Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

SCHEME OF INSTRUCTION & SYLLABI

Programme: Electronics & Communication Engineering

Scheme of Instructions: Third Year B. Tech. in Electronics & Communication Engineering

Semester – V

Sr. No.	Course Category	CourseCode	Course Title	L	T	P	Contact Hrs./Wk	Credits	EXAM SCHEME				
									CT1	CT2	TA/CA	ESE	TOTAL
1	PCC	EC3501	Analog & Digital Communication	3	-	-	3	3	15	15	10	60	100
2	PCC	EC3502	Digital Signal Processing And Application	3		-	3	3	15	15	10	60	100
3	PCC	EC3503	Control System Engineering	3		-	3	3	15	15	10	60	100
4	PCC	EC3504	Analog & Digital Communication Lab	-	-	2	2	1	-	-	25	25	50
5	PCC	EC3505	Digital Signal Processing lab	-	-	2	2	1	-	-	25	25	50
6	PEC	EC3506-8	Program Elective-I	3	-	-	3	3	15	15	10	60	100
7	PEC	EC3506-8	Program Elective-I Lab			2	2	1	-	-	25	25	50
8	PEC	EC3509-11	Program Elective-II	4	-	-	4	4	15	15	10	60	100
9	OEC	B$$XX01-16	Open Elective-I	4	-	-	4	4	15	15	10	60	100
10	PROJ	EC3510	Micro Project Based on Simulation	-	-	2	2	1			25	25	50
11	MCC	BAU3511	Heritage	2	-	-	2	Audit	-	-	-	-	-
			Total	22	-	8	30	24	90	90	160	460	800

L- Lecture T-Tutorial P-Practical

CT1- Class Test 1 TA/CA- Teacher Assessment/Continuous Assessment

CT2- Class Test 2 ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective courses from other discipline)	Project / Seminar / Industrial Training	MCC (Mandatory Courses)
Credits	--	--	--	11	08	04	01	Yes
Cumulative Sum	5	21	24	27	08	04	01	--

PROGRESSIVE TOTAL CREDITS :78+24 =102

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Program Elective- I	Program Elective- II
Semester V	**Semester V**
EC3506 Digital System Design	**EC3509** Introduction to MEMS
EC3507 Embedded Systems	**EC3510** Information Theory and Coding
EC3508 Power Electronics	**EC3511** Biomedical Instrumentation

List of Open Elective

Sr. No.	Course Code	Course Title	Sr. No.	Course Code	Course Title
1	BCSXX01	Cyber Law and Ethics	9	BMEXX09	Nanotechnology and Surface Engineering
2	BCSXX02	Block chain Technology	10	BMEXX10	Automobile Engineering
3	BITXX03	Cyber Security	11	BEEXX11	Power Plant System
4	BITXX04	Artificial Intelligence	12	BEEXX12	Electrical Materials
5	BECXX05	Internet of Things	13	BAEXX13	Avionics
6	BECXX06	Embedded Systems	14	BAEXX14	Unmanned Aerial Vehicles
7	BCEXX07	Introduction to Art and Aesthetics	15	BBTXX15	Biomaterials
8	BCEXX08	Metro Systems and Engineering	16	BBTXX16	Food and Nutrition Technology

08/09/23

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B.Tech Third Year (Semester-V) Electronics and Communication Engineering

EC3501: Analog And Digital Communication

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	-
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Contents

Unit I	**Analog Modulation:-** Analog and Digital Messages, Channel Effect, Signal-to Noise ration and capacity, Modulation, Need for Modulation, Amplitude Modulation, Types of Modulation, AM DSB-SC,SSB-SC and vestigial side band modulation and demodulation, AM transmitter (broadcast and low power), FDM, Noise in AM systems.
Unit II	**Angle modulation:** FM and PM, reactance FET modulator Armstrong method, Foster-Seely discriminator, PLL detector, Stereophonic FM, Spectrum of FM, Narrow band and wide band FM, FM transmitter (broadcast and low power). Noise in FM systems. **Radio Receivers :-** Characteristics of Radio Receiver Sensitivity, Selectivity and Fidility, TRF and Super heterodyne Radio Receiver
Unit III	**Sampling and Analog to digital Conversion** :-Sampling theorem, Sampling and signal reconstruction, Aliasing, Types of sampling, Quantization, PCM system, Bandwidth of PCM, Limitations of PCM system, Companding, DPCM, ADPCM, Delta modulation, Adaptive delta modulation, Limitation of DM and ADM , T1 carrier system
Unit IV	**Pass band Data Transmission:-** Overview of ASK, FSK, PSK, Generation, Signal Space Diagram and detection of FSK, Probability of Error for FSK, Probability of Error for QPSK, Generation, signal space diagram and detection of π/4QPSK, Generation, signal space diagram and detection of QAM, FDM & TDM signal multiplexing
Unit V	**Line coding & Spread Spectrum Techniques :-** line coding techniques, pulse shaping, Spread spectrum Communications, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS), Code Division Multiple Access of DSSS,

Text Books

T.1	B.P. Lathi, "Modern Digital and Analog Communication System", Oxford University Press, 3rd Edition, 2005
T.2	John G. Proakis, "Digital Communication", McGraw Hill Inc, 5th Edition, 2008.
T.3	Singh. R. P &Sapre. S. D, "Communication Systems: Analog & Digital," 3rd edition, McGrawHill Education, Seventh Reprint, 2016.

Reference Books

R.1	Simon Haykin, "Communication Systems", John Wiley & Sons, 4th Edition, 20008.
R.2	Simon Haykin and Michael Moher, "Communication Systems," 5th edition, John Wiley &

	Sons, 2013
R.3	Shu Lin, Daniel Costello, "Error control coding – Fundamentals and Applications", Prentice Hall, Upper Saddle River, NJ, 2nd Edition, 2004.
Useful Links	
1	https://nptel.ac.in/courses/117/105/117105143
2	https://nptel.ac.in/courses/117/105/117105144
3	https://nptel.ac.in/courses/117/104/117104121

Course Code	Course Outcomes	CL	Class Sessions
EC3501.1	**Examine** the concepts of analog modulation and demodulation techniques such as AM	3	9
EC3501.2	**Determine** the concept of Angle modulation FM transmitter and receiver with radio receivers parameters	3	9
EC3501.3	**Evaluate** the digital modulation schemes such as PCM ,DM,ADM and their limitations	5	9
EC3501.4	**Analyze** the digital pass band data transmission schemes such as ASK,FSK,PSK,QAM,QPSK and FDM,TDM techniques	4	9
EC3501.5	**Analyze** the different line coding techniques and spread spectrum techniques such as DSSS,FHSS and CDMA	4	9

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EC3502: Digital Signal Processing And Application

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	-
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Contents

Unit I	Basic elements of DSP and its requirement, Advantages of Digital over analog signal processing, sampling theorem, sampling process and reconstruction of sampling data. Discrete time signals & systems: Discrete time signals & systems, classification of discrete time signals and systems, LTI systems, linear convolution, Cross Correlation, Auto correlation.
Unit II	Frequency domain sampling: definition of Discrete Fourier Transform & Properties of DFT, Inverse IDFT , DFT'S of typical time signals, Circular convolution using DFT & IDFT
Unit III	Design of IIR Filter from analog filter using Impulse Invariance, Bilinear transformation, Butterworth and Chebyshev filter, IIR filter structure : Direct form-I, Direct form-II, Parallel & Cascade form
Unit IV	Design of FIR filter design using windowing techniques: Rectangular, Hanning, Hamming, Blackman, FIR filter structure : Direct & Cascade form
Unit V	Introduction to Fast Fourier Transform algorithms: Decimation in Time –FFT Algorithm , Decimation in Frequency- FFT Algorithm using radix 2 FFT – Butterfly structure

Text Books

T.1	Digital Signal Processing and applications- 4th edition, 2013 John G. Proakis McGraw-Hill
T.2	Discrete time Signal Processing- 3rd edition 2010 Alan Oppenheim,Ronald Schafer pearson
T.3	Digital Signal Processing - A computer based approach-Publication-4th edition, 2013 Sanjit K. Mitra, McGraw-Hil

Reference Books

R.1	Digital Signal Processing- 3rd Edition 2017 S Salivahanan ,A Vallavraj ,C Gnanapriya McGraw-Hill
R.2	Digital signal processing- A practical approach 2nd Edition, 2002.E. C. Ifeachar, B. W. Jarvis Pearson

Useful Links

1	https://nptel.ac.in/courses/108/104/108104139/
2	http://nptel.ac.in/courses/117107095
3	http://nptel.ac.in/courses/117103064

Course Code	Course Outcomes	CL	Class Sessions
EC3502.1	**Examine** discrete-time signals analytically and visualize them in the time domains.	3	9
EC3502.2	**Apply** discrete Fourier transform and verify its properties.	3	9
EC3502.3	**Implement** digital filters in a variety of structures.	4	9
EC3502.4	**Structuring** and analyze digital IIR and FIR filter	4	9
EC3502.5	**Analyze** Fast Fourier Transform algorithms	4	9

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B.Tech Third Year (Semester-V) Electronics and Communication Engineering

EC3503 : Control System Engineering

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	-
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Contents

Unit I	**Introduction to Control System:** Introduction, Classification of Control system, Representation of Electrical, Mechanical, Electro mechanical with differential equation, Concept of Transfer Function and State space representation. Advantages of State Space representation over Classical representation
Unit II	**Transfer Function, Block Diagram & Signal flow graph:** Representation of Transfer Function of Electrical & Mechanical, Block diagram algebra, Signal flow graph
Unit III	**Time Response Analysis :** Time response of system, first order and second order system, standard inputs, concept of gain and time constants. Steady state errors, type of control system, approximate methods for higher order system. Types of Controllers.
Unit IV	**Stability & Root Locus:** Stability of control systems, condition of stability, characteristics equation, Routh Hurwitz criterion, special cases for determining stability, relative stability. Root location and effect on time response, elementary idea of root locus, Construction of root locus effect of addition of pole and zero in proximity of imaginary axis
Unit V	**State Space Analysis:** State variable method of analysis, characteristics of system state. Choice of state variables, representation of vector matrix differential equation, standard form, relation between transfer function and state variables.

Text Books	
T.1	I.I.J.Nagrath, M.Gopal, " Control System Engineering",6th Edition, New age International Publishers
T.2	2.B.C.Kuo , "Automatic Control System", PHI
T.3	3. B.S. manke, "Linear Control Systems", Khanna Publishers
Reference Books	
R.1	A.K.Jairath, " Problems and Solutions of Control systems", CBS Publishers, New Delhi
R.2	Nagrath&Gopal, "Control System Analysis".

Useful Links	
1	https://nptel.ac.in/courses/115/108/115108104/
2	https://nptel.ac.in/courses/107/106/107106081/
3	https://nptel.ac.in/courses/108/103/108103007/

Course Code	Course Outcomes	CL	Class Sessions
EC3503.1	**Determine** the basic linear feedback principles & derive its mathematical models of different control system	3	9
EC3503.2	**Implement** the transfer function using various methods.	3	9
EC3503.3	**Analyze** time response & order of system.	3	9
EC3503.4	**Examine** stability & root locus of system.	3	9
EC3503.5	**Analyze** the State space model of system.	3	9

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B.Tech Third Year (Semester-V) Electronics and Communication Engineering

EC3504 : Analog & Digital communication Lab

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	CA	25 Marks
Total Credit	1	ESE	25 Marks
		Total	50 Marks
		Duration of ESE: 3 Hrs 00 Mins.	

Sr. no	List of experiment
1	To Generate AM modulation and Demodulation
2	To Generate DSB-SC modulation and Demodulation
3	To Generate FM Modulation and Demodulation
4	To Generate PAM,PPM,PWM modulation and demodulation
5	To Generate and detect Pulse Code Modulation and Demodulation
6	To Generate and detect DPCM and its Demodulation
7	To Generate and detect PSK Modulation and Demodulation
8	To Generate DM and ADM with analysis of step size
9	To Generate QPSK Modulation and Demodulation
10	To Analyze Simulation of different modulation techniques by using MATLAB

Text Books

1	B.P. Lathi, "Modern Digital and Analog Communication System", Oxford University Press, 3rd Edition, 2005
2	John G. Proakis, "Digital Communication", McGraw Hill Inc, 5th Edition, 2008.

Reference Books

1	Simon Haykin, "Communication Systems", John Wiley & Sons, 4th Edition, 20008.
2	Simon Haykin and Michael Moher, "Communication Systems," 5th edition, John Wiley & Sons, 2013

Useful Links

1	https://nptel.ac.in/courses/117/105/117105143
2	https://nptel.ac.in/courses/117/105/117105144

Course Code	Course Outcomes	CL	Lab Sessions
EC3504.1	**Examine** the concepts of analog modulation and demodulation techniques	3	2
EC3504.2	**Examine** the function of FM modulation and radio transmitters and receivers and familiarize with noise performance of various receivers	3	2
EC3504.3	**Summarize** various digital modulation schemes	3	2
EC3504.4	**Analyze** the various angle modulation techniques and transmission of digital Data through communication systems	4	2
EC3504.5	**Analyze** various digital pass band data transmission schemes, data transmission using spread spectrum and error coding techniques.	4	2

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B.Tech Third Year (Semester-V) Electronics and Communication Engineering

EC3505 : Digital Signal Processing & Application Lab

Teaching Scheme	
Practical	2 Hrs/week
Total Credit	1

Examination Scheme	
CA	25 Marks
ESE	25 Marks
Total	50 Marks
Duration of ESE:3 Hrs 00 Mins	

Sr. no	List of Experiment
1	To plot and represent following basic discrete time signals using MATLAB functions. : Unit impulse, unit step, ramp, real and complex exponential and its representations
2	To plot linear convolution of discrete signals using MATLAB functions.
	To plot circular convolution of discrete signals using MATLAB functions.
3	Write MATLAB program to compute cross-correlation of the given sequences with corresponding plot.
4	Write a program to compute auto-correlation of given discrete- time signals. With corresponding plot.
5	To design Butterworth IIR filters.
6	To design Chebyshev IIR filters.
7	To design FIR filters using windowing techniques
8	To compute DFT and IDFT of discrete time signals.
9	To perform linear convolution of given sequence on Processor kit.
10	To perform circular convolution of given sequence on Processor kit .

Text Books	
T.1	Digital Signal Processing and applications- 4th edition, 2013 John G. Proakis McGraw-Hill
T.2	Discrete time Signal Processing- 3rd edition 2010 Alan Oppenheim, Ronald Schafer pearson
Reference Books	
R.1	Digital signal processing- A practical approach 2nd Edition, 2002.E. C. Ifeachar, B. W. Jarvis Pearson
R.2	Digital Signal Processing - A. Nagoor Kani 2nd Edition McGraw Hill.
Useful Links	
1	https://nptel.ac.in/courses/108/104/108104139/
2	http://nptel.ac.in/courses/117107095

Course Code	Course Outcomes	CL	Lab Sessions
EC3505.1	**Examine** the process the signals in the discrete domain.	3	2
EC3505.2	**Analyze** the filters to suit requirements of specific applications	4	2
EC3505.3	**Apply** the techniques, skills, and modern engineering tools like MATLAB and digital processors.	3	2
EC3505.4	**Implement** FIR & IIR filter and analysis of their frequency response	3	2
EC3505.5	**Analyze** the principle & working of digital signal processing for various applications	4	2

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B.Tech Third Year (Semester-V) Electronics and Communication Engineering

EC3506 : Digital System Design

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	-
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Contents

Unit I	Digital Design Fundamentals, Combinational & Sequential design issues, Introduction to finite state machines, Moore & Mealy Machine, Introduction to programmable devices, PLA, PAL, PROM, Structure of CPLDs, Introduction to FPGA, Architecture, CLB, IOB, Programmable Interconnect Points, Different type of programmable switches used in PLDs.
Unit II	HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modelling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module.
Unit III	Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Physical & Abstract, Constants, Parameter, Verilog Data Operators, Design entry in Verilog & Testbench, Compilation and synthesis, Timing analysis.
Unit IV	Data Flow Modelling, Delay, Continuous Assignment, Delayed Continuous assignment, Structural Modelling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives.
Unit V	Behavioral Modelling, Initial, Always, Procedural Assignment, Blocking and Non-Blocking assignments, Sequential & Parallel Blocks, Race around Condition, Timing Control, Procedural Statements, Conditional Statements if case loop repeat forever etc, Zero Delay Control, Event Based Timing Control, Compiler Directives, Assign De-assign, Force Release, Latch Models, FF Models, State Machine Coding ,Moore and Mealy Machines.

Text Books

T.1	Verilog Digital System Design" Zainalabedin Navabi Second Edition, Tata McGraw Hill , 2009
T.2	Verilog HDL : A Guide to Digital Design and Synthesis Samir Palnitkar 2nd Edition , Prentice Hall India, 2003

Reference Books

R.1	A Verilog HDL Primer" J. Bhaskar, 2nd Edition, Star Galaxy Press 1997
R.2	"Digital Circuits and Logic Design" by A P Godse and U A Bakshi

Useful Links

1	https://nptel.ac.in/courses/108/106/108106177/
2	https://nptel.ac.in/courses/117/105/117105080/

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B.Tech Third Year (Semester-V) Electronics and Communication Engineering

EC3506 : Digital System Design

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	-
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Contents

Unit I	Digital Design Fundamentals, Combinational & Sequential design issues, Introduction to finite state machines, Moore & Mealy Machine, Introduction to programmable devices, PLA, PAL, PROM, Structure of CPLDs, Introduction to FPGA, Architecture, CLB, IOB, Programmable Interconnect Points, Different type of programmable switches used in PLDs.
Unit II	HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modelling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module.
Unit III	Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Physical & Abstract, Constants, Parameter, Verilog Data Operators, Design entry in Verilog & Testbench, Compilation and synthesis, Timing analysis.
Unit IV	Data Flow Modelling, Delay, Continuous Assignment, Delayed Continuous assignment, Structural Modelling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives.
Unit V	Behavioral Modelling, Initial, Always, Procedural Assignment, Blocking and Non-Blocking assignments, Sequential & Parallel Blocks, Race around Condition, Timing Control, Procedural Statements, Conditional Statements if case loop repeat forever etc, Zero Delay Control, Event Based Timing Control, Compiler Directives, Assign De-assign, Force Release, Latch Models, FF Models, State Machine Coding ,Moore and Mealy Machines.

Text Books

T.1	Verilog Digital System Design" Zainalabedin Navabi Second Edition, Tata McGraw Hill , 2009
T.2	Verilog HDL : A Guide to Digital Design and Synthesis Samir Palnitkar 2nd Edition , Prentice Hall India, 2003

Reference Books

R.1	A Verilog HDL Primer" J. Bhaskar, 2nd Edition, Star Galaxy Press 1997
R.2	"Digital Circuits and Logic Design" by A P Godse and U A Bakshi

Useful Links

1	https://nptel.ac.in/courses/108/106/108106177/
2	https://nptel.ac.in/courses/117/105/117105080/

Course Code	Course Outcomes	CL	Class Sessions
EC3506.1	**Examine** programmable devices and discuss the architecture of CPLD and FPGA.	3	9
EC3506.2	**Apply** basic knowledge of Hardware description Language, design flow and design Methodology.	3	9
EC3506.3	**Analyze** combinational circuits which give fundamental concepts and techniques used in digital electronics.	4	9
EC3506.4	**Analyze** sequential circuits and components used in the typical data path designs: Register, Adders, Shifters, Comparators; Counters, Multiplier, Arithmetic-Logic Units (ALUs), RAM.	4	9
EC3506.5	**Implement** Computer-Aided Design (CAD) tools which is essential to the design of digital circuits.	3	9

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B.Tech Third Year (Semester-V) Electronics and Communication Engineering

EC3507: Embedded Systems

Teaching Scheme	
Lectures	3Hrs/week
Tutorial	-
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00Min.	

Course Contents

Unit I	History, Definition, and Classification of Embedded System, Design Metric & Its optimization, Embedded System Design Challenges, Processor selection Criteria, Building blocks of typical Embedded System –Memory Architecture, Memory & Its Types, RISC and CISC.
Unit II	Introduction to ARM, features, architecture, instruction set features, Concepts of RTOS ARM processor and Architecture, Register set, instruction set, programming, interrupts, stack, timers on-chip and off chip peripherals, interfacing and programming.
Unit III	Analyzing Inbuilt of ADC and DAC of ARM7TDMI Microcontroller, Applications based on PWM, Interfacing of Temperature Sensor, USART, Bluetooth, USB Drive, LCD display, GSM and GPS Module.
Unit IV	Protocol of Embedded System:- Bluetooth ,USB Drive,I2C Bus, CAN Bus, IEEE 802.11,,RS232,RS485 ,GPRS, IEEE 802.15, Modbus, Zigbee Architecture.
Unit V	Architecture of the kernel, Task scheduler, Semaphores, Mailbox,Message queues , Pipes, Events, Timers , Memory Management, Case study- Based on Communication Embedded System, Based on Automation Embedded Systems.

Text Books

T.1	M A Mazidi, J G Mazidi, R D McKinlay, The 8051 Microcontroller and Embedded Systems Using Assemble and C, Pearson/Prentice Hall, 2nd Ed
T.2	Raj Kamal, "Embedded Systems ", TMH Publications.
T.3	K M Bhurchandi, A K Ray, Advanced microprocessors and Peripherals, McGraw Hill Education India, 2012, 3rd edition

Reference Books

R.1	Lyla B Das; Embedded Systems and Integrated Approach, Pearson, India, 2013, first edition,
R.2	Dr. K.V.K.K. Prasad , "Embedded / Real Time Systems", Dreamtech Publications
R.3	Steve Heath, "Embedded System Design", Neuwans Publications

Useful Links	
1	https://nptel.ac.in/courses/117/106/117106112/
2	https://nptel.ac.in/courses/117/106/117106111/
3	https://nptel.ac.in/courses/117/104/117104072/

Course Code	Course Outcomes	CL	Class Sessions
EC3507.1	**Examine** the importance of Embedded Systems in Real life, Engineering and Industrial applications and also to observe importance of embedded processors over general systems.	3	9
EC3507.2	**Implement** programming using concepts of microcontroller.	3	9
EC3507.3	**Analyze** peripherals, interfacing and their programming to solve prototype problems.	4	9
EC3507.4	**Test** Real life/ Engineering and Industry problems using Embedded Systems.	5	9
EC3507.5	**Explore the** concepts of ARM (Advance RISK machine) and RTOS (Real Time Operating System)	4	9

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B.Tech Third Year (Semester-V) Electronics and Communication Engineering

EC3508 : Power Electronics

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	-
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Contents

Unit I	**SCR :** Construction, Operation, Transistor analogy, Static & dynamic Characteristics, Switching characteristics, SCR Ratings, Gate characteristics, Triggering requirements, Triggering techniques, Isolation Techniques, Pulse triggering, Burst triggering **TRIAC:** Construction, Operation, steady stage characteristics, Triggering modes, Principle of DIAC, P base control using TRIAC
Unit II	**IGBT** : Construction, operation, Steady stage characteristics, Switching characteristics, Safe operating area, Need for gate/base drive circuits, Isolation techniques, Base drive circuits for Power BJT **Power MOSFET**: Construction, operation, Static characteristics, Switching characteristics, forward and reverse bias operation, Gate drive circuits for Power MOSFET and IGBT. **GTO** : Construction, Operation, Turn-off mechanism, Applications
Unit III	**Phase controlled Rectifiers (AC-DC Converters) :** Single phase half Wave controlled, full wave controlled rectifiers with R and RL load, Bridge Configurations with R and RL load, Effect of Freewheeling diode, Three phase full wave and half wave controlled with resistive load.AC-AC Converters: Basic Principle, Operation, Single phase AC voltage controller for R and RL loads, Working of Three phase AC-AC controller with R Load.
Unit IV	**DC-DC converters (Chopper)** : Working principle of chopper, Types of chopper : Step-Up & Step- Down chopper for RL Load, Class-A, class-B, Class-C, Class-D and Class-E chopper, Control Strategies **DC-AC Converters (Inverter):** Classification of inverter, Working Principle of single phase Half Bridge and Single Phase Full Bridge inverter for R and RL load, Three phase Bridge inverter for Resistive (Star) load.
Unit V	**Three Phase Induction Motor**: Principle of operation, Necessity of starters, DOL starter, Autotransformer starter, Star-Delta Starter, Speed control techniques of three-phase induction motor. **DC Motors** : Principle of Operation, Types of Motor, Speed Control of Shunt Motor : Flux Control, Armature Control and voltage control method, Speed Control of Series : Flux Control, Rheostatic Control method **Universal Motor** : Construction, Working ,characteristics and applications

Text Books	
T.1	M.H. Rashid : "Power Electronic circuits devices and applications", PHI Publications.
T.2	M.D. Singh & Khanchandani : "Power Electronics", TMH Publications, New Delhi.
T.3	B.L. Theraja : "Electrical Technology" , Volume-2, S.Chand Publications
Reference Books	
R.1	P.C. Sen : "Modern Power Electronics", S. Chand & Co, New Delhi.
R.2	P. Bhimra ," Power Electronics", Khanna publications
R.3	Nagrath Kothari : "Electrical Machines", TMH Publications
Useful Links	
1	https://nptel.ac.in/courses/108/102/108102145/
2	https://nptel.ac.in/courses/108/105/108105066/

Course Code	Course Outcomes	CL	Class Sessions
EC3508.1	**Examine** the working and nature of characteristics of different power.	3	9
EC3508.2	**Integrate** the power devices and acquire knowledge about fundamental concepts and techniques used in power electronics.	3	9
EC3508.3	**Validate** the application of Power devices as controlled rectifier, AC-DC converters.	4	9
EC3508.4	**Apply** the Knowledge of Power Devices to understand concept of Choppers & Inverters.	3	9
EC3508.5	**Evaluate** AC/DC motor and the power electronics devices to electrical Machines.	5	9

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EC3506 : Digital System Design Lab

Teaching Scheme	
Practical	2 Hrs/week
Total Credit	1

Examination Scheme	
CA	25 Marks
ESE	25 Marks
Total	50 Marks
Duration of ESE:3 Hrs 00 Mins	

Sr. no	List of Experiment
1	Design & hardware Implementation of 2 Bit Adder/ Subtractor Using XOR as well as NAND gate.
2	4:1 Multiplexer using Universal gates & Realization of full adder using Multiplexer.
3	BCD Adder using two binary adders.
4	3:8 Decoder & realization of Full adder
5	Realization of R-S, D, J-K Flip-Flop
6	Realization of Mod-8 Up Down Ripple Counter
7	Realization of synchronous Mod-2 Mod-3 Counters
8	Modeling Different types of gates
9	Modeling of half adder , Full adder
10	Modeling of D Flip-Flop

Text Books

T.1	Verilog Digital System Design" Zainalabedin Navabi Second Edition, Tata McGraw Hill , 2009.
T.2	Verilog HDL : A Guide to Digital Design and Synthesis Samir Palnitkar 2nd Edition , Prentice Hall India, 2003

Reference Books

R.1	A Verilog HDL Primer" J. Bhaskar, 2nd Edition, Star Galaxy Press 1997
R.2	"Digital Circuits and Logic Design" by A P Godse and U A Bakshi

Useful Links

1	https://nptel.ac.in/courses/108/106/108106177/
2	https://nptel.ac.in/courses/117/105/117105080/

Course Code	Course Outcomes	CL	Lab Sessions
EC3506.1	**Examine** programmable devices and discuss the architecture of CPLD and FPGA.	3	2
EC3506.2	**Apply** basic knowledge of Hardware description Language, design flow and design Methodology.	4	8
EC3506.3	**Analyze** combinational circuits which give fundamental concepts and technpiques used in digital electronics.	3	2
EC3506.4	**Analyze** sequential circuits and components used in the typical data path designs: Register, Adders, Shifters, Comparators; Counters, Multiplier, Arithmetic-Logic Units (ALUs), RAM.	3	4
EC3506.5	**Implement** Computer-Aided Design (CAD) tools which is essential to the design of digital circuits.	4	4

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EC3507 : Embedded Systems Lab

Teaching Scheme	
Practical	2 Hrs/week
Total Credit	1

Examination Scheme	
CA	25 Marks
ESE	25 Marks
Total	50 Marks
Duration of ESE:3 Hrs 00 Mins.	

Sr. No.	List of Experiment	CO
1	Write an assembly language program to find largest and smallest number in an array using Keil software	CO1
2	Write an assembly language program to find Least Common Multiple (LCM) and Greatest Common Divisor (GCD) of two given numbers using Keil software	CO2
3	Write an assembly language program to find HCF of five numbers in an array using Keil software.	CO2
4	Write an assembly language program to sort an array in ascending and descending order using Keil software	CO3
5	Write an assembly language program to find sum and count of numbers divisible by 4 using Keil software.	CO3
6	To Perform experiment on DAC of LPC2103.	CO3
7	Study of RTOS.	CO3
8	Write device driver for UART.	CO4
9	Interface pen drive for writing predefined file.	CO4
10	To read values from RTC and display on LCD.	CO5

Text Books

T.1	Raj Kamal, "Embedded Systems ", TMH Publications.
T.2	Frank Vahid, "Embedded System Design", Wiley Publiications, New edition 2001.

Reference Books

R.1	Dr. K.V.K.K. Prasad , "Embedded / Real Time Systems", Dreamtech Publications
R.2	Steve Heath, "Embedded System Design", Neuwans Publications

Useful Links

1	https://nptel.ac.in/courses/117/106/117106112/
2	https://nptel.ac.in/courses/117/106/117106111/

Course Code	Course Outcomes	CL	Lab Sessions
EC3507.1	**Examine** importance of Embedded Systems in Real life, Engineering and Industrial applications and also to observe importance of embedded processors over general systems.	3	2
EC3507.2	**Implement** programming using concepts of microcontroller and test numerical programs on Keil 8051 and the hardware platform.	3	2
EC3507.3	**Analyze** peripherals, interfacing and their programming to solve prototype problems.	4	2
EC3507.4	**Test** Real life/ Engineering and Industry problems using Embedded Systems.	5	2
EC3507.5	**Explore** the concepts of ARM (Advance RISK machine) and RTOS (Real Time Operating System)	4	2

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EC3508 : Power Electronics Lab

Teaching Scheme	
Practical	2 Hrs/week
Total Credit	1

Examination Scheme	
CA	25 Marks
ESE	25 Marks
Total	50 Marks
Duration of ESE: 3 Hrs 00 Mins	

Sr.No.	Course Contents	CO
1	To study and plot V-I Characteristics of SCR	CO1
2	To study and plot V-I Characteristics of TRIAC.	CO1
3	To study UJT as a relaxation oscillator.	CO2
4	To study and plot IGBT characteristics.	CO2
5	Use CRO to observe the output waveform of a half-wave controlled rectifier with resistive load and determine the load voltage.	CO3
6	Draw the output waveform of the Full-wave controlled rectifier with R load. RL load, freewheeling diode and determine the load voltage	CO3
7	To study and plot characteristics of Single phase converter	CO3
8	To study and plot characteristics of DC Chopper.	CO4
9	To study Series Inverter.	CO4
10	To study Three Phase Induction Motor and DC Motors.	CO5

Text Books

1	M.H. Rashid : "Power Electronic circuits devices and applications", PHI Publications.
2	M.D. Singh & Khanchandani : "Power Electronics", TMH Publications, New Delhi.

Reference Books

1	P.C. Sen : "Modern Power Electronics", S. Chand & Co, New Delhi.
2	P. Bhimra ," Power Electronics", Khanna publications.

Useful Links	
1	https://nptel.ac.in/courses/108/102/108102145/
2	https://nptel.ac.in/courses/108/101/108101126/

	Course Outcomes	CL	Lab Sessions
EC3508.1	**Examine** the working and nature of characteristics of different power components used in Power Devices.	3	2
EC3508.2	**calculate** performance parameters for different devices	4	2
EC3508.3	**Analyze** the performance with the help of graphical representation.	4	2
EC3508.4	**Determine** the concept of signal conversion and inversion with the help of graph.	3	2
EC3508.5	**Test** the conversion of signal by observing the converter output	5	2

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B.Tech Third Year (Semester-V) Electronics and Communication Engineering

EC3509 : Introduction to Micro Electromechanical Systems

Teaching Scheme	
Lectures	4 Hrs/week
Tutorial	-
Total Credit	4

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min	

Course Contents

Unit I	**INTRODUCTION TO MEMS AND MICROFABRICATION** History of MEMS Development, Characteristics of MEMS-miniaturization - micro electronics integration - Mass fabrication with precision. Micro fabrication - microelectronics fabrication process- silicon based MEMS processes - new material and fabrication processing- points of consideration for processing.
Unit II	**MEMS FABRICATION TECHNOLOGIES** **Microsystem fabrication processes:** Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials.
Unit III	**MICRO SENSORS** MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor
Unit IV	**MICRO ACTUATORS** Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators.
Unit V	**NANOSYSTEMS AND QUANTUM MECHANICS** Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Shrodinger Equation and Wavefunction Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

Text Books	
T.1	Chang Liu, "Foundations of MEMS", Pearson International Edition, 2006.
T.2	Marc Madou, "Fundamentals of Micro fabrication", CRC press 1997.
T.3	Stephen D. Senturia," Micro system Design", Kluwer Academic Publishers,2001
Reference Books	
R.1	GaberielM.Rebiz, "RF MEMS Theory,Design and Technology", John Wiley & Sons,2003
R.2	Charles P.Poole, Frank J.Owens, "Introduction to nanotechnology" John Wiley & sons, 2003.
R.3	Julian W.Gardner, Vijay K Varadhan, "Microsensors, MEMS and Smart devices", John Wiley & sons, 2001.
R.4	Tai Ran Hsu ,"MEMS and Microsystems Design and Manufacture" ,Tata Mcraw Hill, 2002.
R.5	Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006.
Useful Links	
1	https://nptel.ac.in/courses/108106165
2	https://www.me.iitb.ac.in/~gandhi/me645/05L1_coursecontents_mtvn.pd

Course Code	Course Outcomes	CL	Class Sessions
EC3509.1	**Examine** the operation of micro devices, micro systems and their applications	3	9
EC3509.2	**Identify** the MEMS fabrication process to micro devices, micro systems .	4	9
EC3509.3	**Determine** the design process of various sensor using the MEMS fabrication technique	5	9
EC3509.4	**Evaluate** the Designing of various actuator using the MEMS fabrication	5	9
EC3509.5	**Validate** the on micro and nano systems for photonics.	5	9

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B.Tech Third Year (Semester-V) Electronics and Communication Engineering

EC3510 : Information Theory And Coding

Teaching Scheme	
Lectures	4 Hrs/week
Tutorial	-
Total Credit	4

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Contents

Unit I	**Information Theory & Source Coding:**-Introduction to information theory, Entropy and its properties, Source coding theorem, Huffman coding, Shannon-Fano coding, The Lempel Ziv algorithm, Run Length Encoding, Discrete memory less channel, Mutual information, Examples of Source coding-Audio and Video Compression.
Unit II	**Information Capacity & Channel Coding:**-Channel capacity, Channel coding theorem, Differential entropy and mutual Information for continuous ensembles, Information Capacity theorem, Linear Block Codes: Syndrome and error detection, Error detection and correction capability, Standard array and syndrome decoding, Encoding and decoding circuit, Single parity check codes, Repetition codes and dual codes, Hamming code, Golay Code, Interleaved code.
Unit III	**Cyclic Codes:-** Galois field, Primitive element & Primitive polynomial, Minimal polynomial and generator polynomial, Description of Cyclic Codes, Generator matrix for systematic cyclic code, Encoding for cyclic code, Syndrome decoding of cyclic codes, Circuit implementation of cyclic code.
Unit IV	**BCH and Convolutional Codes:**-Binary BCH code, Generator polynomial for BCH code, Decoding of BCH code, RS codes, generator polynomial for RS code, Decoding of RS codes, Cyclic Hamming code and Golay code. Introduction of convolution code, State diagram, Tree diagram, Trellis diagram, Sequential decoding and Viterbi decoding.
Unit V	**Data Communication & Physical Layer:**-Data Communications – Networks - Network models – OSI model – Layers in OSI model – TCP / IP protocol suite – Addressing – Guided and Unguided Transmission media.

Text Books

T.1	BernadSklar, —Digital Communication Fundamentals & applicationsl, Pearson Education. Second Edition.
T.2	Behrouz A. Foruzan, —Data communication and Networkingl, Tata McGraw-Hill.
T.3	Linear Network Theory - Kelkar and Pandit, Pratibha Publication 39thEdition.

Reference Books	
R.1	Ranjan Bose, —Information Theory coding and Cryptographyl, McGraw-Hill, 2nd Ed.
R.2	MurlidharKulkarni, K.S.Shivaprakasha, —Information Theory & Codingl, Wiley Publications.
R.3	Simon Haykin, —Communication Systemsl, John Wiley & Sons, Fourth Edition.
Useful Links	
1	https://nptel.ac.in/courses/117/101/117101053/
2	https://nptel.ac.in/courses/117/104/117104129/

Course Code	Course Outcomes	CL	Class Sessions
EC3510.1	**Examine** information of theoretical analysis of communication system.	3	9
EC3510.2	**Analyze** data compression scheme using suitable source coding technique.	4	9
EC3510.3	**Analyze** channel coding scheme for a communication system.	4	9
EC3510.4	**Examine** the fundamental principles of data communication and networking.	3	9
EC3510.5	**Analyze** the flow and error control techniques in communication networks.	4	9

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B.Tech Third Year (Semester-V) Electronics and Communication Engineering

EC3511 : Biomedical Instrumentation

Teaching Scheme	
Lectures	4 Hrs/week
Tutorial	-
Total Credit	4

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Contents

Unit I	Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.
Unit II	Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers
Unit III	The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, heart sound measurement. Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers.
Unit IV	Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG.
Unit V	Patient care and monitoring, the elements of intensive care monitoring , diagnosis, calibration, reparability of patient monitoring equipment, instrumentation for monitoring patient, pacemakers, defibrillators.

Text Books

T.1	Biomedical Instrumentation & Measurement, By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer, 2nd Edition ,PHI
T.2	Handbook of Biomedical Instrumentation, R.S.Khandpur, 2nd Edition, TMH

Reference Books

R.1	Biomedical Digital Signal Processing, Tompkins, 1993 Edition, PHI
R.2	Introduction to Biomedical Equipment Design ,Carr and Brown, 4th Edition, John Wiley

Useful Links	
1	https://nptel.ac.in/courses/108/105/108105101/
2	http://www.digimat.in/nptel/courses/video/108105101/L28.html

Course Code	Course Outcomes	CL	Class Sessions
EC3511.1	**Examine** Biology, Physiology and problems encountered in measuring a living system.	3	9
EC3511.2	**Determine** measurements on and interpret data from living systems	3	9
EC3511.3	**Analyze** problems of the interface of engineering and biology	4	9
EC3511.4	**Evaluate** the problems associated with the interaction between Instruments and living systems.	5	9
EC3511.5	**Analyze** diagnosis, calibration, reparability of patient monitoring equipment.	4	9

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Open Elective -1

BECXX06: Embedded Systems

Teaching Scheme	
Lectures	4 Hrs/week
Tutorial	-
Total Credit	4

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00Min.	

Course Contents

Unit I	History, Definition, and Classification of Embedded System, Design Metric & Its optimization, Embedded System Design Challenges, Processor selection Criteria, Building blocks of typical Embedded System –Memory Architecture, Memory & Its Types, RISC and CISC.
Unit II	Introduction to ARM, features, architecture, instruction set features, Concepts of RTOS ARM processor and Architecture, Register set, instruction set, programming, interrupts, stack, timers on-chip and off chip peripherals, interfacing and programming.
Unit III	Analyzing Inbuilt of ADC and DAC of ARM7TDMI Microcontroller, Applications based on PWM, Interfacing of Temperature Sensor, USART, Bluetooth, USB Drive, LCD display, GSM and GPS Module.
Unit IV	Protocol of Embedded System:- Bluetooth ,USB Drive,I2C Bus, CAN Bus, IEEE 802.11,,RS232,RS485 ,GPRS, IEEE 802.15, Modbus, Zigbee Architecture.
Unit V	Architecture of the kernel, Task scheduler, Semaphores, Mailbox,Message queues , Pipes, Events, Timers , Memory Management, Case study- Based on Communication Embedded System, Based on Automation Embedded Systems.

Text Books

T.1	M A Mazidi, J G Mazidi, R D McKinlay, The 8051 Microcontroller and Embedded Systems Using Assemble and C, Pearson/Prentice Hall, 2nd Ed
T.2	Raj Kamal, "Embedded Systems ", TMH Publications.
T.3	K M Bhurchandi, A K Ray, Advanced microprocessors and Peripherals, McGraw Hill Education India, 2012, 3rd edition

Reference Books

R.1	Lyla B Das; Embedded Systems and Integrated Approach, Pearson, India, 2013, first edition,
R.2	Dr. K.V.K.K. Prasad , "Embedded / Real Time Systems", Dreamtech Publications
R.3	Steve Heath, "Embedded System Design", Neuwans Publications

Useful Links	
1	https://nptel.ac.in/courses/117/106/117106112/
2	https://nptel.ac.in/courses/117/106/117106111/
3	https://nptel.ac.in/courses/117/104/117104072/

Course Code	Course Outcomes	CL	Class Sessions
EC3507.1	**Examine** the importance of Embedded Systems in Real life, Engineering and Industrial applications and also to observe importance of embedded processors over general systems.	3	9
EC3507.2	**Implement** programming using concepts of microcontroller.	3	9
EC3507.3	**Analyze** peripherals, interfacing and their programming to solve prototype problems.	4	9
EC3507.4	**Test** Real life/ Engineering and Industry problems using Embedded Systems.	5	9
EC3507.5	**Explore the** concepts of ARM (Advance RISK machine) and RTOS (Real Time Operating System)	4	9

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2	https://nptel.ac.in/courses/117/106/117106111/
3	https://nptel.ac.in/courses/117/104/117104072/

Course Code	Course Outcomes	CL	Class Sessions
BECXX06.1	**Examine** the importance of Embedded Systems in Real life, Engineering and Industrial applications and also to observe importance of embedded processors over general systems.	3	9
BECXX06.2	**Implement** programming using concepts of microcontroller.	3	9
BECXX06.3	**Analyze** peripherals, interfacing and their programming to solve prototype problems.	4	9
BECXX06.4	**Test** Real life/ Engineering and Industry problems using Embedded Systems.	5	9
BECXX06.5	**Explore the** concepts of ARM (Advance RISK machine) and RTOS (Real Time Operating System)	4	9

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2	https://nptel.ac.in/courses/117/106/117106111/
3	https://nptel.ac.in/courses/117/104/117104072/

Course Code	Course Outcomes	CL	Class Sessions
BECXX06.1	**Examine** the importance of Embedded Systems in Real life, Engineering and Industrial applications and also to observe importance of embedded processors over general systems.	3	9
BECXX06.2	**Implement** programming using concepts of microcontroller.	3	9
BECXX06.3	**Analyze** peripherals, interfacing and their programming to solve prototype problems.	4	9
BECXX06.4	**Test** Real life/ Engineering and Industry problems using Embedded Systems.	5	9
BECXX06.5	**Explore the** concepts of ARM (Advance RISK machine) and RTOS (Real Time Operating System)	4	9

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