Bharatiya Vidya Bhavan's

Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai)

Revision: SPIT-3-17

Bachelor of Engineering/Technology (B.E./B.Tech)
in
Electronics Engineering

Third Year Engineering
(Sem. V and Sem. VI)
Effective from Academic Year 2017 -18

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

Sardar Patel Institute of Technology

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

Preamble:

Concept of academic autonomy is based on the argument that Institutions can undertake the work expected of them by all stakeholders such as Students , Parents , University , Industry , Society in general, only if they have freedom of choice and action.

We at S.P.I.T. would like to believe that this freedom of choice and action as far as academics is concerned will make us more Proactive in our offerings.

An academic autonomy is as good as its Curricula and execution of it is as well as its faculty. S.P.I.T. is confident of succeeding on both the fronts.

In the first offering we have tried to pro-actively bridge the ever discussed "Industry-academic gap" by way of our SCOPE program. The issue about sensitizing students to social needs is being addressed by special activity based courses. Liberal arts courses have been introduced to enhance functionality of both sides of brain. In all this the professional core has not been overlooked. Thus the curricula are designed to achieve multi dimensional outcomes.

The evaluation mechanism is tuned for assessing the attainment of the designed outcomes and is designed as a fair mechanism.

As our learning cycle begins from July 2017, I wish to place on record that entire S.P.I.T. staff and faculty will work with singular focus and commitment towards the success of this endeavour.

Dr. Prachi Gharpure
Principal, S.P.I.T.

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From the Desk of Dean Academics and Head of Electronics Engg. Dept.

Greetings and congratulations to all the students, teaching and supporting staff of Sardar Patel Institute of Technology for getting autonomous status to the institute from the year 2017-18. We look towards autonomy as a great opportunity to design and implement curriculum sensitive to needs of Indian Society and Industries.

In the proposed curriculum we have made an attempt to provide opportunity for students to develop themselves as competent engineering graduates with knowledge, skill and ethical behavior required for global career. Curriculum is designed to provide multiple learning opportunities for students to acquire and demonstrate competencies for rewarding careers. The curriculum model is outcome based that focuses on learning by doing. This is achieved through activity based learning, minor projects, problem solving and innovative styles of pedagogy. Various steps are taken to transform teaching-learning process to make learning a joyful experience for students. Special laboratory based courses are introduced to give more practical exposure to the students.

To create socially responsible citizen curriculum offers courses like Constitution of India, Environmental Studies and Human Health Systems Approach. Also various activity based learning modules like 'Building Automation, Fire Safety and Electronic Security', 'Occupational Safety & Legal Studies for Engineers', 'Technical Presentation Skills', 'Technical Paper and Patent Drafting', 'Engineering Solution for Environmental Problems' and 'Financial Planning, Taxation Policies and Investment' are introduced. For overall development of the learner, various elective courses like Yoga Vidya, Music Appreciation, Dramatics, Industrial and Organizational Psychology, Law for Engineers, French Language, German Language etc. are introduced. To encourage interdisciplinary studies institute level Open Elective courses are offered.

One of the special feature of this curriculum is Skill development programme called SCOPE (Skill Certification for Outcome-Based Professional Education) planned to enhance employability, innovation and research culture in the institute. Every department is offering six domain specific tracks, each track containing six courses. Student will have an opportunity to enroll for more than 140 courses in any of the department of his choice. Some of the courses under SCOPE will be delivered in co-ordination with industries.

We believe that this curriculum will raise the bar of academic standards with the active involvement and cooperation from students, academic and administrative units. Faculty of S.P.I.T. deserves a special appreciation for their relentless efforts in designing curriculum and assessment instruments which will bring transformation in the quality and transparency in assessment of learners.

Looking forward for your active cooperation and constructive feedback to create vibrant and joyful learning environment at Sardar Patel Institute of Technology.

Dr. Surendra Singh Rathod
Professor and Dean Academics

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Scheme for B.E./B.Tech Electronics Engineering (SEM V)					
SEM V					
Course Code	**Course Name**	**Teaching Scheme (Hrs/week)**			**Credits**
		L	**T**	**P**	**Total**
EXC501	Microcontrollers and Applications	4	--	--	4
EXC502	Design with Linear Integrated Circuits	4	--	--	4
EXC503	Electromagnetic Engineering	4	--	--	4
EXC504	Signals and Systems	4	1	--	5
EXC505	Digital Communication	4	--	--	4
EXS506	Business Communication and Ethics	--	--	*4	2
EXL501	Microcontrollers and Applications Laboratory	--	--	2	1
EXL502	Design with Linear Integrated Circuits Laboratory	--	--	2	1
EXL503	Digital Communication Laboratory	--	--	2	1
EXL504	Mini Project I	--	--	2	2
	Total	20	--	10+02	28

***Common to all branches**

Scheme for B.E./B.Tech Electronics Engineering (SEM VI)					
SEM VI					
Course Code	**Course Name**	**Teaching Scheme (Hrs/week)**			**Credits**
		L	**T**	**P**	**Total**
EXC601	Basic VLSI Design	4	--	--	4
EXC602	Advanced Instrumentation Systems	4	--	--	4
EXC603	Computer Organization	4	--	--	4
EXC604	Power Electronics I	4	--	--	4
EXC605	Digital Signal Processing and Processors	4	--	--	4
EXC606	Modern Information Technology for Management	2	--	--	2
EXL601	VLSI Design Laboratory	--	--	2	1
EXL602	Digital Signal Processing and Processors Laboratory	--	--	2	1
EXL603	Advanced Instrumentation and Power Electronics Laboratory	--	--	2	1
EXL604	Mini Project II	--	--	2	2
	Total	22	--	8	27

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Semester V

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXC501	Microcontrollers and Applications	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		EXC303: Digital Circuits and Design EXC402: Discrete Electronic Circuits EXC403: Microprocessor and Peripherals
Aftersu ccessful completion of the course, student will be able to		
Course Outcomes	CO1	Discuss architecture and pin configuration of ARM7TDMI and Intel 8051.
	CO2	Apply the knowledge of instruction set of 8051 microcontroller and ARM7TDMI to implement Assembly Language Programs
	CO3	Design various applications using 8051 microcontroller and ARM7TDMI.
	CO4	Develop C program applications in LPC2148

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**8051 Microcontroller Architecture**		06
	1.1	8051 architectural features and its purpose, advantages	1,2	
2		**8051 Microcontroller Assembly Language Programming**		12
	2.1	Bit, byte, word processing, format conversion between HEX, BCD, ASCII	1,2	
	2.2	Data movement / copy operations, Block transfer of data, data swap / exchange	1,2	
	2.3	Arithmetic, logical, and stack operation, loops, condition evaluation, decision making based on flags	1,2	
	2.4	Call, return, jumps, serial and parallel port handling, timer / counter handling, interrupts and its handling	1,2	
3		**8051 Microcontroller Hardware and Software Applications** **Objectives:** Interpreting logical, electrical, timing specification, requirement of following interfaces and interfacing and accessing/controlling using assembly programs		10
	3.1	External memory interfacing and memory access cycles, polled I/O, Interrupt I/O	1,2	
	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)	1,2	
	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)	1,2	

		sensors interfacing, 16x2 generic alphanumeric LCD interfacing		
4		**ARM7TDMI(ARMv4T) Architectural**		**10**
	4.1	Features, purpose, and advantages	4,5	
	4.2	Processor operating states, memory formats, data types, operating modes, registers	4,5	
	4.3	The program status registers, exceptions, interrupt latencies, and pipelined architecture advantage	4,5	
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	4,5	
	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 ←→ THUMB)	4,5	
	5.3	Exceptions, interrupts and its handling	4,5	
6		**LPC2148 based C Program Applications**	6	**4**
	6.1	Applications for On-chip ADC, DAC, parallel port, and serial port accessing		
			Total	**52**

References:

[1] Kenneth J. Ayala, "The 8051 Microcontroller architecture, Programming and Applications" Penram international, Cengage Learning India Pvt. Ltd, Second Edition.

[2] M. A. Mazadi and J. C. Mazadi, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition.

[3] V. Udayashankara, "8051 Microcontroller Hardware, Software and Application", McGraw-Hill.

[4] David Seal, "ARM Architecture", Reference Manual (Second Edition)

[5] William Hohl, "ARM Assembly Language: Fundamentals and Techniques", Second Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXC502	Design With Linear Integrated Circuits	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		FEC105: Basic Electrical & Electronics Engineering EXC302: Electronic Devices EXC303: Digital Circuits and Design EXC402: Discrete Electronic Circuits
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Discuss fundamentals of IC operational amplifier
	CO2	Analyze the various applications and circuits based on particular linear integrated circuit
	CO3	Design linear application with the use of operational amplifier IC
	CO4	Design non-linear application with the use of operational amplifier IC
	CO5	Design an application with data converters, voltage regulator ICs and special purpose ICs

Module No.	Unit No.	Topics	Ref.	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	1,3,5	
	1.2	Operational amplifier open loop and closed loop configurations, Inverting and non-inverting amplifier	1,3,5	
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	1,3,5	
	2.2	**Converters:** Current to voltage and voltage to current converters, generalized impedance converter	1,3,5	
	2.3	**Active Filters:** First order filters, second order active finite and infinite gain low pass, high pass, band pass and band reject filters	1	
	2.4	**Sine Wave Oscillators:** RC phase shift oscillator, Wien bridge oscillator, Quadrature oscillator	4	

3		**Non-Linear Applications of Operational Amplifier**		**12**
	3.1	**Comparators:** Inverting comparator, non-inverting comparator, zero crossing detector, window detector and level detector	1,3,5	
	3.2	**Schmitt Triggers:** Inverting Schmitt trigger, non-inverting Schmitt trigger with adjustable threshold levels	1,3,5	
	3.3	**Waveform Generators:** Square wave and triangular wave generator with duty cycle modulation	4	
	3.4	**Precision Rectifiers:** Half and full wave precision rectifiers and their applications	1,3,5	
	3.5	Peak detectors, sample and hold circuits, voltage to frequency converter, frequency to voltage converter, logarithmic converters and antilog converters	1,3,5	
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	1,3,5	
	4.2	Performance parameters of DAC, binary weighted register DAC, R/2R ladder DAC, inverted R/2R ladder DAC, DAC0808 and its interfacing	1,3,5	
5		**Special Purpose Integrated Circuits**		**08**
	5.1	Functional block diagram, working, design and applications of Timer 555	3,5	
	5.2	Functional block diagram, working and applications of VCO 566, PLL 565, multiplier 534, waveform generator XR 2206, power amplifier LM380	3,5	
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	1,3,5	
	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	1,3,5	
			Total	**52**

References:

[1] Sergio Franco, "Design with operational amplifiers and analog integrated circuits", Tata McGraw Hill, Third Edition.

[2] William D. Stanley, "Operational Amplifiers with Linear Integrated Circuits", Pearson, Forth Edition

[3] D. Roy Choudhury and S. B. Jain, "Linear Integrated Circuits", New Age International Publishers, Forth Edition.

[4] David A. Bell, "Operation Amplifiers and Linear Integrated Circuits", Oxford University Press, Indian Edition.

[5] R. A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson Prentice Hall, Fourth Edition.

[6] R. P. Jain, "Modern Digital Electronics," Tata McGraw Hill, Third Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXC503	Electromagnetic Engineering	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		Knowledge of Vector Calculus, Cylindrical and Spherical coordinate systems
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Apply basic laws of electromagnetic and Maxwell's equations
	CO2	Illustrate the behavior of EM waves and travelling of waves in free space as well as media.
	CO3	Solve problems related to the propagation of electromagnetic waves
	CO4	Discuss the types of antennas and their parameters
	CO5	Discuss types of radio wave propagation

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**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	2	
	1.2	Boundary conditions for static electric and magnetic fields	2	
	1.3	**Maxwell's Equations:** Integral and differential form for static and time varying fields and its interpretations	2	
2		**Uniform Plane Wave Equation and Power Balance**		10
	2.1	**Wave equation:** Derivation and its solution in cartesian co-ordinates	2	
	2.2	**Solution of wave equations:** Partially conducting media, perfect dielectrics and good conductors, concept of skin depth	2	
	2.3	**Electromagnetic Power:** Poynting Vector and power flow in free space and in dielectric, conducting media	2	
	2.4	**Polarization of wave:** Linear, Circular and Elliptical	2	
	2.5	**Propagation in different media:** Behavior of waves for normal and oblique incidence in dielectrics and conducting media, propagation in dispersive media	2	
3		**Radiation Field and Computation**		12
	3.1	Concept of vector potential, fields associated with Hertzian dipole	3	
	3.2	Radiation resistance of elementary dipole with linear current distribution, radiation from half-wave dipole and quarter-wave monopole	4	
	3.3	**Finite Difference Method (FDM):** Neumann type and mixed boundary conditions, Iterative solution of finite difference equations, solutions using band matrix method	4	

	3.4	**Finite Element Method (FEM)**: triangular mesh configuration, finite element discretization, element governing equations, assembling all equations and solving resulting equations	4	
	3.5	**Method of Moment (MOM):**Field calculations of conducting wire, parallel conducting wires	4	
4		**Fundamentals of Antenna**		**10**
	4.1	**Antenna Parameters:** Radiation intensity, directive gain, directivity, power gain, beam width, band width, gain and radiation resistance of current element	3	
	4.2	**Half-wave dipole and folded dipole:** Reciprocity principle, effective length and effective area	3	
	4.3	Radiation from small loop and its radiation resistance, Helical antenna	3	
5		**Radio Wave Propagation**		**10**
	5.1	**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	1,2	
	5.2	**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	1,2	
	5.3	**Sky Wave Propagation:** Reflection and refraction of waves, ionosphere and earth magnetic field effect	1,2	
	5.4	**Measures of ionosphere propagation:** Critical frequency, angle of incidence, maximum unstable frequency, skip distance, virtual height, variations in ionosphere	1,2	
			Total	**52**

References:

[1] W.H. Hayt, and J.A. Buck, "Engineering Electromagnetics", McGraw Hill Publications, Seventh Edition.

[2] R.K. Shevgaonkar, "Electromagnetic Waves", TATA McGraw Hill Companies, Third Edition.

[3] Edward C. Jordan and Keth G. Balmin, "Electromagnetic Waves and Radiating Systems", Pearson Publications, Second Edition.

[4] Matthew N.D. Sadiku, "Principles of Electromagnetics", Oxford International Student Forth Edition.

[5] J.D. Kraus, R.J. Marhefka, and A.S. Khan, "Antennas & Wave Propagation", McGraw Hill Publications, Forth Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXC504	Signals and Systems	4	1	--	4	1	--	5
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		--
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Classify continuous time & discrete time signals and systems
	CO2	Apply time and frequency domain analysis techniques to different signals
	CO3	Analyze continuous time system using Laplace Transform
	CO4	Analyze discrete time system using Z- Transform

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Continuous And Discrete Time Signals And Systems**		08
	1.1	Mathematical representation, classification of CT and DT signals, arithmetic operations on the signals, transformation of independent variable	1,4	
	1.2	Mathematical representation, classification of CT and DT systems	1,4,5	
	1.3	Sampling and reconstruction, aliasing effect		
2		**Time Domain Analysis Of Continuous and Discrete Signals And Systems**		06
	2.1	Properties of LTI systems, impulse and step response.	3,4,5	
	2.2	Use of convolution integral and convolution sum for analysis of LTI systems.	3,4,5	
	2.3	Properties of convolution integral/sum.	3,4,5	
3		**Frequency Domain Analysis of Continuous Time System Using Laplace Transform**		08
	3.1	Need of Laplace transform, review of Laplace transform, properties, inverse of Laplace transform, concept of ROC, poles and zeros	1,4	
	3.2	Unilateral Laplace transform	1,4	
	3.3	Analysis and characterization of LTI system using Laplace transform: impulse and step response, causality, stability, stability of causal system	1,4	
	3.4	Block diagram representation	1	
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	3,5	
	4.2	Z transform of standard signals, ROC, poles and zeros of transfer function, inverse Z transform	3,5	

	4.3	Analysis and characterization of LTI system using Z transform: impulse and step response, causality, stability, stability of causal system	3,5	
	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	4	
	5.2	Fourier transform, properties of Fourier transform, relationship with Laplace and Z transform	4	
	5.3	Discrete time Fourier transform, properties, frequency sampling, Discrete Fourier transform, properties	4,5	
6		**Correlation and Spectral Density**		**04**
	6.1	Comparison of convolution and correlation, Auto and cross correlation, energy/power spectral density	1	
	6.2	Relation of ESD, PSD with auto-correlation	1	
	6.3	Relationship between ESD/PSD of input and output of LTI system	1	
			Total	**52**

References:

[1] Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab, "Signals and Systems", Second Edition, PHI learning.

[2] Tarun Kumar Rawat, "Signals and Systems", Oxford University Press, Edition 2014.

[3] John Proakis and Dimitris Monolakis, "Digital Signal Processing", Pearson Publication, Forth Edition.

[4] A. Nagoor Kani, "Signals & Systems", McGraw Hill Education (India) Pvt Ltd, Fourteenth Edition.

[5] S.Salivahanan, A Vallavaraj, C Gnanapriya, "Digital Signal Processing", Tata McGraw Hill, First Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXC505	Digital Communication	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		Knowledge of Probability Theory and Signals and Systems
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Determine nature of random signal and its statistical characteristics
	CO2	Identify source and channel coding techniques
	CO3	Explain techniques to enhanced transmission efficiency of the system
	CO4	Describe digital modulation formats and its properties
	CO5	Demonstrate the use of error control and spread spectrum techniques in wired and wireless communication.

Module No.	Unit No.	Topics	Ref.	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	1,2,3	
	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	1,2,3	
	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.	1,2,3	
	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	1,2,3	

	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	1,2,3	
	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)	1,2,5	
	6.2	Processing gain and jamming margin, frequency–hop spread spectrum (FHSS)		
	6.3	**Application of spread spectrum :** DS-CDMA		
			Total	**52**

References:

[1] Simon Haykin, "Communication System", John Wiley And Sons, Fourth Edition

[2] Taub Schilling And Saha, "Principles Of Communication Systems", Tata Mc-Graw Hill, Third Edition

[3] Amitabha Bhattacharya, "Digital Communication", Tata Mcgraw Hill, Edition 2006

[4] Lan A. Glover and Peter M. Grant, "Digital Communications", Pearson, Second Edition.

[5] John G. Proakis, "Digital Communications", Mcgraw Hill, Fifth Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXS 506	Business Communication and Ethics	--	--	4	--	--	2	2
		Examination Scheme						
		ISE			Practical		Oral	Total
		50			--		--	50

Pre-requisite Course Codes		FEC206: Communication Skills
After successful completion of the course, student will be able to		
Course Outcomes	CO1	communicate effectively in both verbal and written form and demonstrate knowledge of professional and ethical responsibilities
	CO2	Participate and succeed in Campus placements and competitive examinations like GATE, CET.
	CO3	Possess entrepreneurial approach and ability for life-long learning.
	CO4	Have education necessary for understanding the impact of engineering solutions on Society and demonstrate awareness of contemporary issues.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**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		**Technical Proposals**		02
	2.1	Objective of technical proposals		
	2.2	Parts of proposal		
3		**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		**Meetings and Documentation**		02
	4.1	Strategies for conducting effective meetings		
	4.2	Notice		
	4.3	Agenda		
	4.4	Minutes of the meeting		

5		**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		**Employment Skills**		**06**
	6.1	Cover letter		
	6.2	Resume		
	6.3	Group Discussion		
	6.4	Presentation Skills		
	6.5	Interview Skills		
			Total	**26**

References:

[1] Fred Luthans, "Organizational Behavior", Mc Graw Hill, First 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, Twelfth 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,Third edition.

[7] Dr.K.Alex , "Soft Skills", S Chand and Company

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXL501	Microcontrollers and Applications Laboratory	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		10		10		60

Pre-requisite Course Codes		EXC501 (Microcontrollers and Applications)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Compose assembly language and C programs for 8051 microcontroller based system
	CO2	Interface various peripherals with 8051 microcontroller
	CO3	Prepare initialization procedure for internal peripherals of ARM7 TDMI-S (LPC2148)
	CO4	Develop device drivers for ARM7 using datasheet
	CO5	Practice professional design techniques for microcontroller based system design

Exp. No.	Experiment Details	Ref.	Marks
1	Interfacing of LED and Switch	1	5
2	Print characters on LCD	1	5
3	WAP for transfering block of data/ Arrange data in ascending order	1	5
4	Mixed language program form timer	1	5
5	Interfacing of Serial port	1	5
6	Initialization of ARM7 and blink LED using ARM 7 LPC2148	2	5
7	Transmit and receive data using UART in LPC2148	2	5
8	To transfer block of data from one location to another in ARM7	2,3	5
		Total Marks	40

References:

[1] M. A. Mazadi and J. C. Mazadi, "*The 8051 Microcontroller and Embedded Systems*", Pearson Education, Asia
[2] ARM User Manual
[3] www.arm.com

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXL502	Design with Linear Integrated Circuits Laboratory	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		10		10		60

Pre-requisite Course Codes		EXC502 (Design with Linear Integrated Circuits)
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Validate electrical characteristics of given ICs.
	CO2	Design, debug and test electronic circuit using ICs like op-amp 741, IC 555, IC 566, IC723, etc.
	CO3	Validate circuits by simulation using modern tools available like ngspice and LTspice, TINA, Multisim.
	CO4	Design, develop and troubleshoot the complete electronic system for typical applications like speed control of DC Motor, Temperature control, development of signal conditioning circuits for various transducers.
	CO5	Infer the data sheet of electronic components/ICs

Exp. No.	Experiment Details	Ref.	Marks
1	To measure (a) Input bias current, (b) Input offset current,(c)Input offset voltage & (d) Slew rate of the given Op-Amp IC	1,2,3	5
2	Design, Implement and analyze Schmitt Trigger Circuit using given Op-Amp IC and also Square Wave, Triangular Wave Generator Circuit using given Op-Amp IC.	1,2,3	5
3	Design, Implement and analyze Monostable Multivibrator Circuit using given Timer and its operation as divide by N frequency.	1,2,3	5
4	Design, Implement and analyze Voltage Regulator Circuit using given Voltage Regulator IC.	1,2,3	5
5	Design, Implement and analyze given application using given ICs like Op-Amp, DAC, Multiplier, and VCO with Analog System Trainer Kit - TEXAS INSTRUMENTS.	1,2,8	5
6	To measure the performance specifications of given ADC, DAC ICs and interface these ICs to Microcontroller to perform ADC and DAC conversions.	1,2,3	5
7	Design, Simulate and analyze the given problem statement (circuit) using Circuit Simulation S/W preferably NI-Multisim /TINA/SPICE. (Please refer to the extra sheet attached).	1,2,4,5,6	5

8	Score in Quiz on TSE-2017	7	**5**
		Total Marks	**40**

References:

[1] D. Roy Choudhury and S. B. Jain, "*Linear Integrated Circuits*", New Age International Publishers, 4th Edition.

[2] David A. Bell, "*Operation Amplifiers and Linear Integrated Circuits*", Oxford University Press, Indian Edition.

[3] DLIC Laboratory Manual

[4] www.ti.com

[5] www.ni.com

[6] www.pspice.com

[7] TSE-2017 Brochure

[8] Analog System Trainer Manual by Texas Instruments.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXL503	Digital Communication Laboratory	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes	EXC503 (Digital Communication)
After successful completion of the course, student will be able to	

Course Outcomes	CO1	Observe the characteristics of waveforms using digital modulation techniques
	CO2	Validate line coding techniques experimentally
	CO3	Demonstrate the significance of channel and source coding techniques in digital communication systems
	CO4	Observe the characteristics of spread spectrum techniques using scilab
	CO5	Accept the attributes of plagiarism pertaining to creating the screencast of lab experiment
	CO6	Show audio power point presentation on technological drift in communication

Exp. No.	Experiment Details	Ref.	Marks
1	To design and build a simple Analog-to-Digital (ADC) using OpAmp circuits and resistors.	1	5
2	To observe the waveform of ASK signal.	1,2	5
3	To convert NRZ coded data to NRZ -RZ codes.	1	5
4	To understand the working and implementation of LBC using gates	1,2	5
5	To understand the working and implementation of Hamming codes using gates.	1,2	5
6	To analyze the receiver performance by using the eye diagram.	1,2	5
7	To find out the entropy of binary memory less source using Scilab.	2	5
8	To find out the entropy, average length and variance of Huffman coding using Scilab.	1,2	5
		Total Marks	40

References:

[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

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXL504	Mini Project-I	--	--	2	--	--	2	2
		Examination Scheme						
		ISE		Practical	Oral			Total
		Phase-I:10 Phase-II:10 Phase-III:10 Phase-IV:20		--	50			100

ISE:

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.

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Semester VI

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXC601	Basic VLSI Design	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		EXC302: Electronic Devices EXC303: Digital Circuits and Design EXC402: Discrete Electronic Circuits EXC502: Design With Linear Integrated Circuits
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Distinguish between technologies and MOSFET models
	CO2	Analyze MOSFET based circuits like inverters, logic circuits and semiconductor memories
	CO3	Design MOSFET based logic circuits with different design styles
	CO4	Design data path for adders, multipliers and shifters
	CO5	Discuss issues in VLSI Clocking and System Design

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Technology Trend**		06
	1.1	**Technology Comparison:** Comparison of BJT, NMOS and CMOS technology	1	
	1.2	**MOSFET Scaling:** Types of scaling, Level 1 and Level 2 MOSFET Models, MOSFET capacitances	1	
2		**MOSFET Inverters**		10
	2.1	**Circuit Analysis:** Static and dynamic analysis (Noise, propagation delay and power dissipation) of resistive load and CMOS inverter, comparison of all types of MOS inverters, design of CMOS inverters, CMOS Latch-up	1	
	2.2	**Logic Circuit Design:** Analysis and design of 2-I/P NAND and NOR using equivalent CMOS inverter	1	
3		**MOS Circuit Design Styles**		10
	3.1	**Design Styles:** Static CMOS, pass transistor logic, transmission gate, Pseudo NMOS, Domino, NORA, Zipper, C2MOS, sizing using logical effort	1,7	
	3.2	**Circuit Realization:** SR Latch, JK FF, D FF, 1 Bit Shift Register, MUX, decoder using above design styles	1,7	
4		**Semiconductor Memories**		08
	4.1	**SRAM:** ROM Array, SRAM (operation, design strategy, leakage currents, read/write circuits), DRAM (Operation 3T, 1T, operation modes, leakage currents, refresh operation, Input-Output circuits),	1,2	

		Flash (mechanism, NOR flash, NAND flash)		
	4.2	**Peripheral Circuits:** Sense amplifier, decoder	1,2,3	
5		**Data Path Design**		**08**
	5.1	**Adder:** Bit adder circuits, ripple carry adder, CLA adder	7	
	5.2	**Multipliers and shifter:** Partial-product generation, partial-product accumulation, final addition, barrel shifter	7	
6		**VLSI Clocking and System Design**		**10**
	6.1	**Clocking:** CMOS clocking styles, Clock generation, stabilization and distribution	2,5,6	
	6.2	**Low Power CMOS Circuits:** Various components of power dissipation in CMOS, Limits on low power design, low power design through voltage scaling	5,6	
	6.3	**IO pads and Power Distribution:** ESD protection, input circuits, output circuits, simultaneous switching noise, power distribution scheme	5,6	
	6.4	**Interconnect:** Interconnect delay model, interconnect scaling and crosstalk	5,6	
			Total	**52**

References:

[1] Sung-Mo Kang and Yusuf Leblebici, "CMOS Digital Integrated Circuits Analysis and Design", Tata McGraw Hill, Third Edition.

[2] Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: A Design Perspective", Pearson Education, Second Edition.

[3] Etienne Sicard and Sonia Delmas Bendhia, "Basics of CMOS Cell Design", Tata McGraw Hill, First Edition.

[4] Neil H. E. Weste, David Harris and Ayan Banerjee, "CMOS VLSI Design: A Circuits and Systems Perspective", Pearson Education, Third Edition.

[5] Debaprasad Das, "VLSI Design", Oxford, First Edition.

[6] Kaushik Roy and Sharat C. Prasad, "Low-Power CMOS VLSI Circuit Design", Wiley, Student Edition.

[7] John P. Uyemura, "Introduction to VLSI Circuits and Systems", Wiley, Student Edition, 2013.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXC602	Advanced Instrumentation System	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Identify process control system components and their applications.
	CO2	Apply the knowledge of Pneumatic and Hydraulic components in Instrumentation Process System.
	CO3	Discuss principles of transmission and conversion of process parameters to electrical and vice versa.
	CO4	Decide the appropriate types of controllers and their tuning methods to build the process control system

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Concepts of Advancement in Instrumentation**		06
	1.1	Data acquisition and data logging, telemetry in measurement, basic requirement of control system and components	7	
2		**Pneumatic Components**		12
	2.1	ISO symbols, pneumatic air supply system, air compressors, pressure regulation devices, directional control valves	4	
	2.2	**Special types of pneumatic valve:** pilot-operated valves, non-return valves, flow control valves, sequence valves, and time delay valve	4	
	2.3	Single and double acting linear actuators, special type of double acting cylinder, rotary actuators, air motors	4	
	2.4	**Process control pneumatics:** flapper nozzle system, volume boosters, air relays, pneumatic transmitters and controllers, pneumatic logic gates, dynamic modeling of pneumatic circuits	4	
3		**Hydraulic Components**.	4	06
	3.1	Hydraulic pumps, Pressure regulation method, loading valves	4	
	3.2	Hydraulic valves and actuators, speed control circuits for hydraulic actuators	4	
	3.3	Selection and comparison of pneumatic, hydraulic and electric systems	4	
4		**Transmitters and Converters**		12
	4.1	Electronic versus pneumatic transmitters, 2-wire; 3-wire and 4-wire current transmitters	4,1	
	4.2	**Electronic type:** temperature, pressure, differential pressure, level, flow transmitters and their applications Smart (Intelligent) transmitters, Buoyancy transmitters and their applications.	4,1	

	4.3	**Converters**: Pneumatic to Electrical and Electrical to Pneumatic converters	4,1	
5		**Process Control Valves**		**08**
	5.1	Globe, ball, needle, butterfly, diaphragm, pinch, gate, solenoid, smart control valves and special designs of globe valves	4	
	5.2	Flow characteristics, control valve parameters, control valve capacity, valve rangeabilty, turn-down, valve size, valve gain	4	
	5.3	Selection criteria, specifications and installation of control valves	4	
	5.4	**Valve Positioners**: Necessity, types-motion balance and force-balance, effect on performance of control valve	4	
	5.5	**Control Valve Actuators:** Electrical, pneumatic, hydraulic, electro-mechanical, digital actuators. selection criteria of valve actuators	4	
6		**Controllers and Controller Tuning**		**08**
	6.1	**Continuous and discontinuous controller:** proportional controller, proportional band, RESET controller, rate controller, composite controller, cascade controller, feed-forward controller	4,1	
	6.2	Need and different method of controller tuning	4,1	
			Total	**52**

References:

[1] Bella G. Liptak, "Process Control and Optimization, Instrument Engineer's Handbook", CRC Press , Fourth Edition

[2] WG Andrews and Williams, "Applied Instrumentation in the process Industries, Vol. - I and II", Gulf Publication

[3] Terry Barlett, "Process Control System and Instrumentation", Delimar Cengage learning Reprint-2008

[4] Andrew Parr, "Hydraulics And Pneumatics- A Technician's And Engineer's Guide", Jaico Publishing House, Mumbai

[5] C.D.Johnson, "Process Control and Instrument Technology", Tata Mcgraw Hill.

[6] J. W. Hatchison, "ISA Handbook of Control Valves", ISA, Second Edition.

[7] A. K. Sawhney, Electrical & Electronic Instruments & Measurement, Dhanpat Rai and Sons, Eleventh Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXC603	Computer Organization	4	--	--	4	--	--	--
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Outline the basic structure of a digital computer and illustrate the integer and floating point arithmetic.
	CO2	Design the control unit of a CPU using two approaches namely hardwired and micro-programmed control.
	CO3	Classify and Create a memory organization
	CO4	Discuss the concepts of I/O organization
	CO5	Discuss instruction level parallelism and IA32 family architecture.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction to Computer Organization**		10
	1.1	Fundamental units of computer organization, evolution of computers, von neumann model, performance measure of computer architecture	1,3	
	1.2	Introduction to buses and connecting I/O devices to CPU and Memory, bus structure,	1,3	
	1.3	Introduction to number representation methods, integer data computation, floating point arithmetic.	3	
2		**Processor Organization and Architecture**		14
	2.1	CPU Architecture, register organization, instruction formats, basic instruction cycle, instruction interpretation and sequencing	1,3	
	2.2	**Control unit:** soft wired (micro-programmed) and hardwired control unit design methods	1,3	
	2.3	Microinstruction sequencing and execution, micro operations, concepts of nano programming.	1,3	
	2.4	Introduction to RISC and CISC architectures and design issues, case study on 8085 microprocessor, features, architecture, pin configuration and addressing modes		
3		**Memory Organization**		12
	3.1	Introduction to memory and memory parameters, classifications of primary and secondary memories, types of RAM and ROM, allocation policies, memory hierarchy and characteristics	1,3	
	3.2	Cache memory concept, architecture (L1, L2, L3), mapping techniques, cache coherency	1,3	
	3.3	Interleaved and associative memory, virtual memory, concept,	1,3	

		segmentation and paging, page replacement policies		
4		**Input / Output Organization**		**08**
	4.1	Types of I/O devices and access methods, types of buses and bus arbitration, I/O interface, serial and parallel ports	1,3	
	4.2	Types of data transfer techniques, programmed I/O, interrupt driven I/O and DMA	1,3	
	4.3	Introduction to peripheral devices, scanner, plotter, joysticks, touch pad, storage devices	1,3	
5		**Introduction To Parallel Processing System**		**04**
	5.1	Introduction to parallel processing concepts, Flynn" s classifications, pipeline processing, instruction pipelining, pipeline stages, pipeline hazards	1,2	
6		**Introduction to Intel IA32 Architecture**.		**04**
	6.1	Intel IA32 family architecture, register structure, addressing modes, advancements in arithmetic and logical instructions, exception handling in IA32 architecture	1	
			Total	**52**

References:

[1] Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Tata McGraw-Hill, Fifth Edition

[2] John P. Hayes, "Computer Architecture and Organization", Third Edition.

[3] William Stallings, "Computer Organization and Architecture: Designing for Performance", Pearson, Eighth Edition.

[4] B. Govindarajulu, "Computer Architecture and Organization: Design Principles and Applications", Tata McGraw-Hill, Second Edition.

[5] Dr. M. Usha and T. S. Srikanth, "Computer System Architecture and Organization", Wiley-India, First Edition.

[6] Ramesh Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", Penram, Fifth Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXC604	Power Electronics I	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		EXC302: Electronic Devices
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Analyze different circuits involving Silicon Controlled Rectifier
	CO2	Interpret tradeoffs involved in power semiconductor devices.
	CO3	Analyze different types of controlled rectifiers and inverters
	CO4	Analyze DC-DC convertors (choppers) and AC-AC converters.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Silicon Controlled Rectifiers**		10
	1.1	Principle of operation of SCR, static and dynamic characteristics, gate characteristics	3,7	
	1.2	Methods of turning on (type of gate signal), firing circuits (using R, R-C, UJT),commutation circuit	3,7	
	1.3	Protection of SCR	3,7	
2		**Other Switching Devices**		08
	2.1	**Principle of operation, characteristics, rating and applications of:** TRIAC, DIAC, GTO, MOSFET, IGBT and power BJT	2	
	2.2	Driver circuits for power transistors	2,7	
3		***Controlled Rectifiers**		12
	3.1	Half wave controlled rectifiers with R, R-L load,	2,8	
	3.2	Full wave controlled rectifiers, half controlled and fully controlled rectifiers with R, R-L load **(effect of source inductance not to be considered)**	2,8	
	3.3	Single phase dual converter, three phase half controlled and fully controlled rectifiers with R load only ***Numerical based on calculation of output voltage**	2,8	
4		***Inverters**		10
	4.1	**Introduction, principle of operation, performance parameters of:** Single phase half / full bridge voltage source inverters with R and R-L load, three phase bridge inverters (120_0 and 180_0 conduction mode) with R and R-L load	2,7	
	4.2	Voltage control of single phase inverters using PWM techniques, harmonic neutralization of inverters, applications ***Numerical with R load only**	2,7	

5		**Choppers**		**06**
	5.1	Basic principle of step up and step down choppers	2	
	5.2	**DC-DC switching mode regulators:** Buck, Boost, Buck-Boost, Cuk regulators, (CCM mode only)	2	
6		**AC Voltage Controllers**		**04**
	6.1	Principle of On-Off control, principle of phase control, single phase bidirectional control with R and RL load	1,2	
7		**Cycloconvertor**		**02**
	7.1	Introduction, single phase and three phase Cyclo-converters, applications	2,7	
			Total	**52**

References:

[1] M. H. Rashid, "Power Electronics", Prentice-Hall of India, Third Edition.

[2] Ned Mohan, "Power Electronics", Undeland, Robbins, John Wiley Publication, Third Edition.

[3] Ramamurthy, " Thyristors and Their Applications", East-West Press, Third Edition.

[4] Alok Jain, "Power Electronics and its Applications", Penram International Publishing (India) Pvt. Ltd, Second Edition.

[5] Vedam Subramanyam, "Power Electronics", New Age International, Second Edition.

[6] Landers, "Power Electronics", McGraw Hill, Second Edition.

[7] M.D. Singh and K. B. Khanchandani, "Power Electronics", Tata McGraw Hill, Second Edition.

[8] P. C. Sen, "Modern Power Electronics", Wheeler Publication, Second Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXC 605	Digital Signal Processing and Processors	4	--	--	4	--	--	4
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Apply DFT Properties and Illustrate FFT algorithms
	CO2	Design and Realize Digital IIR & FIR Filters
	CO3	Analyze the effect of hardware limitations
	CO4	Justify the need and use of DSP processor

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Discrete Fourier Transform and Fast Fourier Transform**		10
	1.1	**Discrete Fourier Series**: Properties of discrete Fourier series, DFS representation of periodic sequences.	1,2,7	
	1.2	**Discrete Fourier transforms**: Properties of DFT, linear convolution of sequences using DFT, computation of DFT, relation between Z-transform and DFS	1,2,7	
	1.3	**Fast Fourier Transforms**: Fast Fourier transforms (FFT), Radix-2 decimation in time and decimation in frequency FFT algorithms, inverse FFT, and composite FFT	1,2,7	
2		**IIR Digital Filters**		10
	2.1	Mapping of S-plane to Z-plane, impulse invariance method, bilinear Z transformation (BLT) method, frequency warping, pre-warping	1,3,7	
	2.2	**Analog filter approximations**: Butter worth and Chebyshev, design of IIR digital filters from analog filters, design examples	3,7	
	2.3	Analog and digital frequency transformations		
3		**FIR Digital Filters**		10
	3.1	Characteristics of FIR digital filters, frequency response, location of the zeros of linear phase FIR filters	1,3,7	
	3.2	Design of FIR digital filters using window techniques, Gibbs phenomenon, frequency sampling technique, comparison of IIR and FIR filters	1,3,7	
4		**Finite Word Length Effects in Digital Filters**		08
	4.1	Number representation, fixed point, sign-magnitude, one‟s complement, two‟s complement forms, floating point numbers	3,4	
	4.2	Quantization, truncation, rounding, effects due to truncation and rounding, Input quantization error, Product quantization error, co-	3,4	

		efficient quantization error, zero-input limit cycle oscillations, overflow limit cycle oscillations, scaling		
	4.3	Quantization in Floating Point realization IIR digital filters, finite word length effects in FIR digital filters, quantization effects in the computation of the DFT- quantization errors in FFT algorithms		
5		**Introduction to DSP Processors**		**08**
	5.1	Introduction to fixed point and floating point DSP processor, multiplier and multiplier accumulator (MAC), modified bus structures and memory access schemes in DSPs, multiple access memory, multiport memory, VLIW architecture, pipelining, special addressing modes, on-chip peripherals	4	
	5.2	Features of TMS 320c67xx DSP processor, architecture of TMS 320c67xx DSP processor, architecture features: computational units, bus architecture memory, data addressing, address generation unit, program control, program sequencer, pipelining, interrupts, features of external interfacing, on-chip peripherals, hardware timers, host interface port, clock generators, SPORT	4	
6		**Applications of DSP Processors**		**06**
	6.1	Speech Processing: Speech analysis, speech coding, sub band coding, channel vocoder, homomorphic vocoder, digital processing of audio signals.	5	
	6.2	**Radar signal processing**: Radar principles, radar system and parameter considerations, signal design	5	
			Total	**52**

References:

[1] Proakis J., Manolakis D., "Digital Signal Processing", Pearson Education, Fourth Edition

[2] Oppenheim A., Schafer R., Buck J., "Discrete Time Signal Processing", Pearson Education, Second Edition.

[3] Babu R., "Digital Signal Processing", Scitech Publications, Fourth Edition

[4] B. Venkata Ramani and M. Bhaskar, "Digital Signal Processors, Architecture, Programming and Applications", Tata McGraw Hill, Edition 2004.

[5] L. R. Rabiner and B. Gold, "Theory and Applications of Digital Signal Processing", Prentice-Hall of India, Edition 2006.

[6] B. Kumar, "Digital Signal Processing", New Age International Publishers, Edition 2014.

[7] S.Salivahanan, A Vallavaraj, C Gnanapriya, "Digital Signal Processing", Tata McGraw Hill Edition Private Limited, New Delhi, Edition 2010

Sardar Patel Institute of Technology

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXC 606	Modern Information Technology for Management	2	--	--	2	--	--	2
		Examination Scheme						
		ISE		MSE	ESE			
		10		30	100 (60% Weightage)			

Pre-requisite Course Codes		
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Identify production tools, various protocols which run the business infrastructure system and business system managements
	CO2	List the importance of IT tools in content management
	CO3	List various network management protocols and their applicability in global connectivity.
	CO4	Identify keys applications of Management Information System in various businesses.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**IT Infrastructure**		06
	1.1	Information technology	1	
	1.2	Computing infrastructure: software		
	1.3	Networking infrastructure		
	1.4	Cabling infrastructure		
	1.5	Wires less infrastructure		
	1.6	Storage infrastructure		
2		**IT Production Tool**		06
	2.1	Security infrastructure	1	
	2.2	Office tools		
	2.3	Data management tools		
	2.4	Web tools		
3		**Internet and Network Protocol**		04
	3.1	Network management tools	1	
	3.2	Network protocols and global connectivity		
4		**IT Management**		06
	4.1	E-Business Highway- business automation platform	1	
	4.2	Infrastructure management		
	4.3	Security management		
	4.4	Information management and audit		
5		**IT Applications**		04
	5.1	E Governance	1,2	
	5.2	Connected world and E-commerce		

	5.3	Information systems		
	5.4	Business systems		
			Total	**26**

References:

[1] B Muthukumaran, "*Information Technology for Management*", Oxford University Press, Edition 2010.

[2] Kenneth C. Laudon and Jane P. Laudon, "*Management Information Systems*", Pearson Education, Fourth Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXL601	VLSI Design Laboratory	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE			Total	
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes		
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Make use of simulation tools to verify characteristics of MOSFET based circuits
	CO2	Set-up simulation environment for VLSI circuit simulation
	CO3	Observe characteristics of MOSFETS via simulation
	CO4	Discuss tradeoffs in VLSI circuits by observing simulation results
	CO5	Validate design of MOSFET based circuits
	CO6	Reproduce the given abstract of the IEEE paper

Exp. No.	Experiment Details	Ref.	Marks
1	To Analyze NMOS and PMOS Transistor characteristics.	1,2	5
2	To simulate Resistive Load Inverter and CMOS Inverter, verify the VTC. Compare both the topologies. Comment on the Noise Margins.	1,2	5
3	Implement CMOS NAND, NOR, AND, OR using Static CMOS Logic.	1,2	5
4	Design and Implement AB+CD bar using different CMOS Logic styles.	1,2	5
5	Simulate Pseudo NMOS Inverter and comment on the result.	1,2	5
6	Simulate 6 Transistor SRAM and check the read and write stability	1,2	5
7	Design and Implement given equation using Pseudo NMOS ,Domino Logic and C^2MOS Logic	1,2	5
8	Simulate Clocked JK and D Flip Flop using Static CMOS Logic.	1,2	5
		Total Marks	40

References:

[1] Sung-Mo Kang and Yusuf Leblebici, "*CMOS Digital Integrated Circuits Analysis and Design*", Tata McGraw Hill, 3rd Edition.

[2] Etienne Sicard and Sonia Delmas Bendhia, "*Basics of CMOS Cell Design*", Tata McGraw Hill, First Edition.

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXL602	Digital Signal Processing and Processors Laboratory	--	--	2	--	--	1	1
		Examination Scheme						
		ISE		ESE				Total
				Practical		Oral		
		40		--		20		60

Pre-requisite Course Codes		
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Test Fast Fourier Transform Algorithm
	CO2	Design a Digital Filter
	CO3	Adapt open source tools for signal processing application
	CO4	Demonstrate Real Time Signal Processing using DSP Processor

Exp. No.	Experiment Details	Ref.	Marks
1	Convolution and Correlation		5
2	Discrete Fourier Transform		5
3	Fast Fourier Transform		5
4	Overlap Add Method / Overlap Save Method		5
5	Digital IIR Filter Design		5
6	Digital FIR Filter Design		5
7	Real Time Signal Processing		5
8	Signal Processing Application		5
		Total Marks	40

References:
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
Course EXL603a	Advanced Instrumentation System	--	--	2	--	--	1	1
		Examination Scheme						
		ISE			ESE			Total
					Practical		Oral	
		40(50%weightage)			--		10	30

Pre-requisite Course Codes		
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Make use of Virtual Instrumentation software (LabVIEW) in process control applications.
	CO2	Differentiate Pneumatic and Hydraulic components
	CO3	Make use of simulator to build Pneumatic and Hydraulic control circuit
	CO4	Design PID control circuit

Exp. No.	Experiment Details	Ref.	Marks
1	To construct a VI to convert Fahrenheit to Celsius, $c = (f - 32)/1.8$ and convert into sub-VI by selection.	1	5
2	To construct a VI to add 8 numeric pressure input values and light up LED if sum <25	1	5
3	To constructs a VI to monitor industry temperature and display warning text and glow warning LED if: 1) Current temperature > max temperature. warning text: Heat stroke warning 2) Current temperature < min temperature. warning text: Freeze warning 3) min. temperature < current temperature <max temperature. warning text: no warning text.	1	5
4	To construct a VI to generate a sine wave using Simulate signal express VI. Add uniform white noise then use suitable filter to filter signal and show filtered and unfiltered signal.	1	5
5	To construct a VI to create a table to display pressure values P, $P, \sqrt{P}$	1	5
6	To demonstrate and understand different types of Pneumatic	2	5

	Components: i) 5/3 way hand lever valve, ii) 5/2 way pushbutton valve, iii) 5/2 way single solenoid valve, iv) 5/2 way double solenoid valve, v)5/2 way direction control valve, vi)Double acting cylinder, vii) Compressor, viii) FRL unit.		
7	To design a PLC based pneumatic system which will operate double acting cylinder using 5/2 way double solenoid valve and pushbutton	2	**5**
8	To design and simulate PID controller for process control application of plant using MATLAB	3	**5**
		Total Marks	**40**

References:

[1] www.ni.com
[2] Electro-pneumatic manual
[3] www.mathworks.com

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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXL603b	Power Electronics – I Lab	--	--	2	--	--	1	1
		Examination Scheme						
		ISE			ESE			Total
					Practical		Oral	
		40(50%weightage)			--		10	30

Pre-requisite Course Codes		
After successful completion of the course, student will be able to		
Course Outcomes	CO1	Make use of simulation tool to analyze power electronic circuits and comment on its performance
	CO2	Analyze different power semiconductor switches with their characteristics
	CO3	Evaluate different performance parameters of rectifiers and choppers
	CO4	Evaluate different performance parameters of inverters and cycloconverters

Exp. No.	Experiment Details	Ref.	Marks
1	Analysis of V-I Characteristics of SCR.	4	5
2	Analysis of Half Wave Controlled Rectifier using SCR.	1	5
3	Analysis of V-I Characteristics of TRIAC.	7	5
4	Analysis of Light Dimmer using DIAC and TRIAC.	7	5
5	Analysis of different performance parameters of semi-converter using PSIM	2	5
6	Analysis of different performance parameters of full converter using PSIM	2	5
7	Evaluation of different performance parameters of Buck Converter using PMLK	2	5
8	Evaluation of different performance parameters of Boost Converter using PMLK	2	5
		Total Marks	40

References:
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Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
EXL604	Mini Project II	--	--	2	--	--	2	2
		Examination Scheme						
		ISE		Practical		Oral		Total
		Phase-I:10 Phase-II:10 Phase-III:10 Phase-IV:20		--		50		100

ISE:

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 topic of Mini Project I and II may be different and / or may be advancement in the same topic. 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.