6th Semester

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
EC-14601	Digital Communication System	3	1	-	40	60	100	4
EC-14602	Microwave & Radar Engineering	3	1	-	40	60	100	4
EC-14603	Wireless & Mobile Communication System	3	1	-	40	60	100	4
EC-14604	Microcontrollers and Embedded System	3	1	-	40	60	100	4
DEEC-146XX	Department Elective-II	3	1	-	40	60	100	4
OEXX-146XX	Open Elective	3	-	-	40	60	100	3
EC-14611	Microcontrollers and Embedded System Lab	-	-	2	30	20	50	1
EC-14612	Microwave Engineering Lab	-	-	2	30	20	50	1
EC-14613	Digital Communication System Lab	-	-	2	30	20	50	1
PREC-14601	Minor Project	-	-	1	60	40	100	1
GF-14601	**General Fitness**				100	NA	100	1
TOTAL		**18**	**5**	**7**	**490**	**460**	**950**	**28**

Department Elective-II

DEEC-14605 Micro Electronics
DEEC-14606 Digital System Design
DEEC-14607 Information Theory & Coding
DEEC-14608 Intelligent Robotics
DEEC-14609 Java Programming
DEEC-14610 Computer Networks

Open Elective (For other Branches)

OEEC-14601 Microprocessors and Microcontrollers
OEEC-14602 Neural Networks & Fuzzy logic

COURSE NAME: DIGITAL COMMUNICATION SYSTEM
COURSE CODE: EC-14601
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 20%-30%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Comprehend the basic concept of signal processing sub-systems in digital communications.	1(M)	1(H)
C02	Apply the knowledge of working principles of various signal processing operations and coding techniques for effective connectivity in digital communication systems	1(H), 3(L)	1(H)
CO3	Analyze performance of different types of waveform coding and digital modulation techniques for a given set of parameters	1(M), 2(H)	1(H)
CO4	Select and utilize tools like eye pattern to analyze the performance of digital communication system.	1(M), 2(M), 5(H)	1(H)
C05	Demonstrate the basic concept of source coding theorem, sampling theorem, Nyquist's criterion and companding laws and applying them for the designing of digital communication system.	1(M), 3(M)	1(H)
C06	Engage in self-learning of advanced concepts and application of Digital Communication.	1(M), 2(M), 12(H)	1(H)

Syllabus: Total Contact Hours: [39+13(T) = 42]
Unit 1. Fundamentals of Digital Communication System [10+4=14]
Basic signal processing operations in digital communications, uncertainty, information and entropy, source coding theorem, Huffman coding, discrete memory less channels, mutual information, channel capacity, channel coding theorem, differential entropy, channel capacity theorem, sampling theorem, quardrature sampling of band-pass signals, reconstruction of a message process from its samples, signal distortion in sampling, practical aspects of sampling and signal recovery.

Unit 2. Waveform Coding Techniques [8+2=10]

Pulse code modulation, channel noise and error probability, quantization noise and signal-to-noise ratio, robust quantization, dynamic range, coding efficiency, A law and μ law companding, differential pulse code modulation, delta modulation, Adaptive delta modulation, coding speech at low bit rates

Unit 3. Baseband Shaping for Data Transmission [10+3=13]

Discrete PAM signal, power spectra of discrete PAM signals, Intersymbol interference, Nyquist's criterion for distortionless baseband binary transmission, correlative coding, eye pattern, adaptive equalization for data transmission, Basics of TDMA, FDMA and CDMA

Unit 4. Digital Modulation Techniques [11+4=15]

Introduction, Amplitude Shift Keying (ASK), ASK Spectrum, ASK Modulator, Coherent ASK Detector, Noncoherent ASK Detector, Frequency Shift Keying (FSK), FSK Bit Rate and Baud, FSK Transmitter, Non-coherent FSK Detector, Coherent FSK Detector, FSK Detection Using PLL, Binary Phase Shift Keying, Binary PSK Spectrum, BPSK Transmitter, Coherent PSK Detection, Quadrature Phase Shift Keying (QPSK), QPSK Demodulator, Offset QPSK, π/4 QPSK, Quadrature Amplitude Modulation (QAM); MQAM transmitters and receivers, Band Width efficiency, Carrier Recovery; Squaring Loop & Costas Loop, Differential PSK, DBPSK transmitter and receiver, Constant Envelop Modulation; Minimum Shift Keying (MSK) & Gaussian Minimum Shift Keying (GMSK), matched filter receivers

Text Books:

1. S. Haykin, "Digital Communications", Wiley publication, 2012.
2. W. Tomasi, "Advanced Electronic Communication System", PHI, 6th Edition, 2015.

Reference books and other resources:

1. G. M. Miller, "Modern Electronic Communication", Prentice-Hall, 6th edition, 1999.
2. F. G. Stremler, "Introduction to Communication Systems", Addison- Wesley, 1990.
3. E.A. Lee and D.G. Messerschmitt, "Digital Communication", Kluwer Academic Publishers,1994.
4. H. Meyr, M. Moeneclaey, and S.A. Fechtel, "Digital Communication Receivers", Wiley, 1998.
5. J. G. Proakis, "Digital communications", McGraw-Hill Education, 4th edition, 2001.

E books and online learning materials:

1. http://nptel.ac.in/courses/Webcoursecontents/IIScBANG/Data%20Communication/Learning%20Material%20%20DataCommunication.pdf
2. http://home.iitk.ac.in/~vasu/book0.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114101051/3
2. http://nptel.ac.in/courses/114101051/6

COURSE NAME: MICROWAVE & RADAR ENGINEERING
COURSE CODE: EC-14602
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 20%-30%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Describe and analyze microwave components using S parameters	1(H), 3(H)	1(L)
CO2	Explain the various techniques of measurement at microwave frequencies	1(H),2(H)	1(H)
CO3	Describe the operation of different types of radar	1(H),2(H)	1(H)
CO4	Explain the basics of scanning and tracking techniques in radar	1(H), 2(H)	1(H)
CO5	Develop systems using microwave devices with concern to public health and safety	1(H), 3(H)	1(H)
CO6	Design and develop radar solutions to meet societal and environmental needs	1(H), 3(H)	1(H)

Syllabus: **[39+13(T) =: 42]**

Unit 1. Microwave Tubes **[6+2]**
Limitations of conventional tubes, Frequency allocations and frequency plans, Construction, operation and properties of Klystron Amplifier, Reflex Klystron, Magnetron, Travelling Wave Tube (TWT), Backward Wave Oscillator (BWO), Crossed field amplifiers.

Unit 2. Microwave Solid State Devices **[6+2]**
Limitation of conventional solid state devices at Microwaves, Transistors (Bipolar, FET), Diodes (Tunnel, Varactor, PIN), Transferred Electron Devices (Gunn diode), Avalanche transit time

effect (IMPATT, TRAPATT, SBD), Microwave Amplification by Stimulated Emission of Radiation (MASER), Microwave integrated circuit and it's classification techniques.

Unit 3. Microwave passive devices & components [7+3]

Analysis of Microwave components using S-parameters, Junctions (E, H, Hybrid), Directional coupler, Bends and Corners, Microwave posts, Attenuators, Phase shifter, Ferrite devices (Isolator, Circulator, Gyrator),Cavity resonator, Matched termination.

Unit 4. Microwave Measurements [5+1]

Power measurements using calorimeters and bolometers, Measurement of Standing Wave Ratio (SWR), Frequency and wavelength, Microwave bridges.

Unit 5. Introduction to Radar Systems [5+1]

Basic Principle: Block diagram and operation of Radar, Radar range Equation, Pulse Repetition Frequency (PRF) and Range Ambiguities, Applications of Radar.

Unit 6. Doppler Radars [7+3]

Doppler determination of velocity, Continuous Wave (CW) radar and its limitations, Frequency Modulated Continuous Wave (FMCW) radar, Basic principle and operation of Moving Target Indicator (MTI)radar, Delay line cancellers, Blind speeds and staggered PRFs.

Unit 7. Scanning and Tracking Techniques [6+1]

Various scanning techniques (Horizontal, vertical, spiral, palmer, raster, nodding), Angle tracking systems (Lobe switching, conical scan, monopulse), Range tracking systems, Doppler (velocity) tracking systems.

Text Books:

1. S. Liao, "Microwave devices and circuits", 3rd edition,PHI.
2. M.I. Skolnik, "Introduction to radar systems",McGraw Hill .
3. R.E. Collin, "Foundation of Microwave Engg", 2nd edition McGraw Hill, 1992.

Reference books and other resources:

1. M.Kulkarni, "Microwave devices and Radar Engg", Umesh Publications.
2. K.C Gupta, "Microwave Engg", Tata McGraw-Hill, 7th Edition, 2007.
3. D.Pozar, "Microwave Engineering", John Wiley & Sons, New York, 1998.

E books and online learning materials:

1. https://www.tutorialspoint.com/microwave_engineering/microwave_engineering_tutorial.pdf
2. https://ecedmans.files.wordpress.com/2014/10/microwave-devices-and-circuits-samuel-liao.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114105130/2
2. http://nptel.ac.in/courses/114105130/9

COURSE NAME: WIRELESS AND MOBILE COMMUNICATION SYSTEM
COURSE CODE: EC-14603

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 10%-20%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Demonstrate the basic theory, performance criteria, operation and components of cellular systems.	1(H)	1(M)
CO2	Comprehend different networks using 2G, 3G and beyond 3G systems.	1(M)	1(M)
CO3	Analyse the performance of mobile systems in terms of interference.	2(H)	1(H)
CO4	Design omnidirectional antenna for analysis of system.	3(H)	1(H)
CO5	Illustrate the concept of handoffs and dropped calls in wireless communication system.	2(M)	1(M)
CO6	Implement various intelligent networks for effective wireless communication.	5(H)	1(H)

Syllabus: **[Total Contact Hours: 39+13=53]**

Unit 1. Cellular Systems **[5+2]**

Basic cellular systems, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, concept of frequency reuse channels, , handoff mechanism, cell splitting, cell sectoring, consideration of the components of cellular systems

Unit 2. 2G, 3G and Beyond 3G systems **[8+3]**

2G systems, GSM Architecture and channels, 3G systems, WCDMA-UMTS (UTRA-FDD) physical layer, WCDMA-ARIB physical layer, WCDMA-TDD physical layer UMTS network architecture, Evolution of UMTS-3GPP release 4 and beyond ,CDMA2000 physical layer,

CDMA2000 network, CDMA2000 EV-DO and EV-DV

Unit 3. Interference in Mobile Systems [8+3]

Cochannel interference**,** cochannel interference reduction factor, desired C/I from a normal case in an omnidirectional antenna system, exploring cochannel interference areas in a system, real-time cochannel interference measurement at mobile radio transceivers, design of an omnidirectional antenna system in the worst case, adjacent-channel interference, near-end–far-end interference.

Unit 4. Handoffs and dropped calls [9+2]

Value of implementing handoffs, initiation of a hard handoff, delaying a handoff, forced handoffs, queuing of handoffs, power-difference handoffs, mobile assisted handoff (maho) and soft handoff, cell-site handoff only, intersystem handoff, introduction to dropped call rate, formula of dropped call rate

Unit 5. Intelligent Network for wireless communication [9+2]

Advanced intelligent network (AIN), SS7 network and ISDN for AIN, AIN for mobile communication, asynchronous transfer mode (ATM) technology, IP Network, future of IP networks, an intelligent system: future public land mobile telecommunication system (FPLMTS), Mesh Network/Ad Hoc Network, wireless information superhighway

Text Books:

1. W. C. Lee, "Wireless and Cellular Communications". 3rd Edition, McGraw Hill.

Reference books and other resources:

1. Jochen H. Schiller, "Mobile Communications", Second Edition, Pearson Education.
2. IEEE Communication Magazine

E books and online learning materials:

1. http://ee.sharif.edu/~pr.wireless.comm/references/Schwartz.pdf
2. http://www.egr.msu.edu/~tongli/Introduction-WCN.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114102062/3
2. http://nptel.ac.in/courses/114102062/6

COURSE NAME: MICROCONTROLLERS AND EMBEDDED SYSTEM
COURSE CODE: EC-14604

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Apply the knowledge of microcontrollers and embedded systems for advanced applications	1(H)	1(H)
CO2	Explain the internal architecture and interfacing of different peripheral devices with microcontroller	1(L)	1(L)
CO3	Demonstrate the ability to write the programs for microcontroller	3(M), 5(L)	1(L)
CO4	Develop the ability to understand the role of embedded system in industry	3(M)	1(M)
CO5	Extend and apply the acquired knowledge to the embedded application development platform	3(M)	1(L)
CO6	Explain the instruction set of microcontrollers	1(L)	1(L)

Syllabus: **[Total Contact Hours: 39+13(T)=53]**

Unit 1. Introduction to Embedded Systems **[7+3]**

Overview of Embedded systems, Embedded processors, Embedded hardware units and devices, Design parameters of an Embedded system, Present trends and applications of Embedded systems.**]**

Unit 2. The 8051 Microcontrollers **[14+4]**

Overview of 8051 family, Architecture and pin configuration of 8051, 8051 Assembly language programming: ROM space, data types and directives, PSW register, register banks and stack; Jump, loop and call instructions, I/O Port programming, Addressing modes, Programs using Arithmetic, Logic and Single bit instructions, Timer/counter programming, Serial

communication. Assembly/C language programs to interface LED, LCD and ADC with 8051 microcontroller.

Unit 3. ARM Processor Architecture and Programming [12+3]

The ARM design philosophy, ARM data flow architecture, Registers, Interrupts & vector table, ARM 32-bit instruction set: Data processing instructions and Load-store instructions. Assembly/C language programs to configure GPIO and interface stepper motor and relay modules with ARM7 microcontroller.

Unit 4. Embedded Application Development [6+3]

Introduction to Embedded application development platforms such as Arduino, Raspberry Pie, Tiva C Series and MSP430 based development kits.

Text Books:

1. M. A. Mazidi and J. A. Mazidi, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Prentice Hall, 2000.
2. N. Sloss, D. Symes and C. Wright, "ARM system developer's guide", Elsevier/ Morgan Kaufman, 1st Edition, 2004.

Reference books and other resources:

1. R. Kamal, "Embedded systems", McGraw-Hill Higher Education, 1st Edition, 2008.
2. UM10139 LPC214x User manual.
3. Technical documents related to MSP-EXP430G2 and Tiva C Series TM4C123G.

E books and online learning materials:

1. https://www.tutorialspoint.com/embedded_systems/embedded_systems_tutorial.pdf
2. http://people.bu.edu/bkia/PDF/01.%20Introduction%20to%20Embedded%20Systems.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108102045/3
2. http://nptel.ac.in/courses/108102045/7

COURSE NAME: MICROELECTRONICS
COURSE CODE: DEEC-14605

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: Nil

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Comprehend the miniaturization of electronic systems and examine its influence on device characterization.	1(M)	1(L), 3(L)
CO2	Apply the knowledge of semiconductors in various steps of fabrication process.	1(H)	1(L), 3(L)
CO3	Analyze different techniques for crystal growth, epitaxy, lithography, oxidation, etching and diffusion process.	1(H), 2(H)	1(L),3(M)
CO4	Assess the consequences of external factors at various levels of fabrication and engage in life-long learning	1(H), 2(M), 12(H)	3(M)
CO5	Examine the defects and faults in the process under various operating conditions.	1(H)	3(M)
CO6	Distinguish between thin and thick film hybrid ICs.	1(H)	3(M)

Syllabus: **[Total Contact Hours: 39+13(T)=53]**

Unit 1. Miniaturization of Electronic Systems & its impact on characterization [4+2]

Introduction, Trends & Projections in microelectronics, Monolithic chips trends, Advantages, limitations & classification of ICs.

Unit 2. Crystal growth and Epitaxial Process in Fabrication [8+3]

Crystal growth: Electronics grade silicon production, Crystal growth techniques: float zone

method, Czochralski method, Wafer Preparation & Crystal Defects.

Epitaxial Process: Vapour phase epitaxy-reactor design, selective epitaxy, epitaxial process induced defects, molecular beam epitaxy, recent trends in Epitaxy.

Unit 3. Oxidation and Lithography Process [8+2]

Oxidation: Types of oxidation techniques, dry & wet oxidation, oxidation induced faults, recent trends in oxidation.

Lithography: Lithography techniques, resists and mask preparation of respective lithographies, printing techniques, recent trends in lithography at nano regime.

Unit 4. Etching, Diffusion and Metallization [9+2]

Etching: Etching techniques-ion beam, sputter ion plasma etching and reactive ion etching (RIE), etching induced defects.

Diffusion and Ion Implantation: Diffusion mechanisms, parameters affecting diffusion profile. Ion Implantation-impurity distribution profile, low energy and high energy ion implantation.

Metallization: Metallization choices, metallization techniques–vacuum evaporation, sputtering.

Unit 5. Monolithic Components & their Isolation [5+2]

Resistors, Capacitors, Transistors, MOS and Various isolation techniques.

Unit 6. Thick Film and Thin Film Hybrid ICs [5+2]

Features of Hybrid IC technology, Thick film processing and design. Thin film technology and design.

Text Books:

1. J. Millman and A. Grabel, "Microelectronics", Tata McGraw-Hill, 2nd Edition, 2009.
2. G. Bose, "IC Fabrication Technology", McGraw Hill Education, 2014.
3. S.M. Sze, "VLSI Technology", McGraw-Hill, 2nd Edition, 2008.
4. J. D. Plummer, M. D. Deal and P. B. Griffin, "Silicon VLSI Technology", Pearson Education, 2009.

Reference books and other resources:

1. D. Nagchoudhuri, "Principles of Microelectronics Technology", Wheeler, 1998.
2. S.K. Gandhi, "VLSI Fabrication Principles", John Willey & Sons, 1994.
3. S.A. Campbell, "The Science and Engineering of Microelectronic Fabrication", Oxford University Press, 1996.

E books and online learning materials:

1. http://www2.elo.utfsm.cl/~lsb/elo102/datos/microelectronics.pdf
2. http://www2.units.it/carrato/didatt/doc/Fonstad_MicroelecDevCkt_2006EEd.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/103106075/2

2. http://nptel.ac.in/courses/103106075/12

COURSE NAME: DIGITAL SYSTEM DESIGN
COURSE CODE: DEEC-14606
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 40%-50%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Design solutions for complex combinational and sequential circuits through standard design process.	1(M), 3(H), 5(L)	3(H)
C02	Apply the knowledge of working principle of standard combinational circuits and sequential machines in implementation of other digital circuits	1(H), 3(L)	3(H)
CO3	Analyze the complex synchronous and asynchronous sequential logic through standard analysis process.	1(M), 2(H)	3(H)
CO4	Select and utilize tools like state diagram, MDS diagram, ASM chart to model the complex synchronous and asynchronous sequential circuits	1(M), 3(M), 5(H)	3(H)
CO5	Demonstrate the basic concept of programmable devices and applying them for the designing of combinational and sequential circuits	1(M), 3(M)	3(H)
CO6	Comprehend the basic concept of memory, binary cell and hazards and apply for digital circuit design problems.	1(M), 3(M)	3(H)

Syllabus: **[Total Contact Hours: 39+13(T)=52]**

Unit 1. Combinational Logic **[8+3=11]**
Design of arithmetic circuits, comparators, multiplexers, code converters, multiplier, EXOR and AND-OR-INVERT gates

Unit 2. Synchronous Sequential logic **[8+3=11]**
Concept of memory, binary cell, fundamental difference between sequential machines, classification of sequential machines, capabilities and limitations of finite state machines, design

procedure of flip-flops, flip-flop conversion, state diagram, analysis of synchronous sequential circuits, design procedure of traditional synchronous sequential circuits, state reduction, minimizing the next decoder, output decoder design, modeling and simulation of Moore and Mealy machines, design of counters, shift register

Unit 3. Algorithmic State Machines [8+3=11]

ASM chart, Timing considerations, Control implementation, Control Design with multiplexers, PLAs, etc

Unit 4. Asynchronous Sequential Logic [8+2=10]

Analysis Procedure, Circuits with latches, Design procedure, Reduction of state and flow tables, Race-free state assignment, Hazards, Design examples

Unit5.Designing with Programmable Logic Devices and Programmable Gate Arrays [7+2=9]

Read only memories, Programmable logic arrays, Programmable array logic, designing with FPGAs, Xilinx series FPGAs

Text Books:

1. W. I. Fletcher, "An engineering approach to digital design", PHI, 2002.
2. G. K. Kharate, "Digital electronics", OXFORD university press, 2010.

Reference books and other resources:

1. S. Brown and Z. Vranesic, "Fundamentals of Digital Logic with VHDL design", TMH, 2009.
2. D. D. Givone, "Digital principles and design", TMH, 2002
3. J. P. Uyemura, "A first course in digital system design", Thomson, 2006
4. Grout, "Digital systems design with FPGAs and CPLDs", Newnes(Elsevier), 2011

E books and online learning materials:

1. http://nptel.ac.in/courses/106108099/Digital%20Systems.pdf
2. https://dvikan.no/ntnu-studentserver/kompendier/digital-systems-design.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114105080/12
2. http://nptel.ac.in/courses/114105080/24

COURSE NAME: INFORMATION THEORY & CODING
COURSE CODE: DEEC-14607
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 60%-70%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. Section B shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. Section C shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of Section C may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Apply the knowledge of various channel coding techniques for effective communication in digital systems.	1(H)	1(H), 2(M)
C02	Construct the linear block codes for detecting error while transmission of data in digital communication system.	1(H)	1(H), 2(M)
CO3	Build the circuits for implementation of error codes.	4(H)	1(H), 2(M)
CO4	Construct advanced error control codes for error- free decoding on receiver side in digital communication system.	1 (H) , 3(L)	1(H), 2(M)
CO5	Develop advanced error coding techniques for given set of specifications in communication system.	1(H)	1(H), 2(M)
CO6	Compare various automatic repeat request strategies.	1(M)	1(H)

Syllabus: **[Total Contact Hours: 40+13(T)=53]**

Unit 1. Elements of Information Theory **[8+3=11]**
Introduction to Information theory, Uncertainty and information, information measures, entropy, Information rate, Shannon's Theorem, Mutual information; Channel capacity; BSC and other channels, Capacity of a Gaussian Channel, Bandwidth – S/N Trade-off , Information Capacity Theorem , Shannon Limit, Source Coding Theorem, Huffman coding, Lempel Ziv Coding, Run Length encoding.

Unit 2. Error Control Coding **[7+2=9]**

Linear Block Codes: Introduction, Basic Definition, Equivalent codes, parity – check matrix, decoding of Linear Block codes, syndrome decoding, Perfect Codes, Hamming Codes, Optimal Linear codes, Maximum Distance Separable (MDS) codes.

Unit 3. Cyclic Codes [7+2=9]

Introduction to polynomials, The Division Algorithm, Method for generating cyclic codes, Burst Error correction, CRC Codes, Circuit implementation.

Unit 4. Bose Chaudhuri Hocquenghem (BCH) Codes [6+2=8]

Introduction, Primitive elements, minimum polynomial, Examples of BCH codes, Decoding of BCH codes.

Unit 5. Convolution Codes [6+2=8]

Introduction, Tree Codes and Trellis Codes, Polynomial description, The Generating Function, Matrix Description, Viterbi Decoding, Distance bounds.

Unit 6. Automatic Repeat Request Strategies: [6+2=8]

Stop and wait, Go back and selective repeat ARQ strategies, Hybrid ARQ Schemes.

Text Books:

1. Ranjan Bose, *Information Theory, Coding and Cryptography*, TMH Publication,2005.

Reference books and other resources:

1. Roberto Togneri, Christopher J.S. deSilva, *Fundamental of information theory and coding design*. CRC Press. ISBN: 978-1584883104
2. Cover, Thomas, and Joy Thomas. *Elements of Information Theory*. 2nd ed. New York, NY: Wiley-Interscience, 2006. ISBN: 9780471241959
3. Coding Theory, Algorithm, Architectures and Application. Andre Neubauer, Jurgen Freudenberger, Volker Kuhn. John Wiley & Sons, Ltd.

E books and online learning materials:

1. http://www-public.tem-tsp.eu/~uro/cours-pdf/poly.pdf
2. http://www.cl.cam.ac.uk/teaching/0910/InfoTheory/InfoTheoryLectures.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114101053/5
2. http://nptel.ac.in/courses/114101053/12

COURSE NAME: INTELLIGENT ROBOTICS
COURSE CODE: DEEC-14608

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Able to understand the general principles of intelligence and robotics	1(H)	1(H), 2(H)
CO2	Able to display the creativity and innovation in solving unfamiliar problems	2(H) 3(M)	2(H)
CO3	Ability to apply knowledge of computing appropriate to the discipline	4(H)	2(H)
CO4	Ability to design implement and evaluate a computer based system, process to meet desired needs	4(H)	3(H), 2(M)
CO5	Ability to function effectively on teams to accomplish a goal	5(H)	3(H), 2(H)
CO6	Identify appropriate AI methods to solve a given problem	5(M), 3(M)	3(M)

Syllabus: **[Total Contact Hours: 38+13(T)=51]**

Unit 1. Introduction **[7+3=10]**

Automation & Robotics, Drive System, Control System and dynamic performance precision of movement, Sensors.

Unit 2. Sensors & Machine Vision **[7+3=10]**

Common Sensors and their properties, Sensing & Digitizing functions in Machine Vision, Image Processing and analysis.

Unit 3. Planning approach to Robot Control **[8+3=11]**

Control system models and analysis, Robot manipulator kinematics, Robot Arm Kinematics & Dynamics, Transformations.

Unit 4. Control Theory [8+2=10]

Feedback, Feed-forward and open loop control, Linear first order lag processes, Limitations of Control theory.

Unit 5. Robot Programming &Artificial Intelligence [8+2=10]

Languages, A Robot Program as a Path in Science, Motion Interpolations, Introduction of AI, goals, Techniques, Role of AI in Robotics, Machine.

Text Books:

1. Mikell P Groover, M Weiss, "Industrial Robotics", Mc Graw Hill Education.
2. C.S.G. Lee, K.S. Fu, R.C. Gonzalez, "Robotics", Mc Graw Hill Education.

Reference books and other resources:

1. Arkin R.C. 1998, "Behaviour Based Robotics", MIT Press, Cambridge MA.
2. Negnewitsky, M, "Artificial intelligence: A guide to Intelligent Systems", Harlow: Addison-Wesley, 2002.

E books and online learning materials:

1. http://www.tmrfindia.org/ijcsa/v5i33.pdf
2. http://www.sciencemag.org/sites/default/files/custom-publishing/documents/Brain-inspired-robotics-supplement_final.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108104049/1
2. http://nptel.ac.in/courses/108104049/3

COURSE NAME: JAVA PROGRAMMING
COURSE CODE: DEEC-14609
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: 20%-30%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Use the Java SDK environment to create and run simple Java programs.	1(M)	2(M)
C02	Understand fundamentals of programming such as variables, conditional and iterative execution, methods etc	1(H)	2(M)
CO3	Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries etc	1(L)	2(L)
CO4	Understand the hierarchy of classes and their implementation in real world problems.	3(H),7(L)	2(H)
CO5	Implement, compile, test and run Java programs comprising more than one class, to address a particular software problem.	5(H)	2(H)
CO6	Use exception handling using tries, catch and throw.	1(L)	2(L)
CO7	Create Java applets and embed in a simple HTML document	1(L)	2(L)

Syllabus: **[Total Contact Hours: 39+13(T)=52]**

Unit 1. Introduction **[3+2=5]**
History of Java, Features and importance of Java to the internet, Differences between Java and C++, structure of Java Program, understanding class path.

Unit 2. Building blocks of Java **[6+2=8]**
Literals**,** Tokens, Keywords, constants, Variables and Data-types, Operators, Expressions,

Control statements, Arrays, Vectors, Type conversion, command line arguments, Parameter passing, Recursion, String handling.

Unit 3. Classes and Objects [7+2=9]

Concepts of classes and objects, static classes, abstract classes, Method Overloading and overriding, Constructors, Access control, this keyword, Garbage collection.

Unit 4. Inheritance [8+2=10]

Basics of inheritance, Types of inheritance, Member access rules, Using super, Using final with inheritance, Method overriding, Dynamic method dispatch, Using abstract classes.

Unit 5. Interfaces and Packages [3+2=5]

Interfaces and implementing interface, defining a package, Accessing a package, Importing packages.

Unit 6. Exception Handling [6+2=8]

Concepts of exception handling, Exception types, Using try, catch, throw, throws and finally, Java's built in exceptions, Creating own exception subclasses.

Unit 7. Applets [6+1=7]

Basics of applets, Differences between applets and applications, Life cycle of an applet, Types of applets, The HTML applet tag, Creating applets, Passing parameters to applets.

Text Books:

1. Herbert Schildt , "The Complete Reference Java 2" , Tata McGraw-Hill.

Reference Books and other Resources:

1. Joyce Farrell, "Java for Beginners", Cengage Learning.
2. J. Nino and F.A. Hosch, "An Introduction to programming and OO design using Java", John Wiley & Sons.
3. Y. Daniel Liang, "Introduction to Java programming", Pearson education.

E books and online learning materials:

1. http://www.tutorialspoint.com/java/java_tutorial.pdf
2. http://www.iitk.ac.in/esc101/share/downloads/javanotes5.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106106147/2
2. http://nptel.ac.in/courses/106106147/4

COURSE NAME: COMPUTER NETWORKS
COURSE CODE: DEEC-14610
Internal Marks: 40 **L T P**
External Marks: 60 **3 1 -**
Numerical & Design Problems Content: NIL
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Explain the concepts of networking and classify the different networks and their topologies.	1(M)	2(M)
CO2	Outline the advantages and usage of various network connecting devices.	1(M), 5(M)	2(M)
CO3	Review the network protocols and apply this knowledge to make efficient networks.	1(H)	2(M)
CO4	Demonstrate and analyze the impact of congestion in the network and apply appropriate techniques for congestion avoidance.	2(M), 3(H)	2(H)
CO5	Design solutions for routing issues in the network.	3(H)	1(M), 2(H)
CO6	Assess the security issues in the network and apply ethical principles to address them.	8(H)	2(M)

Syllabus: **[Total Contact Hours: 40+13(T)=53]**

Unit 1. Introduction **[7+3=10]**

Introductory networking concepts , Network topologies, Categories of networks (Wired networks Vs wireless networks, LAN, MAN, WAN), Internet, Intranet & Extranet, Connection-Oriented and Connectionless Services, Need of Protocols, OSI and TCP/IP reference Model, Comparison of OSI & TCP/IP, Network connecting devices (Repeaters, Bridges, Hubs, Routers and Switches), Virtual LANs.

Unit 2. Network Protocols **[7+3=10]]**

Multiple Access Protocols (ALOHA, Carrier Sense Multiple Access Protocols), ARP, RARP, Framing and its methods, Sliding window protocols (One-Bit Sliding Window Protocol, Protocol Using Go Back n, Protocol Using Selective Repeat), High-Level Data Link Control (HDLC).

Unit 3. Congestion Control in Data Networks [9+3=12]

Causes of congestion, Effects of Congestion, Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets, Load Shedding, Jitter Control, Tunneling, Congestion Control in Packet-Switching Networks.

Unit 4. Routing Algorithms [9+2=11]

The optimality principle, Sink tree formation, Shortest path routing and solution of network problems using Dijkstra's Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts, Routing in Ad Hoc Networks, Node lookup in peer- to- peer networks.

Unit 5. Internetwork Protocols [8+2=10]

Internet Protocol & IP Addresses, Principles of Internetworking, Structure of IP, IPv4, IPv6, Virtual Private Networks, Security Issues and IP Security (Digital Signatures, Intrusion Detection Systems).

Text Books:

1. B. A. Forouzan, "Data Communications and Networking", Tata Mcgraw-Hill, 3rd edition, 2004.
2. A.S. Tanenbaum, "Computer Networks", Pearson Education, 4th edition, 2011.

Reference books and other resources:

1. W.Stallings, "Data and Computer Communication", Prentice Hall, 6th edition, 2002.
2. D. P. Bertsekas, "Data Networks", Prentice Hall, 2nd edition, 1992.
3. K. C. Mansfield and J. L. Antonakos , "An Introduction to Computer Networking", PHI.

E books and online learning materials:

1. http://cnp3book.info.ucl.ac.be/2nd/cnp3bis.pdf
2. https://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_tutorial.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106105081/2
2. http://nptel.ac.in/courses/106105081/14

COURSE NAME: MICROPROCESSORS and MICROCONTROLLERS
COURSE CODE: OEEC-146XX

	L	T	P
Internal Marks: 40			
External Marks: 60	**3**	**1**	**-**

Numerical & Design Problems Content: 20%-30%

Note: The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Analyze and differentiate between the architecture, features and functioning of microprocessor and microcontroller.	2(H)	3(M)
C02	Apply the knowledge of instruction set for performing various operations on microprocessor and microcontroller.	1(M)	3(H)
CO3	Compare and contrast the role of different interrupts.	2(M)	3(L)
CO4	Utilize the timer/counters in any of the applications.	1(M)	3(L)
CO5	Describe the interfacing of various devices with microcontroller.	3(L), 4(L)	1(L), 3(M)
CO6	Work in a team to demonstrate an application of microprocessor and microcontroller by engaging in self-learning	4(H), 9(H), 10(H),12(H)	1(M), 3(M)

Syllabus: **[Total Contact Hours: 39+13(T)=52]**

Unit 1. Basic Architecture **[6+2=8]]**

8085 Architecture, Arithmetic and Logic Unit, Flags, Clock, Buses, 8085 Pin configuration, Timing diagrams.

Unit 2. Instruction Set [10+3=13]

Introduction to Basic 8085 Instructions, Addressing modes, Data transfer instructions, Arithmetic instructions, Logic instructions, Branch instructions, Conditional call and return instructions, Assembly language programming, Stack, Subroutines.

Unit 3. Interrupts [3+2=5]

8085 interrupts, Basic interrupt processing, ISR, RST, RIM, SIM.

Unit 4. 8051 Microcontroller [5+2=7]

Comparison of microprocessor and microcontroller, architecture and pin configuration of 8051, flag bits and PSW register, Register banks and stacks, Timer/Counter.

Unit 5. 8051 Assembly Language programming [9+2=11]

Introduction to 8051 assembly language programming, Arithmetic instructions, Logic instructions, Single bit instructions, Jump, loop and call instructions, I/O port programming, timer/counter programming, Addressing modes, Directives.

Unit 6. Interfacing [6+2=8]

8051 connection to RS 232, interfacing of 8051 microcontroller: LCD, ADC, DAC, Stepper motor.

Text Books:

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 5th Edition, Penram International Publishing, New Delhi, 2007.
2. Muhammed Ali Mazidi, Rolin McKinlay, Janice Gillispe "The 8051 Microcontroller and Embedded Systems", Pearson Education, 2007
3. K. J. Ayala, "The 8051 Microcontroller", Cengage Learning, 2004.

Reference books and other resources:

1. A.K. Ray and K.M.Burchandi, "Intel Microprocessors Architecture Programming and Interfacing", McGraw Hill International Edition, 2000
2. M. Rafi Quazzaman, "Microprocessors Theory and Applications: Intel and Motorola", Prentice Hall of India, Pvt. Ltd., New Delhi, 2003.
3. D.V. Hall, "Microprocessor and Interfacing-Programming and Hardware", 2nd Ed., Tata McGraw-Hill Publishing Company Limited, 2008.
4. J. Stewart ,"Microprocessor Systems- Hardware, Software and Programming", Prentice Hall International Edition,1990
5. K. L. Short, "Microprocessors and Programmed Logic", 2nd Ed.,Pearson Education, 2008.
6. Davies J H, "Microcontroller Basics", Elsevier, 2011.

7. Subrata Ghoshal, "Microcontroller: Internals, Instructions, Programming and Interfacing", Pearson Education, 2010

E books and online learning materials:

1. http://nptel.ac.in/courses/Webcoursecontents/IIScBANG/notused/Microprocessors%20and%20Microcontrollers/Learning%20Material%20%20Microprocessors%20and%20microcontrollers.pdf
2. https://courses.cs.washington.edu/courses/cse466/15au/pdfs/lectures/02-Microprocessors-Microcontrollers.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108107029/1
2. http://nptel.ac.in/courses/108107029/10

COURSE NAME: NEURAL NETWORKS & FUZZY LOGIC
COURSE CODE: OEEC-146XX
Internal Marks: 40 **L T P**
External Marks: 60 **3 - -**
Numerical & Design Problems Content: 20%-30%
Note: The Question paper shall have three sections:
Section A shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub–divided (if required) into two parts of five (05) marks each.

Course Outcomes
On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Analyze the fundamental concepts of biological neural networks and understand the evolution of artificial neural networks	1(H)	1(M)
CO2	Summarize different types of artificial neural network learning	1(H)	1(M)
CO3	Demonstrate adequate knowledge about feedback networks	1(H)	1(H)
CO4	Apply neural networks concepts to model and solve complicated practical problems	1(M), 3(M)	1(M)
CO5	Comprehend the rules of fuzzy logic for fuzzy logic control	1(M)	3(H)
CO6	Apply the knowledge of application of fuzzy logic control to real time systems and design systems that meet desired needs within realistic constraints	1(M), 3(M)	3(H)

Syllabus: **[Total Contact Hours: 39]**

Unit 1. Introduction **[10]**
Biological neural networks, history of development in neural networks principles, artificial neural net terminology, models of neuron, activation functions, topology, learning, types of learning: supervised, unsupervised, re-enforcements learning, learning rules/methods.

Unit 2. Artificial Neural Networks **[10]**
Introduction to feedforward and feedback neural networks, back-propagation learning algorithm, architecture of back propagation networks, selection of various parameters in back propagation networks, Hopfield model, Kohonen's self-organizing networks.

Unit 3. Applications of neural networks **[10]**

Applications of neural nets such as pattern recognition, optimization, associative memories, speech and decision-making. VLSI implementation of neural networks.

Unit 4. Fuzzy Logic **[9]**

Crisp & fuzzy sets; properties, operations, arithmetic and relations, membership functions, fuzzification, fuzzy rule based systems, fuzzy-inference systems, defuzzication techniques, applications/ case-studies.

Text Books:

1. Y. Narayanan, " Artificial Neural Networks", Wiley India, 2nd edition, 2009
2. T. J. Ross., "Fuzzy Logic with Engineering Applications", John Wiley & Sons, 2009.
3. G. J. Klir, "Fuzzy sets and fuzzy logic: Theory and Applications", PHI Learning, 2009.

Reference books and other resources:

1. S. K. Valluru and T. N. Rao, "Introduction to Neural Networks, Fuzzy Logic & Genetic Algorithms", Jaico, 1st edition, 2010.
2. S. Rajasekaran and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications", PHI, 2010.
3. Related IEEE/IEE/ Science Direct publications.

E books and online learning materials:

1. http://users.monash.edu/~app/CSE5301/Lnts/LaD.pdf
2. http://www.site.uottawa.ca/~petriu/ELG5196-SoftComputing-NN_FL.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108104049/1
2. http://nptel.ac.in/courses/108104049/4

COURSE NAME: LAB MICROCONTROLLERS AND EMBEDDED SYSTEM
COURSE CODE: EC-14611

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE:

1) Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.
2) All students shall design and implement a small project related to lab.

Course Outcomes

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Develop programs for microcontroller for performing mathematical operations	1(M), 4(M), 10(H)	3(M)
CO2	Comprehend the working of microcontroller based development boards	1(L), 4(M), 10((H)	3(L)
CO3	Illustrate programming concepts to interface peripheral devices with the microcontroller	1(L), 4(H), 10(H)	3(M)
CO4	Develop source codes for interfacing of peripherals	4(H), 10(H)	3(M)
CO5	Design high end applications using microcontrollers	3(M), 4(H), 10(H)	3(H)
CO6	Work in a team to demonstrate an application of microcontroller and embedded system by engaging in self	9(H), 10(H)	3(M)

Syllabus:

Experiment 1. Study 8051 microcontroller kits and write programs to add and multiply two numbers lying at two memory locations.

Experiment 2. Write a Program to arrange 10 numbers stored in memory in ascending and descending order.

Experiment 3. Write a program to flash LED using 8051 microcontroller.

Experiment 4. Write a program to interface LCD display with 8051 microcontroller.

Experiment 5. Write a program to interface ADC/DAC with 8051 microcontroller.

Experiment 6. Study ARM microcontroller kits and write a program to blink multiple LEDs connected to the microcontroller.

Experiment 7. Write a program to control the speed and direction of a stepper motor using ARM7 microcontroller.

Experiment 8. Write a program to interface a relay with ARM7 microcontroller.

Experiment 9. Write a program to interface RFID module with ARM7 microcontroller.

Experiment 10. Write a program to interface a color LCD display with ARM Cortex microcontroller.

Experiment 11. Write a program to demonstrate the use of Real Time Clock using ARM Cortex microcontroller.

Experiment 12. Write a program to configure GPIO ports for MSP430 microcontroller.

Experiment 13. Study of Tiva C series TM4C123G development kit.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114104072/38
2. http://nptel.ac.in/courses/114104072/39

COURSE NAME: MICROWAVE ENGINEERING LAB
COURSE CODE: EC-14612

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

Note: The evaluation of the Lab work shall be done as per the approved Rubrics.

Course Outcomes

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Conduct experiments using microwave devices to investigate characteristics.	4(M), 5(H)	1(M)
CO2	Demonstrate the measurement and interpretation of radiation parameters of antenna using network analyzer.	1(L), 4(M)	1(H)
CO3	Identify and formulate microwave components and their characteristics	2(H)	1(H)
CO4	Develop communication systems using horn antennas	3(H), 4(H)	1(H)
CO5	Apply the knowledge of S-parameters to solve complex engineering systems	1(H)	1(H)
CO6	Use knowledge of microwave components and devices to develop systems for societal needs	3(H), 4(H)	1(H)

Syllabus:

Experiment 1. Study of microwave components and instruments.

Experiment 2. Measurement of crystal characteristics and proof of the square law characteristics of the diode.

Experiment 3. Measurement of klystron characteristics.

Experiment 4. Measurement of VSWR and standing wave ratio.

Experiment 5. Measurement of Dielectric constants.

Experiment 6. Measurement of Directivity and coupling coefficient of a directional coupler.

Experiment 7. Measurement of Q of a cavity.

Experiment 8. Calibration of the attenuation constant of an attenuator.

Experiment 9. Determination of the radiation characteristics and gain of Horn antenna.

Experiment 10. Determination of the phase-shift of a phase shifter.

Experiment 11. Measurement of return loss of patch antenna using Vector Network Analyzer.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114101119/6
2. http://nptel.ac.in/courses/114101119/16

COURSE NAME: LAB-DIGITAL COMMUNICATION SYSTEM
COURSE CODE: EC-14613

	L	T	P
Internal Marks: 30			
External Marks: 20	**-**	**-**	**2**

NOTE:

1) Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.
2) All students shall design and implement a small project related to lab.

Course Outcomes

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Comprehend the concept of Time division multiplexing using communication system modules	1(L), 4(H) 10(H)	1(H)
CO2	Demonstrate the various pulse coding and decoding techniques	1(L), 4(H) 10(H)	1(H)
CO3	Illustrate the modulation and demodulation process for amplitude shift keying, frequency shift keying and phase shift keying.	1(L),4(H),10(H)	1(H)
CO4	Conduct experiments using system modules to demonstrate the operation of PCM and DM and analyze their performances.	2(L), 4(H), 10(H)	1(H)
CO5	Apply hamming codes and demonstrate its use in detection and correction of errors.	1(L),4(H), 10(H)	1(H)
CO6	Select and utilize tools like SIMULINK to model delta modulation and binary phase shift keying	4(H), 5(H), 10(H)	1(H)

Syllabus:

Experiment 1. To demonstrate time division multiplexing system.
Experiment 2. To demonstrate pulse code modulation and demodulation.
Experiment 3. To demonstrate adaptive delta modulation and demodulation.
Experiment 4. To study pulse data coding and decoding techniques for various formats.
Experiment 5. To study of amplitude shift keying modulator and demodulator.
Experiment 6. To study of frequency shift keying modulator and demodulator.
Experiment 7. To study of quadrature phase shift keying modulator and demodulator.
Experiment 8. To demonstrate error detection & correction using Hamming Code.
Experiment 9. To simulate delta modulation and demodulation using MATLAB (SIMULINK).
Experiment 10. To simulate binary phase shift keying using MATLAB (SIMULINK).

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114101051/30
2. http://nptel.ac.in/courses/114101051/31

COURSE NAME: MINOR PROJECT
COURSE CODE: PREC-14601

	L	T	P
Internal Marks: 60			
External Marks: 40	**-**	**-**	**2**

Course Outcomes

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	To apply knowledge of electronics and communication field to identify, collect relevant literature and analyze the information to formulate the problem definition for project.	1(H), 2(H), 4(M)	1(H), 2(H), 3(H)
C02	Demonstrate ethical principles in project planning, execution and documentation.	8(H), 11(M)	1(H), 2(H), 3(H)
CO3	Select and utilize appropriate **tools** to implement and demonstrate the proposed project.	5(H)	1(H), 2(H), 3(H)
CO4	Design and develop sustainable solution/system for the improvement of environment conditions and betterment of the society.	3(H), 6(H), 7(H)	1(H), 2(H), 3(H)
CO5	Communicate effectively on developed solution/system with engineering community as individual or team through effective presentation and report writing.	9(H),10(H), 11(M)	1(H), 2(H), 3(H)
CO6	Develop sustainable system with scope for enhancement and continue life-long learning	12(H)	1(H), 2(H), 3(H)

Syllabus:

Students may choose a project based on any subject of Electronics and Communication Engineering. The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports. Evaluation of the project work shall be done as per the approved Rubrics.

Reference Books and Other Resources:

Various projects based magazines available in the college/department library.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/114106111/
2. http://nptel.ac.in/courses/114103063/