DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, UTTAR PRADESH, LUCKNOW

Syllabus

For

M.Tech.

Electrical Engineering

(INSTRUMENTATION AND CONTROL ENGINEERING, CONTROL SYSTEM)

(Effective from the Session: 2016-17)

EVALUATION SCHEME FOR MTECH COURSES (ELECTRICAL ENGINEERING)
TO BE EFFECTIVE FROM SESSION 2016-17

SEMESTER-I

S.NO.	SUBJECT CODE	NAME OF THE SUBJECT	PERIODS			CREDIT	EVALUATION SCHEME					SUBJECT TOTAL
							THEORY			PRACTICAL		
			L	T	P		CT	TA	ESE	TA	ESE	
1	MTEE-101	ADVANCED CONTROL SYSTEM	3	0	0	3	20	10	70			100
2	MTEE-102	POWER SYSTEM OPERATION & CONTROL	3	0	0	3	20	10	70			100
3	MTEE-01?	DEPARTMENTAL ELECTIVE-I	3	0	0	3	20	10	70			100
4	MTEE-02?	DEPARTMENTAL ELECTIVE-II	3	0	0	3	20	10	70			100
5		RESEARCH PROCESS & METHODOLOGY	3	0	0	3	20	10	70			100
6	MTEE-151	ADVANCED CONTROL SYSTEM LAB	0	0	3	2				20	30	50
7	MTEE-152	ADVANCED POWER SYSTEM LAB	0	0	2	1				20	30	50
	TOTAL					18						600

SEMESTER-II

S.NO.	SUBJECT CODE	NAME OF THE SUBJECT	PERIODS			CREDIT	EVALUATION SCHEME					SUBJECT TOTAL
							THEORY			PRACTICAL		
			L	T	P		CT	TA	ESE	TA	ESE	
1	MTEE-201	MICROCONTROLLER & ITS APPLICATIONS	3	0	0	3	20	10	70			100
2	MTEE-202	ADVANCED INSTRUMENTATION CONTROL	3	0	0	3	20	10	70			100
3	MTEE-03?	DEPARTMENTAL ELECTIVE-III	3	0	0	3	20	10	70			100
4	MTEE-04?	DEPARTMENTAL ELECTIVE-IV	3	0	0	3	20	10	70			100
5	MTEE-05?	DEPARTMENTAL ELECTIVE-V	3	0	0	3	20	10	70			100
6	MTEE-251	ADVANCED MICROCONTROLLER LAB	0	0	3	2				20	30	50
7	MTEE-252	SEMINAR-I	0	0	2	1				50		50
	TOTAL					18						600

SEMESTER-III

S.NO.	SUBJECT CODE	NAME OF THE SUBJECT	PERIODS			CREDIT	EVALUATION SCHEME					SUBJECT TOTAL
							THEORY			PRACTICAL		
			L	T	P		CT	TA	ESE	TA	ESE	
1	MTEE-351	SEMINAR-II	0	0	6	3				100		100
2	MTEE-352	DISSERTATION	0	0	30	15				200	300	500
	TOTAL											600

SEMESTER-IV

S.NO.	SUBJECT CODE	NAME OF THE SUBJECT	PERIODS			CREDIT	EVALUATION SCHEME					SUBJECT TOTAL
							THEORY			PRACTICAL		
			L	T	P		CT	TA	ESE	TA	ESE	
1	MTEE-451	DISSERTATION(FINAL)	0	0	36	18				200	400	600
	TOTAL					18						600

CODE	ELECTIVE-I
MTEE-011	HIGH VOLTAGE ENGINEERING
MTEE-012	DIGITAL SIGNAL PROCESSING
MTEE-013	NON CONVENTIONAL ENERGY SOURCES & ENERGY CONVERTERS
	ELECTIVE-II
MTEE-021	FACTS
MTEE-022	POWER ELECTRONIC DRIVES
MTEE-023	ENERGY SYSTEM MANAGEMENT
	ELECTIVE-III
MTEE-031	POWER SYSTEM PLANNING
MTEE-032	DIGITAL CONTROL SYSTEM
MTEE-033	ROBOTICS
	ELECTIVE-IV
MTEE-041	NEURAL NETWORKS & FUZZY SYSTEM
MTEE-042	MODELLING & SIMULATION OF POWER ELECTRONIC CIRCUITS
MTEE-043	POWER SYSTEM OPTIMIZATION
	ELECTIVE-V
MTEE-051	SMART GRID
MTEE-052	POWER QUALITY
MTEE-053	OPTIMIZATION TECHNIQUES

I YEAR (I SEMESTER)

MTEE-101 ADVANCED CONTROL SYSTEM

L T P
3 0 0

State Space Analysis:
Review of State space representation of continuous linear time invariant system, conversion of state variable models to transfer functions and vice-versa, transformation of state variables, solution of state equations, state and output controllability and observability.

Analysis of Nonlinear System:
Common physical nonlinearities singular points, phase plane analysis limit cycles, describing function method and stability analysis, jump resonance, Linearization of nonlinear systems. Lyapunov stability, methods for generating lyapunov function statement of Lure problem, circle critcrion, popov criterion.

Analysis of Discrete System:
Discrete time signals and system, z-transformation, modeling of sample-hold circuit, pulse transfer function, solution of difference equation by z-transform method, stability analysis in z-phane.
Basic concepts of optimal control, adaptive control and robust control systems.

Reference:

1. K. Ogata, "Modern Control Engineering", Prentics Hall of India, 1999.
2. Norman S. Nise, "Control System Engineering", John Wiley & Sons. 2001.
3. Kuo B.C., "Digital Control System," saunders College Publishing, 1992.
4. M.Gopal "Digital Control and State Variable Methode" Tata Mergraw hill 1997.
5. M.Gopal "Modern Control System Theory", Wiley Eastern 1993.
6. K. Ogata "Discrete Time Control system", Prentice Hall International 1987

MTEE-102 POWER SYSTEM OPERATION AND CONTROL

L T P
3 0 0

Objective & Out come of learning.
To impart knowledge about the structure and control aspect of the power system operation. This includes SCADA, optimal economic operations, AGC control, excitation and reactive power control, system security and the elements of FACTS control. At the end of the course a student will be able to do operations at a Load dispatch centre or planning such operations.

1. Introduction:
Large scale power systems-their interconnections and operation ; load dispatch centre and control centre, introduction to centralized and decentralized controls ; various operational stages of power system ; power system security.

2. Economic Operation:
Problem of unit commitment, system constraints, incremental fuel cost, economic load scheduling with and without transmission losses, penalty factor, loss coefficient, incremental transmission loss ; optimal power flow problem ; optimal operation of hydro-thermal system.

3. Load Frequency Control :
Concept of load frequency control, speed governing systems and its representation, automatic control, modeling of single area and multiarea systems, tie line control, supervisory control ; automatic generation control including excitation system; optimum load frequency controller, PID controller.

4. Voltage Reactive Power Control

Concept of voltage control, methods of voltage control, reactive power injection, control by tap changing transformer, series compensation, static VAR compensation, Excitation system & stabilizer, rate feedback controller, PIDcontroller.

5. State Estimation:

State estimation, linear and nonlinear models, detection and identification of measurement errors.

6. Flexible AC Transmission System :

Concept and objectives, basic FACTS controllers:
TCR,FC-TCR, TSC, SVC, STATCOM, TCSC, SSSC, PAR and UP FC

References:

1. O.I. Elgerd, "Electric Energy System Theory", Mc Graw Hill, 1971
2. Leon K. Kirchmayer, "Economic operation of Power Systems" Wiley Eastern Ltd.,
3. A. Chakrabarti, D.P. Kothari and A.K. Mukhopadhyay, "Performance Operation and Control of EHV Power Transmission Systems", Wheeler Publishing Co.
4. A. J. Wood & B.F. Wolfenberg "Power Generation Operation and control" Second Edition John Wiley & Sons.
5. D.P. Kothari & J.S. Dhillon "Power System Optimization" Prentice Hall, 2004.
6. HG Hingorani and L Gyugyi "Understanding FACTS", New York, IEEE Press 2000.
7. K.R. Padiyar "FACTS Controllers in Power Transmission and distribution" New Age Delhi, 2007.

Related e-Journals and books for advanced work.

(i) IEEE Transactions on Power System
(ii) IEEE Transactions on Power Delivery
(iii) IET Research Journal on Generation, Transmission and Distribution
(iv) NPTEL Courses on Electrical Engg.

MTEE-151 ADVANCED CONTROL SYSTEM LABORATORY

L T P
0 0 3

1. Design and simulation of Linearised models using MATLAB/PSPICE.
2. Simulation and analysis of State space models for continuous time and discrete time systems using MATLAB/PSPICE
3. Design and Simulation of LTI models of Feedback Control System using MATLAB/PSPICE.
4. Simulation and analysis of Digital Control System using MATLAB/PSPICE.
5. Simulation and Stability analysis of control system with common non-linearities using MATLAB/PSPICE.
6. Familiarization and use of MATLAB command associated with Robust Control Systems.
7. Familiarization and use of PSIM software.

MTEE-152 ADVANCED POWER SYSTEM LAB

L	T	P
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1. Formation of Y-BUS matrix using MATLAB coding.
2. MATLAB coding N-R Load flow in polar co-ordinates.
3. Load flow calculation using MATLAB and PST package.
4. Optimal power flow using PSAT.
5. Distribution load flow.
6. Symmetrical and unsymmetrical fault studies.
7. Small signal stability analysis using MATLAB and PST package.
8. Transient stability analysis using MATLAB and PST package.
9. State Estimation using MATLAB program.
10. Power quality calculation using PSCAD/EMTDC.
11. Time-domain simulation in PSCAD for observing various power system scenarios like power swing, voltage instability etc

ELECTIVE-I

MTEE-011 HIGH VOLTAGE ENGINEERING

L T P
3 0 0

Objective & Out come of learning.

To review the breakdown phenomena in insulating materials and to impart advanced knowledge regarding the Generation of High Voltage & Currents for the equipment testing and corresponding measurements. It also includes the problem of insulation coordination. At the end of the course a student may be ready to handle the testing in HV Labs.

1. Breakdown Phenomena :

Basic processes of breakdown, breakdown phenomena in gaseous, liquid, solid composite dielectrics, Breakdown in vacuum insulation.

2. Generation of Test High Voltages :

Generation of high d.c. voltage by voltage multiplier circuit and electrostatic generators, generation of high a.c. voltage by cascaded transformers and resonant transformers, generation of impulse voltage, triggering and synchronization of impulse generator, generation of high impulse current.

3. Measurement of High Voltage and Current :

Resistance, capacitance and R-C potential dividers, sphere gap, electrostatic voltmeter, generating voltmeter, impulse voltage measurement, measurement of high d.c. a.c. and impulse currents.

4. High Voltage Testing :

Requirement of high voltage test circuit I.S. specifications, impulse and power frequency tests of transformers, lighting arresters, bushings, Power cables, circuit breakers and isolators ; measurement of resistivity, dielectric constant and loss factor ; partial discharge measurement.

5. Over Voltage Phenomenon and Insulation Coordination :

Lightning and switching phenomena as causes of over voltages, protection of transmission line and substation against overvoltage, insulation coordination.

References

1. E. Kuffel W.S. Zaongol, High Voltage Engineering Pergaman Press
2. N.S. Naidoo V Kamaraju, High Voltage Engineering
3. H.. Chaurasia, High Voltage EngineeringKhanna Publisher
4. R.S. Jha, High Voltage Engineering
5. C.L. Wadhwa, High Voltage Engineering Wiley Eastern Limited,

Related e-Journals and books for advanced work.

(i) IEEE Transactions on Power System
(ii) IEEE Transactions on Power Delivery
(iii) IET Research Journal on Generation, Trans and Distribution
(iv) NPTEL Course on Electrical Engg.

MTEE-012 DIGITAL SIGNAL PROCESSING

L T P
3 0 0

Objective & Outcome of learning
This course will make students conversant with the designing of analog and digital FIR filters using various digital signal processing techniques. At the end of the course the students will be able to design and analyze digital filters**.**

1. Introduction:
Motivation, advantages and applications of digital signal processing, review of A/D and D/A conversion, quantization noise.

2. Discrete Time Signals and Systems:
Representation of discrete signals, linear time invariant system, FIR and HR system, stability and causality of the systems, systems described by difference equations, solution of difference equations

3. Realization of Digital Systems:
Block diagram and signal flow representations, matrix representation, direct, cascade, parallel, lattice and ladder realization of HR systems, direct, cascade and lattice realization of FIR systems.

4. Fast Fourier Transform:
Introduction to discrete Fourier transform and fast Fourier transform, circular and linear convolutions ,FFT algorithms, Radix-2 , Radix-4 and split radix algorithms, applications of FFT algorithms.

5. FIR Digital Filter Design:
Properties of linear phase FIR filter, frequency sampling design techniques, window design techniques (Uniform window, Hamming window, kaisc window), optimal FIR filter design.

6 . FIR Filter Design
Characteristics of proto type analog filter, comparison of HR and FIR filters, impulse invariant transformation and bilinear transformation, design of digital, butterworth, chebyshev and elliptic filters, introduction to digital signal processor

Reference:
1. A.V. Openheim and R.W. Schafev, “Discrete Time Signal Processing”, Prentice Hall Englewood Cliffs, N.J. 1975
2. J.G. Proakis and D.G. Manolakis, “Digital Signal Processing Principles, Algorithms and Applications”, Prentice Hall of India
3. L.R. Rabiner and B. Gold, “Theory and Applications of Digital Signal Processing”, Prentice Hall Englewood cliffs, nj 1975
4. Vinay K. Ingle & John G. Proakis, “Digital Signal Processing UsingMatlab”, Thomson Asia Pvt. Ltd.
5. Sanjit K. Mitra, “Digital Signal Processing”,Tata Mcgraw Hill 2001

Related Journals and Booksfor applications and advanced works.
(i) IEEE Transactions on digital signal processing
(ii) IEEE Transactions on Power Electronics
(iii) IEEE Transactions on Automatic control
(iv) NPTEL Courses on Electrical Engineering

MTEE-013

NON CONVENTIONAL ENERGY SOURCES & ENERGY CONVERTERS

L T P
3 0 0

Objective & Out come of learning.

This course is designed for the development of self study and seminar delivery skills in Non-conventional Energy Sources. The total course structure covers wind energy, Solar Energy and Fuel Cell Technologies. Subparts of each topic will be allotted to each student who will then deliver the talk during scheduled lecture hours to be evaluated by participants & the teacher.

1. Introduction:

Various non-conventional energy resources-importance, classification, relative merits and demerits

2. Solar Energy:

Solar photovoltaic's: Introduction, solar radiation & its relation with photovoltaic effect. Solar cell material; silicon mono & poly crystalline, raw material other than silicon. Different types of solar cell construction and design, flat plate arrays:-optimal system sizing & protection. Photovoltaic concentration, photovoltaic systems-standalone, PV-hybrid, grid-interactive. Stationary and tracking panels, maximum power point tracking, energy storage, converter & inverter systems & their control. Application-water pumping & power plants, cost & economics, recent developments.

3.Solar thermal:

Thermal characteristics of solar radiation, solar collectors:-materials, types, focussing. Solar thermal power plant-layout and arrangement, solar cooling, recent Developments.

4. Wind Energy:

Wind power and its sources, site selection criterion, wind characteristics, momentum theory, Classification of wind machines. Wind mills-different design & their control, wind generators-different types, wind farms & grid. Wind generation in India. Issues of wind integrations-intermittent supply, economics, governmental regulations & subsidies. Wind penetration & its effects, economic issues, recent developments, international scenario.

5. Fuel Cell:

Basic construction & principle of operation of fuel cell, Gibbs-Helmholtz equations, thermodynamic free energy and conditions of equilibrium, classification of fuel cell, different types of fuel cell:-direct type-low or medium temperature alkaline type, low temperature ion exchange membrane, direct high temperature fuel cells, Redox fuel cells, operation characteristic. Fuel cell power plants & its integration with wind and solar photovoltaic systems, smart grids.

References;

1. F.C. Treble, “Generating electricity from sun”, pergamon press, U K
2. Tapan Bhattacharya, “Terrestrial solar photovoltaics”, Narosa publishing house, New Delhi, 1998.
3. G.D. Rai, “Non-conventional energy resources”, Khanna Publishers, New Delhi, 2003.
4. S.P. Sukhatme, “Solar energy principles of thermal collection and storage”,McGraw-Hill publishing company, limited, New Delhi, 1984.
5. C.J. Winter, L.C. Sizmann and Van-Hull, “Solar power plants”, Sringer-Verlog publishers, 1991.
6. N.G. Clavert, “Wind Power Principle, their application on small scale”, Calvert Technical Press edition, published 2004.
7. “Fuel Cell Handbook” (Fifth Edition) by EG&G Services, Parsons, Inc. Science Applications International Corporation.
8. I Earnest and T. Wizelius “Wind Power Plants and Projects development” PHI, 2010.

Related e-Journals and books for advanced work.

(i) IEEE Transactions on Power Delivery
(ii) IEEE Transactions on Power System
(iii) IEEE Transactions on Energy Conversion
(iv) IET Research Journal on Renewable Power Generation.
(v) NPTEL Courses on Electrical Engg.

ELECTIVE-II

MTEE-021 FACTS

L T P
3 0 0

Objective & Outcome of learning
To impart advanced knowledge about the FACTS – systems involving their applications in long Bulk power Transmission line, in distribution systems, in custom Power and improving stability & voltage profile in power system. This is a new technology which has found acceptance in Power Industry. At the end of the course the student should be able to design power and distribution system using various FACT devices.

1. Basic Issues Involved in Bulk Power Transmission:
Angle stability, voltage stability, power flow control and sub-synchronous resonance (SSR).

2. Basic Issues Involved in Power distribution Systems:
Harmonics, load unbalance, poor powerfactor and voltage interruptions.

3. Introduction of Basic FACTS devices:
SVC, STATCOM,TCSC, SSSC and UPFC. Introduction to concepts of Custom Power (CP) devices

4. Introduction to CP devices:
DSTATCOM, DVR, UPQC. Modeling of SVC, STATCOM,TCSC, SSSC and UPFC.

5. Case Study
DSTATCOM in Current Control Mode:Reference current generation techniques.
DSTATCOM in voltage control Mode: Reference voltage generation, DVRreference voltage generation.

References:

1. N.G. Hingirani and L.Gyugi, Understanding FACTS, IEEE Press, 1999.
2. Y.H. Song and A.T. Johns, “Flexible AC Transmission Systems (FACTS), IEEE, 1999.
3. M.H.J. Bollen, “ Understanding Power Quality Problems:, IEEE Press, 2000.
4. R.c. dugan, M.F. Mc Granaghan and H.W. Beaty, “Electric Power Systems Quality”, Mc Graw Hill, 1996.
5. K.R. Padiyar, “FACTS controllers in Power Transmission and Distribution”, New Age, New Delhi, 2007.

Related Journals and Books for applications and advanced works.

(i) IEEE Transactions on Industrial applications
(ii) IEEE Transactions on Power Electronics
(iii) IEEE Transactions on Power Delivery
(iv) MATLABTools on Control and power system
(v) NPTEL Courses on Electrical Engineering
(vi) IET Research Journal on Power Electronics
(vii) IET Research Journal on Generation, Transmission and Distribution.

MTEE-022 POWER ELECTRONIC DRIVES

L T P
3 0 0

Basic power electronic drive system, components. Different types of loads, shaftload coupling systems. Stability of power electronic drive.

Conventional methods of D.C.motor speed control, single phase and three phase converter fed D.C motor drive. Power factor improvement techniques, Four quadrant operation.

Chopper fed drives, input filter design. Step -up chopper for photovoltaic systems. Braking and speed reversal of DC motor drives using choppers, multiphase choppers.

Conventional methods of induction motor speed control.Solid state controllers for Stator voltag control, soft starting of induction motors, Rotor side speed control of wound rotor induction motors. Voltage source and Current source inverter fed induction motor drives.

Speed control of synchronous motors, field oriented control, load commutated inverter drives, switched reluctance motors and permanent magnet motor drives.

References :

1. P.C Sen „Thyristor DC Drives , John wiely and sons, New York, 2001.
2. R.Krishnan, „Electric Motor Drives – Modeling, Analysis and Control , Prentice-Hall of India Pvt Ltd., New Delhi, 2003.
3. Bimal K.Bose, „Modern Power Electronics and AC Drives , Pearson Education (Singapore) Pte. Ltd., New Delhi, 2003.

MTEE-023 ENERGY SYSTEM MANAGEMENT

L T P
3 0 0

Objective & Outcome of learning
To emphasize the important problem of integrated energy management. This involves the improving efficiencies & economics of equipment used including retrofitting. It includes the life cycle savings & pay back period & return of investments. Energy audit is another important area which may be handled here. At the end of the course a student will be better equipped to think in terms of over all system efficiencies & economics.

I. Energy Resources
Perspective on energy resources, Utilization and demand projections, Energy resource definition & classification, Causes of Energy scarcity and social disparity, Energy as a parameter of Techno-Socio-Economic development, Factors solving the energy crunch, Energy system model – Description & qualitative analysis, Acceptability Index and its significance.

II. Concept Of Energy Management
Definition and Significance, Benefits, Classifications, Key Issues - Techno economic Issues, Programmatic and Institutional Issues, Energy management implementation criteria, Approaches of Energy management: Procedural Energy Management Opportunities (PEMOS), Equipment Modifications, Additions or Replacement EMOS (Retrofit EMOS), Research and Development and New Installation (R&DEMOS), Resource or Fuel Substitution (Substitution EMOS), Examples for each. Comparative features.

III. General Principles Of Energy Management-
Proper/Optimal Control, Optimize Capacity, Reduce Loads, More Efficient Equipment and Appliances, More Efficient Processes, Employ Special Techniques to Reduce Losses, Energy Containment, Cascade Energy Use, Energy Conversion & storage Principle. (Introduction with examples & comparative features).

IV. Energy Efficiency Analysis-
Different types of losses involved in Process and industry. First Law of Efficiency, simple examples & calculations, Limitation, Efficiency and its significance Second law of Efficiency – Quality of Energy form, Available work, Coefficient of Performance (COP), Effectiveness, Simple calculations.

V. Energy Economics-
Comparison of alternatives options; Simple economic calculations, Life cycle casting, Life cycle savings, payback period and return of investments. Break Even Analysis & its limitations, Benefit / Cost analysis, Time value of money , Calculation of present worth & present worth factor, Simple calculation of Payback period, solar energy economics.
(I) Case study:-Electric loads- Lighting, Motor and Power; Fluid Flow Control- pump, fan, blower, and compressor; Residential colony.
(II) Planning For Energy Management- Planning phases; Initial phasedecision to Undertake Program, Commitment by Management, Statement of Objectives.

Analysis and simulation phase- Database and information collection, Energy Audit, Computer Analysis and Simulation. Implementation phase- implementation, Monitoring of program, periodic review, Modification, and optimization. Modeling and parameter for planning.

References :
1. C.B. Smith ,'Energy Management Principles' Pergammon Press, 1981
2. Y. Y. Haimes (ed), 'Energy Auditing and Conservation'. Hemisphere Publishing Corporation, New York, 1980.
3. J. S. Hsieh, 'Solar Energy Engineering'. Prentice Hall Inc, New Jersey, 1981.
4. D. Millington.'System Analysis and Design for Computer Applications'. Affiliated East West Press Pvt Ltd, New Delhi, 1981.

Related e-Journals and books for advanced work.
(i) IEEE Transactions on Power Delivery
(ii) IEEE Transactions on Power System
(iii) IEEE Transactions on Energy Conversion
(iv) IET Research Journal on Renewable Power Generation

I YEAR (II SEMESTER)

MTEE-201 MICROCONTROLLER & ITS APPLICATIONS

L T P
3 0 0

1. Introduction:
history of microcontrollers, embedded versus external memory devices, 8 bit and 16 bit microcontrollers, CICS and RISC processors, architecture of 8051,register banks, addressing mode programming MCS51 family features 8031/8051/8751, MCS-51 instruction set , interrupts. timer and counters, serial communication, power saving modes

2 MCS-51 APPLICATIONS
overview of 89CXX and 89C20XX Atmel microcontrollers, pin description of 89C51 and 89C2051, using flash memory square wave generation ,rectangular wave generation, pulse generation, stair case ramp generation, sine wave generation, pulse width measurement, frequency counter

3.MOTOROLA 68HC11:
controller features different modes of operation and memory map, functions of I/O port in single chip and expended multiplexed mode, timer system, input capture, output compare and pulsed accumulator features of 68HC11, serial peripheral and serial communication interface, analog to digital conversion features, watchdog features.

4. PIC 18FXX2 MICROCONTROLLERS:
architecture, addressing modes ,instruction set, timer, capture/compare/PWM(CCP) modules, interrupts ,I/O ports, A/D converters, USART, interfacing LCD display, keypad interfacing, ADC and DAC interfacing, programming techniques using C and assembly

5. APPLICATIONS:
LED, push buttons, relays and latch connections, sensor and other applications, stepper motor control, DC motor control ,AC power control, brushless DC motor control, Temperature controller system using 8051,PICI 8FXX2 and Motorola 68HC11 .

References:
1." 8 Bit Embedded Controllers", intel corporation ,1990
2. John B Peat Man,"Design With Microcontroller", Tata Mc Graw Hill Singapore,1998
3. Microprocessor and Microcontroller - Gaonkar
4"The 8051 Microcontroller",K.J.Ayala

MTEE-202 ADVANCED INSTRUMENTATION & CONTROL

L T P
3 0 0

1. Introduction, principle, construction and design of various active and passive transducers. Introduction to semiconductor sensors and its applications.

2. Design of signal conditioning circuits for various Resistive, Capacitive and Inductive transducers and piezoelectric transducer.

3. Special Control Techniques: Advanced control techniques, cascade, ratio, feed forward, adaptive control, Smith predictor, internal model control.

4. Multivariable Control Analysis: Introduction to state-space methods, , Control degrees of freedom analysis and analysis, Interaction, Bristol arrays, Niederlinski index - design of controllers, Tuning of multivariable controllers.

5. Sample Data Controllers: Basic review of Z transforms, Response of discrete systems to various inputs. Open and closed loop response to step, impulse and sinusoidal inputs, closed loop response of discrete systems. Design of digital controllers. Introduction to PLC and DCS.

TEXT BOOKS:

1. John P. Bentley, Principles of Measurement Systems, Third edition, Addison Wesley Longman Ltd., UK, 2000.
2. Doebelin E.O, Measurement Systems - Application and Design, Fourth edition, McGraw-Hill International Edition, New York, 1992.
3. D.R. Coughanour, ‘Process Systems analysis and Control’, McGraw-Hill, 2nd Edition, 1991.
4. D.E. Seborg, T.F. Edger, and D.A. Millichamp, ‘Process Dynamics and Control’, John Wiley and Sons, 2nd Edition, 2004.

MTEE-251 ADVANCED MICROCONTROLLER LAB

L T P
0 0 3

LIST OF EXPERIMENTS

1.To demonstrate the procedure for flash programming for reprogrammable embedded system board using NXP's FlashMagic.

2.To demonstrate the procedure of flash programming source code for reprogrammable embedded system board using Sunrom technology's 89SXX USB flash programmer, ISP Model.

3.To demonstrate the procedure and connections for multiple controllers programming of same type of controller with same source code in one go, using flash magic.

4.To interface 8 LEDs at Input-output port and create different patterns.

5.To demonstrate use of general purpose port i.e. Input/ output port of two controllers for data transfer between them.

6.To demonstrate block wise programming of memory for micro controller using flash magic.

7.To demonstrate block wise erasing of memory for micro controller using flash magic.

8.To demonstrate timer working in timer mode and blink LED without using any loop delay routine.

9.To demonstrate interfacing of seven-segment LED display and generate counting from 0 to 99 with fixed time delay.

10.To demonstrate serial communication between PC and controller using serial UART of controller.

11.To demonstrate communication between two controllers using SPI in master mode. Only master will send and Slave will receive.

12.To demonstrate communication between two controllers using SPI in master and slave mode. Master will send, Slave will receive and vice versa.

13.To demonstrate interfacing of 16x2 LCD and print some welcome message on it.

ELECTIVE-III

MTEE-031 POWER SYSTEM PLANNING

L T P
3 0 0

Objectives of planning – Long and short term planning . Load forecasting – characteristics of loads – methodology of forecasting – energy forecasting – peak demand forecasting – total forecasting – annual and monthly peak demand forecasting.

Load forecasting Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.

Expansion planning Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.

Distribution system planning overview
Introduction, sub transmission lines and distribution substations-Design primary and secondary systems-distribution system protection and coordination of protective devices

Reference:
1. R.L. Sullivan, "Power System Planning", Tata McGraw Hill Publishing Company Ltd, 2012.
2. X. Wang & J.R. McDonald, "Modern Power System Planning", McGraw Hill Book Company,1994.
3. T. Gonen, "Electrical Power Distribution Engineering", McGraw Hill Book Company, 1986.

MTEE-032 DIGITAL CONTROL SYSTEM

L T P
3 0 0

Objective & Outcome of learning
This course imparts knowledge to students about application of digital signal processing and state space analysis in designing of digital control systems and analyzing the stability of digital control systems using various techniques. At the end of the course the students will be able to design and analyze the stability of digital control systems.

1. Signal Processing in Digital Control:
Basic digital control system, advantages of digital control and implementation problems, basic discrete time signals, Z – transform and inverse Z- transform, modeling of sample hold circuit, pulse transfer function, solution of difference equation by Z- transform method, stability on the z-plane and jury stability criterion, bilinear transformation, Routh Stability Criterion on plane.

2. Design of Digital Control Algorithms:
Steady state accuracy, transient response and frequency response specifications, digital compensator design using frequency response plots and root locus plots.

3. State Space Analysis and Design:
State space representation of digital control system, conversion of state variable models to transfer functions and vice versa, solution of state difference equations, controllability and absorbability, design control system with state feedback, stability analysis using Lyapunov stability theorem, optimal digital control system.

Reference:
1. B.C. Kuo, "Digital Control System", Saunders college publishing 1992
2. K.Ogata, "Discrete Time Control System", Prentice Hall 1987
3. C.L. Philips and T. Nagle, "Digital Control System Analysis and Design", Prentice Hall 1990
4. M.Gopal, "Digital Control and State VariableMethods",TMH 1997
5. J.R leigh, "Applied Digital Control", Prentice Hall 1985
6. C.H. Houpis and G.B. Lamont, "Digital Control System Theory Hardware & Software", Mcgraw Hill 1992

Related Journals and Booksfor applications and advanced works.
(i) IEEE Transactions on Control SystemTechnology
(ii) IEEE Transactions on Automatic Control
(iii) IEEE Transactions on Embedded System
(iv) IET Journal on Control Theory & Applications
(v) NPTEL Courses on Electrical Engineering research Journal on Generation, Trans and Distribution
(vi) NPTEL Course on Electrical Engg.

MTEE-033 ROBOTICS

L T P
3 0 0

UNIT I-INTRODUCTION

Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problemsSpecifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systemsHydraulic, Pneumatic and Electric system.

UNIT II-END EFFECTORS AND ROBOT CONTROLS

Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

UNIT III-ROBOT TRANSFORMATIONS AND SENSORS

Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation- Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors. 4 RB-2013 SRM

UNIT IV-ROBOT CELL DESIGN AND APPLICATIONS

Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions-Robot applicationsMaterial handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot.

UNIT V-MICRO/NANO ROBOTICS SYSTEM

Micro/Nanorobotics system overview-Scaling effect-Top down and bottom up approach- Actuators of Micro/Nano robotics system-Nanorobot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nanorobot in targeted drug delivery system.

REFERENCES

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012
3. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated Approach, Phi Learning., 2009.
4. Francis N. Nagy, Andras Siegler, Engineering foundation of Robotics, Prentice Hall Inc., 1987.
5. P.A. Janaki Raman, Robotics and Image Processing an Introduction, Tata McGraw Hill Publishing company Ltd., 1995.
6. Carl D. Crane and Joseph Duffy, Kinematic Analysis of Robot manipulators, Cambridge University press, 2008.
7. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., “Robotics control, sensing, vision and intelligence”, McGraw Hill Book co, 1987
8. Craig. J. J. “Introduction to Robotics mechanics and control”, Addison- Wesley, 1999.
9. Ray Asfahl. C., “Robots and Manufacturing Automation”, John Wiley & Sons Inc.,1985.
10. Bharat Bhushan., “Springer Handbook of Nanotechnology”, Springer, 2004.
11. Julian W. Gardner., “Micro sensor MEMS and Smart Devices”, John Wiley & Sons, 2001

ELECTIVE-IV

MTEE-041 NEURAL NETWORKS AND FUZZY SYSTEM

L T P
3 0 0

A. Neural Networks :

1. Basics :

Simple neuron, nerve structure and synapse, concept of neural network multilayer nets, auto-associative and hetero-associative nets, neural network tools (NNTs), artificial neural network (ANN) and traditional computers.

2. Neural Dynamics :

Neurons as functions, neuronal dynamic systems, signal functions, activation models

3. Synaptic Dynamics :

Learning in neural nets, Unsupervised and supervised learning, signal hebbian learning competitive learning, differential hebbian learning, differential competitive learning single layer perception models, the back propagation algorithm.

4 Applications :

Applications in load flow study, load forecasting detection of faults in distribution system and steady state stability, neural network simulator, applications in electric drive control.

B. Fuzzy System :

5. Basics :

Fuzzy sets and systems, basic concepts, fuzzy sets and crisp sets, fuzzy set theory and operations, fuzzy entropy theorem, fuzzy and crisp relations, fuzzy to crisp conversions.

6. Fuzzy Associative Memories :

Representation of fuzzy sets, membership functions, basic principle of interference in fuzzy logic, fuzzy IF-THEN rules, fuzzy systems and algorithms, approximate reasoning, forms of fuzzy implication, fuzzy inference engines, fuzzification/defuzzification

7. Applications :

Fuzzy control system design and its elements, fuzzy logic controller applications of fuzzy control in electric drive, power system, measurement and instrumentation.

References :

1. Bart Kosko, “Neural Networks fuzzy systems”, Prentice Hall International
2. George J. Klin, & Tina A. Polger, “Fuzzy Sets, uncertainty and Information”,
3. Russel C. Ebehart Roy W. Dobbins, “Neural Network PC tools”, Academic press Inc.
4. Martin T. Hagan, H.B. “Neural Network design”, Thomson Demuth Mark Beate, Asia Pvt Ltd.
5. Simon Haykin “Neural Network and Learning machines” Third Edition, PHI learning, new Delhi,2011.
6. J.R. Jang, C. Sun and E. Mizuatani, “Neuro-fuzzy Soft computing: A Computational Approach to learning and Machine Intelligence.” PHI, 2011.

MTEE-042 MODELING AND SIMULATION OF POWER ELECTRONIC CIRCUITS

L T P
3 0 0

Objective & Outcome of learning

This course will make students conversant with the modeling and simulations of various power electronic devices and converters using simulation softwares like PSICE and MATLAB simulink. At the end of the course the students will be able to simulate power electronic converters and analyze their performance on computer, which will help in selecting the specifications of various components for fabricating the actual systems.

1. Simulation tools:

General overview and understanding of SPICE/PSPICE and MATLAB SIMULINK softwares.

2. Modeling of power electronics devices:

Criteria for switch selection , modeling of Diode , SCR , Power transistor MOSFET AND IGBT for ac and dc circuit using SPICE /PSPICE and MATLAB SIMULINK software, simulation of driver and snubber circuits.

3. Simulation of power electronics circuits:

Simulation and design of converters, Choppers, A.C. Voltage Controllers ,Inverters and Cyclo-converters

Reference:

1. M.H. Rashid " Power Electronics Circuit Devices and Applications", Prentice Hall of India 1996
2. D.W. Hart, "An Introduction to Power Electronics", Prentice Hall International , 1997
3. L.P. Huelsman, "Basic Circuit Theory", Prentice Hall of India 1995
4. The Mathworks Inc., "MAT LAB the Language of Technical Computing", version 6
5. The Mathworks Inc., "SIMULINK Dynamic System Simulation"

Related Journals and Books for applications and advanced works.

(i) IEEE Transactions on Industrial applications
(ii) IEEE Transactions on Power Electronics
(iii) IEEE Transactions on Power Delivery
(iv) MATLAB Tools on Control and power system
(v) NPTEL Courses on Electrical Engineering
(vi) IET Research Journal on Power Electronics

MTEE-043 POWER SYSTEM OPTIMIZATION

L T P
3 0 0

1. Load Flow Studies
Network Model Formulation , YBUS Formulation , ZBUS Formulation ,Load Flow Problem , Computation of Line Flows , Modelling of Regulating Transformers , DC system Model , AC-DC Load Flow

2. Economic Load Dispatch of Thermal Generating Units
Generator Operating Cost , Economic Dispatch Problem on a Bus Bar ,Optimal Generation Scheduling , Economic Dispatch Using Newton-Raphson Method , Economic Dispatch Using the Approximate Newton-Raphson Method , Economic Dispatch using Efficient Method , Transmission Loss Coefficients , Transmission Loss Formula: Functions of Generation and Loads , Economic Dispatch for Active and Reactive Power Balance , Evaluation of Incremental Transmission Loss , Alternative Method to Evaluate Incremental Loss , Economic Dispatch Based on Penalty Factors

3. **Optimal Hydrothermal Scheduling**
Hydro Plant Performance Models , Short-Range Fixed-Head Hydrothermal Scheduling , Newton-Raphson Method for Short-Range Fixed-Head Hydrothermal Scheduling , Approximate Newton-Raphson Short-Range Fixed-Head Hydrothermal Scheduling Problem , Short-Range Variable-Head Hydrothermal Scheduling ProblemClassical Method , Approximate Newton-Raphson Method for Short-Range VariableHead Hydrothermal Scheduling Problem , Hydro Plant Modelling for Long-Term Operation , Long-Range Generation Scheduling of Hydrothermal Systems

4. **Multiobjective Generation Scheduling**
Multiobjective Optimization- State-of-the-Art , Fuzzy Set Theory in Power Systems , The surrogate Worth Trade-off Approach for Multiobjective Thermal Power Dispatch Problem , Multiobjective Thermal Power Dispatch Problem- Weighting Method , Multiobjective Dispatch for Active and Reactive Power Balance , Multiobjective Short-Range Fixed-Head Hydro-thermal SchedulingApproximate Newton-Raphson Method

Text Books:

1. D.P.Kothari and J.S. Dhillon" Power System Optimization " PHI Learning Pvt. Ltd.

ELECTIVE-V

MTEE-051 SMART GRID

L T P
3 0 0

Unit I

Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid. CDM opportunities in Smart Grid.

Unit II

Smart Grid Technologies: Part 1: Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

Unit III

Smart Grid Technologies: Part 2: Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU).

Unit IV

Microgrids and Distributed Energy Resources: Concept of microgrid, need & applications of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid. Plastic & Organic solar cells, thin film solar cells, Variable speed wind generators, fuelcells, microturbines, Captive power plants, Integration of renewable energy sources.

Unit V

Power Quality Management in Smart Grid: Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring.

Text Books:

1. Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press
3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley
4. Jean Claude Sabonnadière, Nouredine Hadjsaïd, "Smart Grids", Wiley Blackwell 19
5. Peter S. Fox Penner, "Smart Power: Climate Changes, the Smart Grid, and the Future of Electric Utilities", Island Press; 1 edition 8 Jun 2010
6. S. Chowdhury, S. P. Chowdhury, P. Crossley, "Microgrids and Active Distribution Networks." Institution of Engineering and Technology, 30 Jun 2009
7. Stuart Borlase, "Smart Grids (Power Engineering)", CRC Press

Reference Books:

1. Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability: 1", Artech House Publishers July 2011
2. James Northcote, Green, Robert G. Wilson "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press
3. Mladen Kezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert "Substation Automation (Power Electronics and Power Systems)", Springer
4. R. C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, "Electrical Power System Quality", 2nd Edition, McGraw Hill Publication

MTEE-052 POWER QUALITY

L T P
3 0 0

1. Power Quality Problems and Monitoring :

Introduction, surges, voltage sag and swell, over voltage, under voltage, outage voltage and phase angle imbalances, electrical noise, harmonic, frequency deviation monitoring.

2. Solution to power quality problems : Design, measures to minimize the frequency and duration of outages in distribution systems, voltages regulators, harmonic filters, power conditioners, uninterruptible power supplies, emergency and standby power systems, application of power conditioners.

3 Minimization of disturbances at Customer site : Power quality standards, standard test waveforms, power distribution system design, measure to minimize voltage disturbances.

References :

1. Roger C. Dugan, Mark F. Mcgranaghan, Surya Santoso, "Electrical Power System Quality", McGraw Hill
2. C. Sankaran, Power Quality CRC Press, USA
3. Wilson E. Kazibwe, "Electrical Power Quality Control Techniques", Van Nostrand Reinhold.
4. M. H. J. Bolen "Understanding Power Quality Problems", IEEE Press 2000.
5. J. Arrillaga, N.R. Watson, S. Chen "Powr System Quality Assessment", John Wiley, 2000.

MTEE-053 OPTIMIZATION TECHNIQUES

L T P
3 0 0

1.Linear programming –
formulation-Graphical and simplex methods-Big-M methodTwo phase method-Dual simplex method-Primal Dual problems.

2.Unconstrained one dimensional optimization techniques -
Necessary and sufficient conditions –Unrestricted search methods-Fibonacci and golden section methodQuadratic Interpolation methods, cubic interpolation and direct root methods.

3. **Unconstrained n dimensional optimization techniques –**
direct search methods – Random search –pattern search and Rosen brooch's hill claiming methodDescent methods-Steepest descent, conjugate gradient, quasi -Newton method.

4.Constrained optimization Techniques-
Necessary and sufficient conditions – Equality and inequality constraints-Kuhn-Tucker conditions-Gradient projection method-cutting plane method- penalty function method .

5.Dynamic programming-
principle of optimality- recursive equation approach-application to shortest route, cargo-loading, allocation and production schedule problems.

References :

1. Rao,S.S., Optimization :Theory and Application Wiley Eastern Press, 2nd edition 1984.
2. Taha,H.A., Operations Research –An Introduction,Prentice Hall of India,2003.
3. Fox, R.L., „Optimization methods for Engineering Design , Addition Welsey, 1971.