West Bengal University of Technology

BF-142, Salt Lake City, Kolkata-700064

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STRUCTURE

3rd Semester Structure

A. Theory							
SI No.	**Code**	**Subject**	**Contacts Periods/Week**				**Credits**
			L	**T**	**P**	**Total**	
1.	M 302	Mathematics	3	1	--	4	4
2.	EE 301	Circuit Theory & Networks	3	1	--	4	4
3.	EC 301	Solid State Devices	3	0	--	3	3
4.	CS 302	Data Structure & Algorithms	3	1	--	4	4
5.	M(CS) 312	Numerical Methods & Programming	3	0	--	3	3
6.	EI 302	Electronic Measurement & Instrumentation	3	1	--	4	4
		Total Theory				**22**	**22**
B. Practicals							
	EE 391	Circuit & Network Lab	--	--	3	3	2
	CS 382	Data Structure & Programming Lab	--	--	6	6	4
	EI 382	Electronic Measurement & Instrumentation Lab	--	--	3	3	2
Total Practical						**15**	**8**
		Total of Semester				**37**	**30**

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4th Semester Structure

A.THEORY:

A. Theory							
	Code	**Theory**	**Contacts Periods/Week**				**Credits**
			L	**T**	**P**	**Total**	
	EC 401	Analog Electronic Circuits	3	1	0	4	4
	EC 402	Digital Electronic Circuits	3	1	0	4	4
	EC 403	Analog Communication	3	1	0	4	4
	EC 404	Electromagnetic waves & radiating Systems	3	1	0	4	4
	EC 405	Micro electronic & Opto electronic devices	3	1	0	4	4
Total Theory						**20**	**20**

B. PRACTICAL:

B. Practicals							
	Code	**Practicals**	**Contacts Periods/Week**				**Credits**
			L	**T**	**P**	**Total**	
	EC 491	Analog Electronic Circuits Lab	0	0	3	3	2
	EC 492	Digital Electronic Lab	0	0	3	3	2
	EC 493		0	0	3	3	2
	EC 494	Prop. & Antenna Lab Analog Communication Lab	0	0	3	3	2
Total Practical						**12**	**8**

C. SESSIONAL:

HU 481	Technical Report writing & / Language Practice Lab	0	0	0	3	2
	TOTAL OF SESSIONAL				3	2
	TOTAL OF SEMESTER :				**35**	**30**

West Bengal University of Technology

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5th Semester Structure

A. THEORY:

CODE	THEORY	Contacts periods Per week			Total	Credits
		L	T	P		
EC-501	Telecommunication System	3	1	0	4	4
EC-502	Digital Communication	3	1	0	4	4
EC-503	Computer Architecture & Organization	3	1	0	4	4
EC-513	Control System	3	1	0	4	4
EI(ECE)-502	Microprocessor & Microcontroller	3	1	0	4	4
	TOTAL OF THEORY	**15**	**5**	**0**	**20**	**20**

B. PRACTICAL:

CODE	PRACTICAL	Contacts periods Per week			Total	Credits
		L	T	P		
EC-592	Digital Communication Lab	0	0	3	3	2
EC-583	Control System lab	0	0	3	3	2
EI(ECE)-592	Microprocessor & Microcontroller Lab	0	0	3	3	2
	TOTAL OF PRACTICAL	**0**	**0**	**9**	**9**	**6**

	TOTAL OF SEMESTER	**29**	**26**

West Bengal University of Technology

BF-142, Salt Lake City, Kolkata-700064

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6th Semester Structure

A. Theory						
Code	**Theory**	**L**	**T**	**P**	**Total**	**Credits**
HU 601	Industrial Management	3	0	0	3	3
EC 601	Digital Signal Processing	3	1	0	4	4
EC 602	Computer Communication & Networking	3	1	0	4	4
EC 603	Power Electronics	3	1	0	4	4
EC604	VLSI Circuits & Systems	3	1	0	4	4
Total of Theory					**19**	**19**

B. Practical						
Code	**Practicals**	**L**	**T**	**P**	**Total**	**Credits**
EC 691	Digital Signal Processing Lab	0	0	3	3	2
EC694	VLSI Circuits & Systems Lab	0	0	3	3	2
Total of Practicals					**6**	**4**

C. Sessional						
Code	**Sessionals**	**L**	**T**	**P**	**Total**	**Credits**
EC 682	Seminar-I	0	0	3	3	2
EC 683	Electronic Circuit Design Lab	0	0	5	5	4
	Total of Sessionals				**8**	**6**
Total of Semester					**33**	**29**

6 –Week Industrial Training during Summer Vacation

West Bengal University of Technology

BF-142, Salt Lake City, Kolkata-700064

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ECE 7th Semester Structure

A. Theories

Sl. No.	Code	Subject	Contacts Periods/Week			Total	Credit
			L	T	P		
1	EC701	RF & Microwave Engineering	3	1	0	4	4
2	EC702	EDA for VLSI Design	3	1	0	4	4
3	EC703	Coding & Information Theory	3	1	0	4	4
4	EC 704	Elective-I	3	0	0	3	3
		Total of theory				**15**	**15**

B. Practicals

Sl. No.	Code	Subject	Contacts Periods/Week			**Total**	Credit
			L	T	P		
1	EC791	Microwave Engineering Lab	0	0	3	3	3
2	EC792	EDA Lab	0	0	3	3	3
		Total of practical				**6**	**6**
					Total	**21**	**21**

C. Sessionals

Sl. No.	Code	**Subject**	**Contacts Periods/Week**			**Total**	**Credit**
			L	**T**	**P**		
1	EC783	Project-I	0	0	3	3	2
2	EC784	Group discussion	0	0	3	3	4
Total of sessionals						**6**	**6**
Total credit of semester							**27**

Elective-I

	Code	Subject
1	EC704A	System Programming & Operating System
2	EC704B	Advanced Engineering Mathematics for Electronic Engineers
3	EC704C	Database Management System
4	EC704D	Process Control Engineering
5	EC704E	Pattern Recognition & Machine Intelligence
6	EC704F	Telecommunication Network Management

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BF-142, Salt Lake City, Kolkata-700064

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SYLLABUS
Syllabus
Third Semester

MATHEMATICS
Code: **M 302**
Contacts: **3L + 1T**
Credits: **4**

Fourier Series:
Introduction: Euler's formula; Problems on general Fourier Series; Conditions for Fourier Expansion; Fourier Expansions of Discontinuous Functions; Even and Odd functions; Change of interval; Half range series; Typical Waveforms (Square, Saw-toothed, Triangular, Half Wave rectifier, Full Wave rectifier); Parseval's Identity (statement only); Fourier Transform (FT) and its properties; Inverse Fourier Transform (statement only); Fourier transform of derivative (statement only); Convolution (statement only); Application of Fourier Transform in solving partial differential equations — Laplace's Equation (2D only), Heat Conduction Equation (1D only) and Wave Equation (1D only). *12L*

Calculus of Complex Variable:
Functions; Limits and Continuity; Analytic Functions; Cauchy Riemann Conditions; Analytic Continuation; Complex Integration and Cauchy's Theorem; Cauchy's Integral Formula; Taylor's and Laurent Series; Zeros of an Analytic Function; Poles; Essential Singularities; Residue Theorem (statement only) and it's application to evaluation of integral; Introduction to Conformal Mapping; Simple problems. *14L*

Probability and Statistics:
Mean, Median, Mode and Standard Deviation; Samples Space; Definition of Probability; Conditional Probability; General Multiplication Theorem; Independent Events; Bayes' Theorem; Random Variable; Discrete and Continuous Probability Distributions - Probability mass function; Probability density function; Distribution Function; Expectation; Variance; Probability Distribution—Binomial, Poisson and Normal. Correlation and Regression; Method of Least Squares; Linear Curve Fitting. *10L*

Graph Theory:
Graphs; Digraphs; Isomorphism; Walk; Path; Circuit; Shortest Path: Dijkstra's Algorithm; Tree; Properties of Tree; Binary Tree; Fundamental Circuit; Minimal Spanning Tree: Kruskal's Algorithm; Prim's Algorithm. Cut Set; Fundamental Cut Set and Cut Vertices; Matrix Representation of Graphs (Adjacency and Incidence Matrices); Network; Flow Augmenting Path; Ford-Fulkerson Algorithm for Maximum Flow; Max Flow – Min Cut Theorem (statement only). *12L*

Total 48L

Text Books:

1. Rathor, Choudhari,: Descrete Structure And Graph Theory.
2. Gupta S. C and Kapoor V K: Fundamentals of Mathematical Statistics - Sultan Chand & Sons.
3. Lipschutz S: Theory and Problems of Probability (Schaum's Outline Series) - McGraw Hill Book. Co.
4. Spiegel M R: Theory and Problems of Probability and Statistics (Schaum's Outline Series) - McGraw Hill Book Co.
5. Goon A.M., Gupta M K and Dasgupta B: Fundamental of Statistics - The World Press Pvt. Ltd.
6. Spiegel M R: Theory and Problems of Complex Variables (Schaum's Outline Series) - McGraw Hill Book Co.
7. Bronson R: Differential Equations (Schaum's Outline Series) - McGraw Hill Book Co.

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8. Ross S L: Differential Equations - John Willey & Sons.
9. Sneddon I. N.: Elements of Partial Differential Equations - McGraw Hill Book Co.
10. West D.B.: Introduction to Graph Theory - Prentice Hall/Pearson Education
11. Deo N: Graph Theory with Applications to Engineering and Computer Science - Prentice Hall.
12. Grewal B S: Higher Engineering Mathematics (thirtyfifth edn) - Khanna Pub.
13. Kreyzig E: Advanced Engineering Mathematics - John Wiley and Sons.
14. Jana- Undergradute Mathematics
15. Lakshminarayan- Engineering Math 1.2.3
16. Gupta- Mathematical Physics (Vikas)
17. Singh- Modern Algebra
18. Rao B: Differential Equations with Applications & Programs, Universities Press
19. Murray: Introductory Courses in Differential Equations, Universities Press
20. Delampady, M: Probability & Statistics, Universities Press
21. Prasad: Partial Differential Equations, New Age International
22. Chowdhury: Elements of Complex Analysis, New Age International
23. Bhat: Modern Probability Theory, New Age International
24. Dutta: A Textbook of Engineering Mathematics Vol.1 & 2, New Age International
25. Sarveswarao: Engineering Mathematics, Universities Press
26. Dhami: Differential Calculus, New Age International

Circuit Theory & Networks
Code: EE 301
Contact: 3L + IT
Credit: 4

Different types of systems & networks: continuous & Discrete, Fixed and Time varying, Linear and Non-linear, Lumped and distributed, Passive & Active Networks & Systems
Laplace transform of impulse and sinusoidal steps waveforms for RL, RC, LC and RLC Circuits. Transient analysis of different electrical circuits with and without initial conditions, Fourier Series and Fourier Transform
Network theorems and their applications in circuit analysis, Formulation of network equations, Source transformations, Loop variable analysis and node variable analysis
Graph of network, concept of tree branch, tree link. Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials
Two port networks, Open circuit Impedance and Short circuit Admittance parameters, Transmission parameters, hybrid parameters, and their inter-relations
Indefinite admittance matrix- their applications to the analysis of active network
Active filter analysis and synthesis using operational amplifier

SPICE: How SPICE works. Model statement, models for passive and active device, D.C. circuits analysis, small signal analysis, capacitors and inductors in D.C. Circuits, steady state and transient, plotting and printing, input and output Impedance, D.C. sensitivity analysis, harmonic decomposition (Fourier Series), Harmonic re-composition, voltage controlled components

Text books **:**

1. Sudhakar:Circuits & Networks:Analysis & Synthesis 2/e TMH New Delhi
2. Valkenburg M. E. Van, "Network Analysis", Prentice Hall./Pearson Education
3. Engineering circuit analysis with PSPICE and probe-Roger
4. Engg Circuit Analysis,: Hayt 6/e Tata Mcgraw-Hill
5. A. Chakravarty: Networks, Filters & Transmission Lines
6. D.Chattopadhyay and P.C.Rakshit: Electrical Circuits
7. A.V. Oppenheimer and A.S.Wilsky: Signals & Systems, PHI/Pearson
8. R.V.Jalgaonkar.: Network Analysis & Synthasis.EPH.

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9 . Sivandam- Electric Circuits and Analysis, Vikas
10. V.K. Chandna, A Text Book of Network Theory & Circuit Analysis, Cyber Tech

References **:**

1.Reza F. M. and Seely S., "Modern Network Analysis", Mc.Graw Hill Book Company
2.Roy Choudhury D., "Networks and Systems", New Age International Publishers.
3.Kuo F. F., "Network Analysis & Synthesis", John Wiley & Sons.

Data Structures and Algorithms
Code: CS 302
Contact: 3L + IT
Credit: 4

Overview of C language
Time and Space analysis of Algorithms - Order Notations.

Linear Data Structures - Sequential representations - Arrays and Lists, Stacks, Queues and Dequeues, strings, Application.

Linear Data Structures - Link Representation - Linear linked lists, Circularly linked lists. Doubly linked lists, application.

Recursion - Design of recursive algorithms, Tail Recursion, When not to use recursion, Removal of recursion.

Non-linear Data Structure : Trees - Binary Trees, Traversals and Threads, Binary Search Trees, Insertion and Deletion algorithms, Height-balanced and weight-balanced trees, B-trees, B+ -trees, Application of trees; Graphs - Representations, Breadth-first and Depth-first Search.

Hashing - Hashing Functions, collision Resolution Techniques.

Sorting and Searching Algorithms - Bubble sort, Selection Sort, Insertion Sort, Quicksort, Merge Sort, Heapsort and Radix Sort.

File Structures - Sequential and Direct Access. Relative Files, Indexed Files - B+ tree as index. Multi-indexed Files, Inverted Files, Hashed Files.

Text books:

1. Data Structures and Algorithms- O.G.Kadke and U.A.Deshpandey, ISTE/EXCEL
2. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., "Data Structures and Algorithms", Pearson Education
3. Ajoy Agarwal.: Data Structures Through C.Cybertech.
4. Lipschutz: Data Structures TMH

References :

1.Heileman: Data structures,algorithims &OOP Tata McGraw Hill
2. Data Structures Using C, M.Radhakrishnan and V.Srinivasan, ISTE/EXCEL BOOKS
3.Weiss Mark Allen, "Algorithms, Data Structures, and Problem Solving with C++", Pearson Education.
4. Horowitz Ellis & Sartaj Sahni, "Fundamentals of Data Structures", Galgotria Pub.
5. Tanenbaum A. S. , "Data Structures using 'C' "Pearson Education

NUMERICAL METHODS AND PROGRAMMING
Code: M(CS) 312
Contacts: 3L
Credits: 3

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Computer Number Systems; Overflow and underflow;
Approximation in numerical computation; Truncation and round off errors; Propagation and control of round off errors; Chopping and rounding off errors; Pitfalls (hazards) in numerical computations (ill conditioned and well conditioned problems). *2L*

Algorithmic Approach in C Language to all the Numerical Problems Discussed below must be followed:

Interpolation:
Lagrange's Interpolation, Newton's forward & backward Interpolation Formula. Extrapolation; Newton's Divided Difference Formula; Error; Problems. *4L*

Numerical Differentiation:
Use of Newton's forward and backward interpolation formula only. *1L*

Numerical Integration:
Trapezoidal formula (composite); Simson's 1/3rd formula (composite); Romberg Integration (statement only); Problems. *2L*

Numerical Solution of System of Linear Equations:
Gauss elimination method; Matrix Inversion; Operations Count; LU Factorization Method (Crout's Method); Gauss-Jordan Method; Gauss-Seidel Method; Sufficient Condition of Convergence. *6L*

Numerical Solution of Algebraic and Transcendental Equations:
Iteration Method: Bisection Method; Secant Method; Regula-Falsi Method; Newton-Raphson Method. *4L*

Numerical solution of Initial Value Problems of First Order Ordinary Differential Equations:
Taylor's Series Method; Euler's Method; Runge-Kutta Method (4th order); Modified Euler's Method and Adams-Moulton Method. *6L*

C Language Overview:
Loop; Recursion; Function; Array; Pointers; Structures and Unions; Various types of File Access Methods: Sequential, Indexed Sequential, Random; Binary. *11L*
Various types of Files in C and Various types of File Handling Statements in C

Total 36L

Implementation above Numerical & Statistical Problems in C Language;

Text Books:

1 Numerical Analysis & Algorithms, Pradeep Niyogi, TMH, 1st ed.
2 C Language and Numerical Methods by C.Xavier
3 Introductory Numerical Analysis by Dutta & Jana
4 Numerical Method:Balagurusamy
5 Numerical Mathematical Analysis by J.B.Scarborough
6 Numerical Methods (Problems and Solution) by Jain, Iyengar , & Jain
7 Numerical Methods In Computer Applications – P.U.Wayse. EPH
8 Computer Oreinted Numerical Method- Dutta,N. ,Vikas
9 Numerical Methods with Programs in Basic Fortran Pascal & C++ - S.B.Rao, Universities Press
10 Computer Programming & Numerical Analysis – N.Dutta, Universities Press

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11 Numerical Methods for Engineers – Gupta, New Age International
12 Numerical Solutions of Differential Equations – Jain M.K.,New Age International
13 Numerical Methods for Scientific & Engg Computation – Jain M.K.,New Age International
14 Numerical Analysis – Rao G.S.,New Age International
15 Discrete Mathematical Structures – Rao G.S., New Age International
16 Foundations of Discrete Mathematics – Joshi K.D., New Age International
17 Applied Discrete Structures – Joshi, New Age International
18 Groups, Rings & Modules with Applications – Adhikari, M.R.,Universities Press

Electronic Measurement and Instrumentation (EI-302)

Sec I - **Basic Measurement Techniques:** Moving coil, Moving Iron, dynamometer, Wattmeter, Electro-static Instruments,

Sec II - **Errors in Measurement :** Definition of accuracy, precision speed of response, non-linearity, techniques of linearization, classification of errors. Statistical analysis. Introduction to reliability.

Sec III - **AC Bridges:** Wheatstone Bridge Principle, Kelvin, Wein, Anderson Desauty and Scherring Bridges, measurement of inductance, capacitance and frequency

Sec IV - **Cathode Ray Oscilloscope:** Construction and principle of operation. Sweep and sweep synchronization. Measurement of various parameters by CRO. High frequency and low frequency limitations – sampling and storage oscilloscopes.

Sec V - **Frequency domain instruments :** Wave analyzer, spectrum analyzer

Sec VI - **Digital Instrumentation** – DVM, DMM, frequency counter

Sec VII - **Transducers and actuators:** piezoelectric sensors, LVDT, Measurement of pressure, Temperature and flow

Sec VIII - **Special Purpose Instruments:** Signal generators, Q-meter

Books-

Text:
1) Electronic Instrumentation – by Kalsi (2/e) (TMH)
2) Modern Electronic Instrumentation and Measuring Instruments: by Helpic & Cooper – PHI/Pearson Education

Reference

1) Instrumentation, Measurement and Analysis (2/e) by Nakra & Chowdhury
2) Electrical Measuring Instruments & Measurements – by Golding & Wides
3) A course in Electrical & Electronic Measurement & Instruments – A.K. Sawhany (Dhanpat Rai)
4) Elements & Electronic Instrumentation and Measurement (3/e) – by J. Carr (Pearson)
5) Digital Instrumentation – by Bowens (TMH)

Circuits & Networks Lab

Code: EE 391
Contact: 3P
Credit: 2

List of Experiments:

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1. Transient response in R-L and R-C Network: Simulation/hardware
2. Transient response in R-L-C Series & Parallel circuits Network: Simulation/hardware
3. Determination of Impedance (Z) and Admittance(Y) parameters of two port network
4. Frequency response of LP and HP filters
5. Frequency response of BP and BR filters
6. Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form
7. Evaluation of convolution integral, Discrete Fourier transform for periodic & non-periodic signals and simulation of difference equations using MATLAB

19 Representation of poles and zeros in z-plane, determination of partial fraction expansion in z-domain and cascade connection of second order system using MATLAB

20 Determination of Laplace transform and inverse Laplace transformation using MATLAB

21 Spectrum analysis of different signals

Note: An Institution/College may opt for some other software or hardware simulation wherever possible in place of MATLAB

Electronic Measurement & Instrumentation Lab (EI382)

Module - I

1. Instrument workshop – observe the construction of PMMC, Dynamometer, Electro thermal and Rectifier type instrument, Oscilloscope and digital multimeter.

Module - II

2. Calibrate moving iron and electrodynamometer type ammeter/voltmeter by potentiometer
3. Calibrate dynamometer type Wattmeter by potentiometer
4. Calibrate A. C. energy meter

Module - III

5. Measure the resistivity of material using Kelvin Double Bridge
6. Measurement of power using Instrument transformer
7. Measurement of power in Polyphase circuits

Module-IV

8. Measurement of Frequency by Wien Bridge using Oscilloscope
9. Measurement of Inductance by Anderson Bridge
10. Measurement of Capacitance by De Sauty Bridge

Module - V

11. Study of static characteristic (accuracy, precision, hysteresis, repeatability, linearity) of a measuring instrument.
12. Study of dynamic characteristic (fidelity, speed of response)

Module - VI

13. Acquaintance with basic structure of DMM and measurement of different electrical parameters.

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Module - VII

14. Statistical analysis of errors in measurement using computer simulation

Module-VIII

15. Study of A/D converter along with its associate circuitry
16. Study of D/A converter

Module - IX

17. Realization of Data Acquisition System

Module -X

18. Wave and spectrum analysis using digital storage oscilloscope & spectrum analyzer.

Note: Each module is to be covered and at least 12 experiments are to be performed.

Solid State Deices EC – 301

Sec I Physics of semi conductor; Crystal lattice, e k diagram, concept of hole, effective mass, mobility-drift and diffusion

Sec II Junction Devices : P N and metal semiconductor conductor junctions, rectifier and detector diodes, photovoltaic effect, solar cells, zener and varacter diodes

Sec III Bipolar transistor – physical mechanism current gain, punch-through and avalanche effect. Equivalent circuit –h and pi-parameters

Sec IV Field Effect Transistors:- JFETS, MOS-capacitor flat band and threshold voltages-P and N channel. MOSFETS, CMOS and VLSI MOSFETS, enhancement and depletion mode devices

Sec V Negative Resistance devices – tunnel, Gunn & Impatt diode

Sec VI Elements of Fabrication Technology

Books:

Text Books: 1) Semiconductor physics and Devices by Neamen (TMH)
2) Principles of semiconductor devices by Dimitrijev (oxford)

Reference Books 1) Microelectronics (2/e) by millman & Grabel (TMH)
2) Solid state Electronic Devices (5/e)- by Streetman & Banerjee (PHI)/Pearson Education
3) Electronic Devices and Circeits by Cathey (schaum services) – (TMH)

Data Structure & Programming Lab
Code: CS 382
Contact: 6P
Credit: 4

Experiments should include but not limited to:

Module-I Implementation of array operations:

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Module -II	Stacks and Queues : adding, deleting elements circular Queue: adding & deleting element Merging Problem: Evaluation of expressions operations on Multiple Stacks & Queues
Module -III	Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues using linked lists:
Module -IV	Polynomial addition, Polynomial multiplication Sparse Matrices: Multiplication, addition.
Module -V	Recursive and Non-recursive traversal of Trees Threaded binary tree traversal. AVL tree implementation. Application of Trees, Application of sorting and searching algorithms
Module -VI	Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

Module – VII

1. Assignments on Interpolation: Newton forward & backward, Lagrange
2. Assignments on Numerical Integration: Trapezodial Rule, Simson's 1/3 Rule, Weddle's Rule

Module – VIII

1. Assignments on Numerical solution of a system of linear equation: Gauss elimination, Gauss Jacobi, Matrix Inversion, Gauss Seidal

Module – IX

1. Assignments on Algebric Equation: Bisection, Secant, Regular – falsi, Newton Raphson.

Module – X

1. Assignments on Ordinary Differential Equation: Taylor Series, Euler's method, Runga-Kutta

Module – XI

1. Assignments on Statistical Problem: Mean, Median, Mode, Standard deviation (for simple & frequency type data), Correlation & Regression.

Module-XII

1. Innovative Expt on data structure programming
2. Innovative Expt on numerical analysis programming.

4th Semester

EC401: **Analog Electronic Circuits**

1] Introduction to Analogue Circuits: Active & Passive Devices,overview of analog circuits,application of analog circuits-implementation etc. [2]

2] Diodes and their Applications: Characteristics of ideal & real diodes,diode circuits-rectifiers,clipping,clamping,special types of diodes & their applications-schottky,varactor,photodiodes,LEDs. [3]

[3] Bipolar Junction Transistors and Amplifiers: Characteristics of BJT; Ebers-Moll equations and large signal models; inverse mode of operation, early effect; BJT as an amplifier and as a switch; DC biasing of BJT amplifier circuits; small signal operations and models; Single state BJT amplifiers – CE, CB and CC amplifiers; high frequency models and frequency response of BJT amplifiers; Basic design in discrete BJT amplifiers; complete design examples; Basic BJT digital logic inverter; SPICE modeling of BJT and amplifier circuits. [6]

[4] MOSFETS and Circuits: MOSFET -operational Characteristics; PMOS, NMOS and CMOS current voltage characteristics; SPICE model of MOSFET; DC analysis; Constant Current Sources and Sinks; MOSFET as an Amplifier and as a Switch; Biasing on MOS Amplifiers; Small Signal Operation of MOS amplifiers; Common-source, common gate and source Follower Amplifiers; CMOS amplifiers; MOSFET Digital logic inverters; voltage transfer characteristics, SPICE modeling of MOSFET circuits. [6]

[5] Voltage & Power: Classification amplifiers; Class A, Class B, Class AB Class C – Circuit operation, transfer characteristics, power dissipation, efficiency. Practical BJT and MOS power transistors; thermal resistance; heat sink design; IC power amplifiers. [3]

[6] Feedback in Amplifiers and Oscillators: Feedback concept and definition; Four basic feedback topologies; Analysis of Series-shunt, series-series, shunt-shunt and shunt-series feedback amplifiers; stability in feedback amplifiers, frequency compensation; principle of sinusoidal oscillators and barkhausen criterion; Active-RC and Active-LC sinusoidal oscillators; Wien Bridge; Phase-Shift; Quadrature Oscillators; Crystal Oscillators,application in voltage regulation [3]

[7] Differential Amplifiers: Advantages of differential amplifiers; MOS and BJT differential pair; Small signal and large signal operation of differential pairs; Parameters and non-ideal characteristics of differential amplifiers; differential amplifier with active load frequency response; spice simulation examples. [2]

[8] Operational Amplifiers and its Applications: Concept of operational amplifiers; Ideal operational amplifier parameters; Inverting and noninverting configurations; Common OPAMP Ics:Gain-frequency and Slew rate; SPICE modeling and simulation examples; Instrumentation amplifiers; Integrators, Differentiators; Logarithmic Amp; Multipliers; Comparators; Schmitt triggers [5]

[9] Filters and Tuned Amplifiers: Filter characteristics and specifications; First and Second Order Filter functions; First-order and second order filter network using OPAMPS; Tuned Amplifiers; Basic principle; amplifiers with multiple tuned circuits; Synchronous and Stagger tuning; RF amplifiers considerations. [5]

[10] Waveform Generation and Shaping Circuits: Multivibrators – Astable, monostable and bistable circuits; bistable circuit as memory element comparator generation of square, triangular waveforms and standardized pulse using AMV and MMV; Application of 555 timer. [5]

Total: [40] Lectures

Books

1] Microelectronic Circuits – Sedra and Smith (Fifth Edition) (Oxford)
2] Microelectronics – Analysis and Design – Sundaram Natarajan (TMH)

Reference

1] Electronic Circuits – D.L. Schilting and C. Belove (TMH)
2] Sergio Franco – Operational Amplifier (JMH)
3] Millman and Halkias – Integrated Electronics – TMH Op Amp and Linear Ics.
4] R. A. Gackward – PHI/Pearson Education
5] Electronic Devices and Circuit theory – Boylestead and Nashesky – PHI/Pearson Education

West Bengal University of Technology

BF-142, Salt Lake City, Kolkata-700064

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Digital Electronic Circuits (EC 402)

1) **Number System and Codes**:
Decimal, binary, octal and hexadecimal number systems and their arithmetic operations; conversion of one number system to another. Signed and floating point representations of binary numbers. 1's complement and 2's complement representations.
Binary codes, natural BCD codes; weighted, non-weighted, sequential, self-complementing and cyclic codes; Excess-3, Alphanumeric, EBCDIC and Gray codes; code conversion- from one code to another; error detection and correction using parity and Hamming code. [5]

2) **Logic Gates and Boolean Algebra**
Basic logic gates -NOT, AND, OR, NAND, NOR, XOR and XNOR –operations, truth tables and Venn diagram representations; universal gates; commonly used 7400 series IC's; standard and IEEE symbols of logic gates; postulates and laws of Boolean algebra, De Morgan's theorem; Canonical forms of expressions, minterms and maxterms, SOP and POS forms. [4]

3) **Simplification of Logic Expressions**
Simplification and minimization of logic expressions using Boolean algebra, K-maps, and Quinn McClusky methods (up to 6 variables); use of don't care terms. [4]

4) **Combinational and arithmetic logic circuits**: multiplexers and demultiplexers and their cascading; design with multiplexers; decoders and encoders, priority encoders, parity generator and checkers, comparators; Arithmetic circuits- Half adder, Full adder and common adder /subtractor circuit using logic gates, multiplexers and decoders; CLA adder. BCD adder and subtractor. [6]

5) **Memory and Programmable Logic Devices:**
Memory elements; ROM in combinational logic circuits, RAM, EPROM, EEPROM, Flash ROM,DRAM, SDRAM. Memory expansion; Programmable and gated array devices for designing combinational circuits-PAL, PLA, PLD, CPLD, FPGA with examples. [4]

6) **Sequential Logic Circuits**
Flip-flop as memory element; S-R, J-K, D and T type flip-flops and their conversions; master-slave configuration; edge triggered and level triggered clock; registers; left, right, serial, parallel and universal shift registers; synchronous and asynchronous counters; binary, modulo-N and arbitrary sequence counters; ring and Johnson (twisted ring) counters. [6]

7) **Finite State Machines:**
Brief introduction to finite automata theory; Moore, Mealy and Turing machine; state diagram, state variable, state table and state minimization. design of state machines using combinational logic circuits and memories [3]

8) **Logic Families**:
Evolution of logic families, TTL, ECL, MOS, CMOS and BiCMOS logic families - their properties and comparison; TTL outputs, - totem pole, tri-state and open collector; TTL-CMOS interfacing [5]

9) **Analog- Digital Conversion**
D/A conversion- R-2R ladder type, weighted resistor type, switched current type and switched capacitor type; A/D conversion-counter type, flash type, tracking type, successive approximation type and dual-slope type. [3]

TEXT BOOKS:

1) Fundamental of digital circuits by A.Anand Kumar (PHI)
2) Modern digital Electronics (3/e) by R. P. Jain (TMH)
3) Digital design by M. Mano (Pearson)

REFERENCE BOOKS.

1) Digital systems (9/e) by R.J.Tocci, N.S.Widemer,G.L.Mos (Pearson)
2) Digital Fundamentals by T.L.Floyd, R.P.Jain (Pearson)
3) 2000 solved problems in digital electronics by S.P.Bali (TMH)
4) Digital design principals and applications (6/e) by D.P.Leach, A.P.Malvino, G.Saha (TMH)
5) Digital Electronics-Bignell & Donovan,Delmer,Thompson Learning

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6) Digital principals and design by D.D.Givone (TMH)
7) Digital design principals and practices by J.F.Wakerly (Pearson/PHI)

Analog Communication (EC 403)

1. **Introduction-Signal Analysis and Transmission: O**verview of communication- base-band transmission, various types of signals, analog signal, fundamental limitations in communication system- noise, bandwidth and hardware; Modulation and its need and types; Time domain and frequency domain analysis; Fourier series representations- exponential and polar forms; Fourier Transformation, Inverse Fourier Transformation and its properties (with examples);Statistical Methods. [4]

2. **Linear Systems-:** Various types of systems, LTI systems; Low pass and band pass signals; basic concepts on analog filters; Energy and power signals, Parseval's theorem; Laplace transformation, convolution theorems, convolution integral. [4]

3. **Amplitude Modulation (AM):** Generation and transmission of AM signals, DSBSC, SSBSC and VSB with block diagrams, relative merits and demerits of various AM schemes, balance modulators, switching and ring modulators(block diagrams), time domain and frequency domain expressions, phasor diagrams, modulation index, normalized power, side band filter [6]

4. **Demodulation of AM:** Demodulation of AM signals, square law and envelop detectors. Superheterodyne receiver for standard AM radio, effects of frequency and phase errors in local oscillator. Synchronous demodulation of AM, DSB, SSB and VSB; PLL for detection of AM; Comparison of AM systems; Frequency Division Multiplexing and Quadrature-Carrier Multiplexing. [6]

5. **Angle Modulation:** Frequency and phase modulations, phasor diagram, time and frequency domain representation. power calculation, modulation index; Generation of FM signals using Armstrong method, Modulation and Demodulation of FM and PM signals with limiter discriminator and PLL respectively, narrow band and wide-band FM. [6]

6. **Pulse Modulation:** Sampling theory, Shannon's law, PAM, orthogonal signals, Sample and hold, signal reconstruction, PCM, , PWM, PPM techniques. [3]

7. **Practical Communication Systems:** Concept of Multiplexing,Concept of commercial FM radio and Stereo FM radio; Narrow band and wideband modulation;. Recording and reproduction of sound; high fidelity stereophonic systems; compact disc. Television broadcasting- block diagram of TV transmitter and receiver, characteristics of TV transmission; characteristics of receiving and transmitting antennas; VHF & UHF communication. [5]

8. **Random signal and Noise:** Signals power and spectral representations, energy and power signals, auto correlation and cross correlation functions, power spectral density functions, White noise, thermal noise, PSDF of white signal; Noise in communication systems, threshold effect in Angle Modulation, Pre-emphasis and De-emphasis filtering; Signal to noise Ratio(SNR) and Carrier to Interference Ratio(CIR). Noise power, Noise bandwidth of a LTI System and its use in communication.

Narrowband Noise Representation, generation of narrow band noise and its PSDF time domain expressions. [6]

9. **Introduction to Information Theory:** Measure of information, entropy, mutual information; source coding theorem, modeling of communication channels, Gaussian channel capacity. [3]

BOOKS:

TEXT:
1. Communication Systems 5/e –A.B.Carlson- (TMH/MGH)
2. Fundamentals of Communication System – J.G.Proakis & M.Salehi –(Pearson/PHI)
3. Communication Theory –T.G.Thomas & S Chandrasekhar (TMH)

REFERENCE:
1. Principle of Communication Systems- H.Taub & D.L.Schilling (TMH)
2. Analog Communication Systems – Sanjay Sharma (Katson)
3. Modern Digital and Analog Communication Systems- B.P.Lathi (Oxford)
4. Digital and Analog Communication Systems- L.W.Couch (Pearson)
5. Contemporary Communication Systems using MATLAB and Simulink- J.G.Proakis, M.Salehi and G.Bauch (Thomson)

Electromagnetic waves and Radiating Systems
[EC 404]

Electromagnetic theory

1. Basics of Vector Analysis – orthogonal Coordinate Systems, Transformations of coordinate systems; Del operator; Gradient, Divergence, Curl – their physical interpretations; Laplacian operator. [3]

2. Coulomb's law, electric field intensity, charge distribution.; Gauss' law, flux density and electric field intensity. Divergence theorem. Current Densities, Conductors, Poisson's & Laplace's equations, Uniqueness theorem, Biot-Savart law, Ampere's law, Relation between **J** & **H**, Vector magnetic Potential, Stokes' theorem. [4]

3. Faraday's law & Lenz's law, Displacement Current, $\mathbf{J}_C - \mathbf{J}_D$ Relation, Maxwell's equations, Time-harmonic fields, Wave Equation, Boundary Conditions between media interface; Uniform Plane wave; Wave Propagation in Lossy Dielectric, Loss-less Dielectric, Free space. Poynting Theorem, Power flow, Poynting vector.
[4]

4. Transmission Lines: Concept of Lump parameters and Distributed parameters, Line Parameters, Transmission line equations and solutions, Physical significance of the solutions. Propagation constant, Characteristic Impedance; Wavelength; Velocity of Propagation; Distortion-less Line, Reflection and Transmission coefficients; Standing Waves, VSWR, Input Impedance, Smith Chart – Applications; Load Matching Techniques. [5]

Antennas

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5. Retarded Potential Functions, Field solutions; Radiations from Hertz Dipole and short Magnetic Loop; Near-Field and Far-Field Concept. [4]

6. Antenna Parameters & characteristics: Definitions- Radiation Pattern, Beam Area, Beam Efficiency, Directivity, Gain, Antenna Aperture, Aperture Efficiency, Radiation Resistance, Resonant antennas, Wire antennas – Dipole, Folded dipole, Yagi-Uda, Log-periodic, Spiral antennas, Monopole. [4]

7. Aperture antennas: Parabolic Reflector, Cassigrain Feed, Horn Antennas: Pyramidal, Sectoral Horns [3]

8. Antenna Array: Two element Array, Uniform Linear Array; Electronic Scanning, Grating-lobe Concept [4]

Propagation

9. Different modes of Radio Wave Propagation: Ground Wave Propagation, Tilt, Sky Wave Propagation, MUF, Skip Distance, Critical Frequency, Virtual Height. [3]

10. Space Wave Propagation, Modified Refractive Index, Its effects on wave propagation, Propagation over Plane Earth and spherical earth, Anomalous Propagation Diffraction, Duct Propagation, Troposphere Propagation, [3]

11. Radar Equation, Friis Equation; Case study of LOS Antennas and Radar Systems. [3]

Recommended Text Books;

1. *Electromagnetic Waves & Radiating Systems, 2ed Edition* – E. C. Jordan and K.G. Balmain, Pearson Education
2. *Elements of Electromagnetics, 4th Edition* – Matthew N O Sadiku Oxford University Press
3. *Engineering Electromagnetics, 2ed Edition* - Nathan Ida Springer India

Reference Book

1. *Electromagnetics, 2ed Edition* – J A Edminister Tata-McGraw-Hill
2. *Electromagnetic Waves* – R K Shevgaonkar Tata-McGraw-Hill
3. *Engineering Electromagnetics, 7th Edition*-W.H.Hayt & J.A.Buck Tata-Mc Graw-Hill

Microelectronics and optoelectronic Devices[EC 405]

1. Semiconductor Device physics : Change transport phenomenon, continent equations, Non equilibrium Excess carriers in semiconductor, Surface effects, change storage and diode transients; contact, ohmic and non ohmic.

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2. Semiconductor Hetero junctions: Energy band diagram, 2-D electron gas, Current Voltage Characterization, high electron mobility.

3. Sub micron MOSFET: MOSFET scaling; Short channel effect, ballistic transport, sub threshold conduction.

4. Power BJTS and MOSFETs thyristors: Vertical power BJT structure and characterization , Darlington pair, Power MOSFET structure and characterization, thyristors , structure and characterization, trigging circuits, Insulated gate Bipolar transistor.

5. Change transfer devices: Dynamic effects in MOS capacitors, Basic CCD Application of CCD, Thin film Transistors.

6. Mems- Micromachining of Silicon, bulk and surface Micromachining piezo sensitive MEMS pressure sensors.

7. Optoelectronic Devices: Optical processes in semiconductors, absorption, emission, radiation in semiconductors, LED, Laser Diode, Photo Diode, Solar Cells, OEIC.

TEXT: Pallab Bhattacherya- Semiconductor Optoelectronics
Sanjoy Banerjee & Streetman- Semiconductor device
Neaman- Micro Electonics Devices.

Propagation and Antenna Laboratory
[EC 493]

[At least two experiments from each module must be performed]

I 1. Radiation Pattern of Dipole and Dipole with Parasitic elements
2. Radiation Pattern of Printed antennas
3. Radiation Pattern of aperture antennas *e.g.,* Horn antennas, Open-ended Waveguides, Parabolic Reflectors.

[Radiation patterns E-Plane, H-Plane, 3-dB Beam-width, No. of Side-Lobes, FNBW; Polar & Rectangular Plots of patterns]

II 1. Study of Smith Chart
2. Input Impedance of a terminated waveguide using Shift in minima technique
3. Single and Double- stub matching

III 1. Gain, Directivity and Bandwidth of a three-element Yagi-Uda antenna
2. Gain, Directivity and Bandwidth of a Pyramidal Horn antenna
3. VSWR and Reflection coefficient of a coaxial line for various load condition using frequency domain Technique

IV 1. Study of Spectrum Analyser
2. Measurement of EMI Field using EMC Sensors
3. Study of field-patterns in near field region and far-field region of an antenna

West Bengal University of Technology
BF-142, Salt Lake City, Kolkata-700064

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EC-492
Digital Electronic Lab

1. Realization of basic logic functions using Universal logic gates.
2. Code conversion circuits-BCD to Excess-3 & Vice Versa.
3. Construction of simple decoder & multiplexer circuits using logic gates.
4. 4-bit parity generator & compare circuits.
5. Design of combinational circuits for BCD to decimal conversion to drive 7-segment display using multiplexer.
6. Construction of simple arithmetic circuits –adder,subtractor using logic gates.
7. Construction of simple arithmetic circuits –adder,subtractor using multiplexer.
8. Construction of simple arithmetic circuits –adder,subtractor using decoders.
9. Realization of RS-JK & D flip flops using universal logic gates.
10. Realization of universal register using logic gates,JK flip-flops & multiplexer.
11. Realization of Asynchronous Up/Down counter.
12. Realization of Synchronous Up/Down counters.
13. Design of sequential counter with irregular sequences.
14. Realization of ring counter & Johnson's counter.
15. Construction of adder circuit using shift register & full adder.
16. Study of DAC & ADC.
17. One innovative experiment.

EC-491: Analog electronic circuits lab

1. Design & implementation of diode clipping circuits.
2. Design & implementation of diode clamping circuits.
3. Design & implementation of 2-stage R-C coupled transistor amplifiers & to measure the gain & bandwidth.
4. Design & implementation of the class A & class B power amplifiers(using transistors) to measure the efficiency & distortion (using power & distortion meter).
5. Design & implementation of of the class C & push-pull amplifiers(using transistors) to measure the efficiency & distortion (using power & distortion meter).
6. Design & implementation of differentiator & integrator using OP-AMP(IC 741).
7. Design & implementation of adder & subtractor using OP-AMPS(IC 741)
8. Design & implementation of of monostable & astable multivibrator using NE555 timer.
9. Design & implementation of bistable multivibrator using NE555 timer.
10. Design of a simple function generator(Sawtooth,sine wave, ramp etc.) using OpAMPs(IC 741) to observe the waveform on CRO.
11. Design & implementation of a V-to-I & I-to-V converter using OPAMPs.
12. Study the signal patterns at different test point of a switched mode power supply circuit & to measure the voltage regulation.
13. One innovative experiment.

Analog communication Lab
EC-494

1. Measurement of modulation index of an AM signal.
2. measurement of output power with varying modulation index f an AM signal(for both DSB-SC & SSB).
3. Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).

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4. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth.
5. Design a PLL using VCO & to measure the lock frequency.
6. Design a FM demodulator using PLL.
7. Measurement of SNR of a RF amplifier.
8. Measurement of selectivity ,sensitivity,fiedility of a superhetrodyne receiver.
9. Study of waveforms of various functional points (output of RF,IF & video) of a B/W TV receiver.
10. Study of the vertical & horizontal sweep of the time base unit of a B/W TV.
11. One innovative experiment.

TECHNICAL REPORT WRITING & / LANGUAGE PRACTICE LABORATORY
Code: HU 481
Contact: 3
Credits: 2
Topics to be covered and number of hours required for it:

1. Introductory lecture is to be given to the students so that they get a clear idea of the syllabus and understand the need for having such a practice lab in the first place(3 hours)
2. Conversion practice is done on given situation topics. The students are also made to listen to pre-recorded cassettes produced by British Council and also by the Universities of Oxford and Cambridge (6 hours)
3. Group Discussions:- The students are made to understand the difference between the language of conversion and group discussion. Strategies of such discussions are to teach to them. It is also helpful to use videocassettes produced by the U.G.C. on topics like group-discussion. After wards the class is divided into groups and the students have to discuss on given topics on current socio-economic-political-educational importance(12 hours)
4. Interview sessions-students are taught the do's and don'ts of facing a successful interview. They then have to face rigorous practices of mock-interviews. There simulations of real life interview sessions where students have to face an interview panel(12 hours)
5. Presentations: The secrets of an effective presentation are taught to the students. Then each and every student has to make lab presentations with the help of the Overhead projector/ using power point presentation and other audio-visual aids in the laboratory. They also have to face the question answer sessions at the end of their presentation (12 hours)
6. Classes are also allotted to prepare the students for competitive examinations like the T.O.E.F.L. by making the students listen to specially produced C.D. cassettes of such examinations (3 hours)

The overall aim of this course is to inculcate a sense of confidence in the students and help them to become good communicators in their social as well as professional lives.

Text:
1. Sharma—Business Correspondence & Report Writing, TMH
2. Prasad—Group Discussion & Interview (With Audio Cassette) , TMH

Reference:
1. Sashi Kumar—Spoken English (with Cassette) , TMH

West Bengal University of Technology
BF-142, Salt Lake City, Kolkata-700064

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Fifth Semester ECE
Telecommunication Systems

Code: EC 501
Contacts: 3-1-0
Credits: 4

Module No.	Topic	Periods /Classes
1.	Introduction; Evolution of Telecommunication; Components and Examples of Telecommunication systems	2
2.	Telephone Systems; Pulse dialing & Tone dialing; Telephone Instruments - rotary dial and push button types.	3
3.	Telecommunication Transmission Lines- G.I, Copper, Co-axial, and Fiber optic cables; Transmission Bridge -Hybrid circuit for 2-wire to 4-wire conversion and vice versa. PCM Carriers; American and European standards of carrier channels.	5
4.	Subscriber loop systems, BORSCHT Functions; Switching hierarchy & routing, signaling techniques-in channel & common channel signaling, SS7.	4
5.	Basics of Switching System: Classification of Switching System, Automatic Switching System,	2
6.	Principle of Operation of Strowger & Crossbar Electro-mechanical Systems; Step by step Circuit Switching, - Director and Non-Director systems.	4
7.	TDM, FDM and SDM; Time/Digital Switching systems - Time division Time switch, Time multiplexed Space switch, Time multiplexed Time switch, Hybrid switching, ; TS, ST, STS, TST systems; Architecture of 5ESS systems; Generation of Electronic Exchanges	5
8.	Stored Program Control, Software architecture, Application software;	3
9.	Traffic Engineering: Blocking network, blocking probability, grade of service, traffic load, Erlang-B and C-congestion formulas-case studies	4
10.	Modems and their standards, RS 232C; DTE and DCE, Facsimile Transmission	3
11.	Introduction to ISDN channels & access arrangements, formats, service capabilities and user-network interfaces; Limitations of ISDN, Introduction to B-ISDN.	3
12.	Introduction to cordless telephones, Digital PABX and WLL	2

TOTAL LECTURE HOURS: 40

Text Books:

1. T. Viswanathan, " Telecommunications Switching Systems & Networks", PHI
2. P. Gnansivam,"Telecommunication Switching Systems & Networks";New Age.

References:

1. Syed Riffat Ali,"Digital Switching System";TMH
2. J. Martin "Telecommunication and Computer" 3/e (PHI)
3. A.Z.Dodd "The Essential Guide to Telecommunication" (Pearson)
4. B.A.Farouzan "Data Communication and Networking" 4/e (TMH)
5. S. Rambhandran, " Telecommunication Principles, Circuits & Systems", (Khanna Publishers)
6. N.N.Deb: "Telecommunication Engineering" Vol-I & II, New Age
7. J.E Flood: Tele Communication Switching-Traffic & Networks-.(Pearson)

West Bengal University of Technology

BF-142, Salt Lake City, Kolkata-700064

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Digital Communication System
Code: EC-502
Contacts: 3-1-0
Credits: 4

Module No.	Topic	Lect/ Periods
1.	Introduction: Analog and digital communication. Discrete signals. Elements of digital communication system	1
2.	Source encoding: Pulse code modulation, quantization noise, linear and non-linear quantization, companding- A-law and μ-law. Differential pulse code modulation, delta modulation, adaptive delta modulation, Linear predictive coders	5
3.	Baseband transmission: Baseband signal receiver: probability of error calculations, optimum filters, coherent reception, matched filter and its transfer function. Integrate and dump type filter. Regenerative repeater, Bit synchronization, Inphase and midphase synchronizer. Early late gate synchronizer. Frame synchronization.	7
4.	Line coding: Polar/Unipolar/Bipolar NRZ and RZ; Manchester, differential encoding and their spectral characteristic, self synchronization properties of some of the encoded signal.	2
5.	Equalization: Inter symbol interference (ISI), Purpose of equalization, Eye pattern, Nyquist criterion for zero ISI, fixed equalizer. Design of equalizer, Adaptive equalizer.	4
6.	Digital modulation techniques: BPSK, DPSK. BFSK, M-Ary PSK & FSK, QPSK, MSK, QASK, Error calculations.	8
7.	Spread-spectrum modulation: Pseudo-Noise Sequence, A notion of Spread Spectrum, Direct-Sequence Spread-Spectrum with Coherent Binary Phase-Shift Keying, Processing Gain, Probability of Error, Frequency-hop Spread Spectrum, Code-Division Multiplexing	3
8.	Information theory Discrete and continuous messages, Message source, zero memory source, Discrete memory-less source, extension of zero memory source, Markov source and their entropy, Channel with and without memory, Hartley and Shannon's law.	7
9.	Introduction to Coding Theory: Compact codes, Instantaneous codes, Huffman code, Shanon-Fano code. Error control and correcting Codes; Linear block codes, Cyclic codes- BCH, Convolution codes	4
	Total lectures	**41**

Text Books:

1.Taub & Schilling, Principle of Communication System, McGraw Hill.
2.J.G. Proakis, Digital Communications, McGraw Hill.
3. P.K.Ghosh, Principles of communication Engineering Analog & Digital, University Press

Reference:

1.Simon Haykin, Communication System, John Wiley & Sons,
2.Hsu: Analog & Digital Communication, Schaum series, TMH
3.M.B.Pursley: Introduction to Digital Communication, PHI/Pearson
4.B.P. Lathi, Modern Digital and Analog Communication System, Oxford University Press.
5.R.P.Singh & S.D.Sapre, Communication Systems 2/e- Analog and Digital , TMH
6.J.G. Proakis, & M.Salehi; "Fundamentals of Communication Systems" Pearson
7.J.G. Proakis, & M.Salehi; "Communication Systems Engineering" 2/e – PHI/Pearson
8.A.Bhattacharya- "Digital Communication", TMH
9.L.W. Couch II, Modern Communication System, PHI/Pearson.
10.B.Sklar, "Digital Communications- Fundamentals and Applications- 2/e Pearson .
11.W.Tomasi: "Electronic Communication Systems Fundamental Through Advanced" 5/e Pearson
12.Roden, Analog & Digital Communication Systems, 5/e, SPD

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13.Dungan, Electronics Communication System, Vikas
14.Zeimer & Tarnter, Principles of Communication, Jaico
15.Rekha, Digital Communications, Scitech
16.Graveno,An introduction to error correcting codes, OUP
17. N.B.Chakraborty & A.K.Dutta "An Introduction to the Principles of Digital Communication", Newage
18.Couch:Digital & Analog Communication System, Pearson.

Computer Architecture & Organization (EC-503)
L-T-P: 3-1-0

Course content	No. of lectures
Module 1: Introduction: A brief history of computers, difference between computer architecture & organization	1
Module 2: Basics of computer organization: structure of digital computer-CPU, ALU, I/O devices, Harvard & Neumann architecture.	3
Module 3: Arithmatic & logic circuits: Serial adder, Ripple carry adder, carry look-ahead adder, design of floating point adder Multiplier & divider: Booths multiplier, array multiplier, restoring & non-restoring divider.	7
Module 4: Tri-state bus & Bus inter connection: Register transfer & RTL notation. ALU Design: Combinational ALU & sequential ALU Instruction Set: Instruction format, instruction types, CPI, MIPS & FLOPS, addressing modes of Instruction	6
Module 5: Memory organization: memory technology, types of memory-volatile & non-volatile, ROM, PROM, EPROM, EEPROM, Flash memory, SRAM, DRAM, SDRAM, Content addressable memory	3
Module 6: Control Unit Design-hardwired control, microprogrammed control, nano-program control. Pipeline control Unit-throughput & efficiency, instruction level pipelining different pipelined stages in CPU, pipeline hazards (data, control & structure). Cache & virtual memory: Direct, associative & set-associative , Cache miss & cache penalty, instruction cache & data cache, virtual memory paging	7
Module 7: CPU organization: Fundamentals, Processor-memory communication with & without cache, overview of CPU functions, accumulator based CPU. RISC & CISC based architecture: Examples of RISC processor(SPARC & C 490), introduction to superscalar & VLIW architectures	7
Module 8: I/O devices & system organization: External devices(key boards, monitors, CD ROM drive , HDD, Mouse, light Pen etc.), I/O modules, programmed I/O, interrupt driven I/O. DMA-I/O processors, parallel processing & multiprocessors	6

Total lecture hours : 40

Text Books:

1.Computer Architecture & Organization , Hayes, 4/e, MH
2.Computer Architecture , B. Parhami, OUP

3. Computer System Architecture, 3/e, Mano, Pearson/PHI

Reference Books:
1.Computer Organization, Hamacher, 5/e, MH
2.Computer Architecture , N.Carter, Schaum Outline Series, MH
3.Computer Organization, ISRD, MH
4.Digital Logic & Computer Organization, V. Rajaraman & T. Radhakrishnan, PHI
5.Computer Architecture, A.S Tannenbaum, Pearson
6. Computer Architecture & Organization, P.Chakraborty, Jaico
7. Computer Architecture & Organization, Govindrajan, MH
8. Computer Architecture & Organization, Stallings, PHI/Pearson.
9. Computer System Organization & Architecture-Carpinelli-Pearson.

CONTROL SYSTEMS(EC-513)
L-T-P: 3-1-0

1] Introduction to Control Systems

Introduction to automatic control, open loop and closed loop control system, mathematical modeling of a system with typical examples. Block diagram representation. [1L]

2] Transfer Function Representation

Transfer function for single input single output system, characteristic equation, poles and zeroes, effect of parameter variations, effect of feedback on sensitivity gain and stability. Laplace transform effect of steps, ramp and impulse response on first order, second order and higher order systems in terms of steady state error and time constant, signal flow graph from transfer function and differential equations, block diagram from signal-flow graph Mason's gain formula. [5L]

3] State Space Analysis

Advantages of state space techniques, state space representation for electrical network, with order differential equation, transfer function solution of time-invariant state equation, Laplace transform method, properties of state transition matrices, solution of non-homogeneous state equations, transfer matrix Eigen values and vectors, multiple input multiple of system, controllability and observability, Kalman's test, state space representation in canonical form – controllable, observable and diagonal commercial form, decomposition transfer function – direct, cascade and parallel decomposition, effect of pole-zero cancellation. [6L]

4] Stability Analysis

Concept of stability effect of location of poles on stability, conditions of stability, Routh Hurwitz criteria, Relative stability analysis, Root locus, rules for construction of root lock mapping of closed contour and principle of agreement, Nyquist contour, Nyquist plot, polar plot, Lyapanov's stability analysis. [6L]

5] Frequency domain Analysis

Bode plot, Minimum and non-minimum phase systems, phase margin and gain margin, Relative and absolute stability, constant magnitude and phase circles (M & N circles) gain adjustment by M-circles. [4L]

6] Compensation Techniques

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Types of compensation, design of compensation using Bode's plot – phase lead and lag network, analysis using root locus. [3L]

7] Non-linear system analysis

Common types of non-linearities – saturation, dead zone, friction, relays backlash, function description of the non-linear systems, stability analysis, phase-plane technique-phase trajectory of a second order system using method of isoclines, asymptotic stability [4L]

8] Controllers

.Response of first order and second order systems with proportional control, derivative control, integral control, P&D control, P&I control, PID control, practical method.

.Introduction to Digital Control system .PLC & Application Case Studies: Speed control of DC Motors, Temp control

Introduction to Fuzzy logic applications in control engineering. [11L]

Text Books:

1.Control systems engineering – Nagrath & Gopal, New Age International Ltd.
2.Modern control Engineering, 4/e – Ogata, PHI/Pearson
3. Control System , Madan Gopal, MH

Reference Books:

1. Automatic Control System, Kuo, PHI
2.Digital control & state variables, M.Gopal
3.Control Engineering, Theory & Practice, M.N. Bandyopadhyay, PHI
4. Digital control systems – Kuo, Oxford
5. Systems and Control – Stanislawhizak, Oxford
6. Automatic control systems – S. Hasan Saeed, S.K. Kataria & Sons
7. Neural networks and fuzzy systems – Bart Kosko, Prentice Hall/Pearson.
8. Fuzzy Logic Applications in Engineering Science – J. Harries Springer.
9.Introduction to Linear & Digital Control System,-A.K Ghosh, PHI
10.Control System-Theory & Application- S. Ghosh- Pearson.

Microprocessor & Microcontroller
Code: EI(ECE)-502
Credit: 4

1. Introduction to Microprocessors:
The evolution of microprocessors (from 4 bits onwards). Basic functions of a microprocessor. Programmer's model, data formats. [1L]

2.Architecture of 8085 microprocessors:
Pin-out configuration o 8085, Instruction timing & execution, Demultiplexing & buffering of system buses of 8085 CPU.
Instruction set, classification of instructions, addressing modes, software model of 8085 CPU [4L]

3. Assembly Language Programming using 8085 CPU:

Program writing for different arithmetic operation with 8-bit & 16-bit binary numbers and BCD numbers, program for searching & sorting. Code conversion, concept of look-up table. Use of SID and SOD pins of 8085, writing program using time delays & calculation of T-states. Stacks & Sub-routines [6L]

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4. Interrupt structure of 8085 & their uses. [3L]

5. Memory & their interfacing:

Interfacing of RAM, ROM, EPROM & DRAM etc.Battery backup of memories , EPROM programming algorithm & its software implementation. [4L]

6. I/O interfacing technique:

Addressing the I/O devices, data transfer schemes-synchronous & asynchronous data transfer, interrupt driven data transfer, DMA. [4L]

7. Support chips:

8255, 8253, 8251, 8279, 8259, 8237,8212.

Interfacing of DAC, ADC, keyboards, printer, and displays using 8255. [6L]

8. Architecture of 8086/8088 microprocessors:

8086-pin assignment, addressing modes, software model, instruction sets, classification of instructions, assembly language programming, memory interfacing, interrupts, I/O interfacing, interfacing of support chips, interfacing of ADC, DAC , keyboards, displays etc. [6L]

9. Introduction to Microcontroller:

8051 microcontroller, 8051 pin description connection, I/O ports memory & memory organization, addressing modes & instruction set, 8051 assembly language programming, interrupts-a few applications of Microcontroller.

Industrial applications of Microcontroller: Traffic Control, Stepper motor, Scrolling Display. [6L]

Text Books:

1. Microprocessor Architecture, Programming & Application-R. Gaonkar, Wiley
2. Advanced Microprocessor & Peripherals-Ray & Bhurchnadi, MH
3. Microcontroller, Deshmukh, MH 2/e

Reference Books:

1. Microprocessor & interfacing, Hall, MH
2. Fundamental of microprocessor, Uday Kumar, Pearson
3. The 8051 microcontroller & Embedded System, Mazidi & Mazidi, Pearson/PHI
4. Microprocessor & Microcontroller, Krishnakant, PHI
5. Microprocessor & Peripherals, Chowdhury & Chowdhury, Scitech
6. Advance Microprocessor -Badriram & Badriram-MH
7. 8085 Microprocessor Programming & Interfacing- N.K Srinath-PHI
8. Microprocessor-Theory & Application-M. Rafiquezzaman;PHI
9. Microcontroller & Microcomputer Principles of H/W & S/W Engg. F.M Cady-Oxford.

Microprocessor and Micro-controller Lab

Code: **EI (ECE) 592**
Contacts: **3P**
Credits: **2**

Sl. No.	Name of the Experiments	No.of hours
1.	Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical) Assignments based on above.	3
2.	a) Familiarization with 8085 simulator on PC. Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator. Assignments based on above	3

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3. Programming using kit and simulator for: **6**
- i) Table look up
- ii) Copying a block of memory
- iii) Shifting a block of memory
- iv) Packing and unpacking of BCD numbers
- v) Addition of BCD numbers
- vi) Binary to ASCII conversion
- vii) String Matching Multiplication using Booth's Algorithm

4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly. **3**

5. :Study of timing diagram of an instruction on oscilloscope.. **3**

6. **Interfacing of 8255**: Keyboard and Multi-digit Display with multiplexing using 8255 **6**

7. Study of 8051 Micro controller kit and writing programs for Interfacing of Keyboard, DAC and ADC using the kit. **3**

8. Serial communication between two trainer kits **3**

Total 30 hours (10 classes each of 3 periods)

Control System Laboratory
Code: EC 583
Contacts: 3P Credits: 2

Sl.No.	Name of the Experiment	Periods
1.	Familiarization with MATLAB Control System tool Box, MATLAB- SIMULINK tool box & pSPICE.	3
2.	Determination of step response for 1st order & 2nd order system with amity feedback on CRO & calculation of control system specifications for variations of system design.	3
3.	Simulation of step response & impulse response for Type-I & Type-II system with unity feedback using MATLAB & pSPICE.	3
4.	Determination of root locus, Bode-plot, Nyquist Plot, using MATLAB control system toolbox for a given 2nd order transfer function & determination of different control system specifications.	6
5.	Determination of PI, PD, and PID controller action on 1st order simulated process.	3
6.	Determination of approximate transfer function experimentally using Bode Plot.	3
7.	Evaluation of steady-state error, setting time, percentage peak overshoots, gain margin, phase margin with addition of lead compensator in forward path transfer functions using MATLAB & pSPICE.	3
8.	Study of position control system using servomotor.	3
9.	Design and hardware implementation of a temperature controller using microprocessor/microcontroller.	6

Total 33 hours (11 classes each of 3 periods)

West Bengal University of Technology

BF-142, Salt Lake City, Kolkata-700064

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Digital Communication Lab (EC 591)

Contact: 3P

Credit: 2

(Students are required to perform at least ten experiments taking 3 from Group A, 3 from Group B, 3 from Group C and 1 from Group D)

	GROUP - A (At least three experiments)
1.	Design, implementation and studies of the properties of 15 bit P.N. Sequence using shift register
2.	Studies of the properties of A/D and D/A converter (AD7820/ADC0820 and ICL 8018A/8019A/8020A). (Properties like transfer characteristics, code central line method of nonlinearity study, differential nonlinearity, integral nonlinearity, resolution etc).
3.	Study of pulse amplitude modulation and demodulation. (Studies of distortion factor of the constructed signal as a function of signal frequency & amplitude. Further study of distortion factor of filtered reconstructed signal as a function of sampling frequency and thus verify the sampling theorem).
4.	Studies of PCM transmitter and receiver. (To measure the bit rate, bandwidth requirement and distortion factor of the reconstructed signal in presence of channel noise).
5.	Study of line coders: UPNRZ, PRZ, BPRZ, PNRZ (To study the nature of waveform in CRO and its spectrum by spectrum analyzer. At least any one of the line coders has to design, fabricated and tested).
6.	Studies of Manchester coding and decoding technique. (Studies of the nature of waveform, spectrum and self-synchronizing characteristic).
	GROUP - B (At least three experiments)
7.	Studies of PSK modulator and demodulator, connected by physical channel.
8.	Studies on FSK modulator and demodulator, connected by simulated channel
9.	Studies on ASK modulator and demodulator, connected by physical channel
10.	Studies on QPSK modulator and demodulator, connected by either physical or simulated channel (In all above experiments, nature of the modulated waveform is to be studied by a CRO. The spectrum is to be studied with a spectrum analyzer and the essential bandwidth is to be determined; finally the reception quality is to be analyzed by cross co-relation characteristics and measurement of bit error rate in presence of channel noise).
	GROUP - C (At least three experiments)
11.	Studies on Delta modulator & Demodulator using trainer kits
12.	Studies on Adaptive delta modulation using trainer kits
13.	Studies on delta signal modulation using trainer kits
14.	Studies on PCM/TDM system (Multiplexing/Demultiplexing) (Object is to measure distortion factor of the demodulated signal with variable signal amplitude and frequency, measure the essential B.W. of the modulated signal
15.	Studies of PCM/TDM system (Multiplexer & Demultiplexer) (To study the interchannel interference and synchronization problem in multiplexer and demultiplexer system
	GROUP - D (At least one experiment)
16.	Studies of direct sequence spread spectrum modulation and demodulation
17.	Studies of frequency hopped spread spectrum modulation and demodulation (To study spreading and dispersing, effect of channel noise, single tone interference etc.
18.	Study of features of ISDN network.
19.	Study of ISDN Emulator and its programming, using appropriate communication software (like protocol analyzer software).

Total 30 hours minimum (10 experiments each of 3 periods)

West Bengal University of Technology
BF-142, Salt Lake City, Kolkata-700064

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Sixth Semester

INDUSTRIAL MANAGEMENT

Code: HU-601

Basic concepts of management, objectives, classification and hierarchy, different schools of management thought, principal functions of management, Management as an organizing and directing force, Structure of the management decision making process, Organization structure, authority and responsibility, Organisation dynamics, Managerial leadership, communication systems, Managing human factors in business and industry, Industrial relation, Union activities, trade union acts, collective bargaining, disciplinary procedure.

Organizational objectives and long range forecasting, planning, organizing, programming and controlling process, managerial control strategies; quantity and quality control, cost benefit analysis, present work and breakeven analysis, budgetary control, use of management science for the efficient administration of economic units, production, financial and marketing management.

Adoption of statistical and computer methods and techniques to managerial research and managerial decision making and general management.

Books:

1. Essentials of Mgmt, Koontz, TMH
2. Industrial Management - S C Jain, W S Bawa, Dhanpat Rai & Co. (P) Ltd.
3. Industrial Management, Vol.1 L.C. Jhamb, EPH,
4. Industrial Engineering & Production Management - Martand Telsang, S. Chand
5. Industrial & Business Management - Martand T. Telsang, S. Chand
6. Introduction to Materials Management - J Tony Arnold & Stephen N. Chapman, Pearson Education Asia
7. Production & Operations Management – Adam, Pearson Education /PHI
8. Altekar, Production Management, Jaico
9. Industrial Relations, Trade Unions & Labour Legislation - Sinha, Pearson Education Asia
10. Business Organisation & Management - Tulsian, Pearson Education Asia.

DIGITAL SIGNAL PROCESSING

EC601
Contact: 3L+1T
Credit:4

Discrete-time signals:

Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, Sampling Theorem sequences – periodic, energy, power, unit-sample, unit-step, unit-ramp, real & complex exponentials, arithmetic operations on sequences.

3L

LTI systems:

Definition, representation, impulse response, derivation for the output sequence, Concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercises, properties of convolution, interconnections of LTI systems with physical interpretations, stability and causality conditions.

8L

Z-transform:

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Definition, mapping between s-plane and z-plane, unit circle, convergence and ROC, properties of z-transform, z-transform on sequences with examples and exercises, characteristic families of signals along with ROCs, convolution, correlation and multiplication using z-transform, initial value theorem, Persevals relation, Inverse z-transform by contour integration, power series & partial-fraction expansions with examples and exercises.

6L

Discrete Fourier Transform:

Brief recapitulation of Fourier Series,
Concept and relations for DFT/IDFT, Twiddle factors and their properties, computational burden on direct DFT, DFT / IDFT as linear transformations, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circular convolutions, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Add & Overlap Save methods with examples and exercises.

6L

Fast Fourier Transform:

Radix-2 algorithm, decimation –in time and decimation-in-frequency algorithms, signal flow graphs, Butterflies, computation in one place, bit reversal, examples and exercises.

5L

Filter Design:

Basic concepts behind IIR and FIR filters, Butterworth IIR analog filter, Impulse Invariant and Bilinear transforms, design of IIR digital filter, design of linear phase FIR filter with rectangular window.

5L

Digital Signal Processor:

Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor (any one), writing of small programs in Assembly Language.

6L

Text Books:

1. Digital Signal Processing – Principles, Algorithms and Applications - J.G.Proakis & D.G.Manolakis, Pearson Education/ PHI.

2. Digital Signal Processing Signals, Systems and Filters – A. Antoniou, TMH Publishing Co.

3. Digital Signal Processors Architectures, Implementations and Applications – S.M.Kuo & W. Gan, Pearson Education

Reference Books:

1. Digital Signal Processing – A Computer Based Approach – S.K.Mitra, TMH Publishing Co,

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2. Digital Signal Processing – P. Rameshbabu,
   Scitech Publications (India)

3. Digital Signal Processing – S. Sharma,
   S.K.Kataria & Sons

4. Digital Signal Processing - S. Salivahanan, A. Vallavaraj & C. Gnanapriya,
   TMH Publishing Co.

5. DSP Spectral Computation and Filter Design – C. Chen
   Oxford University Press.

6. Digital Signal Processing A Hands on Approach – C. Schuler & M. Chugani
   TMH Publishing Co.

7. DSP: System Analysis & Design-Pablo S.R Diniz, Eduardo A.B Desilva & Sergis L. Netts-
   Cambridge University Press.
8. Introduction to Digital Signal Processing - Roman Kuc – BS Publications

DIGITAL SIGNAL PROCESSING LABORATORY:
EC691
CONTACT: 3P
CREDIT:2

Simulation Laboratory using Standard Simulator:

Simulation of sampled Sinusoidal signal, various sequences and different arithmetic operations.

Simulation of convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.

Simulation of z-transform of various sequences - verification of the properties of z-transform.

Simulation of Twiddle factors – verification of the properties.
Simulation of DFTs/IDFTs using matrix multiplication and also using commands,
Simulation of circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.
Verifications of the different algorithms associated with filtering of long data sequences and overlap-add & overlap-save methods.

Simulation of DIT & DIF Radix-2 FFT algorithms

Simulation of Butterworth Filter design with different set of design parameters, Simulation of FIR Filters using Rectangular, Hamming, Hanning, Bartlett windows and comparisons of these designs.

Hardware Laboratory using either 5416 or 6713 Processor:

Practising of writing & execution of small programs related to arithmetic operations & convolution using Assembly Language of TMSC205416/6713 Processor, Study of MAC instruction.

Computer Communication and Networking
Code: EC 602

West Bengal University of Technology
BF-142, Salt Lake City, Kolkata-700064

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Contacts: 3-1-0
Credits: 4-0-0
Total lectures:40

Topic	Lectures
Review of Computer Communications Foundations	
Review of data transmission principles, transmission components; ASK, PSK, QPSK, QAM, M-ary digital modulation; data compression;	3
Components of computer network	
Hosts, communications channels, terminals, protocols, multiplexers, concentrators etc. modems and their standards; Error control procedures, point to point, multi-drop, circuit, message and packet switching;	6
ISO/OSI Reference model	
Seven Layers- their functions and protocols; TCP and UDP;	3
Local Area Networks	
MAC protocols; ALOHA; CSMA/CD; Repeater, Hub, Switch, Router and Gateway; LAN standards and protocols; Ethernet and IEEE802.3; Token Ring, Token Bus, DQDB; High Speed Ethernet, Gigabit Ethernet.	6
TCP/IP Protocols	
Internet Addressing, Routing, Congestion Control, Transport layer protocols: UDP, TCP, SCTP, Client – Server Model, Application protocols; facsimile transmission, electronic mail, voice mail, internetworking; case study of computer communication networks.	6
Switching	
Switch performance measures Time and space switches, Modular switch design Packet switch and distributed Buffer	3
Optical N/W	
DWDM, Optical LAN. High- speed Networks-Circuit switched Network: SONET and SDH,	4
Introduction to Network Security	
Introduction to Cryptography, Data Encryption standard, RSA Algorithm, Digital signature, Public keys, IPSec, Firewalls	3
Advance Networks.	
Introduction to Mobile Communication and Networks - their types and basic principles; ISDN and B-ISDN; ATM- Header structure, Protocol stack, Signaling and Service category, Virtual Private Networks (VPN), MPLS support for VPN	6

***Text Books*:**

1. B A. Forouzan, "Data Communication and Networking",4/e, McGraw Hill,2006.
2. A Tanenbarum, "Computer Networks" –4th Edition, PHI, 2004/Pearson Education 4th Edition.
3. W Stallings, "Data and Computer Communication" –7/e Pearson

References:

1. Leon-Garcia and Widjaja, "Communication Networks", 2/e McGraw Hill, 2004
2. Zheng - "Communication Networks"- Oxford
3. F Halsall & LG Kulkarni "Computer Networking and the Internet" — Pearson 5/e.
4. J Martin "Telecommunication and the Computer" 3rd edn., - PHI, 1992

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5. ISRD "Data Communication and Computer Networks" McGraw Hill, 2006
6. S.Kundu, "Fundamentals of Computer Networks" PHI
7. Kurose and Rose. "Computer Networks- A Top Down Approach"- 3/e Pearson
8. ISDN and Broadband ISDN – W Stallings 4/e Pearson.
9. Singh, "Data Communication and Networks" 2/e PHI
10. P.C,Gupta ""Data Communication and Computer Networking"- PHI
11. W.Tomasi "Introduction to Data Communication and Networking"- Pearson
12. S. Keshav "An Engineering Approach to Computer Networking : ATM Networks, the Internet, and the Telephone Network", 1/e -- © 1997- Pearson
13. T Housley "Data Communication & Teleprocessing" – BS Publications

Power Electronics
EC603
LTP: 3-1-0
Credits: 5
Total Lectures: 40 hours

Sl. No.	Topic	Lecture Hours
1.	Need for Power Electronics Converters;	1
2.	Power Electronic Converters - classification and scope;	2
3.	Power semiconductor switches, diodes, (convertor grade and fast), SCR, transistors (BJT, MOSFET and IGBT), Ratings, static and dynamic characteristics, trigger, drive and switching-aid circuits (snubber) and cooling	8
4.	DC to DC conversion: non-isolated Buck, Boost, Buck-Boost and CuK converters, circuit configuration and analysis with different kinds of loads, Isolated forward and flyback convertors, Full bridge inverter, Half bridge inverter, Asymmetric Topology for Single Phase. Converter magnetic	11
5.	Rectifiers: single-phase and three-phase operation, power-factor, R-L, R-L-back emf loads, voltage and current expressions, harmonics; Active Front End Convertors;	8
6.	Resonant Converters: series, parallel, Series-parallel, quasi-resonant, Zero-current and zero-voltage convertors;	5
7.	Power Electronic applications: UPS, Power line conditioner, electronic ballast, induction heating	3
8.	Microprocessor based triggering angle control	2
	Total	40 hours

Text Books:

1. P. C. Sen, "Modern Power Electronics", S. Chand, NDelhi-55, 2004
2. Muhammed Rashid, "Power Electronics - Circuits, Devices and Applications", PHI,Pearson Education N Delhi-1, 1994

Reference Books:

1. Mohan, Udeland, Robbins, "Power Electronics - Converters, Application and Design, John Wiley and Sons
2. V. R. Moorthi "Power Electronics-Devices,Circuits and Industrial Applications" Oxford UP, N Delhi-1, 2005

3. M.S.Jamil Asghar, - "Power Electronics" PHI
4. M.D.Singh,and K.B.Khanchandani - "Power Electronics" -2/e McGraw-Hill

VLSI Circuits & Systems
EC604
Total lecture Hrs: 40
Lecture Hrs /Week : (L-T-P: 3-1-0)

Digital VLSI Circuits

1. Introduction to ASIC Design (3)
   a. Design Strategies: Hierarchy, Regularity, Modularity & Locality
   b. Chip Design Options: Gate Array, Field Programmable Gate Array, PLA, PLD, Standard Cell, Full Custom Design
2. Fabrication & Layout of CMOS (4)
   a. Fabrication Process Flow: Basic steps
   b. CMOS n-Well Process
   c. Layout & Design Rules
   d. CMOS inverter Layout Design
3. MOS Inverter Characteristics (3)
   a. Transfer Characteristics: MOS with resistive load, n-MOSFET Load (Enhancement & Depletion), CMOS inverter
   b. Transient Analysis of CMOS Inverter and Delay analysis
4. CMOS Logic Circuits (3)
   a. NAND & NOR Gates
   b. Complex Logic Circuits
   c. Pseudo n-MOS logic
   d. CMOS Full adder circuit
   e. CMOS Transmission Gate (Pass transistor Logic)
5. Advanced CMOS Logic circuits (3)
   a. Dynamic CMOS Logic
   b. Domino CMOS Logic

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c. Differential Cascode voltage switch logic

d. NORA Logic

6. Sequential CMOS logic circuits (3)

a. Behaviour of Bi-stable elements

b. SR Latch Circuit

c. Clocked JK Latch/Master-Slave JK

d. CMOS D-latch and edge triggered Flip-flop

7. Subsystem Design (5)

a. Adders: Carry ahead adder, carry save adder, Manchester carry chain.

b. Multipliers: Serial-parallel Multiplier, array multiplier

c. High Density Memory: ROM, Static RAM, Dynamic RAM, SD RAM, Flash Memory

8. Physical Design (3)

a. Floor Planning Methods: Block Placement & Channel Definition, Global and Channel Routing

Analog VLSI Circuits

9. Introduction: (1)

a. Analog Signal Processing

b. Analog VLSI Mixed Signal Circuits

c. Basic Building Blocks in Analog Circuits

10. Basic Building Blocks: (5)

a. MOS Switches

b. Resistor realisation using Switched Capacitor

c. Voltage level shifter

d. CMOS Current Sources and sinks

e. CMOS Voltage and Current references

f. CMOS Differential Amplifier

g. Output Amplifier

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11. Analog Circuits (7)
    a. CMOS Operational Amplifier
    b. Comparator
    c. Switched Capacitor Filter
    d. ADC & DAC (FLASH ADC, Delta-Sigma Modulator)
    e. Phase locked Loop
    f. FPAA

Text Books:

1. Neil H.E Weste, Kim Haase, David Harris, A.Banerjee, "CMOS VLSI Design : A circuits & Systems Perspective", Pearson Education (For module 1)
2. Wayne Wolf," Modern VLSI Design – System-on-chip Design", Prentice Hall India/Pearson Education (For module 2,5,6,7,8)
3. Sung-Mo Kang & Yusuf Lablebici, "CMOS Digital Integrated Circuits, Analysis & Design", Tata McGraw-Hill Edition (For Module 2,3,4,5,6)
4. Philips E. Allen & Douglas R. Holberg, " CMOS Analog Circuit Design" , Oxford University Press (For Module 9,10,11)

References:

5. David Hodges, Horace G Jackson, & Resve A Saleh, " Analysis & Design of Digital Integrted Circuits", Tata McGraw-Hill Edition (For Module 2,3,4,5)
6. Ken Martin," Digital Integrated Circuits", Oxford University Press (For Module 2,4,5,6)
7. R. L. Geiger, P.E.Allen, Noel R. Strader," VLSI Design techniques for Analog and Digital Circuits", McGraw-Hill International Edition.(For Module 9, 10 & 11)

VLSI Circuits & System Lab
EC 694
Contact: 3P
Credit: 2

1. Familiarisation with LASI or equivalent layout tools & Design rules
2. Design layout of a two input CMOS NAND gate using LASI or any equivalent layout tool. Use any standard Design rules
3. Using LASI, draw the layout of a simple CMOS amplifier
4. Familiarisation with SPICE CMOS Model parameters
5. Using SPICE simulate MOS Inverter with different loads (Specify C_{ox}, μ, VTO, W, L *etc.* of any standard MOS).
6. Using SPICE, simulate a CMOS inverter.
    a. Obtain the transfer characteristics for different values of β_n/β_p

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b. Plot Supply current Vs input voltage for different values of β_n/β_p

7. Obtain the transient response of CMOS Inverter for different values of β_n/β_p
8. Using SPICE, simulate a simple CMOS amplifier and obtain the transfer characteristics and frequency response
9. Using SPICE, simulate a CMOS differential amplifier with a current source. Use <.SUBCKT> command of SPICE
10. Draw a full adder using AND/OR/INVERT gates in schematic editor
11. Innovative experiment
12. Innovative experiment

} To be decided by the college

Text Books

1. CMOS Circuit Design, Layout and Simulation - R.J.Baker, H.W. Li and D.E. Boyce,PHI
2. Sung –Mo Kang & Yusuf Lablebici, " CMOS Digital Integrated Circuits, Analysis & Design", Tata McGraw-Hill.
3. Adel S. Sedra & Kenneth C. Smith, "Microelectronic Circuits", Oxford University Press.

Electronic Circuit Design LAB
EC-683
Objective: To impart the essential knowledge of electronic circuit design and fault analysis, to enhance hands on experience and to encourage innovativeness.

Modus operandi: The subject will be a sessional subject so that students can employ all their resources in order to excel.
Total 18 designs have been indicated in the syllabus classified in 4 groups. Each student has to complete at least 8 designs in a semester taking two from each group.
At the end of the semester, the student will be interviewed by a panel of examiners, constituted by the head of the department/institution.

Guidelines: Each design given in the syllabus indicates the basis. On this basis, the teacher will prepare an exact design problem with specified parameters and assign to the student.
Objective of the job in brief is also given in the syllabus. As such the teacher can further elaborate or specialize the problem creating enough room for the student to learn and innovate.
If same job is assigned to more than one student/group, it must be with different parameter values.
The students will find their own design solutions with minimum input from the teacher. Of course there can be more than one solution but the student should ultimately know their comparative merits/demerits.
The hardware assembly and testing has to be done only during assigned class hours under general supervision of a teacher. The student must always make a comparative study between the theoretical and measured performance parameters and analyze their causes.
At the end of each job, the student will prepare a report including detail technical specification of his design, circuit diagram, design calculations, theoretical & measured values, graphs, references etc.

Scoring: The total score of 100 will be in two parts, e.g. a) continuous evaluation-60 and b) semester end viva-40.

A full mark of 10 is allotted to each job. At the end of each job, the teacher will evaluate the performance on the basis of initiative, innovativeness, speed and insight. The sum of 6 such evaluations will make the total for continuous evaluation.
At end semester, each student will be interviewed to assess his expertise in various facets of electronic design, and a score out of 40 will be allotted.

A. DISCRETE ANALOG CIRCUITS.

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1. Rectifiers.
   (To design a rectifier for a given average output dc voltage and a given load resistance, compare between the theoretical values of V_{dc}, V_{rms}, RF, HD, output regulation, transformer utility factor etc. with the measured values, and thus comprehend the relevance/effect of these various parameters.)
2. DC power supplies regulation and protection circuits.
   (To learn designing a series transistor based output regulation circuit, an output current limiting circuit, fold back circuit needed for a given output parameters.)
3. Single stage audio frequency voltage amplifier with BJT for a given A_v, Z_{in} and Z_{out} and maximum symmetrical out put swing.
   (To learn basic design principles, different methods of biasing, bias stability, selection of transistor from data manuals and effect of ac coupling on bandwidth.)
4. Single stage audio frequency emitter follower with JFET for a given A_v, Z_{in} and Z_{out} and maximum symmetrical out put swing.
   (To learn the design principles and applications of an emitter follower.)
5. Complimentary symmetry power amplifier with pre amplifier, if necessary, for a given out put power to a given load with single ended power supply.
   (To learn the distinction of a power amplifier over and above a voltage or current amplifier, its design principles, issues like, efficiency, cross over distortion etc.)
6. RC phase shift Oscillator , Wien Bridge oscillator, Hartley and Colpitt oscillator
(To learn the design of oscillators and measuring the frequency and amplitude of oscillations)

B. OPAMP BASED ANALOG CIRCUITS

1. Inverting and non-inverting amplifier of given dc gain, input impedance and output impedance.
   (To learn the basic design, inter relation between the dc gain and input/output impedances, offset balance and the relation between feedback and GBW.)
2. Adder and subtractor.
   (To learn the basic design and function of a multi input adder/subtractor (with ac and dc inputs present simultaneously).
3. Comparator/voltage level detector for a given upper threshold level and a given lower threshold level with facility of independent adjustment of hysteresis and center point.
   (To learn the design and the technique of independent adjustment of both hysteresis and center point.)
4. Active filters: LP, BP, HP, 1st order, 2nd order.
   (To learn the design of a filter and it's inherent phase shifting characteristics.)
5. 555 based monostable and astable of duty cycle below and above 50%.
   (To learn designing 555 based timer circuits.)

DIGITAL LOGIC CIRCUITS

1. Design and implement a BCD to 7-segment decoder with basic and universal gates.
   (To understand clearly the method of writing a truth table, use of K-map, simplifying a logic function and optimum design with minimum number of ICs and inputs.)
2. Design and implement a 4-digit frequency counter with a clock generator.
   (To learn designing a digital circuit using available standard gate, FF, counter and display Ics.)
3. Designing logic circuits using multiplexers, demultiplexers and gates to implement logic functions.
   (To learn the use multiplexers and demultiplexers)
4. Design and implement a sequence detector.
   (To learn designing a sequential circuit, whose output is 1 or 0 when any input bit is preceded or succeeded by a predefined binary sequence. To define the input & output sequence from a

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given physical problem, to prepare a state diagram, derive a minimal state table, to find the simplified state equation, to implement the same & verify the result)

5. To design and implement a combination of a logic circuit and a RAM in order to generate a 4-bit data after simplifying a logic expression, to store the output data at a predefined location in the RAM, to retrieve the same and verify.
(To comprehend the structure and operating principle of memory devices.)

D. Power Electronics

1. Design a Single-phase full & shaft controlled converter.
2. Design of Microprocessor based Triggering socket.

7th Semester Syllabus

RF & Microwave Engineering
Total Lectures: 41 periods (minimum)
EC – 701
(L-T-P: 3-1-0)

1 Introduction:
RF & Microwave Spectrum, Historical Background, Typical applications of RF & Microwaves [1]

2 Microwave Waveguides :
Rectangular and Circular Waveguides– Mode structures, Cut-off frequency, Propagation Characteristics, wall currents, Attenuation constant, waveguide excitations. [5]

3 Waveguide Passive Components:
Waveguide Resonators – Rectangular & Cylindrical; Resonant frequencies, Mode structures, Q-factor, Co-axial Resonators; Excitation & coupling of cavities, Design of resonators. Periodic Structures-Filters. [5]

N-port networks – circuit representations, Z-matrix, Y-matrix, S-matrix, transmission matrix,; their relationships; attenuators, phase shifter, directional couplers, Bethe-hole coupler, Magic tee, hybrid ring, circulators, isolators, antennas: Horns- sectoral horns, Pyramidal horns, Parabolic reflector, Cassigran feed, Patch antennas, antenna arrays. Scattering matrix representations of passive components. Transitions: coaxial lines to waveguide, to micro-strip lines. Design of transitions. [5]

4 Planar structure:
Strip lines, Micro-strip lines, coplanar structure, Slot lines, Suspended strip lines, Fin lines – Configurations, Field patterns, propagation characteristics, Design considerations. Comparison of characteristics of lines. [5]

5 Microwave Tubes:

Limitations of conventional tubes in microwaves; Multi-cavity Klystron, Reflex klystron; Magnetron, Travelling wave tube, Backward wave oscillator – working principles, characteristics. [5]

6 Semiconductor Microwave Devices:
Tunnel diode; Gunn diode–design considerations for their waveguide mount. Avalanche diode – IMPATT, TRAPATT, Microwave bipolar transistor, hetero-junction bipolar transistor, Microwave field-effect transistor–JFET, MOSFET, MESFET, Parametric amplifiers; ICs [5]

7 Applications of Microwave
Radar systems – Pulsed radar, MTI, Tracking radars, Altimeter- Principles of operation, applications.
Satellite communication systems - basic working principles. Up-link & down-link gain budgets.
Industrial applications: Process control, Measurement Techniques of parameters, A few examples of industrial measurements: Thickness of dielectric sheets, diameters of wires, Moisture content in solid & liquids. Doppler sensors, Microwave heating, its applications. Applicators for bio-med applications. [5]

8 Microwave Measurements:
Microwave Bench, Slotted line, Tuneable Probe, VSWR Meter, Slide screw tuner, Variable shorted line – operating principles with diagrams.
Measurements of VSWR – Low, Medium and High, Measurement of Power – Calorimetric method, Thermocouple, Bolometers, Frequency measurement, Impedance measurement by shift in minima. Network Analysers, TDR, and Spectrum analyser.
[5]

Text Books

1 K C Gupta *Microwaves* New Age Publishers
2 ML Sisodia & GS Raghuvansi *Microwave Circuits and Passive Devices* New Age Publishers
3. David M Pozar *Microwave Engineering* John Willy & Sons Inc.

References Books

1 Robert E Collin *Foundation of Microwave Engineering,* 2ed edition, McGraw Hill, Inc.
2 SY Liao *Microwave Devices & Circuits* Pearson Education /PHI
3 MI Skolnik *Introduction to Radar Systems* Tata-McGraw Hill
4 PA Rizzi *Microwave Engineering-Passive Circuits* Pearson Education
5 GP Srivastava & VL Gupta *Microwave Devices & Circuit Design* PHI
6 S Das & A Das *Microwave Engineering* Tata-McGraw Hill

Microwave Engineering Laboratory
EC 791
(L-T-P: 0-0-3)

(Students are required to perform at least Ten experiments taking any six from Group A and any four from Group B)

GROUP – A

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1. Measurement of wavelength, guide wavelength and frequency using X-band waveguide test bench. Calculation of broad wall dimension of a X-band waveguide. Determination of phase and group velocities within a waveguide from Dispersion diagram [ω–β Plot].
2. Measurement of unknown impedance (inductive, capacitive and resonant windows) using shift in minima technique.
3. Calibration of a crystal detector using waveguide test bench.
4. Measurement of Attenuator [A_D – Dissipative attenuation and A_R – Reflective attenuation].
5. Measurement of coupling factor and Directivity of a Directional coupler using calibrated attenuator.
6. Klystron characteristics [Static method and dynamic method] using power meter with bolometer and calibrated wave-meter.
7. Study of Gunn Oscillator characteristics using power meter with bolometer and calibrated wave-meter.
8. Measurement of reflection coefficient using two directional couplers and one calibrated attenuator.

GROUP – B

1 Measurement of phase shift of a microwave phase shifter
2 Scattering matrix of a magic tee / E-plane tee / H-plane tee using waveguide test bench at X-band.
3 Measuring of dielectric constant of a material using waveguide test bench at X-band.
4 Measuring of radiated emission in open area test side (OAT)
5 Measurement of Conduction EMI using LISN and spectrum analyser
6 Frequency response of RF amplifier using spectrum analyser with tracking generator
7 Frequency response of low-pass filter, high-pass filter, band-pass filter using spectrum analyser with tracking generator
8 Studies on VCO and mixer using spectrum analyser

Reference Books

1. ML Sisodia & GS Raghuvanshi *Basic Microwave Techniques and Laboratory Manual* Wiley Eastern Limited 1987
2. EL Gintzton *Microwave Measurements,* McGraw-Hill Book Co.
3. M Sucher and J Fox, *Handbook of Microwave Measurements, Vol I, Wiley-Interscience Inc.*

EDA for VLSI Design
EC702
Total lecture Hrs: 40
Lecture Hrs /Week : (L-T-P: 3-1-0)

1. Introduction to: (5)

   i) Application specific Integrated circuits(ASICs) &design automation.
   ii) CMOS Technology and design rules.
   iii) PLA, PLD and CPLD

2. Overview of Hardware modeling with VHDL. (5)

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3. FPGA Concept ,Architecture and Programming . (3)
4. Simulation of Digital circuits using CAD tools. (2)
5. High Level Synthesis: Datapath and Control synthesis. (4)
6. Logic Level Synthesis and Optimization of Combinatorial and Sequential circuits. (5)
7. Analog Design automation tools.(6)
8. Testing (Fault modeling, Simulation, Test generation) and Design for Testability. (4)
9. Physical Design Automation (Placement , Floor Planning ,Routing). (4)
10. Timing Analysis , Verification and Validation. (4)

Text books:

1. M.J.S Smith , "Application Specific Integrated circuits " , Pearson education .
2. P.J Anderson , "The designer's guide to VHDL" , Morgan Kaufman , 2nd edition ,2002.
3. Neil H.E. Weste, Kim Haase, David Harris , A. Banerjee , "CMOS VLSI Design: A circuits and Systems Perspective", Pearson Education.
4. W.Wolf ,FPGA System design, Pearson .
5. G.Hatchel and F.Somenzi , logic Synthesis and verification Algorithms,Kluwer,1998

References:

1. http://www-ee.eng.hawaii.edu/~msmith/ASIC/HTML/ASIC.htm#anchor935203
2. J.Bhasker ,A VHDL Primer , Pearson publication /BS Publications
3. www.xilinx.com
4. www.actel.com
5. www.altera.com

Electronic Design automation(EDA) Lab
EC792
List Of assignments (L-T-P: 0-0-3)
LAB Hrs: 3 Hrs/Week
(48 Hrs.)

Laboratory 1. Familiarity with Spice simulation tool (3 Hrs.)

Laboratory 2. Spice Simulation of Inverter , NAND , NOR Gates. (3 Hrs.)

Laboratory 3 Familiarity with EDA tools for VLSI design /FPGA based system design (6 Hrs.)

Laboratory 4. Layouts ,Transistors and tools,. (3 Hrs.)

Laboratory 5. Standars cell Design (3 Hrs.)

Laboratory 6. Design of CMOS XOR/XNOR Gates. (3 Hrs.)

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Laboratory 7. Design of CMOS Full adder (3 Hrs.)

Laboratory 8. Design of CMOS Flip flops (R-S ,D , J-K) (3 Hr.s)

Laboratory 10. Design of 8 bit synchronous Counter (3 Hrs.)

Laboratory 11. Design of 8 bit bi-directional register with tri-stated input/output bus (3 Hrs.)

Laboratory 12 Design of a 12 bit CPU with few instructions and implementation and validation on FPGA (15 Hrs.)

6. M.J.S Smith , Application Specific Integrated circuits ,Pearson.
7. P.J Anderson ,The designer's guide to VHDL, Morgan Kaufman , 2nd edition ,2002.
8. W.Wolf , Modern VLSI Design: Systems on silicon , Pearson
9. G.Hatchel and F.Somenzi , logic Synthesis and verification Algorithms,Kluwer,1998

References:

6. http://www-ee.eng.hawaii.edu/~msmith/ASIC/HTML/ASIC.htm#anchor935203
7. J.Bhasker ,A VHDL Primer , BS Publications/Pearson Education.

Coding and Information Theory
Code: EC 703
Contact: 3-1-0
Credit: 4
No. of Lectures- 44

Module No.	Topic	Periods
1.	Introduction: Coding for reliable digital transmission and storage, Types of codes, Types of errors encountered, Error Control Strategies.	6
2.	Linear block codes: Definition, Syndrome and Error detection, Minimum distance, Error detecting and Error-correcting capabilities, Standard Array and Syndrome decoding, Probability of an undetected error for linear codes over BSC, Hamming code.	7
3.	Cyclic codes: Description, Generator & parity-check matrices of cyclic codes, Encoding of cyclic codes, Syndrome computation and error detection, Decoding, Cyclic Hamming Codes, Shortened cyclic codes.	5
4.	BCH codes: Description, Decoding BCH codes, Implementation of error correction, Non binary BCH codes and Reed-Solomon codes, Weight distribution and Error detection of Binary BCH codes.	7
5.	Convolution codes: Encoding, Structural properties, Distance properties, Maximum likelihood decoding of convolution codes, Viterbi algorithm, Performance bound for convolution codes, Application of Viterbi decoding.s	5
6.	Information Theory-Basic Definition, Information & Entropy, Shannon's Charred Capacity Theorem, Source encoding, Channel capacity of a discrete memoriless channel, Channel capacity of a continuous channel.	6

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7.	Cryptography & Cryptosystems-Encryption & decryption, Public & private key cryptography, DES algorithm, RSA algorithm, Diffy-Hellman key exchange, Introduction of quantum cryptography, Applications of cryptography in network security.	8

Text books:

1. Jones- Information & Coding Theory, -Springer
2. Ranjan Bose, Information Theory, Coding and Crypotography, -MH
3. Wells- Applied Coding and Information Theory -Pearson

References :

1. Gravano: An Introduction to Error control codes, Oxford
2. Trappe & Washington- Introduction to Cryptography With Coding Theory 2/e - Pearson
3. Shu Lin & Costello, Jr. D.J., Error Control Coding: Fundamentals and Applications, PHI.
4. Senn J., "Analysis and Design of Information Systems", McGraw Hill
5. Roft Johannesson and K S Zigangirov, Fundamentals of Convolutional Coding, University Press
6. Paterson, W.W. and Weldon, Jr. E.J., Error Correcting Codes; PHI
7. Whitten—System Analysios & Design Methods,5/e,MH
8. Murdic RG., Rose J. and Claggtt JR., "Information Systems for Modern Management", PHI

Project-I
EC 783
Contact: 3P
Credit: 2

- Students (preferably not more than four in each group) need to complete one project during 7th & 8th semester together.
- It is suggested that the project involves investigative study over & above the routine curriculum and also hardware activity. It should be result oriented and should explore newer topics.
- Students will finally prepare a comprehensive project report and give a demonstration & presentation of their project to the class of students and the review committee as nominated by the university.
- Total score of 200 (credit = 6) is distributed in 7th & 8th semester. Depending on the progress and quality, each student will be given a score out of 100 at the end of 7th semester, and at the end of 8th semester.

Group Discussion
EC 784
Contact: 3P
Credit: 2

- Purpose: - To train the students in the art & science of professional speaking and also in presenting themselves properly to their prospective employers.
- They need to communicate with clarity, structure and conciseness in both one to one and group situations. They have to gear their presentations to the level of the listener.
- The institute may choose any appropriate method available with them to train the students on this very important aspect.
- The evaluation should be continuous during the semester and at the end, a total score out of 100 will allotted to each student.

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Electives:
EC704

System Programming & Operating System
Code: EC704A
Contacts: 3L
Credits: 3

Will be published soon.

Advanced Engineering Mathematics for Electronic Engineers
Code: EC704B
Contacts: 3L
Credits: 3

1. Linear Algebra, Matrices, Rank, Determinant, Inversion.

Hermitian, Unitary, Orthogonal & Orthonormal Matrices.
Eigen values & Eigen vectors with examples of Symmetric T & PI network. [12]

2. Complex variable: Derivation of Couchy-Rieman conditions, Equations, Poles & Zeroes, Mapping.
Residue calculus technique, Contour integration technique.
Evaluation of series using contour integration.
Conformal mapping with examples of evaluation capacitances of two wire lines of cross-section (1) Concentric circles, (2) Confocal ellipses, (3) Two circles of identical radius separated by a distance.
Schwartz Christoffel Transformation. [16]

3. Special Functions: Bessel Function, Neumann Function, Hankel Function, Fourier Bessel Series with example of frequency, Phase modulation. [8]

4. Legendre Function, Mathiew Function. [2]

Books:

5. Partial Differential equations, Green's function, Transform techniques--- Laplace, Fourier, Hilbert, Hadamand, Cosine, Bilinear. [12]

6. Wavelet Transform.

Database Management System
Code: EC704C
Contacts: 3L
Credits: 3

Introduction [4L]
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Entity-Relationship Model [6L]
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Relational Model [5L]

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Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

SQL and Integrity Constraints [8L]
Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL,PL/SQL, Stored procedures and triggers, Cursors.

Relational Database Design [9L]
Functional Dependency, Different anamolies in designing a Database., Normalization using funtional dependencies, Decomposition, 1NF, 2NF, 3NF, Boyce-Codd Normal Form, Nomalization using multi-valued depedencies, 4NF, 5NF, 6NF.

Internals of RDBMS [9L]
Physical data structures, Query optimization : join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock based protocols, two phase locking, Deadlocks, Deadlock avoidance, Wait die & wound wait protocol.

File Organization & Index Structures [6L]
File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .

Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company?Pearson Education
3. Ramakrishnan: Database Management System , McGraw-Hill
4. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan Kauffman Publishers.
5. Jain: Advanced Database Management System CyberTech
6. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley. /Pearson Education
7. Ullman JD., "Principles of Database Systems", Galgottia Publication.

Reference:

1. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi
2. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition

"Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

Electives:

Process Control Engineering
Code : EC 704D
Contacts : 3L
Credits : 3

Module no.	Topic	No. of Lectures
1.	General Review of Process, Process Control and Automation :Different Process Variables for process control with case studies, Characteristic parameters of a typical process plant, a self regulation, potential value, process reaction rate, process time lag, process resistance and capacitance etc.	3

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2.	Characteristics and functions of different modes of control actions – ON-OFF, Multistep, P, PI, PD, PID controllers.	5
3.	Generation of Control Action in pneumatic & electronic controller, construction of different controllers.	3
4.	Tuning of Controller – open loop & closed loop methods.	2
5.	Final Control Element – different types of actuators (pneumatic, hydraulic, electric motor & stepper motor type),	3
6.	Control Valves, valves positioner, trim of control action, valve characteristics, single & double seated valve, special type of control valves – gate valve, butterfly valve etc.	4
7.	Advanced control strategies – microprocessor/Microcontroller/DSP Processor based control, PLC, DDC, Introduction of DCS	6
8.	Conversion of existing control schemes in operating plants with a complete example.	2
9.	Transmitters – pneumatic, electronic (analog and SMART)	2

Total 30 hrs.

Text Books:s

1. Harriot – Process Control, TMH
2. Johnson – Process Control Instrumentation Technology, - Pearson Education/PHI
3. Bhanot- Process Control: Principles & Applications - Oxford

References:

1. Bequette – Process Control – Modeling, Design and Simulation, PHI
2. Patranabis – Principles of Process Control, MH
3. Patrick, Industrial Process Control Systems, Vikas
4. Considine Doglas M – Process /Industrial Instruments and Control Handbook,-MH

Pattern Recognition and Machine Intelligence
Code: EC704E
Contacts: 3L
Credits: 3

Symbolic Reasoning; Intelligent Problem Solving Techniques: Generate and Test, Hill Climbing, Means and Ends Analysis, Problem Decomposition; Constraint Satisfaction; Production systems, Heuristic Search, Game Playing, Predicte Logic and Reasoning; Structured Approach to Knowledge Representation; Non-monotonic Reasoning; Probabilistic Reasoning: Paerl's Evidential Reasoning, Dempster - Shafer Theory; Machine Learning Algorithms: Supervised Learning, Unsupervised learning, Reinforcement Learning and Competitive Learning; Intelligent planning; Visual and Linguistic Perception; Pattern Clustering and Pattern Classification Problems- Distinction; Linear and Non-linear Classification; k-means clustering, Fuzzy C-means Clustering; Hotelling Transform; Principal Component Analysis; Bayes' Classifier; Neural Net-based algorithms for pattern classification and clustering; Decision Tree; Applications in image segmentation, machine vision, Robotics and Communication.

Books:

1] Konar, A. Artificial Intelligence and Soft Computing, CRC Press (Low Priced Indian Reprint).

2] Duda, R. and Hart, P.E., Pattern Classification and scene Analysis, John Wiley (Low Priced Edition).

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3] Russel, S. and Norvig, P., Artificial Intelligence – A Modern Approach, Prentice-Hall (Low Priced Edition)./Pearson Education.

Telecommunication Network Management
Code: EC704F
Contacts: 3L
Credits: 3

Overview of Data, Telephone and Cable Networks, Information Modeling, Networks Management Overview. Network Management Protocols. Management Information Bases. Management Platforms. Telecommunication Management Networks. Intelligent Networking. Examples and Case Studies – Internet, Telephone, Mobile, CATV, Optical; Networks.