NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

SEMESTER: V

S. No.	BoS	Sub Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/2
				L	T	P	TA	FE	SE	T.C.A.	ESE		
1	ETC	ET2053X	Elective-1	3	1	-	20	15	15	50	70	120	4
2	ETC	ET20511	Analog integrated circuits and applications	3	1	-	20	15	15	50	70	120	4
3	ETC	ET20512	Automatic control systems	3	1	-	20	15	15	50	70	120	4
4	ETC	ET20513	Digital signal processing	3	1	-	20	15	15	50	70	120	4
5	ETC	ET20514	Microcontroller and embedded systems	3	1	-	20	15	15	50	70	120	4
6	ETC	ET20515	Digital communication	4	1	-	20	15	15	50	70	120	5
7	ETC	ET20521	Digital communication lab	-	-	3	30	-	-	30	20	50	2
8	ETC	ET20522	Analog integrated circuits lab	-	-	3	30	-	-	30	20	50	2
9	ETC	ET20523	Digital signal processing lab	-	-	3	30	-	-	30	20	50	2
10	EN		Managerial Skill	-	-	2	25	-	-	25	0	25	1
11			Technical Visit/ Practical Training	-	-	-	25	-	-	25	0	25	1
			Total	19	6	11	260	90	90	440	480	920	33

ELECTIVE 1			
S. No	BoS	Sub Code	Subject Name
1	ETC	ET20531	Internet and web technology.
2	ETC	ET20532	Electronic system design.
3	ETC	ET20533	Power electronics.
4	ETC	ET20534	Fundamentals of operating systems
5	ETC	ET20535	Audio system engineering
6	ETC	ET20536	Introduction to Linear Dynamical Systems

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: ET20511**
Subject: Analog Integrated Circuits and Applications
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I

Operational Amplifiers: Basic operational amplifier; Block Schematic of OPAMP, Differential Amplifier: DC & AC analysis of transistorized & FET differential amplifier; Analysis of MC1435 & 741 op-amp; measurement of op-amp parameters; Open Loop & Closed Loop Configuration of OPAMP. Input & Output impedance of closed loop OPAMP; Input Offset-error compensation, Maximum Ratings. Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower, frequency response, stability, frequency compensation: Lag & Lead compensation. SPICE Simulation.

UNIT II

Applications of OPAMP: *Linear Circuits*- Summing amplifier, Difference amplifier, V to I and I to V converter, Instrumentation amplifier , Bridge amplifier, Integrator, Differentiator.

Nonlinear Circuits- Comparators, Comparator IC such as LM339, Schmitt trigger, Precision rectifiers, Peak detector, Analog switches, Sample and Hold Amplifiers, Log & Anti-log Amplifiers.

UNIT III

Active Filter Design: Transfer function, first order active filter, standard second order responses, KRC filters, Generalized impedance converters, Switched capacitor filters.

UNIT IV

Signal Generators: Square Wave Generator, Triangular Wave Generator, Sawtooth Wave generator, function generator IC8038. *555 Timer*: Functional Diagram: Monostable and Astable operation.

D-A and A-D Converters : D/A Converter using Binary Weighted Resistor Network and R-2R Ladder Network ; Inverted Ladder Network, IC DAC0832,DAC7545, D/A Specification ; Analog Switches Sample & HoldCircuits ; Analog Multiplexers, Parallel Comparator type A/D Converter, Successive Approximation A/D Converter, Counting & Dual Slope A/D Converter, A/D Converter using Voltage to Frequency and Voltage to Time Conversion, Delta Modulation type A/D Converter, ADC0844, ADC12181.

UNIT V

PLL:Functional diagram and principle of operation of 565; Transfer characteristics; lock range & capture range; Applications of PLL. *Voltage Regulators:* Voltage regulator characteristics, Regulator Performance parameters, Types of Voltage regulator, Shunt & Series Regulator using OPAMP, Transistorised Series Feedback Regulator, Safe Operating Area, Protection Circuit, Short Circuit Protection, Current Limiting Circuit, Foldback Limiting, Three Terminal IC Regulator(LM 317, LM 337, 78XX, 79XX) [Description, Schematic Diagram and Pin Diagram] General Purpose IC Regulator (723): Important features and Internal Structure, SMPS.

Text Books:

1. Design with Operational Amplifiers and Analog Integrated circuits by Serrgio Franco, Tata McGRAW – Hill.
2. Integrated Electronics by Millman & Halkias, TMH Publishing Co.
3. Operational Amplifiers and Linear Integrated Circuits by Coughlin Driscoll, Pearson Education.
4. Operational Amplifiers by G.B.Clayton , International Edition.

Reference Books:

1. Linear Integrated Circuits D.Roy Choudhary, Shail Jain, New Age International.
2. OP-AMP and Integrated Circuits by Ramakant Gaikwad, Pearson Education.
3. Analog Filter Design by M.E.Van Valkenburg, PHI.
4. Design and Applications of Analog Integrated Circuits by Soclof, PHI

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: ET20512**
Subject: Automatic Control Systems
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Mathematical Model of Physical Systems: Differential Equation of Physical system. Transfer function, Block Diagram Algebra, signal flow graphs. Feedback characteristics of control systems. Feedback & Non feedback systems, reduction of parameter variation, control of system Dynamic. Control of the effect of dynamic signal by use of feedback, regeneration feedback.

UNIT-II
Time Response Analysis: Design specification and performance Indices. Standard Text signals, Time response of first and second order system, steady state error and error constants, Effect of adding a zero to a system. Design specification of second order system stability concept, Routh- Hurwitz stability criteria relation stability analysis.

UNIT-III
Root Loci's Technique: Root loci's concept construction for Root loci, Root contours, system with transportation by Polar Plots, Bode Plots. All pass and minimum phase system.

UNIT-IV
Stability in Frequency Domain: Nyquist stability criteria, Assessment of relation stability. Realization of basic compensators, Cascade compensation in time and frequency Domain. Feedback compensation.

UNIT-V
Sate Variable Analysis and Design: Concept of stab, state variables and state model. State model for linear continuous time systems, Diaganalization, solution of state equation, concept of controllability and observability. Pole placement by state feedback.

Text Books:
1. Control System Engineering, L. Nagrath and Gopal, New Age International Publications
2. Automatic Control System, B.C. Kuo, PHI

Reference Books:
1. Modern Control Engineering, Ogata, Pearson Education
2. Modern Control Engineering, Roychoudhury, PHI
3. Control Engineering – A Comprehensive Foundation, Ramakalyan, Vikas Publishing House Pvt. Ltd.
4. Introduction to Control Engineering, Ajit K. Mandal, New Age International Publications.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: ET20513**
Subject: Digital Signal Processing
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Need of digital signal processing, Analog IO interface for real time DSP system, Block diagram, Review of FFT algorithm, Review of Z transform, Properties of z transform, Rational z transforms, Inversion of z transform, One sided z transform, Analysis of LTI system in z domain, Stability. Correlation and convolution methods.

UNIT II
IMPLEMENTATION OF DISCRETE TIME SYSTEMS: Structures for realization of discrete time systems, Structures for FIR systems, Structures for IIR systems, State space system analysis and structures, Representation of numbers, Quantization of filter coefficients, Round off effects in digital filters, Introduction to digital signal processors, MAC unit, Circular buffer.

UNIT III
FIR FILTER DESIGN: Features of FIR filers, Linear phase response and its implications, FIR filter specifications, FIR filter design, Coefficient calculation methods, Window method, Optimal method, Frequency sampling method, Design of FIR differentiators, Design of Hilbert transformer, Comparison of various design methods. Introduction to adaptive FIR filters.

UNIT IV
IIR FILTER DESIGN: Features of IIR filters, Design stages, specifications, Pole-zero placement method, Impulse invariant method, Matched Z transform method, Bilinear Z transform method, Calculating coefficients by mapping s-plane poles and zeros, Choice of coefficient calculation methods, Finite word-length effects, Digital frequency oscillators, DTMF detection using Goertzel algorithm.

UNIT V
MULTIRATE DSP: Decimation and interpolation, Sampling rate conversion by rational factor, Implementation of sampling rate conversion, Multistage implementation of rate converters, Sampling rate conversion of bandpass signals, Conversion by arbitrary factor, Application of MDSP, Digital filter banks, Quadrature mirror filter bank.

Text books:

1. Digital signal processing, 4/e, J G Proakis, D G Manolakis, Pearson Education 2007.
2. Digital signal processing – A practical approach, 2/e, E C Ifeachor, B W Jervis, Pearson Education 2002.

Reference Books:

1. Digital signal processing – Fundamentals and applications, Li Tan, Elsevier Inc, USA 2008.
2. C algorithms for real time DSP, P M Embree, Prentice Hall Inc, USA 1995.
3. Digital signal processing laboratory, B P Kumar, CRC Press, USA 2005.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: ET20514**
Subject: Microcontroller and Embedded System
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT 1
Microcontrollers : Microprocessors and Micro-controllers, Types of Micro-controllers – Embedded; External memory, Processor Architecture – Harvard v/s Princeton; CISC v/s RISC, Micro-controller Memory types – control storage; variable area; stack; hardware register space, Micro-controller features – clocking; I/O pins, Interrupts, Timers, Peripherals.

UNIT 2
8051 Processor Architecture And Instruction Set : The CPU, Addressing modes, external addressing, Interrupt handling, Instruction execution, Instruction set – data movement; arithmetic; bit operators; branch, Software development tools like assemblers; simulators; cross-compilers, O/P file formats. Hardware Features : 8051 – Device packaging, Chip technology, Power considerations, Reset, System clock/oscillators, Parallel I/O, Timers, Interrupts, Serial I/O, Control store and External memory devices.

UNIT 3
Pic Microcontrollers and Instruction Set: PIC Micro-controllers – overview; features, PIC-18 architecture, file selection register, Memory organization, Addressing modes, Instruction set, Interrupt handling.
PIC-18 – Reset, low power operations, oscillator connections, I/O ports – serial; parallel, Timers, Interrupts, ADC.

UNIT 4
Enhanced Features: Dallas HSM & Atmel Micro-controllers – Architecture enhancements, control store and external memory, scratchpad RAM enhancements, Timers, Serial I/O, Analog I/O, Voltage comparators. PIC-18 Flash Micro-controllers – STATUS; OPTION_REG; PCON registers, Program & Data Memory, Data EEPROM & Flash Program EEPROM, Interrupts, I/O ports, Timers, Capture/Compare/PWM module, Master Synchronous Serial Port module, USART, ADC.

UNIT 5
Interfacing & Microcontroller Applications :LEDs, Push Buttons, Relays, Latch connections, Keyboard, Seven Segment and LCD displays interfacing, I2C bus operation, Serial EEPROM. Software development tools.

Text books:

1. The 8051 Microcontroller and Embedded Systems using Assembly and C, Mazidi, Mazidi & McKinlay, PHI.
2. Programming and Customizing the 8051 Micro-controller, Myke Predko, Tata McGraw-Hill edition.
3. Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC18 Microcontroller Family), R A Gaonkar, Penram Publishing India.

Reference books:

1. The 8051 Microcontroller & Embedded Systems Using Assembly and C by Kenneth J. Ayala, Dhananjay V. Gadre, Cengage Learning India Publication.
2. Embedded Systems, Shibu K, Tata McGraw Hill Publishing, New Delhi 2009.
3. Technical references on www.microchip.com

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: ET20515**
Subject: Digital Communication
Credits: 5
Total Theory Periods: 40 **Total Tutorial Periods: 10**

UNIT I
Digital transmission of analog signal, sampling theorem, quantization, companding, PAM, PWM, PPM, PCM, DPCM, delta modulation, adaptive delta modulation, delta sigma modulation, bandwidth requirements of PCM, TDM, noise in PCM, PPM, PWM, DM.

UNIT II
Signalling formats ,base band data transmission in presence of white Gaussian noise , pulse shaping , inter symbol interference , Nyquist theorem for pulse shaping ,raised cosine filters ,digital signalling through band limited channels ,synchronisation techniques .

UNIT III
Digital modulation formats ASK ,BFSK , PSK , FSK , MFSK , DPSK ,QPSK transmitters, receivers, signals spectrum, bandwidth, constellation diagrams, M-array data communication systems.

UNIT IV
Binary synchronous data transmission, matched filters, errors probability for matched filter receivers, correlated implementation for the matched filters, Coherent and non coherent detection of ASK, PSK, BPSK, FSK.

UNIT V
Optimum receivers and signal space concepts, orthonormal representation of signals, binary signal detection and hypothesis testing, probability of error calculation, ASK, PSK, FSK, BPSK, MPSK, QAM. Error correction coding.

Text Books:

1. Communication Systems, 4/e, Simon Haykin, John Wiley and Sons.
2. Communication system, A B Carlson, McGraw Hill.

Reference Books:

1. Communication systems, Ziemmer, Tarner, John Wiley and Sons.
2. Analog and digital communication systems, B P Lathi, Oxford University Press.
3. Schaum's outline in analog and digital communication, Hsu, Tata McGraw Hill.
4. Communication systems, Taub, Schilling, Tata McGraw Hill.

Semester: 5 **Code: ET20521**
Subject: Digital Communication Laboratory
Credits: 2

Lab assignments based on ET20515 Communication system II using trainer kits and LabView software and hardware.

Semester: 5 **Code: ET20522**
Subject: Analog Integrated Circuits and Applications Laboratory
Credits: 2

Lab assignments based on ET20511 Analog integrated circuits and applications using trainer kits and Multisim/Orcad.

Semester: 5 **Code: ET20523**
Subject: Digital Signal Processing Laboratory
Credits: 2

Lab assignments based on ET20513 Digital signal processing using TMS320C6713 DSK (and daughter cards) and code composer studio (or any Analog Devices processor and Visual DSP++ environment), Matlab or LabView.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: ET20531**
Subject: Internet and Web Technology
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
INTRODUCTION TO INTERNET: Introduction, Evolution of Internet, Internet Applications, Internet Protocol -TCP/IP, UDP, HTTP, Secure Http(Shttp), Internet Addressing – Addressing Scheme – Ipv4 & IPv6, Network Byte Order, Domain, Name Server and IP Addresses, Mapping. Internet Service Providers, Types Of Connectivity Such As Dial-Up Leaded Vsat Etc. Web Technologies: Three Tier Web Based Architecture; Jsp, Asp, J2ee, .Net Systems

UNIT II
HTML CSS AND SCRIPTING: HTML - Introduction, Sgml, Dtd(Document Type Definition, Basic Html Elements, Tags and usages, HTML Standards , Issues in HTML Dhtml: Introduction Cascading Style Sheets: Syntax ,Class Selector, Id Selector Dom (Document Object Model) & Dso (Data Source Object) Approaches To Dynamic Pages: Cgi, Java Applets, Plug Ins, Active X, Java Script – Java Script Object Model, Variables-Constant – Expressions, Conditions-Relational Operators- Data Types – Flow Control – Functions & Objects-events and event handlers – Data type Conversion & Equality – Accessing HTML form elements.

UNIT III
XML: What is XML – Basic Standards, Schema Standards, Linking & Presentation Standards, Standards that build on XML, Generating XML data, Writing a simple XML File, Creating a Document type definition, Documents & Data ,Defining Attributes & Entities in the DTD ,Defining Parameter Entities & conditional Sections, Resolving a naming conflict, Using Namespaces, Designing an XML data structure, Normalizing Data, Normalizing DTDS.

UNIT IV
INTERNET SECURITY & FIREWALLS: Security Threats From Mobile Codes, Types Of Viruses, Client Server Security Threats,Data & Message Security, Various electronic payment systems, Introduction to EDI, Challenges–Response System, Encrypted Documents And Emails , Firewalls: Hardened Firewall Hosts, Ip- Packet Screening, Proxy Application Gateways, Aaa (Authentication , Authorization and Accounting).

UNIT V
WEBSITE PLANNING & HOSTING: Introduction, Web Page Lay-Outing, Where To Host Site, Maintenance Of Site, Registration Of Site On Search Engines And Indexes, Introduction To File Transfer Protocol, Public Domain Software, Types Of Ftp Servers (Including Anonymous), Ftp Clients Common Command. Telnet Protocol, Server Domain, Telnet Client, Terminal Emulation. Usenet And Internet Relay Chat.

Text Books:

1. Internet & Intranet Engineering,- Daniel Minoli, TMH.
2. Alexis Leon and Mathews Leon – Internet for Every One, Tech World.

Reference Books:

1. Eric Ladd, Jim O'Donnel –"Using HTML 4, XML and JAVA"-Prentice Hall of India - 1999.
2. Beginning Java Script– Paul Wilton – SPD Publications –2001.
3. Frontiers of Electronics of Commerce, Ravi kalakota & Andrew B. Whinston, Addison Wesley.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: ET20532**
Subject: Electronic System Design
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I

Introduction to Electronic System Design, Packaging & Enclosures of Electronic System: Cooling in/of Electronic System, Electromagnetic Compatibility (EMC).

UNIT II

Cabling of Electronic Systems, Grounding of Electronic Systems, Balancing & Filtering in Electronic Systems, Shielding of Electronic Systems, Protection Against Electrostatic Discharges (ESD).

UNTI III

Analog & Mixed Signal Circuit Design Issues and Techniques: Understanding and interpreting data sheets and specifications of various passive and active components, non-ideal behavior of passive components, over voltage effects on analog integrated circuits - amplifier input stage over voltage, amplifier output voltage phase reversal, protecting integrated circuits from ESD, amplifier guard shields, amplifier decoupling. Selection of amplifiers for data converters. Properties of a high quality instrumentation amplifier. Design issues affecting dc accuracy & error budget analysis in instrumentation amplifier applications. Selection of isolation amplifiers. ADC and DAC static transfer function and DC errors, AC errors in Data converters and dynamic performance. Selecting An A/D Converter. Analog Signal handling for high speed and accuracy. Error budget considerations for an electronic system. Circuit layout and grounding in mixed signal system. Analog & Mixed Signal circuit and PCB design exercises.

UNIT IV

Logic Circuit Design Issues and Techniques: Transmission lines, reflections and termination. Digital circuit radiation. Digital circuit layout and grounding. PCB design guidelines for reduced EMI. Basic design considerations for backplanes. Digital circuit & PCB design exercises.

Text Books:

1. Electronic Instrument Design, 1st edition; by: Kim R. Fowler; Oxford University Press.
2. Noise Reduction Techniques in Electronic Systems, 2nd edition; by: Henry W.Ott;John Wiley&Sons.
3. Digital Design Principles& Practices, 3rd edition by: John F. Wakerly; Prentice Hall International, Inc.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: ET20533**
Subject: Power Electronics
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Power diodes - basic structure and V-I characteristics - various types - power transistors - BJT, MOSFET and IGBT - basic structure and V-I characteristics - thyristors - basic structure - static and dynamic characteristics - device specifications and ratings - methods of turning on - gate triggering circuit using UJT - methods of turning off - commutation circuits - TRIAC

UNIT II
Line frequency phase controlled rectifiers using SCR - single phase rectifier with R and RL loads - half controlled and fully controlled converters with continuous and constant currents - SCR inverters - circuits for single phase inverters - series, parallel and bridge inverters - pulse width modulated inverters - basic circuit operation

UNIT III
AC regulators - single phase ac regulator with R and RL loads - sequence control of ac regulators - cycloconverter - basic principle of operation - single phase to single phase cycloconverter - choppers - principle of operation - step-up and step-down choppers - speed control of DC motors and induction motors

UNIT IV
Switching regulators - buck regulators - boost regulators - buck-boost regulators - cuk regulators - switched mode power supply - principle of operation and analysis - comparison with linear power supply - uninterruptible power supply - basic circuit operation - different configurations - characteristics and applications

UNIT V
Applications of power electronics: Single-phase AC voltage controller and solid-state AC regulators, separately excited DC motor control using line commutated converters. Stepper motor control. Electronic ballast for fluorescent lighting. Active power filters.

Text Books:

1. Power Electronics, Sen P.C., Tata Mc Graw Hill,2003
2. Power Electronics, Rashid, Prentice Hall India,1993

Reference Books:

1. Power Electronics, Ned Mohan et.al, John Wiley and Sons, 1989
2. Thyristorised Power Controllers, G.K.Dubey et.al, Wiley & Sons, 2001
3. Power Semiconductor Circuits, Dewan & Straughen, Wiley & Sons, 1984
4. Power Electronics, Singh M.D, Khanchandani K.B., Tata McGraw Hill, 1998

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: ET20534**
Subject: Fundamentals of Operating Systems
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
INTRODUCTION: Operating System objective and function. The Evolution of Operating Systems, Batch, interactive, time – sharing and real time systems. Protection. Operating System Structure: System COMPONENTS, operating system service, System structure. Distributed Computing, The Key Architecture Trend: Parallel Computation, Input-Output Trends.

UNIT II
CONCURRENT PROCESSES: Process concept: - Introduction Definitions of "Process", Process States, Process State Transitions, The process Control Block, Operations on Processes, Suspend and Resume, Interrupt Processing, The Nucleus of the Operating System. Asynchronous Concurrent Process: - Introduction, Parallel Processing, A Control Structure for Indicating Parallelism, Mutual Exclusion, The Producer / consumer problem, the critical section problem, semaphores, Classical problems in concurrency, Inter process Communication, Process generation, Process Scheduling. CPU Scheduling: Scheduling concepts, Performance criteria, and scheduling algorithms. Algorithm evaluation, Multiprocessor scheduling.

UNIT III
DEAD LOCKS: System model, Deadlock characterization. Prevention, avoidance and detection, Recovery from dead lock Combined approach.

UNIT IV
MEMORY MANAGEMENT: Base machine, resident Monitor, Multiprogramming with fixed partitions. Multiprogramming with variable partitions. Multiple Base Registers. Paging, segmentation paged segmentation, Virtual Memory concept, Demand Paging, Performance, Page Replacement algorithms, Allocation of frames, Thrashing, Cache memory organization impact on performance.

UNIT V
I/O MANAGEMENT & DISK SCHEDULING: I/O Devices and the organization of the I/O function. I/O Buffering, Disk I/O, Operating System Design issues. File System: File concept- File organization and Access mechanism, File Directories, File sharing. Implementation issues. Case Studies: - Unix System, MVS, OS/2, A Virtual Machine Operating System.

Text Books:

1. Operating System Concepts, Silbersehatz A. and Peterson, J. L., Wiley.
2. An Introduction to Operating Systems, Dietel, H. N., Addison Wesley.

References Books:

1. Operating System: Concept & Design, Milenkovic M., and McGraw Hill.
2. Operating System, Stalling, William, Maxwell McMillan International Editons, 1992.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: ET20535**
Subject: Audio System Engineering
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
INTRODUCTION: Decibel, Neper in acoustics, Directivity, Phon, Harmonic distortion, Impedance and gain of electrical system, Impedance Properties of Moving Coil Loudspeakers, Handling the Acoustic Input and Output of the System, Interfacing the Electrical Output Power to the Acoustic Environment, Loudspeaker directivity and coverage.

UNIT II
ACOUSTIC ENVIRONMENT: Inverse Square Law , Atmospheric Absorption, Doppler Effect, Reflection and Refraction, Effect of a Space Heater on Flutter Echo, Absorption , Classifying Sound Fields, Acoustic Environment Indoors, Acoustics measurements, Large room acoustics, Small room acoustics.

UNIT III
DESIGN FOR ACOUSTIC ENVIRONMENT: Designing for Acoustic Gain, Maximum Physical Distance, Establishing an Acceptable Signal-to-Noise Ratio (SNR), Establishing an EAD, Needed Acoustic Gain (NAG), Number of Open Microphones, Feedback Stability Margin, Calculating Potential Acoustic Gain, Obtaining ΔDx Values, Measuring Acoustic Gain, Achieving Potential Acoustic Gain, Limiting Parameters in Sound Reinforcement System Design, Finding Required Electrical Power (REP). Designing for Speech Intelligibility, Articulation Losses of Consonants in Speech, Maxfield's Equation, Speech Power and Articulation, Speech Intelligibility Calculations, Non-Acoustic Articulation Problems, Relationship Between Qmin and D2(MAX), High Density Overhead Distribution, %ALCONS Variables.

UNIT IV
MICROPHONES AND LOUDSPEAKERS: Microphone as the System Input, Microphone Sensitivity, Thermal Noise, Microphone Selection, Nature of Response and Directional Characteristics, Boundary Microphones, Wireless Microphones, Microphone Connectors, Cables, and Phantom Power, Measurement Microphones, Microphone Calibrator. Loudspeaker Types, Radiated Power, Axial Sound Pressure Level, Efficiency, Loudspeaker Electrical Impedance, Loudspeaker Directivity Factor, Loudspeaker Sensitivity, Direct Radiator Example Calculations, Horns and Compression Drivers, Practical Considerations Involving Horns, Horn Compression Drivers, Crossover Networks, Loudspeaker Arrays, Bessel Array, Line Arrays, Vented Enclosure Bass Loudspeakers.

UNIT V
SYNCHRONIZATION AND EQUALIZATION: Signal Delay, Synchronization and Alignment of Arrays, Finding Acoustic Origins of Unlike Devices. Sound system equalization, System criteria, Transient Nature of Acoustic Feedback, Introduction of Real-Time Analyzers, Band-Rejection, Bandpass, and Band-Boost Filters, TEF Analysis in Equalization , How to Approach Equalization, What Real-Time Regenerative-Response Method of Equalizing a Sound System , Equalizing for Playback, Improper Use of Real Time Analysis in Monitoring Music and Speech, Diaphragmatic Absorbers, Proximity Modes, Checking Microphone Polarity, Loudspeaker Polarity.

Text Book:
1. Sound System Engineering, 3/e, D Davis, E Patronis, Elsevier Inc, USA 2006.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

Semester: 5 **Code: ET20536**
Subject: Introduction to Linear Dynamical Systems
Credits: 4
Total Theory Periods: 30 **Total Tutorial Periods: 10**

UNIT I
Overview linear dynamical systems; Linear algebra review: concept of vector spaces and functions, basis and dimension, null space, range of matrix, change of coordinates, norms etc. Over determined systems: Geometric interpretation, least square solution. Under determined systems: Geometric interpretation, least norm solution. Linear estimation: Weighted least square method, BLUE, Application in navigation from range of measurements.

UNIT II
Observability of a system: concept of state estimation, observability condtion; Minimum mean square estimation over noisy measurements. Concept of Kalman filter: Gauss Markov model, time update, measurement update, Riccati equation. Application: Navigation from range of measurements.

UNIT III
Controllability of a system: state transfer, reachability. Linear quadratic controller (LQR): least square solution, dynamic programming solution, Lagarange multiplier solution. Infinite horizon LQR. Linear quadratic stochastic control. Application: Trajectory control and tracking problem.

UNIT IV
System stability: global/local asymptotic stability, basic Lyapunov theory, Lasalle's theorem. Linear quadratic Lyapunov theory: Lyapunov operator, controllability and observability Grammians. Lyapunov theory with inputs and outputs.

UNIT V
Linear optimization: system modeling, problem formulation. Introduction to concepts of convex optimization, duality, KKT conditions. Simplex programming and Barrier method. Application: filter design, control applications.

Text Books:
1. Introduction to Dynamic Systems, Luenberger, Wiley
2. Introduction to Linear Optimization, D. Bertsimas and J. N. Tsitsiklis

Reference Books:
1. Online lectures by Prof. Stephen Boyd http://www.stanford.edu/~boyd/ EE263/EE363
2. Linear Systems, Antsaklis & Michel, McGraw-Hill
3. Optimal Filtering and Optimal, Anderson & Moore, Dover
4. Control: Linear Quadratic Methods, Anderson & Moore, Dover