Department of Electronics and Telecommunication Engineering

Course Code	Name of Course	Course Category	Teaching Scheme				Credits	Evaluation Scheme					
								Theory			Practical		Total Marks
			L	T	P	Total Hours		TAE	CAE	ESE	INT	EXT	
SEMESTER-V													
23BTECL301	Electromagnetics and Waveguides	PCC 6	3	-	-	3	3	10	15	50	-	-	75
23BTECL302 23BTECP302	Digital System Design	PCC 7	2	-	2	4	3	10	15	50	25	-	100
23BTECL303 23BTECP303	Analog Communication	PCC 8	3	-	2	5	4	10	15	50	25	-	100
23BTECLXXX 23BTECPXXX	Program Elective I	PEC 1	3	-	2	5	4	10	15	50	25	-	100
23BTXXXXX	Open Elective III	OE 3	2	-	-	2	2	10	15	50	-	-	75
23BTXXXXX	Multidisciplinary Minor	MDM 3	3	-	2	5	4	10	15	50	25	-	100
23BTSHP301	Research Methodology	RM	-	-	4	4	2	-	-	-	25	-	25
		TOTAL	**16**	**-**	**12**	**28**	**22**	**60**	**90**	**300**	**125**	**-**	**575**

Course	Offered to Department	Name of Subject	Course Code (L)
Program Elective I	ETC	Introduction to Computer Networks	23BTECL306 23BTECP306
		Embedded System Design and RTOS	23BTECL307 23BTECP307
		Power Electronics	23BTECL308 23BTECP308
Open Elective III	Other than ETC	Introduction to Mechatronics	23BTECL309
Open Elective III	ETC	Cloud Computing	23BTAIL312
		Environmental Impact Assessment	23BTCEL308
		Scripting Languages	23BTCSL306
		Soft Computing	23BTDSL331
		Cyber Forensics	23BTITL303
Multidisciplinary Minor (MDM 3)	Other than ETC	Microcontroller and Applications	23BTECL205XX 23BTECP205XX
Multidisciplinary Minor (MDM 3)	ETC	Data Structure with C Programming	23BTXXXXX 23BTXXXXX

Department of Electronics and Telecommunication Engineering

Course Title: Electromagnetics and Waveguide										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC 6	3		--	3	10	15	50	--	--
Course Code	23BTECL301									
Teaching Mode	Offline	3 Hrs			Total	**75**				
Duration of ESE	3 Hrs					75				

Course Objectives	1. To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields, and apply them to solve physics and engineering problems.
	2. To distinguish between static and time-varying fields, and understand the significance and utility of Maxwell's Equations and Boundary Conditions, and gain ability to provide solutions to communication engineering problems.
	3. To analyze the characteristics of Uniform Plane Waves (UPW), determine their propagation parameters and estimate the same for dielectric and dissipative media.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Distinguish between the static and time-varying fields
	CO2: Analyze and classify magnetic materials, and solve magneto static field problems using Biot-Savart law and Ampere's circuit law with the associated boundary conditions.
	CO3: Make use of Maxwell's equations to solve field problems
	CO4: Analyze the Wave Equations and evaluate the UPW Characteristics with estimation of Polarization.
	CO5: Demonstrate the fundamentals of transmission line theory and impedance matching in high frequency lines

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CO1	3	2	2	2	2	0	0	0	1	1	0	2	3		
CO2	3	3	2	2	2	0	0	0	1	1	0	2	3		
CO3	3	3	2	2	2	0	0	0	1	1	0	2	3		
CO4	3	3	2	3	3	0	1	0	1	1	1	3	3		
CO5	3	3	3	3	3	0	1	0	1	1	1	3	3		

Department of Electronics and Telecommunication Engineering

Course Contents:

Unit	Contents	Hours
I	**Electrostatics:** Coordinate Systems – Vector fields, Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss Law, Divergence theorem and applications, Physical significance of Divergence and Curl with numerical, Relations Between E and V, Gradient.	8
II	**Magnetostatics:** Continuity Equation, Biot-Savart's Law, Ampere's Circuital Law and Applications (Stoke's Theorm), Magnetic Flux Density, Curl, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields	8
III	**Maxwell's Equations and its applications:** Maxwell's Equations for static and time varying fields, Maxwell's Equations in differential and integral Forms and their significance, Conditions at a Boundary Surface, Electric and magnetic boundary conditions.	8
IV	**Uniform Plane Waves:** Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Wave Propagation in Good Conductors and Good Dielectrics, Skin effect, Poynting Vector and Poynting Theorem.	8
V	**Waveguide:** Introduction, wave equation in Cartesian, Coordinates, Rectangular waveguide, TE, TM, TEM waves in rectangular guides, wave impedance, loses in wave guide.	8

Text Books	1.	A.U.Tinguria, Fundamentals of Electromagnetic Fields, Third Edition, Denett & Co., 2010
	2.	Principles of Electromagnetics, Matthew N.O. Sadiku and S.V. Kulkarni, Oxford University Press,2015,6
E--Books	1.	W.H Hayt. and J.A. Buck, Engineering Electromagnetics, Seventh Edition, Tata Mc-Graw Hill, 2006
Reference Books	1.	K. D. Prasad, Antenna & wave propogation, Third Edition, PHI Publication, 2009
	2.	E.C. Jordan and K.C. Balamin, Electromagnetic Waves and Radiating System, Second Edition, Prentice Hall of India Private Limited, 1985
	3.	J.D Krauss, Electromagnetics, Third Edition, Mc-Graw Hill, 1984 Rao, Elements of Engineering Electromagnetics, Sixth Edition, Pearson education, 2006

Department of Electronics and Telecommunication Engineering

Course Title: **Digital System Design**										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC 7	2Hr.	-	2Hr	3	10	15	50	25	-
Course Code	23BTECL302 23BTECP302									
Teaching Mode	Offline	4Hr			Total	75			25	
Duration of ESE	3 Hr.					100				

Course Objectives	1.To understand basic digital system & modelling
	2.To apply knowledge on VHDL program for implementing Combinational & Sequential
	3.To interpret complex problem in the field of digital system design
Course Outcomes	**Upon successful completion of the course ,students shall be able to**
	CO1: Understand digital systems and its modelling using VHDL language
	CO2 Analyse and model combinational digital systems using VHDL
	CO3: Design and analyse sequential digital systems and Finite State Machines using VHDL
	CO4: Synthesize the modelled systems using suitable programmable logic devices
	CO5: Apply the concepts of HDL synthesis to design, optimize and analyze digital systems.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	**Program Outcomes and Program Specific Outcomes**														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1	2	2	1	2	-	-	-	1	-	-	2	3	-	-
CO2	2	3	3	2	3	-	-	-	2	-	-	2	3	-	-
CO3	2	3	3	2	3	-	-	-	2	-	-	2	3	-	-
CO4	2	2	3	2	3	-	-	-	2	-	-	2	3	-	-
CO5	2	3	3	2	3	-	-	-	2	-	-	2	3	-	-

Department of Electronics and Telecommunication Engineering

Course Contents:

Unit	Contents	Hours
I	**Introduction:** Hardware Description Languages, Introduction to VHDL, packages and library, Methodologies, design units, data objects, VHDL data types, Attributes, Concurrent and sequential, inertial and transport delays, delta delay, signal drivers.	07
II	**Combinational Circuit Design using VHDL** Modelling combinational circuit using behavioural, data flow and structural architecture. Design of basics gates, adder, decoder, encoder, multiplexer, Demultiplexer, comparator, ALU. Use of generic and generate statement. Concurrent and sequential statements. Subprograms – Functions, Procedures. Testbench	07
III	**Sequential Circuit Design and Finite state machine:** Latches, Flip-Flops, SR, JK, D, T, Master slave Flip-Flops, Shift Registers & Counters, Controller design, Accumulator design. Finite state machine: Mealy and Moore, implementation of FSMs, Linear feedback shift register (Pseudorandom and CRC)	05
IV	Introduction and Application of PLDs: Introduction to place & route process, Pipelining and timing issues, PALs, PLAs, Look up Table, PROMs, DRAMs, Flash memory. FPGA, CPLD architecture. MPSOC	05
V	HDL Synthesis : HDL Synthesis: The Synthesis Concept, Timing Analysis of Logic Circuits, Efficient Coding Styles, Combinatorial Logic Synthesis, Partitioning for Synthesis, Pipelining Resource sharing, Optimizing arithmetic expressions. Power Analysis of FPGA based system, RTL, Process annotation.	06

Text Book/Reference Books/Online Material

Text Books	1.	Fundamentals of Digital Logic with VHDL design – Stephen Brown, Zvonko Vranesic – TMH.
	2.	VHDL A Design Oriented Approach – S.S. Limaye The Mc Graw Hill
Reference Books	1.	VHDL Primer – J Bhasker – Pearson Education
	2.	Digital System Design Using VHDL – Chales H. Roth.
	3.	Digital System Design – John Wakerley.
	4.	VHDL – Zainalabedin Navabbi.VHDL – D. Smith.
	5.	VHDL – 3rd Edition – Douglas Perry – TMH
EBooks	1.	Free Range VHDL-Bryan Mealy, Fabrizio Tappero Copyright ©2018 B. Mealy, F. Tappero, Release: 1.21, Date: 4 January 2018
	2	VHDL: Programming by Example- Douglas L. Perry (Mountain View, CA) McGraw-Hill Education; 4 edition ISBN-10: 0071400702
	3	Effective Coding with VHDL: Principles and Best Practice -Ricardo Jasinski is Founder and Lead Developer at Solvis Ltd. The MIT Press, ISBN-10: 0262034220
	4	DIGITAL FUNDAMENTAL, Ninth Edition-Thomas l. Floyd-Pearson Education International ISBN: 0-13-197255-3
Online TL Material	1.	https://nptel.ac.in/courses/117/105/117105080/

Department of Electronics and Telecommunication Engineering

Sr. No.	Name of Experiments / Mini Projects/ Case Studies	CO Mapping
1	Simulation and synthesis of Logic Gates using VHDL.	CO1
2	Testing of multiplexer for all input combination using VHDL.	CO2
3	Verification of 16 bit ALU operation using VHDL.	CO2
4	Design BCD to seven segment decoder & display “GHRCEM”.	CO2
5	Validation of priority encoder using VHDL.	CO2
6	Simulation of 4:16 decoder using VHDL.	CO2
7	Simulation and synthesis of Flip-flop.	CO3
8	Design and simulation of counter using VHDL.	CO3
9	Implementation of Mealy FSM using VHDL.	CO3
10	Synthesis and implementation of one bit full adder on FPGA board.	CO4
11	To analyze efficient HDL coding and Combinational Logic Synthesis.	CO5
Open Ended Experiments		
1	Write a VHDL code for to divide clock frequency of 50 MHz.	CO3
2	Write a code for 8 Bit RAM Module	CO3

Department of Electronics and Telecommunication Engineering

Course Title: Analog Communication										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC 8	3	-	2	4	10	15	50	25	-
Course Code	23BTECL303 23BTECP303									
Teaching Mode	Offline	5 Hrs			Total	75			25	
Duration of ESE	3 Hrs					100				

Course Objectives	1. To understand the basic concept of communication and different modulation systems based on basic parameters.
	2.To understand the concept of Sampling
	3. To understand working of Radio receivers.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Understand the concept of modulation and their types, propagation of waves and evaluate the influence of noise on communication signals
	CO2: Understand and analyze various types analog modulation techniques and can generate AM signal.
	CO3: Apply performance parameters on analog demodulation techniques.
	CO4: Analyze and apply the generation of frequency modulation signal.
	CO5: Analyze and apply FM signal receiver techniques.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CO1	3	2	1	1	2	0	0	0	1	1	0	2	1	1	1
CO2	3	3	2	2	2	0	0	0	1	1	1	2	1	2	1
CO3	3	3	2	2	3	0	0	0	1	1	1	2	1	2	1
CO4	3	3	2	2	3	0	0	0	1	1	1	2	1	2	1
CO5	3	2	2	2	3	0	0	0	1	1	1	3	1	2	1

Department of Electronics and Telecommunication Engineering

Course Contents:

Unit	Contents	Hours
I	**Introduction to Analog Communication Radiation and Propagation**: Block Schematic of Communication System, Simplex and duplex systems, Base Band Signals and their bandwidth requirements, RF Bands. Modes of communication: Broadcast and point to point communication, Necessity of modulation, Classification of modulation. Concept of Radiation and Electromagnetic waves, Mechanism of Propagations: Ground Wave, Sky Wave, Space Wave, Noise, Types of Noise, S/N ratio, Noise Figure.	8
II	**Amplitude Modulation:** Amplitude Modulation: Introduction, Mathematical analysis and expression for AM, Modulation index, Frequency spectrum and bandwidth of AM, Power calculations, Generation of AM using nonlinear component, Low- and high-level modulation, Balance Modulator. Types of AM: DSB-FC, DSB-SC, SSB-SC, ISB and VSB, their generation methods and comparison.	8
III	**AM Demodulation:** Performance Parameters of AM receivers: Selectivity, Sensitivity, Fidelity, Image frequency and rejection ratio, TRF receiver, Superheterodyne receiver, RF amplifier, Local oscillator and mixer, IF amplifier, AGC, Envelope detection,	8
IV	**Frequency Modulation:** Introduction, Mathematical analysis of FM and PM, Modulation Index, Frequency spectrum and bandwidth of FM, Narrow band and wide band FM, Direct and indirect methods of FM generation, Pre emphasis and de-emphasis, Comparison of AM, FM and PM.	8
V	**FM Demodulation:** Varactor diode and FET modulators, Armstrong method, FM receiver, FM discriminator, Balanced Slope detectors and PLL detectors, Advance topic based on course.	8

Text Books	1.	Electronic Communication Systems , Kennedy & Devis ,Tata McGraw Hills Publication (Fourth Edition)
	2	Electronic Communication, Dennis Roddy & Coolen, Pearson Education (Fourth Edition)
	3	Modern Digital and Analog. Communication Systems: B. P. Lathi, Oxford Press Publication (Third Edition)
	4	Communication Systems, Dr. Sanjay Sharma ,Katariya and sons ,2006,4th
Reference Books	1.	Simon Haykin: Communication Systems, John Wiley & Sons (Fourth Edition)
	2.	Taub & Schilling: Principles of Communication Systems, Tata McGraw-Hill
	3.	Leon W. Couch, II: Digital and Analog Communication Systems, Pearson Education (Seventh Edition)
E-Books	1	Analog Communication, U A Bakshi, A. P. Godse, Technical Publications, 2010
	2	Analog Communication, K. N. Hari, Pearson Publication
Online TL Material	1	Swayam Link:https://swayam.gov.in/

Department of Electronics and Telecommunication Engineering

Sr. No.	Name of Experiments	CO Mapped
1	To study the operation of Amplitude Modulation and Demodulation and plot the graph for Modulation and Demodulation.	CO2
2	To perform AM demodulation using super heterodyne receiver & check the parameters Selectivity, Sensitivity, Fidelity of receiver.	CO3
3	To study the operation of Frequency Modulation.	CO4
4	Design of Pre-emphasis and De-emphasis circuit using Multisim.	CO4
5	To Perform Frequency demodulation and verify simulation on MATLAB.	CO4
6	To Perform Frequency demodulation using PLL detectors.	CO3
7	To study Direct and indirect methods of FM generation.	CO5
8	To study FM discriminator.	CO5
Open Ended Experiments		
1	To perform PWM using MATLAB & Simulink.	CO5

Department of Electronics and Telecommunication Engineering

Program Elective - I

Department of Electronics and Telecommunication Engineering

Course Title: **Introduction to Computer Networks (Program Elective-I)**										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	TH	TU	PR	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PEC1	3 Hrs	-	2 Hrs	4	10	15	50	25	
Course Code	23BTECL306 23BTECP306									
Teaching Mode	Offline	5 Hrs.			TOTAL Marks	75			25	
Duration of ESE	3 Hrs.					100				

Course Objectives	**1.** To develop an understanding of computer networking basics.
	2. To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Understand network architectures, models, and fundamental concepts of physical layer communication.
	CO2: Analyze data link layer functions including error detection, correction, MAC protocols, and wireless technologies.
	CO3: Evaluate network layer protocols including routing, congestion control, QoS, and internetworking.
	CO4: Understand and compare transport layer protocols and mechanisms like TCP, UDP, IPv4/IPv6, and flow control.
	CO5: Examine application layer protocols, web services, DNS, FTP, SNMP, and Telnet used in real-time networking.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	2	2	1	1	0	1	1	0	2	0	1	1
CO2	3	3	2	3	3	1	1	0	1	1	0	2	0	2	1
CO3	3	3	3	3	3	1	1	0	1	1	0	2	0	3	2
CO4	3	3	2	3	3	1	0	0	1	1	0	2	0	3	1
CO5	3	2	2	2	2	1	1	0	1	1	1	3	0	3	1

Department of Electronics and Telecommunication Engineering

Course Contents:

Unit	Contents	Hours
I	**INTRODUCTION**: Network applications, hardware and software networks, reference models: OSI, TCP/IP, Internet, Connection-oriented network - X.25, frame relay. PHYSICAL LAYER: Theoretical basis for communication, guided transmission media, wireless transmission, the public switched telephone networks and mobile telephone system.	8
II	**THE DATA LINK LAYER**: Design issues, detection and correction of error, elementary data link and sliding window protocols, example data link protocols - HDLC. THE MEDIUM ACCESS SUBLAYER: Channel allocations problem, multiple access protocols, Ethernet, Wireless LAN, Data Link Layer switching, Broadband Wireless, and Bluetooth.	8
III	**THE NETWORK LAYER:** Network layer design issues, routing, and congestion control algorithms, Quality of Service. Internet working, the network layer on the internet.	8
IV	**THE TRANSPORT LAYER:** TCP/IP Network architecture, Transport service, elements of transport protocol, Simple Transport Protocol, Internet transport layer protocols: UDP, TCP, IPV4 & IPV6, Leaky Bucket algorithm.	8
V	**THE APPLICATION LAYER:** Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and http. APPLICATION LAYER PROTOCOLS: Simple Network Management Protocol and File Transfer Protocol, Telnet.	8

Text Books	1.	A. S. Tanenbaum (2003), Computer Networks, 4th edition, Pearson Education/ PHI, New Delhi, India.
Reference Books	1.	Behrouz A. Forouzan (2006), Data communication and Networking, 4th Edition, Mc Graw-Hill, India.
	2.	Kurose, Ross (2010), Computer Networking: A top down approach, Pearson Education, India.

Department of Electronics and Telecommunication Engineering

List of Experiments

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Sr. No.	Name of Experiments	Mapping with Course Outcomes
1	Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.	CO1
2	Study of Network Devices in Detail.	CO1
3	Study of network IP.	CO3
4	Connect the computers in Local Area Network.	CO2
5	Study of basic network command and Network configuration commands.	CO3
6	Configure a Network topology using packet tracer software.	CO3
7	Configure a Network using Distance Vector Routing protocol.	CO4
8	Configure Network using Link State Vector Routing protocol.	CO4
9	Open Ended Expertiment:	
10	V-Lab Experiment:	

Department of Electronics and Telecommunication Engineering

Course Title: Embedded System Design and RTOS (Program Elective-I)										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PEC1	3	-	2	4	10	15	50	25	-
Course Code	23BTECL307 23BTECP307									
Teaching Mode	Offline	5 Hrs			Total	75			25	
Duration of ESE	3 Hrs					100				

Course Objectives	1. To understand the design parameters of embedded systems applications
	2. To study and impart different tools for embedded system and IoT application design.
	3. To understand RTOS and IDE for Embedded Systems.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Demonstrate the principle of embedded systems and Microcontroller
	CO2: Make Use of ARM Controller for Designing of Embedded Applications
	CO3: Develop programming for applications develop real time applications
	CO4: Interfacing peripherals with ARM.
	CO5: Understand concept of RTOS and IDE.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	0	1	0	0	0	0	0	0	0	0	3	0	0
CO2	3	2	2	1	0	0	0	0	0	0	0	0	3	0	0
CO3	3	3	3	2	2	0	0	0	0	0	0	0	3	0	0
CO4	3	3	3	2	3	0	0	0	0	0	0	2	3	0	0
CO5	3	3	3	2	3	1	1	1	1	2	1	3	3	0	0

Department of Electronics and Telecommunication Engineering

Course Content:

UNIT	Contents	Hours
I	**Embedded System Concepts**: Introduction to embedded systems, Application Areas, Categories of embedded systems, Overview of embedded system architecture, Specialties of embedded systems, Architecture of embedded systems, Hardware architecture, and Software architecture, Application Software, Communication Software, Development and debugging Tools. Design Process in Embedded System	**8 Hrs.**
II	**ARM Family Processors:** Introduction to ARM processors and its versions, ARM7, ARM9 & ARM11 features, advantages & suitability in embedded application, registers, CPSR, SPSR, ARM and RISC design philosophy, ARM7 data flow model, programmers model, modes of operations	**8 Hrs.**
III	**ARM7 Based Microcontroller:** ARM7 based Microcontroller LPC2148: Features, Architecture. System Block (PLL and VPB divider), Memory Map, GPIO, Pin connect Block, timer, Instruction set basic programming in assembly language.	**8 Hrs.**
IV	**Real World Interfacing with ARM7 Based Microcontroller:** Interrupt structure of LPC2148, Interfacing with LED, LCD, simple LPC2148 GPIO Programming examples Using timers of LPC2148 to generate delay, serial communication programming for transmission and reception from computer, programming for UART. C Programming. Introduction to Cortex.	**8 Hrs.**
V	**RTOS and IDE for Embedded System Design**: Operating System basics, Types of operating systems, Task, process and threads, Thread pre-emption, Pre-emptive Task scheduling techniques, Task Communication, Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores, selection of an RTOS, Advance Topic	**8 Hrs.**

Text Book and Reference Book		
Text Book	**1.**	Embedded/Real Time Systems Concepts, Design and Programming Black Book, Prasad, KVK.
	2.	David Seal "ARM Architecture Reference Manual", 2001 Addison Wesley, England; Morgan Kaufmann Publishers
Reference Book	**1.**	Andrew N Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide - Designing and Optimizing System Software", 2006, Elsevier.
	2.	Steve Furber, "ARM System-on-Chip Architecture", 2nd Edition, Pearson Education
	3.	Cortex-M series-ARM Reference Manual

Department of Electronics and Telecommunication Engineering

Sr. No.	Name of Experiments	CO Mapped
1	Study of IDE overview-Project creation, downloading & debugging.	CO5
2	Write a program to interface LED with ARM7.	CO2
3	Write a program to interface common cathode seven segment display with ARM7	CO4
4	Write a program to interface common anode seven segment display with ARM7	CO4
5	Write a program to interface Stepper motor with ARM7.	CO3
6	Write a program for blinking LED depending on the status of the switch using ARM7	CO3
7	Write a program to interface LCD with ARM7	CO4
8	Write a program to interface 4*4 matrix keypad with ARM7.	CO4
9	**Open Ended Experiments** : Write a program to generate square wave from pin 0.21 using Proteus Vsm.	CO1

Department of Electronics and Telecommunication Engineering

Course Title: Power Electronics (Program Elective –I)										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	TH	TU	PR	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PEC1	3 Hrs.	-- Hr.	2 Hrs.	4	10	15	50	25	-
Course Code	23BTECL308 23BTECP308									
Teaching Mode	Offline	5 Hrs.			TOTAL Marks	75			25	
Duration of ESE	3 Hrs					100				

Course Objectives	1. To study the characteristics & working of modern power electronic devices.
	2. To study the working of Commutation and Triggering Methods.
	3. To understand DC Choppers, Converters.
	4. To study single phase Inverters along with its applications
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO-1: To Understand various Power Electronic devices.
	CO-2: To Evaluate the design parameters of various Commutation and Triggering Methods.
	CO-3: To Analyse the working of various types of D.C Choppers ,Converters
	CO-4: Understand Single phase Inverters
	CO-5: Design motor drives with R & RL Load

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	1	1	0	0	1	0	2	1	1	3
CO2	3	3	2	2	2	1	1	1	1	1	1	2	1	1	3
CO3	3	3	3	2	3	1	1	0	1	1	0	3	1	1	3
CO4	3	3	3	3	3	1	1	1	1	1	1	3	1	1	3
CO5	3	3	3	3	3	1	1	1	2	2	1	3	1	1	3

Department of Electronics and Telecommunication Engineering

Course Contents:

Unit	Contents	Hours
I	**Introduction to Power Electronic devices:** Construction, Characteristics & Working of SCR, DIAC, TRIAC, MOSFET & IGBT. SCR Ratings: IL, IH, VBO, VBR, dv/dt, di/dt & Surge current.	7
II	**Commutation Methods , Triggering Methods and Radio Frequency (RF) shielding of Silicon Controlled Rectifiers** Concept of line & forced communication, Types of commutation methods .Types of triggering methods, Types of RF Shielding method for SCR.	7
III	**Application of Power Devices : D.C. Choppers Converters** Step down chopper & step up chopper for R & RL, Applications of choppers.1ϕ Semi & Full Converters with R & RL load and the effect of Free-wheeling diode.	7
IV	**Single phase Inverters** Construction & Working of Single phase bridge inverters with R & RL Load, Single phase PWM Inverters, Design of Single Phase Inverters & Its Applications	7
V	**Power Electronic DC Motor Drives** Single phase separately excited DC motor drive, Over voltage & over current protection circuits. Design of separately excited DC Motor drive of various ratings. Recent Advanced topics of Power Electronics.	8

Text Books	1.	1. M.H. Rashid, Power Electronics Circuits , Devices and Applications, 4th Edition, Pearson Education Publication, 2013
	2.	C. W. Lander, Power Electronics, 3rd Edition, Paper Back Publication, 1993
	3.	Dr. P. S. Bimbhra, Power Electronics, 4th Edition, Khanna Publishers, 2012
	4.	M.S. Jamil Asghar, “Power Electronics”, PHI 2004,New Delh
Reference Books	1.	P.C.Sen, Power Electronics, 30th reprint, 30th Reprint Tata McGraw Hill, 2001
	2.	Dr. M. Ramamoorthy, An Introduction to Thyristors and their Applications, 2nd Edition, East-West Press, 1991
	3.	Ned Mohan,T.Undeland & W. Robbins,”Power Electronic Converters applications & design” 2nd edition, John Wiley &sons,Singapore.

Department of Electronics and Telecommunication Engineering

List of Experiments

Sr. No.	Name of Experiments	Mapping with Course Outcomes
1	Observe the effect of gate current ,Measure IH & IL for different readings of gate current and plot V-I characteristics of SCR.	CO1
2	Plot Output Characteristics and transfer characteristics of MOSFET (V-I characteristics of MOSFET).	CO1
3	Plot Input and Output Characteristics of TRIAC.	CO1
4	Observe Current Commutated Chopper.	CO2 & CO3
5	Observe Load voltage waveform by varying the firing angle & plot the waveforms of a single-phase Converter.	CO2 & CO3
6	Observe Load voltage waveform by varying the ON & OFF time & plot the waveforms of a DC Chopper.	CO2 & CO3
7	Observe Load voltage waveform & plot the waveforms of SCR Series Inverter.	CO4
8	To Design a single-phase Semi/Full Converter in PSim Software	CO3
9	To Design a single-phase Inverter in PSim Software.	CO4
10	Open Ended Expertiment:	
11	V-Lab Experiment:	

Department of Electronics and Telecommunication Engineering

MULTIDICIPLINARY MINOR (MDM3) – V SEM

Department of Electronics and Telecommunication Engineering

Course Title: Microcontroller and Applications (Multidisciplinary Minor)										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	MDM3	3	-	2	4	10	15	50	25	-
Course Code	23BTECL205XX 23BTECL205XX									
Teaching Mode	Offline	5 Hrs.			Total	75			25	
Duration of ESE	3 Hrs					100				

Course Objectives	1. To study and understand various microcontrollers and embedded systems
	2. To understand the design parameters of embedded systems applications.
	3. To study and impart different tools for embedded system and IoT application design.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1 Demonstrate the principle of embedded systems and Microcontroller
	CO2 Design the interfacing of devices and peripherals
	CO3 Develop programming for applications develop real time applications
	CO4 Make Use of Arduino Controller for Designing of Embedded Applications.
	CO5 Design and Develop different embedded system and IoT applications.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	0	0	0	0	0	2	1	3	2	3
CO2	2	2	3	2	3	0	0	0	0	0	2	1	3	2	3
CO3	3	2	3	2	3	0	0	0	0	0	2	1	3	2	3
CO4	3	2	3	2	3	0	0	0	0	0	2	1	3	2	3
CO5	3	2	3	3	3	0	0	0	0	0	2	1	3	2	3

Department of Electronics and Telecommunication Engineering

Course Contents:

Unit	Contents	Hours
I	**Embedded Systems:** Introduction to embedded Systems, Requirements /Components of Embedded Systems, Design process of Embedded System, Design metrics of Embedded System. Introduction to RTOS, Introduction of Microprocessor, Difference between Microprocessor and Microcontroller. **Microcontrollers:** Introduction to microcontrollers, different types of Microcontrollers, 8051 architecture, data types and directives, flag bits and PSW register, register bank and stack.	9
II	**Assembly Language Programming:** Jump, Loop and Call Instructions, I/O Port Programming, Addressing modes, Arithmetic, Logic instructions and programs, data types and time delay. Interfacing to External Memory.	9
III	**Programming:** Timer/counter, Interrupts and serial communications, Serial I/O, Programming Tools **Interfacing with 8051:** ADC and DAC interfaces for microcontrollers, Real time interfacing with LED, Keypad, LCD display, Sensors interfacing.	9
IV	**Arduino Application:** Introduction to Arduino, serial communication and timer, control designusing arduino. Real time interfacing with LED, LCD & Sensors.	9
V	**Embedded IoT Applications:** Introduction to IoT, Design and performdifferent embedded system and IoT Applications: Robotic, Industrial Automations& Health care.	9

Text Books	1.	Muhammad Ali Mazidi, the 8051 Micro-controller & Embedded System using assembly& C, Pearson Education,2008, Second
	2	Muhammad Ali Mazidi, ARM Assembly language programming and Architecture, Second
	3	Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design,Pearson Education India, 2009, Second
Reference Books	1.	Shibu K. V. Introduction to Embedded System, The McGraw Hill, 2011
	2.	Ajay V. Deshmukh, Micro-controllers - Theory and Applications, Tata McGraw Hill,
	3.	Kenneth J. Ayala, The 8051 Micro-controller – Architecture, Programming & Applications, Penram International & Thomson Asia, 1996, Second
	4.	Embedded System Design- Frank Vahid, Wiley India Pvt. Limited 2006.

Department of Electronics and Telecommunication Engineering

List of Experiments

Sr. No.	Name of Experiments	Mapping with Course Outcomes
1	Validate Arithmetic operations using 8051 microcontroller	CO1
2	Design a program to perform data transfer between two memory blocks using 8051 microcontroller	CO2
3	Design & validate a program to find smallest number from memory blocks using 8051microcontroller	CO2
4	Design a program to blink LED connected to Pin P2.0 using 8051 microcontroller.	CO3
5	Design a program to interface 7 Segment display with 8051 Microcontroller.	CO3
6	Design a program to generate squire wave using 8051 microcontroller.	CO3
7	Test the working of LCD by interfacing it with 8051 Microcontroller	CO4
8	Design and perform IoT based soil moisture sensor.	CO5
9	Interface blue tooth Module HC-05 with Arduino for wireless communication System.	CO4
10	Interface different sensor like LDR, IR with 8051 Microcontroller.	CO4
11	Design and perform different embedded system and IoT Applications	CO5
12	Project Module-1	CO3, CO5

Department of Electronics and Telecommunication Engineering

Open Elective- III

Department of Electronics and Telecommunication Engineering

Course Title: Introduction to Mechatronics (Open Elective – III)										
Semester	V	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	OE 3	2	-	-	2	10	15	50	-	-
Course Code	23BTECL309									
Teaching Mode	Offline	2 Hrs			Total	**75**			-	
Duration of ESE	3 Hrs					75				

Course Objectives	1. Understand the key elements of mechatronics, 2. Understand the concept of Sensors and Transducers and their characteristics 3. Understand various hydraulic and pneumatic Systems 4. Understand the principle and operation of Electrical and Electromechanical Actuators
Course Outcomes	**Upon successful completion of this course, student will be able to:** CO1: Understand and apply the key elements of mechatronics in automation, CO2: Apply the principle of sensor and Transducers and their characteristics in industry applications CO3: Understand and analyse the principles of hydraulic systems in complex engineering applications CO4: Understand and analyse the principles of pneumatic systems. CO5: Apply and evaluate the applications of Electrical Actuators and Electro-Mechanical Actuators

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	1	1	2	1	1	0	0	0	1	2	1	0	0
CO2	3	2	1	2	1	2	1	0	0	0	2	3	1	0	0
CO3	2	3	2	2	1	1	1	0	0	0	1	3	1	0	0
CO4	2	3	2	1	1	2	1	0	0	0	1	2	1	0	0
CO5	3	2	1	1	1	0	0	1	0	0	2	2	1	0	0

Department of Electronics and Telecommunication Engineering

Course Content:

UNIT	Contents	Hours
I	**Unit I : Introduction to Mechatronics** Basics of Mechatronics Systems: Definition of Mechatronics, Key elements of Mechatronics Systems, Levels of mechatronics systems, Measurement Characteristics, Mechatronics design process, phases of mechatronics design process, integrated design approach.	**6 Hrs.**
II	**Unit II: Signal Conditioning:** Introduction to Data Acquisition system, Sensors, Micro sensors, Transducers, Signal Conditioning, Relays, Contactors and Timers. Robot drive systems: Hydraulic, Pneumatic and Electric drive systems	**6 Hrs.**
III	**Unit III : Hydraulic Systems** Introduction to Hydraulic Actuators Fluid Power systems: Concept of Actuators, Classification of Actuators. Physical Components of a Hydraulic systems, Hydraulic Pumps (e.g. Gear Pumps, Piston Pumps), Filters and Pressure Regulation, Relief Valve, Accumulator.	**6 Hrs.**
IV	**Unit IV : Pneumatic Systems** Introduction to Pneumatic a Actuators Physical Components of a Pneumatic Systems, Pneumatic Cylinders, Pneumatic Actuators (e.g. Spring Actuator and Spring Actuator with positioner), Air compressor, Air Receiver, Air Dryer	**6 Hrs.**
V	**Unit V : Electrical Actuators, Electron-Mechanical Actuators** Electrical-Actuation system: Selection criteria and specifications of stepper motors, solenoid valves, relay (Solid State relays and Electromechanical relays). Selection Criterion of control valve, Single acting and Double acting Cylinders.	**6 Hrs.**

Text Book and Reference Book		
Text Book	**1.**	W. Boltan -Mechatronics: Electronic Control Systems in Mechanical and
	2.	Electrical Engineering, 6th Edition, Pearson Education, 2016
	3.	David Alciatore and Maichael B Histand, -Introduction to Mechatronics and Measurement Systems‖,4th Edition, Tata McGraw Hill 2013.
Reference Book	**1.**	Nitaigour P. Mahalik, ‖ Mechatronics-Principles, Concepts and Applications‖, Tata McGraw Hill, Eleventh reprint 2011.
	2.	Devdas Shetty and Richard A. Kolk, -Mechatronics System Design‖, Thomson India Edition 2007.HMT Limited, - Mechatronics‖, Tata McGraw-Hill Publishing House.