UNIVERSITY OF MUMBAI

Bachelor of Electronics Engineering

Third Year (Semester V), Revised course

(Rev2012) From Academic Year 2013-14

(As per Credit Based Semester and Grading System with effect from the academic year 2012–2013)

Semester V

Sub Code	Subject Title	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXC501	Microcontrollers and Applications	04	--	--	04	--	--	04
EXC502	Design with Linear Integrated Circuits	04	--	--	04	--	--	04
EXC503	Electromagnetic Engineering	04	--	--	04	--	--	04
EXC504	Signals and Systems	04	--	#01	04	--	01	05
EXC505	Digital Communication	04	--	--	04	--	--	04
EXS506	* Business Communication and Ethics	--	*04	--	--	02	--	02
EXL501	Microcontrollers and Applications Laboratory	--	02	--	--	01	--	01
EXL502	Design with Linear Integrated Circuits Laboratory		02			01	--	01
EXL503	Digital Communication Laboratory	--	02	--	--	01	--	01
EXL504	Mini Project I	--	#02	--	--	02	--	02
Total		20	10+02	01	20	07	01	28

*Common to all branches, 02 Hrs. Class wise and 02 Hrs. Batch wise   # Class wise

Semester V

Subject Code	Subject Title	Examination Scheme							
		Theory Marks				Term Work	Practical And Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. of Test 1 & Test 2					
EX501	Microcontrollers and Applications	20	20	20	80	--	--	--	100
EX502	Design with Linear Integrated Circuits	20	20	20	80	--	--	--	100
EX503	Electromagnetic Engineering	20	20	20	80	--	--	--	100
EX504	Signals and Systems	20	20	20	80	25	--	--	125
EX505	Digital Communication	20	20	20	80	--	--	--	100
EX506	* Business Communication and Ethics	--	--	--	--	50	--	--	50
EXL501	Microcontrollers and Applications Laboratory	--	--	--	--	25	25	--	50
EXL502	Design with Linear Integrated Circuits Laboratory	--	--	--	--	25	25	--	50
EXL503	Digital Communication Laboratory	--	--	--	--	25	25	--	50
EXL504	Mini Project I	--	--	--	--	25	--	25	50
Total		100	100	100	400	175	75	25	775

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXC501	Microcontrollers and Applications	04	--	--	04	--	--	04

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of Test 1 and Test 2					
EXC501	Microcontrollers and Applications	20	20	20	80	--	--	--	100

Course Pre-requisite:
- EXC303: Digital Circuits and Design
- EXC402: Discrete Electronic Circuits
- EXC403: Microprocessor and Peripherals

Course Objectives:
1. Learner shall study Architecture of microcontroller like intel8051 and ARM and its usages.
2. Learner shall also develop interpretation, analysis and design skill using microcontrollers and various peripherals.
3. At the end of course learner should be capable to design and develop a simple microcontroller based application.

Course Outcomes:
The student should be able to:
1. Explain basic terminology and describe the components, parts and operation of a microcontroller based system.
2. Describe the microcontroller architecture and usages of the instruction set of the representative microcontrollers.
3. Explain and perform input/output and interrupt operations in a microcontroller system.
4. Interpret and write simple programs for microcontroller applications.

Module No.	Unit No.	Topics	Hrs.
1		**8051 Microcontroller Architecture**	**6**
	1.1	8051 architectural features and its purpose, advantages	
2		**8051 Microcontroller Assembly Language Programming**	**12**
	2.1	Bit, byte, word processing, format conversion between HEX, BCD, ASCII	
	2.2	Data movement / copy operations, Block transfer of data, data swap / exchange	
	2.3	Arithmetic, logical, and stack operation, loops, condition evaluation, decision making based on flags	
	2.4	Call, return, jumps, serial and parallel port handling, timer / counter handling, interrupts and its handling	
3		**8051 Microcontroller Hardware and Software Applications**	**10**
		Objectives: Interpreting logical, electrical, timing specification, requirement of following interfaces and interfacing and accessing/controlling using assembly programs	
	3.1	External memory interfacing and memory access cycles, polled I/O, Interrupt I/O	
	3.2	**Serial communication using RS232**: Pulse width modulation and DC motor interfacing, electromagnetic relay, stepper motor interfacing, switch interfacing, SCR firing circuit (with electrical isolation)	
	3.3	**Parallel input/output interfacing**: 7-segment LED display interfacing, 8-bit parallel DAC interfacing, 8-bit parallel ADC interfacing, 4x4 matrix keyboard interfacing, temperature (resistive, diode based) sensor, optical (photodiode/ phototransistor, LDR) sensors interfacing, 16x2 generic alphanumeric LCD interfacing	
4		**ARM7TDMI(ARMv4T) Architectural**	**10**
	4.1	Features, purpose, and advantages	
	4.2	Processor operating states, memory formats, data types, operating modes, registers	
	4.3	The program status registers, exceptions, interrupt latencies, and pipelined architecture advantage	
5		**ARM7TDMI(ARMv4T) Assembly Language Programming**	**10**
	5.1	8,16,32 bit and floating point numbers processing, format conversion between Hex, BCD, ASCII, data movement/copy operations, block transfer of data, data swap/exchange	
	5.2	Arithmetic, logical, and stack operation, loops, condition evaluation and decision making based on flags, control transfers (Call, Return, Jumps), processor state changing (ARM $\leftrightarrow$ THUMB)	
	5.3	Exceptions, interrupts and its handling	
6		**LPC2148 based C Program Applications**	**4**
	6.1	Applications for On-chip ADC, DAC, parallel port, and serial port accessing	
		Total	**52**

Reference Books:

1. Kenneth J. Ayala, "*The 8051 Microcontroller architecture, Programming and Applications*" Penram international, Cengage Learning India Pvt. Ltd, (Patparganj), New Delhi.
2. M. A. Mazadi and J. C. Mazadi, "*The 8051 Microcontroller and Embedded Systems*", Pearson Education, Asia
3. V. Udayashankara, "*8051 Microcontroller Hardware, Software and Application*", McGraw-Hill.
4. David Seal, "*ARM Architecture*", Reference Manual (2nd Edition)
5. William Hohl, "*ARM Assembly Language: Fundamentals and Techniques*"

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3: Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining questions will be selected from all the modules.

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Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXC502	Design With Linear Integrated Circuits	04	--	--	04	--	--	04

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of Test 1 and Test 2					
EXC502	Design With Linear Integrated Circuits	20	20	20	80	--	--	--	100

Course Pre-requisite:
- FEC105: Basic Electrical & Electronics Engineering
- EXC302: Electronic Devices
- EXC303: Digital Circuits and Design
- EXC402: Discrete Electronic Circuits

Course Objectives:
1. To teach fundamental principles of standard linear integrated circuits.
2. To develop a overall approach for students from selection of integrated circuit, study its specification, the functionality, design and practical applications

Course Outcomes:
After successful completion of the course student will be able to
1. Demonstrate an understanding of fundamentals of integrated circuits.
2. Analyze the various applications and circuits based on particular linear integrated circuit.
3. Select and use an appropriate integrated circuit to build a given application.
4. Design an application with the use of integrated circuit

Module No.	Unit No.	Topics	Hrs.
1		**Fundamentals of Operational Amplifier**	06
	1.1	Ideal Op Amp, characteristics of op-amp, op-amp parameters, high frequency effects on op-amp gain and phase, slew rate limitation, practical determination of op-amp parameters, single supply versus dual supply op-amp	
	1.2	Operational amplifier open loop and closed loop configurations, Inverting and non-inverting amplifier	
2		**Applications of Operational Amplifier**	12
	2.1	**Amplifiers:** Adder, subtractor, integrator, differentiator, current amplifier, difference amplifier, instrumentation amplifier and application of Op-Amp in transducer measurement system with detail design procedure, single supply DC biasing techniques for inverting, non-inverting and differential amplifiers	
	2.2	**Converters:** Current to voltage and voltage to current converters, generalized impedance converter	
	2.3	**Active Filters:** First order filters, second order active finite and infinite gain low pass, high pass, band pass and band reject filters	
	2.4	**Sine Wave Oscillators:** RC phase shift oscillator, Wien bridge oscillator, Quadrature oscillator	
3		**Non-Linear Applications of Operational Amplifier**	12
	3.1	**Comparators:** Inverting comparator, non-inverting comparator, zero crossing detector, window detector and level detector	
	3.2	**Schmitt Triggers:** Inverting Schmitt trigger, non-inverting Schmitt trigger with adjustable threshold levels	
	3.3	**Waveform Generators:** Square wave and triangular wave generator with duty cycle modulation	
	3.4	**Precision Rectifiers:** Half and full wave precision rectifiers and their applications	
	3.5	Peak detectors, sample and hold circuits, voltage to frequency converter, frequency to voltage converter, logarithmic converters and antilog converters	
4		**Data Converters**	06
	4.1	Performance parameters of ADC, single ramp ADC, ADC using DAC, dual slope ADC, successive approximation ADC, flash ADC, ADC0808/0809 and its interfacing	
	4.2	Performance parameters of DAC, binary weighted register DAC, R/2R ladder DAC, inverted R/2R ladder DAC, DAC0808 and its interfacing	
5		**Special Purpose Integrated Circuits**	08
	5.1	Functional block diagram, working, design and applications of Timer 555.	
	5.2	Functional block diagram, working and applications of VCO 566, PLL 565, multiplier 534, waveform generator XR 2206, power amplifier LM380	
6		**Voltage Regulators**	08
	6.1	Functional block diagram, working and design of three terminal fixed (78XX, 79XX series) and three terminal adjustable (LM 317, LM 337) voltage regulators	
	6.2	Functional block diagram, working and design of general purpose 723 (LVLC, LVHC, HVLC and HVHC) with current limit and current fold-back protection, Switching regulator topologies, functional block diagram and working of LT1070 monolithic switching regulator	
		Total	52

Recommended Books:
1. Sergio Franco, "*Design with operational amplifiers and analog integrated circuits*", Tata McGraw Hill, 3rd Edition.
2. William D. Stanley, "*Operational Amplifiers with Linear Integrated Circuits* ", Pearson, 4th Edition
3. D. Roy Choudhury and S. B. Jain, "*Linear Integrated Circuits*", New Age International Publishers, 4th Edition.
4. David A. Bell, "*Operation Amplifiers and Linear Integrated Circuits*", Oxford University Press, Indian Edition.
5. Ramakant A. Gayakwad, "*Op-Amps and Linear Integrated Circuits*", Pearson Prentice Hall, 4th Edition.
6. R. P. Jain, "*Modern Digital Electronics*," Tata McGraw Hill, 3rd Edition.
7. J. Millman and A. Grabel, "*Microelectronics*", Tata McGraw Hill, 2nd Edition.

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3: Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining questions will be selected from all the modules.

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Subject Code	Subject Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXC 503	Electromagnetic Engineering	4	--	--	4	--	--	04

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXC 503	Electromagnetic Engineering	20	20	20	80	--	--	--	100

Prerequisites: Knowledge of Vector Calculus, Cylindrical and Spherical coordinate systems

Course Objective:
1. To study relationship between electrostatics, steady magnetic field and time varying fields using Maxwell's equations for different media
2. To understand the propagation of wave in different media like dielectric and conducting media by solving wave equation and find parameters of media
3. To calculate energy transported by means of electromagnetic waves from one point to another and to study polarization of waves
4. To solve electromagnetic problems using different numerical methods
5. To extend students' understanding about wave propagation by different techniques such as ground waves and space waves
6. To study radiation from a current element

Course Outcomes:
1. Ability to find nature of electric or magnetic fields produced due to different charge distributions
2. Ability to understand working of different equipment based on electromagnetic effects used in day to day life
3. Knowledge of behavior of EM waves and travelling of waves in free space as well as media
4. Ability to identify and solve problems related to the propagation of waves
5. Ability to understand the basics of wave propagation required for the study of antennas

Module No.	Unit No.	Topics	Hrs.
1.0		**Basic Laws of Electromagnetic and Maxwell's Equations**	**10**
	1.1	Coulomb's law, Gauss's law, Bio-Savart's law, Ampere's law, Poisson's and Laplace equations	
	1.2	Boundary conditions for static electric and magnetic fields	
	1.3	**Maxwell's Equations:** Integral and differential form for static and time varying fields and its interpretations	
2.0		**Uniform Plane Wave Equation and Power Balance**	**10**
	2.1	**Wave equation:** Derivation and its solution in cartesian co-ordinates	
	2.2	**Solution of wave equations:** Partially conducting media, perfect dielectrics and good conductors, concept of skin depth	
	2.3	**Electromagnetic Power:** Poynting Vector and power flow in free space and in dielectric, conducting media	
	2.4	**Polarization of wave:** Linear, Circular and Elliptical	
	2.5	**Propagation in different media:** Behavior of waves for normal and oblique incidence in dielectrics and conducting media, propagation in dispersive media	
4.0		**Radiation Field and Computation**	**12**
	4.1	Concept of vector potential, fields associated with Hertzian dipole	
	4.2	Radiation resistance of elementary dipole with linear current distribution, radiation from half-wave dipole and quarter-wave monopole	
	4.3	**Finite Difference Method (FDM):** Neumann type and mixed boundary conditions, Iterative solution of finite difference equations, solutions using band matrix method	
	4.4	**Finite Element Method (FEM):** triangular mesh configuration, finite element discretization, element governing equations, assembling all equations and solving resulting equations	
	4.5	**Method of Moment (MOM):** Field calculations of conducting wire, parallel conducting wires	
5.0		**Fundamentals of Antenna**	**10**
	5.1	**Antenna Parameters:** Radiation intensity, directive gain, directivity, power gain, beam width, band width, gain and radiation resistance of current element	
	5.2	**Half-wave dipole and folded dipole:** Reciprocity principle, effective length and effective area	
	5.3	Radiation from small loop and its radiation resistance, Helical antenna	
6.0		**Radio Wave Propagation**	**10**
	6.1	**Types of wave propagation:** Ground, space, and surface wave propagation, tilt and surface waves, impact of imperfect earth and earth's behavior at different frequencies	
	6.2	**Space wave propagation:** Effect of imperfection of earth, curvature of earth, effect of interference zone, shadowing effect of hills and building, atmospheric absorption, Super-refraction, scattering phenomena, troposphere propagation and fading	
	6.3	**Sky Wave Propagation:** Reflection and refraction of waves, ionosphere and earth magnetic field effect	
	6.4	**Measures of ionosphere propagation:** Critical frequency, angle of incidence, maximum unstable frequency, skip distance, virtual height, variations in ionosphere	
		Total	**52**

Recommended Books:

1. W.H. Hayt, and J.A. Buck, "*Engineering Electromagnetics*", McGraw Hill Publications, 7th Edition, 2006
2. R.K. Shevgaonkar, "*Electromagnetic Waves*", TATA McGraw Hill Companies, 3rd Edition, 2009
3. Edward C. Jordan and Keth G. Balmin, "*Electromagnetic Waves and Radiating Systems*", Pearson Publications, 2nd Edition, 2006
4. Matthew N.D. Sadiku, "*Principles of Electromagnetics*", Oxford International Student 4th Edition, 2007
5. J.D. Kraus, R.J. Marhefka, and A.S. Khan, "*Antennas & Wave Propagation*", McGraw Hill Publications, 4th Edition, 2011

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3: Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining questions will be selected from all the modules.

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Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXC 504	**Signals and Systems**	**04**	**--**	**#01**	**04**	**--**	**01**	**05**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXC504	**Signals and Systems**	**20**	**20**	**20**	**80**	**25**	**-**	**-**	**125**

#Class wise

Course Objective:
1. To provide a comprehensive coverage of continuous time and discrete time of Signals and Systems.
2. To introduce various time domain and frequency domain methods for analysis of   Signals and systems.

Course Outcome:
1. Student will be able to differentiate between continuous time and discrete time of Signals and Systems.
2. Student will be able to do time domain and frequency domain analysis of Signals and systems**.**

Module No.	Unit No.	Topics	Hrs.
1.		**Continuous And Discrete Time Signals And Systems**	**8**
	1.1	Mathematical representation, classification of CT and DT signals, arithmetic operations on the signals, transformation of independent variable	
	1.2	Mathematical representation, classification of CT and DT systems	
	1.3	Sampling and reconstruction, aliasing effect	
2		**Time Domain Analysis Of Continuous and Discrete Signals And Systems**	**6**
	2.1	Properties of LTI systems, impulse and step response.	
	2.2	Use of convolution integral and convolution sum for analysis of LTI systems.	
	2,3	Properties of convolution integral/sum.	
3		**Frequency Domain Analysis of Continuous Time System Using Laplace Transform**	**8**
	3.1	Need of Laplace transform, review of Laplace transform, properties, inverse of Laplace transform, concept of ROC, poles and zeros	
	3.2	Unilateral Laplace transform	
	3.3	Analysis and characterization of LTI system using Laplace transform: impulse and step response, causality, stability, stability of causal system	
	3.4	Block diagram representation	
4		**Frequency Domain Analysis of Discrete Time System Using Z Transform**	**14**
	4.1	Need of Z transform, definition, properties of unilateral and bilateral Z Transform, mapping with s plane, relationship with Laplace transform	
	4.2	Z transform of standard signals, ROC, poles and zeros of transfer function, inverse Z transform	
	4.3	Analysis and characterization of LTI system using Z transform: impulse and step response, causality, stability, stability of causal system	
	4.4	Block diagram representation, system realization	
5		**Frequency Domain Analysis of Continuous and Discrete Signals**	**12**
	5.1	Review of Fourier series, Discrete time Fourier series, its properties	
	5.2	Fourier transform, properties of Fourier transform, relationship with Laplace and Z transform	
	5.3	Discrete time Fourier transform, properties, frequency sampling, Discrete Fourier transform, properties	
6		**Correlation and Spectral Density**	**04**
	6.1	Comparison of convolution and correlation, Auto and cross correlation, energy/power spectral density	
	6.2	Relation of ESD, PSD with auto-correlation	
	6.3	Relationship between ESD/PSD of input and output of LTI system	
		Total	**52**

Recommended Books:
1. Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab, "*Signals and Systems*", 2nd Edition, PHI learning, 2010.
2. Tarun Kumar Rawat, "*Signals and Systems*", Oxford University *Press 2010.*
3. John Proakis and Dimitris Monolakis, "*Digital Signal Processing*", Pearson Publication, 4th Edition.

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3: Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining questions will be selected from all the modules.

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Term Work:
At least 10 assignments based on the entire syllabus of Subject **EXC504 (Signals and Systems)** should be set to have well predefined inference and conclusion. The assignments should be students' centric and attempt should be made to make assignments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every assignment graded from time to time**. The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme.
The final certification and acceptance of term work ensures satisfactory performance of tutorial work and minimum passing marks in term work.

Subject Code	Subject Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXC 505	Digital Communication	4	--	--	4	--	--	04

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXC 505	Digital Communication	20	20	20	80	--	--		100

Prerequisites: Knowledge of Probability Theory and Signals and Systems
Course Objective:
1. To understand basic Concept of Probability Theory in communication systems.
2.   To understand basic concept of Information Theory and Source Coding.
3. To understand Pulse Shaping techniques for optimum transmission of signal.
4. To understand Band pass digital modulation and demodulation (binary and M-level;
5. ASK, PSK and FSK), including their performance in noise.
6. To understand basic concept of channel error correcting codes.
7. To understand basic concept of spread spectrum techniques.
Expected Outcomes:
1. Ability to find nature of random signal and its statistical characteristics.
2. Ability to understand how to make code optimum in containing information generated by source..
3. Ability to find the technique to enhanced the transmission efficiency of the system.
4. Ability to understand different modulation techniques such as bandwidth limited and power limited.
5. Ability to find the technique to combat transmission impairments.
6. Ability to find the modulation technique used in wireless communication..
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Module No.	Unit No.	Topics	Hrs.
1		**Application of Probability Theory in Communication Systems**	07
	1.1	Introduction to digital communication system, significance of AWGN channel, pulse dispersion in the channel	
	1.2	Introduction to probability and sample space , Baye's rule, conditional probability and statistical independence, random variables, probability functions, mean and variance of random variables and sum of random variables	
	1.3	**Probability Models**: Binomial Distribution, Poisson Distribution, Gaussian PDF, Rayleigh PDF and Rician PDF, Central-Limit Theorem	
	1.4	Binary Synchronous Channel(BSC), development of optimal receiver	
2		**Information Theory and Source Coding**	05
	2.1	Measure of Information, Entropy, Information rate, Channel capacity	
	2.2	Capacity of a Gaussian channel, bandwidth, S/N trade-off, Shannon's source coding theorem	
	2.3	Coding to increase the average information per bit, Huffman coding, Lempel Ziv coding, examples and applications of source coding	
3		**Pulse Shaping for Optimum Transmission**	08
	3.1	Line codes and their desirable properties, PSD of digital data.	
	3.2	**Baseband PAM transmission**: Concept of inter channel and inter symbol interference, eye pattern	
	3.3	Concept of equalizer to overcome ISI, Nyquist's Criterion for distortion less transmission	
	3.4	Duo-binary encoding and modified duo-binary encoding	
4		**Digital Modulation Techniques**	15
	4.1	Digital modulation formats, coherent and non- coherent reception	
	4.2	**Binary modulation techniques:** BPSK, BFSK , BASK	
	4.3	**M-ary Modulation techniques:** QPSK, M-ary PSK, MSK , M-ary FSK, M-ary QAM, Differential encoded BPSK & D-QPSK	
	4.4	**Optimal Reception of Digital Data**: A baseband signal receiver and its Probability of error	
	4.5	Optimum receiver and its transfer function, matched filter and its properties	
5		**Error Control Codes**	12
	5.1	Need for channel encoding, discrete memory-less channel , redundancy, code rate ,code efficiency and hamming bound	
	5.2	Linear block codes, cyclic codes, block interleaving	
	5.3	**Convolution codes**: State diagram, code tree, trellis diagram	
	5.4	Decoding of Convolutional codes using Viterbi algorithm	
6		**Spread Spectrum Modulation**	05
	6.1	Need for spread spectrum modulation, pseudo noise sequence generation, direct-sequence spread spectrum (DSSS)	
	6.2	Processing gain and jamming margin, frequency–hop spread spectrum (FHSS)	
	6.3	**Application of spread spectrum :** DS-CDMA	
		Total	52

Recommended Books:

1. Simon Haykin, "*Communication System*", John Wiley And Sons ,4th Ed
2. Taub Schilling And Saha, "*Principles Of Communication Systems*", Tata Mc-Graw Hill, Third Ed
3. Amitabha Bhattacharya, "*Digital Communication*", Tata Mcgraw Hill
4. Lan A. Glover and Peter M. Grant, "*Digital Communications*", Pearson, 2nd Ed.
5. John G. Proakis, "*Digital Communications*", Mcgraw Hill , 5th Ed

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3: Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining questions will be selected from all the modules.

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Subject Code	Subject Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXS 506	Business Communication and Ethics	--	*04	--	--	02	--	02

*02 hrs. Theory class wise and 02 hrs. Practical batch wise

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
EXS 506	Business Communication and Ethics	--	--	--	--	50	--	--	50

Course Pre-requisite
- FEC206 Communication Skills

Course Objective
1. To inculcate in students professional and ethical attitude, effective communication skills, teamwork, skills, multidisciplinary approach and an ability to understand engineer's social responsibilities.
2. To provide students with an academic environment where they will be aware of the excellence, leadership and lifelong learning needed for a successful professional career.
3. To inculcate professional ethics and codes of professional practice
4. To prepare students for successful careers that meets the global Industrial and Corporate requirement' provide an environment for students to work on Multidisciplinary projects as part of different teams to enhance their team building capabilities like leadership, motivation, teamwork etc.

Course Outcomes: A learner will be able to …..
1. communicate effectively in both verbal and written form and demonstrate knowledge of professional and ethical responsibilities
2. Participate and succeed in Campus placements and competitive examinations like GATE, CET.
3. Possess entrepreneurial approach and ability for life-long learning.
4. Have education necessary for understanding the impact of engineering solutions on Society and demonstrate awareness of contemporary issues.

Module No.	Unit No.	Topics	Hrs.
1.0		**Report Writing**	08
	1.1	Objectives of report writing	
	1.2	Language and Style in a report	
	1.3	Types of reports	
	1.4	Formats of reports: Memo, letter, project and survey based	
2.0		**Technical Proposals**	02
	2.1	Objective of technical proposals	
	2.2	Parts of proposal	
3.0		**Introduction to Interpersonal Skills**	08
	3.1	Emotional Intelligence	
	3.2	Leadership	
	3.3	Team Building	
	3.4	Assertiveness	
	3.5	Conflict Resolution	
	3.6	Negotiation Skills	
	3.7	Motivation	
	3.8	Time Management	
4.0		**Meetings and Documentation**	02
	4.1	Strategies for conducting effective meetings	
	4.2	Notice	
	4.3	Agenda	
	4.4	Minutes of the meeting	
5.0		**Introduction to Corporate Ethics and etiquettes**	02
	5.1	Business Meeting etiquettes, Interview etiquettes, Professional and work etiquettes, Social skills	
	5.2	Greetings and Art of Conversation	
	5.3	Dressing and Grooming	
	5.4	Dinning etiquette	
	5.5	Ethical codes of conduct in business and corporate activities (Personal ethics, conflicting values, choosing a moral response, the process of making ethical decisions)	
6.0		**Employment Skills**	06
	6.1	Cover letter	
	6.2	Resume	
	6.3	Group Discussion	
	6.4	Presentation Skills	
	6.5	Interview Skills	
		Total	26

Recommended Books:

1. Fred Luthans, "*Organizational Behavior*" , Mc Graw Hill, edition
2. Huckin and Olsen, "*Technical Writing and Professional Communication*", Mc Graw Hill
3. Wallace and Masters, "*Personal Development for Life and Work*" , Thomson   Learning, 12th edition
4. Heta Murphy, "*Effective Business Communication*" , Mc Graw Hill,   edition
5. B N Ghosh, "*Managing Soft Skills for Personality Development*", Tata McGraw
6. Bell . Smith, "*Management Communication*" Wiley India Edition,3rd edition.
7. Dr.K.Alex , "*Soft Skills*",S Chand and Company

Internal Assessment (IA): There will be no IA written examination

End Semester Examination: There will be no ESE written examination

List of Assignments

Term Work
Term work shall consist of assignments as listed below
1. Report Writing (Synopsis or the first draft of the Report)
2. Technical Proposal (Group activity, document of the proposal)
3. Interpersonal Skills (Group activity and Role play)
4. Interpersonal Skills (Documentation in the form of soft copy or hard copy)
5. Meetings and Documentation (Notice, Agenda, Minutes of Mock Meetings)
6. Corporate ethics and etiquettes (Case study, Role play)
7. Cover Letter and Resume
8. Printout of the PowerPoint presentation

The distribution of marks for term work shall be as follows,
1. Assignments :   20 marks
2. Project Report Presentation: 15 marks
3. Group Discussion: 15 marks

At least total 08 assignments, project report presentation and group discussion covering entire syllabus must be given during the batch wise practical. The assignments and project work should be students' centric and an attempt should be made to make assignments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every assignment / project / group discussion graded from time to time. The average of grades converted in to marks should be taken into account for term work assessment.
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Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXL501	Microcontrollers and Applications Laboratory	--	02	--	--	01	--	01

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of Test 1 and Test 2					
EXL501	Microcontrollers and Applications Laboratory	--	--	--	--	25	25		50

Term Work:
At least 10 experiments based on the entire syllabus of Subject **EXC501 (Microcontrollers and Applications Laboratory)** should be set to have well predefined inference and conclusion. Few computation/simulation based experiments are encouraged. The experiments should be students' centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time**. The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme.
The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
Practical and Oral exam will be based on the entire syllabus.

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXL502	**Design with Linear Integrated Circuits Laboratory**	--	**02**	--	--	**01**	--	**01**

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of Test 1 and Test 2					
EXL502	**Design With Linear Integrated Circuits Laboratory**	--	--	--	--	**25**	**25**	--	**50**

Term Work:
At least 10 experiments based on the entire syllabus of Subject **EXC502 (Design with Linear Integrated Circuits)** should be set to have well predefined inference and conclusion. Few computation/simulation based experiments are encouraged. The experiments should be students' centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time**. The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme.
The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
Practical and Oral exam will be based on the entire syllabus.

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXL 503	Digital Communication Laboratory	--	02	--	--	01	--	01

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of Test 1 and Test 2					
EXL 503	Digital Communication Laboratory	--	--	--	--	25	--	25	50

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Term Work:

At least 10 experiments based on the entire syllabus of Subject **EXC 505(Digital Communication) should** be set to have well predefined inference and conclusion. Computation/simulation based experiments are encouraged. The experiments should be students' centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the **overall performance** of the student with **every experiment graded from time to time**. The grades should be converted into marks as per the **Credit and Grading System** manual and should be **added and averaged**. The grading and term work assessment should be done based on this scheme.

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work

Oral examination will be based on the entire syllabus.

Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/Practical	Tutorial	Total
EXL504	**Mini Project I**	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical and Oral	Total
		Internal assessment			End Sem. Exam			
		Test 1	Test 2	Ave. Of Test 1 and Test 2				
EXL504	**Mini Project I**	--	--	--	--	25	25	50

Term Work:

The main intention of Mini Project is to make student enable to apply the knowledge and skills learned out of courses studied to solve/implement predefined practical problem. The students undergo various laboratory/tutorial/simulation laboratory/work shop courses in which they do experimentation based on the curriculum requirement. The Mini Project 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 science by working in a group

The group may be maximum **four** (04) students. Each group will be assigned one faculty as a supervisor. The college should keep proper assessment record of progress of the project and at the end of the semester it should be assessed for awarding TW marks. The TW may be examined by approved internal faculty appointed by the head of the institute. The final examination will be based on demonstration in front of internal and external examiner. In the examination each individual student should be assessed for his/her contribution, understanding and knowledge gained about the task completed.

The students may use this opportunity to learn different computational techniques as well as some model development. This they can achieve by making proper selection of Mini Projects.