JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

EEE

Common for the following Specializations:

Advanced Power Systems
Power Systems.
Power System Engineering.
Power System Control.
Electrical & Power Engineering.
Electrical Power Systems
Power System Control and Automation
Power System Control and Automation Engineering.

COURSE STRUCTURE

M.Tech I YEAR I SEMESTER

S. No.	Subject	L	P	Credits
1	Microprocessors & Microcontrollers	4	--	3
2	HVDC Transmission	4	--	3
3	Power System Operation and Control	4	--	3
4	Reactive Power Compensation & Management	4	--	3
5	Elective – I i. Electrical Distribution Systems ii. HVAC Transmission iii. Analysis of Power Electronics Converters iv. Renewable Energy Systems v. Artificial Intelligence Techniques	4	--	3
6	Elective – II i. Power System Security ii Advanced Digital Signal Processing iii. Generation & Measurement of High Voltages iv. Programmable Logic Controllers & Applications v. Modern Control Theory	4	--	3
7	Simulation Laboratory	--	4	2
Total Credits				**20**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

SYLLABUS

I-I	MICROPROCESSORS & MICRO CONTROLLERS	L / P / Credits
		4 / -- / 3

Unit-I: Register Organization of 8086, Architecture, Signal description of 8086, memory segmentation, addressing modes of 8086. 8086/8088 instruction set and assembler directives, machine language instruction formats, Assembly language Programs.

Unit-II: General Bus Operation, minimum mode operation of 8086 and timing diagrams, Fundamental I/O considerations, Programmed I/O, Interrupt I/O, Block transfers and DMA.

Unit-III: Introduction to stack, stack structure of 8086/8088, Interrupts and Interrupt service routine, interrupt cycle of 8086/8088. Interfacing ROM/RAM, Interfacing of I/O ports to Micro Computer System, PPI (Programmable Peripheral Interface), 8255 modes of operation, Interfacing A to D converters, Interfacing D to A converters, Interfacing Principles and stepper motor interfacing.

Unit-IV : Programmable Interval timer 8254, Programmable Interrupt Controller 8259A, Key Board or Display Controller 8279, Programmable Communication Interface 8251 USART.

Unit-V: Introduction to 8051/31 Micro Controller, PIN diagram, architecture, Different modes of Operation of timer/counters, addressing modes of 8051 and instruction set. Over view of 16 bit Microcontrollers.

Reference Books:

1. Microprocessors and Interfacing: Programming and Hardware by Douglas V. Hall, 2nd edition, TMH, New Delhi, 1999.
2. Advanced Microprocessors and Peripherals, Architecture Programming and Interfacing by A.K. Ray & K.M. Bhurchandi, Forth reprint 2004, TMH
3. The 8051Microcontrollers: Architecture, Programming & Applications by Kenneth J Ayala, Second Edition, Penram International Publishing (India).
4. Micro Computer Systems: The 8086/8088 family by YU-CHENG LIU, GLENN A.GIBSON, 2nd edition, PHI India, 2000.
5. The 8051 Microcontroller and Embedded Systems – Mohammad Ali Mazdi, Janice Gillispie Mazidi, Pearson Education (Singapore) Pvt. Ltd., 2003.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I	H.V.D.C. TRANSMISSION	L / P / Credits
		4 / -- / 3

Unit 1 : Limitation of EHV AC Transmission .Advantages of HVDC Technical economical reliability aspects. H.V.D.C. Transmission: General considerations, Power Handling Capabilities of HVDC Lines, Basic Conversion principles, static converter configuration. Types of HVDC links-Apparatus and its purpose.

Unit 2 : Static Power Converters : 6-pulse bridge circuit and 12-pulse converters, converter station and Terminal equipment, commutation process, Rectifier and inverter operation, equivalent circuit for converter – special features of converter transformers. Comparison of the perform of diametrical connection with 6-pulse bridge circuit

Unit 3 : Control of HVDC Converters and systems : constant current, constant extinction angle and constant Ignition angle control. Individual phase control and equidistant firing angle control, DC power flow control. Factors responsible for generation of Harmonics voltage and current harmonics effect of variation of α and μ. Filters Harmonic elimination.

Unit 4 : Interaction between HV AC and DC systems – Voltage interaction, Harmonic instability problems and DC power modulation. Development of DC circuit Breakers, Multi-terminal DC links and systems; series, parallel and series parallel systems, their operation and control.

Unit 5 : Transient over voltages in HV DC systems : Over voltages due to disturbances on DC side, over voltages due to DC and AC side line faults. Converter faults and protection in HVDC Systems: Converter faults, over current protection - valve group, and DC line protection, circuit breakers. Over voltage protection of converters, surge arresters.

Reference Books :

1. K.R.Padiyar : High Voltage Direct current Transmission, Wiley Eastern Ltd., New Delhi – 1992.
2. E.W. Kimbark : Direct current Transmission, Wiley Inter Science – New York.
3. J.Arillaga : H.V.D.C.Transmission Peter Peregrinus ltd., London UK 1983
4. E.Uhlman : Power Transmission by Direct Current, Springer Verlag, Berlin Helberg – 1985.
5. HVDC Transmission-S Kamakshaih and V Kamaraju MG hill.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I	POWER SYSTEM OPERATION AND CONTROL	L / P / Credits
		4 / -- / 3

Unit 1 : Unit commitment problem and optimal power flow solution : Unit commitment : Constraints in UCP,UC solutions. Methods-priority list method, introduction to Dynamic programming Approach.

Unit 2 : Load Frequency Control-I : Necessity of keeping frequency constant. Definition of control area, single area control, Block diagram representation of an isolated Power System, Steady State analysis, Dynamic response-Uncontrolled case. Proportional plus Integral control of single area and its block diagram representation, steady state response, load frequency control and Economic dispatch control.

Unit 3 : Load Frequency Control-II : Load frequency control of 2-area system : uncontrolled case and controlled case, tie-line bias control. Optimal two-area LF control-steady state representation, performance Index and optimal parameter adjustment.

Unit 4 : Generation with limited Energy supply : Take-or-pay fuel supply contract, composite generation production cost function. Solution by gradient search techniques, Hard limits and slack variables, Fuel scheduling by linear programming.

Unit 5 : Interchange Evaluation and Power Pools Economy Interchange, Economy interchange Evaluation, Interchange Evaluation with unit commitment, Multiple Interchange contracts. After-the-fact production costing, Transmission Losses in transaction Evaluation, other types of Interchange, power pools.

Reference Books :

1 Modern Power System Analysis - by I.J.Nagrath & D.P.Kothari, Tata Mc Graw-Hill Publishing Company ltd, 2nd edition.
2 Power system operation and control PSR Murthy B.S publication.
3 Power Generation, Operation and Control - by A.J.Wood and B.F.Wollenberg,John wiley & sons Inc. 1984.
4 Electrical Energy Systems Theory - by O.I.Elgerd, Tata Mc Graw-Hill Publishing Company Ltd, 2nd edition.
5 Reactive Power Control in Electric Systems - by TJE Miller, John Wiley & sons.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I	REACTIVE POWER COMPENSATION & MANAGEMENT	L / P / Credits
		4 / -- / 3

UNIT I: Load Compensation

Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads- examples.

UNIT II: Reactive power compensation in transmission system:

Steady state -Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation – examples

Transient state - Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation –compensation using synchronous condensers – examples

UNIT-III: Reactive power coordination:

Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency – Harmonics, radio frequency and electromagnetic interferences

UNIT-IV: Distribution side Reactive power Management:

System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks

User side reactive power management:

KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations

UNIT-V: Reactive power management in electric traction systems and are furnaces:

Typical layout of traction systems – reactive power control requirements – distribution transformers- Electric arc furnaces – basic operations- furnaces transformer –filter requirements – remedial measures –power factor of an arc furnace

Reference Books:

1. Reactive power control in Electric power systems by T.J.E.Miller, John Wiley and sons, 1982

2. Reactive power Management by D.M.Tagare,Tata McGraw Hill,2004

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I **ELECTRICAL DISTRIBUTION SYSTEMS (ELECTIVE-I)** **L / P / Credits**
4 / -- / 3

Unit I : General : Introduction to Distribution systems, an overview of the role of computers in distribution system planning-Load modeling and characteristics: definition of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor-Relationship between the load factor and loss factor - Classification of loads

(Residential, Commercial, Agricultural and Industrial) and their characteristics.

Unit II : Distribution Feeders and Substations : Design consideration of Distribution feeders: Radial and loop types of primary feeders, voltage levels, feeder-loading. Design practice of the secondary distribution system. Location of Substations : Rating of a Distribution Substation, service area with primary feeders. Benefits derived through optimal location of substations.

Unit III : System analysis : Voltage drop and power loss calculations : Derivation for volt-drop and power loss in lines, manual methods of solution for radial networks, three-phase balanced primary lines, non-three-phase primary lines.

Unit IV : Protective devices and coordination : Objectives of distribution system protection, types of common faults and procedure for fault calculation. Protective Devices: Principle of operation of fuses, circuit reclosers, line sectionalizer and circuit breakers. Coordination of protective devices : General coordination procedure.

Unit V : Capacitive compensation for power factor control: Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched) power factor correction, capacitor location. Economic justification. Procedure to determine the best capacitor location. Voltage control : Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop compensation.

Reference Books :

1. "Electric Power Distribution System Engineering " by Turan Gonen, Mc.Graw-Hill Book Company,1986.

2. Electric Power Distribution-by A.S.Pabla, Tata Mc Graw-Hill Publishing Company, 4th edition, 1997.

3. Electrical Distribution V.Kamaraju-Mc Graw Hill

4.Handbook of Electrical Power Distribution – Gorti Ramamurthy-Universities press

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I

HVAC TRANSMISSION (ELECTIVE-I)

L / P / Credits
4 / -- / 3

Unit 1 : E.H.V. A.C. Transmission , line trends and preliminary aspects ,standard transmission voltages – power handling capacities and line losses – mechanical aspects. Calculation of line resistance and inductance : resistance of conductors, temperature rise of conductor and current carrying capacity. Properties of bundled conductors and geometric mean radius of bundle, inductance of two conductor lines and multi conductor lines, Maxwell's coefficient matrix. Line capacitance calculation : capacitance of two conductor line, and capacitance of multi conductor lines, potential coefficients for bundled conductor lines, sequence inductances and capacitances and diagonalization.

Unit 2 : Calculation of electro static field of AC lines - Effect of high electrostatic field on biological organisms and human beings. Surface voltage Gradient on conductors, surface gradient on two conductor bundle and cosine law, maximum surface voltage gradient of bundle with more than 3 sub conductors, Mangolt formula.

Unit 3 : Corona : Corona in EHV lines – corona loss formulae – attenuation of traveling waves due to corona – Audio noise due to corona, its generation, characteristics and limits, measurement of audio noise.

Unit 4 : Power Frequency voltage control : Problems at power frequency, generalized constants, No load voltage conditions and charging currents, voltage control using synchronous condenser, cascade connection of components : Shunt and series compensation, sub synchronous resonance in series – capacitor compensated lines

Unit 5 : Static reactive compensating systems : Introduction, SVC schemes, Harmonics injected into network by TCR, design of filters for suppressing harmonics injected into the system.

Reference Books :

1. Extra High Voltage AC Transmission Engineering – Rakesh Das Begamudre, Wiley Eastern ltd., New Delhi – 1987.
2. EHV Transmission line reference book – Edison Electric Institute (GEC) 1986.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I	ANALYSIS OF POWER ELECTRONIC CONVERTERS (ELECTIVE-I)	L / P / Credits 4 / -- / 3

Unit-I :AC voltage Controllers

Single Phase AC Voltage Controllers with RL and RLE loads-ac voltage controller's with PWM control-Effects of source and load inductances –synchronous tap changers –Application-numerical problems

Three Phase AC Voltage controllers-Analysis of Controllers with star and delta connected resistive, resistive –inductive loads-Effects of source and load inductances–Application-numerical problems.

Unit –II ac-dc converters

Single phase Half controlled and Fully controlled Converters with RL load– Evaluation of input power factor and harmonic factor-Continuous and Discontinuous load current-Power factor improvements-Extinction angle control-symmetrical angle control-PWM single phase sinusoidal PWM-Single phase series converters- numerical problems. Three Phase ac-dc Converters- Half controlled and fully controlled Converters with RL load– Evaluation of input power factor and harmonic factor-Continuous and Discontinuous load current-three phase dual converters-Power factor improvements-three phase PWM-twelve pulse converters- numerical problems

Unit-III: Power Factor Correction Converters

Single-phase single stage boost power factor corrected rectifier, power circuit principle of operation, and steady state- analysis, three phase boost PFC converter

Unit –IV: PWM Inverters

Principle of operation-Voltage control of single phase inverters - sinusoidal PWM – modified PWM – phase displacement Control – Trapezoidal, staircase, stepped, harmonic injection and delta modulation – numerical problems. Voltage Control of Three-Phase Inverters- Sinusoidal PWM- 60^0 PWM- Third Harmonic PWM- Space Vector Modulation- Comparison of PWM Techniques-current source inverters-Variable dc link inverter - numerical problems

Unit V: Multi level inverters

Introduction, Multilevel Concept, Types of Multilevel Inverters- Diode-Clamped Multilevel Inverter, Principle of Operation, Features of Diode-Clamped Inverter, Improved Diode-Clamped Inverter- Flying-Capacitors Multilevel Inverter- Principle of Operation, Features of Flying-Capacitors Inverter- Cascaded Multilevel Inverter- Principle of Operation- Features of Cascaded Inverter- Switching Device Currents-DC-Link Capacitor Voltage Balancing- Features of Multilevel Inverters- Comparisons of Multilevel Converters

Textbooks

1. Power Electronics-Md.H.Rashid –Pearson Education Third Edition- First Indian Reprint- 2008
2. Power Electronics- Ned Mohan, Tore M.Undelan and William P.Robbins –John Wiley & Sons -2nd Edition.
3. Power Electronics – Lander –Ed.2009
4. Modern power Electronics and AC Drives – B.K.Bose
5. Power Converter Circuits – William Shepherd & Li Zhang-Yes Dee Publishing Pvt Ltd.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I	RENEWABLE ENERGY SYSTEMS (Elective-I)	L / P / Credits
		4 / -- / 3

Unit-I

Solar Energy - Availability - Solar radiation data and measurement - Estimation of average solar radiation - Solar water heater types - Heat balance – Flat plate collector efficiency – Efficiency of heat removal - Thermo siphon flow calculation - Forced circulation calculation - Evacuated collectors - Basics of solar concentrators Solar Energy Applications - Solar air heaters – Solar Chimney - Crop driers - Passive solar system - Active solar systems - Water desalination - Output from solar still – Principle of solar ponds.

Unit-II

Wind Energy – Nature of wind – Characteristics – Variation with height and time – Power in wind – Aerodynamics of Wind turbine – Momentum theory – Basics of aerodynamics – Aero foils and their characteristics – HAWT – Blade element theory – Prandtl's lifting line theory (prescribed wake analysis) VAWT aerodynamics – Wind turbine loads – Aerodynamic loads in steady operation – Yawed operation and tower shadow. Wind Energy Conversion System – Siting – Rotor selection – Annual energy output – Horizontal axis wind turbine (HAWT) – Vertical axis wind turbine (VAWT) – Rotor design considerations – Number of blades – Solidity - Blade profile – Upwind/Downwind – Yaw system – Tower – Braking system - Synchronous and asynchronous generators and loads – Integration of wind energy converters to electrical networks – Inverters – Control system – Requirement and strategies – Noise Applications of wind energy

Unit-III

Biomass energy - Bio fuel classification – Examples of thermo chemical, Pyrolysis, biochemical and agrochemical systems – Energy farming – Direct combustion for heat – Process heat and electricity – Ethanol production and use – Anaerobic digestion for biogas – Different digesters – Digester sizing – Applications of Biogas - Operation with I.C.Engine

Unit-IV

Ocean Energy - OTEC Principle - Lambert's law of absorption - Open cycle and closed cycle - heat exchanger calculations – Major problems and operational experience. Tidal Power - Principles of power generation - components of power plant – Single and two basin systems – Turbines for tidal power - Estimation of energy – Maximum and minimum power ranges - tidal powerhouse.

Wave Energy – Concept of energy and power from waves – Wave characteristics – period and wave velocities - Different wave energy conservation devices (Saltor duck, oscillating water column and dolphin types) – operational experience.

Unit-V

Geothermal Energy - Classification- Fundamentals of geophysics - Dry rock and hot aquifier energy analysis - Estimation of thermal power - Extraction techniques - Prime movers.

References:

1. Renewable Energy Resources / John Twidell and Tony Weir / E & F.N.Spon
2. Renewable Energy Resources Basic Principles and Applications / G.N.Tiwari and M.K.Ghosal / Narosa
3. Solar Energy - Principles of thermal collection and storage/ S.P. Sukhatme / TMH
4. Solar Energy Thermal Processes,/Duffie & Beckman
5. Solar Heating and Cooling / Kreith & Kreider
6. Wind Energy Handbook / Tony Burton, David Sharpe, Nick Jenkins and Ervin Bossanyi / WileyWind Electrical Systems / S.N.Bhadra, D.Kastha and S.Banerjee / Oxford
7. Biogas Technology - A Practical Hand Book / K.Khendelwal & S.S. Mahdi / McGraw-Hill

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I	ARTIFICIAL INTELLIGENCE TECHNIQUES (Elective-I)	L / P / Credits
		4 / -- / 3

Unit – I: Introduction to Neural Networks

Introduction, Humans and Computers, Biological Neural Networks, Historical development of neural network, Terminology and Topology, Biological and artificial neuron models, Basic learning laws.

Unit- II: Feed Forward Neural Networks

Introduction, Perceptron models: Discrete, continuous and multi-category, Training algorithms: Discrete and Continuous Perceptron Networks, Perceptron convergence theorem, Limitations and applications of the Perceptron model, Generalized delta learning rule, Feedforward recall and error back propagation training-Radial basis function algorithms-Hope field networks

Unit III: Genetic algorithms & Modelling-introduction-encoding-fitness function-reproduction operators-genetic operators-cross over and mutation-generational cycle-convergence of genetic algorithm

Unit – VI: Classical and Fuzzy Sets

Introduction to classical sets - properties, operations and relations; Fuzzy sets, membership, Uncertainty, operations, properties, fuzzy relations, cardinalities, membership functions.

Fuzzy Logic System Components-Fuzzification, Membership value assignment, development of rule base and decision making system, defuzzification to crisp sets, defuzzification methods.

UNIT V: APPLICATION OF AI TECHNIQUES-load forecasting-load flow studies-economic load dispatch-load frequency control-reactive power control-speed control of dc and ac motors

TEXT BOOK:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.

2. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I | **POWER SYSTEM SECURITY (ELECTIVE II)** | **L / P / Credits**
4 / -- / 3

Unit-I: Short circuit analysis techniques in AC power Systems- Simulation of short circuit and open circuit faults using network theorems- fixed impedance short circuit analysis techniques- time domain short circuit analysis in large scale power systems- analysis of time variation of AC and DC short circuit components

Unit-II: Fixed impedance Short circuit analysis of large scale power systems-general analysis of balanced, unbalanced and open circuit faults- 3-phase short circuit analysis in large scale power systems, Network equivalents and practical short circuit current assessments in large scale Ac power systems-general studies- uncertainties in short circuit current calculations-probabilistic Short circuit analysis

Unit-III: Risk assessment and safety considerations-control and limitation of high short circuit currents-limitation of short circuit currents in power system operation, design and planning, Types of short circuit fault current limiters- earthing resistor or reactor connected to transformer neutral-pyrotechnic fault current limiters- series resonant current limiters- saturable reactor limiters-other types of fault current limiters and their applications.

Unit-IV: Power System Security analysis- concept of security- security analysis and monitoring- factors affecting power system security- detection of network problems –overview, contingency analysis for generator and line outages by ILPF method – fast decoupled inverse Lemma-based approach, network sensitivity factors –contingency selection –concentric relaxation and bounding.

Unit-V: Computer control power systems – need for real time and computer control of power systems- operating states of power system – SCADA- implementation considerations – software requirements for implementing above functions.

Reference Books:

1.Allen J. Wood and Bruce Woolenberg: Power System Generation, Operation and Control ,John Willey and sons,1996

2.John J.Grainger and William D Stevenson Jr.: Power System analysis,McGraw Hill,ISE,1994.

3.Nasser D.Tleis : Power System Modelling and fault analysis, Elsevier, 2008

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I	ADVANCED DIGITAL SIGNAL PROCESSING(Elective II)	L / P / Credits
		4 / -- / 3

UNIT-I: Digital Filter Structure

Block diagram representation-Equivalent Structures-FIR and IIR digital filter Structures All pass Filters-tunable IIR Digital Filters-IIR tapped cascaded Lattice Structures-FIR cascaded Lattice structures-Parallel-Digital Sine-cosine generator-Computational complexity of digital filter structures.

UNIT-II: Digital filter design

Preliminary considerations-Bilinear transformation method of IIR filter design-design of Low pass high pass-Band pass, and Band stop- IIR digital filters-Spectral transformations of IIR filters, FIR filter design-based on Windowed Fourier series- design of FIR digital filters with least –mean- Square-error-constrained Least-square design of FIR digital filters

UNIT-III: DSP algorithm implementation

Computation of the discrete Fourier transform- Number representation-Arithmetic operations-handling of overflow-Tunable digital filters-function approximation.

UNIT-IV : Analysis of finite Word length effects

The Quantization process and errors- Quantization of fixed -point and floating -point Numbers-Analysis of coefficient Quantization effects - Analysis of Arithmetic Round-off errors, Dynamic range scaling-signal- to- noise ratio in Low -order IIR filters-Low-Sensitivity Digital filters-Reduction of Product round-off errors using error feedback-Limit cycles in IIR digital filters-Round-off errors in FFT Algorithms.

UNIT V : Power Spectrum Estimation

Estimation of spectra from Finite Duration Observations signals – Non-parametric methods for power spectrum Estimation – parametric method for power spectrum Estimation, Estimation of spectral form-Finite duration observation of signals-Non-parametric methods for power spectrum estimation-Walsh methods-Blackman & torchy method.

Reference Books:

1. Digital signal processing-sanjit K. Mitra-TMH second edition
2. Discrete Time Signal Processing – Alan V.Oppenheim, Ronald W.Shafer - PHI-1996 1st edition-9th reprint
3 Digital Signal Processing principles, algorithms and Applications – John G.Proakis -PHI –3rd edition-2002
4. Digital Signal Processing – S.Salivahanan, A.Vallavaraj, C. Gnanapriya – TMH - 2nd reprint-2001
5. Theory and Applications of Digital Signal Proceesing-LourensR. Rebinar & Bernold
6. Digital Filter Analysis and Design-Auntonian-TMH

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I

GENERATION & MEASUREMENTS OF HIGH VOLTAGES
(Elective II)

L / P / Credits
4 / -- / 3

Unit 1- Electrostatic fields and field stress control : Electric fields in homogeneous Isotropic materials and in multi dielectric media-Simple configurations-field stress control. Methods of computing electrostatic fields-conductive analogues-Impedance networks Numerical techniques-finite difference method-finite element method and charge simulation method.

Unit 2-Generation of High AC & DC Voltages:
Direct Voltages : AC to DC conversion methods electrostatic generators-Cascaded Voltage Multipliers.
Alternating Voltages : Testing transformers-Resonant circuits and their applications, Tesla coil.

Unit 3-Generation of Impulse Voltages :
Impulse voltage specifications-Impulse generations circuits-Operation, construction and design of Impulse generators-Generation of switching and long duration impulses.
Impulse Currents : Generation of High impulse currents and high current pulses.

Unit 4- Measurement of High AC & DC Voltages :
Measurement of High D.C. Voltages : Series resistance meters, voltage dividers and generating voltmeters.
Measurement of High A.C. Voltages : Series impedance meters electrostatic voltmeters potential transformers and CVTS-voltage dividers and their applications.

Unit 5-Measurement of Peak Voltages : Sphere gaps, uniform field gaps, rod gaps.
Chubb-Fortesque methods. Passive and active rectifier circuits for voltage dividers.
Measurement of Impulse Voltages : Voltage dividers and impulse measuring systems-generalized voltage measuring circuits-transfer characteristics of measuring circuits-L.V. Arms for voltage dividers-compensated dividers.

Measurement of Impulse Currents : Resistive shunts-current transformers-Hall Generators and Faraday generators and their applications-Impulse Oscilloscopes.

Text Books :

1. High Voltage Engineering – by E.Kuffel and W.S.Zaengl. Pergaman press Oxford, 1984.
2. High Voltage Engineering – by M.S.Naidu and V.Kamaraju, Mc.Graw-Hill Books Co., New Delhi, 2nd edition, 1995.

Reference Books :

1. High Voltage Technology – LL Alston, Oxford University Press 1968.
2. High Voltage Measuring Techniques – A. Schwab MIT Press, Cambridge,USA, 1972.
3. Relevant I.S. and IEC Specifications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I

PROGAMMABLE LOGIC CONTROLLERS & APPLICATIONS
(Elective II)

L / P / Credits
4 / -- / 3

Unit 1:

PLC Basics: PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

Unit 2:

PLC Programming: Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation. Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams for process control: Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

Unit 3:

PLC Registers: Characteristics of Registers, module addressing, holding registers, input registers, output registers. PLC Functions: Timer functions and Industrial applications, counters, counter function industrial applications, Arithmetic functions, Number comparison functions, number conversion functions.

Unit 4:

Data Handling functions: SKIP, Master control Relay, Jump, Move, FIFO, FAL, ONS, CLR and Sweep functions and their applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axis and three axis Robots with PLC, Matrix functions.

Unit 5:

Analog PLC operation: Analog modules and systems, Analog signal processing, multi bit data processing, analog output application examples, PID principles, position indicator with PID control, PID modules, PID tuning, PID functions.

Reference Books:

1. Programmable Logic Controllers – Principle and Applications by John W. Webb and Ronald A. Reiss, Fifth Edition, PHI
2. Programmable Logic Controllers – Programming Method and Applications by JR. Hackworth and F.D Hackworth Jr. – Pearson, 2004.
3. Introduction to Programmable Logic Controllers- Gary Dunning-Cengage Learning.
4. Programmable Logic Controllers –W.Bolton-Elsevier publisher

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I | **MODERN CONTROL THEORY(ELECTIVE-II)** | **L / P / Credits**
4 / -- / 3

Unit –I State Variable Analysis
The concept of state – State Equations for Dynamic systems – State diagram - Linear Continuous time model for physical systems – Existence and Uniqueness of Solutions to Continuous – Time State Equations – Solutions – Linear Time Invariant Continuous – Time State Equations – State transition matrix and it's properties

Unit – II State Variable Techniques
General concept of Controllability - General concept of Observability Controllability tests for Continuous &Time Invariant systems - Observability tests for Continuous &Time Invariant systems - Controllability and Observability of state model in Jordan Canonical form - Controllability and Observability Canonical forms of State model – State feedback controller design through pole assignment.

Unit – III Non Linear Systems – 1
Introduction – Non Linear Systems – Types of Non – Linearities – Saturation – Dead – Zone – Backlash – Jump Phenomenon etc; - Singular Points – Introduction to Linearization of nonlinear systems, properties of Non Linear Systems – Describing function – describing function analysis of nonlinear systems- Stability analysis of Non – Linear systems through describing functions.

Unit – IV Non Linear Systems – 11
Introduction to phase – plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase – plane analysis of nonlinear control systems.

Unit – V Stability Analysis
Stability in the sense of Lyapunov, Lyapunov's stability and Lyapunov's instability theorems – Stability Analysis of the Linear Continuous time invariant systems by Lyapunov second method – Generation of Lyapunov functions – Variable gradient method – Krasooviski's method.

Text books:

1. Modern Control System Theory by M. Gopal – New Age International – 1984
2. Modern Control Engineering by Ogata. K – Prentice Hall – 1997
3. Nonlinear systems, Hassan K. Klalil, Prentice Hall, 1996
4. Modern control systems, Richard C. Dorf and Robert H. Bishop, 11th Edition, Pearson Edu, India, 2009

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I-I

SIMULATION LABORATORY

L / P / Credits
-- / 4 / 2

Any 10 of the following experiments are to be conducted

List of Experiments:

1. Y Bus formation for p systems with and without mutual coupling, by Singular transformation.
2. Y Bus formation for p systems with and without mutual coupling, by inspection method.
3. Determination of bus currents, bus power and line flow for a specified system voltage (Bus) Profile
4. Formation of Z-bus, using Z-bus building Algorithm without mutual.
5. ABCD parameters: Formation for symmetric II/I configuration. Verification of AD-BC=1 Determination of coefficient and regulation
6. Determination of power angle diagrams for salient and non-salient pole synchronous m/c s, reluctance power, excitation, emf and regulation.
7. To determine I) Swing curve II) critical clearing time for a single m/c connected to infinity bus through a pair of identical transmission lines, 3-phase fault on one of the lines for variation of inertia constant/line parameters /fault location/clearing time/pre-fault electrical output.
8. Formation of Jacobian for a system not exceeding 4 buses *(no PV buses) in polar coordinates
9. Write a program to perform load flow using Gauss- Seidel method (only p q bus)
10. To determine fault currents and voltages in a single transmission line systems with star-delta transformers at a specified location for SLGF, DLGF.
11. Load flow analysis using Gauss- Siedel method for both pq and pv buses.
12. Load flow analysis using NR method for both pq and pv buses.
13. Fast decoupled flow method for both pq and pv buses.
14. Optimal Generator Scheduling for Thermal power plants.
15. Economic dispatch using lambda-iteration method