SCHEME FOR MASTER OF ENGINEERING (INDUSTRY ORIENTED AND PRACTICE BASED) PROGRAMME REGULAR AND MODULAR ELECTRICAL ENGINEERING IN INSTRUMENTATION AND CONTROL

AIM

To offer Master of Engineering (industry oriented and practice based) Regular & Modular Programmes Electrical Engineering in Instrumentation and Control, for technical teachers and professionals working in industries.

RATIONALE

The rapid pace at which changes and advancements are taking place in technology pose a great challenge to training and supplying the right kind and quality of technical manpower. The training of technical personnel is largely influenced by the nature of curriculum, quality of instructional processes, management of instructional system and the role played by industry in their training.

In order to increase the relevance of technical personnel to the world of work, it has all along been felt that the nature of programmes offered by the technical institutes should be oriented towards technology applications and practices. These programmes should focus on learning of industrial practices, practical and generic skills of problem solving, learning to learn skill and entrepreneurship skill.

As per the latest recommendations of the AICTE regarding pay scales and qualifications for technical teachers, the minimum qualification for lecturers is prescribed as degree in Engineering or Technology or equivalent and they have to acquire Master’s degree or such higher qualifications for promotions to higher grades. Majority of these teachers are fresh graduates and lack the knowledge of industrial practices and related practical skills, which in turn affects, the quality of technician engineers produced by the Polytechnics/ Engineering Colleges. They, therefore, need a strong orientation in technological and field practices in the areas of fabrication, erection, construction, installation, operation, production, testing, maintenance and quality control.

The practice-based M.E. degree programme in Instrumentation and Control will provide the above education and training to the Polytechnic/ Engineering College teachers specially to equip them with the necessary knowledge and skills related to industry and field practices. They will be in a position to transfer such knowledge and training to the students of Polytechnics, so that their effective contribution in the world of work is increased.

In order to meet the above long felt need for higher education of polytechnic/ Engineering College teachers, it is necessary to offer practice based Masters degree programmes specially designed to incorporate credit based system of evaluation. The system will have all the inbuilt flexibility to allow for self pacing, taking up study of courses in the sequence and at the time convenient to in-service graduate personnel and obtaining specialization in the areas specific to their profession and carrier development.

In view of the above, NITTTR (earlier known as TTTI) Chandigarh have started offering a practice based M.E Electrical Engineering programme (Regular) in Instrumentation and Control for
technical teachers having a B.E. degree or an A.M.I.E qualification in Electrical/ Electronics/ Instrumentation & Control Engineering or equivalent, since August, 1998. The course aims to provide an in-depth knowledge of field practices and ability to innovate and conduct research in technology areas. This will not only change the orientation of technician programmes but will also reduce the widening gap between technician courses and field practices and will greatly improve the performance of industries. Limited numbers of seats are also available to professionals working in industries and field organizations.

An acute problem faced by technical institutions both for degree and diploma level is that they are not able to spare their teachers for two long years for higher studies away from their institutes. In order to face the above situation, the institute is also offering another M.E. Electrical Engineering programme (Modular) in Instrumentation & Control for technical teachers and professionals working in Industries. This programme has been structured modular in nature where the teachers could be relieved from their institute to this institute for attending classes during summer and winter vacations. They will however also have to undertake follow up study when they return to their institutions so as to prepare themselves for University examinations before the beginning of subsequent modules. The contact type ME programme which is of two years duration has been made modular without any dilution with respect to rigour of teaching learning practices as also University examinations. However, the duration of the programme has been increased to 3 years. Classes will begin from first week of June and second week of December having a contact period of 5 weeks each where the students will study two subjects simultaneously.

Objectives

The specific objective of this course is Continuing Education and Training and Retraining of:

- in service technical teachers.
- industry personnel
- any other sponsored candidate desirous of pursuing a career in teaching.

Target Population

The envisaged target group includes:

- teachers with a B.E degree or an equivalent qualification such as A.M.I.E. etc, in Electrical/Electronics/Instrumentation and Control Engineering.
- working professionals from Industries and other organizations having a B.E. degree in Electrical/Electronics/Instrumentation and Control Engineering or an equivalent qualification such as A.M.I.E. etc. in Electrical/ Electronics/ Instrumentation and Control Engineering.

SPECIAL FEATURES OF THE PROGRAMMES

i) Both the programmes are flexible, and allow self-pacing and taking up course of study in the sequence and at times convenient to the students:

ii) The courses focus on the mastery of minimum essential competencies and development of capabilities such as learning to learn, problem solving, human relations and management skills in addition to learning of Instrumentation Control Engineering subjects.
iii) These make use of a combination of instructional techniques such as group discussions, home assignments, individual and group projects, independent study, seminars etc.

iv) Assessment of student’s performance will be based on both continuous evaluation using variety of assessment techniques matching the learning objectives of the different courses of study and end of term University evaluation.

v) Completion of the course work is followed by Thesis work
# STUDY & EVALUATION SCHEME
OF
M.E. ELECTRICAL ENGINEERING (INSTRUMENTATION & CONTROL) – REGULAR PROGRAMME

## Semester – I CORE SUBJECTS (COMPULSORY)

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
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<th>Theory</th>
<th>Sessional</th>
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**Total** 20  250  250  250  750

## Semester – II  CORE SUBJECTS (COMPULSORY)

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**Total** 22  250  300  300  850
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**NOTE:**

1. Requirement for the award of ME in Instrumentation & Control degree is 75 credits with minimum CGPA of 6.0 and successful completion of thesis work.

2. No numerical marks are to be assigned to thesis work. It is either “Accepted” or “Rejected”. If Accepted the Quality of work reported in thesis can be graded as in table below.

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<th>Requirement</th>
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<td>Publication in SCI Journal</td>
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<tr>
<td>Publication in Indexed Journal</td>
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<td>Publication in National Journals/Proceedings of Indexed International Conference such as IEEE, ASME etc/Proceedings of International Conference</td>
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<td>Proceedings of National Conference</td>
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**SPELL – VI**

|        |                  | L    | P    | TOTAL | THEORY | SESSIONAL | TOTAL |
| 12     | Subject – 1      | 4    | ---  | 4     | 50     | 50        | 100   |
| 13     | Subject – 2      | 4    | ---  | 4     | 50     | 50        | 100   |
| 14     | Preliminary Thesis | --- | 20   | 20    | ---    | ---       | ---   |
|        | TOTAL            | 18   |      |       |        |           | 200   |

**SPELL – VII**

|        | Thesis           | L    | P    | TOTAL | THEORY | SESSIONAL | TOTAL |
| 15     | --- 30 30        | 30   | 30   | 15    | ---    |           | ---   |
|        | TOTAL            | 15   |      |       |        |           | ---   |
INSTRUCTIONS TO PAPER SETTERS

The instructions for the paper setters for all the subjects of M.E. Electrical Engineering (Instrumentation & Control) are as follows:

1. The paper must be set by taking into consideration the total syllabus.
2. There should be in all 8 questions covering the total syllabus.
3. The examinees are supposed to attempt any five out of the 8 questions.
4. The paper should be set by following the principle of simple to complex approach.
5. The paper must be set in such a pattern that it examines knowledge, analytical power and the reasoning power of the examinee.
6. Where ever appropriate, proper numerical problems should be included.
7. Maximum marks for the paper should be 50 and time allotted should be three hours.
DETAILED SYLLABUS OF SUBJECTS

MEI 6101 MEASUREMENT SCIENCES AND TECHNIQUES

CONTENTS

Introduction

Generalized Performance Characteristics
Static and Dynamic performance characteristics, Characteristic of periodic and transient inputs and the response of measuring system to these inputs. Response of measuring system to random inputs, Frequency spectra, auto correlation, cross correlation spectral density, Experimental determination of system parameters, requirement of instrument transfer function to ensure accurate measurement.

Signal Conditioning
AC/DC signal conditioning, Analog to Digital and Digital to Analog converters, modulation – types, filters – active, passive, digital, Data transmission and telemetry-classification, Recorders – Types of recorders, XY-Plotters, Ultraviolet, magnetic and digital recording.

Measurement of Non-Electrical Quantities

LABORATORY/FIELD EXPERIENCES
1. Experimental determination of system parameters.
2. Study and verification of transducer characteristics.
3. Study of signal conditioning techniques.
4. Verification of dynamic performance characteristics of a given system.
5. Case study of a real life measuring system in an industry.
6. Various data acquisition software.

BOOKS RECOMMENDED
CONTENTS

Review of Process and Control systems

Design aspects of Process Control System

Dynamic Behaviour of Feedback Controlled Process

LABORATORY/FIELD EXPERIENCES
1. Study and analysis of a feedback controller
2. Simulation of control schemes
3. Verification of desired characteristics of P,I,D, and PID controllers
4. Design fabrication and testing of an electronic controller
5. Case study of digital computer controlled system in industry

BOOKS RECOMMENDED
CONTENTS


Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT): Discrete Fourier Transform and its Properties, Efficient Computation of DFT using FFT algorithms: Direct computation of the DFT, Divide and Conquer Approach, Radix-2 and Radix-4 FFT algorithms, Linear Filtering Approach to Computation of DFT.

The z-transforms: Introduction, z-transform, Properties of z-transform, Inverse z-transform, System function and Pole-zero plots from z-transform, Causality and Stability in terms of z-transform, Bilateral z-transform, Computation of z-transform

Structures for the Realization of Discrete-time System: Structures for FIR systems-Direct from I and II, cascade and parallel form, structures for IIR systems.


LABORATORY / FIELD EXPERIENCES

Implement the following programs in MATLAB
2. Circular Convolution.
3. DFT and FFT of Discrete time sequences.
4. Design of FIR Filters.
5. Design of IIR Filters.

BOOKS RECOMMENDED

5. Digital Signal Processors, Venkataramani, Bhaskar, PHI
CONTENTS

Semiconductor Devices
Power Diodes, Bipolar Junction Transistor (BJT), Thyristors, Gate Turn-off Thyristor (GTO) and Insulated Gate Bipolar Transistors (IGBT) – Basic Structure, Physics of Device Operation, V-I Characteristics and Switching Characteristics.

Line-Frequency Diode Rectifiers (Line Frequency ac to Uncontrolled dc)

Line-Frequency Phase Controlled Rectifiers (Line Frequency ac to Controlled dc)
Thyristor Circuit and their Control, Single-Phase Converters, Three-Phase Converters

Chopper
Control of dc-dc Converters Buck Converters, Boost Converters, Buck-Boost converters, Cuk dc-dc Converters, Full Bridge dc-dc Converter, dc – dc Converter Comparison

Inverters
Basic Concepts of Switch Mode Inverters, Single-Phase Inverters, Three-Phase Inverters, Effect of Blanking Time on Output Voltage in PWM Inverters, other Inverter Switching Schemes, Rectifier Mode of Operation, Concept of Multi-Level Inverter.

Cycloconverters
Single Phase Mid-point and Bridge type Cycloconverters. Three Phase Half-Wave Cycloconverters, Output Voltage Equation, Load Commutated Cycloconverters.

Power Conditioners and Uninterrupted Power Supplies
Power Line Disturbances, Power Conditioners and UPS

Solid State Control of Motors
Single-Phase and Three-Phase dc Drives, Chopper Drives, ac Drives, Induction Motor Drives, Speed Control of Three-Phase Induction Motors, Synchronous Motor Drives, Microcontroller based ac and dc Drives.

LABORATORY / FIELD EXPERIENCES

1. MATLAB/SIMULINK based simulation of (i) rectifier (ii) chopper and (iii) inverter.
2. MATLAB/SIMULINK based simulation of (i) cycloconverter and (ii) dc chopper drive
3. Fabrication, testing and trouble shooting of Illumination Control using Thyristor.
4. Fabrication, testing and trouble shooting of three phase diode bridge rectifier.
5. Fabrication, testing and trouble shooting of dc chopper drive.
6. MPPT of PV array using buck converter with MATLAB/SIMULINK and D-space interface.

BOOKS RECOMMENDED

CONTENTS

Industrial Instrumentation and Control Schemes
Field bus concept. Data acquisition system, Data loggers, Supervisory control, DDC, DCS, SCADA, Instrumentation in hazardous situations, Robotics and Automation.

PLC Programming
Programmable logic controller (PLC) basics: Definition, overview of PLC systems, input/output modules, power supplies, isolators. Ladder logic diagram, General PLC programming procedure. Auxiliary commands and functions.

PLC Intermediate Functions
Arithmetic functions, number comparison functions, Skip and MCR functions, data move systems. PLC Advanced intermediate functions: Utilizing digital bits, sequencer functions, matrix functions. PLC Advanced functions: Alternate programming languages, analog PLC operation, networking of PLC, PLC-PID functions, PLC installation, troubleshooting and maintenance, design of interlocks and alarms using PLC. Creating ladder diagrams from process control descriptions.

Applications of Industrial Instrumentation
Study of Instrumentation Schemes for Thermal, Nuclear and Hydro power stations, Cement plant, Fertilizer, Chemical and Steel plant Paper industry.

LABORATORY/FIELD EXPERIENCES
1. PLC Programming practices based on ladder diagrams using relays, timers, counters, sequencers.
2. Case study of a PLC based instrumentation scheme in a process industry.

BOOKS RECOMMENDED
MEI 6201 MICRO CONTROLLER BASED EMBEDDED SYSTEM

CONTENTS

Introduction to Embedded System
Embedded system processor, hardware unit, software embedded into a system, Example of an embedded system, Embedded Design life cycle, Embedded System modeling [flow graphs, FSM, Petri nets]

Introduction to 8 bit microcontroller
8bit Architecture [8051], memory, Ports, Timers / Counters, Serial Communication, Interrupts, Programming in Assembly.

ARM Architecture
ARM Design Philosophy, Overview of ARM architecture, States (ARM, Thumb, Jazelle), Registers, Modes, Conditional Execution, Pipelining, Vector Tables, Exception handling.

ARM Core Based Microcontroller
Introduction to ARM Cortex (TM)- Microcontroller, Embedded C Programming of ARM Microcontrollers,

LABORATORY/FIELD EXPERIENCES
1. Programming of 8051 Microcontroller using Proteus Software
2. Performing experiments on microcontroller universal kits
3. Design of small embedded system projects
4. GPIO programming and Timers programming of ARM microcontroller. [C Programming]
5. PWM Generation ARM Microcontroller. [C Programming]
6. UART, Interrupts ARM Microcontroller. [C Programming]
7. Programming of Microcontroller using VisSim Software

BOOKS RECOMMENDED
CONTENTS

Control System Analysis using State Variable Methods
State variable representation, Conversion of state variable models to transfer function and of transfer function to canonical state variable models, Eigen values and Eigen vectors, Solution of state difference equations, controllability and Observability, Multivariable system.

Pole-Placement Design and State Observers

Lyapunov stability analysis
Basic concepts, Stability definitions and theorems, Lyapunov functions for linear and non linear systems, A model reference adaptive system.

Linear Quadratic Optimal Control
Parameter optimization and optimal control, Quadratic performance index, control configurations. State regulator design through the Lyapunov equation, Optimal state regulator through the Matrix Riccati equation for digital control systems.

BOOKS RECOMMENDED
2. Digital Control Systems; B.C. Kuo, Prentice Hall of India.
CONTENTS

Introduction
PN junction, Electrostatics of PN junction, Schottky Barrier and Ohmic contacts, Semiconductor
Heterojunction, Metal Semiconductor (Schottky Barrier) Photo Diode, Metal Semiconductor Metal
(MSM) Photodiode, Microcavity Photodiode, PIN Photo-Diodes.

Photo Sensitive Devices
Photo Sensitive Device, Electro Luminescence Process, Heterojunction LED, Burrus Surface Emitting
LED, Edge Emitting LED, Photoconductors, Heterojunction Diodes, Avalanche Photodiodes, High
Speed Measurement, Optical sensors.

Lasers
Einstein relations and Population Inversion, Lasing condition and gain in a Semiconductor, Axial and
Transverse Laser Modes, Junction Laser Operating Principles, Heterojunction Laser, Quantum Well

Optical Fibers
Introduction to fiber communication, Optical fiber materials, their properties, Optical fiber based sensors
eg. strain and temperature, Optical fiber communication schemes, Comparison of optical fiber
communication with the conventional communication.

LABORATORY / FIELD EXPERIENCES

1. Study and verification of characteristics of a light emitting diode.
2. Experiments on laser beam production and their control
3. Study and verification of Characteristics of a photo conductor device.
4. Study and verification of characteristics of an avalanche photo diode.
5. Study of an opto-electronic integrating circuit used in industries.

BOOKS RECOMMENDED

   Ltd., New Delhi.
CONTENTS

Artificial Neural Networks
Biological Neural Network-structure of human brain, Characteristics of ANN, Artificial neurons, Types of ANN-single layer and multilayer, Hopkinsons, counter propagation, back propagation, feedforward etc., Non Linear activation functions, Training of ANN and different training algorithms, bidirectional associative memories, various applications of ANN in the field of engineering in general and electrical engineering in particular, programming methods using ANN Techniques.

Fuzzy Logic
Introduction, Comparison of Fuzzy logic with digital logic, Fuzzy set theory, Fuzzification process, Defuzzification methods, Fuzzy logic controllers, Fuzzy associated memories, Application of fuzzy logic techniques in various fields of engineering, Programming methods using fuzzy logic techniques, Concepts and Applications of Neuro-fuzzy systems.

Bio-Inspired Optimisation
Concept of optimization, Evolutionary-Inspired Methods: Genetic algorithms, Behavior-Inspired Methods: Ant colony optimization, Particle Swarm Optimization.

LABORATORY / FIELD EXPERIENCES

Implementation of the following using MTLAB toolboxes
1. Design and train NN for AND or gate using perceptron
2. Design and train perceptron to classify odd and even numbers
3. Design and train NN for alphabet recognition using back propagation
4. Design and train Hopfield network for recognizing patterns such as ‘+’ and ‘−’
5. Design and train NN for E-XOR classification using back propagation

BOOKS RECOMMENDED

CONTENTS

Introduction
Need for system planning and operational studies – basic components of a power system. Introduction to restructuring - Single line diagram – per phase and per unit analysis – Generator - transformer – transmission line and load representation for different power system studies. - Primitive network - construction of Y-bus using inspection and singular transformation methods – z-bus.

Power Flow Analysis

Fault Analysis – Balanced Faults

Fault Analysis – Unbalanced Faults
Introduction to symmetrical components – sequence impedances – sequence circuits of synchronous machine, transformer and transmission lines – sequence networks analysis of single line to ground, line to line and double line to ground faults using Thevenin’s theorem and Z-bus matrix.

Stability Analysis

FACTS Controllers
Basic Principles and Applications of SVC, TCSC, STATCOM, SSSC, UPFC

BOOKS RECOMMENDED
MEI 6207 INSTRUMENTATION FOR ENVIRONMENTAL ENGINEERING

L T P C
3 2 4

CONTENTS

Air pollution measurement
Impact of man on the environment: An overview, Air pollution sources and effects, Meteorological aspects of air pollution dispersion. Air pollution methods and equipment, Air sampling techniques, gas analyzers, gas chromatography. Control of specific gaseous pollutants, measurement of automobile pollution; smoke level meter, orsat gas apparatus, CO/HC analyzer.

Water pollution measurement
Sources and classification of water pollutants; Biological Oxygen Demand (BOD), Chemical oxygen demand (COD), Dissolved oxygen (DO), waste water sampling and analysis. Waste water sampling techniques and analyzers, gravimetric, volumetric, calorimetric, potentiometer, flame photometry, atomic absorption spectroscopy, ion chromatography. Instruments used in wastewater treatment and control, solid waste management techniques.

Measurement of other pollutants
Measurement of radioactive pollutants, ganger counter, Noise level measurement techniques.

LABORATORY / FIELD EXPERIENCES

1. Experimental analysis of air pollution of a given sample
2. Study of air pollution control techniques used in a given industry
3. Sampling and analysis of pollution level of a given water sample
4. Case study of air pollution control in an industry
5. Case study of flue gas handling in a thermal power station
6. Case study of water pollution control.

BOOKS RECOMMENDED

1. Environmental Pollution Control Engineering, C. S. Rao; Wiley Eastern LTD, New Delhi, 1996.
CONTENTS

Analytical Methods of Measurements
Physical methods of chemical analysis, special methods of analysis, basic techniques, terminologies, units, Interaction of electromagnetic radiations with matter, emission, absorption and scattering techniques. Instrumentation related to X-Ray, Ultraviolet and Infrared techniques.

Spectral Analysis
Various light sources, spectrometer, detectors and data processing, comparison of various spectral analytical techniques, refractometry, nuclear magnetic resonance spectrometry. Analytical techniques based on separation method: Basics of chromatography liquid, gas and HPLC Mass Spectrometry and related instrumentation.

Electrometric Methods of Analysis

LABORAOTRY / FIELD EXPERIENCES

1. Study of operation and maintenance of mass-spectrometry related instruments
2. Study of operation and maintenance of pH and selective potentiometry related instruments.
3. Study of operation and maintenance of voltmetry related instruments
4. Study of operation and maintenance of colorimetry related instruments
5. Study of operation and maintenance of conductometry
6. Case study of operation and maintenance of an analytical instrumentation laboratory.

BOOKS RECOMMENDED

CONTENTS

Principles of Electromagnetic Energy Conversion
Magnetic circuits, permanent magnet, stored magnetic energy, co-energy force and torque in singly and
doubly excited systems –machine windings and air gap mmf - winding inductances and voltage
equations.

DC Machines
Elementary DC machine and analysis of steady state operation -Voltage and torque equations –dynamic
characteristics of permanent magnet and shunt d.c. motors –Time domain block diagrams -solution of
dynamic characteristic by Laplace transformation –digital computer simulation of permanent magnet and
shunt d.c. machines.

Reference Frame Theory
Historical background –phase transformation and commutator transformation – transformation of
variables from stationary to arbitrary reference frame –variables observed from several frames of
reference.

Induction Machines
Three phase induction machine, equivalent circuit and analysis of steady state operation –free
acceleration characteristics –voltage and torque equations in machine variables and arbitrary reference
frame variables –analysis of dynamic performance for load torque variations –digital computer
simulation.

Synchronous Machines
Three phase synchronous machine and analysis of steady state operation -voltage and torque equations in
machine variables and rotor reference frame variables (Park’s equations) –analysis of dynamic
performance for load torque variations –digital computer simulation.

BOOKS RECOMMENDED
1. Analysis of Electric Machinery and Drive Systems, Paul C.Krause, Oleg Wasyyczuk, Scott S,
MEI 7101 VIRTUAL INSTRUMENTATION

CONTENTS

Introduction to Virtual Instrumentation
Historical perspective, advantages, block diagram and architecture of a virtual instrument, conventional vs virtual instrumentation.

Learning LabVIEW
Introduction to LabVIEW, Front panel, Block diagram, c, Data acquisition, Instrument Control, Signal Generation and Signal Processing Examples.

Elements of Data acquisition
ADC, DAC, DIO, Counters and timers, PC Hardware structure, Timing, Interrupts; DMA Software and hardware installation Current loop RS232C/ RS485, GPIB.

System buses, Interface buses
USB, PCMCIA, VXI, SCXI, PXI, etc., networking basics for office and industrial applications, VISA and IVI, Motion Control.

Machine Vision
Digital images, definition, types, files, borders ad masks, Image display, Pallets, Region of Interest, Non-Destructive overlays, Convolution kernels, Spatial filters, Gray scale morphology, Thresholding, Particle measurement, Edge detection, Pattern matching.

LABORATORY / FIELD EXPERIENCES
1. Graphical programming using Menus, Palettes, Sub VI, Structures, Arrays, Clusters, Charts and Graphs LabVIEW
2. Development of projects using LabVIEW

BOOKS RECOMMENDED
CONTENTS

Data Communication
General communication system, ASK, FSK, PSK, DPSK, Modulation and demodulation techniques, Baseband signal receiver, Probability of error, Optimum filter, Matched filter correlator examples.

Pulse Modulation
Sampling, Nyquist theorem, Calculation of percentage distortion due to undersampling, Spectrum of sampled signal, sampling with narrow pulses, Pulse amplitude modulation, pulse width modulation, pulse position modulation, digital modulation principles, Pulse code modulation, intersymbol interference, eye patterns, equalization, companding, Bandwidth and noise of PCM systems, Delta modulation, Adaptive DM, Comparison between various techniques.

Information and Theory
Information, Entropy, Mutual information, Redundancy and channel capacity, Shannon – Hartley theorem, Bandwidth S/N Trade off

Coding Theory
Shannon’s Theorem, Coding efficiencies, Shannon-Fano coding, Huffman coding, Hamming coding, Bit error detection and correction, Error detection using parity bits, Block codes, CRC, convolution codes, Line and interface coding, NRZ codes, Manchester codes, Miller code.

Modem Equipment
Modern Technology, Modem classification, Modem Modulation Methods, Modem Interface specifications, Modem Transmission characteristics, Modem features, compatibility, selection criteria.

Applications of Digital Communication
E-mail, voice managing, teletext, View Data, Digital satellite communication, Mobile Modulation System.

LABORATORY / FIELD EXPERIENCES
1. Implementation of ASK.
2. Practice on A/D cards.
3. Implementation of PCM
4. Familiarization and Application of modems.

BOOKS RECOMMENDED
CONTENTS

Sensors and Transducers for Biological Applications
Types, properties, characteristics and selection of transducers for biological instrumentation.

Measurement of Bio-Signals
Leads and electrodes, electrocardiography, electrical activity of the heart, equivalent cardiac generator. Einthoven lead system, standardization of recording and display of ECT (Electrocardiogram), EEG (Electroencephalogram), EMG (Electromyogram), EEG (Electroocculogram), ERG (Electroretinogram), EGG (Electrogastogram).

Measurement of Physical parameters
Bloodflow, droprecorder, electromagnetic flow meter, measurement of systolic and distolic pressures, blood pressure instruments, intraocular pressure, lung air pressure, audiometers. Measurement of body temperature, thermography. Cardiac tachometer, respiration rate phonocardiogram, heart sounds, electrical stethoscope, pulmonary function analysers. CO₂ - O₂ - Concentration in exhaled air, blood and lungs, pH value of blood, impedance plethysmography, blood gas analysers, blood cell counters.

Medical Imaging Systems
Medical display systems, medical thermography, X-Ray, diathermy equipment. Ultrasonics in biomedical application for diagnostic and therapeutic, CAT, MRI, Laser applications in biomedical field.

Patient safety
Electrical Safety of Medical Equipments, Shock Hazards from Electrical Equipment, Methods of Accident Prevention, Test Instruments for checking Safety parameters of biomedical equipments.

LABORATORY / FIELD EXPERIENCES
1. Study of sensors and transducers used in Bio-medical applications
2. Study of Bio Medical instruments used in Heart-care system
3. Study of operation and maintenance of ECG instrument
4. Study of operation and maintenance of instruments used for thermography
5. Study of operation and maintenance of instruments used for blood analysis
6. Case study of operation and maintenance of an ultrasonic machine

BOOKS RECOMMENDED
CONTENTS

Transformations

Digital Filters

Multi-rate Digital Signal Processing
Sampling Rate Alteration Devices, Multi-rate Structures for sampling rate conversion, Multistage design of Decimator and Interpolator, The Poly-phase Decomposition, Arbitrary Rate Sampling Rate Converter, Filter Banks, QMF banks, Multilevel Filter Banks, Sub-band Coding, Discrete Wavelet Transform.

Linear Prediction and Optimum Linear Filters
Forward and Backward Linear Prediction, Properties of Linear Prediction-Error Filters, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

Adaptive Digital Filters

Power Spectrum Estimation

DSP Chips
Introduction to fixed point and floating point processors, ADSP21xx and TMS320Cxx- Architecture, Memory, Addressing Modes, Interrupts, Applications. Comparison of ADSP21xx and TMS320Cxx series.

LABORATORY / FIELD EXPERIENCES

Implement the following programs in MATLAB
1. Simulation of Digital Filters.
3. Decimation and Interpolation of Discrete time sequences.
4. Implementation of an Arbitrary rate Sampling Rate Converter.
5. Illustrate Adaptive Filtering using LMS Algorithm and RLS Algorithm.
8. System Design based on ADSP 21XX DSP chip.

**BOOKS RECOMMENDED**

4. Discrete Time Signal Processing, Oppenheim & Schafer. PHI.
6. Digital Signal Processing, Schuam’s Series.
CONTENTS

Introduction Research Methodology
Definition of Research, Need of Research, Concept and steps of Research Methodology, Uses of Research Methodology, Research Techniques.

Reviewing Literature
Need, Sources-Primary and Secondary, Purposes of Review, Scope of Review, Steps in conducting review.

Identifying and defining research problem
Locating, Analyzing stating and evaluating problem, Generating different types of hypotheses and evaluating them.

Method of Research
Descriptive research design-survey, case study, content analysis, Ex-post Facto Research, Correlational and Experimental Research.

Sampling Techniques
Concept of population and sample’sampling techniques-simple random sampling, stratified random sampling, systematic sampling and cluster sampling, quota sampling techniques determining size of sample.

Procedure of data collection
Aspects of data collection, Techniques of data Collection

Statistical Methods of Analysis
Descriptive statistics: Meaning, graphical representations, mean, range and standard deviation, characteristics and uses of normal curve.

Inferential statistics
t-test. Chi-square tests. Correlation (rank difference and product moment), ANOVA (one way).

Procedure for writing a research proposal and report
Purpose, types and components of research proposal, Audiences and types of research reports, Format of Research report and journal.

Case Studies on s/w tools used for research work.

BOOKS RECOMMENDED
4. Statistical Methods, S.P Gupta, Sultan Chand & Sons, 2006
CONTENTS

Introduction to Human Resource Development
Evolution, Mission and Purpose, Components of HRD, HRD problems and issues related to Indian Industry and technical education, HRD in the context of new Industrial Policy

Staff Development, Professional Development and Career Development
Stages of HRD, Initial or Induction Training, Training for job-related/professional development, Training for horizontal and vertical mobility of employees

Concept of Training
Assumptions for prevailing and alternative concept of training, Action through training or action through force.

Training Strategy
Strategic issues, Basic phases, Modalities in training, Formulating a coherent strategy

Training Methods
Learning on the job-training in the fields, Simulating real life-role playing and games, Incidents and cases-individualized training, Seminars and syndicates, Lecture method

Developing Group and the Climate
The Social process, Indicators of group development, Training climate

Evaluation of Training
Issues for evaluations, Role of the Training System with evaluators from other constituencies

Systems Approach to HRD
Definition and importance of needs assessment, Methods employed in needs assessment (Interviews, Questionnaire, Tests, Records and Reports Study, Job Analysis and Performance Review. Strategies for HRD : on the job, off the job, Programme Planning Design, Implementation and Evaluation

BOOKS RECOMMENDED

CONTENTS

Introduction
Energy scenario-in context of Indian and global, conventional and non-conventional sources of energy.

Renewable energy
Generation of electrical energy using non-conventional sources- Solar, Wind, Magnetohydro, Tidal, Geo-thermal, Ocean etc.

Energy Storage
Energy storage methods, Secondary batteries, Fuel cells, Hydrogen energy system, Energy management systems.

Energy Efficient Technology
Technology for efficient utilization of electrical energy, Energy efficient devices, Instrumentation schemes for measuring and controlling electrical energy for implementation of energy efficient systems.

Energy Conservation
Various methods of energy conservation, Energy management techniques, case studies.

Energy Audit
Methods for doing preliminary, secondary and final energy audit, impact of power factor on electrical power systems, Improvement of power factor. Electronic instrumentation schemes adopted for energy conservation and energy audit.

Various Case Studies, Mini projects on energy audit.

BOOKS RECOMMENDED

Relevant journals and Reports
MMT 6109  OPTIMIZATION TECHNIQUES

CONTENTS

Numerical Techniques
Introduction to numerical techniques, Numerical differentiation and numerical integration, Eigen value problems, Newton-Raphson’s method, Computer based numerical analysis.

Introduction to optimization
Introduction and Engineering applications of optimization, Optimal Problem Formulation; Design-variables, Constraints, Objective function, Variable bounds.

Single-variable Optimization

Multivariable Optimization

Constrained Optimization

Integer Programming

Geometric Programming

BOOKS RECOMMENDED