



Rajiv Gandhi Technological University, Bhopal (MP)
B.E. (EC) Electronics and Communication Engg
 Revised Syllabus and Scheme of Examination Effective from July 2007

THIRD SEMESTER

S.No	Course Category	Course Code (New)	Subject	Period Per Week				Theory	Practical	Internal Assessment		Total
				L	T	P	C			MST	TW	
1.	BS-5	BE-301	Mathematics III	3	1	0	4	100	-	20	-	120
2.	HS-2	CS/IT/EC /..302	Energy, Environ. Ethics & Society	3	1	0	4	100	-	20	-	120
3.	DC-1	EC-303	Electronic Instrumentation	3	1	2	6	100	50	20	30	200
4.	DC-2	EC/BM-304	Electronic Devices	3	1	2	6	100	50	20	30	200
5.	DID-1	EC/EX-305	Network Analysis	3	1	2	6	100	50	20	30	200
6.	IT-2	CS/EC-306	Java	0	0	4	4	-	50	-	50	100
7.	NECC-1	EC-307	Self Study	0	0	1	1	-	-	-	30	30
8.	NECC-2	EC-308	Seminar/ Group Discussion etc.	0	0	1	1	-	-	-	30	30
Total				15	5	12	32	500	200	100	200	1000

BS	Basic Sciences	HS	Humanity Sciences
DC	Department Core	DID	Department Inter Disciplinary
IT	Information Technology subjects	NECC	Non Exam Credit Course
MST	Mid Semester Test	TW	Term Work (Session/ Practical)
C	Credits	L	Lecture Hrs
P	Practical Hrs	T	Tutorial Hrs



Rajiv Gandhi Technological University, Bhopal (MP)
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FOURTH SEMESTER

S. No.	Course Category	Course Codes (New)	Subject	Period Per Week				Distribution of Marks				
				L	T	P	C	Theory	Practical	Internal Assessment		Total
										MST	TW	
1.	DID-2	CS/IT/EC-401	Computer System Organization	3	1	0	4	100	-	20	-	120
2.	DID-3	EC-402	Control Systems	3	1	0	4	100	-	20	-	120
3.	DC 3	EC 403	Digital Electronics	3	1	2	6	100	50	20	30	200
4.	DC 4	EC 404	Electronic Circuits	3	1	2	6	100	50	20	30	200
5.	DC-5	EC-405	Analog Communication	3	1	2	6	100	50	20	30	200
6.	IT-3	EC-406	Software lab – I	0	0	4	4	-	50	-	50	100
7.	NECC-3	EC-407	Self Study	0	0	1	1	-	-	-	30	30
8.	NECC-4	EC-408	Seminar/Group Discussion etc.	0	0	1	1	-	-	-	30	30
Total				15	5	12	32	500	200	100	200	1000

BS	Basic Sciences	HS	Humanity Sciences
DC	Department Core	DID	Department Inter Disciplinary
IT	Information Technology subjects	NECC	Non Exam Credit Course
MST	Mid Semester Test	TW	Term Work (Session/ Practical)
C	Credits	L	Lecture Hrs
P	Practical Hrs	T	Tutorial Hrs

COURSE CONTENTS

Category	Title	Code	Credits-4C			Theory Papers
Basic Sciences BS-5	Mathematics-III	BE 301	L	T	P	Max Marks-100 Min Marks-35 Duration-3 Hrs
			3	1	0	

Unit 1 Functions of Complex Variables: Analytic functions, Harmonic Conjugate, Cauchy - Riemann Equations, Line integral, Cauchy's theorem, Cauchy's Integral formula, Singular points, Poles and Residues, Residue theorem, Evaluation of Real Integral, Bilinear Transformation.

Unit 2 Numerical Analysis: Difference operators, Errors and Approximations, Interpolation, Inverse interpolation, Numerical differentiation, Numerical Integration by using Simpson's method, Weddel's rule and Gauss legendre open quadrature formula.

Unit 3 Solutions of algebraic and transcendental equations(Regular False, Newton-Raphson, Iterative, Graffe's root squaring methods), Solutions of simultaneous algebraic equations, Solutions of ordinary differential equations (Taylor's Series, Picard's Method, Modified Euler's method, Runge Kutta Method, Predictor-Corrector Method), Solution of Partial differential equation.

Unit 4 Introduction to optimization by linear programming, only two variable problems solution by graphical and simplex method, concept of degeneracy and duality; simple three variable transport and assignment problems and modeling into LPP.

Unit 5 introduction to Q theory and Markovian process, time independent property of exponential distribution, solution of only M/M/1 (∞/∞ /FCFS) Queues; introduction to design of experiments, factorial design, sampling methods, Taguchi Loss Function, robust design methods, variance reduction and six (± 3) σ outliers in quality.

References:

1. Kreyszig E; Advanced Engineering Mathematics; Wiley Eastern Limited.
2. Ramana BV; Higher Engineering Mathematics; TMH
3. Grewal BS; Higher Engineering Mathematics; Khanna Publisher.
4. Taha H; Operations Research an Introduction; PHI
5. Ross; Taguchi techniques for Quality engineering, TMH
6. Spiegel; Theory and problems of probability and statistics; TMH
7. Chandrasekharaiah DS; Engineering Maths Part II & III; Prism Books Pvt.
8. Johnson; Miller and Freund's Probability and statistics for Engineers; PHI.
9. Jaggi, Mathur; Engineering Mathematics; Khanna Publisher.

COURSE CONTENTS

Category	Title	Code	Credits-4C			Theory Papers
			L	T	P	
Humanities	Energy Environment	BM/CS/EC/				Max Mark-100
Science HS	Ethics and Society	EE/EI/EX/IT	3	1	0	Min Mark-35
2		302				Duration-3Hrs

Unit 1 Energy: linkage with development, world energy scenario, fossil fuel resource- estimates and duration, India's energy scenario; Finite/ depleting energy resources, coal, oil, gas, nuclear fission, promises and present status of nuclear fusion energy; Renewable energy, solar, hydro, wind, biomass, ocean, tidal, wave and geothermal. Synergy between energy and environment, global environment issues, greenhouse gas emission, global warming, green energy solutions.

Unit 2 Society and environment: exponential growth in population, environmentally optimum sustainable population, free access resources and the tragedy of commons; environment problems and impact of P.A.T (Population, Affluence and Technology), environmentally beneficial and harmful technologies; environment impact assessment policies and auditing interaction between environment, life support systems and socio-culture system.

Unit 3 Ecosystem: definition, concepts, structure, realm of ecology, lithosphere, hydrosphere, biosphere, atmosphere-troposphere-stratosphere; energy balance to earth, matter and nutrient recycling in ecosystems; nitrogen, oxygen, carbon and water cycles, food producers, consumers and decomposers, food chains; biodiversity, threat and conservation of biodiversity. Worldviews and environmentally sustainable economic growth, introduction to Design For Environment (DFE), product lifecycle assessment for environment and ISO 14000; triple bottom-line of economic, environment and social performance; environmental ethics, its world impact and challenges.

Unit 4 (a) Air pollution-primary, secondary; chemical and photochemical reactions, effects of CO, NO, CH and particulates, acid rain, Ozone depletion; monitoring and control of pollutants
 (b) Noise pollution-sources and control measures.
 (c) Water pollution, analysis and management, heavy metals- and nuclear pollutions; industrial pollution from paper, pharmacy, distillery, tannery, fertilizer, food processing and small scale industries.

Unit 5 Ethics and moral values, ethical situations, objectives of ethics and its study, role morality and conflicts; values, policies and Organization Culture; Non-professional, quasi- and hard-professionals; preventive, personal, common and professional ethics; different ethical value criteria like utilitarian, virtue, right and duty ethics with discussion on the case of priority for improvement of urban (high traffic) or rural (low traffic) intersections causing equal number of fatalities; codes of ethics and their limitations; Institute of engineers code for corporate member, IEEE and ACM professional-code.

References:

1. Miller G. T Jr; Living in the environment; Cengage Publisher.
2. Cunningham W; Principles of Environmental Science: TMH
3. Harris CE, Prichard MS, Rabins MJ, Engineering Ethics; Cengage Pub.
4. Martin; Ethics in Engineering; TMH
5. Govindrajan, Natrajan, Santikumar; Engineering Ethics; PHI pub.
6. Rana SVS;Essentials of ecology and environment; PHI Pub.
7. Gerard Kiely, Environmental Engineering; TMH
8. Khan BH; Non Conventional energy resources; TMH Pub.
9. Raynold G.W. "Ethics in Information Technology; Cengage

Course Contents

Category	Title	code	Credit-6			Theory paper
DC-1	Electronic Instrumentation	EC--303	L	T	P	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.
			3	1	2	

Unit-I Measurement and Error, Accuracy and Precision, Sensitivity, Linearity, Resolution, Hysteresis, Loading Effect. Measurements of Current, Voltage, Power and Impedance: DC and AC Ammeter, DC Voltmeter-Chopper type and solid-state, AC voltmeter using Rectifier, Average, RMS, Peak Responding voltmeters, Multi-meter, Power meter, Bolometer and Calorimeter.

Unit-II Cathode Ray Oscilloscope (CRO): Different parts of CRO, Block diagram, Electrostatic focusing, Electrostatic deflection, Post deflection acceleration, Screen for CRTs, Graticules, Vertical and Horizontal deflection system, Time base circuit, Oscilloscope Probes, Applications of CRO, Special purpose CROs-Multi input, Dual trace, Dual beam, Sampling, Storage (Analog and Digital) Oscilloscope.

Unit-III AC Bridges: Maxwell's bridge (Inductance and Inductance-Capacitance), Hay's bridge, Schering bridge (High voltage and Relative permittivity), Wein bridge, Wagner earth detector, Impedance measurement by Q-meter. **Non-Electrical Quantities (Transducer)**: Classification of Transducers, Strain gauge, Displacement Transducer- Linear Variable Differential Transformer (LVDT) and Rotary Variable Differential Transformer (RVDT), Temperature Transducer- Resistance Temperature Detector (RTD), Thermistor, Thermocouple, Piezo-electric transducer, Optical Transducer- Photo emissive, Photo conductive, Photo voltaic, Photo-diode, Photo Transistor, Nuclear Radiation Detector.

Unit-IV Wave Analyzer (Frequency selective and Heterodyne), Harmonic Distortion Analyzer, Spectrum Analyzer, Network Analyzer, Signal and Function Generators, Sweep Frequency Generator, Pulse and Square Wave Generator, Beat Frequency Oscillator.

Unit-V Digital Measurement and Instruments: Advantages of Digital Instrument over Analog Instrument, Digital-to-analog conversion (DAC) - Variable resistive type, R-2R ladder Type, Binary ladder, Weighted converter using Op-amp and transistor, Practical DAC. Analog-to-digital Conversion (ADC) -Ramp Technique, Dual Slope Integrating Type, Integrating Type (voltage to frequency), Successive Approximations, digital voltmeters and multi-meters, Resolution and sensitivity of digital meter, PLC structure, principal of operation, response time and application.

References:

1. H. S. Kalsi : Electronics Instrumentation, TMH.
2. K. Sawhney : Instrumentation and Measurements, Dhanpat Rai and Co.
3. Helfric and Cooper: Modern Electronic Instrumentation and Measurement Techniques; Pearson.

List of Experiments (Expandable):

All experiments (wherever applicable) should be performed through the following steps. **Step 1:** Circuit should be designed/ drafted on paper. **Step 2:** The designed/drafted circuit should be simulated using Simulation S/W (TINA-V7/ PSPICE/ Labview/ CIRCUIT MAKER). **Step 3:** The designed/drafted circuit should be tested on the bread board and compare the results with the simulated results. **Step 4:** The bread board circuit should be fabricated on PCB prepared on PCB machine.

1. Study of CRO and Function Generator.
2. Displacement measurement by LVDT.
3. Force measurement by strain gauge.
4. Measurement of Capacitor, Self-induction using Q-meter.
5. Temperature measurement by thermister, RTD and thermocouple.
6. Optical Transducer- Photo conductive, Photo voltaic, Photo-diode, Photo-Transistor
7. Designe of digital to analog converter.
8. PLC operation and applications (for example: relay, timer, level, traffic light etc.)

Course Contents

Category	Title	code	Credit-6			Theory paper
Department DC-2	Electronic Devices	EC--304	L	T	P	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.
			3	1	2	

Unit-I :Semiconductor intrinsic and extrinsic, p-type and n-type, energy band diagrams, majority and minority carrier, charge density in semiconductor, generation and recombination of charges, process of diffusion, diffusion and drift currents, Hall effects and its applications. p-n junction, depletion layer, potential barrier, electric field, forward and reverse biased junction, current components in p-n diode, current equation, V-I characteristics, cut in voltages of Si and Ge diode, transition and diffusion capacitance, power dissipation, p-n junction diode as rectifier, clipper and clamper.

Unit II: Optoelectronic and miscellaneous devices: Characteristics and application of Zener diode, Varactor diode, Schottky diode, Tunnel Diode, PIN diode, LED, photoconductor cells, photodiodes, solar cell, phototransistors, opto-couplers, thermistors, Seven segment displays.

Unit-III: Bipolar junction transistor – Construction, basic operation, current components and equation. CB, CE and CC-configuration, input and output characteristics, Early effect, region of operation- active, cutoff and saturation region, Ebers-Moll model, power dissipation in transistor ($P_{d_{max}}$ rating), Uni-junction Transistor (UJT) : Principle of operation, characteristics.

Unit IV: FET construction- Construction, n channel and p channel, characteristics, parameters, equivalent model and voltage gain, Enhancement and depletion MOSFET and its characteristics, analysis of FET in various configuration.

Unit V:Thyristor Family- Silicon Controlled Rectifier, V-I Characteristics, Transistor Analogy, Turn-On and Turn-Off Mechanism, Series and Parallel Combination of SCR, Protection Circuits. Introduction to Diac, Triac, Power MOSFET, IGBT and GTO.

References:

1. Boylestad and Nashelsky : Electronic Devices and Circuit Theory, Pearson Education
2. Millman and Halkias : Integrated electronics, TMH
3. Graham Bell : Electronic Devices and Circuits , PHI
4. Ned Mohan : Power electronics, John Wiley and Sons
5. Sendra and Smith : Microelectronics, Oxford Press.
6. Streetman : Electronic Devices, Pearson Education.
7. Neamen Donald : Electronic Circuits Analysis and Design, TMH
8. Salivahanan et al : Electronic Devices and Circuits, TMH

List of Experiments(Expandable):

All experiments (wherever applicable) should be performed through the following steps. **Step 1:** Circuit should be designed/ drafted on paper. **Step 2:** The designed/drafted circuit should be simulated using Simulation S/W (TINA-V7/ PSPICE/ Labview/ CIRCUIT MAKER). **Step 3:** The designed/drafted circuit should be tested on the bread board and compare the results with the simulated results. **Step 4:** The bread board circuit should be fabricated on PCB prepared on PCB machine.

1. V-I characteristics of various Diodes (p-n, Zener, Varactor, schottky. Tunnel, Photodiode etc)
2. Characteristics of Transistors (BJT and FET)
3. Study of Power electronic devices (Diac, Triac, SCR, Power Mosfet, IGBT etc.)

Course Contents

Category	Title	Code	Credit-6			Theory paper
DID 1	Network Analysis	BM/EC/EE /EI/EX-305	L	T	P	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.
			3	1	2	

Unit I

Introduction to circuit elements R,L,C and their characteristics in terms of linearity & time dependant nature, voltage & current sources controlled & uncontrolled sources KCL and KVL analysis, Nodal & mesh analysis, analysis of magnetically coupled circuits, Transient analysis :- Transients in RL, RC&RLC Circuits, initial conditions, time constants. Steady state analysis- Concept of phasor & vector, impedance & admittance, Network topology, concept of Network graph, Tree, Tree branch & link, Incidence matrix, cut set and tie set matrices, dual networks, Dot convention, coupling co-efficient, tuned circuits, Series & parallel resonance.

Unit II

Network Theorems for AC & DC circuits- Thevenins & Norton's, Superpositions, Reciprocity, Compensation, Substitution, Maximum power transfer, and Millman's theorem, Tellegen's theorem, problems with dependent & independent sources.

Unit III

Frequency domain analysis – Laplace transform solution of Integro-differential equations, transform of waveform synthesized with step ramp, Gate and sinusoidal functions, Initial & final value theorem, Network Theorems in transform domain

Unit IV

Concept of signal spectra, Fourier series co-efficient of a periodic waveform, symmetries as related to Fourier coefficients, Trigonometric & Exponential form of Fourier series.

Unit V

Network function & Two port networks – concept of complex frequency, Network & Transfer functions for one port & two ports, poles and zeros, Necessary condition for driving point & transfer function. Two port parameters – Z,Y, ABCD, Hybrid parameters, their inverse & image parameters, relationship between parameters, Interconnection of two ports networks, Terminated two port network.

References:

1. M.E. Van Valkenburg, Network Analysis, (PHI)
2. F.F.Kuo, Network Analysis.
3. Mittal GK; Network Analysis; Khanna Publisher
4. Mesereau and Jackson; Circuit Analysis- A system Approach; Pearson.
5. Sudhakar & Pillai; Circuit & Networks- Analysis and Synthesis; TMH
6. Hayt W.H. & J.E. Kemmerly; Engineering Circuit Analysis; TMH
7. Decarlo lin; Linear circuit Analysis; Oxford
8. William D Stanley : Network Analysis with Applications, Pearson Education
9. Roy Choudhary D; Network and systems; New Age Pub
10. Charles K. Alexander & Matthew N.O. Sadiku: Electrical Circuits :TMH
11. Chakraborti :Circuit theory: Dhanpat Rai
12. B.Chattopadhyay & P.C.Rakshit; Fundamental of Electrical circuit theory; S Chand
13. Nilson & Riedel , Electric circuits ;Pearson

List of experiments (Expandable):

All experiments (wherever applicable) should be performed through the following steps. **Step 1:** Circuit should be designed/ drafted on paper. **Step 2:** The designed/drafted circuit should be simulated using Simulation S/W (TINA-V7/ PSPICE/ Labview/ CIRCUIT MAKER). **Step 3:** The designed/drafted circuit should be tested on the bread board and compare the results with the simulated results. **Step 4:** The bread board circuit should be fabricated on PCB prepared on PCB machine..

1. To Verify Thevenin Theorem.
2. To Verify Superposition Theorem.
3. To Verify Reciprocity Theorem.
4. To Verify Maximum Power Transfer Theorem.
5. To Verify Millman's Theorem.
6. To Determine Open Circuit parameters of a Two Port Network.
7. To Determine Short Circuit parameters of a Two Port Network.
8. To Determine A,B, C, D parameters of a Two Port Network
9. To Determine h parameters of a Two Port Network
10. To Find Frequency Response of RLC Series Circuit.
11. To Find Frequency Response of RLC parallel Circuit.

Course Contents

Category	Title	Code	Credit-4			Practical
IT-2	Java	CS/EC/BM 306	L	T	P	Max. Marks-50
			-	-	4	Min. Marks: 25

UNIT-I Basic Java Features - C++ Vs JAVA, JAVA virtual machine, Constant & Variables, Data Types, Class, Methods, Objects, Strings and Arrays, Type Casting, Operators, Precedence relations, Control Statements, Exception Handling, File and Streams, Visibility, Constructors, Operator and Methods Overloading, Static Members, Inheritance: Polymorphism, Abstract methods and Classes

UNIT-II Java Collective Frame Work - Data Structures: Introduction, Type-Wrapper Classes for Primitive Types, Dynamic Memory Allocation, Linked List, Stack, Queues, Trees, Generics: Introduction, Overloading Generic Methods, Generic Classes, Collections: Interface Collection and Class Collections, Lists, Array List and Iterator, Linked List, Vector. Collections Algorithms: Algorithm sorts, Algorithm shuffle, Algorithms reverse, fill, copy, max and min Algorithm binary Search, Algorithms add All, Stack Class of Package java. Util, Class Priority Queue and Interface Queue, Maps, Properties Class, Un-modifiable Collections.

UNIT-III Advance Java Features - Multithreading: Thread States, Priorities and Thread Scheduling, Life Cycle of a Thread, Thread Synchronization, Creating and Executing Threads, Multithreading with GUI, Monitors and Monitor Locks. Networking: Manipulating URLs, Reading a file on a Web Server, Socket programming, Security and the Network, RMI, Networking, Accessing Databases with JDBC: Relational Database, SQL, MySQL, Oracle

UNIT-IV Advance Java Technologies - Servlets: Overview and Architecture, Setting Up the Apache Tomcat Server, Handling HTTP get Requests, Deploying a web Application, Multitier Applications, Using JDBC from a Servlet, Java Server Pages (JSP): Overview, First JSP Example, Implicit Objects, Scripting, Standard Actions, Directives, Multimedia: Applets and Application: Loading, Displaying and Scaling Images, Animating a Series of Images, Loading and playing Audio clips

UNIT-V Advance Web/Internet Programming (Overview): J2ME, J2EE, EJB, XML.

References:

1. Deitel & Deitel, "JAVA, How to Program"; PHI, Pearson.
2. E. Balaguruswamy, "Programming In Java"; TMH Publications
3. The Complete Reference: Herbert Schildt, TMH
4. Peter Norton, "Peter Norton Guide To Java Programming", Techmedia.
5. Merlin Hughes, et al; Java Network Programming , Manning Publications/Prentice Hall

List of Program to be performed (Expandable):

1. Installation of J2SDK
2. Write a program to show Scope of Variables
3. Write a program to show Concept of CLASS in JAVA
4. Write a program to show Type Casting in JAVA
5. Write a program to show How Exception Handling is in JAVA
6. Write a Program to show Inheritance
7. Write a program to show Polymorphism
8. Write a program to show Access Specifiers (Public, Private, Protected) in JAVA
9. Write a program to show use and Advantages of CONTRUCTOR
10. Write a program to show Interfacing between two classes
11. Write a program to Add a Class to a Package

12. Write a program to show Life Cycle of a Thread
13. Write a program to demonstrate AWT.
14. Write a program to Hide a Class
15. Write a Program to show Data Base Connectivity Using JAVA
16. Write a Program to show "HELLO JAVA " in Explorer using Applet
17. Write a Program to show Connectivity using JDBC
18. Write a program to demonstrate multithreading using Java.
19. Write a program to demonstrate applet life cycle.
20. Write a program to demonstrate concept of servlet.

Course Contents

Category	Title	Code	Credits-4C			Theory Paper
DID-2	Computer System Organization	CS/IT/EC 401	L	T	P	Max. Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	0	

Unit I Computer Basics and CPU: Von Newman model, various subsystems, CPU, Memory, I/O, System Bus, CPU and Memory registers, Program Counter, Accumulator, Instruction register, Micro operations, Register Transfer Language, Instruction Fetch, decode and execution, data movement and manipulation, Instruction formats and addressing modes of basic computer. 8085 microprocessor organization

Unit-II Control Unit Organization: Hardwired control unit, Micro and nano programmed control unit, Control Memory, Address Sequencing, Micro Instruction formats, Micro program sequencer, Microprogramming,

Arithmetic and Logic Unit: Arithmetic Processor, Addition, subtraction, multiplication and division, Floating point and decimal arithmetic and arithmetic units, design of arithmetic unit.

Unit-III Input Output Organization: Modes of data transfer – program controlled, interrupt driven and direct memory access, Interrupt structures, I/O Interface, Asynchronous data transfer, I/O processor, 8085 I/O structure, 8085 instruction set and basic programming. Data transfer – Serial / parallel, synchronous/asynchronous, simplex/half duplex and full duplex.

Unit-IV Memory organization: Memory Maps, Memory Hierarchy, Cache Memory - Organization and mappings. Associative memory, Virtual memory, Memory Management Hardware.

Unit V Multiprocessors: Pipeline and Vector processing, Instruction and arithmetic pipelines, Vector and array processors, Interconnection structure and inter-processor communication.

References:

1. Morris Mano: Computer System Architecture, PHI.
2. Gaonkar: Microprocessor Architecture, Programming, Applications with 8085; Penram Int.
3. William Stallings: Computer Organization and Architecture, PHI
4. Carter; Computer Architecture (Schaum); TMH
5. Carl Hamacher: Computer Organization, TMH
6. Tanenbaum: Structured Computer Organization, Pearson Education

Course Contents

Category	Title	Code	Credit-4			Theory paper
DID-2	Control System	EC-402	L	T	P	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.
			3	1	0	

Unit I Basic Control System Terminology and Classification of control System, Examples of control System, Transfer Function of Linear Control System, Block Diagram Representation, Signal flow Graph Techniques.

Mathematical Modeling of Electrical Network: AC and DC Servomotors, Error Detector, Stepper Motor, Optical Encoder, Linearization.

Unit II Sensitivity of control Systems, Effects of Feedback on gain and time constant, pole location, bandwidth, Sensitivity, Stability, Disturbance signal, Control over System Dynamics by use of Feedback. **Time Response Analysis**- Standard Test Signals, Time Response of 1st Order System, Model of Prototype DC Position Control System, Time Response of Prototype 2nd Order System, Performance Specification of 2nd Order System, Steady-State Errors and Error Constants, Effects of Additions of Poles and Zeros to Open Loop and Closed Loop System, Design Specification of 2nd Order System and Higher-Order System, Performance Indices, Optimal Control System.

Unit III : Time Domain Stability Analysis- Concept of Stability of Linear Systems, Effects of Location of Poles on Stability, Necessary Conditions for Stability, Routh-Hurwitz Stability Criteria, Relative Stability Analysis, Root Locus Concept, Guidelines for Sketching Root-Locus,. Frequency Domain Stability Analysis- Performance Specification in Frequency Domain, Co-relation between frequency Domain and Time Domain, Bode Plot, Minimum-Phase and Non-Minimum Phase System, Polar Plots, Inverse Polar Plot, Nyquist Stability Criterion, Assessment of Relative Stability (Phase Margin, Gain Margin and Stability), Constant-M and N Circle, Nichols Chart.

Unit IV : Approaches to System Design, Types of Compensation, Design of Phase-Lag, Phase Lead and Phase Lead-Lag Compensators in Time and Frequency Domain, Proportional, Derivative, Integral and PID Compensation.

Unit V : Concept of State, State Variables and State Model, State Space Representation of Systems, Block Diagram for State Equation, Transfer Function Decomposition, Solution of State Equation, Transfer Matrix, Relationship between State Equation and Transfer Function, Controllability and Observability.

References:

1. B. C Kuo : Automatic Control System, Prentice Hall of India, New Delhi.
2. Nagrath and Gopal : Control System Engineering, New Age International Publishers.
3. Samarjit Ghose : Control Systems Theory and Applications, Pearson Education
4. Distefano; Feedback and Control System (Schaum); TMH
5. B. S. Manke : Linear Control System (with MATLAB Application), Khanna Publishers.
6. Ogata : Modern Control Engineering, PHI
7. AK Mandal : An introduction to Control Engineering – Modeling, Analysis and Design, New Age International Publishers

Course Contents

Category	Title	Code	Credit-6			Theory paper
Departmental Core DC-3	Digital Electronics	EC-- 403	L	T	P	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.
			3	1	2	

Unit I Review of Number systems and Binary codes, Binary arithmetic, addition, subtraction, multiplication and division algorithms. **Boolean algebra:** theorems and functions, Simplification of Boolean functions, minimization techniques, Karnaugh's map method, Quine and McCluskey's method, realization of various binary functions using AND ,OR ,NOT ,XOR logic gates.

Unit II: Universal gates: NAND, NOR, realization of Boolean function using universal gates. Half and full adder, half and full subtractor, Series and parallel adder, BCD adders, look-ahead carry generator, Decoders, Encoders, multiplexers and de-multiplexers. Analysis and design of combination circuits, realization of various Boolean functions using NAND, NOR gates and Multiplexers.

Unit III Multivibrators: Astable, Monostable and bistable multivibrators, 555 timer chip and its application in multivibrators. **Flip-Flops:** R-S, Clocked R-S, T, D, J-K, race around problem, Master-slave J-K., State and Excitation Tables **Shift registers and counters:** synchronous and asynchronous counters, Binary ripple counter, up-down counter, Johnson and ring counter, Analysis and Design of Sequential Circuits.

Unit IV: Semiconductor memories: Organization and construction of RAM, SRAM, DRAM, RAMBUS ROM, PROM, EPROM, EEPROM. PAL and PLAs etc

Unit V Logic families: RTL, DTL, TTL, ECL, IIL, PMOS, NMOS and CMOS logic etc. Interfacing between TTL and MOS, vice-versa.

References

1. M. Mano : Digital Logic and Computer Design, Pearson Education
2. W.H. Gothman : Digital Electronics, PHI.
3. Millman and Taub : Pulse, Digital and Switching Waveforms, TMH
4. Salivahanan and Ari Vahagan : Digital Circuits and Design, Vikas Publishing House
5. Leach and Malvino : Digital Principles and Applications, TMH
6. Rajkamal : Digital Systems – Principles and Design, Pearson Education

List of Experiments (Expandable):

All experiments (wherever applicable) should be performed through the following steps. **Step 1:** Circuit should be designed/ drafted on paper. **Step 2:** The designed/drafted circuit should be simulated using Simulation S/W (TINA-V7/ PSPICE/ Labview/ CIRCUIT MAKER). **Step 3:** The designed/drafted circuit should be tested on the bread board and compare the results with the simulated results. **Step 4:** The bread board circuit should be fabricated on PCB prepared on PCB machine..

1. To test and study of operation of all logic Gates for various IC's.
2. Implementation of AND, OR, NOT, NOR, EX-OR and X-Nor Gates by NAND and NOR Universal gates.
3. Binary Addition by Half Adder and Full Adder circuit.
4. Binary Subtraction by Half Subtractor and Full Subtractor circuit.
5. Design a BCD to excess-3 code converter.
6. Verification of the Demorgan's Theorem.
7. Study of RS, JK, T & D flip-flops.
8. Multiplexer/Demultiplexer based boolean function realization.
9. Study and Application of 555 timer (Astable, Monostable, Schmitt trigger, VCO).

Course Contents

Category	Title	Code	Credit-6			Theory paper
Departmental Core DC-4	Electronic Circuits	EC/BM-404	L 3	T 1	P 2	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.

Unit-I Amplifier Basics, Transistor as an amplifier, load line, Q-point and its selection criteria, designing of fixed bias and self-bias, stability of biasing circuits, calculation of stability factor.

Transistor at low frequency: frequency response, bandwidth, h-parameter analysis of CC, CB and CE configuration, simplified model, gain and impedance calculation of single stage amplifier.

Transistor at high frequency, high frequency model (hybrid- π), Parameters and their definition, Miller capacitance and its effect on voltage gain,

Unit-II Feedback amplifier: positive and negative feedback loop gain, effect of negative feedback on gain stability, distortion, bandwidth, input and output impedance of amplifier, types of feedback (voltage, current, series and shunt) and their analysis.

Oscillators: condition of sustained oscillation, RC phase shift, LC (Hartley and Collpit) Oscillators, Wein Bridge, Negative resistance (Tunnel diode and UJT) oscillators, crystal oscillators.

Unit III Power amplifier, classification, operation, analysis and design of Class A, Class B, Class-AB, Class C, transformer coupled, push pull and complementary symmetry amplifiers, power dissipation in transistors ($P_{d_{max}}$ rating) and efficiency calculations.

Tuned amplifier and its applications, Q factor, selectivity and bandwidth, effect of loading, double tuning (synchronous and stagger)

Unit IV Cascade amplifiers, Calculation of gain, Input and output impedance, Effect of Cascading on bandwidth, Transformer, RC and direct-coupled amplifier and their performance.

Darlington connection, equivalent circuit and Calculation of gain and impedances, Cascade amplifier: advantage, circuit diagram and analysis, feedback pair and applications of BIFET, Bootstrapping technique.

Differential amplifier - configuration, transfer characteristics, DC analysis, h-parameter analysis, differential and common mode gain, CMRR, constant current source and current mirror, level shift.

Unit-V Operational amplifier (IC741), specifications, ideal and practical characteristics, frequency response, unity gain bandwidth, limitations, slew rate and its effect on full power bandwidth, input offset voltage, bias and offset currents, compensation.

Applications of Op-Amp: Inverting and non-inverting amplifier Analog computation, summer (inverting and non-inverting), averager, integrator, differentiator, scalar, sign changer, phase changer, multiplier, buffer, Differential amplifier, instrumentation amplifier, comparator, Schmitt trigger, precision rectifier, log and antilog amplifier, voltage-to-current and current-to-voltage converter.

References:

1. Millman and Halkias : Integrated electronics, TMH
2. Gayakwad ; OPAMP and Linear Integrated Circuits, Pearson Education
3. Boylestad and Nashelsky : Electronic Devices and Circuit Theory, PHI
4. Sendra and Smith : Microelectronics, Oxford Press
5. Graham Bell : Electronic Devices and Circuits , PHI
6. Donald A Neamen : Electronic Circuits Analysis and Design, TMH
7. Salivahanan et al : Electronic Devices and Circuits, TMH

List of Experiments (Expandable):

All experiments (wherever applicable) should be performed through the following steps. **Step 1:** Circuit should be designed/ drafted on paper. **Step 2:** The designed/drafted circuit should be simulated using Simulation S/W (TINA-V7/ PSPICE/ Labview/ CIRCUIT MAKER). **Step 3:** The designed/drafted circuit should be tested on the bread board and compare the results with the simulated results. **Step 4:** The bread board circuit should be fabricated on PCB prepared on PCB machine..

1. Char. Of Op-Amp (input offset voltage, slew rate, CMRR, BW, input bias current).
2. Linear application of Op-Amp (voltage follower, inverting and non-inverting amplifier and their frequency response, adder, subtractor, differential amplifier, integrator and differential frequency response)
3. To design and construct a shunt and series regulator and find line and load regulation.
4. Design and performance evaluation of transistors amplifiers in CE, CB and CC configuration
5. Design and performance evaluation of FET amplifiers.
6. Design and performance evaluation of feedback amplifiers.
7. Design and performance evaluation of power amplifiers.
8. Design and performance evaluation of tuned amplifiers.

Course Contents

Category	Title	Code	Credit-6			Theory paper
Departmental Core DC-5	Analog Communication	EC-405	L	T	P	Max. Marks-100 Min. Marks: 35 Duration: 3 hrs.
			3	1	2	

Unit-I Different types of Signals (Continuous, Discrete, Periodic), Time Domain and Frequency Domain Representation, Introduction to basic Transform Techniques applicable to these Signals. **Spectral Analysis:** Fourier Technique, Fourier Transform and their Properties, Transform of Gate Signal, Impulse Function and Unit Step Function, Fourier Transform Technique for Periodic Signal, Transform of Train of Pulses and Impulses, Sine and Cosine wave.

Signal Energy and Power, Spectral Density of various types of signals, Spectra (Parseval's Theorem), Density Spectra of Periodic Gate and Impulse train.

Linear Time Invariant (LTI) Systems, Impulse Response, Convolution, Convolution with Impulse Function, Casual and Non Casual System, Distortion less System, Impulse Response of Distortion less System, Ideal Filter and Practical Filter.

Unit-II : Modulation Techniques: Need and types of modulation techniques, Amplitude Modulation, Frequency Spectrum, Power Distribution, Modulation by Complex Signal, Low Level and High Level AM Modulators, Linear Integrated Circuit AM Modulators, Suppressed Carrier Generation (Balance/Chopper and Square Law Modulation), SSB Generator (Phase and Frequency Discrimination Method), VSB Transmission and Application. Detection of AM signals: Envelope Detector Circuit, RC Time Constant, Synchronous Detection Technique, Error in Synchronous Detection, SSB signal detection, PLL and its use in demodulation.

Unit-III : Angle Modulation: Frequency and Phase Modulation Frequency spectrum, bandwidth requirement, Frequency and Phase Deviation, Modulation Index, NBFM and WBFM, Multiple frequencies FM. FM Modulators: Direct (Parameter Variation Method) and Indirect (Armstrong) Method of frequency modulation. FM Detector: Slope Detector, Foster Seely Discriminator, Ratio Detector and PLL detectors.

Unit-IV : Radio Transmitters: AM transmitter, block diagram and working of Low Level and High Level Transmitters, Trapezoidal Pattern and Carrier Shift, SSB Transmitters, FM transmitters - Frequency Multiplication Applied to FM Signals, FM transmitters.

Radio Receivers: Block Diagram of Radio Receiver, Receiver Characteristics (Selectivity, Fidelity and Sensitivity), AM Receiver, RF Receiver, Super-heterodyne Receiver, RF Amplifier, Frequency Mixer, AVC and AFC, Image Signal, Intermediate Frequency Selection, Diversity Reception, FM Receiver.

Unit-V Noise : Sources and types of noise and their power density, White Noise, Noise from Single and Multiple noise source for Linear Systems, Super Position of Power Spectrum, Equivalent Noise Bandwidth, Noise Figure, and Equivalent Noise Temperature, their Relationship, Calculation of Noise Figure and Noise Temperature for Cascade Systems, Noise Performance of Communication System, Band Pass Noise Representation in Terms of Low Pass, In-phase and Quadrature Phase Component and their Power Spectral Density, Figure of Merit, Calculation for AM, AM-SC and SSB System, Noise in Angle Modulate System, Figure of Merit for FM, Noise Density of Output of FM Detector, Pre-emphasis and De-emphasis, Phasor Representation of Noise, Capture Effect, Comparison of Noise Performance of AM and FM.

References:

1. B.P. Lathi : Modern Analog and Digital Communication System, Wiley Eastern limited
2. Taub and Schilling : Principles of communication Systems, TMH

3. Singh and Sapre : Communication Systems, TMH
4. S Haykin : Communication Systems, John Wiley and Sons Inc
5. S Ghose, Signals and Systems, Pearson Education.
6. A Bruce Carlson : Communication System, TMH
7. Steven : Communication Systems – Analysis and Design, Pearson Education
8. Hsu: Analog and digital communication (Schaum); TMH

List of Experiments (Expandable):

All experiments (wherever applicable) should be performed through the following steps. **Step 1:** Circuit should be designed/ drafted on paper. **Step 2:** The designed/drafted circuit should be simulated using Simulation S/W (TINA-V7/ PSPICE/ Labview/ CIRCUIT MAKER). **Step 3:** The designed/drafted circuit should be tested on the bread board and compare the results with the simulated results. **Step 4:** The bread board circuit should be fabricated on PCB prepared on PCB machine..

1. Analysis of AM Modulation and Demodulation Techniques (Transmitter and Receiver), Calculation of Parameters
2. Analysis of FM Modulation and Demodulation (Transmitter and Receiver) and Calculation of Parameters
3. To Construct and Verify Pre-emphasis and De-emphasis and Plot the Waveforms.
4. Study of Super-heterodyne Receiver and Characteristics of Radio Receiver.
5. To Construct Frequency Multiplier Circuit and to Observe the Waveform
6. Study of AVC and AFC.
7. Study of PLL chip (566) and its use in various systems

Course Contents

Category	Title	Code	Credit-4			Practical
IT-3	Software lab - I	EC- 406	L	T	P	Max. Marks-50 Min. Marks: 25 Duration: 3 hrs.
			-	-	4	

SECTION-A MATLAB

Introduction to MATLAB, Study of MATLAB programming environment, Modeling, Design and development of Programs.

Programs Related to Analog Communication- (Example-Plots of Different Signals and their Fourier Transforms, Computation of Linear and Cyclic Convolution between Two Signals, Simulation of Different Types of modulation, AM Transmitter and Receiver, FM Transmitter and Receiver, Simulation of a Communication System (Generation, addition of noise and Detection).

Programs Related to Control System- Open-Loop and Closed Loop Control System Response using MATLAB, Determining Transient Response, Specification of Second Order System, Effect of PID controller on Control System, Bode Plot, Nyquist Plot and Root Locus Plot.

SECTION-B CIRCUIT SIMULATION/ PCB DESIGNING SOFTWARES

Study of Circuit Simulation Software (any one - TINA-PRO/ PSPICE/ Labview/ CIRCUIT MAKER).
PCB Layout Software (any one - PROTEL/ ORCADE/ ALTERA).

Design and Simulation of basic Electronic Circuits (Example Rectifiers, Amplifiers, Oscillators, Digital Circuits, Transient and steady state analysis of RC/RL/RLC circuits etc). Design and fabrication of PCB pertaining to various circuits studied on PCB machine.

References:

1. Chapman Stephen J.: MATLAB Programming for Engineers, 3rd Edition, Thomson /Cengage.
2. Rudra Pratap: Getting Started with MATLAB 7, Oxford University Press (Indian Edition).
3. Palm; Matlab 7.4; TMH.
4. Proakis John G.: Contemporary Communication System Using MATLAB; Thomson Vikas Pub.
5. B.S. Manke: Linear Control Systems - with MATLAB Application, Khanna Publishers.
6. Simulation/Designing Software Manuals.
7. Hassan S; Automatic Control Systems (with MATLAB Programming); Kataria and Sons, Delhi.

List of Experiments/ Programs:

Programs to be performed based on the topics contained in the syllabus.