SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VIth Semester

Subject Category :**DC**	Subject Code: **EC-601**	Subject Name: **CMOS Circuit Design**

Maximum Marks Allotted								Contact Hours			**Total Credits**
Theory				Practical			**Total Marks**				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	-	2	4

Prerequisites:

- Basic Physics
- Digital System Design
- Electronic Devices

Course Objective:

The objective of this course is to make student aware of VLSI technology, fabrication process used for designing IC components. To make student capable for analysing the performance of MOS based devices.

Course Outcomes:

On successful completion of this course student should be able to:

CO 1: Understand and demonstrate different IC technologies, fabrication process, design approaches, MOS transistor, inverters, dynamic logic circuits & HDL based design. — (BL1, BL2)

CO 2: Use MOS inverter as a switch —(BL2, BL3)

CO 3: Analyse MOSFET characteristics, logic circuits and Dynamic circuit techniques. -(BL3, BL4)

CO 4: Design and simulate logic circuits and systems using HDL— (BL3, BL6)

UNITs	Descriptions	Hrs.	CO's
I	*Introduction*: Introduction to IC Technology –MOS, PMOS, NMOS, CMOS & Bi-CMOS technologies. *CMOS Fabrication and Layout:* Fabrication Process, Layout Design rules, Gate Layout, Stick Diagrams. *VLSI Design Flow:* VLSI Design Consideration, Hierarchy, Concepts of Regularity, Modularity and Locality, VLSI Design Approaches, Methodologies and Classifications, VLSI Design Qualities.	08	1
II	*MOS Transistor:* The Metal Oxide Semiconductor (MOS) structure, The MOS System under external bias, Structure & Operation of MOS transistor, MOSFET Current-Voltage characteristics. MOSFET scaling effects, MOSFET capacitances.	07	1,2,3
III	*MOS inverter Static characteristics:* Introduction, Resistive load Inverter, Inverter with n-type MOSFET load, CMOS Inverter. *MOS inverters Switching characteristics and Interconnect Effects*: Delay-time definitions, Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect Parasitic, Calculation of interconnect delay, Switching Power Dissipation of CMOS Inverters.	08	2,3
IV	*Combinational MOS & Dynamic Logic circuits*: Combinational Logic, NAND Gate, NOR Gate, Compound Gates, Transmission Gates, Tristate. Sequential MOS Logic circuits: Introduction, Behaviour of Bi-stable elements, The SR latch circuit, clocked latch & Flip-flop circuit, CMOS D-latch & Edge triggered flip-flop. *Dynamic Logic Circuits*: Introduction, Basic principles of pass transistor circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, CMOS Dynamic Circuit Techniques. High-performance Dynamic CMOS circuits.	10	1,2,3
V	*IC Fabrication & layout designing using EDA tools, VHDL based design:* HDL and its components, Language Fundamentals, Behavioural and RTL style of modelling, Data Flow style of description, Structural style, Test-Bench.	07	3,4
Guest Lectures (if any)			
Total Hours		40	

Suggestive list of experiments:

1. Combinational Design Exercises using VHDL-CO4
    a. Design of 2:1 Multiplexer using other Basic gates
    b. Design 2:4 Decoder
    c. Design Half Adder, Full Adder
    d. Design 3: 8 Decoder
    e. Design 8:3 Priority Encoder
2. Sequential Design Exercises using VHDL-CO4
    a. Design of 4 Bit Binary to Gray Code Converter
    b. Design of 4 Bit Binary to BCD Converter
    c. Design of 8 Bit Parity Generator

d. Design of all types of Flip Flop using (if then else) Sequential constructs 3. Design of basic and universal gates using Microwind Simulation Software-CO4 a. NOT Gate b. 2 & 3 input OR & NOR Gate c. 2 & 3 input AND & NAND Gate2 d. 2 & 3 input XOR & XNOR Gate
Text Book- • Kang & Leblebici, CMOS Digital Integrated Circuits, Mcgraw Hill Publication 3e • J. Bhaskar, A Vhdl Primer, Prentice Hall.
Reference Books- • Neil H.E. Weste, David Harris, Ayan Banerjee: CmosVlsi Design, Third Edition, • Pearson Education. • Neil H.E. Weste, Kamran Eshraghian: Principle Of CmosVlsi Design, Pearson Education. • J. P. Uyemura: Chip Design For Submicron VLSI, Cengage Learning. • Philip E. Allen And Douglas R Holberg: Cmos Analog Circuit Design, Oxford • Carver Mead And Lynn Conway: Introduction To Vlsi Systems, Bs Publication. • J. P. Uyemura: Introduction To Vlsi Circuits And Systems, Wiley. • Vlsi Technology – S.M. Sze, 2nd Edition, Tmh, 2003. • Angsuman Sarkar, VLSI Design and EDA Tools 2e, Scitech Publications
Modes of Evaluation and Rubric
Final Exam, Mid Sem Exam, Quiz, Assignments, Practical, External/Internal Viva, Attendance

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Niraj Kumar

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VIth Semester

Subject Category: **DC**	Subject Code: **EC-602**	Subject Name: **Data Communication and Computer Network**

Maximum Marks Allotted								Contact Hours			**Total Credits**
Theory				Practical			**Total Marks**				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	-	2	4

Prerequisites:

Basics of communication engineering

Course Objective:

- To understand the basic concepts of data communication, layered model, protocols and internetworking between computer networks and switching components in communication systems.
- To develop a sound understanding of the protocol mechanisms employed at the IP and Transport layers of the Internet.
- To give an overview of security issues related to data communication in networks.

Course Outcomes:

On successful completion of this course students will be able to:

CO 1: Understand network communication, multiplexing, switching and connecting devices using the layered concept: Open System Interconnection (OSI) and TCP/IP Model. (BL1, BL2, BL3)

CO 2: Apply and differentiate various network topologies, error and flow control technique (BL2, BL3)

CO 3: Identify and analyze different medium access methods and protocols used in computer networks (BL4)

CO4: Classify and understand network security and IP routing (BL1-BL3)

UNITs	Descriptions	Hrs.	CO's
I	**Introduction:** Data Communication, Networks - Physical structures; different topologies, Categories of Networks: LAN, MAN, WAN,PAN, CANetc,Interconnection of networks, Transmission Modes, Protocols and Standards, The OSI model, different layers in OSI model. TCP/IP protocol suite with different layers, Addressing - physical, logical, port and specific addresses, Digital Data Transmission- Synchronous and asynchronous transmission.	8	1, 2
II	**Physical Layer**: Types of Cables,Line Coding, Line Coding Schemes, Multiplexing - Frequency Division, Wavelength Division, Synchronous Time Division, Statistical Time Division Multiplexing. Switching-Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks. Connecting Devices- Hubs, Repeaters, Bridges, Routers and Gateway.Digital Subscriber Line(DSL), Modern Internet Alternatives to DSL.	8	1, 2
III	**Data Link Layer**: Introduction - Types of Errors, Redundancy, Forward Error Correction Vs Retransmission, Error Detection, Error Correction, Parity – LRC, Cyclic Redundancy Check, Hamming Code, Flow Control, Sliding Window,Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ.	8	2, 3
IV	**Medium Access**: Medium Access: Random Access- ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA). Controlled Access-Reservation, Polling, Token Passing. Channelization- Frequency-Division Multiple Access (FDMA), Time- Division Multiple Access (TDMA), Code-Division Multiple Access (CDMA)	7	1, 3
V	**Network Security and Connecting Networks**: Encryption/Decryption, Symmetric and Asymmetric key cryptography, Digital Signature, Data Encryption Standard (DES), AES,PGP, Virtual LANs, Routing Protocols - Distance Vector, Link State Routing,IPv4- Header,Address Space, Notation, Classful& Classless Addressing, IPv6 –Header, Address Space, Advantages.	9	4
Guest Lectures (if any)			
Total Hours		45	

Suggestive list of experiments:

1. Introduction to Network Simulator – Packet Tracer/NETSIM/NS
2. Study different types of Transmission Media - Open Wire, Twisted Pair, Coaxial Cable, Optical Fibre
3. Creating and configuring a LAN using hub and repeater.
4. Creating and configuring a LAN using a switch.
5. Creating and configuring an Inter-LAN communication using a router.
6. To construct a VLAN and make the PC's communicate among a VLAN.
7. To construct a Wireless LAN and make the PC's communicate wirelessly.
8. To understand the concept and operation of Routing Information Protocol (RIP)
9. To construct multiple router networks and understand the operation of OSPF Protocol
10. To understand the operation of TELNET by accessing the router in server room from a PC in IT office.

11. Ethernet LAN protocol to create scenario and study the performance of CAMA/CD (Carrier Sense Multiple Access with Collision Detection Protocol through simulation
12. Implementation and study of Stop and Wait Protocol.
13. Implementation of Data Encryption and Decryption.

Experiments can be performed using experimental kits/simulation tools: Scientech software/NETSIM/ NS3/ Packet Tracer etc

Text Books-

- Data Communications & Networking – 5th Edition- B A Forouzan- Tata McGraw-Hill.
- Computer Networking: A Top-Down Approach Featuring the Internet. James F.Kurose& Keith W. Ross, 3rd Edition, Pearson Education.
- A. Leon-Garcia and I. Widjaja, Communication Networks, McGraw Hill
- Peterson, Davie, "Computer Networks", Elsevier 3rd Edition

Reference Books-

- W. Tomasi: Introduction to Data Communications and Networking, Pearson Education.
- S. Tanenbaum: Computer Networks, Pearson Education.
- W. Stalling: Data and Computer Communication, Pearson Education.
- P. C. Gupta: Data Communications and Computer Networks, PHI.
- Elahi and M. Elahi: Data Network and Internet-Communications Technology, Cengage Learning.
- Duck: Data Communication and Networking, Pearson Education.
- The TCP/IP Guide, by Charles M. Kozierok, Free online Resource, http://www.tcpipguide.com/free/index.htm

Modes of Evaluation and Rubric	
Final Exam, Mid Sem Exam, Quiz, Assignments, Practical, External/Internal Viva, Attendance	
Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Abhishek Jain

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VIth Semester

Subject Category: **DE**	Subject Code: **EC-603**	Subject Name: **Elective-II (A) Optical Communication**

Maximum Marks Allotted								Contact Hours			**Total Credits**
Theory				Practical			**Total Marks**				
ES	MS	Assign.	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	-	2	4

Prerequisites:

Introduction to communication system, Electromagnetic Theory

Course Objective:

The objective of course is to familiarize students with various optical fiber modes, configurations and various signal losses occur in optical fiber and to study about various optical sources and optical receivers and their use in the optical communication system.

Course Outcomes:

CO1: Develop basic understanding of concepts of optical communication, understand and measure signal degradation.: Apply the knowledge for measuring and comparing the performance of different optical systems. (BL1, BL2, BL3)
CO2: Analyse different optical signals, optical communication systems and networks.(BL3, BL4)
CO3: Design optical systems like sources, couplers, various types of receivers and splices based on required specifications of application.(BL3, BL5)

UNITs	Descriptions	Hrs.	CO's
I	Overview of optical fiber communication - Historical development, The general system, advantages of optical fiber communications. Element of an Optical Fiber Transmission link, Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays. Cylindrical fibers- Modes, Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index. Fibre materials. Multi Mode Fibers, Linearly Polarized Modes , V-number, Mode coupling, Step Index fibers, Graded Index fibers.	11	CO1,CO2
II	Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling -RI profile and cut-off wavelength.	8	CO1,CO2
III	lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies -Laser Diodes, Temperature effect, Laser operation – Semi conductor laser diode – Spatial Emission pattern of Laser – operation – Semi conductor laser diode – Spatial Emission pattern of Laser, Power Launching and coupling.	8	CO2,CO3
IV	Optical fiber Connectors- Connector types, Single mode fiber connectors, Connector return loss. Fibre -to- Fibre joints, Fibre splicing. Fiber Splicing- Splicing techniques, Splicing single mode fibers. Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints, Optical amplifiers, EDFA.	10	CO2,CO3
V	Point-to-Point links System considerations -Link Power budget -Rise - time budget - Noise Effects on System Performance	3	CO2,CO3
Guest Lectures (if any)			
Total Hours		40	

Suggestive list of experiments:

1. Optical Power Measurements.-CO2
2. The HeNe Laser Intensity Profile: Experimental Verification-CO2
3. Light Polarization and Focal Length measurement of of Thin Lenses.-CO2
4. Determination of the Acceptance Angle and Numerical Aperture of Optical Fibers-C02
5. Light Coupling to Multimode Graded Index Fiberr.-CO2
6. Fiber Misalignment Loss Measurement.-CO2
7. OTDR Measurement of Fiber Length, Attenuation and Splice Loss..-CO2
8. Setting up fiber optic analog and digital link.-CO3
9. Intensity modulation system using analog and digital input signal.-CO2
10. Frequency modulation and pulse modulation system.-CO2

Note: Some experiments can be performed through simulation using a Virtual Lab.

Text Book-

- J. Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994.
- Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, Singapore, 3rd ed., 2000
- Text Book on Optical Fibre Communication and its Applications – S. C. Gupta, PHI, 2005.

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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Program: Electronics and Communication Engineering
Department : Electronics Engineering

Subject Catagory	DE-II VIth/IIIrd	Subject Code	EC-603(B)	Subject Name	Information Theory and Coding

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	-	2	4

Prerequisites:

- Boolean Algebra
- Digital Communication

Course Objective:

The objective of this course is to make student aware of concepts of Information Theory and Coding.

Course Outcomes:

On successful completion of this course student should be able to

CO1: Acquire knowledge, understand and able to demonstrate the basic concepts of information theory, coding, compression and cryptography. (BL1, BL2)

CO2: Analyse different error correction and detection codes, compression techniques, encryption and decryption techniques. (BL3, BL4)

CO3: Develop new algorithms and codes for error correction and detection, compression, encryption and decryption. (BL3, BL6)

UNITs	Descriptions	Hrs	CO's
I	Definitions, scope and history; limitation of classical and relative-frequency based definitions. Sets, fields, sample space and events; axiomatic definition of probability. Combinatorics: Probability on finite sample spaces. Joint and conditional probabilities, independence, total probability; Bayes' rule and applications. Definition of random variables, continuous and discrete random variables, cumulative distribution function (cdf) for discrete and continuous random variables; probability mass function (pmf); probability density functions (pdf) and properties.	8	1, 2
II	Uncertainty, Information and Entropy Information Measures, Characteristics on information Measure, Shannon's concept of information, Shannon's measure of information, Model for source coding theorem, Communication system, Source coding and line/channel coding, channel mutual information capacity (Bandwidth).	8	1, 2, 3
III	Channel coding, Theorem for discrete memory less channel, Information capacity theorem, Error detecting and error correcting codes, Types of codes, Block codes, Tree codes, Hamming Codes, Description of linear block codes by matrices, Description of linear tree code by matrices, Parity check codes, Parity check polynomials.	12	1, 2, 3
IV	Compression: Lossless and lossy, Huffman codes, Binary Image compression schemes, Run – length Encoding, CCITT group-3 1D compression, CCITT group-3 2D compression, CCITT group-4 2D compression.	6	1, 2, 3
V	Cryptography: Encryption, Decryption, Cryptogram (cipher text), Concept of cipher, Cryptanalysis, Keys: Single key (Secret key), Cryptography, two-key (Public key) Cryptograph, Single key cryptography, Ciphers, Block Cipher code, Stream ciphers, Requirements for secrecy, fata Encryption Standard, Public Key Cryptography, Diffie-Hellmann public key distribution, The Rivest- Shamin Adelman(R-S-A) system for public key Cryptography, Digital Signature.	6	1, 2, 3
Guest Lectures (if any)			
Total Hours		40	

Text Book-

- Digital Communication by Das, Mullick& Chatterjee, New Age Pub.
- Local Area Network by G. Keiser, TMH (for Unit – V)

Reference Books-

- Digital Communication by Proakis, TMH
- Digital Image Processing by Gonzales & Woods, Pearson (for Unit – III & IV)

Modes of Evaluation and Rubric

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal
Programme: B.Tech. Electronics and Communication Engineering, VIth Semester

Subject Category :**DE**	Subject Code: **EC 603**	Subject Name: **Elective-II (C) Bio Signal Processing**

Maximum Marks Allotted								Contact Hours			**Total Credits**
Theory				Practical			**Total Marks**				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	30	10	10	100	3	-	2	4

Prerequisites:

- Matlab Programming
- Signals and Systems
- Digital Signal Processing

Course Objective:

The objective of this course is to provide biomedical signal processing background, signal conditioning, time domain and frequency domain analysis of biosignals, feature extraction, classification and application in detail.

Course Outcomes:

On successful completion of this course, student will be able to:
CO1: Gain the knowledge about the origin of bio-potentials.
CO2: Understand the basic research challenges involve in different biomedical signals monitoring and their analysis.
CO3: Realize the different filter design concepts required for biomedical data.
CO4: Study the applications of different signal processing methods on biomedical field.

UNITs	Descriptions	Hrs.	CO's
I	Review of DSP basics, sampling, Z-transform, DFT, convolution, correlation, difference equations IIR and FIR filters. Biomedical Signal Origin and dynamics of ECG, EEG, EMG, PCG, VMG, VAG, etc., Challenges in Physiological signals monitoring and analysis.	8	CO1
II	Time domain filters, Frequency domain Filters, Principles of adaptive filters, Wiener Filtering- Steepest Descent algorithms, Least mean square adaptive algorithms, Adaptive noise canceller - Interference cancellation in Electrocardiography - noise cancellation in electro surgery.	9	CO2
III	ECG parameters and their estimation; Use of multi-scale analysis for parameters estimation of ECG waveforms, Event Detection. Correlation and coherence analysis of EEG channels, Detection of EEG spike and wave complexes.	8	CO3
IV	Morphological analysis of ECG waves. HRV and Arrhythmia analysis, Pattern detection and classification. Time domain and spectral domain parameters of short term recording.	7	CO3
V	Neurological Signal Processing: Brain and its potentials, Electrophysiology origin of brain waves, EEG Signal and its characteristics, EEG analysis, Linear prediction theory, The autoregressive (AR) method, Transient detection and elimination-the case of epileptic patients	8	CO4
Guest Lectures (if any)			
Total Hours		40	

List of Experiments:

1. Design Henning moving average filter. Plot the magnitude and phase response of this filter also filters the ECG signals using this filter and plot the filtered and raw ECG.
2. Design 8-point moving average filter. Plot the magnitude and phase response of this filter also filters the ECG signals using this filter and plot the filtered and raw ECG.
3. The ECG signal has a wondering base line drift. Filter the signal with the first-order difference operator (derivative) and plot the magnitude response of filter. Also plot filtered and raw ECG signal.
4. The ECG signal has a wondering base line. Filter the signal with the point central difference operator and plot the magnitude response of filter, filtered and raw ECG.
5. An ECG signal sampled at 200 Hz, with a significant amount of 50 Hz power line artifact. Design a Notch filter to remove the artifact and implement it, plot the frequency response of the filter. Also plot the filtered raw ECG.
6. Filter the noisy ECG signal using Butterworth Low Pass Filter realized through MATLAB with the following characteristics: order 2, cut off frequency10Hz plot the magnitude response of the filter, filtered ECG and raw ECG.

7. Filter the noisy ECG signal using Butterworth Low Pass Filter realized through MATLAB with the following characteristics: order 8, cut off frequency 20Hz plot the magnitude response of the filter, filtered ECG and raw ECG. Filter the noisy ECG signal using Butterworth low pass filter realized through MATLAB with the following characteristics: order 8, cut off frequency 40Hz plot the magnitude response of the filter, filtered ECG and raw ECG. 8. Filter the noisy ECG signal using Butterworth high pass filter realized through MATLAB with the following characteristics: order 8, cut off frequency 1Hz plot the magnitude response of the filter, filtered ECG and raw ECG. 9. Filter the noisy ECG signal using Butterworth high pass filter realized through MATLAB with the following characteristics: order 8, cut off frequency 2Hz plot the magnitude response of the filter, filtered ECG and raw ECG. 10 To determine the various time intervals and amplitude of a given ECG signal.
Text Book- 1. Reddy D C. "Modern Biomedical Signal Processing – Principles and Techniques", TMH, New Delhi, 2005 2. Tompkins W J "Biomedical Signal Processing", PHI 3. Rangaraj M. Rangayyan, "Biomedical Signal Analysis: A case study Approach", Wiley 4. Akay M. "Biomedical Signal Processing", Academic press 5. Bronzino J D "The Biomedical Engineering handbook", CRC and Free press, Florida, 1995. 6. Arnon Cohen "Biomedical Signal Processing" CRC Press.
Reference Books- 1. Rangaraj M. Rangayyan, "Biomedical Signal Analysis: A case study Approach", Wiley
Modes of Evaluation and Rubric
Final Exam, Practical's, Mid Sem Exam, Quiz, Assignments, Attendance

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Dr. D. K. Shakya

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VIth Semester

Subject Category: **DE**	Subject Code: **EC-604**	Sub .Name: **Elective- III (A) Cellular and Mobile Communication**

Maximum Marks Allotted								Contact Hours			**Total Credits**
Theory				Practical			**Total Marks**				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	--	--	--	100	3	1	0	4

Prerequisites:(Only for open electives)

- Analog & Digital Communication

Course Objective:

The course Objectives are

- To provide the students with an understanding of the cellular concept frequency reuse.
- To enable the students to analyze and understand wireless and mobile cellular communication systems over stochastic fading channels.
- To provide the students with an understanding of Co-channel and Non-Co channel Interference.
- To give students an understanding of cell coverage for signal and traffic diversity techniques and mobile antennas.
- To give the students an understanding of frequency management channel assignment and types of handoff.

Course Outcomes:

On successful completion of this course student should be able to:
CO1: The student will be able to understand all generations of cellular system, concept of spectrum efficiency techniques.
CO2: The student will be able to understand the co-channel and non-cochannel reductance techniques. CO3: The student will be able to understand the different cell coverage models.
CO4: The student will be able to understand the frequency management, channel assignment and mobile antennas.
CO5: The student will be able to understand the types of handoffs, GSM architecture and some case studies.

Contents :

UNITs	Descriptions	Hrs.	COs
I	**Basic cellular systems**: first, second, third, fourth, fifth and sixth generation cellular wireless systems, Operation of Cellular System, performance criteria, Uniqueness of mobile radio environment: fading, coherence bandwidth, Doppler spread. **Fundamentals of cellular Radio System Design**: Concept of frequency reuse channels, Co channel interference reduction factor, desired C/I from a normal case in a Omni directional Antenna system, Cell splitting, Trunking and grade of service	8	1, 2
II	**Co-Channel & Non Co-Channel Interference:** Co-channel Interference, Design of antenna system - Omni directional and directional, lowering the antenna height, Reduction of co-channel interference, Umbrella-Pattern effect. Diversity techniques: Space diversity, Polarization diversity, frequency diversity and time diversity. **Non-co channel interference**-Types of Non co-channel interference- adjacent channel Interference, Near-End-Far-End interference, Effects on coverage and interference by power decrease, antenna height decrease, Beam Tilting. Interference between systems.	10	3
III	**Cell Coverage for Signal and Traffic:** Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile radio propagation, propagation over water and flat open area, Foliage loss, near and long distance propagation.	8	4
IV	**Frequency Management and Channel Assignment:** Frequency management, access channels, paging channels, channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment. **Cell Site And Mobile Antennas:** Space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, Mobile Antennas.	8	4,5

V	**Handoffs:** Hand off mechanisms, Types of handoff, Initiation of handoff, Delaying a handoff, Forced handoff, Queuing of handoff, Power-difference handoff, Mobile assisted handoff and soft handoff, cell-site handoff and Intersystem handoff. **Case study of Digital Cellular System:** GSM Architecture, Layer Modeling, Transmission, GSM channels and Channel Modes. Architectures of GPRS, EDGE, UMTS, IMT 2000.	8	5
Guest Lectures (if any)			
Total Hours		42	

Text Books-

- Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2rd Edn., 2006.

Wireless Communications - Theodore. S. Rapport, Pearson education, 2nd Edn., 2002.

Reference Books-

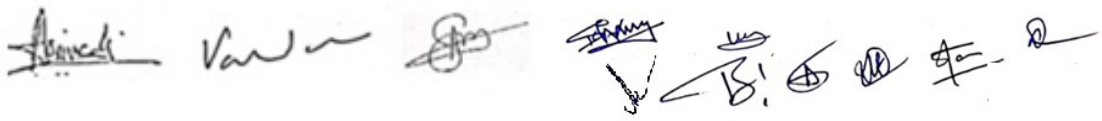
- Principles of Mobile Communications – Gordon L. Stuber, Springer International 2nd Edition, 2001.
- Modern Wireless Communication –Simon Haykin Michael Moher, Persons Eduction, 2005.

Wireless Communication theory and Techniques, Asrar U.H .Sheikh, Springer, 2004.

Modes of Evaluation and Rubric:

There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. Out of 40 sessional marks, 20 shall be awarded for Mid semester test, 20 marks to be awarded for day-to-day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by Board of studies on	Date:
Approval by Academic council on	Date:
Compiled and designed by	Name 1. Munna Lal Jatav



SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
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Programme: B.Tech. Electronics and Communication Engineering, VIth Semester

Subject Category: **DE**	Subject Code: **EC-604**	Subject Name: **Elective-III** (B) **Nano Electronics & MEMS**

Maximum Marks Allotted								Contact Hours			**Total Credits**
Theory				Practical			**Total Marks**				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	-	4

Prerequisites:

- *Electronics Devices*

Course Objective:

The objective of this course is to familiarize the student with the advancement in the field of Nano Technology.

Course Outcomes:

On successful completion of this course, student will be able to:

CO1: Understand the fundamentals of material science and potential of Nano Technology infuture.
CO2: Analyse the Nano level circuits and physics behind quantum wells, its structure and working.
CO3: Explain Microelectromechanical systems (MEMS), Present, Future and Challenges and various applications of MEMS.

UNITs	Descriptions	Hrs.	CO's
I	**Introduction Nano scale technology:** Consequences of the nano scale for technology and society. Molecular building blocks for nanostructure systems, Nano-scale 1D to 3D structures, Band structure and density of states at low dimensional structure. Size dependent properties (Electrical, mechanical, optical, thermal etc.). Top down and bottom-up technique, lithographic, nanolithography and non-lithographic techniques: pulsed laser deposition, plasma arc discharge, e-beam sputtering, ball milling, sol-gel, electro deposition, chemical vapor deposition.	8	1,2
II	**Characterization technique Scanning probe microscopy:** (Principle, construction and working) Scanning tunnelling microscope, atomic force microscope, scanning electron microscope, Transmission electron microscope, Carbon materials: Allotropes of carbon, Structure of Carbon Nano tubes, types of CNTs-, Electronic properties of CNTs, Band structure of Graphene, Band structure of SWNT from graphene, electron transport properties of SWNTs,	9	1, 2
III	**Fundamental of Nano electronics:** Tunnel junction and applications of tunnelling, Tunnelling Through a Potential Barrier, Metal—Insulator, Metal-Semiconductor, and Metal-Insulator-Metal Junctions, Coulomb Blockade, Tunnel Junctions, Tunnel Junction Excited by a Current Source. Field Emission, Gate—Oxide Tunnelling and Hot Electron Effects in Nano MOSFETs, Theory of Scanning Tunnelling Microscope, Double Barrier Tunnelling and the Resonant Tunnelling Diode.	9	1,2
IV	**The Single-Electron Transistor :** Single- Electron Transistor Single-Electron Transistor Logic, Other SET and FET Structures, Carbon Nanotube Transistors (FETs and SETs), Semiconductor Nanowire FETs and SETs, Coulomb Blockade in a Nano-capacitor, Molecular SETs and Molecular Electronics.	6	1,3
V	**MEMS and NEMS:** Introduction to MEMS and NEMS, working principles, as micro sensors (acoustic wave sensor, biomedical and biosensor, chemical sensor, optical sensor, capacitive sensor, pressure sensor and thermal sensor), micro actuation (thermal actuation, piezoelectric actuation and electrostatic actuation–micro gripers, motors, valves, pumps, accelerometers, fluidics and capillary electrophoresis, active and passive micro fluidic devices, Piezo-resistivity, Piezo-electricity and thermoelectricity, MEMS/NEMS design, processing, Oxidation, Sputter deposition, Evaporation, Chemical vapor deposition etc.	8	1,2,3
Guest Lectures (if any)			
Total Hours		40	

Text Book-

1. G. W. Hanson: Fundamentals of Nano electronics, Pearson Education.
2. K. K. Chattopadhyay and A. N. Banerjee: Introduction to Nanoscience and Nanotechnology,PHI Learning.
3. John H. Davis: Physics of low dimension semiconductor, Cambridge Press.
4. Julian W. Gardnes, Vijay K. Varda, Micro sensors MEMS & Smart Devices, 2001.
5. Z Cui, "Mico-Nanofabrication", Higher Education press, Springer, 2005.

Reference Books- 2. KTu, JW Mayer, LC Feldman, "Electronic Thin Film Science", Macmillan, New York, 1992. 3. T. Fukada&W.Mens, Micro Mechanical system Principle & Technology, Elsevier, 1998. 4. CaoGuozhong, "Nanostructures and Nanomaterials - Synthesis, Properties and Applications", Imperial College Press, 2004.	
Modes of Evaluation and Rubric	
Final Exam, Mid Sem Exam, Quiz, Assignments, Attendance	
Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Dr. D. K. Shakya

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VIth Semester

Subject Category: **DE**	Subject Code: **EC-604**	Subject Name: **Elective-III (C) Adaptive Signal Processing**

Maximum Marks Allotted								Contact Hours			**Total Credits**
Theory				Practical			**Total Marks**				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	1	-	4

Prerequisites:

- Engineering Mathematics
- Signals & Systems
- Digital Signal Processing

Course Objective:

The objective of this course is to enable to understand the concepts of Adaptive signal processing and then Design and Develop Adaptive Filtering Systems

Course Outcomes:

On successful completion of this course student should be able to:

CO1: understand, analyse and compare adaptive systems in terms of different performance parameters and their characteristic equations

CO2: implement the concepts and types of LMS algorithm, and other methods

CO3: design and develop their own adaptive algorithms and improve the performance of existing systems

UNITs	Descriptions	Hrs.	CO's
I	Discrete Time Stochastic Process: Probability and Random Variable, Discrete Time Random Process, Power Spectral Density, autocorrelation and covariance structures of Discrete time random Process, Eigen analysis of autocorrelation matrices	8	1
II	Adaptive Systems: Definitions and Characteristics, Adaptive Linear Combiner, input signal and weight vector, performance function gradient, and minimum mean square error. Introduction to filtering: smoothing and prediction, linear optimum filtering orthogonality, Wiener-Hopf equation, performance surface.	10	1,2
III	Searching performance surface, stability and rate of convergence, learning curve, gradient search, Newton's Method, method of steepest descent, comparison, gradient estimation, performance penalty, variance, excess MSE and time constants, mis-adjustments.	10	1
IV	LMS Algorithm: convergence of weight vector, LMS/Newton Algorithm, The sign LMS and normalized LMS algorithm, Block LMS, Review of circular convolution, overlap and save method, circular correlation, Frequency Transform based implementations of Block LMS.	10	2
V	Applications: Adaptive modeling and system identification, adaptive modeling for multi path communication channel, adaptive equalization of telephone channels, active noise control, echo cancellation, and beam forming.	7	2,3
Guest Lectures (if any)			
Total Hours		45	

Text Book-

- "Adaptive Filter Theory", S. Haykin, Pearson Education 2003.
- "Adaptive Signal Processing" B. Widrow, and S. D. Sterns, Pearson Education 2005.
- "Statistical and Adaptive Signal Processing" Manolakis, Ingle, and Kogon, McGraw Hill International Edition.

Modes of Evaluation and Rubric

Final Exam, Mid Sem Exam, Quiz, Assignments, Attendance

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Aman Sharma

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VIth Semester

Subject Category: **OE**	Subject Code: **OE 605**	Subject Name: **Open Elective-II (A) Medical Imaging System**

Maximum Marks Allotted								Contact Hours			**Total Credits**
Theory				Practical			**Total Marks**				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	--	--		100	3	-	-	3

Prerequisites:

Applied Physics, Basic Electronics, Fundamentals of Instrumentation, Medical Instrumentation.

Course Objective:

The medical imaging system has emerged as a recent expansion in biomedical engineering. The Medical imaging modalities utilizes various sources like electromagnetic radiation, Sound, magnetic field, thermal signatures and nuclear radiations etc. to map images of internal organs, structures and their association with surrounding tissues and structure.
The core objective of this one-semester open course is to enable the students to learn about the principle and functioning of various medical imaging modalities. Moreover, the course will offer to learn about the relative merit-based performance of imaging systems for different tissues, the hazards involved and their safety aspect. The course further will help the candidate to learn various aspects about medical imaging like sources, sensors, image capturing, image reconstruction and image storage and use of computer in the field of medical imaging. The course will include simplified approach for any necessary mathematics and data transforms.
The course will be better suited for students with Electrical/ Electronics, computers or allied engineering stream background, and will help to grow their career in healthcare industry.

Course Outcomes:

The completion of this course will enable the students to:

CO1: Engross basic concepts, working principles for various medical imaging modalities and their relative merits.

CO2: Understand the concept of using radiations for medical imaging, associated hazards and safety measures.

CO3: establish the use of acoustic pressure waves in soft tissue imaging and possible scanning modes.

CO4: learn about the application of magnetic fields for imaging of soft tissues and fluids.

CO5: Imbibe the knowledge about the application of thermal radiations in capturing internal organ details and functioning.

UNITs	Descriptions	Hrs.	CO's
I	**X- ray Machine and Digital Radiography:** Basics of Radiation physics, Diagnostic Radiology, Nature of X- ray, Production of X-rays, X-ray Machine, visualization of X-rays, Dental X-ray Machines, Portable and mobile X-ray units, Physical Parameters for X-ray Detectors, Digital Radiography (DR). **X-ray Computed Tomography (CT) imaging:** Computed Tomography (CT) imaging, CT scan generations, CT System Components, detectors, Gantry Geometry, image reconstruction techniques, Patient Dose in CT Scanner, Dental X-ray and Mammography. Medical Fluoroscopy, C-Arm systems. X-ray hazards and safety measures.	10	CO1, CO2
II	**Magnetic Resonance Imaging (MRI) System:** Principle of NMR Imaging System, Basic MRI system, Image generation and Reconstruction Techniques, Functional MRI (f-MRI) Components, Biological effects of NMR Imaging, Advantages of NMR Imaging System.	9	CO1, CO4
III	**Ultrasonic Imaging System:** Diagnostic Ultrasound, Physics of ultrasonic waves, medical ultra sound, Basic pulse – echo apparatus, A- scan, Echocardiograph, B-scanner, M-mode scan, real time ultrasonic Imaging System, Multi- element linear array scanners, Digital Scan converter, Biological Effects of ultrasound.	7	CO1, CO3
IV	**Thermal Imaging System.** Medical Thermography, Physics of thermography, Infrared Detectors, Thermo-graphics Equipment, Quantitative medical thermography, pyroelectric vidicon Camera, Thermal Camera based on IR Sensor with digital focal plane array.	6	CO1 CO5
V	**Nuclear Medical Imaging System:** Radio Isotopes in medical diagnosis, Physics of radioactivity, radiation detectors, pulse height analyzer, uptake monitoring equipment, radio isotopes rectilinear scanner, the gamma Camera, Multi Crystal Gamma Camera Emission Computed Tomography (ECT),	8	CO1, CO2

	Single Photon emission Computed Tomography (SPECT), Positron Emission Tomography (PET Scanner).		
Guest Lectures (if any): The Guest lectures from experienced Radiologists, Radiotherapists, and medical physicists, can be arranged.			
Total Hours		40	

Suggestive list of experiments:

isits to Medical colleges, Hospitals and Medical Imaging centers, Imaging System manufacturing industries, research centers and labs to see various modalities of medical imaging.

Text Book-

- Introduction to Biomedical Imaging, Andrew G. Webb, Wiley 2017.
- Handbook of Biomedical Instrumentation, R.S. Khandpur, McGraw Hill Education, 2014
- Introduction to Medical Imaging: Physics, Engineering and Clinical Applications by N.B. Smith, A. Webb, Cambridge University Press, 2010.
- Fundamentals of Medical Imaging, Paul Suetens, Cambridge University Press, 2009.

Reference Books-

- Handbook of Biomedical Imaging: Methodologies and Clinical Research: 779 (Lecture Notes in Computer Science), by Editors - N. Paragios, J. Duncan, and Ayache. Spinger, 2015.
- Biomedical Imaging: Principles of Radiography, Tomography and Medical Physics, S. Aeffner, T. Salditt, and T. Aspelmeier. De Gruyter, 2015.
- Medical Imaging: Technology and Applications: 18 (Devices, Circuits, and Systems), T. Farncombe, K. Iniewski, CRC Press, 2013.

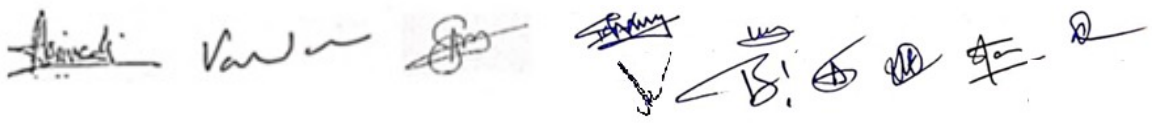
Modes of Evaluation and Rubric

- Mid semester tests
- Quiz
- Assignments
- End Semester Exam

List/Links of e-learning resource

- NPTEL Course - Introduction to Biomedical Imaging Systems, IIT Madras, Prof. Arun K. Thittai, https://nptel.ac.in/courses/102105090
- https://www.udemy.com/course/intro-to-medical-imaging/
- https://www.udemy.com/course/master-magnetic-resonance-the-essentials-part-1/

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	
Subject handled by department	Dr. Ashutosh Datar, Professor (Electronics Engg.)



SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VIth Semester

Subject Category: **OE**	Subject Code: **OE 605**	Subject Name: **Open Elective-II (B) Embedded System Design**

Maximum Marks Allotted								Contact Hours			**Total Credits**
Theory				Practical			**Total Marks**				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	-	-	3

Prerequisites:

- Digital Electronics.
- Microprocessors & Microcontroller

Course Objective:

Upon completion of this course, the student will be able to:

1. Learn different Embedded systems Architecture and Embedded software development methods, particularly Top-Down design
2. Develop Real-world embedded solutions.
3. Learn the Trade-off between hardware and software design and different communication Protocols.

Course Outcomes:

On successful completion of this course student should be able to:
CO 1: Understand what is about the concepts of embedded system and microcontroller architecture
CO 2: Consolidate concepts communication protocols for real life engineering and industrial Applications.
CO 3: Learn, practice and implement ARM program for problem solving and peripherals interfacing
CO 4: Learn about the Real Time operating Systems (RTOS) features, and deployment strategies for optimal Performance.

UNITs	Descriptions	Hrs.	CO's
I	Define System &Embedded System, Embedded Systems Vs General Computing Systems, Architecture of Embedded Systems: Hardware & software, Design and Development Process, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.	08	1,2
II	Advanced Processor Architecture: Introduction to Advance Architecture-ARM Processor, ARM design philosophy, ARM Processor fundamental, ARM Instruction set, Thumb instruction set, elementary Programming, AMBA, exception and Interrupt handling, watchdog timer, etc. General structural units in processors**.**	08	1,2,3
III	Device and Communication Buses for devices network: I/O Types and Examples, Serial, Parallel and wireless communication devices, Timer and Counter devices. Serial bus communication Protocols, Parallel bus communication Protocols, Wireless and mobile System Protocols and Network Protocols.	08	2,3
IV	Embedded Software development process and tools: Development process and Hardware-software, Requirement engineering, Design: design trade-off, hardware-software co-design, hardware/software design, implementation, integration & testing, packaging. Assembler, cross compiler, simulators, emulator, debugger, Integrated Development Environment. GNU development tools, tools for device driver development, and Embedded systems Programming using high-level language.	08	2,3,4
V	RTOS: RTOS Based Embedded System Design Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling approaches. Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, RTOS selection criteria and features, Introduction to FPGA , Advantages FPGA over RTOS, FPGAs for High speed data acquisition and control.	08	4
Guest Lectures (if any)			
Total Hours		45	

Suggestive list of experiments:

Text Book-

- Embedded Systems-Architecture, Programming and Design by Rajkamal, 2007, TMH.
- ARM Systems Developer's Guides-Designing &Optimizing System Software–Andrew N.Sloss, Dominic Symes, Chris Wright, 2008, Elsevier

Reference Books- • Introductionto Embedded Systems-Shibu K.V, McGraw Hill. • Embedded System Design-FrankVahid,Tony Givargis, John Wiley. • Embedded Systems–Lyla, Pearson, 2013 • Embedded/ Real time systems: concepts, design & Programming-K.V.K.K. Prasad, Dream tech press	
List of Experiments- Elementary programming and interfacing using AVR, PIC and ARM Processor with real world interfacing. (LED, Switch, Motor, Key pads, ADC, DAC, etc) . This may also include case study of RTOS application.	
Modes of Evaluation and Rubric	
Final Exam, Mid Sem Exam, Quiz, Assignments, Practical, External/Internal Viva, Attendance	
Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Bharti Mehra

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (Engineering College), VIDISHA M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Programme: B.Tech. Electronics and Communication Engineering, VIth Semester

Subject Category: **OE**	Subject Code: **OE 605**	Subject Name: **Open Elective-II (c) Control System**

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
ES	MS	Assignment	Quiz	ES	LW	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	-	-	3

Prerequisites:

- Signal & System
- Basic Mathematics

Course Objective:

1. To make the students capable understanding the fundamental concept of control system and mathematical modelling of the system
2. To make the students capable analyzing the time response, frequency response and stability of system.

Course Outcomes:

After completion of the course, students would be able to -

CO 1: Acquire knowledge and understanding of different type of system and their representation stability time domain and frequency behaviour controller and compensators to obtain mathematics. (BL1,BL2)

CO 2: Apply knowledge to obtain mathematical modelling of different systems, find out transfer function and obtain knowledge about the signal flow graph. (BL2,BL3)

CO 3: Analyze the time domain and frequency domain behavior of different types of signal and system stability (BL3,BL4)

CO4: Design feedback controller and compensation circuits. (BL3,BL5)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	2	2	-	-	-	-	-	-	-
CO3	3	3	3	2	2	-	-	-	-	-	-	-
CO4	3	2	3	2	2	2	-	-	-	-	-	-

Contents:

UNITs	Descriptions	Hrs.	CO's
I	**Introduction:** Control system, Mathematical modeling of physical system, Differential equation representation of physical system, Transfer function concepts, Block diagram representation, Signal flow graph.	08	1, 2, 3, 4
II	**Feedback characteristics of control system:** Introduction Reduction of parameter variation by use of feedback, control system dynamics by use of feedback, control of effects of disturbance signals by use of feedback, Regenerative feedback, Illustrative examples.	08	1, 2, 3, 4
III	**Time Response Analysis:** Introduction, standard test signal, performance indicator, Time response of first order system, Time response of second order system, Design specification of second order system, compensation scheme, design specification of higher order system.	07	1, 2, 3, 4
IV	**Stability Analysis in Time domain:** The concept of stability from pole position, Necessary condition for stability, Routh Stability Criteria, Relative stability analysis, Root locus technique: Introduction, root locus concept, root locus construction rules, Root contours.	07	1, 2, 3, 4
V	**Frequency Response Analysis:** Introduction, performance indices Frequency response of second order system, Polar plot, Nyquist plot, Bode plot, All pass system, minimum phase and non minimum phase system, Design problem, Concept of cascade and feedback compensation, Realisation of basic compensators, case study. Concept of state, state variable and state model, State model of linear continuous time system, Concept of controllability and Observability Illustrative examples.	10	1, 2, 3, 4

Guest Lectures (if any)	Nil	
Total Hours	40	

Suggestive list of experiments:

Text Books-

1. B.C. Kuo and F. Golnaraghi, Automatic control System.
2. J. NagrathMadan Gopal, Control system Engineering, New Age International Publishers Ltd-New Delhi.
3. B.S. Manke, Linear Control System.

Reference Books-

1. S. Hasan Saced, Control System 7th Edition, S K Kataria & Sons.
2. Narasimham R. L., Analysis of Linear Control System.
3. Padmanabhank, Control System.
4. Bhattacharya, Control System Engineering.

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by Board of studies on	Date:
Approval by Academic council on	Date:
Compiled and designed by	Prof. Niraj Kumar
Checked and approved by