codes, if any.	MA101, MA102
Course Objective: To provide the fundamentals and advanced concepts of probability theory and random process to support core courses in electronic and Electronic and communication engineering. The required mathematical foundations will be studied at a fairly rigorous level and the applications of the probability theory and random processes to engineering problems will be emphasized.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MA203.1	Apply concepts of mathematics to set operations and probability theory
MA203.2	Apply concepts of probability theory to single random variables
MA203.3	Apply theorems to multiple random variables and investigate significance of Central Limit Theorem.
MA203.4	Determine solutions to various characteristics of random variables/distributions/processes
MA203.5	Investigate characteristics of random processes
MA203.6	To interpret use of probability distributions in real world and illustrate Markov Theory application to Queuing theory.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA203.1	3	3			1				1	3		1
MA203.2	3	3			1				1	3		1
MA203.3	3	3			1				1	3		1
MA203.4	3	3			1				1	3		1
MA203.5	3	3			1				1	3		1
MA203.6	3	-							1	3		1

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA203.1	2	2					
MA203.2	2	2					
MA203.3	2	2					
MA203.4	2	2					
MA203.5	2	2					
MA203.6	2	2					

Department of EXTC

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember√	Understand√	Apply√	Analyze√	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Probability**	1,2	08
	1.1	Sets and set operations; Probability space; Conditional probability and Bayes theorem		
2	Title	**Single Random Variable**	1,2	08
	2.1	Discrete random variables, probability mass function, probability distribution function, example random variables and distributions		
	2.2	Continuous random variables, probability density function, probability distribution function, example distributions		
3	Title	**Multiple Random Variables**	1,2	10
	3.1	Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution		
	3.2	densities and moments; Characteristic functions of a random variable		
	3.3	Markov, Chebyshev and Chernoff bounds		
4	Title	**Sequence of Random Variables**	1,2	06
	4.1	Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square)		
	4.2	Limit theorems; Strong and weak laws of large numbers, central limit theorem.		
5	Title	**Random Process**	1,2	10
	5.1	Random process. Stationary processes. Mean and covariance functions. Ergodicity.		
	5.2	Transmission of random process through LTI. Power spectral density.		
6	Self-Study	**Application of different probability distributions (to any one field of interest but not limited to)** 1.Wireless Communication 2.Queuing theory 3. Networking 4. Digital Signal Processing. 5.VLSI	1,2	06*
			Total	**42**

***Not included in the total**

Textbooks

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Probability, Random Variables and Stochastic Processes	4th	A. Papoulis and S. Unnikrishnan Pillai	McGraw Hill	2002
2	Probability and Random Processes with Applications to Signal Processing	3rd	H. Stark and J. Woods	Pearson education	2002

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Probability And Random Processes for Electrical Engineering	3rd	Alberto Leon Garcia	Pearson education	2008
2	Probability, Statistics and Random Processes	3rd	T Veerarajan	McGraw Hill	2008

Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Foundations of Mathematics-II	2	1	0	6	9	2	1	0	3
MA204		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300

Pre-requisite Course Codes, if any.	Foundations of Mathematics-I
Course Objective: To develop basic foundation of mathematical skills.	
Course Outcomes (CO): At *the End of the course students will be able to: -*	
MA204.1	Integrate a function of one variable using various techniques
MA204.2	Sketch basic curves and solve double and triple integrals.
MA204.3	Solve basic problems using properties of complex numbers.
MA204.4	Solve differential equations of first order.
MA204.5	Apply the techniques of solving first order differential equations to electrical engineering problems.
MA204.6	Solve differential equations of higher order

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA204.1	1											
MA204.2	1											
MA204.3	1											
MA204.4	2											
MA204.5	1	1										
MA204.6	2											

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA204.1							
MA204.2							
MA204.3							
MA204.4							
MA204.5							
MA204.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember√	**Understand√**	**Apply√**	**Analyze**	**Evaluate**	**Create**

Department of EXTC

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	Title	**Integral Calculus**	1,2	**13**
	1.1	Formulae for integral of standard functions, integration by parts, integration by method of substitution.		04
	1.2	Gamma functions, Beta functions. Differentiation under Integral sign with constant limits and one parameter.		04
	1.3	Standard curves (lines, circles, parabolas, ellipses). Concept of double integration. Evaluation of double and triple integrals.		05
2	Title	**Complex Numbers**	1,2	**03**
	2.1	Operations on complex numbers, polar form of a complex number, properties of a complex number.		03
3	Title	**Differential Equations**	1,2	**12**
	3.1	Exact differential equations. Linear differential equations of the first order and equations reducible to linear.		04
	3.2	Solving differential equations of first order in electrical networks.		01
	3.3	Linear differential equations with constant coefficients: complementary function and particular integral.		07
			Total	**28**

Textbooks

Sr. No.	Title	Edition	Authors	Publisher	Year
1	**Higher Engineering Mathematics**	**44th**	**Dr. B. S. Grewal**	**Khanna Publications**	**2020**

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	**Advanced Engineering Mathematics**	**10th**	**Erwin Kreysizg**	**John Wiley & Sons**	**2011**
2	**Advanced Engineering Mathematics**	**28th**	**H. K. Dass**	**S. Chand**	**2014**

Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Analog Circuits	3	0	2	6	11	3	0	1	4
		Examination Scheme								
EC205		Component	ISE		MSE		ESE		Total	
		Theory	75		75		150		300	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	ET101, ET202
Course Objective: To teach fundamentals of analog electronic circuits	
Course Outcomes (CO): At *the End of the course students will be able to*	
EC205.1	Apply the concept of negative and positive feedback
EC205.2	Discuss differential amplifier and power amplifier circuits
EC205.3	Discuss fundamentals of operational amplifier IC
EC205.4	Design linear and non-linear applications using operational amplifier IC
EC205.5	Discuss various data conversion techniques
EC205.6	Design applications with special purpose ICs

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC205.1	1	1	2	2								
EC205.2	1	1	2	2								
EC205.3	1	1	2	2								
EC205.4	1	1	2	2								
EC205.5	1	1	2	2								
EC205.6	1	1	3	2								

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
EC205.1							
EC205.2							
EC205.3							
EC205.4							
EC205.5							
EC205.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember√	**Understand√**	**Apply√**	**Analyze√**	**Evaluate**	**Create**

Department of EXTC

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Feedback topologies and Oscillators**	1	8
	1.1	Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.		
	1.2	**Oscillators:** Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.) and LC oscillators (Hartley, Colpitt, Clapp etc.)		
2	Title	**Differential amplifier and Power Amplifier**	1	8
	2.1	**Current mirror:** Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load.		
	2.2	**Differential amplifier:** Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR.		
	2.3	**Power amplifiers:** Power BJTs, Power MOSFETs, Heat Sinks, Class A, Class B, Class C and Class AB operation, Power efficiency		
3	Title	**Operational Amplifier**	2	12
	3.1	Functional Block Diagram of op amp, DC and AC characteristics of an op-amp, Ideal op-amp		
	3.2	**Linear Applications of Operational Amplifier** Inverting and non-inverting amplifier, adder, subtractor, integrator, differentiator, difference amplifier, instrumentation amplifier **Active Filters:** First order filters, second order active finite and infinite gain low pass, high pass		
	3.3	**Non-Linear Applications of Operational Amplifier** **Comparators:** Inverting comparator, non-inverting comparator, zero crossing detector **Schmitt Triggers:** Inverting Schmitt trigger		
4	Title	**Data Converters**	2	6
	4.1	Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc.		
	4.2	Analog to-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc.		
	4.3	Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.		
5	Title	**Special Purpose Integrated Circuits**	2	8
	5.1	Timer 555 and its applications		
	5.2	Three-terminal fixed (78XX series) and general purpose 723 voltage regulators.		

6	**Self-Study**	Multiplier IC's, Power Amplifier IC's, PLL and VCO. Design of applications using these IC's.	**6***
		Total (*Not included)	**42**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Design and implement any one negative feedback amplifier
2	Design and implement any one oscillator circuit
3	Design and implement differential amplifier with and without current mirror circuit
4	Design and implement any one power amplifier circuit
5	To measure (a) Input bias current, (b) Input offset current, (c)Input offset voltage & (d) Slew rate of the given Op-Amp IC 741.
6	Design and implement linear application using Op-Amp IC 741.
7	Design and implement non-linear application using Op-Amp IC 741
8	Design and implement active filter circuit using Op-Amp IC 741.
9	Design and implement data converter circuit
10	Design and Implement Multivibrator Circuits using IC 555
11	Design, Implement and analyze Voltage Regulator Circuit using IC 723.

Textbooks:

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Electronic Circuit Analysis and Design	**Third**	Donald A. Neamen	Tata McGraw Hill	**2006**
2	Linear Integrated Circuits	**Fourth**	D. Roy Choudhury and S. B. Jain	New Age International Publishers	**2018**

Reference Books:

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Millman's Electronic Devices and Circuits	**Third**	Jacob Millman, Christos C Halkias, and Satyabratata JIT	McGraw Hill	**2014**
2	Design with operational amplifiers and analog integrated circuits	**Fourth**	Sergio Franco	Tata McGraw Hill	**2016**
3	Op-Amps and Linear Integrated Circuits	**Fourth**	Ramakant A. Gayakwad	Pearson Prentice Hall	**2015**

Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Microcontrollers	3	0	2	6	11	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
EC206		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	EC101, ET201
Course Objective: Imparting the detailed architectural features of various microcontrollers like 8051, PIC and ARM along with integrated peripherals and programming	
Course Outcomes (CO): *At the End of the course students will be able to*	
EC206.1	Compare and contrast traditional microprocessor with traditional microcontroller 8051
EC206.2	Understand and describe architectural features of microcontrollers like PIC and ARM
EC206.3	Comprehend ARM core model and classify different modes of operation with justification
EC206.4	Classify various instructions with addressing modes of microcontrollers like PIC and ARM
EC206.5	Analyze the given problem statement and apply the programming concepts to solve the problem through program in PIC and ARM
EC206.6	Illustrate and utilize the integrated peripherals of 16- and 32-bit microcontrollers

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC206.1	3											
EC206.2	3											
EC206.3	3											
EC206.4	3											
EC206.5		3			3			3		3		
EC206.6		3	2									

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
EC206.1							
EC206.2							
EC206.3							
EC206.4							
EC206.5							
EC206.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze √	Evaluate	Create

Department of EXTC

Theory Component

Module	Unit	Topics	Ref.	Hrs.
1	**Title**	**Introduction of 8-bit Microcontroller – 8051**		**4**
	1.1	Overview of 8051 Family of Controllers	1	
	1.2	Architecture of 8051 with block diagram schematic	1	
	1.3	Brief description of integrated components of 8051	1	
2	**Title**	**PIC Microcontroller**		**10**
	2.1	Microcontroller architecture and Programming model	2	
	2.2	Instruction set with addressing modes	2	
	2.3	Programming and Problem-solving approaches	2	
3	**Title**	**PIC Integrated Peripherals**		**9**
	3.1	I/O Ports with its interfacing	2	
	3.2	Interrupt Structure	2	
	3.3	Timers with its configuration	2	
	3.4	Data Converters (ADC and DAC)	2	
	3.5	Serial I/O (SPI and I^2C protocol)	2	
4	**Title**	**ARM7TDMI(ARMv4T) Architecture**		**10**
	4.1	Features and advantages, ARM versions	3,4	
	4.2	Processor operating states, ARM core data flow model, operating	3,4	
	4.3	Instruction set with addressing modes	3,4	
5	**Title**	**LPC2148 ARM7 Processor Programming and Interfacing**		**9**
	5.1	Processor state changing (ARM←→THUMB), Exceptions, interrupts,	3,4	
	5.2	Timer Programming, Watchdog Timer	3,4	
	5.3	ADC and Sensor Interfacing	3,4	
	5.4	SPI and I2C Peripheral Interface	3,4	
6	**Self Study**	ARM-v7-M (Cortex-M3), Comparison of ARM-v&-A (Cortex A8), ARM-v7-R (Cortex R4), ARM-v7-M (Cortex M3). Application Case Study for PIC and ARM controllers		**6***
			Total (*Not included)	**42**

Department of EXTC

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Programming the I/O Port of 8-bit 8051 Microcontroller and effectively interface the LED and switch.
2	Programming and Interfacing for utilization of on-chip resources like Timers and Serial Communication of 8-bit 8051 Microcontroller.
3	PIC assembly language programming and simulation
4	PIC LED/LCD interfacing and programming
5	PIC Timers and interrupts programming
6	PIC ADC Programming
7	ARM LEDs and Keyboard Interface
8	ARM Programming and Interfacing of sensors using on chip ADC
9	ARM Programming and Interfacing on chip Serial Port
10	ARM Programming and Interfacing on chip timer

Textbooks

Sr. No.	Title	Edition	Authors	Publisher	Year
1	The 8051 Microcontroller and Embedded Systems: Using Assembly and C	**Second**	Muhammad Ali Mazidi, Janice G. Mazidi and R. D. McKinlay	**Pearson**	**2006**
2	Fundamentals of Microcontrollers and Applications in Embedded Systems (with PIC18 microcontroller family)	**Fourth**	Ramesh Gaonkar	**Penram International Publishing Pvt. Ltd**	**2007**
3	ARM System Developer's Guide Designing and Optimizing System Software	**First**	Andrew N. Sloss, Dominic Sysmes and Chris Wright	**Elsevier Inc Morgan Kaufmann**	**2004**
4	ARM Architecture, Reference Manual	**Second**	David Seal	**Addison Wesley**	**2001**

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	PIC Micron roller: An Introduction to Software & Hardware Interfacing	**Second**	Han- Way Huang	**Cengage Learning**	**2005**
2	ARM System-on-Chip Architecture	**Second**	Steve Furber	**Addison-Wesley**	**2000**

Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Signals and Systems	3	0	2	6	11	3	0	1	4
EC207		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
		Theory	75		75		150		300	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	MA101, MA102
Course Objective: To develop strong foundation of continuous time signals and systems	
Course Outcomes (CO): ***At the End of the course students will be able to***	
EC207.1	Classify and illustrate various operations on signals and systems.
EC207.2	Analyze the properties of a continuous time signal in frequency domain and observe the spectrum.
EC207.3	Apply Laplace Transform on continuous time signals
EC207.4	Evaluate Linear Time Invariant system response using Laplace Transform
EC207.5	Design analog Butterworth and Chebyshev filter
EC207.6	Interpret system using state space model

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC207.1	3	-			3				3	3		2
EC207.2	3	2			3				3	3		2
EC207.3	3	2			3				3	3		2
EC207.4	3	2			3				3	3		2
EC207.5	3	2			3				3	3		2
EC207.6	3	-			1				3	3		1

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
EC207.1	2	2				2	
EC207.2	2	2				2	
EC207.3	2	2				2	
EC207.4	2	2				2	
EC207.5	2	2				2	
EC207.6	2	2				-	

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember√	Understand√	Apply√	Analyze√	Evaluate	Create

Department of EXTC

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Overview of Continuous Time Signals and Systems**	1,2	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 Signals, deterministic and non-deterministic, periodic and aperiodic, symmetric (even) and asymmetric (odd), energy and power, causal and anti-causal signals.		
	1.3	Operations of Signals: Shifting, Scaling, Time Reversal, Addition and Multiplication, Convolution, Correlation		
2	Title	**Fourier Series and Fourier Transform**	1,2	10
	2.1	**Fourier series**: Orthogonal representation of signals, Continuous Time Fourier Series (CTFS), magnitude and phase spectra, Gibbs phenomenon, Parsevel's relation,		
	2.2	**Fourier Transform**: Fourier Transform and Inverse Fourier Transform on periodic and non-periodic signals, Limitations of Fourier Transform and need for Laplace Transform, Properties of Fourier Transform, Parsevel's relation, Energy and Power Spectral Density and Bandwidth.		
3	Title	**Laplace Transform**	1,2	04
	3.1	Laplace Transform, Properties of Laplace Transform, Relation between Laplace Transform and Fourier Transform,		
	3.2	Inverse Laplace Transform using Partial Fraction method		
4	Title	**Linear Time Invariant (LTI) Systems**	1,2	08
	4.1	**Classification of systems:** Static and dynamic, time variant and time invariant, linear and nonlinear, causal and non-causal, stable and unstable systems.		
	4.2	Impulse Response, Transfer Function, Differential Equation, Stability of Systems, Frequency Response, Solution of Differential Equation using Laplace Transform		
5	Title	**Analog Filter Design**	1,2	12
	5.1	Design of Ideal Analog filter, Butterworth Low Pass Filter (LPF) design, Butterworth High Pass Filter (HPF) design, Butterworth Band Pass Filter (BPF) and Band Reject Filter design, Pole zero plot of Butterworth filters, Magnitude Spectrum		
	5.2	Equiripple Filters, Chebyshev Type-I LPF, HPF Design, Pole zero plot of Chebyshev filter, magnitude spectrum.		

	5.3	Realization diagram (Form I and II)		
6	**Self Study**	**State Space Model:** Procedure to determine state equations, State equations from transfer function, Laplace transform solution of state equations		**6***
			Total (*Not included)	**42**

Laboratory Component

Sr. No.	**Title of the Experiment**
1	Representation of Signals
2	Operations on Signals
3	Convolution on Continuous Time Signals
4	Synthesis of signals using Fourier Series
5	Synthesis of signals using Fourier Transform
6	Analysis of LTI system using Laplace Transform
7	Plotting of frequency spectrum
8	Butterworth filter design
9	Chebyshev filter design
10	Mini project: Analysis of real-world signals

Text Books

Sr. No.	**Title**	**Edition**	**Authors**	**Publisher**	**Year**
1	Signals and Systems	3rd	Nagoor Kani	Tata McGraw Hill	2011
2	Digital Signal Processing	4th	Ramesh Babu	Scitech	2014

Reference Books

Sr. No.	**Title**	**Edition**	**Authors**	**Publisher**	**Year**
1	Signals and Systems	2nd	Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab	Pearson	2002
2	Signals and Systems	3rd	Simon Haykin and Barry Van Veen	John Wiley & Sons	2002
3	Linear Systems and Signals	4th	B. P. Lathi	Oxford University Press	2005
4	Signals and Systems	2nd	H. P Hsu, R. Ranjan	Schaum's outlines	2006

Department of EXTC

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned				
		L	T	P	O	E	L	T	P	O	Total
(SBC)	Mini Project-I	0	0	0	4	4	0	0	0	2	2
		Examination Scheme									
EC208		Component			ISE		MSE		ESE		Total
		Theory			--		--		--		--
		Laboratory			--		--		--		--
		Self-Study			100		--		100		200

Pre-requisite Course Codes, if any.	
Course Objective: To apply engineering knowledge and propose innovative, sustainable solutions to the real-life challenges	
Course Outcomes (CO): At *the End of the course students will be able to*	
EC208.1	Discover potential research areas for addressing societal issues
EC208.2	Conduct a survey of basic and contemporary literature in the preferred field of study.
EC208.3	Formulate and propose a plan for creating a solution for the research plan identified.
EC208.4	Exercise the team building, communication and management for design and implementation of projects.
EC208.5	Compare and contrast the several existing solutions for research challenge
EC208.6	Report and present the findings of the study conducted in the preferred domain.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC208.1												
EC208.2												
EC208.3												
EC208.4												
EC208.5												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
EC208.1						
EC208.2						
EC208.3						
EC208.4						
EC208.5						

Department of EXTC

BLOOM'S Levels Targeted (Pl. appropriate)

Remember	Understand√	Apply√	Analyze√	Evaluate√	Create

Pre-requisite Course Codes	All the Courses till third Semester

Mini project is an opportunity to make a difference in the experience of education in its own way. It is an attempt of scientific study of the problem in surrounding in order to guide, correct and evaluate the actions and decisions about it. It is based on a small project correlating scientific knowledge and day to day experience which encourages development of scientific attitude to solve real life problems among students.

The Objectives of Action Research are:

- ✓ To make students sensitive towards societal issues
- ✓ To learn scientific principles from day-to-day experiences
- ✓ To develop psycho-technological skills through observation, classification, statement of hypothesis etc.
- ✓ Development of communication, organizational skills and maturity through discussion, presentation etc.
- ✓ To develop ability to correlate science, technology and society
- ✓ To apply engineering knowledge and propose innovative, sustainable solutions to the real-life challenges

Steps for Implementation: (ISE: Through 2 Phases of Evaluation) and ESE

- ✓ Keen observation of the surrounding/society
- ✓ Identification of the problem
- ✓ Analysis of the problem
- ✓ Collection of relevant information by formulating research questions
- ✓ Suggesting plan of action
- ✓ Conducting experiments
- ✓ To draw conclusion
- ✓ To find the possible solution to rectify the problem
- ✓ To execute experiments and remedial measures wherever possible

Students can seek guidance from teachers, other experts and make effective use of other sources of information available around them. Students must ensure that problem to be solved in manageable in one semester.

Teachers must follow the below mentioned principles:

- ✓ Make student confront problem solving
- ✓ Develop methods and techniques of handling problems.
- ✓ Teach how to use the methods and not directly give solution to the problem.

- ✓ Lead the students to the peak of their powers for improvement of better learning.

The H/W and S/W resources required to complete the Mini-Project-I may be beyond the scope of curriculum of courses taken or may be based on the courses but thrust should be on

- Learning additional skills
- Development of ability to define and design the problem and lead to its accomplishment with proper planning
- Learn the behavioral discipline by working in a team. The team may be maximum three (03) students.

Evaluation:

Project report should contain project title, student details, certificate and acknowledgements. Other sections of the report shall be decided by the department based on projects. But it must have introduction, necessity of project, objectives, hypothesis, plan, observations, and analysis of results, conclusion and references along with other sections related to technology. The ISE and ESE evaluation will be carried out based on the rubrics framed by the Department. The ESE marks will be based on final demonstration of the project and viva based on it and report/poster/technical paper of the project in the standard format provided by the Department.