REVISED CURRICULUM
OF

ELECTRONIC ENGINEERING

B.Sc. B.E / B.E.E.E. & M.S. E.E. / M.E. E.E.

Curriculum Development Project
Sponsored by
Ministry of Science & Technology
Islamabad

HIGHER EDUCATION COMMISSION
H-9, ISLAMABAD
2003

CURRICULUM DIVISION, HEC

Prof. Dr. Altaf Ali G. Shaikh	Director General (Curriculum)
Mr. Muhammad Younus	Director Curriculum
Malik Ghulam Abbas	Deputy Director
Miss Ghayyur Fatima	Research Associate
Mr. M. Shabbir Baig	Curriculum Officer
Mr. M. Tahir Ali Shah	Assistant Director

*Composed by **Mr. Zulfiqar Ali,** HEC, Head Office, Islamabad*

CONTENTS

PREFACE

Curriculum of a subject is said to be the throbbing pulse of a nation. By looking at the curriculum of a subject, one can judge the state of intellectual development and the state of progress of a nation. The world has turned into a global village, new ideas and information are pouring in a constant stream. It is, therefore, imperative to update our curricula by introducing the recent developments in the relevant fields of knowledge.

In exercise of the powers conferred by Sub-section (1) of section 3 of the Federal Supervision of Curricula Textbooks and Maintenance of Standards of Education Act 1976, the Federal Government vide Notification No.D773/76-JEA (Cur.), dated December 4, 1976, appointed Higher Education Commission as the Competent Authority to look after the Curriculum Revision Work beyond Class XII at Bachelor level and onwards to all Degrees, Certificates and Diplomas awarded by Degree Colleges, Universities and other Institutions of higher education.

In pursuance of the above decisions and directives, the Commission is continually performing curriculum revision in collaboration with the Universities. According to the decision of the special meeting of Vice-Chancellors' Committee, curriculum of a subject must be reviewed after every 3 years. For the purpose, various Committees are constituted at the national level comprising senior teachers nominated by the Universities. Teachers from local degree colleges and experts from user organizations, where required, are also included in these Committees.

The National Curriculum Revision Committee on **Electronic Engineering** in its meeting held in May 2003 at the H.E.C. Head Office, Islamabad finalized the draft curriculum after due consideration of the comments and suggestions received from the Universities and Colleges where the subject under consideration is taught.

The Final draft prepared by the Curriculum Revision Committee duly approved by competent authority is being circulated for implementation by the Universities.

(PROF. DR. ALTAF ALI G. SHAIKH)
D.G. (CURRICULUM)

July 2003

INTRODUCTION

The final meeting of National Curriculum Revision Committee for **Electronic Engineering** was held during May 27-29, 2003 to finalize the draft curriculum developed in the first meeting of the committee (September 10-12, 2002), at the Higher Education Commission, Islamabad.

The following attended:

1. Prof. Engr. Hyder Ali Khan, — Convener
   Chairman,
   Department of Electronic Engineering,
   Dawood College of Engg. & Technology,
   M.A. Jinnah Road, Karachi.

2. Prof. Dr. Tahir Izhar, — Member/Secretary
   Professor,
   Department of Electrical Engineering,
   University of Engg. & Tech., Lahore.

3. Prof. Muhammad Zahir Khan, — Member
   Professor,
   Department of Electrical & Electronic Engg.,
   NWFP University of Engg. & Tech., Peshawar.

4. Air Cdre. (R) Dr. Ejaz Muhammad, — Member
   National University of Science and Technology (NUST)
   Peshawar Road,
   Rawalpindi.

5. Engr.Rifat Mehmood, — Member
   Incharge,
   Department of Electronics & Computer Engineering,
   NFC Institute of Engineering & Technological Training,
   P.O Fertilizer Project,
   Khanewal Road, Multan.

6. Mr. M. Waqas Ahmad, — Member
   Manager, Electronics,
   POF Institute of Technology,
   Pakistan Ordinance Factory, Wah Cantt.

7. Dr. M. Tahir Khaleeq, — Member
   PSO, ED
   Pakistan Institute of Nuclear Science & Technology,
   PINSTECH, P.O. Nilore, Islamabad.

The meeting was chaired by Prof. Engr. Hyder Ali Khan, Chairman, Electronic Engineering, Dawood College of Engineering & Technology, Karachi. The meeting started with the recitation from the Holy Quran by Dr. Tahir Izhar of UET Lahore.

Dr. Altaf Ali G. Sheikh, Director General Curriculum, HEC welcomed the participants of the meeting on behalf of the Chairman, HEC and briefed about obligations of the Commission to review and revise curriculum every three years as per provision of the Act of the Parliament 1976. He mentioned about the recommendations and feedback from the Industry pertaining to the curriculum. He requested to incorporate the recommendations and suggestions from the Industry where appropriate.

Prof. Engr. Hyder Ali Khan, Convener of the Committee welcomed the participants and thanked HEC for the their efforts and the following universities/organizations for sending their representatives to participate in the important national cause.

1. Dawood College of Engg. & Tech. Karachi
2. P.O.F. Institute of Technology, Pakistan Ordinance Factory, Wah Cantt.
3. NWFP University of Engg. & Tech., Peshawar.
4. National University of Science & Technology, (NUST), Rawalpindi.
5. University of Engg. & Tech., Lahore.
6. NFC, Institute of Engg. & Technological Training, Multan.
7. Mehran University of Engg. & Tech., Jamshoro.
8. Pakistan Institute of Science and Technology, PINSECH, Islamabad.

Since most of the work on undergraduate curricula was completed in previous meeting of NCRC in Electronic Engineering, Curricula for graduate study in Electronic Engineering was the main focus of the committee. The fields of specialization were increased from 3 to 5. Improvements in the structure of the syllabi were brought-in, in main areas and important topics various Core Courses were elaborated. Though all the members of NCRC E.E. contributed in formulating the Graduate Syllabi in E.E., efforts poured in by Air Cdre (R) Dr. Ejaz Muhammad of NUST, Rawalpindi were highly appreciated.

The Committee appreciated the suggestions and observations from the institutions and industry and discussed all the suggestions in detail to incorporate them where appropriate.

The Committee also reviewed the recommendations of the orientation workshop for representatives of Engineering Universities and Conveners of various committees on engineering disciplines, held on May 8, 2003 at HEC Islamabad. The recommendations of the workshop, in particular, views of the Group on Electrical & Electronic Engineering of the workshop were given due considerations.

NCRC SUB-COMMITTEES FOR REVISION

OF UNDERGRADUATE ELECTRONIC ENGINEERING CURRICULA

The following Sub-Committees were formed in the ist meeting of NCRC Electronic Engineering to prepare the contents/details/draft of the revised syllabi for the discipline of Electronic Engineering.

1. a. Prof. Muhammad Zahir Khan
   b. Prof. Dr. Mukhtiar Ali Unar,

   All the courses of Mathematics, Control Systems, Signals and System/Processing. Information Theory and Communication Systems, Electronic workshop, Introduction to computing, Digital signal processing, digital image processing, Robotics, Digital system, Nueral Networks, Fuzzy logic, Modeling and Simulation, Advance control system, optimal control, Multivariable control, Introduction to adaptive control. Introduction to Non-linear control, Stochastic control.

2. a. Dr. M. Tahir Khaleeq
   b. Mr. M. Waqas Ahmad,

   Instrumentation, Engineering Management, Industrial Electronic, Data System and Algorithm Digital Logic, Electronic, Devices and Circuits, Electromagnetic Field Theory. Electronic Workshop, Microprocessor Architecture and Programming, Computer Communication and Networking, Microprocessor and Microcontroller applications. Digital System Design, VLSI Design, Opto-electronics, Engineering Economics, Artificial Intelligence and Decision Support Systems.

3. a. Prof. Dr. Tahir Izhar
   b. Engr. Rifat Mehmood.

   Basic Electronic Engg. Semiconductor Materials and Devices, Electronic Circuits, Electrical Machines, Power Electronics, Wave Propagation and Antennas

NCRC ELECTRONIC ENGINEERING SUB-COMMITTEE FOR GRADUATE CURRICULA

1. Air Cdr.(R) Dr. Ejaz Muhammad
2. Dr Mukhtiar Ali Unar

SCHEME OF STUDIES FOR
B.E./B.Sc

ELECTRONIC ENGINEERING
FIRST YEAR

1st Semester		**Credits Hours** Th + Pr	Th+Pr	**Marks**
GS111	Calculus and Analytical Geometry	3+0		100+00
EE112	Basic Electrical Engineering.	3+1		100+50
EE113	Computer Fundamental	3+1		100+50
HS114	Communication Skills	2+0		050+00
GS115	Pak Studies and Islamic Studies/Ethical Behaviour	3+0		100+00
	Total:	14+2 = 16		450+100 =550

2nd Semester

EE120	Semiconductor Materials and Device	3+1	100+50
GS124	Linear Algebra and Differential Equations	3+0	100+00
CE121	Computer Aided Engineering Drawing	0+2	000+50
EE123	Electronics Workshop	0+2	000+50
ME124	Engineering Mechanics	3+1	100+50
	Total:	9+6= 15	300+200 = 500

ELECTRONIC ENGINEERING
SECOND YEAR

3rd Semester

EE211	Electrical Machines	3+1	100+50
GS212	Complex Variables and Transforms	3+0	100+00
CE213*	Data Structure & Algorithms	3+1	100+50
CE214	Digital Logic Design	3+1	100+50
EE215	Electronic Devices & Circuits	3+1	100+50
	Total:	15+4 = 19	500+200 = 700

4th Semester

GE221	Numerical Methods	3+0	100+00
EE222	Network Analysis	3+1	100+50
EE223	Instrumentation & Measurement	3+1	100+50
EE224	Electromagnetic Field Theory	3+0	100+00
GS225	Engineering Economics	2+0	050+00
	Total:	14+2 =16	450+100 = 550

THIRD YEAR ELECTRONIC ENGINEERING

5th Semester		Credits Hours Th + Pra	Marks
EE311	Signals and Systems	3+1	100+50
EE312	Integrated Circuits	3+1	100+50
EE313	Control System	3+1	100+50
CE314	Microprocessor Architecture & Programming	3+1	100+50
GS315	Engineering Management	2+0	050+00
	Total:	14+4 = 18	450+200=650

6th Semester			
EE321	Wave Propagation and Antennas	3+1	100+50
EE322	Power Electronics	3+1	100+50
EE323	Information Theory & Communication Systems	3+1	100+50
GS324	Engineering Statistics	2+0	050+00
xxxxx	*Elective-I	3+1	100+50
	Total	14+4 = 18	450+200=650

FINAL YEAR ELECTRONIC ENGINEERING

7th Semester			
CE412	Computer Communication and Networking	3+1	100+50
xxxxx	*Elective-II	3+1	100+50
xxxxx	*Elective-III	3+1	100+50
xxxxx	*Elective-IV	3+1	100+50
xxxxx	*Elective-V	3+1	100+50
	Total:	15+5 = 20	500+250=750

8th Semester			
CE421	Microprocessor & Microcontroller Applications	3+1	100+050
EE422	Projects	0+4	000+200
xxxxx	*Elective-VI	3+1	100+050
xxxxx	*Elective-VII	3+1	100+050
		Total: 9+7 =16	300+350=650

Total credit hours = 138

* Please consult the enclosed list of elective courses. More elective courses may be added by the respective universities and the credit hours may split according to their own requirements/suitability.

Note: Numbering scheme of the courses is just a guide line, the universities may choose their own scheme. The first two letters of the proposals course numbers indicate the department, first digit represent year, second digit represent the semester and third number is the course number.
Course Code: CE: Computer Engineering, EE: Electronic Engineering, HS: Humanities, Science. GS: General Sciences.

*CE-214 is the pre-requisite for CE-314

Elective Courses

		Credit Hours Th+Pr	Marks Th+Pr
Electronics			
1.	VLSI Design	3+1	100+00
2.	Opto-Electronics	3+1	100+50
3.	Industrial Electronics	3+1	100+50
Communication and Signal Processing			
1.	Optical Fiber Theory and Techniques	3+1	100+50
2.	Optical Communication Systems	3+1	100+50
3.	Integrated and Guided Wave Optics	3+1	100+50
4.	Navigational Aids	3+1	100+50
5.	Mobile Communication	3+0	100+00
6.	Satellite Communication Systems	3+0	100+00
7.	Microwave Engineering	3+1	100+50
8.	Digital Communication Systems	3+1	100+50
9.	Telecommunication Engineering	3+1	100+50
10.	Digital Signal Processing	3+1	100+50
11.	Digital Filter Design	3+1	100+50
12.	Analog Filter Design	3+1	100+50
13.	Digital Image Processing	3+1	100+50
Control Engineering			
1.	Robotics	3+1	100+50
2.	Digital Control Systems	3+1	100+50
3.	Neural Networks	3+1	100+50
4.	Fuzzy Logic	3+1	100+50
5.	Modeling and Simulation	3+1	100+50
6.	Advanced Control Systems	3+1	100+50
7.	Optimal Control	3+1	100+50
8.	Multi-variable Control	3+1	100+50
9.	Introduction to Adaptive Control	3+1	100+50
10.	Introduction to Non-linear Control	3+1	100+50
11.	Stochastic Control	3+0	100+00

Computer Systems

1.	Computer Graphics	3+1	100+50
2.	Digital System Design	3+1	100+50
3.	Artificial Intelligence and Decision Support Systems	3+1	100+50
4.	Digital Instrumentation and Systems	3+1	100+50
5.	Parallel and Distributed Computing Systems	3+1	100+50

Biomedical/Electro-medical

1.	Biomedical Instrumentation	3+1	100+50
2.	Fields, Forces and Flows in Physiology	3+1	100+50
3.	Bio-electric Signals: Analysis and Interpretation	3+1	100+50
4.	Diagnostic Imaging Systems	3+1	100+50
5.	Biomedical Fluid Mechanics.	3+1	100+50

DETAIL OF COURSES FOR B.E./B.Sc ELECTRONIC ENGINEERING

FIRST YEAR ELECTRONIC ENGINEERING

1st Semester

GS111 APPLIED CALCULUS AND ANALYTICAL GEOMETRY

- Introduction to Functions
- Introduction to Limit
- Derivates, higher derivatives and their Applications
- Integral Calculus with applications
- Vector Algebra, and Vector Calculus,

Analytical Geometry

- Introduction
  Straight line in R3, Planes, Cylindriced and Spherical Coordinates, Surfaces, cylinders and cones, Spheres, Spherical Trigonometry.

Suggested Text:

1. Calculus & Analytical Geometry, S.M. Yosuf,
2. Brief Calculus and its Applications, D.D. Benice.
3. Calculus & Analytical Geometry, Thoms & Finny.

EE-112 BASIC ELECTRICAL ENGINEERING

Historical Development: Charge, Current, Potential Difference Current Voltage and Constant Current Sources. Laws of Electrical Circuits. Series and Parallel Circuits. Loop, Mesh, Node, Supper Node and Supper Mash Analysis, AC Circuits, Phasor Analysis. Impedance and Admittance, 3- Phase Systems, Power Factor. Introduction to PSpice.

Basic Principles, Generated Voltage, Electromagnetic Torque, Interaction of Magnetic Fields Alternatively Current Generators, DC Machine DC Generator, Transformers.

Labs.

Study of Ohm's Law, Krichhoff's Current, Voltage Law, Current Divider Theorem, Voltage Divider Theorem, Study of Superposition Theorem, Maximum Power Theorem, Thevenon's Theorem.
Study of RLC Series Circuits, RLC Parallel Circuits, Study of Transformer and DC Machines, Efficiency And Losses. Simulation of Basic Electrical Circuits Using PSpice.

Suggested Text:

1. Engineering Circuit Analysis by David Irwin, Wiley.
2. Electrical Circuit Analysis by William H. Hayat, Mac-Hill.
3. Peter Gerald Higgins Bothum.

EE113 COMPUTER FUNDAMENTALS

History, Classification, Basic Components, CPU, Memory, Peripheral Devices, Storage Media & Devices, Physical & Logical Storage, Data Organization, File Storage, Programs & Software, System Software, Application Software, Operating Systems, Programming Languages, Compilation & Interpolation, Problem Specification, Algorithms, Flow Chart, Pseudo Code, Basic Programming Techniques, Data Types & Declaration, Header File & Linkage, Variables & Constants, Arrays, Input/Output, Termination, Remark, Control Structures, Branching, Conditional Structures, Repetition and Loops, Basic Library Functions.

Practical Work

Lab work should cover simple programming exercises, MS-Dos, and Window 98/2000

Suggested Text:

1. "Computers" Peter Norton
2. Computer Data Processing by G.B Davis

HS114 COMMUNICATION SKILLS

Technical Report Writing and the Study of English to Enable the Student to express his ideas verbally and in writing.
Suggested Text: Arranged by the Faculty.

GS115 a) PAKISTAN STUDIES

b) ISLAMIC STUDIES/ETHICAL BEHAVIOUR

As prescribed by the Government of Pakistan.

2nd Semester

EE120 SEMICONDUCTOR MATERIAL AND DEVICES

Solid State Physics: Crystal Lattices, Unit Cells, Energy Bands. Conductors, Semiconductors, Insulators, Conductivity. Mobility, the Hall Effect. Diffusion and Drift Current. Laser and Superconductivity PN-Junctions Fabrication, Depletion. Diode Equation and its Application for Rectification Forward and Reverse Biased Characterization, Non Liner Behaviour, Reverse Recovery of PN-Junction, Small Signal Analysis, Zener, Tunnel and Varactor Diodes and their Applications. Radioactive Transitions Light Emitting Diode (LED), Laser Diode, Photo Diode, Photo Transistor Characteristics and Applications. NPN and PNP Transistor Construction and Characteristics. JFET and MOSFET:
Construction and Characteristics.

Labs.

Study of forward and reverse bias characteristic
Study Characteristics, Zener Diode, LED, Tunnel Diode, Laser Diode, Photo Diode, Reverse of Recovery Times of Diode, PNP & NPN Transistor Characteristics, Photo Transistor, JFET, MOSFET, Rectifiers (Half wave), Full wave Centre Tape and Bridge Rectifier.

Suggested Text:

1. Electronics Devices and Circuits by Bogard
2. Introduction to Electronics Devices and Circuits by Painter.

GS124 LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS

Matrices Introduction, Types of Matrices, Matric Operations, Elementary Row Operation, Echelon Form and Reduced Echelon Form.

Determinants: Introduction, Properties of Determinants and Applications

System of Linear Equations: System of Homogeneous and Non Homogeneous Linear Equations, Guass Elimination Method, Guass Jordan Method and other Methods, Applications.

Differential Equations

Ist Order Differential Equations, 2nd and higher order diff. Equations. System of Differential Equations.

Suggested Text:

1. Advanced Engg. Mathematics, by Erwin, Kreyszig, John Wiley,
2. Mathematical Methods Dr. S. M. Yousuf.

CE121 COMPUTER AIDED ENGINEERING DRAWING:

Types of Lines and Usage. Dimensioning Lettering Orthographic Ist Angle Projection. Sheet Planning. Orthographic 3rd Angle Projection. Introduction of Computer Aided Drawing. Isometric Projection. Sectional Drawing and Assembly Drawing. The Course Consists of Scale Drawing Only. Drawing Sheets will be prepared on Drawing Board and on ACAD.

Suggested Text:

1. A.C. Parkinson, First year Engineering Drawing, Latest ed., E.L.B.S.
2. T.W. Berghauser and P.L. Selive, Illustrated AutoCAD. Release 10, BPB Publishers.

EE123 ELECTRONIC WORKSHOP

Operation of Voltmeters, Ohm Meters, Power Supplies, Function Generators and Oscilloscopes. Measuring Parametric Values Of Discrete Passive Components. Coil Forming, House-Wiring/Testing,
PCB design and fabrication: Fabricating Simple Electronic Circuit on Breadboard, Use of Software Tools for PCB Design, Fabricating a PCB (Drilling, Etching etc.), Assembling and Soldering Components on a PCB.
Electronic Repair/Maintenance Lab Management
Hazards and Safety, Electronic Instruments and Device Handling and Storage, Service Instruments and Tools Operational Procedures.

Use of Data Books, Specification Sheets and Applications notes of Devices etc.

Industrial Visits may be arranged for demonstration:

a. Electronic Instruments, Plant and Machinery e.g., Process Controllers, Telephone Exchanges, CNC Machines, SCADA Systems, Laboratory Instruments, Hospital Equipment etc.
b. Electronic and Non-Electronic Components e.g., Relays, Connectors, Batteries, Cables, Transformers, Motors etc.

Computer Workshop: Computer in view of Hardware and Software, Basic Units Of A Computer, Identification of Computer Components and Peripherals, Dismantling and Assembling Computer Components and Peripherals, Precautionary Measures to save Computers, Hardware and Software Installation of Computers, Computer Environment and Preventive Maintenance.

Suggested Text:

1. First Practical Book of Electronic Workshop, B.S. Chowdary and A.A. Ursani
2. IBM PC Troubleshooting and Repair Manual.

ME124 ENGINEERING MECHANICS

Statics: Fundamental Concepts and Principles of Mechanics. Important Vector Quantities. Fundamental Units. Moments and Couples. Resultants of Forces and Couples. Laws of Equilibrium, Free Body Diagrams, Structures, Frames and Machines.

Dynamics: Fundamentals of Dynamics. Dynamics of Particles and Rigid Body Including Kinematics and Kinetics. Applications of Newton's Second Law of Motion. Analysis of Motion in two Dimensional and three Dimensional Space. Methods of Energy and Momentum. Applications of Dynamics to the Engineering Concepts.

Suggested Text:

1. J.L. Meriam & L.G. Kraige, Engineering Mechanics Vol. 2 Dynamics, John & Wiley Sons.

ELECTRONIC ENGINEERING

SECOND YEAR

3rd Semester

EE211 ELECTRICAL MACHINES

Magnetic Circuits, Transformers, Principles of Electromechanical Energy Conversion and Rotating Machines, Construction and Operation of Synchronous Generators and Motors, Induction Machines, Construction, Operation and Performance of Different Types of DC Machines, Small Power A.C. Motors, their Types and Applications. Introduction to Brushless D.C. Motors and Switched Reluctance Motors.

Lab work

Study of Short circuit test of transformer
Study of Open circuit test of transformer
Study of Internal Characteristic of DC Generator and Motor
Study of Load Characteristics of DC Generator and Motor
Study of Internal Characteristics of AC Generator
Design of Inductor, Speed control of DC Machines

Speed Control of AC machines
Study of brushless DC Motors, Basic operation and speed control.
Study of switched reluctance motor; Basic operation and speed control.
Modeling and Simulation of Electrical Machines using computer packages: i.e. MATLAB., PSpice etc.

Suggested Text:

1. Fitzgerald, Kingsely and Umans, McGraw Hill.
2. Electric Machines and Transformers, Oxford University Press B.S. Guru and H.R. Hizirolu.
3. Electrical Machine, M. Yasine.
4. Electrical Madune, Siskind.

GS212 COMPLEX VARIABLES AND TRANSFORMS

Complex Number System & Complex Variable Theory

Introduction to Complex Number System, DeMoivre Theorem and its Applications, Complex and Analytical Functions, Harmonic Function, Cauchy-Remann Equation, Singularities, Poles, Residues and Contour Integration.

Laplace Transform

Introduction Laplace Transform Of Elementary Functions, Properties, Inverse
Laplace Transform, Solution of Ordinary Differential Equations By Laplace Transform.

Fourier Series

Fourier Co-efficients, Fourier Series of Periodic and Aperiodic Functions, Convergence, Applications

Fourier Transform

Fourier Transform of Simple Functions, Properties and Theorems, Solution of Differential Equations

Suggested Text:

1. Advanced Engg. Mathematics by Erwin Kreyszig
2. Advanced Engg. Mathematics by S.H. K Dass

CE213 DATA STRUCTURE & ALGORITHMS:

Data Types and Structures, Algorithm Design and Analysis, Abstract Data Types, Program Correctness, Dynamic Memory and Linked lists, Implementation of Stacks, Queues, Trees and Graphs, Algorithms for Recursions, Hashing, Searching, Sorting and Pattern Matching, Introduction to Various Program Libraries and object Oriented programming.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Tanenbaum, Langsam and Augenstein, Data Structures Using C, Prentice-Hall.
2. Mark A. Weiss, Data Structures and Algorithm Analysis in C++, The Bengamin/Cummings Publishing Co. Inc. Singapore.
3. Sahni, Fundamentals of Data Structures in C, Computer Science Press.

CE214 DIGITAL LOGIC DESIGN:

Number Systems, Boolean and Switching Algebra, Combinational Logic, Minimization, Programmable Logic Devices. Sequential System Fundamentals, Elements, Circuits. Arithmetic Operations and Circuits. Memory Elements and Systems. Heirarchical Structures. State Machines. Design Problems.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. D.J. Comer, Digital Logic and State Machine Design, Oxford University Press.
2. A.W. Shaw, Logic Circuit Design, Oxford University Press.
3. Digital Design, M. Morris Mano, Prentice Hall.

EE215 ELECTRONIC DEVICES & CIRCUITS:

Devices: P-N Junction Diode and Circuits, (Rectifiers, Clippers, Clampers and Voltage Doubler). SCR, Triac Principles. Bipolar Transistors, Low Freq. Models, Biasing, Stabilization. Varactor Diode, Zener Diode. FET, MOSEFETs Models and Biasing. This subject is supplemented with PSpice Simulation of Electronic Circuits. The students are required to Design Circuits and test their Characteristics on Computers.

Circuits: BJT, FET, MOSFET Circuits and High Frequency Models. Frequency Response of Amplifiers. Frequency Analysis using models. Multistage amplifiers, Feedback Amplifiers and Oscillators. Power Amplifiers Analysis and Design. Wave Generation and Shaping Differential Amplifiers. Operational Amplifiers and Applications. Supplemented with Computer Simulation Emphasis is on Design of Electronic Circuits.

Lab: The lab work will be base on theory taught.

Suggested Text:
1. A.S. Sedra & K.C. Smith. Microelectronic Circuits, Oxford University Press.
2. Principles of Electronic Devices, Malvino.
3. Electronic Devices, Thomas L. Floyd.

4th Semester

GE221 NUMERICAL METHODS

Error in Computer Arithmetic, Root Finding for Non-Linear Equations, Interpolation and Polynomial Approximation, Solution of System of Linear Equations, Numerical Differentiation and Integration, Numerical Solution of Ordinary Differential Equation.

Suggested Text:

1. Mathematical Methods, Dr. S.M. Yusuf.
2. Numerical Methods, Prof. Mumtaz.

EE-222 NETWORK ANALYSIS:

Initial Condition Determination, Laplace Transform and Differential Equations, Laplace Transform of Signals Involving Generalized Functions. Convolution. Routh Hurwitz Criterion and Stability. Poles & Zeros. Impedance Function and Network Theorems. Two Port Parameters, Frequency Response, Magnitude and Phase Plots. Fourier Series and Transform. Transient and Steady State Response of Circuits. Sinusoidal/non- Sinusoidal Functions. This course is supplemented with Computer Simulation of Circuits and the study of responses on Computers.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. S. Franco, Electric Circuits Fundamentals, Oxford University Press.
2. J.S. Kang, PSPice Manual for Electric Circuits Fundamentals, Oxford University Press.
3. M.E, Valkenburg, Network Analysis, Prentice Hall, Inc.

EE223 **INSTRUMENTATION AND MEASUREMENT**

Precision Measurements Terminologies Including Resolution, Sensitivity, Accuracy, Uncertainty. Engineering Units and Standards. Specific Instruments and Systems Including Mechanical Measurements: Length, Force, Displacement, Stress and Strain; Thermodynamic Measurement: Temperature and Pressure: Measurements in Fluid Flows: Velocity, Flow Rate. Data Manipulation and Presentation: Basic data Manipulation Skills Using Personal Computers, Spread Sheets and Graphs. Static and Dynamic Measurement: Time Series and Sampling Requirements. Data Acquisition System. Software Simulation

Principle, Operation, Working and Construction of Different Analog and Digital Meters. Oscilloscopes and its Measurements. Recording Instruments and Signal Generators. Transducers. Different Types of Bridges for Measurements of Resistance, Inductance and Capacitance. High Voltage Measurements.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. W.D. Cooper, Electronic Instrumentation and measurement Techniques.
2. Ernest O. Doebrlin, Measurement systems, Application and Design McGraw Hill Book Co.
3. Hauptmarn, P., Sensors Principles and Applications Prentice Hall.
4. John P. Bentley, Principles of Measurement Systems, John Wiley and Sons, Inc.
5. Berlin Getz, Principles of Electronic Instrumentation and Measurement, by Merrill Publishing Co.
6. Electrical Measurement & Instrument, Houpif & Houpif.

EE224 **ELECTROMAGNETIC FIELD THEORY**

Review of Vector Analysis: Orthogonal Coordinate Systems, Vector Integration, Gradient, Divergence, Curl, Stokes Theorem. Static Electric Fields: Coulombs Law, Gauss Law, Electric Potential, Conductors and Dielectrics in Static Electric Fields, Electric Flux Density, Capacitance, Electrostatic Energy and Force, Poissons and Laplaces Equations, Uniqueness, Method of Images, Boundary Value Problems in Cartesian, Cylindrical and Spherical Coordinates. Static Magnetic Fields: Steady Electric Currents, Current Density, Resistance, Fundamental Postulates Of Magnetostatics. Biot-Savart law, Vector Magnetic Potential, Magnetic Field Intensity, Boundary Conditions, Inductance, Magnetic Energy and Force.

Suggested Text:

1. Elements of Electromagnetic, MINO Sadiku, Oxford University Press.
2. Electromagnetic, William H. Hayat.

GS225 ENGINEERING ECONOMICS

Introduction to Economics. Accounting, Cost Benefit Ratios, Interpretation of Financial Statements. Fundamental Economic Concepts. Supply and Demands. Types of Market and Forecasting.

Suggested Text:

1. Engineering Economy, Anthony J. Tarquim and Loland T.Blank, McGraw Hill.

THIRD YEAR ELECTRONIC ENGINEERING

5th Semester

EE311 SIGNALS AND SYSTEMS

Introduction, Classification of Signals, Basic Operations on Signals, Signals Representation and Models, System Characteristics

Time Domain Analysis

Sinusoidal and Complex Exponential Signals, Singularity Function Signals, Signal Energy and Signal Power, Orthogonal Signals, Signal Representation by Generalized Fourier Series, Continuous and Discrete Time Convolution Evaluation and Properties

Frequency Domain Representation & Analysis

Spectra and Bandwidth of Signals, Fourier Series Representation of Signals, Fourier Transform, Energy Density Spectrum, Power Density Spectrum, System Frequency Response, Phase Delay and Group Delay.

Continuous Time Filters.

Distortion less transmission, Ideal Filters, Butterworth and Chebyshev Filters.

Sampled Continuous Time Signals
Ideal Sampling, Sampling Theorem, Practical Sampling Effects.

Frequency Domain Representation of Discrete Time Signals

z-Transform, Inverse z-Transform, z-Transform Solution of Difference Equations. Stability of Linear Discrete Time Systems.

LAB WORK

- Generation of Commonly Used Signals
- Basic Operation On Signals
- Fourier Series Analysis
- Frequency response of Linear Systems
- Butter Worth and Chebyshev Filter Design
- Sampling Theorem
- Pulse Transfer Function and Stability of Linear Discrete Time Systems.
- Use of MATLAB or Math Cad. is recommended.

Suggested Text:

1. Signal and System by Oppenheim and Willsky, Prentice Hall
2. Signal and Linear System Analysis by G.E. Carlson, Wiley.

EE312 INTEGRATED CIRCUITS

Differential Amplifiers, Operational Amplifier and their Applications: Inverting and Non Inverting Amplifier, Adder, Integrator, Differentiator, Schmitt Trigger etc. Integrated Circuit Logic Families (DTL, TTL, ECL, I^2L, CMOS). LSI and MSI Logic and VLSI Design Basses. Integrator Timers.

Lab

Design of Inverting and Non Inverting Amplifiers
Adder, Integrator, Schmitt Trigger, Differentiator etc.
Design of DTL, TTL, ECL, I^2L, COMS etc.)
Design of Monostable, Astable, Bistable using timer ICs.

Suggested Text:

1. W.D. Cooper, Electronics Instrumentation and Measurement Techniques. Microelectronics, Jacob Millman, McGraw Hill.
2. Digital Integrated Circuits-A Design Perspective, Jan M. Rabaey, Prentice Hall, NJ.
3. Microelectronic Circuits, A.S Sedra & KC Smith, Oxford University Press.

EE313 CONTROL SYSTEMS

Introduction to Control Systems, Open-Loop and Closed- Loop Systems, Transfer Function. Importance of Modeling. Formation of Differential Equations of Electrical, Mechanical Electromechanical and other Systems. Block Diagram, Signal Flow Graph. Poles and Zeros of a Transfer Function, Stability, Standardized Inputs, Steady- State and Transient Response of First – Order, Second Order and Higher Order Systems. Transient Response Specification in Time and Frequency Domain. Introduction to State – Space Concepts and Terminology, Formation of State and Output Equations for Physical Systems. Roulth's Stability Criterion, Types and Analysis of Feedback Control Systems Based on Steady – State Error Coefficients, Sensitivity Functions. Root Locus Method. Bode Plots, Polar Plots, Nyquist Stability Criterion, Gain and Phase Margin, Nichol's Chart.

Lab Work

- Use of Sensors/Transducers
- Position and Speed Control of DC Motors
- Temperature Control
- Time Domain and Frequency Domain Response using MATLAB.

Suggested Text:

1. Modern Control Engineering, K. Ogatta, Prentice Hall.
2. Design of Feedback Control System, Stefni, Savant Shahan and Hosteller, Oxford University Press.
3. Modern Control System, Richard C. Drof.

CE314 MICROPROCESSOR ARCHITECTURE AND PROGRAMMING:

A study of implementation of Digital Systems using Microprocessors, Architecture and Operation of a Standard Microprocessor (Processor Design, Control Design, Memory Organization, System Organization) along with I/O Interfacing (Interrupts, DMA), and Software Design Techniques. Program Assembly and Simulation.

The Laboratory Includes Hardware and Software Design of Digital Systems Using Microprocessors. Design Experiments Concerned with Bus Interfacing, Memory Decoding, Serial Communication, and Programmable Ports. Software Design is accomplished with the Aid of Assemblers.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Avtar Singh and Walter Triebel, The 8086 and 80286 Microprocessor, Hardware, Software, and Interfacing. Englewood Cliffs, N.J., Prentice Hall.
2. Microprocessor, Douglas V. Hall.
3. The Intel Microprocessor, Barry B. Barry.
4. Computer Arch Org. & Design, Jon Haych.

GS315 ENGINEERING MANAGEMENT

Methods used in Industry to Determine the Relative Worth of Alternative Long Term Investments in Plants and Equipment. Topics Include an Introduction to Accounting and Cost Analysis, Selection Among Alternate Investments, Time Value of Money, Annual Cost, Present Worth and Rate of Return Methods of Analysis, Economic Life and Replacement, Risk Uncertainty and the Effects of Inflation. Managerial Decision Making and its Impact on Society Emphasis is on the Selection of Corporate Goals, Measures of Corporate Performance and Concepts of Industrial Regulations.

Maintenance Planning and Training on Software Package. Cost Analysis of Repair, Maintenance, Workshop and Stores Services. Procurement and Marketing. Management of Store. Reliability Estimation, Reliability Specification and Procurement, Consideration of Maintainability in Reliability Programmes, Acceptance Testing.

Suggested Text:

1. Reliability Handbook by W.G. Ireson, McGraw Hill.
2. Any other Material Found Suitable by the Concerned Faculty Members.

6th Semester

EE321 WAVE PROPAGATION AND ANTENNAS

Transmission Lines, Microstrip Transmission Lines, Transient Waves. The Wave Equation and Wave Guides. Travelling and Standing Waves, EM Plane Waves, EM Radiation. Properties of Antennas. Measurement of Antenna Characteristics. Computer Aided Design and Testing Propagation of Radio Waves.

Suggested Text:

1. M.N.O. Sadiku, Elements of Electromagnetic, Oxford University Press.

EE322 POWER ELECTRONICS

Introduction to the Scope of Power Electronics Solid State Device used in Power Electronics, Power Diode, Power BJT, Power MOSFET, SCR. GTO, IGBT, TRIAC, DIAC.
Semi-Controlled , Full Controlled and Uncontrolled Rectifiers: Single Phase and 3 Phase, Sin Puls, Twelve Puls & Twenty four Puls Rectifiers, Single Phase and three Phase Invertor, UPS. DC to DC Converters. Switched Mode Power Supplies AC&DC Motor Drive.

Labs.

Study the Characteristics of SCR, Control Power through load using Thyristors (SCR, TRIACS), Study of Series Inverter and Chopper Circuits, Study of Single Phase and Three Phase Rectifications, Three Phase controlled rectifications.

Suggested Text:
1. Power Electronics, Rashid, Prentice Hall.
2. Elements of Power Electronics, Philips T. Krein, Oxford University Press.
3. Power Electronic, Nawab.
4. Power Electronic, P.C. Sen.

EE323 INFORMATION THEORY AND COMMUNICATION SYSTEMS

Analog Modulation: Amplitude Modulation, DSB-SC and SSB Modulation, Different Types of Amplitude Modulators. Demodulation of DSB and SSB Signals, VSB Modulation. Introduction to Angle Modulation, Frequency Modulation, Phase Modulation, Narrow-Band FM, Wide-Band FM, Modulators and Demodulators of FM.

Pulse Modulation

Pulse Amplitude Modulation, Pulse-Width Modulation, Pulse Position Modulation, Pulse-Code Modulation (PCM), Differential PCM, Delta Modulation.

Digital Modulation Technique

PSK, FSK, QPSK, QAM, Digital Multiplexing, Clock Synchronization, Bit/Byte Interleaving

Information Theory

Information Contents of a Message, Average Information Per Symbol and Source Information Rate, Discrete and Continuous Channels. Channel Capacity, Shanon Hartley Theorem, Huffman, Coding

Lab Work

Lab work should include the demonstration of different Modulation and De-modulation Techniques. The Design of Simple telephone system may be included.

Suggested Text:
1. Modern Digital and Analogue Communication by B.P Lathi
2. Communication Systems by S Haykin.
3. Electronic Communication System, Candi & Davin.

GS324 **ENGINERING STATISTICS**

Basic Concepts of Statistics, Sample Space, Events, Classical and Axiomatic Definition of Probability, Conditional Probability and Bayes Theorem, Distribution and Density Function of Random Variables, Binomial, Poisson and Normal Distributions, Moment Generation Functions, Central Limit Theorem, Sampling Theory Estimation, Reliability.

Suggested Text:

1. Probability Random Variables and Stochastic Processes by A. Populis McGraw Hill.
2. Advance Engineering Mathematics, Erwin Kieyszig, John Willey.

***ELECTIVE-I**

FINAL YEAR ELECTRONIC ENGINEERING

7th Semester

CE412 **COMPUTER COMMUNICATION & NETWORKING:**

Computer Network Architectures and Models. Medium Access Control. Physical, Data Link, Network, Transport, and Session Layers. Local-area and Wide-area Networks. Computer Communication.

Suggested Text:

1. A S. Tanenbaum, Computer Networks, Prentice Hall.

***ELECTIVE-II**

***ELECTIVE-III**

***ELECTIVE-IV**

8th Semester

CE421 **MICROPROCESSOR AND MICROCONTROLLER APPLICATIONS**

Stand alone Applications of Micro controllers. Minimum Component Design. Programming of Mir controllers. Multiple Micro controllers Based Applications. Microprocessor Based Data Acquisition and Control: Interfacing A/D and D/A Converters. Industrial Applications of Microprocessors, System Designing.

Suggested Text:

1. Embedded MCU 68000, Handbook.
2. Microprocessors and Micro Computer Based System Design, M. Rifiq-uz-Zaman.
3. Microprocessor Principles and Applications, Charles M, Gilmore, McGraw Hill.

EE422 PROJECTS

***ELECTIVE-VI**

***ELECTIVE-VII**

DETAILS OF ELECTIVE COURSES FOR B.E./B.Sc

ELECTRONICS

VLSI DESIGN

VLSI Design and Design Tools, Fabrication of VLSI Devices: Concepts and Techniques used in the Fabrication of VLSI Integrated Circuits, Basic Semiconductor and MOSFET Theory, Integrated Circuit Fabrication, Integrated Circuit Layout, NMOS & CMOS Logic Design, Simulation of Circuit, Analog Circuit Design, Memory and Processor Design, Testing of VLSI System Architecture.
VLSI Designing Using Hardware Description Languages: Programming in Verilog and VHDL, Netlisting, Simulation and Testing.

LAB.

There will be lab projects to practice design and simulations using computer aided design tools.

1. Designing and simulating a CMOS gate
2. Designing a simple sequential circuit (e.g. one-bit accumulator)
3. Learning about regular data path structures: Design and Simulation of a 40bit Accumulator.

Suggested Text:

1. Modern VLSI Design – A systems Approach, Wayne Wolf, Prentice Hall.
2. Application-Specific Integrated Circuits, Michael John Sebastian Smith, Addison-Wesley.
3. Verilog HDL, A Guid to Degital Design and synthesis, Samir Palnitkar, Prentice Hall.

OPTO-ELECTRONICS:

Basic Physics of Light. Light Sources; Natural Light Sources, Gas Discharge Lamps, Light Emitting Diodes, Photodiodes, Solar Cells, Photo-Transistor, Infrared Detectors. Opto-isolators. Displays; Digital Display Technology, LED Displays and Liquid Crystal Displays. Gas and Ruby Lasers, Semiconductor Injection Lasers. Fibre Couplers. Waveleghth Division Multiplexers.

Suggested Text:

1. J. Senior, Optical Communications, Latest Edition.
2. Opto Electronic, Wilson and Hawks.

INDUSTRIAL ELECTRONICS

Time Delay Action. Resistance Welding with Solid State Circuits. High Frequencies and Shorter Wavelengths (Ultrasonic, Induction Heating, Light, Color, Infra-red or Heat-rays Ultra-violet-Rays, Lasers, X-Rays, Gamma rays). Programmable Logic Controllers and Distributed Control Systems. Temperature Recorders. Non-electronic Devices.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Electronics in Industry by George M Chute & Robert M Chute McGraw Hill Publishing Company.
2. Modern Industrial Electronics, Timothy J. Maloney, Prentice Hall.

COMMUNICATION AND SIGNAL PROCESSING

OPTICAL FIBER THEORY AND TECHNIQUES:

Historical Developments. General Optical System, Optical Fiber Wave Guide, Ray Theory Transmission, Electromagnetic Mode Theory for Optical Propagation, Cylindrical Fiber, Single Mode Fiber Transmission Characteristics of Optical Fibers, Attenuation, Material Absorption Losses in Silicon Glass Fibers, Linear Scattering Losses, Non-Linear Scattering Losses, Dispersion, Intra-Modal and Inter-Modal Dispersion, Overall Fiber Dispersion, Polarization, Non-Linear Phenomenon, Fiber Measurement Technique, Applications of Optical Fibers.

Lab: The lab work will be base on theory taught.

Suggested text:

1. J. Senior, Optical Communications.

OPTICAL COMMUNICATION SYSTEMS:

Optical Sources, Optical Detectors, Complete Optical Communication system, Optical Amplifiers, Wavelength Division Multiplexing

Lab: The lab work will be base on theory taught.

Suggested text:

1. J. Senior, Optical Communications.
2. Optical Fiber communication, Cruisner, Gerdkiser.

INTEGRATED AND GUIDED WAVE OPTICS:

Propagation in Asymmetric and Symmetric Planar Slab Wave guides, Radiation and Guided Modes; Practical Wave Guiding Geometries in three Dimensions and their Analysis Using the Effective Index Method; Technology of Wave guide Fabrication; Coupled Mode Theory and its Application to Grating Reflectors and Couplers, and Directional Couplers; Modes of the Optical Fiber and Coupled Mode Analysis of Passive Optical Fiber Devices such as Fused Tapered Couplers; Pulse Propagation in Optical Fibers and its Application to Communication Systems; Introduced to Solutions and Solution Based Communication.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Lee, Electromagnetic Principles of Integrated Optics.

NAVIGATIONAL AIDS

Terminology used in Navigation Systems. Direction Finding. Two way Distance Ranging. Differential Distance Ranging. Principle of working of GPS Receiver. Basic Modules Comprising a Typical Radar. Basic Radar Range Equation and the Impact of Various Parameters on Minmum and Maximum Ranges. Principle of working of a Pulsed Doppler Radar. Principle of working of a Secondary Radar (i.e. IFF; Identification of Friend and Foe) Instrument Landing System (ILS) Microwave Landing System (MLS). Very High Frequency Ranging (VOR) System.
Decca, Loran, Omega, Consol, Talking Beacons.

Lab: The lab work will be base on theory taught.

Suggested Text:
1. M.I. Skolnik, Introduction to Radar System,
2. R. Burton, Radar Engineering.

MOBILE COMMUNICATION:

Need for Mobile System Basic Cellular System. Performance Criteria, Operation of Cellular System. Analog and Digital Cellular Systems. Elements of Cellular System Design Specifications of Analog System. Cell Coverage for Signal and Traffic, Cell Site and Mobile Antennas, Co Channel Interference Reduction.

Suggested Text:

1. Wireless communication, Theodore S. Rappaport.
2. Wireless Application Programmers Library, Phil Schmauder.
3. Multiple Access Protocols for M.C.
4. Illustrated Telecom Dictionary.
5. Telecom Fact Book, Garbin.

SATELLITE COMMUNICATION SYSTEMS:

Introduction to Satellite Communication, Satellite Link Design, Propagation Characteristics of Fixed and Mobile Satellite Links, Channel Modeling, Access Control Schemes, System Performance Analysis, System Design, Mobile Satellite Services, Global Satellite Systems, National Satellite Systems, Mobile Satellite Network Design, Digital Modem Design, Speech Code Design, Error Control Codec Design, Low Earth Orbit Communication Satellite Systems.

Suggested Text:

1. Mobile Communication Satellite, Tom Logsden.
2. Global System for Mobile Communication, Joachim Tisat.

MICROWAVE ENGINEERING:

Microwave Components; Waveguides, Waveguide Junctions, Directional Couplers, Isolators, Circulators, Resonators. Microwave Generators: Microwave Tubes, two Cavity Klystron, Reflex Klystron, TWT, Magnetron. Microwave Semiconductor Devices. Gunn Diode, Impact Diode, PIN Diode, Mixers, Detectors. Microwave Measurements, Measurement of Frequency, VSWR, Power, Noise and Impedance.
Lab: The lab work will be base on theory taught.

Suggested Text:

1. Kennedy, Electronic Communication Systems, McGraw Hill.

DIGITAL COMMUNICATION SYSTEMS:

Binary Transmission and the Concept of time: Bits, Baud, words per minute, Timing, Distortion and Channel Capacity. Digital Input and Output Devices, Data Input and Output Devices. Digital Transmission on an Analog Channel. OOK, FSK, PSK, QPSK, BPSK, QAM, PCM, DPCM, Delta Modulation, Companding. Multiplexing and De-multiplexing Systems. TDM, Framing, Synchronization, Pulse Stuffing, PCM Switching, Data Switching and Computer Communication, Packet Switching, Optional Fiber Transmission OSI Reference Model.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Modern Analog and Digital Communications Systems, BP Lathi, Oxford University Press.

TELECOMMUNICATION ENGINEERING:

Conventional Telephone Systems, Digital Telephony, Digital Switching, Digital Transmission System, ISDN, Radio Link System, Fiber Optic Link System, Satellite Link System, Introduction to Telecommunication Management.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Modern Analog and Digital Communications Systems, BP Lathi, Oxford University Press.

DIGITAL SIGNAL PROCESSING:

Discrete Time Signals, Convolution of Signals, Discrete time Fourier Transform, z-Transform, Fast Fourier Transform, Design of FIR and HR filters. This course should be supplemented with practical exercises using Matlab.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Signal and System, Willsky.
2. Discrete-Time Signal Processing, A.V. Oppenheim and R.W. Schafer, Prentice Hall.

DIGITAL FILTER DESIGN:

Design Methods for FIR Filters. Design Methods for HR Filters, Implementation of Digital Filters in Hardware and Software (Architecture, Algorithms, Error Analysis), Multi-rate Processing (Interpolators and Decimators). Active Filter Components, Realizations and Design Techniques, Switched Capacitor Filters, Basic Building Blocks, Switched Current Filters, Continuous Filters and Monolithic Realizations.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. E.P. Cunningham, Digital Filters and Introduction, Houghton Miffin. R.M. Mersereau
2. A. Waters, Active Filter Design, Macmillan.

ANALOG FILTER DESIGN

Introduction to Filters. Active Devices used in Active Filter Design. Circuit Design Approach. Design of First Order Filters Sections in Casacade. The Bi-quad Circuit. Sensitivity Analysis. Circuit Design with simulated elements. Switched Capacitor Filters. Discrete Time Filters.

Lab: The lab work will be base on theory taught.

Suggested Text:
1. Analog Filter Design, Val Vlken Burg, Halt Rainhart, Envenston.

DIGITAL IMAGE PROCESSING:

Image Formation Process, Types of Images (Infrared, Thermal and Video Range etc.), Image Segmentation, Hough Transform, Shape from Stereo, Motion and Shading.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Gonzalez and Wood, Digital Image Processing. Addition Wesley.

CONTROL ENGINEERING

ROBOTICS:

Introduction to Robotics, requirement of a Robot, Types of Robots, Robot Hardware, Robot Sensors, Vision Systems, Robot Applications; Material Transfer, Spray Coating, Machine Loading, Process Operation, Welding, Assembly Inspection.

Lab: The lab work will be base on theory taught.

Suggested texts:

1. W.E. Snyder, Industrial Robots-Computer interface and Control, Prentice-Hall.
2. Malcolm, Robotics- an Introduction, Breton publishers.

DIGITAL CONTROL SYSTEM:

Sampled Data Systems. Discrete Signals and Sampling, Discrete Transfer Functions. Digital to Analog Conversion. Discrete Equivalents for Continuous Controller Discrete Models for Sampled Data Systems, Pulse Transfer Functions for Feedback Systems. Stability of Digital Control Systems. Direct Digital Design by Transform Methods.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Digital Control System Analysis and Design, Charles L. Phillips and H. Troy Nagle, Prentice Hall.

NEURAL NETWORKS:

Introduction, Benefits of Neural Network Technology. Biological Neuron. Model of a Single Artificial Neuron. Neural network architectures.
Learning paradigms; supervised learning, reinforcement learning, Hebbian learning, BoltzMann learning, un-supervised learning.
Early neuron models; Mc Cluchpitt's model, perceptron, ADALINE.
Feedforward neural networks; multilayer perceptron networks, radial basis function networks.
Hoppfield's network, simulated annealing.
Introduction to modular neural networks.

Lab: The lab work will be base on theory taught.
Suggested Text:

1. S. Haykin, Neural Networks a Comprehensive Foundation.

FUZZY LOGIC:

Introduction. Benefits of Fuzzy Technology. Fuzzy Sets. Membership Functions. Fuzzy Logic Fuzzification and De-fuzzification. Fuzzy Logic Control.

Lab: The lab work will be base on theory taught.

Suggested text:

1. Timothy, Engineering Applications of Fuzzy Logic.

MODDELING AND SIMULATION:

Fundamentals of Moddling; Types of Simulation; Basic Simulation Modeling Simulation Methodology; Model Translation, Modeling Complex Systems; Simulation Languages; Review of Basic Probability and Statistics; Sampling from Distributions; Random Number Generators; Generating Random Variables; Output Data Analysis for Single System; Statistical Techniques for Comparing Alternative Systems; Validation of Simulation Models; Variance Reduction Techniques; Experimental Design and Optimization; Advances in Simulation; Case Studies.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Law, A.M.; Kelton, W.D., Simulation, Modeling and Analysis, McGraw Hill.
2. Shanon, R.E.; Systems Simulation: The Art and Science, Prentice Hall.
3. Murray Smith, D.J., System Simulation.

ADVANCED CONTROL SYSTEMS:

Analysis of Control Systems in State Space; Design of Control Systems by State Space Methods; Uncertainty and Robustness; Design for Robust Performance; an Introduction to Multivariable and Adaptive Control.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Astrom, K.J., Computer Control Systems: Theory and Design; Prentice Hall.
2. Ogata, K., Modern Control Engineering, Prentice Hall.

OPTIMAL CONTROL:

State Space Representation of Physical Systems; Selection of a Performance Measure; The Optimal Control Law; The Principle of Optimality Applied to the Optimal Control Problem; The Calculus of Variations; Necessary Conditions of Optimal Control; Linear Regulator Problems; Pontryagin's Minimum Principle and State Inequality Constraints; Minimum Time and Minimum Control Effort Problems; Numerical Determination of Optimal Control by the Method of Steepest Decent and by the Method of Variation of Extremals.

Lab: The lab work will be base on theory taught.

Suggested Text:
1. Kirk, D.E., Optimal control theory; An Introduction, Prentice Hall
2. Lewis, F.L.; Optimal Control, John Wiley.

MULTI-VARIABLE CONTROL:

Algebraic Functions Theory; Non-Properness in Closed Loop Systems; Skew Symmetric Matric Equations in MIMO Systems; Finite Hidden Modes and Causality; Decomposition of MIMO Systems; Stability Analysis of MIMO Systems; Additive and Multiplicative Perturbations; MUDT Systems; Minimizing Conservativeness of Robustness; Frequency Assignment Problems; State Minimal Design; Pole Placement in MIMOs; LQRs and their Sensitivity Reduction; Two level Optimal Regulators; Canonical State-Space Model; Eigen Value Assignment, Feedback Deadbeat Control; State Observer;

Lab: The lab work will be base on theory taught.

Suggested Text:
1. Maciejowski, J.M., Multivariable Feedback Design, Addision Wesley.

INTRODUCTION TO ADAPTIVE CONTROL:

Need of Adaptive Control, Model Reference Adaptive Control, Gain Scheduling, Self-Tuning Control, Adaptive PID Controller, Applications.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Adaptive Control Theory, L'

INTRODUCTION TO NONLINEAR CONTROL:

Introduction, Common Physical Nonlinearities, Describing Function Method, Phase Plan Analysis, Feedback Linearization, Liapunov Stability Analysis.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Nonlinear Control System, Simon Hykim.

STOCHASTIC CONTROL:

Deterministic Signal Representation and Analysis; Introduction to Random Processes and Spectral Analysis; Correlation Function and Power Spectral Density of Stationary Processes, Gaussian and Poisson Processes; The Analysis of Linear and Non-Linear Systems with Random Inputs; Stochastic Signal Representation; Orthogonal Expansions; Linear Mean Square Filtering; The Orthogonal Principle; Optimum Wiener and Kalman Filtering; State Estimation for Discrete and Continuous Stochastic Systems; Extended Kalman Filtering and Adaptive Kalman System.

Suggested Text:

1. Bhat, U.N. Elements of Applied Stochastic Processes, John Wiley, Bhattacharya, R.N. and E.C. and E.C. Waymire: Stochastic Process with Applications John Wiley.

COMPUTER SYSTEMS

COMPUTER GRAPHICS:

Architecture and Implementation of Display and Interaction Devices, 2D and 3D Vision, Clipping and Transformation, Raster Graphics Scan Conversion Algorithms, Hidden Lines, Edges and Surface Removal Algorithms, Rendering Shading Algorithms.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Gillies & Burger, Interactive Computer Graphics, Addition Wesley.
2. Foley & Wandem, Fundamentals of Interactive Computer Graphics, Addition Wesley.

DIGITAL SYSTEM DESIGN:

Basic Hardare Modeling, Herachical Modeling Concepts, Verilog Constructs, Gate-level Modeling, Dataflow Modeling, Behavioral Modeling, Switch-level Modeling. Timing and Delays. Programming Languages Interface, Logic Synthesis and Verilog.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Samir Palnitkar, Verilog HDL, A Guide to Digital Design and Synthesis, Prentice Hall.

ARTIFICIAL INTELLIGENCE AND DECISION SUPPORT SYSTEMS:

Types of Intelligence, Cognitive Models, Knowledge Representation, Pattern Matching, Functional Programming in LISP (or Prolog), Goal-based Systems, Heuristic Search and Games, Expert Systems. Language Understanding, Robotics and Computer Vision, Theorem Proving and Deductive Systems and Learning. Applications Using Commercially Available Expert Systems

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Walker, Knowledge Systems and PROLOG. Addison-Wesley
2. Winston Artificial Intelligence: Addison-Wesley
3. Rich, Artificial Intelligence. McGraw-Hill.

DIGITAL INSTRUMENTATION AND SYSTEMS:

Study of Conventional Electronic Test and Measurement Instruments. Review of Sensors and Transducers. Automatic Testing and Measurement Instruments. Applications of Computers in Automatic Testing and in day to day Applications such as Biomedicine, Radars etc.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Noltingk B.E., Instrumentation, Butterworth Heinemann.

PARALLEL AND DISTRIBUTED COMPUTING SYSTEMS:

Data Parallelism, Multi-Processor Architecture, Process Communication, Data Sharing, Synchronous Parallelism, Multi-Computer Architecture, Data Partitioning, Distributed Memory, Scheduling Parallel Program; Object Oriented Parallel Program.

Lab: The lab work will be base on theory taught.

Suggested Text:

1. Ted, G.Lewis, Hesham El-Rewani, Introduction to Parallel Computing, Prentice Hall.
2. Bruce P. Lester, The Art of Parallel Programming, Prentice Hall.

BIOMEDICAL/ELECTRO-MEDICAL

BIOMEDICAL INSTRUMENTATION:

Physiologic Origin of Bio-potentials, Principles and Design of Biomedical Instruments, Transduction Methods, Advanced Electronics, and Electrical Safety.

FIELDS, FORCES AND FLOWS IN PHYSIOLOGY:

Conduction, Diffusion, Convection in Electrolytes; Fields in Heterogencous Media Electrical Double Layers. Maxwell's Stress Tensor and Electrical Forces in Physiological Systems. Fluid and Solid Continua, Equations of Motion Useful for Porous, Hydrated Biological Tissues. Clinical Examples: Membrane Transport, Electrode Interfaces; Electrical and Chemical Transduction in Tissues; Electro-Phoretic, Electro-Osmotic Flows; Diffusion/Reaction; ECG. Electromechanical and Physiochemical Interactions in Bio-Materials and Cells.

BIO-ELECTRIC SIGNAL: ANALYSIS AND INTERPRETATION:

Detailed Study of Bio-electric Signals that can be recorded from awake humans. Alternative Recording and Signal Processing Procedures with attention to Relative Advantages and Disadvantages, Including Instrumentation Requirements and Examples. Mathematical Models that Relate Signal Parameters to Physiological Events. Examples given to Demonstrate the Applicability of Bio-electric Signals to Control Devices External to the Body.

DIAGNOSTIC IMAGING SYSTEMS:

Methods of obtaining useful Images of the Interior of the Body and Industrial Objects Using X-Rays, Ultra-Sound, and Radionuclides. Image Formation and Display. Projection Radiography. Radiation Detectors. Conventional and Computerized Tomography. Nuclear Imaging. Ultra Sonic Imaging. Automated Diagnosis and Non-destructive Testing. Radiational Safety.

BIOMEDICAL FLUID MECHANICS:

Engineering Characterization of Fluid Flow in Cardio-Vascular, Respiratory, Rental, and Urological Systems. Basic Anatomy and Physiology. Theology of Blood and other Biological Fluids. Velocity Distributions and Dynamic Flow Properties. Principles of Regulation of Flows.

Suggested Texts

1. Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields by Jaakko Malmivuo, Robert Plonsey, Plonsey Malmivuo.
2. Biomedical Engineering Handbook, Volume I by Joseph D. Bronzino (Editor).
3. Principles of Bioinstrumentation by Richard A. Normann.
4. Medical Instrumentation: Application and Design by John G. Webster (Hardcover)
5. Standard Handbook of Biomedical Engineering & Design by Myer Kutz (Editor) (Hardcover).
6. Biomedical Signal Processing and Signal Modeling by Eugene N. Bruce (Author) (Hardcover).
7. Exploring the Biomedical Revolution: A Look at the Work of Frontline Scientists and How they are changing Medicine by Howard Hughes Medical Institute (Editor), Howard Hughes Medical Institute (Hardcover).
8. Biomedical Signal Analysis: A Case-Study Approach by Rangaraj M. Rangayyan (Author) (Hardcover).

ME.E.E/M.S.E.E PROGRAMME

The National Curriculum Review Committee deliberated on the 'Masters Curricula' of Electronic Engineering programme as well. The perception and recommendations of the committee are highlighted in the following paragraphs.

Master level curriculum is based on the international concept of covering at least 8 courses, each of 3 credit hours. Each course must necessarily be of Graduate level. According to American convention, these courses should be of 800/900 level. Subsequently, a student must accomplish an independent research project and the project weightage be counted as six credit hours.

As of present, only five specialties of electronic engineering have been dealt with. Each specialty requires 'Six Core Courses' and at least two 'Elective Courses'. It is strongly recommended that each course will be supplemented with Lab. experiments and Computer based simulation using MATLAB, PSpice or any other pertinent software packages.

The committee is fully cognizant of the fact that Master programmes in so many other areas should also be formalized. Needless to say that permeation of electronics in every systems/fields simply precludes coverage of all specialties. It is, therefore, envisaged that Board of Studies of a university would endeavour to formulate master level courses in other emerging technologies on these very lines. Biomedical Engineering, Industrial Electronics, Nanoelectronics etc.are some of these additional fields which may be pursued through graduate studies and research. In this context, this committee likes to solicit suggestions and ideas from all UETs, and other related quarters.

SCHEME OF STUDIES FOR MASTERS IN ELECTRONIC ENGINERING

SPECIALIZATON IN

1. System Engineering
2. Communication Engineering
3. Control Engineering
4. Microwave Engineering
5. Power Electronic Engineering

SYSTEM ENGINEERING

CORE COURSES

1. Semiconductor Materials and Devices
2. Analogue and Digital Integrated Circuits.
3. Integrated Circuit Fabrication
4. Digital Signal Processing and Stochastic Processes
5. Advanced Mathematical (Linear Algebra, Calculus and Numerical Methods).
6. Research Project

COMMUNICATION ENGINEERING

CORE COURSES

1. Data Communication and Networking
2. Digital Signal Processing
3. Radiating Systems and Antennas
4. Stochastic Processes
5. Advanced Mathematical (Linear Algebra, Calculus and Numerical Methods).
6. Research Project

CONTROL ENGINEERING

CORE COURSES

1. Modeling and Simulation of Dynamic Systems
2. Digital Control
3. Digital Signal Processing
4. Stochastic Processes
5. Advanced Mathematical (Linear Algebra, Calculus and Numerical Methods).
6. Research Project

MICROWAVE ENGINEERING

CORE COURSES

1. Semiconductor Device Physics
2. Microwave Integrated Circuit Design
3. Microwave Devices
4. Advanced DSP& Filter Design
5. Microwave Networks
6. Advanced Mathematics (Linear Algebra, Calculus, Numerical Methods
7. Research Project

POWER ELECTRONIC ENGINEERING

CORE COURSES

1. Power Electronic Devices
2. AC to DC Converters
3. Inverters
4. Switched Mode Power Supplies
5. Advanced Mathematics (Linear Algebra, Calculus, Numerical Methods
6. Research Project

Note: It may be noted that Core Courses of any speciality may be taken as Elective Courses in the other specialities. More elective courses may be added by the Board of Studies of concerned university/institutions.

ELECTIVE COURSES

1. Digital Image Processing
2. A/D and D/A Converter
3. DC Motor Drives and Control
4. Digital Integrated Circuits with PLDs and FPGs
5. Biomedical Instrumentation
6. Instrumentation and Process Control
7. Data Communication & Networking
8. Advanced Microprocessor Systems
9. Advanced Control Systems
10. Mobile and Wireless Communication
11. Digital System Design
12. Intelligent Systems
13. Automation and Robotics

14. Data Acquisition Systems
15. Microprocessors
16. VLSI Design
17. Advanced Analogue Circuits
18. Advanced Computer Networks
19. Mobile and Wireless Communication
20. Advanced Operating Systems
21. Microwave Communication
22. Optical Devices and Fiber Optic Communication
23. Network Security and Quality of Service.
24. Communication Management.
26. Advanced Communication Networks
25. Adaptive Control
26. Robust Control
27. Optimal Control
28. Intelligent Control
29. Non-Linear Control
30. Multivariable Control
31. Instrumentation and Process Control
32. Automation and Robotic
33. Digital Communication
34. Advanced Antenna Systems including Fased Array and Micro Strips
35. Advanced Analysis of Electro Magnetic Fields
36. GSM Technology
37. Microwave Imagery
38. Control of AC Machine
39. Control of DC Machine
40. Simulation of Power Electronic Devices
41. Modeling & Simulation of Power Converters
42. Stochastic Systems Analysis
43. Advanced Statistical Analysis
44. Adaptive Filtering
45. Detection and Estimation of Signals from Noisy Environments

DETAIL OF COURSES FOR
M.E/M.Sc ELECTRONIC ENGINEERING

Core Courses:

SYSTEM ENGINEERING

SEMICONDUCTOR MATERIALS & DEVICES

Crystal structure of Silcon and Ga As, Band Theory, Electrical Transport phenomenon, Metalic contacts, PN Junctions, structure and operation of Bipolar & Unipolar devices and HEMT. Novel semiconductor devices and their structures., High Frequency applications of semiconductor devices, structure of CMOS devices.

Suggested Texts

1. Solid State Electronic Devices and Circuits by Ben G. Streetman, Prentice Hall.
2. Microelectronic Devices, by Yang, McGraw-Hill.

ANALOGUE & DIGITAL INTEGRATED CIRCUITS

Differential amplifiers, operational amplifiers, bipolar & MOS Integrated circuit logic family characteristics. Design & implementation of digital circuits using LSI and MSI logic circuits, VLSI design basics, array structures, ROM, RAM, PLAs, Design & Testing of integrated circuits.

Suggested Texts

1. Microelectronics Circuits, Sidra & Smith, Oxford Press.
2. Digital Integrated Circuits, David Hodges, McGraw Hill.
3. Analysis and Design of Analog Integrated Circuits, Gray & Mayer, John Wiley.

INTEGRATED CIRCUITS FABRICATION

Crystal growth, diffusion phenomenon, ION Implantation, sputtering, Thin Film Deposition, Oxide Growth, Photolithography, Thermal Oxidation, Refractory Metals and their silicides, etching, lift off.

Suggested Texts

1. Silicon Processing for VLSI Era by S. Wolf, R.N Tauber – Lattice Press
2. VLSI Technology, S.Sze, McGraw Hill.

DIGITAL SIGNAL PROCESSING & STOCHASTIC PMOCESSES

Fourier transform (Anolgue & Discrete), Sampling theorem, circular convolution, Z-Transforms, Design of Infinite Impulse response Filters using prototypes and algorithmic methods, design of finite impulse response filters by windowing, frequency sampling stochasticity, mean, correlation, covariance and stationarity, ergodic processes and spectral analysis, linear stochastic systems, ,noisy processes, matched filtering, mean square estimation and filtering theory.

Suggested Texts:

1. Discrete time signal processing, A.V. Oppenhein, R.W. Schafer, Prentice Hall.
2. Prebability and Random Processes, Populis, McGraw Hill.

ADVANCED MATHEMATICS

First order differential equations: separable, homogeneous, exact and integrating factors. Second order differential equations: linear homogeneous, linear non-homogeneous. Series solution: power series, methods of Frobenius. Special functions: Bessel functions, Legendre polynomials. Numerical solution of differential equations: Euler method, Euler-Cachy method, Runge-Kutta. Boundary volve problems: shooting technique, finite differences, matrix analysis. Partial differential equations: Separation of variables, heat equation, wave equation, Laplace equation.

Suggested Text:

1. Advanced Engineering Mathematics, P.V.O'Neil, Wadsworth
2. Further Engineering Mathematics, K.A. Stroud, Macmillan.

COMMUNICATION ENGINEERING

DATA COMMUNICATION & NETWORKING

Discrete signals and Systems, Pulse Code Modulation. Pulse Width Modulation, Channel Capacity, Specialized Modulations (BPSX, QSPX, QAM, MART), Noise, Digital Demodulation, Forward Error Correction codes, Convolution Codes, Block Codes, Digital Communication Media and Interfaces, Computer Network Architecture and Models, Medium Access Control, Physical Data Link, Network, Transport and Session Layers, Local Area and Wide-area Network, Computer communication.

Suggested Text:

1. Computer Network, A.S. Tanenlaum, Prentice Hall.

RADIATING SYSTEMS AND ANTENNAS

Dipole and Multipole Radiation, Kirchoff's Theory, Huygen's Principle and Reciprocity Theorems, Aperture antennal. Radiation from Waveguides, Wire, Slots, Screens and Horn Antennas, Phased Arrays. High Frequency and Broad-Band Antennas.

Suggested Text:

1. Elements of Electromagnetics, M.N.O. Sadiku, Oxford University Press.

DIGITAL SIGNAL PROCESSING

Please see under "Core Courses: System Engineering".

STOCHASTIC PROCESSES

Please see under "Core Courses: System Engineering".

ADVANCED MATHEMATICS (LINEAR ALGEBRA, CALCULUS AND NUMERICAL METHODS).

Please see under "Core Courses": System Engineering.

CONTROL ENGINEERING

MODDELING AND SIMULATION OF DYNAMIC SYSTEMS

General Concepts of Model Building and Simulation. Physical Modeling. State-space Models. Nonlinear Parameter Identification. Numerical Optimization Techniques. Sensitivity Analysis. Model Validation. Continuous-time Simulation. Simulation Exercises using Simulink.

Suggested Text:

1. Modeling and Simulation of Dynamic Systems, Woods, R.L., and Lawrence, K.L., Prentice Hall.

DIGITAL CONTROL

Sampled-Data Modeling: Exact Models for Linear systems, Approximate Models for Nonlinear system, Applications to Pulse-Modulated Systems, System Identification.

Analysis of Sampled-Data Models: Solution of Difference Equations, Pole and Zero Locations, Stability of Systems and their Inverses, Controllability and Observability, Hidden Oscillations.

Translation of Analog Design: Approximations Based on Transfer Functions, Approximations Based on State Equations, Digital PID Controllers. Direct Digital for Regulator: Regulation Design, Pole-Placement, Observer Design, Pole Placement, Deadbeat Design, Gain Calculation, LQ Optimization, Separation Principle.

Direct Digital Design for Tracking, two Degree-of-Freedom Controller Structure, Use of Feedforward Compensation, Approximate Inverses for Non-Minimum-Phase Systems.

Digital Control of Nonlinear Systems, Numerical Methods for Solving Systems of Equations, Controllers and Observers from Newton's Method.

Suggested Text:

1. Digital Control System Analysis and Design, C.L. Phillips and H.T. Nagle, Prentice Hall.
2. Continuous and Discrete Control Systems – Modeling, Identification, Design and Implementation, Dorsey, McGraw Hill.

DIGITAL SIGNAL PROCESSING

Please see under "Core Courses": System Engineering.

STOCHASTIC PROCESSES

Please see under "Core Courses": System Engineering.

ADVANCED MATHEMATICS (LINEAR ALGEBRA, CALCULUS AND NUMERICAL METHODS).

Please see under "Core Courses": System Engineering.

MICROWAVE ENGINEERING

SEMICONDUCTOR DEVICE PHYSICS

Crystal Structure of Silicon and GaAS, Band Theory, Electrical Transport Phenomenon, Metallic Contacts with Semiconductors, Pn-Junction, Structure and Operation of Bipolar and Unipolar and HEMT, Novel Semiconductor Devices and their Structure for High Frequency Applications, Structure of Integrated Circuits.

Suggested Text:

1. Solid State Electronic Devices, Ben G. Streetman, Sanjay Banerjee, Prentice Hall.

MICROWAVE INTEGRATED CIRCUIT DESIGN

Microwave and RF Integrated Circuits, Amplifiers, Frequency Multipliers, Microwave Control Circuits, Noise in Microwave Systems, Design Consideration of RFIC for Wireless Communications.

Suggested Text:

1. Microwave Solid State Circuit Design, Inderbahl, Prakash Bhartia, John Wiley.

MICROWAVE DEVICES

Microwave Tube Devices, Velocity Modulation, Bouncing Process in Klystron, Crossed Field Tube Devices, TWT, Microwave solid State Devices, Varactor, PIN Diode, Tunnel Diode, VARISTORS, IMPATT DIODE, TRAPATT, BARITT Diodes and Gunn Diodes.

Suggested Text:

1. Microwave Transistors, Amplifiers: Analysis and Design, Guillermo Gonzalez, Prentice Hall.

ADVANCE DSP AND FILTER DESIGN

Please see under "Core Courses: System Engineering**".**

MICROWAVE NETWORKS

Transmission Line, Smith Chart, Impedance Transformation, Scattering Parameters and ABCD Parameters, Magic TEE, Isolators, Faraday Rotators, Signal Flow Graphs, Planer Transmission Lines including Microstrip Line, Even and Odd Mode Analysis, Periodic Structure, Butterworth, Chebychef and Elliptical Filters.

Suggested Text:

1. Microwave Engineering, David M. Pozar, John Wiley.
2. Foundations for Microwave Engineering, R.E. Collins, McGraw Hill.

ADVANCED MATHEMATICS (LINEAR ALGEBRA, CALCULUS AND NUMERICAL METHODS).

Please see under "Core Courses": System Engineering.

POWER ELECTRONIC ENGINEERING

POWER ELECTRONIC DEVICES

Power Diodes, SCRS, GTOs, BJTs, MOSFETs, IGBTs, MCTs, Characteristics, Constructions, Operation, Technology of Devices, Ratings, Losses, Efficiency Calculations.

Suggested Text:

1. Power Electronics, Mohen.

AC TO DC CONVERTORS

Diode Rectifiers, Single Phase Half Wave with Resistive and Inductive Loads, Single Phase Bridge Rectifiers, 3-Phase 3 Pulse Rectifiers, 3-Phase 6 Pulse Rectifiers, 12 Pulse and 24 Rectifiers, Controlled Rectifiers, Half Control and Full Controlled Rectifiers, PWM, Converters.

Suggested Text:

1. Power Electronics, Lander.

INVERTERS

Single Phase, DC to AC Converters, Generation of Step and Sine Waves, PWM Inverters, 3 Phase Inverters, 6 Step, 12 Step and 24 Step Inverters, Calculations of Harmonics and Waveform, 3 Phase PWM Inverters, Harmonics in PWM Converters.

Suggested Text:

1. Power Electronics, Landers.

SWITCHED MODE POWER SUPPLIES

Linear Power Supplies, Introduction to Switched Mode Power Supplies, Basic Switch Mode Topologies, Buck, Boost and Inverting Convertors, Forward Converters, Single Ended, Double Ended and Interlaced Topologies, Push-Pull, Half Bridge and Full Bridge Converter, Feed-back Control, Current Mode Control, PWM Control Chips.

Suggested Text:

1. Switch Mode Power Supplies, Pressman.

ADVANCED MATHEMATICS (LINEAR ALGEBRA, CALCULUS AND NUMERICAL METHODS).

Please see under “Core Courses”: System Engineering.

RECOMMENDATIONS

The NCRC discussed at length on different aspects of the syllabi of Electronic Engineering and agreed upon the recommendations given here under.

1. The total curriculum should spread over four academic years or eight academic semesters. Though the courses in the proposed draft are given in the semester system format, it may be the discretion of the university to adopt them according to their own set-up and suitability.

2. The core courses are recommended to be made compulsory in all universities of Pakistan and a set of electives may be chosen to fulfill the complete curriculum requirement. The electives proposed by the committee may not be considered as mandatory. Universities may introduce additional electives to meet their own peculiar requirements on the recommendations of their own Board of Study. Similarly the textbooks proposed, are also meant as a guideline only.

3. Most of the public sector universities/colleges' laboratories need improvements. The education in the field of engineering, particularly in Electronic Engineering, cannot be imparted without practical experiments and hands on practices. Special attention and additional funds may be provided to equip the laboratories. For Core subjects, Laboratory Work is to be deemed absolutely essential.

4. There is an urgent need to commence a Teachers Training Programme to assimilate modern technologies and for enhancement of instructional methodologies.

5. Trained and qualified manpower may be inducted on emergency basis to ameliorate the faculty shortage.

6. Special incentives should be devised for good teachers and students for their encouragement.

7. Engineering universities/colleges should be connected through LAN & WAN so that Internet facility for R&D may be used widely by teachers and students. This connectivity will result in useful interaction between the students/ researchers/faculties.

8. Use and application of Simulation Software Tools be introduced to students for the research/design/development work, at appropriate levels.

9. For Mini Projects and Final Year Projects, Laboratories should be well equipped with components, devices and measuring equipments of common use.

10. Final year projects should involve analysis, design and practical work. The examination for the project should include an open-house formal presentation by the students. Efforts should also be made to invite representatives from the local industries.

11. The Committee is fully cognizant of the need for very strong interaction amongst the universities on academic matters. Therefore, all universities are requested to disseminate any changes in their curricula to others as well.

12. All engineering institutions should arrange for internship training, spanning 4 to 6 weeks for their students in the local industry. The Committee strongly opines that in order to ensure participation of our industry, a legal framework needs to be evolved at the provincial and federal Government levels.

13. Quite akin to Internship concept is the idea of co-opt programme. This will facilitate identification of perspective candidates, from among the students for future employment in the industry.

14. Subject to availability of teaching faculty, engineering institution may offer humanities courses in Philosophy, Logic and Human Resource Development also.

15. The teaching faculty be encouraged to attend short courses, seminars and workshops which may be locally or internationally arranged by various agencies. The expenses to be incurred on this account be made mandatory to be included in all PC-Is. This activity be liberally supported so that a faculty member may avail such an opportunity every 6-months.

16. The Committee has taken into account the recommendations of the orientation workshop for the representatives of the engineering industry which was arranged by the HEC. Accordingly, the curriculum has been suitably amended and changes incorporated where possible.

17. The Committee is unanimous in pronouncing that future progress and prosperity of Pakistan is undeniably linked to our self-sufficiency in Electronic Engineering related fields. It is a very tall order which warrants unstinted and well-focused R&D efforts in certain carefully selected fields. In this context, the Committee recommends that our Engineering Universities must host concerted R&D pursuits which is the compelling need of the hour in the following areas:

a) Electronic Engineering related to space sciences.

b) Guidance and control systems

c) Biomedical Engineering

d) Nano Technologies

e) Milli-meter wave Engineering

f) Aerospace Sciences

g) Avionics Engineering

h) Robotics and Industrial Manipulators

i) Parallel and Distributed Processing

j) Electronic Engineering as applicable to Petroleum Industry and Mining.

k) Semiconductors and other materials, which find applications in Electronic system.

18. The above mentioned recommendations are, by no means, complete and exhaustive. Suitable additions, however, can be made in view of the varying and dynamic nature of the discipline of Electronic Engineering.