SEMESTER IV

Code	Course of Study		L	T	P	C
MA202	Mathematics-IV	3	0	0	3	
EC202	Digital Signal Processing	3	1	0	4	
IC218	Control System		3	1	0	4
EC204	Transmission Lines and Waveguides		3	0	0	3
EC206	Electronics Circuits		3	0	0	3
EC208	Microprocessor and microcontroller		3	0	0	3
EC210	Electronic Circuits Laboratory		0	0	3	2
EC212	Microprocessor and microcontroller Laboratory		0	0	3	2
	TOTAL		**18**	**0**	**6**	**24**

SEMESTER IV

MA202 Mathematics IV (3-0-0)3

Pre-Requisite:None

Objective:

To expose the students to the basics of probability theory and random processes essential for their subsequent study of analog and digital communication.

Topics Covered:

Statistics and Probability: Probability laws – Addition and Multiplication theorems on probability - Baye's theorem – Expectation, Moments and Moment generating function of Discrete and continuous distributions, Binomial, Poisson and Normal distributions, fitting these distributions to the given data.

Testing of Hypothesis - Z-test for single mean and difference of means, single proportion and difference of proportions - t-test for single mean and difference of means, F-test for comparison of variances.Chi-square test for goodness of fit – Correlation, regression.

Numerical Analysis: Lagrange interpolation, Forward, backward and central differences, Newton's forward and backward interpolation formulae, Numerical differentiation at the tabulated points with forward backward and central differences.

Numerical Integration with Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule. Taylor series method, Euler's method, modified Euler's method, Runge-Kutta method of 4^{th} orders for solving first order ordinary differential equations, Numerical solution of algebraic and transcendental equations by Regula-Falsi method, Newton - Raphson's method. Curve fitting by the method of least squares. Fitting of Straight line, Second degree parabola.

Series Solution : Classification of singularities of an ordinary differential equation - Series solution- Method of Frobenius - indicial equation - examples. Bessel and Legendre functions: Bessel function of first kind Recurrence formulae-Generating function-Orthogonality of Bessel functions Legendre polynomial-Rodrigue's formula - Generating function Recurrence formula - Orthogonality of Legendre polynomials.

Course Outcomes:

Students will be able to

1. Understand the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.
2. Characterize probability models and function of random variables based on single & multiples random variables.
3. Evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits.
4. Understand the concept of random processes and determine covariance and spectral density of stationary random processes.

5. Demonstrate the specific applications to Poisson and Gaussian processes and representation of low pass and band pass noise models.

Text Books:

1. Gupta.S.C and Kapoor.V.K, "Fundamentals of Mathematical Statistics", Sultan Chand, 2000.
2. ErwynKreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 8th Edition, 2010.

Reference Books:

1. Grewal.B.S, "Higher Engineering Mathematics", Khanna Publications, 42nd Edition, 2013.

EC202 DIGITALSIGNAL PROCESSING(3-0-0)3

Pre-Requisite:EC201

Objective:

The subject aims to introduce the mathematical approach to manipulate discrete time signals, which are useful to learn digital tele-communication.

Topics Covered:

Unit-1: Signals and Systems
Review of LSI system theory- DTFT-Frequency response of discrete time systems-All pass inverse and minimum phase systems.

Unit-2: Discrete Fourier Transform
Relationship of DFT to other transforms- FFT- DIT and DIF FFT algorithm-Linear filtering using DFT and FFT.

Unit-3: Finite Impulse Response Filters
Frequency response-FIR filter types- Design of FIR filters- Mapping formulas-Frequency transformations-Direct form realization of FIR systems-Lattice structure for FIR systems.

Unit-4: Infinite Impulse Response Filters
IIR filter types-IIR filter design- Bilinear transformation- impulse invariance transformation-Structures of IIR filters-Finite word length effects- Limit cycle oscillations

Unit-5: Applications and Multi-rate signal processing
Sampling rate conversion byan integer and rational factor-Polyphase FIR structures for sampling rate conversion-interpolation- decimation-Homomorphic filtering-Applications of DSP in speech and image processing-Homomorphic de-convolution and the cepstrum- Applications in speech and image processing

Course Outcomes:

Students will be able to

1. Analyze discrete-time systems in both time & transform domain and also through pole-zero placement.
2. Analyze discrete-time signals and systems using DFT and FFT.

3. Design and implement digital finite impulse response (FIR) filters.
4. Design and implement digital infinite impulse response (IIR) filters.
5. Understand and develop multirate digital signal processing systems.

Text Books:

1. *J.G. Proakisetal, Digital Signal Processing, (4/e) Pearson, 2007.*
2. *A.V. Oppenheim & R.W. Schafer, "Discrete Time Signal processing", (2/e),Pearson Education, 2003.*

Reference Books:

1. T. F. Quatieri, Discrete-time Speech Signal Processing: Principles and Practice, Pearson, 2006.
2. *J.R. Jhonson, Introduction to Digital Signal Processing, Prentice-Hall, 1989.*
3. *S.K. Mitra, Digital Signal Processing (3/e), TMH, 2006.*

IC218 CONTROL SYSTEMS (3-0-0)3

Pre-Requisite: EC203

Objectives:

1. To teach the mathematical modelling of control system.
2. To familiarize the students with the need for modelling of systems.
3. To represent the system in various ways mathematically.
4. To teach them the various techniques of stability analysis.

Topics Covered:

Unit -1:Introduction
Block-diagram algebra.Time response of poles.Ruth – Hurwitz criterion.Basic feedback loop.Asymptotic tracking and performance.

Unit -2:Stabilityanalysis
Root loci. Properties.Stability range from the loci, Sensitivity of system Design using root loci, proportional controller, phase lead controller and PD controller. Mechanical Systems- Electrical Systems

Unit -3:Frequency domain analysis
Frequency domain techniques. Bode and Nyquist plots. Phase and gain margins.Frequency domain specifications.Controller design.

Unit-4: State Space analysis
State - space techniques. Canonical form for SISO continuous-time and discrete-time systems.Solution of state equations. State models of MIMO systems. Stability analyses-Lyapunov criterion for stability.

Unit-5: Controller design
Controllability and observability. Design of state feedback controllers. Full order and reduced order observers. Design of observers for continuous-time and discrete-time systems.

Course Outcomes:

1. Able to model the control systems.
2. Able to test the stability of control system using various methods
3. Able to design stable systems.

Text Books:

1. *K. Ogata : Modern Control Engineering, (5/e), PHI, 2009.*
2. *R.C. Dorf& R.H. Bishop, Modern Control Systems (8/e), Pearson, 1999.*

***Reference Books*:**

1. *B.C. Kuo : Automatic Control Systems, (9/e), PHI, 2009.*
2. *K. Morris : An Introduction to Feedback Control, Academic Press, 2001*

EC204 TRANSMISSION LINES AND WAVE GUIDES (3-0-0)3

Pre-Requisite: EC205

Objective:

To impartknowledge on complete fundamentals and essential feature of waveguides, resonators and microwave components and also to give an introduction to microwave integrated circuit design.

Topics Covered:

Unit 1: Transmission line
Transmission line equations -Voltage and current waves - Characteristic impedance–SWR – Reflection Coefficient - Solutions for different terminations - Transmission-line loading.

Unit-2: Impedance Matching Techniques
Impedance transformation and matching - Quarter-wave and half-wave transformers - Binomial and Tchebeyshev transformers - Single, double and triple stub matching.

Unit-3 Graphical Tool
The circle diagram for the dissipationless line – The Smith Chart – Application of the Smith Chart

Unit-4 Waveguides and Resonators
Classification of guided wave solutions-TE, TM and TEM waves - Field analysis - Rectangular and circular waveguides - Excitation of waveguides - Rectangular, circular and cylindrical cavity resonators.

Unit-5 Planar Transmission Lines
Microstriplines –stripline - slot line - coplanar waveguide -fin line -Microstrip MIC design aspects - Computer- aided analysis and synthesis.

Course Outcomes:

Students are able to

1. To understand the fundamentals of Transmission lines and waveguides.
2. To apply the knowledge to understand various Microwave components
3. Find and analyze the transmission lines and their parameters using the Smith Chart
4. Classify the Guided Wave solutions -TE,TM, and TEMAnalyze and design rectangular waveguides and understand the propagation of electromagnetic waves.
5. Evaluate the resonance frequency of cavity Resonators and the associated modal field.
6. Apply the knowledge to understand various Microwave components like Strip Line, Slot Line etc...

Text Books:

1. D.M.Pozar, "Microwave Engineering", 4thedition, Wiley,2011.
2. J.D.Ryder "Networks, Lines and Fields", 2nd edition, PHI Learning, New Delhi, 2011.

References:

1. R.E.Collin, "Foundations for Microwave Engineering", 2nd edition, Mc Graw–Hill, 2009.
2. E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems" PHI Learning, 2ndedition 2011.

EC206 ELECTRONIC CIRCUITS(3-0-0)3

Pre-Requisite: None

Objectives:

The aim of the course is for:

1. Understanding the fundamental characteristics of Rectifiers.
2. Understanding the working principle of BJT and MOSFET transistor models.
3. Understanding the concepts of MOSFET and BJT biasing.
4. Understanding the working principle of BJT and MOSFET amplifiers.
5. Development of the mathematical skills to solve problems involving analysis of amplifier gain, output voltage and current.

Topics Covered:

Unit 1: Rectifiers and Transistor Biasing

Rectifier circuits and filters.MOSFET and BJT amplifiers.Biasing. Low and high frequency models for MOSFET and BJT. Analysis of various amplifier circuits-comparison.

Unit 2: Basic Amplifiers

MOSFET, BJT and BiCMOScircuits.Frequency response of CS and CE amplifiers with active load.Cascodeamplifiers.Source and emitter follower.

Unit 3: Differential Amplifier and Multistage Amplifiers

MOS and BJT differential amplifiers.Differential amplifiers with active load. Two stage amplifiers.

Unit 4: Feedback and Oscillators

Feedback concept.Properties.Feedbackamplifiers.Stabilityanalysis.Sinusoidaloscillators.Condition for oscillation.

Unit 5: Power Amplifiers

Output stages, class A, class B, class AB, Biasing circuits. Power amplifiers.IC power amplifiers.

Course Outcomes:

Students will be able to

1. Apply the knowledge of diode, BJT and MOSFET to electronics circuit analysis.
2. Analyze the characteristics of BJT and MOSFET based biasing circuits and their stability conditions.
3. Classify basic amplifier circuits based on their properties and determine their output voltage, current, resistance and gain.Analyze amplifier circuits by the use of small signal and large signaltransistor models.
4. Classify power amplifier circuits based on their properties and determine their output voltage, current, resistance and gain.
5. Understand the characteristics of BJT and MOSFET amplifiers.

Text Books:

1. A.S.Sedra&K.C.Smith, Microelectronic Circuits (5/e), Oxford, 2004.

Reference Books:

1. Floyd, Electronic Devices, 9th ed, Pearson, 2012.
2. Millman J. and Halkias C.C., 2002 'Integrated Electronics", McGraw Hill. India.
3. David A.Bell, 1998 "Electronic Devices and Circuits", Prentice Hall of India.
4. G.K.Mithal, 2000 "Electronic devices and circuits", khanna publishers, Delhi, India.
5. Allen mottershead, 2002 "Electronic devices and circuits", Prentice Hall of India.

EC208 MICROPROCESSORS AND MICROCONTROLLERS (3-0-0)3

Pre-Requisite:EC209

Objective:

This subject deals about the basic 8 bit (8085) &16-bit (8086) processor and an 8-bit (8051) controllers, their architecture, internal organization and their functions, interfacing an external device with the processors/ controllers.

Topics Covered:

Unit-1:8085 Microprocessor
Architecture- Addressing modes- Instruction set- Programming 8085-Interrupts

Unit-2:8086 Microprocessor
Programmer's model for 8086-Segmented memory operation- Addressing modes- instruction set-Assembly language programming-Programming with DOS and BIOS function calls.

Unit-3: Interfacing
Memory interfacing- I/O interfacing- parallel and serial data transfer methods- 8255 PPI chip-8251serial communication interface- 8259 Interrupt controller- 8237 DMA controller.

Unit-4: 8051 Microcontroller
Programming model - Instruction set of 8051 Microcontroller- Addressing mode supported by 8051- instruction set-Assembly language programming.

Unit-5: 8051 Programming
Programming timer-serial port- I/O and interrupts-DAC- ADC- Stepper motor- LCD and key board interfacing to 8051.

Course Outcomes:

Students are able to

1. Recall and apply a basic concept of digital fundamentals to Microprocessor based personal computer system.
2. Identify a detailed s/w & h/w structure of the Microprocessor.
3. Illustrate how the different peripherals (8255, 8251 etc.) are interfaced with Microprocessor.
4. Distinguish and analyze the properties of Microprocessors & Microcontrollers.
5. Analyze the data transfer information through serial & parallel ports.

Text Books:

1. *Ramesh S.Gaonkar,"Microprocessor-Architecture, Programming and Applications with the 8085" Penram International Publisher, 5th Ed.,2006.*
2. *J.L. Antonakos, An Introduction to the Intel Family of Microprocessors, Pearson, 1999.*
3. *Barry B. Brey, The Intel Microprocessors, (7/e), Eastern Economy Edition , 2006.*
4. *M.A. Mazidi& J.C. Mazidi Microcontroller and Embedded systems using Assembly & C. (2/e), Pearson Education, 2007.*

Reference Books:

1. *Kenneth J Ayala, The 8051 Microcontroller , (3/e), Thomson Delmar Learning, 2004.*
2. *I. Scott MacKenzie and Raphael C.W. Phan. The 8051 Microcontroller.(4/e), Pearson education, 2008.*

EC210 ELECTRONIC CIRCUITS LAB (0 - 0 - 3 - 2)

List of Experiments:

1. Full wave rectifier with filters

2. Bridge rectifier with filters
3. Stability of Q point
4. Single stage RC coupled CE amplifier
5. Single stage RC coupled Current series CE feedback amplifier
6. Darlington emitter follower
7. Differential Amplifier
8. Single stage CS FET amplifier
9. RC phase shift oscillator
10. Wien Bridge Oscillator

EC212 MICROPROCESSORS AND MICROCONTROLLER LABORATORY (0-0-3-2)

List of Experiments:

1.Programming with 8085

2. Programming with 8086

3. Interfacing with 8085/8086- 8251, 8254, 8279

4. Interfacing with 8085/8086-ADC,DAC

5. Programming with 8051 microcontroller

6. Interfacing Stepper motor with 8051