UNIVERSITY OF LUCKNOW
FACULTY OF ENGINEERING & TECHNOLOGY

Evaluation Scheme for B. Tech.

Branch : Electronics & Communication Engineering

SEMESTER - V

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	EC - 501	Principles of Communication Engineering	3--1--0	20	10	30	70	100	4
02.	EC – 502	Microprocessors and Microcontrollers	3--1--0	20	10	30	70	100	4
03.	EC – 503	Integrated Circuits	3--1--0	20	10	30	70	100	4
04.	EC - 504	Antenna & Wave Propagation	3--0--0	20	10	30	70	100	3
05.	EC - 505	Analog Signal Processing	3--0--0	20	10	30	70	100	3
	Practical								
06.	EC - 551	Communication Engineering Lab - I	0--0--3	-	40	40	60	100	2
07.	EC – 552	Microprocessors and Microcontrollers Lab	0--0--3	-	40	40	60	100	2
08.	EC – 553	Integrated Circuits Lab	0--0--2	-	20	20	30	50	1
09.	EC – 554	Advance Electronics Design Lab	0--0--2	-	20	20	30	50	1
10.	GP - 501	General Proficiency				50		50	--
Total			**15-3-10**					**800**	**24**

Abbreviations : CT - Class Test TA - Teacher's Assessment
ESE - End Semester Examination

UNIVERSITY OF LUCKNOW
FACULTY OF ENGINEERING & TECHNOLOGY

Evaluation Scheme for B. Tech.

Branch : Electronics & Communication Engineering

SEMESTER - VI

S. No.	Subject Code	Subject Name	L-T-P	Evaluation					Credit
				Sessional			ESE	Grand Total	
				CT	TA	Total			
	Theory								
01.	EC - 601	Microwave Engineering	3--1--0	20	10	30	70	100	4
02.	EC – 602	Digital Communication	3--1--0	20	10	30	70	100	4
03.	EC – 603	Control System	3--1--0	20	10	30	70	100	4
04.	EC - 604	Digital Signal Processing	3--0--0	20	10	30	70	100	3
05.	EC - 605	Any one from the list (DE –1)	3--0--0	20	10	30	70	100	3
	Practical								
06.	EC – 651	Microwave Engineering Lab	0--0--2	-	20	20	30	50	1
07.	EC – 652	Communication Engineering Lab - II	0--0--2	-	20	20	30	50	1
08.	EC – 653	Mini Project	0--0--3	-	40	40	60	100	2
09.	EC – 654	Seminar	0--0--3	-	40	40	60	100	2
10.	GP - 601	General Proficiency				50		50	
Total			**15-3-10**					**800**	**24**

Abbreviations : CT - Class Test TA - Teacher's Assessment
ESE - End Semester Examination DE - Departmental Elective

Note : The students have to go for Industrial Training for a duration of six week during summer vacation. The report of Industrial Training will be submitted to the Head of Department in the beginning of seventh semester for evaluation.

Departmental Elective – 1 :-

EC - 6051 Data Communication Networks
EC - 6052 Advance Semiconductor Devices
EC - 6053 Advance Digital Design Using Verilog
EC - 6054 Digital System Design using VHDL

EC - 501
PRINCIPLES OF COMMUNICATION ENGINEERING

L	T	P
3	1	0

Unit-I

Introduction: Overview of Communication system, communication channels, need for modulation, base band and pass band signals. Amplitude Modulation : Double side band with carrier (DSB-C), double side band without carrier, single side band modulation, DSB-SC, DSB-C, SSB modulators and demodulators, vestigial side band (VSB), quadrature amplitude modulator. **08**

Unit-II

Angle modulation, modulation index, pre-emphasis & de-emphasis, tone modulated FM signal, arbitrary modulated FM signal, FM modulators, direct method & indirect method and demodulators, PLL, phase discriminator & ratio detector, PM modulator and demodulator, stereophonic FM broadcasting, **08**

Unit-III

Pulse Modulation Digital Transmission of Analog Signals: Sampling theorem and its applications, pulse amplitude modulation (PAM), pulse width modulation, pulse position modulation, their generation and demodulation, digital representation of analog signals. Pulse Code Modulation (PCM) and PCM system. Issues in Digital Transmission: Frequency division multiplexing, time division multiplexing ,line coding and their power spectral density. **08**

Unit-IV

Differential pulse code modulation, delta modulation. adaptive delta modulation, T1 digital system, TDM hierarchy, Noise in Amplitude Modulation: Analysis, signal to noise ratio, figure of merit, noise in frequency modulation **08**

Unit-V

Noise: Types of noise and their sources, noise calculation, noise due to several amplifiers in cascade, noise in reactive circuits, noise figure & noise temperature calculation. **08**

Text Book:

1. H. Taub, D. Schilling, GoutomSaha, "Principles of Communication Systems", 4th Edition, TataMcGraw-Hill Publishing Company Ltd.
2. R.P. Singh, & S.D Sapre, "Communication Systems: Analog & Digital", 3rd Edition McGraw Hill Education.
3. B.P. Lathi, "Modern Digital and Analog communication Systems", 3rd Edition, Oxford University Press,2009.

Reference Books:

1. G. Kennedy, B. Devis, S. R. M. Prasanna, "Electronic Communication Systems" 5th Edition, Tata McGraw-Hill Publishing Company Ltd.
2. Simon Haykin, "Communication Systems",4th Edition, Wiley India.
3. H. Hsu & D. Mitra , "Analog and Digital Communications", 2nd Edition, Tata McGraw-Hill Publishing Company Ltd.

EC - 502
MICROPROCESSORS AND MICROCONTROLLERS

L	T	P
3	1	0

UNIT I

8085 MICROPROCESSOR: Introduction to microprocessor, microprocessor architecture and its operations, address / data bus multiplexing and demultiplexing. Status and control signal generation, instruction set of 8085 microprocessor, classification of instructions, addressing modes, timing diagram of the instruction. **08**

UNIT II

Hardware Interfacing with 8085 : Methods of data Transfer and Interrupts of 8085 microprocessor: Classification of interrupts, programming using interrupts, direct memory access, serial and parallel data transfer, interfacing of memory chips with 8085 microprocessor, interfacing of 8085 with 8155/8156 (RAM), 8355/8755 (ROM). Interfacing of programmable devices with 8085 microprocessor, 8279 programmable keyboard/display interface, 8255A programmable parallel interface, 8254 programmable interval timer, 8259A programmable interrupt controller, assembly language programming. **08**

UNIT III

16-bit low power MCU MSP430 : Introduction to microcontrollers and embedded systems, Von Neumann (Princeton) and Harvard architecture, RISC and CISC machine. Introduction to MSP430: Architecture, programming techniques, addressing modes, programming system registers and configuration I/O ports pull up/down registers concepts. **08**

UNIT IV

Configuring Peripherals in MSP430 : External interrupts and software interrupt, interrupt programming, watchdog timer, clock tree in MSP430, timer/ counter interrupt, programming MSP430 timer, counter programming, real time clock (RTC), PWM control, timing generation and measurements. **08**

UNIT V

Serial Communication Interfaces in MSP430 : Basics of serial communication, mode of serial communication, RS232, serial communication issue, serial port programming. Implementing and programming UART, I2C, SPI interface using MSP430, interfacing external devices, external memory, keyboards, display devices, DAC/ADC, DC motor, stepper motor and servomotor.

08

Text Books :

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", Penram International Publication (India) Pvt. Ltd.
2. DV Hall, "Microprocessors Interfacing", Tata McGraw Hill Publication.
3. N. Senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press Publication.
4. A.Nagoor Kani, "Microprocessors and Microcontrollers", McGraw Hill Publication.

Reference Books:

1. AK Roy & KM Bhurchandi, "Advance Microprocessor and Peripherals (Architecture, Programming & Interfacing)", Tata McGraw Hill Publication.
2. http://processors.wiki.ti.com/index.php/MSP430_16-Bit_UltraLow_Power_MCU_Training
3. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode.

EC - 503
INTEGRATED CIRCUITS

L	T	P
3	1	0

Unit I

Analog Integrated Circuit Design: an overview : Current mirrors using BJT and MOSFETs, simple current mirror, base current compensated current mirror, Wilson and Improved Wilson current mirrors, Widlar current source and cascode current mirror .

The 741 IC Op-Amp : Bias circuit, short circuit protection circuitry, the input stage, the second stage, the output stage, and device parameters. DC Analysis of 741: Small signal analysis of input stage, the second stage, the output stage; gain, frequency response of 741. **08**

Unit II

Linear Applications of IC op-amps : An overview of Op-Amp (ideal and non ideal) based circuits V-I and I-V converters, generalized impedance converter, simulation of inductors filters, first and second order LP, HP, BP BS and all pass active filters and State Variable Biquad filters; Sinusoidal oscillators. **08**

Unit III

Non-Linear applications of IC Op-amps : Log–Anti Log amplifiers, precision rectifiers, peak detectors, sample and hold circuits, analog multipliers and their applications. Op-amp as a comparator, zero crossing detector, Schmitt Trigger, astable multivibrator, monostable multivibrator, generation of triangular waveforms, D/A & A/D converter. **08**

Unit IV

Integrated Circuit Timer : The 555 circuit, implementing a monostable multivibrator, astable multivibrator, VCO, Schmitt Trigger circuit using the 555 IC. Phase locked loops (PLL): Ex-OR gates and multipliers as phase detectors, block diagram of IC PLL, working of PLL and applications of PLL,D/A and A/D converters. **08**

Unit-V

Digital Integrated Circuit Design-An Overview : CMOS Logic Gate Circuits: Basic structure CMOS realization of inverters. AND, OR, NAND and NOR Gates Latches and Flip flops: The latch, the SR flipflop, CMOS implementation of SR flip-flops, a simpler CMOS implementation of the clocked SR flipflop, D flip-flop circuits. **08**

Text Book :

[1] Sedra and Smith, “Microelectronic Circuits”, 4th Edition, Oxford University Press.
[2] Michael Jacob, “Applications and Design with Analog Integrated Circuits”, PHI.
[3] D. Roy Choudhary, “ linear Integrated Circuit” PHI

Reference Books :

[1] Jacob Milliman and Arvin Grabel, “Microelectronics”, 2nd Edition, TMH.
[2] A. K. Maini, Analog Circuits, Khanna Publishing House, Delhi.

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EC – 504
ANTENNA & WAVE PROPAGATION

L	T	P
3	0	0

Unit-I

Antennas Basics: Introduction, Basic antenna parameters, Patterns, Beam area (or beam solid angle) ΩA, Radiation intensity, Beam efficiency, Directivity D and gain G, Directivity and resolution, Antenna apertures, Effective height, The radio communication link, Fields from oscillating dipole, Single-to-noise ratio (SNR), Antenna temperature, Antenna impedance. **08**

Unit-II

Point sources and their arrays introduction, Point source, Power theorem and its application to an isotropic source, Radiation intensity, Arrays of two isotropic point sources, No isotropic but similar point sources and the principle of pattern multiplication, Pattern synthesis by pattern multiplication, Linear arrays of n isotropic point sources of equal amplitude and spacing, Linear broadside arrays with no uniform amplitude distributions. Electric dipoles, Thin liner antennas and arrays of dipoles and apertures the short electric dipole, The fields of a short dipole, Radiation resistance of short electric dipole, Thin linear antenna, Radiation resistance of λ/2 antenna, Array of two driven λ/2 elements: Broadside case and end-fire case, Horizontal antennas above a plane ground, Vertical antennas above a plane ground, Yagi-Uda antenna design, Long-wire antennas, Folded dipole antennas. **08**

Unit-III

The Loop Antenna: Design and its characteristic properties, Application of loop antennas, Far field patterns of circular loop antennas with uniform current, Slot antennas, Horn antennas, Helical antennas, The log-periodic antenna, Micro strip antennas. **08**

Unit-IV

Reflector Antennas: Flat sheet reflectors, Corner reflectors, The parabola-general properties, A comparison between parabolic and corner reflectors, The paraboloidal reflector, Patterns of large circular apertures with uniform illumination, Reflector types (summarized), Feed methods for Parabolic reflectors, Antenna measurements introduction, Antenna measurement ranges, Radiation pattern measurements, Gain and directivity measurements. **08**

Unit-V

Ground wave propagation plane earth reflection, Space wave and surface wave, Space wave propagation introduction, Field strength relation, Effects of imperfect earth, Effects of curvature of earth, Sky wave propagation introduction structural details of the ionosphere, Wave propagation mechanism, Refraction and reflection of sky waves by ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and skip distance, Relation between MUF and the skip distance, Multi-hop propagation. **08**

Text Book:

1. John D Krauss, Ronald J Marhefka and Ahmad S. Khan,"Antennas and Wave Propagation", FourthEdition, Tata McGraw Hill, 2010 Special Indian Edition.
2. A. Das, Sisir K. Das, "Microwave Engineering", Tata McGraw Hill.

Reference Books:

1. A .R. Harish, M. Sachidananda, "Antennas and Wave Propagation", Oxford University Press, 2009.
2. Jordan Edwards C. and Balmain, Keith G."Electromagnetic Waves and Radiating Systems", PHI.

EC – 505
ANALOG SIGNAL PROCESSING

L	T	P
3	0	0

Unit-I

Introduction to domains and the analogue/digital trade off, Introduction to current conveyor, current feedback amplifier.

Analog signal filtering: introduction to bilinear transfer functions and active realizations. Second-order filter realization, filter design parameters (Q and ω_0), frequency response, Three op-amp biquad, effect of finite gain of op-amp over filters, Sallen-Key biquad.. **08**

Unit-II

Ideal low-pass filter, Buttreworth and Chebyshev magnitude response, pole locations,low-pass filter specifications, comparison of Maximally flat and Equal ripple responses **08**

Unit-III

Delay equalization: equalization procedures, equalization with first-order and second order modules, strategies for equalization design. Definition of Bode sensitivity.

08

Unit-IV

The General Impedance Convertor (GIC), optimal design of the GIC, realization of simple ladders, Gorski-Popiel's Embedding Technique, Bruton's FDNR technique. **08**

Unit-V

Elementary transconductorbuilding blocks, resistors, integrators, amplifiers, summers, Gyrator, First and second order filters, Higher order filters. **08**

Text Books :

1. Ramon Pallas-Areny, John G. Webster, "Analog Signal Processing", John Wiley& Sons
2. R. Schaumann and M. E. Valkenberg, "Design of Analog Circuits", Oxford University Press.

Reference Books :

1. Alok Barua, "An Analog Signal Processing: Analysis & Synthesis", John Wiley& Sons.
2. Razavi, Behzad ,"Design of Analog CMOS integrated circuits", Tata McGraw-Hill

EC - 551
COMMUNICATION ENGINEERING LAB - I

L	T	P
0	0	3

Note :- At least **ten** experiments are to be conducted from the following list.

1. To study DSB/ SSB amplitude modulation & determine its modulation Index & power in side bands.
2. To study amplitude demodulation by linear diode detector.
3. To study frequency modulation and determine its modulation factor.
4. To study PLL 565 as frequency demodulator.
5. To study sampling and reconstruction of Pulse Amplitude modulation system.
6. To study the Sensitivity, Selectivity, and Fidelity characteristics of super heterodyne receiver.
7. To study Pulse Amplitude Modulation.
   a) using switching method
   b) by sample and hold circuit
8. To demodulate the obtained PAM signal by 2nd order LPF.
9. To study Pulse Width Modulation and Pulse Position Modulation.
10. To study Pulse code modulation and demodulation technique.
11. To study Delta modulation and demodulation technique.
12. Design and implement an FM radio receiver in 88-108 MHz

EC - 552

MICROPROCESSORS & MICRONTROLLERS LAB

L	T	P
0	0	3

Note :- At least **ten** experiments are to be conducted from the following list.

1. Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers.
2. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers.
3. To perform multiplication and division of two 8 bit numbers using 8085.
4. To find the largest and smallest number in an array of data using 8085 instruction set.
5. To write a program to arrange an array of data in ascending and descending order.
6. To obtain interfacing of RAM chip to 8085 based system
7. To obtain interfacing of keyboard controller
8. To obtain interfacing of DMA controller
9. To obtain interfacing of PPI
10. To obtain interfacing of UART/USART
11. To perform microprocessor based stepper motor operation through 8085 kit
12. To perform microprocessor based traffic light control

13. Learn and understand how to configure MSP-EXP430G2 Launchpad digital I/O pins. Write a C program for configuration of GPIO ports for MSP430 (blinking LEDs, push buttons interface).

Exercises:

a) Modify the delay with which the LED blinks.
b) Modify the code to make the green LED blink.
c) Modify the code to make the green and red LEDs blink:
i. Together
ii. Alternately
d) Alter the code to turn the LED ON when the button is pressed and OFF when it is released.

10. Learn and understand GPIO based Interrupt programming. Write a C program and associated GPIO ISR using interrupt programming technique.

Exercises:

a) Write the code to enable a Timer interrupt for the pin P1.1.
b) Write the code to turn on interrupts globally.

11. Implement Pulse Width Modulation to control the brightness of the on-board, green LED. This experiment will help you to learn and understand the configuration of PWM and Timer peripherals of the MSP430G2553.

Exercises:

a) Observe the PWM waveform on a particular pin using CRO.
b) What is the maximum resolution of PWM circuitry in MSP430G2 Launchpad?

EC - 553
INTEGRATED CIRCUITS LAB

L	T	P
0	0	2

Note :- At least **ten** experiments are to be conducted from the following list.

1. Measurement of Op-amp Parameters. (Open Loop Gain, input offset Voltage, CMRR, Slew rate).
2. Determination of Frequency response of Op-Amp.
3. Design the following amplifiers:
    a. A unity gain amplifier.
    b. A non-inverting amplifier with a gain of "A".
    c. An inverting amplifier with a gain of "A".
    d. Log and antilog amplifiers.
    e. Voltage comparator and zero crossing detectors.
4. Second order filters using operational amplifier for–
    a. Low pass filter of cutoff frequency 1 KHz.
    b. High pass filter of frequency 12 KHz.
    c. Band pass filter with unit gain of pass band from 1 KHz to 12 KHz.
5. Instrumentation Amplifier.
6. Determine capture range; lock in range and free running frequency of PLL.
7. Voltage regulator using operational amplifier to produce output of 12V with maximum load current of 50 mA.
8. A/D and D/A convertor.
9. Voltage to current and current to voltage convertors.
10. Function generator using operational amplifier (sine, triangular & square wave)
11. Astable and monostable multivibrator using IC 555.

EC - 554
ADVANCE ELECTRONICS DESIGN LAB

L	T	P
0	0	2

Note :- At least **ten** experiments are to be conducted from the following list.

SPICE Experiments

1. Schematic & Transient Analysis of NMOS inverter using step input.
    a. Transient Analysis of NMOS inverter using pulse input.
    b. DC Analysis (VTC) of NMOS inverter with and without parameters.
2. Schematic & Analysis of CMOS inverter using step input.
    a. Transient Analysis of CMOS inverter using step input with parameters.
    b. DC Analysis (VTC) of CMOS inverter with and without parameters.
3. Schematic & Transient & DC Analysis of NAND Gate.
4. Schematic & Transient& DC Analysis of NOR Gate.

VHDL Experiments

1. Synthesis and simulation and implementation on FPGA Board of Full Adder.
2. Synthesis and Simulation and implementation on FPGA Board of Full Subtractor.
3. Synthesis and Simulation and implementation on FPGA Board of 3 X 8 Decoder.
4. Synthesis and Simulation and implementation on FPGA Board of 8 X 1 Multiplexer.
5. Synthesis and Simulation and implementation on FPGA Board of 9 bit odd parity generator.
6. Synthesis and Simulation and implementation on FPGA Board of Flip Flop (D and T).
7. Design Simulation and implementation of 8-bit counter using ASIC Flow.

EC - 601
MICROWAVE ENGINEERING

L	T	P
3	1	0

Unit-I

Rectangular Wave Guide: Field Components, TE, TM Modes, Dominant TE10 mode, Field Distribution, Power, Attenuation. Circular Waveguides: TE, TM modes. Wave Velocities, Micro strip Transmission line(TL), Coupled TL, Strip TL, Coupled Strip Line, Coplanar TL, Microwave Cavities. **08**

Unit-II

Passive microwave devices: Scattering Matrix, Microwave Hybrid Circuits, Terminations, Attenuators, Phase Shifters, Directional Couplers: Two Hole directional couplers, S-Matrix of a Directional coupler, Hybrid Couplers, Microwave Propagation in ferrites, Faraday Rotation, Isolators, Circulators, S-parameter analysis of all components. **08**

Unit-III

Microwave Tubes: Limitation of Conventional active devices at microwave frequency, Two Cavity Klystron, Reflex Klystron, Magnetron, Traveling wave tube, Backward wave oscillators, Gyro Devices: Their schematic, Principle of operation, Performance characteristic and their applications. **08**

Unit-IV

Solid state amplifiers and oscillators: Microwave Bipolar Transistor, Microwave tunnel diode, Microwave Field-effect Transistor, Transferred electron devices, Avalanche Transit –time devices: IMPATT diode, TRAPPAT diode, BARITT diode. **08**

Unit-V

Microwave Measurements: General set up of a microwave test bench, Slotted line carriage, VSWR Meter, microwave power measurements techniques, Crystal Detector, frequency measurement, wavelength measurements, Impedance and Refection coefficient, VSWR, Insertion and attenuation loss measurements, EM radiation & measurement. **08**

Text Books :

1. Samuel Y. Liao, "Microwave Devices and Circuits", 3rd Ed, Pearson Education.
2. A. Das and S. K. Das, "Microwave Engineering", TMH.3rd Edition.
3. G. S. Raghuvanshi, "Microwave Engineering", Cengage

Reference Books :

1. R.E Collin, "Foundation for Microwave Engineering ", 2nd Ed., John Wiley India.
2. Om P. Gandhi, Microwave Engineering and Applications; Pergamon Press.

EC - 602
DIGITAL COMMUNICATION

L	T	P
3	1	0

Unit-I

Digital Data transmission, Line coding review, Pulse shaping, Scrambling, Digital receivers, Eye diagram, Digital carrier system, Method of generation and detection of coherent & non-coherent binary ASK, FSK &PSK, Differential phase shift keying, quadrature modulation techniques. (QPSK and MSK),M-ary Digital carrier Modulation. **08**

Unit-II

Concept of Probability, Random variable, Statistical averages, Correlation, Sum of Random Variables, Central Limit Theorem, Random Process, Classification of Random Processes, Power spectral density, Multiple random processes, **08**

Unit-III

Performance Analysis of Digital communication system: Optimum linear Detector for Binary polar signaling, General Binary Signaling, Coherent Receivers for Digital Carrier Modulations, Signal Space Analysis of Optimum Detection, Vector Decomposition of White Noise Random processes, General Expression for Error Probability of optimum receivers. **08**

Unit-IV

Spread spectrum Communications : Frequency Hopping Spread Spectrum (FHSS) systems, Direct Sequence Spread Spectrum, Code Division Multiple Access of DSSS, Multiuser Detection, OFDM Communications.

Introduction to information theory : Measure of Information, Source Encoding, Error Free Communication over a Noisy Channel capacity of a discrete and Continuous Memory less channel. **08**

Unit-V

Error Correcting codes : Hamming sphere, hamming distance and Hamming bound, relation between minimum distance and error detecting and correcting capability.

Linear block codes : encoding & syndrome decoding; Cyclic codes, encoder and decoders for systematic cycle codes; convolution codes, code tree & Trellis diagram, Viterbi and sequential decoding. **08**

Text Book :

1. B.P. Lathi, "Modern Digital and Analog communication Systems", 4th Edition, Oxford University Press, 2010.
2. Simon Haykin, " Digital Communication" John Wiley & Sons.
3. John G. Proakis, "Digital Communications", 4th Edition, McGraw-Hill International

Reference Book :

1. R.N. Mutagi, "Digital Communication" Oxford University Press.
2. Dennis Roddy and John Coolen, " Electronics Communication" PHI
3. Bernard Sklar and Pabitra Kumar Ray, " Digital Communication" Pearson.

EC - 603
CONTROL SYSTEM

L	T	P
3	1	0

Unit-I

Basic Components of a control system, Feedback and its effect, types of feedback control systems. Block diagrams Reduction and signal flow graphs.

Modeling of Physical systems: electrical networks, mechanical systems elements, equations of mechanical systems, sensors and encoders in control systems, DC motors in control systems. **08**

Unit-II

Time domain Analysis of Control Systems: Time response of continuous data systems, typical test signals for the time response of control systems, the unit step response and time-domain specifications, Steady-State error, time response of a first order system, transient response of a prototype second order system. **08**

Unit-III

Stability of Linear Control Systems: Bounded-input bounded-output stability continuous data systems, zero-input and asymptotic stability of continuous data systems, Routh Hurwitz criterion. Root-Locus Technique: Introduction, Properties of the Root Loci, Design aspects of the Root Loci. **08**

Unit-IV

Frequency Domain Analysis: Mr (resonant peak) and ωr (resonant frequency) and bandwidth of the prototype Second order system, effects of adding a zero to the forward path, effects of adding a pole to the forward path, Polar Plot, Nyquist stability criterion, relative stability: gain margin and phase margin, stability analysis with the Bode plot. **08**

Unit-V

State-Variable Analysis: Vector matrix representation of state equation, state transition matrix, state-transition equation, relationship between state equations and high-order differential equations, relationship between state equations and transfer functions. Similarity Transformation, Decomposition of transfer functions, Controllability and Observability. **08**

Text Book :

1. B.C. Kuo & Farid Golnaraghi, "Automatic Control Systems", 8th Edition, John Wiley India, 2008.
2. I. J. Nagrath& M. Gopal, "Control System Engineering", New Age International Publishers.

Reference Books :

1. A. Ambikapathy, Control Systems, Khanna Publishing House, Delhi.
2. Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, "Control Systems" Schaums Outlines Series, 3rdEdition, Tata McGraw Hill, Special Indian Edition 2010.
3. William A. Wolovich, "Automatic Control Systems", Oxford University Press, 2011.

EC – 604
DIGITAL SIGNAL PROCESSING

L	T	P
3	0	0

Unit-I

Digital Signal & System: Introduction to DSP, Representation of Digital Signal, Basic Sequences, Representation of Arbitrary Sequences, Linear Shift Invariant System, stability & causuality, Sampling, Frequency Domain Concept of Digital Signal. **08**

Unit-II

Realization of Digital Systems : Introduction, direct form realization of IIR systems, cascade realization of an IIR systems, parallel form realization of an IIR systems, Ladder structures: continued fraction expansion of H(z), example of continued fraction, realization of a ladder structure, FIR Filter Realization: Direct & Cascade, FIR Linear Phase Realization. **08**

Unit-III

Design of Infinite Impulse Response Digital Filters : Introduction to Filters, Impulse Invariant Transformation, Bi-Linear Transformation, All- Pole Analog Filters: Butterworth and Chebyshev, Design of Digital Butterworth and Chebyshev Filters. **08**

Unit-IV

Finite Impulse Response Filter Design : Windowing and the Rectangular Window, Other Commonly Used Windows, Examples of Filter Designs Using Windows, The Kaiser Window. **08**

Unit-V

Discrete Fourier Transforms : Definitions, Properties of the DFT, Circular Convolution, Linear Convolution.

Fast Fourier Transform Algorithms: Introduction, Decimation–In Time(DIT) Algorithm, Computational Efficiency, Decimation in Frequency(DIF) Algorithm. **08**

Text Books :

1. Johnny R. Johnson, “Digital Signal Processing”, PHI Learning Pvt Ltd.
2. S. Salivahanan, “ Digital Signal Processing”, Mc Graw Hill Education.
3. A.Anand Kumar, “Digital Signal Processing”PHI.

Reference Books :

1. John G Prokias, Dimitris G Manolakis, “Digital Signal Processing”, Pearson Education.
2. Oppenheim & Schafer, “ Digital Signal Processing” PHI.

EC - 651
MICROWAVE ENGINEERING LAB

L	T	P
0	0	2

Note :- At least **ten** experiments are to be conducted from the following list.

1. To study microwave test bench.
2. To study the characteristics of reflex klystron tube and to determine its electronic tuning range.
3. To determine the frequency and wavelength in a rectangular waveguide working on TE_{01} mode.
4. To study measurement of reflection coefficient and standing wave ratio using double minima method.
5. To study V-I characteristic of Gunn diode.
6. To measure an unknown impedance with Smith chart.
7. Study of Circulator/Isolator.
8. Study of Attenuator (Fixed and Variable type).
9. To study simple dipole $\lambda/2$ antenna and to calculate beam-width, front / back ratio, and gain of the antenna.
10. To study folded dipole antenna and to calculate beam-width, front / back ratio, and gain of the antenna.
11. To study $\lambda/2$ phase array end-fire antenna and to calculate beam-width, front / back ratio, and gain of the antenna.
12. To study broadside array antenna and to calculate beam-width, front / back ratio, and gain of the antenna.

EC - 652
COMMUNICATION ENGINEERING LAB – II

L	T	P
0	0	2

Note :- At least **ten** experiments are to be conducted from the following list.

1. To construct a Square wave with the help of Fundamental Frequency and its Harmonic component
2. Study of pulse data coding & decoding techniques for NRZ and RZ formats.
3. Study of Manchester coding and Decoding.
4. Study of Amplitude shift keying modulator and demodulator.
5. Study of Frequency shift keying modulator and demodulator.
6. Study of Phase shift keying modulator and demodulator.
7. Study of single bit error detection and correction using Hamming code.
8. Study of Quadrature Phase shift keying modulator and demodulator.
9. To simulate Differential Phase shift keying technique using MATLAB software.
10. To simulate M-ary Phase shift keying technique using MATLAB software (example8PSK, 16PSK) and perform BER calculations.
11. To simulate convolution coding using MATLAB software.
12. Design a front end BPSK modulator and demodulator.

EC - 6051
DATA COMMUNICATION NETWORKS

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Unit-I

Introduction to Networks & Data Communications The Internet, Protocols & Standards, Layered Tasks, OSI Model, TCP / IP, Addressing, Line Coding Review, Transmission Media: Guided and unguided Media Review. **08**

Unit-II

Switching: Datagram Networks, Virtual Circuit Networks, Structure of a switch ,Ethernet Physical Layer, Data Link Layer: Error detection and Correction Data Link Control: Framing, Flow and Error Control Protocols, Noiseless Channel and Noisy Channel Protocol, HDLC, Point-to-Point Protocol.

08

Unit-III

Multiple Access: RANDOH, CDMA, CSMA/CD, CSMA/CA, Controlled Access, Channelization Wired LANs: IEEE Standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11, Bluetooth IEEE 802.16. **08**

Unit-IV

Network Layer :Design Issues. Routing Algorithms. Congestion control Algorithms.IPV4 Addresses, Connecting Devices, Virtual LAN IPV6Addresses, Internet Protocol, Hardware Addressing versus IP Addressing,IP Data Gram. **08**

Unit-V

Transport Layer Protocol : UDP and TCP, ATM, Cryptography, Network Security.
Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals, Other application. **08**

Text Books :

1. B. A. Forouzan, "Data Communication and Networking", TMH.
2. W. Stallings, “Data and Computer Communication”, Macmillan Press.

Reference Books:

1. A.S. Tanenbaum, “Computer Networks”, PHI.
2. S. Keshav, “An Engineering Approach on Computer Networking”, Addison Wesley.

EC – 6052
ADVANCED SEMICONDUCTOR DEVICES

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Unit-I

Physics of Semiconductors, P-N Junction Diode and BJT: Introduction, Crystal Structure, Phonon, Optical, and Thermal Properties, p-n Junctions–Junction Breakdown, Transient Behavior and Noise Terminal Functions.BJT: Static Characteristics, Microwave Characteristics, Related Device Structures, Heterojunction Bipolar Transistor. **08**

Unit-II

MOSFET, Hetero-Junctions and Basics of Nanostructures: MOSFET: Basic Device Characteristics, Nonuniform Doping and Buried Channel Device, Device Scaling and Short-Channel Effects, MOSFET Structures, Circuit Applications, Single Electron Transistor, JFETs.

Hetero-junctions: Metal-Semiconductor Contacts, Metal-Insulator-Semiconductor Capacitors, MESFETs. **08**

Unit-III

TUNNEL Devices and IMPATT Diodes: TUNNEL DEVICES: Tunnel Diode, Related Tunnel Devices, Resonant Tunneling Diode.

IMPATT Diodes: Static Characteristics, Dynamic Characteristics, Power and Efficiency Noise Behaviour, Device Design and Performance, BARITT Diode. **08**

Unit-IV

Power devices, Photonic devices: Transferred-Electron and Real-Space-Transfer Devices Thyristors, Power Devices.

Photonic Devices and Sensors: Radiative Transitions, Light-Emitting Diode (LED), Laser Physics, Laser Operating Characteristics. **08**

Unit-V

Photodetectors, Solar Cells and Sensors: Photodiodes, Avalanche Photodiode and Phototransistor, Charge-Coupled Device (CCD), Metal- Semiconductor-Metal Photo detector, Quantum-Well Infrared Photo detector, Solar Cell

Sensors: Thermal Sensor, Mechanical Sensors, Magnetic Sensors and Chemical Sensors. **08**

Text Book :

1. M.S. Tyagi, “Introduction To Semiconductor Materials And Devices”, John Willy-India Pvt. Ltd.
2. S. M. Sze, “Physics of Semiconductor Devices”, 2ndEdition, John Willy-India Pvt. Ltd.

Reference Books :

1. B. G. Streetman and S. Banerjee, “Solid state electronics devices”, 5thEdition, PHI.
2. A.K. Maini, All in One Electronics Simplified, Khanna Publishing House, Delhi.

EC – 6053
ADVANCE DIGITAL DESIGN USING VERILOG

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Unit I

Introduction to Mixed Logic, Logic Representation and Minimization with cost, Multiple output minimization, Entered Variable K-Map including don't care handling, XOR Pattern Handling. **08**

Unit II

Combinational Circuit Design, Multiplexers, Decoders, Encoders, Code Comparators, Adders, Subtractors, Multipliers, Introduction to Verilog, Behavioral and Structural specification of logic circuits, Boolean function implementation using Verilog, Timing Analysis, Hazard Detection and Elimination. **08**

Unit III

Synchronous Sequential Circuits Design, Mapping Algorithm, Synchronous State Machines, ASM Charts, Asynchronous Sequential Circuit Design, Races, Multi-level minimization and optimization. **08**

Unit IV

Factoring, Decomposition, BDD, Ordered BDD, LPDD, Fault Detection and Analysis in combinational and sequential systems, Path Sensitization method, Boolean Difference Method, Initial State Method**.** **08**

Unit V

Study of programmable logic families, PLD, CPLD, FPGA, ASIC, PLA, Architectures, Design of Combinational and sequential circuits using CPLD and FPGA, Design Examples. **08**

Text Books:

1. Richard F. Tinder, "Engineering Digital Design", Academic Press.
2. Parag K. Lala, "Digital system Design Using PLDs", PHI India Ltd.
3. Stephen Brown and Zvonko Vranesiv, "Fundamental of Digital Logic with Verilog Design", Tata McGraw Hill.

Reference Books:

1. John Williams, "Digital VLSI Design with Verilog", Springer Publication.
2. Eugene Fabricius, "Modern Digital Design and Switching Theory", CRC Press.
3. Samuel C. Lee, "Digital Circuit and Logic Design", PHI India Ltd.

EC – 5054
DIGITAL SYSTEM DESIGN USING VHDL

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Unit I
Introduction to VHDL, reserve words, structures, modeling, objects, data type and operators, sequential statements and processes, sequential modeling and attributes, conditional assignment, concatenation and case array loops and assert statements, subprograms. **08**

Unit II
Digital System Design Automation– Abstraction Levels, System leveldesign flow, RTL design flow, VHDL. RTL Design with VHDL – Basic structures of VHDL, Combinational circuits, Sequential circuits, Writing Test benches, Synthesis issues, VHDL Essential Terminologies VHDL Constructs for Structures and Hierarchy Descriptions – Basic Components, Component Instantiations, Iterative networks, Binding Alternatives, Association methods, generic Parameters, Design Configuration.**08**

Unit III
Concurrent Constructs for RT level Descriptions – Concurrent Signal Assignments, Guarded signal assignment Sequential Constructs for RT level Descriptions – Process Statement, Sequential WAIT statement, VHDL Subprograms, VHDL library Structure, Packaging Utilities and Components, Sequential Statements. VHDL language Utilities - Type Declarations and Usage, VHDL Operators, Operator and Subprogram overloading, Other TYPES and TYPE– related issues, Predefined Attributes. **08**

Unit IV
VHDL Signal Model – Characterizing hardware languages, Signal Assignments, Concurrent and Sequential Assignments, Multiple Concurrent Drivers Standard Resolution. **08**

Unit V
Hardware Cores and Models - Synthesis rules and styles, Memory and Queue Structures, Arithmetic Cores, Components with Separate Control and Data parts.
Core Design Test and Testability - Issues Related to Design Test, Simple Test benches. **08**

Text Books :

1. Z. Navabi, “VHDL-Modular Design and Synthesis of cores and Systems”, TMH.
2. R.D.M. Hunter, T. T. Johnson, “Introduction to VHDL” Spriger Publication.

Reference Books :

1. Douglas Perry, “VHDL- Programming by examples”, McGraw Hill Publication.
2. C. H. Roth, “Digital System Design using VHDL”, PWS Publishing.