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Dr. BabasahebAmbedkar Technological University

(Established as a University of Technology in the State of Maharashtra)

(Under Maharashtra Act No. XXIX of 2014)

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Proposed Course Contents for

B. Tech. in Electronics & Communication Engineering (Sandwich)

w.e.f. June 2019

From 3rd Semester - 4th Semester

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Vision

The vision of the department is to achieve excellence in teaching, learning, research and transfer of technology and overall development of students.

Mission

Imparting quality education, looking after holistic development of students and conducting need-based research and extension.

Graduate Attributes

The Graduate Attributes are the knowledge skills and attitudes which the students have at the time of graduation. These Graduate Attributes identified by National Board of Accreditation are as follows:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Educational Objectives

PEO 1	Graduates should excel in engineering positions in industry and other organizations that emphasize design and implementation of engineering systems and devices.
PEO 2	Graduates should excel in best post-graduate engineering institutes, acquiring advanced degrees in engineering and related disciplines.
PEO 3	Alumni should establish a successful career in an engineering-related field and adapt to changing technologies.
PEO 4	Graduates are expected to continue personal development through professional study and self-learning.
PEO 5	Graduates should be good citizens and cultured human beings, with full appreciation of the importance of professional, ethical and societal responsibilities.

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Program Outcomes

At the end of the program the student will be able to:

PO 1	Apply the knowledge of mathematics, basic sciences, and electronics and communication engineering to the solution of complex engineering problems.
PO 2	Identify, formulate, research literature, and analyze complex electronics and communication engineering problems reaching substantiated conclusions.
PO 3	Design solutions for complex engineering problems and design electronics system components that meet the specified needs.
PO 4	Use electronics and communication engineering research-based knowledge related to interpretation of data and provide valid conclusions.
PO 5	Create, select, and apply modern electronics and communication engineering and IT tools to complex engineering activities with an understanding of the limitations.
PO 6	Apply reasoning acquired by the electronics and communication engineering knowledge to assess societal and safety issues.
PO 7	Understand the impact of engineering solutions on the environment, and demonstrate the knowledge for sustainable development.
PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communicate effectively on complex engineering activities with the engineering community and with society at large.
PO 11	Understand the engineering and management principles and apply these to the multi disciplinary environments.
PO 12	Recognize the need for life-long learning in the broadest context of technological change.

Program-Specific Outcomes (PSOs)

PSO 1	Make the students employable in engineering industries.
PSO 2	Motivate the students for higher studies and research.

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Abbreviations

PEO:	Program Educational Objectives
PO:	Program Outcomes
CO:	Course Outcomes
L:	No. of Lecture hours (per week)
T:	No. of Tutorial hours (per week)
P:	No. of Practical hours (per week)
C:	Total number of credits
BSH:	Basic Science and Humanity
BSC:	Basic Sciences Course
PCC:	Professional Core Course
OEC:	Open Elective Course
PEC:	Professional Elective Course
BHC:	Basic Humanity Course
ESC:	Engineering Science Course
PC:	Proficiency Course
HSMC:	Humanity Science and Management Course
NCC:	National Cadet Corps
NSS:	National Service Scheme
CA:	Continuous Assessment
MSE:	Mid Semester Exam
ESE:	End Semester Exam

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B. Tech. Electronics & Communication Engineering (Sandwich)

Course Structure for Semester III [Second Year] w.e.f. 2019-2020

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTBSC301	BSC	Engineering Mathematics-III	3	1	0	20	20	60	100	4
BTEXC302	PCC 1	Analog Circuits	3	0	0	20	20	60	100	3
BTEXC303	PCC 2	Electronic Devices & Circuits	3	0	0	20	20	60	100	3
BTEXC304	PCC 3	Network Analysis	3	0	0	20	20	60	100	3
BTEXC305S	PCC 4	Digital Circuits & Microprocessors	3	0	0	20	20	60	100	3
BTHM3401	HSMC	Basic Human Rights	0	2	0	50	--	--	50	Audit (AU/ NP)
BTEXL307	PCC 1 Lab	Analog Circuits Lab	0	0	2	60	--	40	100	1
BTEXL308	PCC 2 Lab	Electronic Devices & Circuits Lab	0	0	2	60	--	40	100	1
BTEXL309	PCC 3 Lab	Network Analysis Lab	0	0	2	60	--	40	100	1
BTEXL310S	PCC 4 Lab	Digital Circuits & Microprocessors Lab	0	0	2	60	--	40	100	1
BTEXW311	PCC 5 Lab	Electronics Workshop	**0**	**0**	**2**	**30**	**--**	**20**	**50**	**1**
BTEXL312S	ESC Lab	Data Structure Lab	**0**	**0**	**2**	**30**	**--**	**20**	**50**	**1**
BTES211P		Field Training / Internship/Industrial Training (minimum of 4 weeks which can be completed partially in first semester and second Semester or in at one time).						**50**	**50**	**1**
Total			15	3	12	450	100	500	1100	23

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B. Tech. Electronics & Communication Engineering (Sandwich)
Course Structure for Semester IV [Second Year] w.e.f. 2019-2020

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTESC401	ESC	Electrical Machines and Instruments	3	0	0	20	20	60	100	3
BTEXC402	PCC 1	Analog Communication Engineering	3	0	0	20	20	60	100	3
BTEXC403S	PCC 2	Microcontroller	3	0	0	20	20	60	100	3
BTEXC404	PCC 3	Signals and Systems	3	0	0	20	20	60	100	3
BTEXC405S	PCC 4	Control System Engineering	3	0	0	20	20	60	100	3
BTEXL406S	PCC 4 Lab	Control System EngineeringLab	0	0	2	60	--	40	100	1
BTESCL407	ESC Lab	Electrical Machines and Instruments Lab	0	0	2	60	--	40	100	1
BTEXL408	PCC 1 Lab	Analog Communication Engineering Lab	0	0	2	60	--	40	100	1
BTEXL409S	PCC 2 Lab	Microcontroller Lab	0	0	2	60	--	40	100	1
BTEXL410	PCC 3 Lab	Signals and Systems Lab	0	0	2	60	--	40	100	1
BTHML411	HSMC	Soft-Skill Development	**0**	**0**	**2**	**60**	--	**40**	**100**	**1**
BTEXF412		Industry Internship Training (Minimum 4 weeks which can be completed partially in third semester or fourth semester or in at one time)								Audit To be evaluated in the V th semester
BTEXC413S	PC Lab	Proficiency E-learning course	**0**	**0**	**2**	--	--	--	--	**1**
Total			15	0	14	460	100	540	1100	22

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Semester III

Engineering Mathematics-III

BTBSC301	BSC	Engineering Mathematics-III	3-1-0	4 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs./week Tutorial: 1 hrs./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Differential and Integral Calculus, Taylor series and Infinite series, Differential equations of first order and first degree, Fourier series, Vector algebra, Algebra of complex numbers.

Course Outcomes: At the end of the course, students will be able to:

CO1	Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
CO2	Solve problems related to Fourier transform, Laplace transform and applications to Communication systems and Signal processing.
CO3	Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.
CO4	Perform vector differentiation and integration, analyze the vector fields and apply to Electromagnetic fields.
CO5	Analyze conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												
CO7												
CO8												

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Course Contents:

Unit 1: Laplace Transform [07 Hours]

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

Unit 2: Inverse Laplace Transform [07 Hours]

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding Inverse Laplace transforms; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

Unit 3: Fourier Transform [07 Hours]

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms.

Unit 4:Partial Differential Equations and Their Applications[07 Hours]

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation ($\partial u/\partial t = c^2 \partial^2 u/\partial x^2$), and two dimensional heat flow equation (i.e. Laplace equation : $\partial^2 u/\partial x^2 + \partial^2 u/\partial y^2 = 0$).

Unit 5: Functions of Complex Variables (Differential calculus)[07 Hours]

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping.

Unit 6: Functions of Complex Variables (Integral calculus)[07 Hours]

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.
3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledge ware,Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan ,Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

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Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy. Knowledge ware,Mumbai.
5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, NewYork.

General Instructions:

1. The tutorial classes in Engineering Mathematics-III are to be conducted batch-wise. Each class should be divided into three batches for the purpose.
2. The Continuous Assessment of the students for 20 marks will be done based on assignments, surprise tests, quizzes, innovative approach to problem solving and percentage attendance.
3. The minimum number of assignments should be eight covering all topics.

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Analog Circuits

BTEXC302	PCC 1	Analog Circuits	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week Tutorial: 0hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites: Basic knowledge of Semiconductor Electronics, Electrical engineering, Voltage amplifiers.

Course Outcomes: At the end of the course, students will be able to:

CO1	Understand the characteristics of IC and Op-Amp and identify the internal structure.
CO2	Derive and determine various performances based parameters and their significance for Op-Amp.
CO3	Comply and verify parameters after exciting IC by any stated method.
CO4	Analyze and identify linear and nonlinear applications ofOp-Amp.
CO5	Understand and verify results (levels of V & I) with hardware implementation.
CO6	Understand and apply the functionalities of PLL.

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

Course Contents:

Unit 1: OP-AMP Basic [08 Hours]

Block diagram of OP-AMP, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configurations, Need and types of level shifter, current mirror circuits. Feedback topologies: Voltage series and voltage shunt feedback amplifier and its effect on R_i, R_o, bandwidth and voltage gain..

Unit 2: Linear Applications of OP-AMP [08 Hours]

Inverting and non-inverting amplifier configurations, voltage follower, summing, averaging scaling amplifier, difference amplifier, integrator, differentiator, and instrumentation amplifiers.

Unit 3: Non-linear Applications of OP-AMP [08 Hours]

Introduction to comparator, characteristics and applications of comparator, Schmitt trigger, clippers and clampers, voltage limiters, square wave generator, triangular

wave generator, Need of precision rectifiers, Half wave and Full wave precision rectifiers.

Unit 4: Converters using OP-AMP [08 Hours]

V-F, I-V and V-I converter, Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, Flash type.

Unit 5: Oscillators [08 Hours]

Principle of Oscillators, Barkhausen criterion, Oscillator types: RC oscillators (design of phase shift, Wien bridge etc.), LC oscillators (design of Hartley, Colpitts, Clapp etc.), non-sinusoidal oscillators, and voltage controlled oscillators.

Unit6: Active filters and PLL [08 Hours]

Design guidelines of Active filters: Low pass, high pass, band pass and band stop filters, block diagram of PLL and its function.

TEXT/REFERENCE BOOKS

1. Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson Education 2000.
2. Salivahanan and Kanchana Bhaskaran, "Linear Integrated Circuits", Tata McGraw Hill, India 2008.
3. George Clayton and Steve Winder, "Operational Amplifiers", 5th Edition Newnes.
4. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits",Tata McGraw Hill.
5. Bali, "Linear Integrated Circuits", McGraw Hill 2008.
6. Gray, Hurst, Lewise, Meyer, "Analysis & Design of Analog Integrated Circuits" , Wiley Publications on Education.

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Electronic Devices and Circuits

BTEXC303	PCC 2	Electronic Devices and Circuits	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3hrs/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites: Basic knowledge of Semiconductor Physics.

Course Outcomes: At the end of the course, students will be able to:

CO1	Comply and verify parameters after exciting devices by any stated method.
CO2	Implement circuit and test the performance.
CO3	Analyze small signal model of FET and MOSFET.
CO4	Explain behavior of FET at low frequency.
CO5	Design an adjustable voltage regulator circuits.

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

Course Contents:

Unit 1: JFET [04 Hours]
Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics, FET Configurations (CS/CD/CG) and their Comparison. Biasing of FET (Self).FET as an amplifier and its analysis (CS) and its frequency response, Small signal model, FET as High Impedance circuit

Unit 2: MOSFET& its DC Analysis [04 Hours]
Basics of MOS Transistor operation, Construction of n-channel E-MOSFET, E-MOSFET characteristics & parameters, non-ideal voltage current characteristics viz. Finite output resistance, body effect, sub-threshold conduction, breakdown effects and temperature effects. Common source circuit, Load Line & Modes of operation, common MOSFET configurations: DC Analysis, constant current source biasing, MOSFET as switch, diode/active resistor, Current sink and source, current mirror, Voltage references, Basic principle of band gap reference, CMOS Inverter as amplifier: Active load, Current source and Push pull configurations.

Unit 3: Electronics Amplifiers [04 Hours]
Classification of amplifiers, Fundamentals of Low noise and Power amplifiers. Feedback amplifiers: Feedback concept and topologies, Effect of feedback on terminal characteristics of amplifiers, feedback amplifier analysis, cascade amplifiers, DC Amplifiers.

Unit 4: Oscillators[04 Hours]
Barkhausen criterion, stability with feedback. Classification of oscillators, RC Oscillators: FET RC Phase Shift oscillator, Wein bridge oscillator, LC Oscillators: Hartley and Colpitts oscillators, Crystal oscillators, UJT Relaxation oscillator.

Unit 5: Multivibrators[04 Hours]
IC555 Block diagram, Types of Multivibrators: Astable, Monostable and Bistable, Operation of Multivibrators using FETs and IC555. Applications of IC555 in Engineering.

Unit 6: Voltage Regulator [04 Hours]
Block diagram of an adjustable three terminal positive and negative regulators (317,337) typical connection diagram, current boosting, Low drop out voltage regulators, Introduction to Switch Mode Power supply (SMPS), Block diagram of SMPS, Types of SMPS. Comparison of Linear Power supply and SMPS.

TEXT/REFERENCE BOOKS

1. Millman Halkias, "Integrated Electronics-Analog and Digital Circuits and Systems", Tata McGraw Hill, 2000

2. Donald Neaman, "Electronic Circuit Analysis and Design", 3rd Edition, Tata McGraw Hill

3. BrijeshIyer, S. L. Nalbalwar, R. Dudhe, "Electronics Devices & Circuits", Synergy Knowledgeware Mumbai, 2017. ISBN:9789383352616

4. David A. Bell, "Electronic Devices and Circuits",5thEdition, Oxford Press

5. R. L. Boylstad, L. Nashlesky, "Electronic Devices and circuits Theory", 9thEdition, Prentice Hall of India, 2006.

Network Analysis

BTEXC304	PCC 3	Network Analysis	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites:
Course Outcomes: At the end of the course, students will be able to:

CO1	Apply knowledge of mathematics to solve numerical based on network simplification and it will be used to analyze the same.

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CO2	Design passive filters and attenuators theoretically and practically. To apply knowledge for design of active filters as well as digital filters and even extend this to advance adaptive filters.
CO3	Identify issues related to transmission of signals, analyze different RLC networks.
CO4	Find technology recognition for the benefit of the society.

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Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

All units carry 10 Marks each for End Semester Examination.

Course Contents:

UNIT – 1 Basic Circuit Analysis and Simplification Techniques[6 hours]

Basic circuit elements, Simplification of networks, Equivalent 'T' and 'Π' networks of any complicated network, Voltage and Current laws (KVL/KCL), Network Analysis: Mesh, Super mesh, Node and Super Node analysis. Principle of duality, Source transformation and source shifting, Network Theorems such as Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems.

***Note**: Above circuit analysis, mentioned in this Unit-1, is for AC network only.*

UNIT - 2Frequency Selective Networks[6 hours]

Significance of Quality factor, Series Resonance: Resonating frequency, Reactance curves, Variation of circuit parameters such as impedance, phase angle, voltage and current with frequency; Bandwidth, Selectivity, Magnification factor, Parallel resonance: Resonant frequency, Variation circuit parameters such as admittance, phase angle, voltage and current with frequency; Bandwidth and selectivity. Analysis of parallel resonating circuit with resistance present in both branches (inductive and capacitive branches) and tank circuit, Effect of generator resistance on BW & Selectivity, Comparison and applications of series and parallel resonant circuits.

UNIT – 3 Electrical Network Parameters and Passive Filters[8 hours]

Classifications: Symmetrical and Asymmetrical networks. Properties of two port Network :(i) Symmetrical Networks (T and Π only): Characteristics impedance and propagation constant in terms of circuit components, open and short circuit parameters (ii) Asymmetrical Networks: Image Impedance and Iterative Impedance. Passive Filters: Filter fundamentals, Introduction to Neper and Decibel, Relation between Neper and Decibel, Constant K-LPF, HPF, BPF and BSF, m-derived LPF and HPF, Terminating

half sections, Concept of composite filters. Attenuators: Symmetrical T and Π type attenuators, Ladder attenuator.

UNIT – 4 Steady State and Transient Response[6 hours]

DC and AC response of R-L, R-C and RLC circuits, Analysis of electrical circuits using Laplace Transform.

UNIT – 5 Two Port Network Parameters and Functions[6 hours]

Terminal characteristics of network: Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions, Applications of the parameters. Network functions for one port and two port networks, Pole-zeros of network functions and network stability.

UNIT – 6 Transmission Line Theory[6 hours]

Types of Transmission lines, Transmission Line Equation, Equivalent circuits, Primary and Secondary line constants, Terminations of transmission lines, VSWR and Reflection Coefficient, Impedance matching, Transmission line measurements using Smith chart.

TEXT/REFERENCE BOOKS

1. D Roy Choudhary, "Network and Systems" 1st edition, New Age International,1988
2. John D. Ryder, "Network Lines and Fields" 2nd edition, PHI,1955
3. C. P. Kuriakose, "Circuit Theory Continuous and Discrete Time System, Elements of Network Synthesis"PHI
4. W.H. Hayt Kemmerly, "Engineering Circuit Analysis", 5th Edition, Tata McGraw Hill Publications,1993.
5. M. E. Van Valkenburg, "Network Analysis", 3rd Edition, Pearson, 2004. 6. Boylestead, "Introductory Circuit Analysis", 4th edition, Charles & Merrill, 1982. 7. Royal Signal Handbook on Line Communication.

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Digital Circuits & Microprocessors

BTEXC305S	PCC 4	Digital Circuits and Microprocessors	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3hrs/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Use the basic logic gates and various reduction techniques of digital logic circuit in detail.
CO2	Design combinational and sequential circuits.
CO3	Design and implement hardware circuit to test performance and application.
CO4	Understand the architecture and use of 8086 microprocessor. Understand instruction set and programming logic

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

Course Contents:

Unit 1: Combinational Logic Design[6 hours]
Standard representations for logic functions, k map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don‘t care conditions, Design Examples: Arithmetic Circuits, BCD - to - 7 segment decoder, Code converters. Adders and their use as subtractor, look ahead carry, ALU, Digital Comparator, Parity generators/checkers, Design of Multiplexers and De-multiplexers, Decoders.

Unit 2 Sequential Logic Design[6 hours]
1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip flops, Conversion of flip flops. Application of Flip- flops: Registers, Shift registers, Counters (ring counters, twisted ring counters), Sequence Generators, ripple counters, up/down counters, synchronous counters,

definitions of lock out, Clock Skew, and Clock jitter.

Unit 3: State Machines[6 hours]

Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, Sequence detector.

Unit 4: Digital Logic Families , PLD and Semiconductor memories [8 hours]

Classification of logic families, Characteristics of digital ICs-Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements. TTL logic, Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs. Tri-State logic. CMOS logic – CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic, open drain output. Interfacing CMOS and TTL, Comparison table of Characteristics of TTL, CMOS, ECL, RTL, I2L and DCTL

Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, Designing combinational circuits using PLDs. General Architecture of FPGA and CPLD Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM, ROM, EPROM, EEPROM, NVRAM, SRAM, DRAM.

Unit 5: Introduction to Microprocessor 8086 [8 hours]

Comparison of 8085 and 8086 microprocessor, 8086 microprocessor salient features, pin description, architecture of 8086: functional block diagram, Register organization, concepts of pipelining, memory segmentation and physical memory address generation, assembly language programming tools: editors, assembler, linker, debugger, assembler directives.

Unit 6: Instruction Set of 8086 and assembly language programming [8 hours]

Machine language instruction format, addressing modes, instruction set of 8086, arithmetic instructions, logical instructions, data transfer instructions, bit manipulation instructions, string operation instructions branching instructions, process control instructions.

Programming using assembler - Finding largest and smallest number from array, sorting numbers in ascending and descending order, finding odd, even, positive and negative numbers in array, block transfer, string operations- length , reverse, compare, concatenation, copy , count number of 1's and 0's in 16 bit numbers, introduction to procedure and macro.

TEXT/REFERENCE BOOKS

1. R.P. Jain, ―Modern digital electronics, 3rd edition, 12threprint Tata McGraw Hill Publication,2007.

2. M. Morris Mano, ―Digital Logic and Computer Design, 4th edition, Prentice Hall of India, 2013.

3. Anand Kumar, ―Fundamentals of digital circuits, 1st edition, Prentice Hall ofIndia, 2001.

4. Microprocessor-Architecture, programming and application with 8086, Gaonkar, penram international.

5. D V kodavade, S. Narvadkar, 8085-86 microprocessors Architecture progg and interfaces, wiley.

6. Rout 8085 microprocessors-architecture, programming and application, 2nd edition,penram

International.

7. Sunil Mathur, Microprocessor 8086 Architecture, Programming and Interfacing, Prentice Hall India,.

Basic Human Rights

BTHM3401	HSMC	Basic Human Rights	0-2-0	Audit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 50 Marks

Pre-Requisites: None

Course Outcomes: At the end of the course, students will be able to:

CO1	Simply put, human rights education is all learning that develops the knowledge, skills, and values of human rights.
CO2	Strengthen the respect for human rights and fundamental freedoms.
CO3	Enable all persons to participate effectively in a free society.
CO4	Learn about human rights principles, such as the universality, indivisibility, and interdependence of human rights.
CO5	Learn about regional, national, state, and local law that reinforces international human rights law.
CO6	Learn and know about and being able to use global, regional, national, and local human rights instruments and mechanisms for the protection of human rights.

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1												
CO2												
CO3												
CO4												

UNIT – 1The Basic Concepts

Individual, Group, Civil Society, State, Equality, Justice, Human Values: - Humanity, Virtues, Compassion.

UNIT – 2 Human Rights and Human Duties

Origin, Civil and Political Rights, Contribution of American Bill of Rights, French Revolution, Declaration of Independence, Rights of Citizen, Rights of working and Exploited people, Fundamental Rights and Economic program, India's Charter of freedom

UNIT – 3 Society, Religion, Culture, and their Inter-Relationship

Impact of Social Structure on Human behavior, Roll of Socialization in Human Values, Science and Technology, Modernization, Globalization, and Dehumanization.

UNIT – 4Social Structure and Social Problems

Social and Communal Conflicts and Social Harmony, Rural Poverty, Unemployment, Bonded Labour, Migrant workers and Human Rights Violations, Human Rights of mentally and physically challenged

UNIT – 5 State, Individual Liberty, Freedom and Democracy

The changing of state with special reference to developing countries, Concept of development under development and Social action, need for Collective action in developing societies and methods of Social action, NGOs and Human Rights in India: - Land, Water, Forest issues.

UNIT – 6 Human Rights in Indian Constitution and Law

The constitution of India:

(i) Preamble

(ii) Fundamental Rights

(iii) Directive principles of state policy

(iv) Fundamental Duties

(v) Some other provisions

Universal declaration of Human Rights and Provisions of India, Constitution and Law, National Human Rights Commission and State Human Rights Commission.

TEXT/REFERENCE BOOKS

1. Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd.),2005.
2. Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

Analog Circuits Lab

BTEXL307	PCC 1 Lab	Analog Circuits Lab	0-0-2	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks External Exam: 40 Marks

Pre-Requisites: None

Course Outcomes: At the end of the course, students will be able to:

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	
CO7	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												
CO7												

List of Practicals/Experiments/Assignments (any ten experiments from the list)

Annexure-I

1. Measure Op-Amp parameters and compare with the specifications. Input bias current, input offset current and input offset voltage. slew rate , CMRR .
2. Design, build and test integrator for given frequency f_a.
3. Design, build and test three Op-Amp instrumentation amplifiers for typical application
4. Design, build and test precision half & full wave rectifier.
5. Design, build and test Schmitt trigger and plot transfer characteristics.
6. Design, build and test PLL.
7. 2 bit DAC and 2 bit ADC.
8. Design and implement 2bit R-2R ladder DAC.
9. Design and implement 2bit flash type ADC.
10. Design, build and test square & triangular wave generator.
11. Verify and understand practically virtual ground and virtual short concept in inverting and non-inverting configuration.
12. Plot DC transfer characteristics of emitter coupled differential amplifier.
13. Study effect of emitter resistance and constant current source on figure of merit (CMRR) of emitter coupled differential amplifier.
14. Design and implement V-I converter.
15. Any experiment based on application of Op-Amp.

Electronic Devices and Circuits Lab

BTEXL308	PCC 2 Lab	Electronic Devices and Circuits Lab	0-0-2	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2hrs/batch	Continuous Assessment: 60 Marks
	External Exam: 40 Marks

Pre-Requisites: None

Course Outcomes: At the end of the course, students will be able to:

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												

CO2												
CO3												
CO4												
CO5												
CO6												

List of Practicals/Experiments/Assignments (any ten experiments from the list)

1. Verify DC operating point for a single stage BJT in CE configuration.
- Calculate values biasing resistors (R1,R2,RE) to operate BJT at a certain VCEQ & ICQ
- Build the circuit with these components
- Measure VCEQ, ICQ, IBQ and VBEQ
- Compare measured quantities with theoretical values

2. Build and test single stage CE amplifier.
- Connect coupling and emitter bypass capacitors
- To measure the voltage gain, input resistance (Ri), output Resistance (Ro) of the amplifier.
- Verify phase difference between input and output voltage.
- To measure the bandwidth.

3. Build and test a sensing circuit for slotted disc using photo diode/Optocoupler [H 21 A 1] in RPM indicator.
- Identify the terminal of optical device.
- Relevance of slot and speed.
- Measure RPM using oscilloscope/frequency counter.

4. Design a single stage FET Amplifier in CS configuration and verify DC operating point.

5. Simulate frequency response of single stage CS amplifier (use same circuit) and find the bandwidth.

6. Simulate Voltage-Series feedback amplifier and calculate Rif, Rof, Avf and Bandwidth.

7. Simulate LC oscillator using FET.

8. Implement Weinbridge /RC phase shift oscillator using FET/MOSFET

9. Build and test MOSFET as a switch.

10. Design and implement an adjustable voltage regulator using three terminals voltage regulator IC.

Annexure-I
Network Analysis Lab

BTEXL309	PCC 3 Lab	Network Analysis Lab	0-0-2	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks
	External Exam: 40 Marks

Pre-Requisites: None

Course Outcomes: At the end of the course, students will be able to:

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

List of Practicals/Experiments/Assignments (all experiments from the list)

1. Network Theorems :
   To verify Thevenin's and Maximum Power Transfer theorem for reactive circuits.
2. Frequency selective networks - I :
   To build and test Series and Parallel resonant circuits.(Resonant frequency, Q and Bandwidth, calculations).
3. Frequency selective networks - II :
   To plot the frequency response of Twin T or Wein-bridge circuit. (Null frequency calculation)
4. Filter circuits:
   To design build and test constant K- LPF and HPF circuits. Plot the frequency response for both.
5. Attenuators:
   To design, build and test T and ∏ attenuator for given fixed attenuation. Plot attenuation Vs RL graph

6. Transmission line:

To measure the primary and secondary line constants of a given transmission line i.e. flat type cable or co-axial cable.

Digital Circuits and Microprocessor Lab

BTEXSL310	PCC 4 Lab	Digital Circuits and Microprocessor Lab	0-0-2	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks
	External Exam: 40 Marks

Pre-Requisites: None

Course Outcomes: At the end of the course, students will be able to:

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

List of Practicals/Experiments/Assignments (any ten experiments from the list)

1. Study of IC-74LS153 as a Multiplexer. (Refer Data-Sheet).Design and Implement 8:1 MUX using IC-74LS153 & Verify its Truth Table. Design & Implement the given 4 variable function using IC74LS153. Verify its Truth-Table.
2. Study of IC-74LS138 as a Demultiplexer / Decoder (Refer Data-Sheet). Practical) (Test Benches and FSM excluded). Design and Implement full adder and subtractor function using IC- 74LS138.Design & Implement 3-bit code converter using IC-74LS138.(Gray to Binary/Binary to Gray)
3. Study of IC-74LS83 as a BCD adder,(Refer Data-Sheet). Design and Implement 1 digit BCD adder using IC-74LS83. Design and Implement 4-bit Binary sub tractor using IC-

74LS83.

4. Study of IC-74LS85 as a magnitude comparator,(Refer Data-Sheet) Design and Implement 4-bit Comparator. Design and Implement 8-bit Comparator.
5. Study of Counter ICs (74LS90/74LS93). (Refer Data-Sheet) Design and Implement MOD-N and MOD-NN using IC-74LS90 and draw Timing diagram. Design and Implement MOD-N and MOD-NN using IC-74LS93 and draw Timing diagram.
6. Study of synchronous counter -Design & Implement 4-bit Up/down Counter and MOD-N Up/down Counter using IC74HC191/ IC74HC193. Draw Timing Diagram.
7. Verify four voltage and current parameters for TTL and CMOS (IC 74LSXX, 74HCXX), (Refer Data-Sheet).
8. Study of Shift Register (74HC194/74LS95), (Refer data-Sheet) Design and Implement Pulse train generator using IC-74HC194/IC74LS95 (Use right shift /left shift).
9. Design and Implement 4-bit Ring Counter/ Twisted ring Counter using shift registers IC 74HC194/IC74LS95.
10. Write an assembly language programs to perform various arithmetic and logical operations.
11. Write an assembly language program to perform internal and external memory transfer operations.
12. Write an assembly language program to perform string operations.
13. Write an assembly language program using procedure and macro.

Electronics Workshop

BTEXW311	PCC 5 Lab	Electronics Workshop	0-0-2	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 30 Marks
	Internal Exam: 20 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

Mini Project based on third semester syllabus will be completed in the semester.

Data Structure Lab

BTEXL312S	ESC Lab	Data Structure Lab	0-0-2	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 30 Marks
	External Exam: 20 Marks

Pre-Requisites: None

Course Outcomes: At the end of the course, students will be able to:

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

Annexure-I

List of Practicals/Experiments/Assignments (any ten experiments from the list)

1. Write C program to store student information (e.g. Roll No, Name, Percentage etc.).
   a) Display the data in descending order of Percentage (Bubble Sort).
   b) Display data for Roll No specified by user (Linear Search).
   c) Display the number of passes and comparisons for different test cases (Worst, Average, Best case).
2. Perform following String operations with and without pointers to arrays (without using the library functions): a. substring, b. palindrome, c. compare, d. copy, e. reverse
3. Data base Management using array of structure with operations Create, display, Modify, Append, Search and Sort.(For any database like Employee or Bank database with and without pointers to structures)
4. Create a singly linked list with options:
   a) Insert (at front, at end, in the middle),
   b) Delete (at front, at end, in the middle),
   c) Display,
   d) Display Reverse,
   e) Revert the SLL.
5. Implement Stack using arrays & Linked Lists. Write a menu driven program to perform following operations on stack a) Push b) Pop c) Display.
6. Implement Queue using arrays & Linked Lists. Write a menu driven program to perform following operations on Queue a) Insert b) Delete c) Display.
7. Binary search tree: Create, search, recursive traversals.
8. Graph using adjacency Matrix with BFS & DFS traversals.
9. Implement set operations using arrays and perform union, intersection, difference, symmetric difference.
10. Accept input as a string and construct a Doubly Linked List for the input string with eachnode contains, as a data one character from the string and perform: a) Insert b) delete, c) Display forward, d) Display backward.
11. Represent graph using adjacency list or matrix and generate minimum spanning tree using Prism's algorithm
12. Read & write operations in a text file.
13. Polynomial addition using array of structure.
14. Evaluation of postfix expression (input will be postfix expression).
15. Implement following Matrix operations:
    a) addition with pointers to arrays,
    b) multiplication without pointers to arrays
    c) transpose with pointers to arrays

Annexure-I

Semester IV
Electrical Machines and Instruments

BTESC401	ESC	**Electrical Machines and Instruments**	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week Tutorial: 0 hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	The ability to formulate and then analyze the working of any electrical machine using mathematical model under loaded and unloaded conditions.
CO2	The skill to analyze the response of any electrical machine.
CO3	The ability to troubleshoot the operation of an electrical machine.
CO4	The ability to select a suitable measuring instrument for a given application.
CO5	The ability to estimate and correct deviations in measurements due to the influence of the instrument and due to the accuracy of the instrument.

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

Course Contents:

Unit 1: DC Machines [08 Hours]

DC machines construction, working principle (motor & generator), EMF equation of DC Machine (motor and generator), Types and its characteristics of DC machines (motor and generator), back emf, starters of dc machine, Speed control of DC motor Breaking of DC motor, applications of DC machines (motor and generator).

Unit 2: Induction Motor and Synchronous Motor [Hours]

Induction Motor: Construction, working principle, types, torque equation, torque slip

characteristics, power stages, losses and efficiency, starters speed control, breaking, applications.

Synchronous motor: Construction, working principle, starting methods, effect of load, hunting, V-curve, synchronous condenser, applications.

Unit 3: Special Purpose Machines[08 Hours]

Construction, working and application of steeper motor, variable reluctance motor, servo motor, FHP motor, hysteresis, repulsion, linear IM.

Unit 4: Sensors and Transducers [08 Hours]

Classification selection of transducers strain gauges, LVDT, Temperature transducers, piezoelectric, photosensitive transducers, Hall Effect transducers, proximity devices Digital transducers need of signal conditioning and types, interfacing techniques of transducers with microprocessor and controller.

Unit 5: Industrial Measurement and Industrial Applications [08 Hours]

Measurement of vibration, electrical telemetry thickness, humidity, thermal conductivity and gas analysis emission computerized tomography, smoke and fire detection, burglar alarm, object counter level measurement, on /off timers, RTC, sound level meter, tachometer, VAW meter.

Unit6: I/O Devices [08 Hours]

Recorder X- Y plotters and its applications, optical oscillograph.

TEXT/REFERENCE BOOKS

1. A course in Electrical and Electronic Measurement and Instrumentation" by A. K. Sawhney (Publisher name: DhanpatRai&Co.)
2. Electronics Instrumentation by H.S. Kalsi (Publisher McGrawHill)
3. Electrical Machines by Ashfaqu Husain, Dhanpatrai and publication
4. Instrumentation Devices System edition C. S. Rajan, G. R.sharma
5. Abhijit Chakrabarti & Sudipta Debnath, "Electrical Machines", Tata McGraw-hill Publication.
6. William H Hayt, Jack E Kimmerly and Steven M. Durbin, "Engineering Circuit Analysis", Tata McGrawHill.
7. A.E. Fitzgerald, Charles Kingsley & Jr. Stephen D. Umans, "Electrical Machinery", Tata McGraw-hill Publication 6thEdition.
8. I.J Nagarath& D.P Kothari, "Electrical Machines", Tata McGraw-hill Publication4th

Edition.

9. T. J. E. Miller, "Brushless permanent-magnet and reluctance motor drives", Oxford University Press(1989).
10. Ned Mohan, "Electric Machines and Drives": A first course,Wiley.
11. B. L. Theraja, "Electrical technology" volume 2, S.Chand.

Analog Communication Engineering

BTEXC402	PCC 1	Analog Communication Engineering	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week Tutorial: 0 hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	1. Understand and identify the fundamental concepts and various components of analog communication systems.
CO2	2. Understand the concepts of modulation and demodulation techniques.
CO3	3. Design circuits to generate modulated and demodulated wave.
CO4	4. Equip students with various issues related to analog communication such as modulation, demodulation, transmitters and receivers and noise performance.
CO5	5. Understand the concepts of modulation and demodulation techniques of angle modulation (frequency and phase).
CO6	6. Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.
CO7	7. Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

Course Contents:

Unit 1: Introduction to Communication System[08 Hours]

Block schematic of communication system, Simplex and duplex systems, Modes of communication: Broadcast and point to point communication, Necessity of modulation, Classification of modulation, sampling theorem and pulse analog modulation, multiplexing: TDM, FDM.

Unit 2: Amplitude Modulation [4 Hours]

Introduction, Mathematical analysis and expression for AM, Modulation index, Frequency spectrum and bandwidth of AM, Power calculations, Generation of AM using nonlinear property, Low and high level modulation, Balance Modulator.

Types of AM: DSB-FC, DSB-SC, SSB-SC, ISB and VSB, their generation methods and comparison.

Unit 3: Angle Modulation [4 Hours]

Introduction, Mathematical analysis of FM and PM, Modulation index for FM and PM, Frequency spectrum and bandwidth of FM, Narrow band and wide band FM, Direct and indirect methods of FM generation, Pre emphasis and de-emphasis, Comparison of AM, FM and PM.

Unit 4: Radio Receivers and Demodulators [08 Hours]

Introduction, Performances characteristic of receivers: Sensitivity, Selectivity, Fidelity, Image frequency and IFRR, Tracking and Double spotting, TRF, Super heterodyne receivers, RF amplifier, Local oscillator and mixer, IF amplifier, AGC.

Unit 5:AM and FM detectors [08 Hours]

AM Detectors: Envelop detector and practical diode detector.

FM Detectors: Slope detector, phase discriminator and ratio detector.

Unit6: Noise [04 Hours]

Introduction, Sources of noise, Classification of noise, Noise calculations (thermal noise), SNR, Noise figure, Noise Factor, Noise Temperature.

Annexure-I

TEXT/REFERENCE BOOKS

1.Kennedy, "Electronics Communications Systems", McGraw-Hill New Delhi-1997

4th Edition.

2.Anokh Singh, "Principles of communication engineering"S.Chand

3.Roddy&Coolen, "Electronic communication"PHI

4.Taub& Schilling "Principles of communication systems" Tata McGrawHill

5.Beasley& Miller, "Modern Electronic Communication", Prentice-Hall India-2006,

8th Edition.

6.WayneTomasi, "Electronic Communication Systems", Pearson Education-2005,

5th Edition.R. G. Gupta, "Audio & Video Systems" Tata McGraw-Hill NewDelhi-2008.

Microcontroller

BTEXC403S	PCC 2	Microcontroller	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week Tutorial: 0 hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	1. Learn importance of microcontroller in designing embedded application.
CO2	2. Learn use of hardware and software tools.
CO3	3. Develop interfacing to real world devices.

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												

CO3												
CO4												
CO5												
CO6												

Course Contents:

Unit 1: Introduction to Microcontroller Architecture[08 Hours]

Overview of MCS-51 architecture, Block diagram and explanation of 8051, Port structure , memory organization, Interrupt structure, timers and its modes, serial communication modes. Overview of Instruction set, Sample programs (assembly): Delay using Timer and interrupt, Programming Timer 0&1, Data transmission and reception using Serial port.

Unit 2: IO Port Interfacing-I [08 Hours]

Interfacing of: LEDS, Keypad, 7-segment multiplexed display, LCD, ADC 0809(All programs in assembly). Programming environment: Study of software development tool chain (IDE), hardware debugging tools (timing analysis using logic analyzer).

Unit 3: Parallel Port Interfacing-II[08 Hours]

Interfacing of: DAC, Temperature sensors, Stepper motor, Motion detectors, Relay, Buzzer, Opto isolaters, Design of DAS and Frequency counter: All programs in assembly.

Unit 4: PIC Microcontroller Architecture[08 Hours]

Features, comparison & selection of PIC series as per application. PIC18FXX architecture- MCU, Program and Data memory organization, Pin out diagram, Reset operations, Oscillator options (CONFIG), BOD, power down modes & configuration bit settings, timer and its programming, Brief summary of Peripheral support, Overview of instruction set.

Unit 5: Real World Interfacing Part I[08 Hours]

Port structure with programming, Interrupt Structure (Legacy and priority mode) of PIC18FWith SFRS. Interfacing of LED, LCD (4&8 bits), and Key board, use of timers with interrupts, CCP modes: Capture, Compare and PWM generation, DC Motor speed control with CCP: All programs in embedded C

Unit 6: Real World Interfacing Part II[08 Hours]

Basics of Serial Communication Protocol: Study of RS232, RS 485, I2C,SPI, MSSP structure (SPI &I2C),UART, Sensor interfacing using ADC, RTC(DS1306) with I2C and EEPROM with SPI. Design of PIC test Board, Home protection System: All programs in embedded C

DC machines construction, working principle (motor & generator), EMF equation of DC Machine (motor and generator), Types and its characteristics of DC machines (motor and generator), back emf, starters of dc machine, Speed control of DC motor Breaking of DC motor, applications of DC machines (motor and generator).

TEXT/REFERENCE BOOKS

1. Mahumad Ali Mazadi, ―The 8051 microcontroller & embedded systems, 2nd Edition ,PHI
2. Mahumad Ali Mazadi,―PIC Microcontroller & Embedded System, 3rd Edition ,Pearson.

Signals and Systems

BTEXC404	PCC 3	Signals and Systems	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week Tutorial: 0 hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	1. Understand mathematical description and representation of continuous and discrete time signals and systems.
CO2	2. Develop input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system.
CO3	3. Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.
CO4	4. Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s-domain.
CO5	5. Understand the basic concept of probability, random variables & random signals and develop the ability to find correlation, CDF, PDF and probability of a given event.

Annexure-I

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

Course Contents:

Unit 1: Introduction to Signals and Systems[08 Hours]

Introduction and Classification of signals: Definition of signal and systems, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power, elementary signals used for testing: exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sinc Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding, Sampling Theorem and reconstruction of sampled signal, Concept of aliasing, examples on under sampled and over sampled signals.

Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

Unit 2: Time domain representation of LTI System[08 Hours]

System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral using graphical method, Computation of convolution sum. Properties of convolution, properties of the system based on impulse response, step response in terms of impulse response.

Unit 3: Fourier Series[08 Hours]

Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, FS representation of CT signals using exponential Fourier series, Fourier spectrum representation, properties of Fourier series, Gibbs phenomenon, Discrete Time Fourier Series and its properties.

Unit 4: Fourier transform[08 Hours]

Fourier Transform (FT) representation of aperiodic CT signals, Dirichlet condition for

existence of Fourier transform, evaluation of magnitude and phase response, FT of standard CT signals, FT of standard periodic CT signals, Introduction to Fourier Transform of DT signals, Properties of CTFT and DTFT, Fourier Transform of periodic signals. Concept of sampling and reconstruction in frequency domain, sampling of bandpass signals.

Unit 5Laplace and Z-transform[08 Hours]

Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform, ROC and its properties, properties of Laplace transform, Laplace transform evaluation using properties, Inverse Laplace transform based on partial fraction expansion, Application of Laplace transforms to the LTI system analysis.

Introduction to Z-transform, and its properties, Inverse Z-transform, different methods of inverse Z-transform, Z-transform for discrete time system LTI analysis.

Unit 6Probability and Random Signals[08 Hours]

Probability: Experiment, sample space, event, probability, conditional probability and statistical independence, Bayes theorem, Random variables: Continuous and Discrete random variables, cumulative distributive function, Probability density function, properties of CDF and PDF. Definitions: Statistical averages, mean, moments and expectations, standard deviation and variance, Introduction to Correlation: Autocorrelation, Cross correlation, and their properties.

TEXT/REFERENCE BOOKS

1. Alan V. Oppenheim. Alan S. Willsky and S. Hamid Nawab, “Signals and Systems”,PHI
2. Dr. S. L. Nalbalwar, A.M. Kulkarni and S.P. Sheth, “Signals and Systems”, 2nd Edition, Synergy Knowledgeware,2017
3. Simon Haykins and Barry Van Veen, “Signals and Systems”, 2nd Edition, WileyIndia.
4. ShailaApte, “Signals and Systems-principles and applications”, Cambridge University press, 2016.
5. MrinalMandal and Amir Asif, Continuous and Discrete Time Signals and Systems, Cambridge University Press,2007.
6. Peyton Peebles, “Probability, Random Variable, Random Processes”, 4th Edition, Tata McGraw Hill.
7. A. NagoorKanni “Signals and Systems”, 2nd edition, McGrawHill.
8. NPTEL video lectures on Signals andSystems.

Annexure-I

Control System Engineering

BTEXC405S	PCC 4	Control System Engineering	3-0-0	3 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week Tutorial: 0 hr/week	Continuous Assessment: 60 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs)

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	1. Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.
CO2	2. Determine the (absolute) stability of a closed-loop control system.
CO3	3. Perform time domain and frequency domain analysis of control systems required for stability analysis.
CO4	4. Perform time domain and frequency domain correlation analysis
CO5	5. Apply root-locus, Frequency Plots technique to analyze control systems.
CO6	6. Express and solve system equations in state variable form.

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

Course Contents:

Unit 1: Control System Modeling [08 Hours]

Basic Elements of Control System, Open loop and Closed loop systems, Differential equations and Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph.

Unit 2: Time Response Analysis[08 Hours]

Standard input signals, Time response analysis of First Order Systems, Time response analysis of second order systems, Steady state errors and error constants, design specifications for second order systems.

Unit 3: Stability Analysis [08 Hours]

Concept of Stability, Routh-Hurwitz Criterion, Relative Stability, Root Locus Technique, Construction of Root Locus, Dominant Poles, Application of Root Locus Diagram.

Unit 4: Frequency Response Analysis [08 Hours]

Frequency domain Versus Time domain analysis and its correlation, Bode Plots, Polar Plots and development of Nyquist Plots. Frequency Domain specifications from the plots, Stability analysis from plots.

Unit 5: State Variable Analysis [08 Hours]

State space advantages and representation, Transfer function from State space, physical variable form, phase variable forms: controllable canonical form, observable canonical form, Solution of homogeneous state equations, state transition matrix and its properties, computation of state transition matrix by Laplace transform method only, Concepts of Controllability and Observability.

Unit 6: Controllers And Digital Control Systems [08 Hours]

Introduction to PLC: Block schematic, PLC addressing, any one application of PLC using Ladder diagram. Introduction to PID controller: P, PI, PD and PID Characteristics and concept of Zeigler-Nicholas method. Digital control systems: Special features of digital control systems, Necessity of sample and hold operations for computer control, z-transform and pulse transfer function, Stability and response of sampled-data systems.

TEXT/REFERENCE BOOKS

1. N. J. Nagrath and M.Gopal, “Control System Engineering”, New Age International Publishers, 5th Edition, 2009.
2. Benjamin C. Kuo, “Automatic control systems”, Prentice Hall of India, 7th Edition,1995.
3. M. Gopal, “Control System – Principles and Design”, Tata McGraw Hill, 4th Edition, 2012.
4. Schaum’s Outline Series, “Feedback and Control Systems” Tata McGraw-Hill, 2007.
5. John J. D’Azzo& Constantine H. Houpis, “Linear Control System Analysis and Design”, Tata McGraw-Hill, Inc., 1995.
6. Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Addison – Wesley, 1999.

Annexure-I

Soft-Skill Development

BTHML411	HSMC	Soft-Skill Development	0-0-2	1 Credits

Teaching Scheme:	**Examination Scheme:**
Lecture: 2hrs/week	Continuous Assessment: 60 Marks Internal Exam (Oral): 40 Marks

Pre-Requisites: None

Course Outcomes: At the end of the course, students will be able to:

CO1	Acquire interpersonal communication skills
CO2	Develop the ability to work independently.
CO3	Develop the qualities like self-discipline, self-criticism and self-management.
CO4	Have the qualities of time management and discipline.
CO5	Present themselves as an inspiration for others
CO6	Develop themselves as good team leaders

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								1				
CO2										2		
CO3												2
CO4									1			
CO5										2		
CO6											3	

Course Contents:

Unit 1:Development of Proficiency in English[06 Hours]
Speaking skills, Feedback & questioning technique, Objectivity in argument (Both one on one and in groups). 5 Wsand 1 H and 7 Cs for effective communication. Imbibing etiquettes and manners. Study of different pictorial expressions of non-verbal communication and their analysis

Unit 2: Self-Management[06 Hours]
Self-Management, Self-Evaluation, Self-discipline, Self-criticism; Recognition of one's own limits and deficiencies, dependency, etc.; Self-Awareness, Self-

Management, Identifying one's strengths and weaknesses, Planning & Goal setting, Managing self-emotions, ego, pride. Leadership and Team Dynamics

Unit 3: Time Management Techniques[06 Hours]

Practice by game playing and other learning strategies to achieve the set targets Time Management Concept; Attendance, Discipline and Punctuality; Acting in time, Quality
/Productive time.

Unit 4: Motivation/Inspiration[06 Hours]

Ability to shape and direct working methods according to self-defined criteria, Ability to think for oneself, Apply oneself to a task independently with self-motivation.

Motivation techniques: Motivation techniques based on needs and field situations

Unit 5: Interpersonal Skills Development[06 Hours]

Positive Relationship, Positive Attitudes, Empathise: comprehending others' opinions, points of views, and face them with understanding, Mutuality, Trust, Emotional Bonding, Handling Situations (Interview), Importance of interpersonalskills.

Unit 6: Effective Computing Skills[06 Hours]

Designing an effective Presentation; Contents, appearance, themes in a presentation, Tone and Language in a presentation, Role and Importance of different tools for effective presentation.

References:

1. Mitra, Barun, "Personality Development and Soft Skills", Oxford University Press,2016.
2. Ramesh, Gopalswamy, "The Ace of Soft Skills: Attitude, Communication and Etiquette for Success", Pearson Education,2013.
3. Stephen R. Covey, "Seven Habits of Highly Effective People: Powerful Lessons in Personal Change", Free Press Publisher,1989.
4. Rosenberg Marshall B., "Nonviolent Communication: A Language of Life" 3rd edition, Puddle dancer Press, 1st September,2003.

Control SystemsEngineering Lab

BTEXL406S	PCC 41 Lab	Control SystemsEngineering Lab	0-0-2	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks External Exam: 40 Marks

Pre-Requisites: None

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Course Outcomes: At the end of the course, students will be able to:

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	
CO7	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												
CO7												

List of Practicals/Experiments/Assignments (all experiments from the list)

1. Time response of First order system.
2. Time response of Second order system.
3. Temperature controller using ON OFF controller.
4. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system .
5. Effect of P, PD, PI, PID Controller on a second order systems.
6. Temperature controller using PID controller.
7. To study DC position control system
8. To determine speed-torque characteristics of an ac servomotor

Electrical Machines and Instruments Lab

BTESC407	ESC2 Lab	Electrical Machines and Instruments Lab	0-0-2	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks
	Internal Exam: 40 Marks

Pre-Requisites: None

Course Outcomes: At the end of the course, students will be able to:

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

List of Practicals/Experiments/Assignments (any ten experiments from the list)

1. Load test on dc shunt motor to draw speed – torque and horse power – efficiency characteristics.
2. Field Test on dc series machines.
3. Speed control of dc shunt motor by armature and field control.
4. Swinburne's Test on dc motor.
5. Retardation test on dc shunt motor.
6. Regenerative test on dc shunt machines.
7. Load test on three phase induction motor.
8. No load and Blocked rotor test on three phase induction motor to draw (i) equivalent circuit and (ii) circle diagram.
9. Determination of performance parameters at different load conditions from (i) and (ii). 9. Load test on induction generator.
10. Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics.
11. Conduct suitable tests to draw the equivalent circuit of single phase induction motor and determine performance parameters.

Analog Communication Engineering Lab

BTEXL408	PCC 1 Lab	Analog Communication Engineering Lab	0-0-2	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks
	External Exam: 40 Marks

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Pre-Requisites: None

Course Outcomes: At the end of the course, students will be able to:

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

List of Practicals/Experiments/Assignments (all experiments from the list)

1. AM Generation (DSB-FC): Calculation of modulation index by graphical method, Power of AM Wave for different modulating signal.
2. Generation of DSB-SC with the help of Balanced Modulator IC1496/1596 & its detection
3. SSB modulator using Filter method/ phase shift method & its detection
4. Frequency modulator & demodulator using IC 565 (PLL based), calculation of modulation index & BW of FM
5. Generate AM and FM waveform for given modulation index, signal frequency and carrier Frequency using suitable software.
6. Verification of Sampling Theorem, PAM Techniques, (Flat top & Natural sampling), reconstruction of original signal,
7. Prove sampling Theorem. Reconstruct the analog signal from its samples. Observe aliasing effect by varying sampling frequency.
8. Study of AM & FM Spectrum: Observe Spectrum of AM & FM on Spectrum Analyzer, Compare & comment on AM & FM spectrum. Observe Effect of Eigen values on carrier power in FM.
9. Measurement of Performance Characteristics of Receiver: Sensitivity, Selectivity, Fidelity
10. Design, Build & Test class C tuned amplifier for AM Generation / Simulate using desirableSoftware

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Microcontroller Lab

BTEXL409S	PCC 4 Lab	Microcontroller Lab	0-0-2	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks
	External Exam: 40 Marks

Pre-Requisites: None

Course Outcomes: At the end of the course, students will be able to:

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

List of Practicals/Experiments/Assignments (any ten experiments from the list)

1. To study development tools/environment for ATMEL/PIC microcontroller programme and Architecture.
2. Write an assembly language program to add, subtract, multiply and divide 16 bit data by AtmelMicrocontroller.
3. Write an ALP to generate square of 10KHz using Timer 0.
4. Write an ALP to display a string on LCD.
5. Write an ALP to interface seven segment with 8051 and display 0-9 on it.
6. Write an ALP to interface Stepper Motor with 8051.
7. Write an ALP to interface ADC with 8051.
8. Write an ALP to interface DAC with 8051.
9. Write an ALP to interface 4x4 keyboard with 8051.

10. Study of Programming and Transmission of data through serial port.
11. Study of Programming and Reception of data through serial port.
12. To study implementation and programming of Temperature measurement.
13. Study and analysis of interfacing of LCD using PIC Controller.
14. Write an embedded C program to interface keyboard with PIC.
15. Write an embedded C program to interface DC motor with PIC
16. Write program to Generate square wave using PIC microcontroller.
17. Writing a C language program to implement PIC micro serial communication.

Signals and Systems Lab

BTEXL410	PCC 3 Lab	**Signals and Systems Lab**	0-0-2	1 Credit

Practical Scheme:	**Examination Scheme:**
Practical: 2 hrs/batch	Continuous Assessment: 60 Marks
	Internal Exam: 40 Marks

Pre-Requisites: None

Course Outcomes: At the end of the course, students will be able to:

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

Mapping of course outcomes with program outcomes

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

List of Practicals/Experiments/Assignments (all experiments from the list)

1. Write a program to generate Sinusoidal Signals.

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2. Write a program to generate the discrete sequences (i) unit step (ii) unit impulse (iii) ramp . Plot all the sequences.
3. Write a program to perform different operations on signals.
4. Write a program to find Convolution of Signals.
5. Write a program to perform Sampling and reconstruction of continuous time signals.
6. Write a program to find the autocorrelation and cross correlation of sequences.
7. Write a program to find the trigonometric Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings.