ACADEMIC REGULATIONS, COURSE STRUCTURE AND DETAILED SYLLABUS

Effective from the Academic Year 2017-18 onwards

M. Tech. Two Year Degree Programme

(MR17 Regulations)

in

Electrical Power Systems (EPS)

Department of Electrical and Electronics Engineering

MALLA REDDY ENGINEERING COLLEGE (Autonomous)

(An UGC Autonomous Institution, Approved by AICTE and Affiliated to JNTUH Hyderabad,
Recognized under section 2(f) &12 (B) of UGC Act 1956, Accredited by NAAC with 'A' Grade (II Cycle)
Maisammaguda, Dhulapally (Post Via Kompally), Secunderabad-500 100
Website: www.mrec.ac.in E-mail: principal@mrec.ac.in

MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

MR17 ACADEMIC REGULATIONS (CBCS)
For M. Tech. (REGULAR) DEGREE PROGRAMME

Applicable for the students of M. Tech. (Regular) programme admitted from the Academic Year ***2017-18*** onwards.

The M. Tech. Degree of Jawaharlal Nehru Technological University Hyderabad, Hyderabad shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

INSTITUTION VISION

To be a premier center of professional education and research, offering quality programs in a socio-economic and ethical ambience.

INSTITUTION MISSION

- To impart knowledge of advanced technologies using state-of-the-art infrastructural facilities.
- To inculcate innovation and best practices in education, training and research.
- To meet changing socio-economic needs in an ethical ambiance.

DEPARTMENT VISION

To become a reputed center for imparting quality education and research in the field of Electrical and Electronics Engineering with human values, ethics and social responsibility.

DEPARTMENT MISSION

- To impart quality education and research to undergraduate and postgraduate students in Electrical and Electronics Engineering
- To produce professionally competent and ethically committed engineers to meet changing socio-economic needs.
- To impart knowledge of advanced technologies for continual improvement in teaching, learning and research.

PROGRAMME OUTCOMES

POs	STATEMENT
PO1	An ability to independently carry out research /investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document.

PO3	Students should be able to demonstrate a degree of mastery over the area as perthe specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4	Pursue for the research and to design, develop and propose theoretical and practical methodologies in Power System domain.
PO5	Inculcate 'Design Thinking Process' among the students, and they are trained to apply Design methodologies for modeling, analyzing and solving various Engineering problems related to Power Systems
PO6	Exhibit broad program management capabilities in addition to their interdisciplinary technical subject expertise. The student is trained to carry out the same in an efficient and effective manner giving due reflections to societal, environmental, economic and financial factors.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	To equip the engineering graduates with ample and appropriate knowledge which help them to hone their skills in the areas of Power Systems so as to excel in advanced level jobs in current corporate sector and/or teaching and learning domain/or higher education and/or research field
PEO 2	To transform engineering graduates to be future thought leaders in their respective domains. The course is geared to help students solve for complex inter-disciplinary problems by analyzing, designing and create world class solutions and services to issues in the areas of Power System that are technically sound, economically feasible and socially acceptable
PEO 3	To train engineering graduates to exhibit professionalism, keep up ethics in their profession and relate engineering issues to address technical and social challenges.

MALLAREDDY ENGINEERING COLLEGE (Autonomous)
Department of Electrical and Electronics Engineering
M. Tech. (Electrical Power Systems)
MR17 - Course Structure and Syllabus

Academic Year 2017-18 (Choice Based Credit System)
(MR17 Regulations)

I SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	PC	72401	Advanced Power System Analysis	2	2	-	3	40	60	100
2	PC	72402	Advanced Power System Protection	2	2	-	3	40	60	100
3	PC	72403	Modern Control Theory	2	2	-	3	40	60	100
4	PE	**Professional Elective–I**		2	2	-	3	40	60	100
		72404	1. EHV AC Transmission							
		72405	2. High Voltage Generation and Measurement							
		70441	3. Advanced Digital Signal Processing							
5	PE	**Professional Elective–II**		2	2	-	3	40	60	100
		72406	1. Power Quality							
		70420	2. Microcontrollers and Applications							
		72407	3. Distribution Automation							
6	O E	**Open Elective-I**		2	2	-	3	40	60	100
		70B16	1. Optimization Techniques							
		72408	2. Energy Management							
		70452	3. Embedded System Design							
7	PC	72409	Power Systems Simulation Lab	-	-	4	2	40	60	100
8	PR	72410	Seminar-I	-	-	4	2	100	--	100
Total				12	12	8	22	Contact Periods: 32		

II SEMESTER

S. No.	Category	Course code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	PC	72411	Power System Dynamics	2	2	-	3	40	60	100
2	PC	72412	Flexible AC Transmission Systems (FACTS)	2	2	-	3	40	60	100
3	PC	72413	Power System Operation and Deregulation	2	2	-	3	40	60	100
4	PE	**Professional Elective–III**		2	2	-	3	40	60	100
		72414	1. Gas Insulated Systems(GIS)							
		70223	2. Programmable Logic Controllers and their Applications							
		72415	3. High frequency magnetic components							
5	PE	**Professional Elective–IV**		2	2	-	3	40	60	100
		72416	1. Reactive Power Compensation and Management							
		72417	2. Power System Reliability							
		72418	3. Voltage Stability							
6	OE	**Open Elective-II**		2	2	-	3	40	60	100
		72419	1. Smart grid technologies							
		72420	2. AI Techniques in Electrical Engineering							
		72421	3. Digital control systems							
7	PC	72422	Power Systems Lab-II	-	-	4	2	40	60	100
8	PR	72423	Seminar-II	-	-	4	2	100	--	100
Total				12	12	8	22	Contact Periods: 32		

III Semester

S. No.	Category	Course Code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	PR	72424	Comprehensive Viva-Voce	--	--	--	6	--	100	100
2	PR	72425	Project work Part I	--	--	--	16	100	--	100
			Total	--	--	--	22	-		

IV Semester

S. No.	Category	Course Code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	PR	72426	Project work Part II	--	--	--	6	100	--	100
2	PR	72427	Project Viva-Voce	--	--	--	16	--	100	100
			Total	--	--	--	22	-		

*** PC – Professional Core, PE – Professional Elective, OE – Open Elective , PR – Project Work**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 72401	ADVANCED POWER SYSTEM ANALYSIS	L	T	P
Credits: 3		2	2	-

Prerequisites: Power System Analysis

Course Objectives:

To analyze a Power System Network using graph theory, interpret the formation of Network matrices. To construct the necessity of load flow studies and various methods of Analysis, examine short circuit analysis using Z_{Bus}.

MODULE I: Admittance Model and Network Calculations 12 Periods

Admittance Model and Network Calculations, Branch and Node Admittances, Mutually Coupled Branches in Y_{BUS} , An Equivalent Admittance Network, Modification of Y_{BUS} , Network Incidence Matrix and Y_{BUS} , Method of Successive Elimination, Node Elimination, Triangular Factorization, Sparsity and Near Optimal Ordering.

MODULE II: Impedance Model and Network Calculations 12 Periods

Impedance Model and Network Calculations, the BUS Admittance and Impedance Matrices, Thevenin's Theorem and Z_{BUS}, Algorithms for building Z_{BUS}, Modification of existing Z_{BUS}, Calculation of Z_{BUS} elements from Y_{BUS}, Power Invariant Transformations, Mutually Coupled Branches in Z_{BUS}.

MODULE III: Power flow Analysis 12 Periods

A: Power flow analysis by Gauss Seidel method and N-R Method.

B: Power flow analysis by Decoupled method and fast decoupled method. Comparison between power flow solutions. DC load flow.

MODULE IV: Contingency Analysis 12 Periods

Z_{BUS} Method in Contingency Analysis, Adding and Removing Multiple Lines, Piecewise Solution of Interconnected Systems, Analysis of Single Contingencies, Analysis of Multiple Contingencies, Contingency Analysis of DC Model, System Reduction for Contingency and Fault Studies.

MODULE V: Fault Analysis 12 Periods

Symmetrical faults - Fault calculations using Z_{BUS} - Fault calculations using Z_{BUS} equivalent circuits – Selection of circuit breakers - Unsymmetrical faults - Problems on various types of faults.

TEXT BOOKS

1. P. Kundur, **"Power System Stability and Control"**, McGraw Hill Education, 1st Edition, 2006.
2. John J.Grainger and W.D. Stevenson, **"Power System Analysis"**, McGraw Hill Education, 1st Edition, 1994.

REFERENCES

1. I.J.Nagrath and D.P.Kothari, **"Modern Power System Analysis"**, Tata McGraw Hill, New Delhi, 4th Edition, 2011.
2. Olle. L.Elgard, **"Electrical Energy Systems Theory"**, McGraw Hill Education, 2nd Edition, 2001.
3. M.A. Pai, **"Computer Techniques in Power System Analysis"**, McGraw Hill, New Delhi,3rd Edition, 2014.
4. Dr. K. Uma Rao, **"Power System: Operation and Control"**, Wiley India Pvt. Ltd., 2012.
5. Robert Miller and James Malinowski, **"Power System Operation (Electronics)"**, McGraw Hill Education, 3rd Edition, 1994.

E-RESOURCES

1. http://www.ieee-pes.org/ieee-transactions-on-power-systems
2. http://www.ieee-pes.org/
3. http://nptel.ac.in/courses/108105067/

Course Outcomes

At the end of the course, students will be able to

1. Obtain the different matrices to analyze the power network.
2. Form bus impedance matrix for the given network.
3. Apply numerical methods for power flow analysis.
4. Analyze the power system under single and multiple contingency.
5. Analyze the power system under fault condition.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**	**2**	**3**	**2**	**2**	**2**
CO2	**2**		**2**	**2**	**2**	**3**
CO3	**3**	**1**	**3**	**2**	**2**	**3**
CO4	**2**	**2**	**3**	**2**	**2**	**3**
CO5	**3**		**2**	**2**	**2**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 72402	ADVANCED POWER SYSTEM PROTECTION	L	T	P
Credits: 3		2	2	-

Prerequisites: Switch Gear and Protection

Course Objectives:
To distinguish all kinds of circuit breakers and relays for protection of Generators, Transformers and feeder bus bars from over voltages and other hazards. To generalize neutral grounding for overall protection. To illustrate the phenomenon of over voltages and its classification.

MODULE I: Static Relays and Comparators 12 Periods
Static Relays: Advantages of static relays - Basic construction of static relays - Level detectors - Replica impedance – Mixing circuits - General equation for two input phase and amplitude comparators - Duality between amplitude and phase comparators.
Amplitude Comparators: Circulating current type and opposed voltage type - Rectifier bridge comparators, Direct and Instantaneous comparators.

MODULE II: Phase Comparators and Static over Current Relays 12 Periods

Phase Comparators: Coincidence circuit type - Block spike phase comparator, Techniques to measure the period of coincidence. Phase comparators - Integrating type, Rectifier and Vector product type.
Static over Current Relays: Instantaneous over-current relay - Time over - Current relays - Basic principles – Definite time and Inverse definite time over-current relays.

MODULE III: Static Differential and Distance Relays 12 Periods
A: Static Differential Relays: Analysis of Static Differential Relays – Static Relay schemes – Duo bias transformer differential protection – Harmonic restraint relay.
B: Static Distance Relays: Static impedance – Reactance – MHO and angle impedance relay - Sampling comparator – Realization of reactance and MHO relay using sampling comparator.

MODULE IV: Multi Input Comparators and Power Swings 12 Periods
Multi-Input Comparators: Conic section characteristics - Three input amplitude comparator – Hybrid comparator - Switched distance schemes – Poly phase distance schemes - Phase fault scheme – Three phase scheme – Combined and ground fault scheme.
Power Swings: Effect of power swings on the performance of distance relays – Power swing analysis - Principle of out of step tripping and blocking relays - Effect of line and length and source impedance on distance relays.

MODULE V: Microprocessor based Protective Relays 12 Periods
(Block diagram and flowchart approach only) - Over current relays – Impedance relays - Directional relay - Reactance relay. Generalized mathematical expressions for distance relays - Measurement of resistance and reactance – MHO and offset MHO relays - Realization of MHO characteristics - Realization of offset MHO characteristics - Basic principle of Digital computer relaying.

TEXT BOOKS
1. Badri Ram and D.N.Vishwakarma, **"Power System Protection and Switch Gear"**, Tata

McGraw Hill Publications, New Delhi, 1995.
2. T.S.MadhavaRao, **"Static Relays"**, Tata McGraw Hill Publications, New Delhi, 2nd Edition, 1989.

REFERENCES

1. Bhavesh Bhalja, R.P. Maheshwari and Nilesh G. Chothani, **"Protection and Switchgear"**, Oxford University Press, 2012.
2. C.Christopoulos and A. Wright, **"Electrical Power System Protection"**, Springer International Publisher, 2nd Edition, 1999.

E-RESOURCES

1. http://www.mytech- info.com/2016/07/types-of-comparator.html
2. http://www.springer.com/energy/systems%2C+storage+and+harvesting/journal/41601
3. http://nptel.ac.in/courses/108101039/26

Course Outcomes

At the end of the course, students will be able to

1. Comprehend the construction and operation of static relays and amplitude comparators.
2. Understand the construction and operation of Phase Comparators and Static over current relays.
3. Apply the differential & static relays for protection schemes.
4. Illustrate the protection system by using Multi-Input comparators, effects of power swings and protection against the power swings.
5. Illustrate how system can be protected against different faults by using microprocessor based relays.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**		**2**		**3**	**2**
CO2		**2**		**1**		
CO3	**2**	**1**	**3**	**2**	**2**	**3**
CO4	**3**			**3**		**2**
CO5			**2**		**1**	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 72403	MODERN CONTROL THEORY	L	T	P
Credits: 3		2	2	-

Prerequisites: Control Systems

Course Objectives:

To explain the concepts of basic and modern control system for the real time analysis and design of control systems. To explain and apply concepts of state variables analysis. To analyze non linear systems. To apply the comprehensive knowledge of optimal theory for Control Systems.

MODULE I: Mathematical Preliminaries 12 Periods

Fields, Vectors and Vector Spaces–Linear combinations and Bases–Linear Transformations and Matrices – Scalar Product and Norms – Eigen-values, Eigen Vectors and a Canonical form representation of Linear operators – The concept of state – State Equations for Dynamic systems – Time invariance and Linearity – Non-uniqueness of state model – State diagrams for Continuous-Time State models.

MODULE II: State Variable Analysis 12 Periods

Linear Continuous time models for Physical systems–Existence and Uniqueness of Solutions to Continuous-Time State Equations – Solutions of Linear Time Invariant Continuous-Time State Equations – State transition matrix and its properties. 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.

MODULE III: Non Linear Systems 12 Periods

A: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

B: Stability analysis of Non-Linear systems through describing functions. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

MODULE IV: Stability Analysis 12 Periods

Stability in the sense of Lyapunov, Lyapunov's stability and Lypanov'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. State feedback controller design through Pole Assignment – State observers: Full order and Reduced order.

MODULE V: Optimal Control 12 Periods

Introduction to optimal control - Formulation of optimal control problems–calculus of variations – fundamental concepts, functional, variation of functional – fundamental theorem of theorem of Calculus of variations – boundary conditions – constrained minimization – formulation using Hamiltonian method – Linear Quadratic regulator.

TEXT BOOKS

1. M.Gopal , **"Modern control system theory",** New Age International , 1984

2. Nagrath and Gopal, **"Control System Engineering"**, New Age International,4th Edition, 2006.

REFERENCES

1. Kirck, **"Optimal control"** , Dover Publications
2. A. NagoorKani , **"Advanced Control Theory"**, RBA Publications, 1999.
3. Ogata.K ," **Modern Control Engineering"**, Prentice Hall, 1997.

E-RESOURCES

1. http://nptel.ac.in/courses/108101037/
2. http://nptel.ac.in/courses/108103007/
3. https://www.electrical4u.com/state-space-analysis-of-control-system/

Course Outcomes

At the end of the course, students will be able to

1. Apply the mathematical analysis for state model and state diagrams.
2. Understand the concepts of state variables analysis.
3. Understand the concepts of Non Linear Systems.
4. Analyze the concept of stability of nonlinear systems.
5. Analyze the concept of optimal control problems.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		3	2	2	1	2
CO2	2	2			2	2
CO3	3		2	1		1
CO4		2			2	
CO5	1		3	2		1

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 72404	EHV AC TRANSMISSION (Professional Elective - I)	L	T	P
Credits: 3		2	2	-

Prerequisites: Power Systems –II

Course Objectives:

To identify the different aspects of Extra High Voltage A.C and D.C Transmission design and Analysis. To understand the importance of modern developments of E.H.V and U.H.V transmission systems. To demonstrate EHV ac transmission system components, protection and insulation level for over voltages.

MODULE I: Introduction to EHVAC **12 Periods**

E.H.V.A.C. Transmission line trends and preliminary aspect standard transmission voltages – Estimation at line and ground parameters-Bundle conductor systems-Inductance and Capacitanceof E.H.V. lines – positive, negative and zero sequence impedance – Line Parameters for Modesof Propagation.

MODULE II: Electrostatic field and voltage gradients **12 Periods**

Electrostatic field and voltage gradients – calculations of electrostatic field of AC lines – effect of high electrostatic field on biological organisms and human beings - surface voltage gradients and maximum gradients of actual transmission lines – voltage gradients on sub conductor.

MODULE III: Over Voltages in EHV lines **12 Periods**

A: Electrostatic induction in unenergized lines – measurement of field and voltage gradients for three phase single and double circuit lines – un energized lines.

B: Power Frequency Voltage control and over-voltages in EHV lines: No load voltage – charging currents at power frequency-voltage control – shunt and series compensation – static VAR compensation.

MODULE IV: Corona in E.H.V. lines **12 Periods**

Corona in E.H.V. lines – Corona loss formulae- attention of traveling waves due to Corona – Audio noise due to Corona, its generation, characteristic and limits. Measurements of audio noise radio interference due to Corona - properties of radio noise – frequency spectrum of RI fields – Measurements of RI and RIV.

MODULE V: Design of EHV lines **12 Periods**

Design of EHV lines based on steady state and transient limits - EHV cables and their characteristics.

TEXT BOOKS

1. R. D. Begamudre ,**"EHVAC Transmission Engineering"**, New Age International (p) Ltd. 3rd Edition.
2. K.R. Padiyar, **"HVDC Power Transmission Systems"**, New Age International (p) Ltd. 2nd revised Edition, 2012.

REFERENCES

1. S. Rao, **"EHVAC and HVDC Transmission Engg. Practice"**, Khanna publishers.
2. Arrillaga.J, **,** 2nd Edition (London) peter Peregrines, IEE, 1998.
3. Padiyar.K.R, **" FACTS Controllers in Power Transmission and Distribution"** , New Age International Publishers, 2007.
4. Hingorani H G and Gyugyi. L, **"Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems",** New York, IEEE Press, 2000.

E-RESOURCES

1. https://www.electrical4u.com/voltage-in-power-lines/
2. https://www.electrical4u.com/corona-effect-in-power-system/
3. http://nptel.ac.in/courses/108108033/

Course Outcomes

At the end of the course, students will be able to

1. List the necessity of EHV AC transmission, choice of voltage for transmission, line losses and power handling capability.
2. Analyze the electrostatic field of AC lines and voltage gradients.
3. Calculate the power frequency voltage control and over voltage in EHV lines.
4. Estimate the Corona loss and Measurements of RI and RIV in EHV lines
5. Emphasize the Statistical procedures for line designs, and characteristics of EHV cables.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**2**	**3**	
CO2	**2**			**3**	**2**	**1**
CO3	**2**		**1**	**2**	**2**	
CO4	**2**			**3**	**2**	**2**
CO5	**3**		**2**	**3**	**3**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 72405	HIGH VOLTAGE GENERATION AND MEASUREMENT (Professional Elective - I)	L	T	P
Credits: 3		2	2	-

Prerequisites: Electrical & Electronics Instrumentation

Course Objectives:

To understand the generation methods of High A.C, DC & Impulse Voltages required for various application. To apply the measuring techniques of High A.C., D.C & Impulse voltages and currents. To identify the testing techniques for High Voltage Equipment.

MODULE I: GENERATION OF DIRECT VOLTAGES 12 Periods

Generation and transmission of electric energy – voltage stress – testing voltages-AC to DC conversion – single phase rectifier circuits – cascaded circuits – voltage multiplier circuits – Cockroft-Walton circuits – voltage regulation – ripple factor – Design of HVDC generator – Vande-Graff generator.

MODULE II: GENERATION OF ALTERNATING VOLTAGES 12 Periods

Testing transformer – single unit testing transformer, cascaded transformer – equivalent circuit of cascaded transformer – series resonance circuit – resonant transformer – voltage regulation.

MODULE III: GENERATION OF IMPULSE VOLTAGES 12 Periods

A: Marx generator – Impulse voltage generator circuit – analysis of various impulse voltage generator circuits.

B: Multistage impulse generator circuits Switching impulse generator circuits – impulse current generator circuits – generation of non-standard impulse voltages and nanosecond pulses.

MODULE IV: MEASURMENT OF HIGH VOLTAGES 12 Periods

Peak voltage measurements by sphere gaps – Electrostatic voltmeter – generating voltmeters and field sensors – Chubb-Fortescue method – voltage dividers and impulse voltage measurements

MODULE V: GENERATION AND MEASUREMENT OF IMPULSE CURRENTS 12 Periods

Generation of impulse currents, measurement of impulse currents – Resistive shunts, measurement using magnetic coupling - Fast digital transient recorders for impulse measurements.

TEXT BOOKS

1. Kuffel, E., Zaengl, W.S. and Kuffel J., **"High Voltage Engineering Fundamentals"**, Elsvier India Pvt. Ltd, 2005.
2. Naidu M S and Kamaraju V, **"High Voltage Engineering",** Tata McGraw-hill Publishing Company Ltd., New Delhi, 2004.

REFERENCES

1. Dieter Kind, Kurt Feser, **"High Voltage Test Techniques"**, SBA Electrical Engineering Series, New Delhi, 1999.
2. Gallagher, T.J., and Permain, A., **"High Voltage Measurement, Testing and Design"**, John Wiley Sons, New York, 1983.

3. R.Mazen Abdel-Salam, Hussein Anis, Ahdab El-Morshedy, RoshdyRadwan, **"High Voltage Engineering Theory and Practice"** 2nd Edition, Revised and Expanded, Marcel Dekker, Inc., New York, 2000.
4. N.H.Malik, A.A.Al_Arainy, M.I.Qureshi**, " Electrical Insulation in Power Systems",** Marcel Dekker,Inc., New York 1988.
5. Adolf J. Schwab**, "High Voltage Measurement Techniques",** M.I.T Press, 1972.

E-RESOURCES

1. http://nptel.ac.in/courses/108104048/
2. http://nptel.ac.in/courses/108104048/ui/TOC.htm
3. http://www.elect.mrt.ac.lk/HV_Chap6.pdf

Course Outcomes

At the end of the course, students will be able to

1. Emphasize the generation of DC voltages.
2. Analyze the generation of AC voltages and calculate the voltage regulation.
3. Analyze the impulse voltages and various impulse voltage generator circuits.
4. Measure the High voltages with different methods.
5. Analyze the generation and measurement of impulse currents.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**2**	**3**	
CO2	**2**			**3**	**2**	**1**
CO3	**2**		**1**	**2**	**2**	
CO4	**2**			**3**	**2**	**2**
CO5	**3**		**2**	**3**	**3**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 70441	ADVANCED DIGITAL SIGNAL PROCESSING (Professional Elective - I)	L	T	P
Credits: 3		2	2	-

Prerequisites: Digital Signal Processing.

Course Objectives:

The objective of the course is to introduce the concepts of multi rate Digital signal Processing, to emphasize the importance of estimation of power spectral density and its evaluation using Non- Parametric methods, to evaluate power spectral density using Parametric methods. The course enablesthe student to learn the design approaches and realization structures of Digital Filters and to know the effect of Finite Word Length.

MODULE I: Multi-Rate Signal Processing **8 Periods**

Multi Rate Signal Processing: Introduction, Decimation by a factor D. Interpolation by a factor I.sampling rate conversion by a rational factor I/D. Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion, Applications of Multirate Signal Processing.

MODULE II: Non - Parametric methods of Power Spectral Estimation **10 Periods**

Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman & Turkey methods, Comparison of all Non-Parametric methods.

MODULE III: Parametric Methods of Power Spectrum Estimation **10 Periods**

A: Autocorrelation & its Properties, Relation between auto correlation & model parameters
B: AR Models - Yule - Waker & Burg Methods, MA & ARMA models for power spectrum estimation.

MODULE IV: Implementation of Digital Filters **10 Periods**

Introduction to filter structures (IIR & FIR), Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for lattice realization, implementation of lattice structures for IIR filters, Advantages of lattice structures.

MODULE V: Finite Word Length Effects **10 Periods**

Analysis of finite word length effects in Fixed-Point DSP Systems–Fixed, Floating Point Arithmetic – ADC quantization noise & signal quality – Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms.

TEXT BOOKS:

1. J. G. Proakis & D. G. Manolokis, **"Digital Signal Processing, Principles, Algorithms & Applications"**, PHI, 4th Edition.
2. Alan V Oppenheim & Ronald W.Schaffer, **"Discrete Time signal processing"**, PHI.
3. Emmanuel C. Ifeacher, Barrie, W.Jervis, **"DSP – A Practical Approach"**, Pearson Education, 2nd Edition.

REFERENCES:

1. S. M. Kay, **"Modern nspectral Estimation: Theory & Application"**, PHI, 1988.
2. P. P. Vaidyanathan, **"Multirate Systems and Filter Banks"**, Pearson Education.
3. S. Salivahanan, A. Vallavaraj, C. Gnanapriya ,**"Digital Signal Processing"**, TMH, 2000.

E-RESOURCES:

1. http://www-syscom.univ-mlv.fr/~zaidi/teaching/dsp-esipe-oc2/Course-Notes_Advanced-DSP.pdf
2. https://www.dss.tf.uni-kiel.de/en/teaching/lectures/adv.-digital-signal-processing
3. http://www.springer.com/engineering/signals/journal/13634
4. https://www.youtube.com/watch?v=4ufeTZ6fSNY
5. http://www.nptelvideos.in/2012/12/advanced-digital-signal-processing.html

Course Outcomes:

After completion of the course, students will be able to:

1. Understand multi-rate signal processing techniques
2. Estimate the power spectrum using non-parametric methods
3. Estimate the power spectrum using parametric methods
4. Implement both IIR and FIR digital filter structures
5. Analyze finite word length effects in fixed point DSP systems

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**2**	**3**	
CO2	**2**			**3**	**2**	**1**
CO3	**2**		**1**	**2**	**2**	
CO4	**2**			**3**	**2**	**2**
CO5	**3**		**2**	**3**	**3**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 72406	POWER QUALITY (Professional Elective - II)	L	T	P
Credits: 3		2	2	-

Prerequisites: Power Systems and Power Electronics

Course Objectives:

This subject deals with power quality issues and solutions. It also discussed some of the power quality issues like interruptions and voltage sag with their reliability evaluation.

MODULE I: Voltage Sags And Interruptions **12 Periods**

Terms and definitions: Overloading, under voltage - sustained interruption; sags and swells; waveform distortion - Total Harmonic Distortion (THD) - Computer Business Equipment Manufacturers Associations (CBEMA) curve - Sources of sags and interruptions – estimating voltage sag performance - fundamental principles of protection - motor starting sags.

MODULE II: Transient Over voltages **12 Periods**

Sources of transient over voltages: Capacitor switching - magnification of capacitor switching transients – lightning - ferro resonance and other switching transients; Devices for over voltage protection: Surge arresters and transient voltage surge suppressors – isolation transformers - low pass filters - low impedance power conditioners - -utility surge arresters, utility system Lightning protection : shielding, line arresters - low side surges – cable protection and scout arrester scheme.

MODULE III: Fundamentals Of Harmonics **12 Periods**

A: Harmonic distortion: Voltage and current distortion - harmonic indices - harmonic sources from commercial and industrial loads.

B: Locating harmonic sources - system response characteristics: resonance.

MODULE IV: Applied Harmonics, Wiring And Grounding **12 Periods**

Effects of harmonic distortion - harmonic distortion evaluation, principles for controlling harmonics - devices for controlling harmonic distortion – inter harmonics caused by induction furnaces - IEEE standard 519-1992 – over view of IEC standards on harmonics – reasons for grounding – typical wiring and grounding problems – isolated ground – summary of wiring and grounding solutions.

MODULE V: Power Quality Monitoring **12 Periods**

Monitoring considerations: Disturbance analyzer - harmonic / spectrum analyzer – combination - Disturbance harmonic analyzer - flicker meters - smart power quality monitors - transducers requirements - applications of expert system - power quality monitoring and the internet – EMI - Electromagnetic compatibility.

TEXT BOOKS

1. Roger.C.Dugan, Mark.F. Mc Granagham**, "Electrical Power Systems Quality"** 3rd Edition, McGraw Hill, 2012.
2. Ewald F. Fuchs, Mohammad A. S. Masoum**, "Power Quality in Power Systems and Electrical Machines"**, 2nd Edition, Academic Press, 2011.

REFERENCES

1. Francisco C. De La Rosa, **"Harmonics and Power Systems",** 1st Edition, CRC Press, 2006.
2. Angelo Baggiri, **"Handbook of Power Quality",** 1st Edition, John Wiley & Sons, 2008.
3. C. Sankaran, **"Power Quality",** 1st Edition, CRC Press, 2002.
4. P.S. Satnam P.S. Kang, **"Power Capacitor for Reactive Compensation",** 1st Edition, Dhanpat Rai & Sons Publications, 2008.

E-RESOURCES

1. http://www.elec.uow.edu.au/apqrc/links
2. http://technav.ieee.org/tag/1354/power-quality#concepts
3. http://nptel.ac.in/courses/108106025/

Course Outcomes

At the end of the course, students will be able to

1. Explain power quality disturbances and typical problems associated with it.
2. Describe the causes of transient over voltages and its mitigation methods.
3. Explain the sources of current and voltage harmonics.
4. Understand the concepts of harmonic distortion and controlling methods.
5. Describe the different types of analyzer used in power quality monitoring.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**			**2**	**1**	
CO2	**1**	**2**			**3**	**2**
CO3			**2**	**3**		**3**
CO4		**1**			**3**	
CO5	**3**		**1**	**2**		**1**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 70420	MICROCONTROLLERS AND APPLICATIONS (Professional Elective - II)	L	T	P
Credits: 3		2	2	-

Prerequisites: Switching Theory and Logic Design, Computer Organization and Microprocessors and Interfacing

Course Objective:

This course introduces the architecture of 8051 Microcontroller, the instruction set of 8051, real-time interrupts, real time Timers and interfacing with 8051 Microcontroller.

MODULE I: 8051 Microcontroller **14 periods**

Introduction, Architecture ofa 8051 microcontroller: Internal and External memories – Counters and Timers – Synchronous serial communication, asynchronous serial communication – Interrupts, I/O Ports, signal description of 8051.

MODULE II: Instruction Set of 8051 **12 periods**

Basic assembly language programming – Data transfer instructions – Data and Bit manipulation instructions – Arithmetic instructions – Logical operations, Internal RAM, and SFRs – Program flow control instructions – Interrupt control flow.

MODULE III: Real-Time Control - Interrupts **14 periods**

A: Interrupt handling structure of an MCU – Interrupt Latency and Interrupt deadline – Multiple sources of the interrupts – Non-maskable interrupt sources

B: Enabling or disabling of the sources – Polling to determine the interrupt source and assignment of the priorities among them – Interrupt structure in Intel 8051.

MODULE IV: Real-Time Control – Timers **12 periods**

Programmable Timers in the MCU's – Free running counter and real time control – Interrupt interval and density constraints, watch dog timer.

MODULEV: Interfacing **12 periods**

Switch and Keypad - LED and Array of LEDs - Seven Segment, LCD and its interfaces Stepper motor and DC motor interfacing.

TEXT BOOKS:

1. Microcontrollers Architecture, Programming, Interfacing and System Design – Raj Kamal,Pearson Education, 2005.
2. The 8051 Microcontroller and Embedded Systems – Mazidi and Mazidi, PHI, 2000.

REFERENCES:

1. Kenneth. J. Ayala, "The 8051 Microcontroller", Cengage Learning, 3rd Edition, 2004.
2. Microcontrollers (Theory & Applications) – A.V. Deshmuk, WTMH, 2005.
3. Design with PIC Microcontrollers – John B. Peatman, Pearson Education, 2005.

E-RESOURCES:

1. https://www.edgefx.in/8051-microcontroller-architecture/
2. http://www.newagepublishers.com/samplechapter/002079.pdf
3. http://8051-microcontrollers.blogspot.in/2015/11/timers-acounterstimers.html#.WYbVGLpuLIU

4. http://ymk.k-space.org/Lecture_Nov5.pdf
5. http://www.rtcmagazine.com/technologies/view/Microcontrollers
6. http://www.satishkashyap.com/2012/02/video-lectures-on-microprocessors-and.html

Course Outcomes:

After completion of the course, students will be able to:

1. Describe the basic architecture of 8051microcontroller.
2. Write assembly language programs for 8051 microcontroller.
3. Know the interrupt handling techniques.
4. Know the usage of timers in real time applications.
5. Develop a microcontroller based system.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**			**1**	**2**	
CO2		**1**	**2**	**3**		**3**
CO3	**2**	**1**	**2**		**1**	**2**
CO4		**3**		**2**	**3**	
CO5		**1**	**3**	**3**		**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 72407	DISTRIBUTION AUTOMATION (Professional Elective - II)	L	T	P
Credits: 3		2	2	-

Prerequisites: Electrical Distribution Systems

Course Objectives:

To list the distribution systems for load modeling. To understand the design & working of substations. To give a comprehensive idea on communication systems.

MODULE I: Distribution Automation and the Utility System 12 Periods

Introduction to Distribution Automation (DA), control system interfaces, control and data requirements, centralized (Vs) decentralized control, DA System (DAS), DA Hardware, DAS software.

MODULE II: Distribution Automation Functions 12 Periods

DA capabilities, Automation system computer facilities, management processes, Information management, system reliability management, system efficiency management, voltage management, Load management.

MODULE III: Communication Systems 12 Periods

A: Communication Systems for DA: DA communication requirements, Communication reliability, Cost effectiveness, Data rate Requirements, Two way capability, Ability to communicate during outages and faults, Ease of operation and maintenance, Conforming to the architecture of data flow

B: Communication systems used in DA: Distribution line carrier (Power line carrier), Ripple control, Zero crossing technique, telephone, cable TV, Radio, AM broadcast, FM SCA, VHF Radio, UHF Radio, Microwave satellite. Fiber optics, Hybrid Communication systems, Communication systems used in field tests.

MODULE IV: DA Technical Benefits 12 Periods

DA benefit categories, Capital deferred savings, Operation and Maintenance savings, Interruption related savings, Customer related savings, Operational savings, improved operation, Function benefits, Potential benefits for functions, and function shared benefits, Guidelines for formulation of estimating equations Parameters required, economic impact areas, Resources for determining benefits impact on distribution system, integration of benefits into economic evaluation.

MODULE V: Economic Evaluation Methods 12 Periods

Development and evaluation of alternate plans, Select study area, Select study period, Project load growth, Develop Alternatives, Calculate operating and maintenance costs, Evaluate alternatives. Economic comparison of alternate plans, Classification of expenses and capital expenditures, Comparison of revenue requirements of alternative plans, Book Life and Continuing plant analysis, Year by year revenue requirement analysis, short term analysis, end of study adjustment, Break even analysis, Sensitivity analysis computational aids.

TEXT BOOKS

1. James, **"Control and Automation of Electrical Distribution Systems",** Northcote – Green Robert Wilson, CRC Press.
2. Dr. M. K. Khedkar, Dr. G.M.Dhole, **"Electric Power Distribution Automation"**, University Science press.

REFERENCES

1. IEEE Tutorial Course **"Distribution Automation"**
2. IEEE Working Group on **"Distribution Automation"**

E-RESOURCES

1. http://nptel.ac.in/courses/108106022/LECTURE%2011.pdf
2. http://nptel.ac.in/courses/108106022/
3. http://magazine.ieee-pes.org/

COURSE OUTCOMES

At the end of the course, students will be able to

1. List the distribution systems for load modeling.
2. Understand the various distribution automation functions.
3. Find the transfer of electrical data in distribution system through Digital Communication.

   Predict load forecasting and reliability in economic point of view.
4. Analyze the various technical benefits of DA.
5. Have a comprehensive idea on economic evaluation methods.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**				**3**	**3**
CO2	**2**	**2**		**3**	**2**	**2**
CO3	**2**		**1**		**2**	**1**
CO4	**3**	**1**		**2**	**3**	**1**
CO5	**3**	**3**	**1**	**1**	**3**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 70B16	OPTIMIZATION TECHNIQUES (Open Elective - I)	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives:

This course deals with the extremely important topics under the broad umbrella of optimization. This is synonymous with efficiency which is the underlying prime rationale for all scientific and technological advances and progress.

MODULE I: Introduction to Operations Research **12 Periods**

Definition, scope, objectives, phases, objectives, models and limitation of Operations Research, Linear Programming Problem-Formulation of LPP, Graphical solution of LPP, Simplex method, Artificial variable, big-M method, two-phase method, degeneracy & unbound solution.

MODULE II: Transportation Problems **12 Periods**

Formulation, solution, Un balanced Transportation problem, Finding basic feasible solution-Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method.

Assignment Models: Formulation Hungarian method for optimal solution. Solving unbalanced problem. Travelling salesman problem as assignment problem.

MODULE III: **12 Periods**

A: Sequencing Models: Solution of sequencing problem-processing n jobs through 2 machines, processing n jobs through 3 machines, processing 2 jobs through m machines, processing n jobs through m machines.

B: Replacement Models: Replacement of items that deteriorate whose maintenance cost increase with time without change in the money value. Replacement of items that fail suddenly: individual replacement policy, group replacement policy.

MODULE IV:Game Theory **12 Periods**

Competitive games, rectangular game, saddle point, minimax(maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principal. Rectangular games without saddle points-mixed strategy for2x2 games.

MODULE V: Inventory Models **12 Periods**

Inventory cost, Models with deterministic demand-model (a) demand rate uniform and production rate infinite, model(b) demand rate non-uniform and production rate infinite, model(c)demand rate uniformand production rate finite.

TEXT BOOKS

1. S.D.Sharma **"Operations Research"** Kedarnath & Ramnath Publisher, 15th edition,2013.
2. J.K. Sharma **"Operations Research Theory & Applications"** Macmillan India Ltd, 4E.

REFFERENCES

1. P.Sankara Iyer **"Operations Research"**Tata McGraw-Hill,2008
2. Taha **"Operations Research"** TMH,2010

3. A.M.Natarajan, P.Balasubramani, A.Tamilarasi **"Operations Research"** Pearson Education, 2005
4. Hiller & Libermann **"Introduction to Operations Research""** McGraw Hill Publications, 9th Edition,2010

E-RESOURCES

1. http://www.mhhe.com/engcs/industrial/hillier/etext/PDF/chap03.pdf (LPP)
2. http://ocw.nctu.edu.tw/upload/classbfs121001503719748.pdf (Transportation Problems)
3. http://shodhganga.inflibnet.ac.in/bitstream/10603/19544/12/7_chapter%201.pdf (Replacement Models)
4. https://www.math.ucla.edu/~tom/GameTheory/mat.pdf (Game Theory)
5. http://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf (Inventory Models)
6. http://www.researchpublish.com/download.php?file=Some%20Applications-2812.pdf (LPP)
7. http://www.rspq.org/pubs/or.pdf (Sequencing Models)
8. http://elib.mi.sanu.ac.rs/files/journals/yjor/18/yujorn18p197-206.pdf (Inventory Models)

9. https://www.youtube.com/watch?v=a2Q gdDk4Xjw&list=PLjc8ejfjpgTf0LaDEHgLB3gCHZYc NtsoX (LPP)
10. https://www.youtube.com/watch?v=Q31jKiEXxdc (Transportation Problems)
11. https://www.youtube.com/watch?v=BUGIhEecipE (Assignment Models)
12. https://www.youtube.com/watch?v=533dp83Er6E (Sequencing Models)
13. https://www.youtube.com/watch?v=a52BtWkyjl0&list=PLOEpD2bjMC9K4iTa9Y7x NToVdehbFRmR6 (Game Theory)
14. https://www.youtube.com/watch?v=9tJv5COGkD0 (Inventory Models)

Course Outcomes:

After completion of the course students will be able to:

1. Find feasible solution to LPP by various Methods.
2. Minimize the cost and time by using Travelling salesmenProblem.
3. Understand the various concepts of Replacement model problems.
4. Solve the game theory problems.
5. Understand the various concepts of inventory models.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**			**3**		
CO2		**1**		**2**		
CO3	**2**			**3**		
CO4	**3**		**1**			
CO5				**3**	**2**	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 72408	ENERGY MANAGEMENT (Open Elective - I)	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives:

To study the concepts behind economic analysis and Load management. To emphasize the energy management on various electrical equipments and metering. To illustrate the concept of lighting systems and cogeneration.

MODULE I: Introduction to Energy Management 12 Periods

Principles of Energy Management – Managerial Organization – Functional Areas for i. Manufacturing Industry ii. Process Industry iii. Commerce iv. Government. Role of Energy Manager in each of these organizations. Initiating, Organizing and Managing Energy Management Programs.

MODULE II: Energy Audit and Conservation 12 Periods

Definition and Concepts, Types of Energy Audits – Basic Energy Concepts – Resources for Plant Energy Studies – Data Gathering – Analytical Techniques.

Energy Conservation: Technologies for Energy Conservation , Design for Conservation of Energy materials – energy flow networks – critical assessment of energy usage – formulation of objectives and constraints – synthesis of alternative options and technical analysis of options – process integration.

MODULE III: Scope & Characterization 12 Periods

A: Scope, Characterization of an Investment Project – Types of Depreciation.

B: Time Value of money – budget considerations, Risk Analysis.

MODULE IV: Cost Mechanism 12 Periods

Payback – Annualized Costs – Investor's Rate of return – Present worth – Internal Rate of Return – Pros and Cons of the common methods of analysis – replacement analysis.

MODULE V: Solar Energy 12 Periods

Solar Energy – Types of devices for Solar Energy Collection – Thermal Storage System – Control Systems-Wind Energy – Availability – Wind Devices – Wind Characteristics – Performance of Turbines and systems.

TEXT BOOKS

1. W.C. Turner, **"Energy Management Hand book",** 6th Edition,2006
2. H.Koontz and Cyrill O Donnell, **"Management"**, 3rd Edition,2008

REFERENCES

1. S.C. Kuchhal **"Financial Management",** 8th Edition,1982.
2. W.R.Murthy and G.Mc Kay **"Energy Management"**,
3. CB Smith, **"Energy Management Principles"**, Edition,1981.

E-RESOURCES

1. http://nptel.ac.in/courses/108106022/
2. http://industrialelectricalco.com/wp-content/uploads/2014/01/Understanding-Energy-Efficient-Motors-EASA.pdf
3. https://beeindia.gov.in/

Course Outcomes

At the end of the course, students will be able to

1. Understand the principles of energy management and Managerial organization.
2. Comprehend the types of Energy audits and Energy conservation technologies.
3. Analyze the economic aspects of investment.
4. Recognize the different methods of evaluation of projects.
5. Understand the different alternative energy sources.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**				**3**	**3**
CO2	**2**	**2**		**3**	**2**	**2**
CO3	**2**		**1**		**2**	**1**
CO4	**3**	**1**		**2**	**3**	**1**
CO5	**3**	**3**	**1**	**1**	**3**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 70452	EMBEDDED SYSTEM DESIGN (Open Elective - I)	L	T	P
Credits: 3		2	2	-

Prerequisites: Microprocessors and Microcontrollers or an Equivalent course

Course Objective:

To introduce various components of a typical embedded system and to teach things required to design a typical embedded system.

MODULE I: Introduction to Embedded Systems **08 Periods**

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

MODULE II: Typical Embedded System **10 Periods**

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

MODULE III: Embedded Firmware **10 Periods**

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

MODULE IV: RTOS Based Embedded System Design **10 Periods**

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

MODULE V: Task Communication **10 Periods**

Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

TEXT BOOKS

1. Shibu K. V, "**Introduction to Embedded Systems"**, McGraw Hill, 2013.

REFERENCES

1. Raj Kamal, **"Embedded Systems"**, TMH.
2. Frank Vahid, Tony Givargis, John Wiley**,"Embedded System Design"**.
3. Lyla, **"Embedded Systems"**, Pearson, 2013.
4. David E. Simon, **"An Embedded Software Primer",** Pearson Education.

E-RESOURCES

1. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.158.9376&rep=rep1&type=pdf
2. http://www.radio-electronics.com/info/processing-embedded/embedded-systems/basics-tutorial.php
3. http://www.gian.iitkgp.ac.in/files/brochures/BR1458666215SESD_brochure_GIAN.pdf
4. http://www.engpaper.com/embedded-system-research-papers-and-projects-11.htm
5. http://www.scirp.org/journal/articles.aspx?searchCode=Embedded+Real-Time+and+Operating+Systems+Program+(ERTOS)%2C+National+ICT+Australia+(NICTA)&searchField=affs&page=1&SKID=0
6. https://onlinecourses.nptel.ac.in/noc17_cs05/preview
7. http://www.nptelvideos.in/2012/11/embedded-systems.html

Course Outcomes:

At the end of the course, students will be able to:

1. Gain knowledge on the basics of an embedded system.
2. Know components of a typical embedded system.
3. Understand different embedded firmware.
4. Know real-time operating systems used in embedded systems.
5. Understand various RTOS concepts.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**	**2**	**3**		**3**	
CO2		**1**		**2**		**2**
CO3	**1**	**2**	**1**	**2**	**1**	
CO4	**3**			**1**		**3**
CO5			**2**		**2**	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. I Semester		
Code: 72409	POWER SYSTEMS SIMULATION LAB	L	T	P
Credits: 2		-	-	4

Course Objectives:

This course deals with the MATLAB application for power system network and to analyze the power system network by MATLAB programming.

List of Experiments:

1. Develop MATLAB program for YBUS formation.
2. Load Flow Analysis for given Power system network using G-S method with MATLAB.
3. Load Flow Analysis for given Power system network using N-R method with MATLAB.
4. Develop MATLAB program for FDLF Load Flow Analysis.
5. Develop MATLAB program for Short Circuit Analysis for Single Line to Ground fault (L-G).
6. Develop MATLAB program for Short Circuit Analysis for Line to Line fault (L-L).
7. Develop MATLAB program for Short Circuit Analysis for Double Line to Ground fault (L-L-G).
8. Transient Stability Analysis for Single Machine connected to Infinite Bus by Point by Point Method.
9. Develop PSPICE Program for Transient response of RLC Circuit To an input (i) pulse (ii) step and (iii) Sinusoidal signals.
10. Develop PSPICE Program for Analysis of Three Phase Circuit representing the generator transmission line and load .plot three phase currents and neutral current.

Course Outcomes

At the end of the course, students will be able to

1. Develop the programming for YBUS formation.
2. Develop MATLAB program for FDLF Load Flow Analysis.
3. Obtain Load Flow Analysis for given Power system network using G-S, N-R methods with MATLAB.
4. Develop MATLAB program for Short Circuit Analysis for various faults in power systems.
5. Develop PSPICE Program for Transient response of RLC Circuit for various input signals.

CO-PO Mapping
(3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak

COs	Program Outcomes(POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2		3	3	1	2
CO2	3		2	3	3	1
CO3	2		3	1	3	3
CO4	3		2	3	1	1
CO5	2		3	3	3	1

2017-18 Onwards (MR-17)	MALLAREDDYENGINEERINGCOLLEGE (Autonomous)	M.Tech. I Semester		
Code: 72410	**SEMINAR-I**	**L**	**T**	**P**
Credits:2		**-**	**-**	**4**

Course Objectives: To promote deeper understanding the basic concepts, physical mechanism behind the processes, participate in scientific analysis and comprehensive of scientific writing of verbal presentation. This course is to introduce post graduate student to ideas, methods and techniques that can improve the content and presentation of scientific seminars.

Course Outcomes:

At the end of the course, students will be able to

1. Write technical documents to the standards.
2. Give oral presentation on technical and general topics.
3. Express ideas clearly with examples.
4. Identify the research opportunities related to their area.
5. Communicate effectively.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**	**3**		**1**		**3**
CO2		**2**			**2**	**3**
CO3	**2**	**3**	**2**	**2**		**1**
CO4	**2**	**3**	**2**	**2**	**1**	**3**
CO5		**3**	**1**		**2**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72411	POWER SYSTEM DYNAMICS	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives:
To impart the basics of dynamic characteristics of power system equipment. Analyze the Dynamic performance of power systems, System stability and controls.

MODULE I: BASIC CONCEPTS 12 Periods

Power system stability, states of operation and system security - system dynamics – problems, system model analysis of steady state stability and transient stability - simplified representation of Excitation control.

MODULE II: MODELING OF SYNCHRONOUS MACHINE 12 Periods

Synchronous machine – park's Transformation-analysis of steady state performance, per unit quantities-Equivalent circuits of synchronous machine-determination of parameters of equivalent circuits.

MODULE III: EXCITATION SYSTEM 12 Periods

A: Excitation system modeling-excitation systems block Diagram - system representation by state equations- Dynamics of a synchronous generator connected to infinite bus - system model Synchronous machine model-stator equations.

B: Rotor equations - Synchronous machine model with field circuit - one equivalent damper winding on q axis (model 1.1) - calculation of Initial conditions.

MODULE IV: ANALYSIS OF SINGLE MACHINE SYSTEM 12 Periods

Small signal analysis with block diagram - Representation Characteristic equation and application of Routh- Hurwitz criterion- synchronizing and damping torque analysis-small signal model - State equations.

MODULE V: APPLICATION OF POWER SYSTEM STABILIZERS 12 Periods

Basic concepts in applying PSS - Control signals - Structure and tuning of PSS - Washout circuit - Dynamic compensator analysis of single machine infinite bus system with and without PSS.

TEXT BOOKS

1. K R Padiyar, **"Power System Dynamics: Stability and Control",** B.S. Publications, 2006.
2. R. Ramanujam, **"Power System Dynamics: Analysis and Simulation"**, PHI Publications, 2009.

REFERENCES

1. P.M. Anderson and A.A. Fouad, **"Power system control and stability",** IEEE Press, 2002.
2. Prabha Kundur, **" Power System Stability And Control**", McGraw Hill Education Publisher, 1st Edition, 2006.
3. El-Shimy Mohamed, **"Dynamic Security of Interconnected Electric Power Systems - Volume 1"**, LAP Lambert Academic Publishing, 2015.

E-RESOURCES

1. ewh.ieee.org/soc/pes/psdpc/
2. http://magazine.ieee-pes.org/
3. nptel.ac.in/courses/108101004/

Course Outcomes

At the end of the course, students will be able to

1. Choose the fundamental dynamic behavior and controls of power systems to perform basic stability analysis.
2. Comprehend concepts in modeling and simulating the dynamic phenomena of power systems.
3. Analyze theory and practice of modeling main power system components, such as synchronous machines.
4. Interpret results of system stability studies.
5. Analyze theory and practice of various components power system stabilizers.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**2**	**1**	**3**	
CO2						**1**
CO3	**2**			**3**	**1**	
CO4			**3**		**2**	**1**
CO5	**1**		**2**	**1**		**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72412	FLEXIBLE AC TRANSMISSION SYSTEMS (FACTS)	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives: The course introduces the fundamentals of FACTS Controllers, Importance of controllable parameters and types of FACTS controllers & their benefits.

MODULE I: Facts Concepts **12 Periods**

Transmission interconnections power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters, basic types of FACTS controllers, benefits from FACTS controllers.

MODULE II: Voltage Source Converters **12 Periods**

Single phase, three phase full wave bridge converters, transformer connections for 12 pulse, 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source Converters, and comparison of current source converters with voltage source converters.

MODULE III: Static Shunt Compensation **12 Periods**

A: Objectives of shunt compensation, mid-point voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping,

B: Methods of controllable VAR generation, variable impedance type static VAR generators, switching converter type VAR generators, hybrid VAR generators.

MODULE IV: SVC and STATCOM **12 Periods**

The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation, damping operating point control and summary of compensator control.

MODULE V: Static Series Compensators **12 Periods**

Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, and functional requirements of GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), Control schemes for GSC, TSSC and TCSC.

TEXT BOOKS

1. N.G. Hingorani and L. Guygi, **"Understanding FACTS Devices",** IEEE Press Publications, 2000.
2. K.R. Padiyar., **" FACTS Controllers in Power Transmission and Distribution**", New Age International Publishers, 2007.

REFERENCES

1. Xiao-Ping Zhang, Christian Rehtanz and Bikash Pal, **"Flexible AC Transmission Systems: Modelling and Control (Power Systems)",** Springer publisher, 2nd Edition, 2012 **.**
2. Rajiv K. Varma R. Mohan Mathur, **"Thyristor-Based FACTS Controllers for Electrical Transmission Systems",** Wiley Publishers, 2011.

3. Nisha Tamta and Ashwini Arya, **"Modelling of Facts Controllers in Power System Networks",** LAP Lambert Academic Publishing, 2012.

E-RESOURCES

1. http://www.electronicshub.org/flexible-ac-transmission-systemfacts/
2. http://www.powerqualityworld.com/2011/09/statcom-static-synchronous-compensator.html
3. https://www.youtube.com/watch?v=6u6twyQYFNM

Course Outcomes

At the end of the course, students will be able to

1. Analyze the importance of controllable parameters and basic concepts of FACTS controllers.
2. Apply the concepts of Voltage source converters and Current Source Converters.
3. Apply the static shunt compensation by using different VAR generators.
4. Interpret the control circuits of Shunt Controllers like SVC & STATCOM for various functions.
5. Detect the Power and control circuits of Series Controllers GCSC, TSSC and TCSC.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**3**	**2**	**3**	
CO2	**3**	**3**	**2**	**3**	**2**	**3**
CO3	**3**		**3**		**3**	**3**
CO4	**3**	**2**			**1**	**2**
CO5	**3**	**1**	**3**	**3**	**3**	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72413	POWER SYSTEM OPERATION AND DEREGULATION	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives:

The course introduces the concept of OPF with security constraints. To describe modeling of load frequency control of a power system. To get awareness on reactive power control of a power system.

MODULE I: Optimal Power Flow **12 Periods**

Introduction- Solution to the optimal power flow-gradient method-Newton's method-Linear sensitivity analysis- Linear programming methods- Security constrained OPF-Interior point algorithm- Bus incremental costs

MODULE II: Power System Security **12 Periods**

Introduction –Factors affecting power system security-Contingency analysis-Detection of network problems-Linear sensitivity analysis-AC power flow methods-contingency selection- concentric relaxation-Bounding area method

MODULE III: State Estimation In Power Systems **12 Periods**

A: Introduction- Power system state estimation- Maximum likelihood Weighted Least squares estimation-Matrix formulation- State estimation of AC network- State estimation by orthogonal decomposition.

B: Detection and identification of Bad measurements- Estimation of quantities not being measured-Network Observability and pseudo measurements

MODULE IV: Power System Deregulation **12 Periods**

Introduction- motivation for restructuring of power systems- Electricity market entities model-benefits of deregulation-terminology-deregulation in Indian power sector-Operations in power markets-power pools-transmission networks and electricity markets.

MODULE V: Available Transfer Capability **12 Periods**

Introduction methods: of determination of ATC - ATC calculation considering the effect of contingency analysis-Transmission open access and pricing-cost components of transmission system- transmission pricing methods-Incremental cost based transmission pricing.

TEXT BOOKS

1. A.J.Wood and B.F.Woollenberg, **" Power Generation Operation and Control",** Wiley-Interscience publication, 2nd Edition, 1996.
2. P.Venkatesh, B.V.Manikandan, S.Charles Raja and A.Srinivasan**, "Electrical Power Systems: Analysis, Security, Deregulation"**, PHI Learning Pvt. Ltd., 2012.

REFERENCES

1. P.S.R. Murty, **"Electrical Power Systems",** Butterworth-Heinemann Publishers, 2017.
2. Subir Ray**, "Electrical Power Systems: Concept, Theory and Practice",** PHI Learning Pvt. Ltd., 2014.

3. Hussain Shareef, **"Modern Power Tracing Methods for Deregulated Power Systems",** LAP Lambert Academic Publishing, 2011.

E-RESOURCES

1. https://neos-guide.org/content/optimal-power- flow
2. https://albertaviews.ca/electricity-deregulation/
3. http://nptel.ac.in/courses/108101005/
4. https://www.inc.com/magazine/20001101/20897.html

Course Outcomes

At the end of the course, students will be able to

1. Analyze the optimal scheduling of power plants.
2. Analyze the Power system security -Contingency analysis.
3. Power system state estimation by using different measurements
4. Restructuring of power systems and deregulation in Indian Power sector.
5. Calculate ATC and the cost of transmission.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**2**	**2**	**3**	**2**
CO2	**2**	**2**	**3**	**2**	**2**	**1**
CO3	**3**		**2**	**3**	**3**	**3**
CO4	**2**		**2**	**2**	**2**	**3**
CO5	**3**		**2**	**2**	**2**	**3**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72414	GAS INSULATED SYSTEMS (GIS) (Professional Elective-III)	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives: To impart the GIS concepts and principles, to compare between Air Insulated Substation and GIS. To understand the design and constructional aspects of GIS.

MODULE I: Introduction To GIS and Properties Of Sf_6 12 Periods

Characteristics of GIS- Introduction to SF_6 - Physical properties-Chemical properties - Electrical properties-Specification of SF_6 gas for GIS application - Handling of SF_6 gas before use - Safe handling of Sf_6 gas in electrical equipment - Equipment for handling the SF_6 Gas - SF_6 and environment.

MODULE II: Layout Of GIS Stations 12 Periods

Advancement Of GIS Station - Comparison With Air Insulated Substation - Economics Of GIS - User Requirements For GIS - Main Features For GIS - Planning And Installation Components Of A GIS Station

MODULE III: Design And Construction Of GIS Station 12 Periods

A: Introduction - Rating of GIS components - Design Features - Estimation of different types of Electrical Stresses -Design Aspects of GIS components

B: Insulation Design for Components- Insulation Design for GIS - Thermal Considerations in the Design of GIS - Effect of very Fast Transient Over-voltages (VFTO) on the GIS design - Insulation Coordination systems - Gas handling and Monitoring System Design.

MODULE IV: Fast Transient Phenomena In GIS 12 Periods

Introduction- Disconnect or Switching in Relation to Very fast Transients-Origin of VFTO-Propagation and Mechanism of VFTO-VFTO Characteristics- Effects of VFTO-Testing of GIS for VFTO.

MODULE V: Special Problems in GIS and GIS Diagnostics 12 Periods

Introduction - particles their effects and their control- Insulating Spacers and their Reliability - SF_6 Gas Decomposition - Characteristics of imperfections in insulation - Insulation Diagnostic methods - PD Measurement and UHF Method.

TEXT BOOKS

1. M. S. Naidu , **"Gas Insulated Substations",** IK International Publishing House.

REFERENCES

1. Hermann J. Koch, "Gas Insulated Substations", Wiley-IEEE Press, 2014.
2. S. A. Boggs, F. Y. Chu and N. Fujimoto, **"Gas-insulated substations: technology and practice"**, Pergamon Press, 1986.

E-RESOURCES

1. http://electrical-engineering-portal.com/gas- insulated-substations- gis
2. https://www.electricity-today.com/overhead-td/gas- insulated-switchgear-options-for-substations
3. https://www.youtube.com/watch?v=q025e5dW32c

Course Outcomes

At the end of the course, students will be able to

1. Analyze the properties of SF6 gas and its functioning.
2. Analyze the features and layout of GIS systems.
3. Observe constructional design features of GIS design.
4. Analyze the Fast Transient Phenomena in Gas.
5. Discriminate the Problems and design diagnostic methods of GIS.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
Cos	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**			**2**	**2**	
CO2	**2**			**2**	**2**	
CO3	**2**			**2**	**2**	
CO4	**2**			**2**	**2**	
CO5	**2**			**2**	**2**	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 70223	PROGRAMMABLE LOGIC CONTROLLERS AND THEIR APPLICATIONS (Professional Elective - III)	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives: To impart knowledge on Mode of operation and programming of a Programmable Logic Controller (PLC), to impart knowledge on Characteristics of a PLC (synchronous, asynchronous), Analysis of the process schematic, analog PLC and PID controllers.

MODULE I: Introduction To PLC **9 Periods**

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.

MODULE II: Plc Programming **10 Periods**

PLC programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation. Digital logical gates programming in the Boolean algebra SYSTEM, CONVERSION EXAMPLES-Ladder diagrams for process control – Ladder diagrams for sequence listings – ladder diagram construction and flow chart for spray process system.

MODULE III: Registers And Counters **10 Periods**

A: PLC Registers: Characteristics of registers – module addressing – holding registers – output registers – PLC functions – Timer functions and industrial application.

B: counters – counter function industrial application – Architecture functions – number function comparison functions.- number conversion functions.

MODULE IV: Data Handling Functions And Sequence Functions **10 Periods**

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 axes and three axis Robots with PLC, Matrix functions.

MODULE V: Analog PLC **9 Periods**

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.

TEXT BOOKS

1. W. Bolton, **"Programmable Logic Controllers"** , 5th Edition, Elsevier, 2009.
2. J R Hackworth and F D Hackworth Jr, "**Programmable Logic Controllers – Programming methods and Applications"** 5th Edition, Pearson Publications, 2004.

REFERENCES

1. John W Webb and Ronald A Reiss, **"Programmable Logic Controllers – Principles and Applications"**, 5th Edition, Prentice Hall of India, 1998.

2. Rajesh Mehra and Vikrant Vij, **"PLCs & SCADA: Theory and Practice", 1st Edition,** Laxmi Publications, 2016.

E RESOURCES

1. https://www.amci.com/industrial-automation-resources/plc-automation-tutorials/what-plc/
2. http://library.automationdirect.com/understanding- ladder- logic/
3. nptel.ac.in/courses/112102011/11

Course Outcomes

At the end of the course, students will be able to

1. Understand the basic concepts of PLC and construct the PLC ladder diagrams.
2. Programming the PLC and Analyze the process schematic.
3. Understand the characteristics of PLC registers and Architecture functions.
4. Analyze the data handling functions and sequence functions.
5. Understand the Analog PLC operation & analog signal processing.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**				**3**	**3**
CO2	**2**	**2**		**3**	**2**	**2**
CO3	**2**		**1**		**2**	**1**
CO4	**3**	**1**		**2**	**3**	**1**
CO5	**3**	**3**	**1**	**1**	**3**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72415	HIGH-FREQUENCY MAGNETIC COMPONENTS (Professional Elective - III)	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives:

To study Fundamentals of Magnetic Devices. To study Fundamentals of, Skin effect and Proximity effect. To study the Design of Transformers, Analysis of Integrated inductors and self capacitance.

MODULE I: Fundamentals Of Magnetic Devices 12 Periods

Introduction, Magnetic Relationships, Magnetic Circuits, Magnetic Laws, Eddy Currents, Core Saturation, Volt-Second Balance, Inductance, Inductance Factor, Magnetic Energy, Self-Resonant Frequency, Classification of Power Losses in Magnetic Components, Non-inductive Coils.

Magnetic Cores: Introduction, Properties of Core Materials, Magnetic Dipoles, Magnetic Domains, Curie Temperature, Magnetization, Magnetic Materials, Hysteresis, Core Permeability, Core Geometries, Iron Alloy Cores, Amorphous Alloy Cores, Nickel–Iron and Cobalt–Iron Cores, Ferrite Cores, Powder Cores, Nano-crystalline Cores, Superconductors, Hysteresis Core Loss, Eddy-Current Core Loss, Total Core Loss, Complex Permeability.

MODULE II: Skin Effect & Proximity Effect 12 Periods

Introduction, Magnet Wire, Wire Insulation, Skin Depth, Ratio of AC-to-DC Winding Resistance, Skin Effect in Long Single Round Conductor, Current Density in Single Round Conductor, Impedance of Round Conductor, Magnetic Field Intensity for Round Wire, Other Methods of Determining the Round Wire Inductance, Power Density in Round Conductor, Skin Effect on Single Rectangular Plate. Proximity and Skin Effects in Two Parallel Plates, Anti- proximity and Skin Effects in Two Parallel Plates, Proximity Effect in Multiple-Layer Inductor, Appendix: Derivation of Proximity Power Loss.

Winding Resistance at High Frequencies: Introduction, Winding Resistance, Square and Round Conductors, Winding Resistance of Rectangular Conductor, Winding Resistance of Square Wire, Winding Resistance of Round Wire, Leakage Inductance, Solution for Round Conductor Winding in Cylindrical Coordinates, Litz Wire, Winding Power Loss for Inductor Current with Harmonics, Effective Winding Resistance for Non-sinusoidal Inductor Current, Thermal Model of Inductors.

MODULE III: Transformers 12 Periods

A: Introduction, Neumann's Formula for Mutual Inductance, Mutual Inductance, Energy Stored in Coupled Inductors, Magnetizing Inductance, Leakage Inductance, Measurement of Transformer Inductances, Stray Capacitance, High-Frequency Transformer Model, Non interleaved Windings, Interleaved Windings, AC Current Transformers, Winding Power Losses with Harmonics, Thermal Model of Transformers.

B: Design of Transformers: Introduction, Area Product Method, Optimum Flux Density, Transformer Design for Fly-back Converter in CCM, Transformer Design for Fly-back Converter in DCM, Transformer Design for Fly-back Converter in CCM, Transformer Design for Fly-back Converter in DCM.

MODULE IV: Integrated Inductors 12 Periods

Introduction, Resistance of Rectangular Trace, Inductance of Straight Rectangular Trace, Construction of Integrated Inductors, Meander Inductors, Inductance of Straight Round Conductor,

Inductance of Circular Round Wire Loop, Inductance of Two-Parallel Wire Loop, Inductance of Rectangle of Round Wire, Inductance of Polygon Round Wire Loop, Bond-wire Inductors, Single-Turn Planar Inductor, Inductance of Planar Square Loop, Planar Spiral Inductors, Multi-metal Spiral Inductors, Planar Transformers, MEMS Inductors, Inductance of Coaxial Cable, Inductance of Two-Wire Transmission Line, Eddy Currents in Integrated Inductors, Model of RF Integrated Inductors, PCB Inductors.

Design of Inductors: Introduction, Restrictions on Inductors, Window Utilization Factor, Temperature Rise of Inductors, Mean Turn Length of Inductors, Area Product Method, AC Inductor Design, Inductor Design for Buck Converter in CCM, Inductor Design for Buck Converter in DCM method.

MODULE V: Self-Capacitance 12 Periods

Introduction, High-Frequency Inductor Model, Self-Capacitance Components, Capacitance of Parallel-Plate Capacitor, Self-Capacitance of Foil Winding Inductors, Capacitance of Two Parallel Round Conductors, Capacitance of Round Conductor and Conducting Plane, Self-Capacitance of Single-Layer Inductors, Self-Capacitance of Multi-layer Inductors, Capacitance of Coaxial Cable.

TEXT BOOKS

1. Umanand L., Bhat,S.R., **"Design of Magnetic Components for Switched Mode Power Converters"** , ISBN:978-81-224-0339-8, Wiley Eastern Publication, 1992.

REFERENCES

1. Marian K. Kazimierczuk, **"High-Frequency Magnetic Components"** , ISBN: 978-0-470-71453-9 John Wiley & Sons, Inc.
2. G.C. Chryssis, **"High frequency switching power supplies"**, McGraw Hill, 2nd Edition. 1989.
3. Eric Lowdon, **"Practical Transformer Design Handbook",** Howard W. Sams& Co., Inc., 1980
4. **"Thompson --- Electro dynamic Magnetic Suspension.pdf"**
5. Witulski, **"Introduction to modeling of transformers and coupled inductors"** Beattie "Inductance 101.pdf

E-RESOURCES

1. ieeexplore.ieee.org/document/777202/
2. nptel.ac.in/courses/117101057/downloads/lec48.pdf

Course Outcomes

At the end of the course, students will be able to

1. Have the fundamentals of magnetic devices.
2. Understand the Fundamentals of Skin effect, Proximity effect and able to calculate winding resistance at high frequencies.
3. Analyze the transformer function by considering different parameters.
4. Design Inductors and describe various types of inductors.
5. Study the self capacitance concept of different conductors and cables.

CO-PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		3	3	1	
CO2	2		3	1	3	
CO3	3		2	3	3	
CO4	2		3	3	1	
CO5	3		2	3	3	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72416	REACTIVE POWER COMPENSATION AND MANAGEMENT (Professional Elective - IV)	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives:

To understand the necessity of reactive power compensation. To design load compensation. To analyze various types of reactive power compensation in transmission systems. To get exposedto distribution side and utility side reactive power management.

MODULE I: Load Compensation **12 Periods**

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

MODULE II: Steady – State Reactive Power Compensation In Transmission System **12 Periods**

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

Transient state reactive power compensation in transmission systems: Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation – compensation using synchronous condensers – examples.

MODULE III: Reactive Power Coordination **12 Periods**

A: Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations.

B: Effects of under voltages – frequency –Harmonics, radio frequency and electromagnetic interferences.

MODULE IV: Demand Side Management **12 Periods**

Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels.

Distribution side Reactive power Management: System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks.

MODULE V: User Side Reactive Power Management **12 Periods**

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

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.

TEXT BOOKS

1. T.J.E.Miller, **"Reactive Power Control in Electric Power Systems",** John Wiley and sons, 1982.
2. D.M.Tagare , **"Reactive Power Management",** Tata McGraw Hill,2004.

REFERENCES

1. A.Chakrabarti, D.P Kothari, A.K Mukhopadhyay and D.E Abinandan, **"An Introduction to Reactive Power Control and Voltage Stability in Power Transmission Systems",**PHI, 2010.
2. George J. Wakileh, **"Power Systems Harmonics; Fundamentals, Analysis and Filter Design"**, Spinger,2014.

E-RESOURCES

1. technav.ieee.org/tag/8412/reactive-power-control
2. ieeexplore.ieee.org/iel5/5/32985/01545767.pd
3. nptel.ac.in/courses/108106025/Chapter%203.pdf

Course Outcomes

At the end of the course, students will be able to

1. Understand the importance of load compensation in symmetrical as well as unsymmetrical loads.
2. Analyze the various compensation methods in transmission lines.
3. Understand the mathematical model for reactive power coordination.
4. Understand the different load patterns and distribution side reactive power management
5. Understand user side reactive power management and reactive power management in electric traction systems and furnaces.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**3**	**3**	**1**	
CO2	**2**		**3**	**1**	**3**	
CO3	**3**		**2**	**3**	**3**	
CO4	**2**		**3**	**3**	**1**	
CO5	**3**		**2**	**3**	**3**	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72417	POWER SYSTEM RELIABILITY (Professional Elective-IV)	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives:

To develop the generation system model and recursive relation for capacitive model Building.
To evaluate the equivalent transitional rates, cumulative probability and cumulative Frequency.

MODULE I: Generating System Reliability Analysis–I **12 Periods**

Generation system model – capacity outage probability tables – Recursive relation for capacitive model building – sequential addition method – unit removal – Evaluation of loss of load and energy indices – Examples.

MODULE II: Generating System Reliability Analysis–Ii **12 Periods**

Frequency and Duration methods – Evaluation of equivalent transitional rates of identical and non-identical units – Evaluation of cumulative probability and cumulative frequency of non-identical generating units – 2- level daily load representation - merging generation and load models – Examples.

MODULE III: Operating Reserve Evaluation **12 Periods**

A: Basic concepts - risk indices – PJM methods – security function approach – rapid start and hot reserve units – Modeling using STPM approach.

B: Bulk Power System Reliability Evaluation: Basic configuration – conditional probability approach – system and load point reliability indices – weather effects on transmission lines – Weighted average rate and Markov model – Common mode failures.

MODULE IV: Inter Connected System Reliability Analysis **12 Periods**

Probability array method – Two inter connected systems with independent loads – effects of limited and unlimited tie capacity - imperfect tie – Two connected Systems with correlated loads – Expression for cumulative probability and cummulative frequency.

Distribution System Reliability Analysis – I (Radial configuration): Basic Techniques – Radial networks –Evaluation of Basic reliability indices, performance indices– load point and system reliability indices – customer oriented, loss and energy oriented indices – Examples.

MODULE V: Distribution System Reliability Analysis - II **12 Periods**

Basic techniques – inclusion of bus bar failures, scheduled maintenance – temporary and transient failures – weather effects – common mode failures –Evaluation of various indices –Examples.

Substations and Switching Stations: Effects of short-circuits - breaker operation – Open and Short-circuit failures –Active and Passive failures – switching after faults – circuit breaker model – preventive maintenance – exponential maintenance times.

TEXT BOOKS

1. Roy Billinton and Ronald N. Allan, **"Reliability Evaluation of Power Systems"**, Plenum press, New York and London, 2nd Edition, 1996.

2. J. Endrenyi,**"Reliability Modeling in Electric Power Systems"**, John Wiley and Sons, 1st Edition, 1978.

REFERENCES

1. D. Elmakias, **"Computational Methods in Power system Reliability"**, Springer-Verlag.

E-RESOURCES

1. technav.ieee.org/tag/8149/power-system-reliability
2. ieeexplore.ieee.org/document/7042739/
3. nptel.ac.in/syllabus/108101039/

Course Outcomes

At the end of the course, students will be able to

1. Find loss of load and energy indices for generation systems model
2. Describe merging generation and load models
3. Apply various indices for distribution systems and evaluation of Bulk Power System Reliability.
4. Apply various indices for distribution systems and evaluation of Bulk Power System Reliability.
5. Analyze the parallel configuration of distribution systems and operation of substations and switching stations.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
Cos	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**2**	**2**	**3**	
CO2	**2**		**3**	**2**	**2**	
CO3	**2**		**2**	**2**	**3**	
CO4	**2**		**3**	**2**	**3**	
CO5	**3**		**3**	**2**	**2**	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72418	VOLTAGE STABILITY (Professional Elective - IV)	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives:

To understand SEC Planning and Operational Standards of Security, Reactive Power Control in Generation/Transmission Interconnected Networks. To understand the Stability/Instability in Generation/Transmission Interconnected Networks.

MODULE I: Introduction To Voltage Stability **12 Periods**

Definitions: Voltage Stability, Voltage Collapse, Voltage Security; Physical relation indicating dependency of voltage on reactive power flow; Factors affecting Voltage collapse and instability; Previous cases of voltage collapse incidences.

MODULE II: Graphical Analysis Of Voltage Stability **12 Periods**

Comparison of Voltage and angular stability of the system; Graphical Methods describing voltage collapse phenomenon: P-V and Q-V curves; detailed description of voltage collapse phenomenon with the help of Q-V curves.

MODULE III: Analysis Of Voltage Stability **12 Periods**

A: Analysis of voltage stability on SMLB system: Analytical treatment and analysis.

B: Voltage Stability Indices: Voltage collapse proximity indicator; Determinant of Jacobin as proximity indicators; Voltage stability margin.

MODULE IV: Power System Loads **12 Periods**

Loads that influences voltage stability: Discharge lights, Induction Motor, Air-conditioning, heat pumps, electronic power supplies, OH lines and cables.

Reactive Power Compensation: Generation and Absorption of reactive power; Series and Shunt compensation; Synchronous condensers, SVC s; OLTCs; Booster Transformers.

MODULE V: Voltage Stability Margin **12 Periods**

Stability Margin: Compensated and un-compensated systems. Voltage Security Definition; Voltage security; Methods to improve voltage stability and its practical aspects.

TEXT BOOKS

1. A.Chakrabarthy, D.P.Kotari and A.K.Mukopadyay, **"Performance, Operation and Control of EHV Power Transmission System"**, A.H. Wheeler Publishing, 1st Edition, 1995.
2. K.R.Padiyar, **"Power System Dynamics: Stability and Control",** 2nd Edition, B.S.Publications.

REFERENCES

1. C.W.Taylor, **"Power System Voltage Stability",** McGraw Hill, 1994.

E-RESOURCES

1. ieeexplore.ieee.org/document/5448823/
2. ieeexplore.ieee.org/iel1/59/6593/00260881.pdf
3. nptel.ac.in/courses/108102080/35

Course Outcomes

At the end of the course, students will be able to

1. Define various terms in Voltage stability concepts.
2. Understand the P-V and Q-V curves & Graphical methods describing voltage collapse phenomenon.
3. Analyze the voltage stability indices.
4. Understand the concepts of load that influences voltage stability & Reactive power compensation.
5. Analyze the voltage stability margin in various systems.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	1		3	2	3
CO2	3		3	2	3	2
CO3	2	2	1	2	1	2
CO4	1		2	1	1	2
CO5	3	2		2	2	3

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72419	SMART GRID TECHNOLOGIES (Open Elective II)	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives:

To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure. To familiarize the power quality management issues in Smart Grid. To familiarize the high performance computing for Smart Grid applications.

MODULE I: Introduction to Smart Grid **12 Periods**

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.

MODULE II: Smart Grid Technologies: Part 1 **12 Periods**

Introduction to Smart Meters, Real Time Pricing, 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.

MODULE III: Smart Grid Technologies: Part 2: **12 Periods**

A: Smart Substations, Substation Automation, Feeder Automation. Geographic Information System (GIS)

B: 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).

MODULE IV: Micro grids and Distributed Energy Resources **12 Periods**

Concept of micro grid, need & applications of micro grid, formation of micro grid, Issues of interconnection, protection & control of micro grid. Plastic & Organic solar cells, Thin film solar cells, Variable speed wind generators, fuel cells, micro turbines, Captive power plants, Integration of renewable energy sources.

MODULE V: Power Quality Management in Smart Grid **12 Periods**

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, Power Quality Au

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.

REFERENCES

1. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama**," Smart Grid: Technology and Applications",** Wiley.

2. Jean Claude Sabonnadière, NouredineHadjsaïd, **"Smart Grids",** Wiley Blackwell.

E-RESOURCES

1. smartgrid.ieee.org/
2. ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5165411
3. nptel.ac.in/courses/108105067/

Course Outcomes

At the end of the course, students will be able to

1. Group the various aspects of smart grid.
2. Emphasize the use of smart meters and plug in hybrid electric vehicles.
3. Describe smart substations and it functions.
4. Understand the concept of micro grid and distributed energy resources.
5. Analyze the power quality management in smart grid.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**	**1**	**1**	**3**	**3**	**3**
CO2	**2**	**2**			**1**	**2**
CO3	**2**				**2**	**2**
CO4			**3**	**3**	**1**	**3**
CO5	**2**	**1**	**1**	**2**	**2**	**3**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72420	AI TECHNIQUES IN ELECTRICAL POWER SYSTEMS (Open Elective II)	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives:

To cater the knowledge of soft commanding methodologies, such as artificial neural networks, Fuzzy logic and genetic Algorithms. To expose the students to the concepts of feed forward neural networks and about feedback neural networks. To understand about genetic algorithm, genetic operations and genetic mutations.

MODULE I: Artificial Neural Networks **12 Periods**

Introduction-Models of Neural Network - Architectures – Knowledge representation – Artificial Intelligence and Neural networks–Learning process – Error correction learning – Hebbian learning –Competitive learning –Boltzmann learning – Supervised learning – Unsupervised learning– Reinforcement learning- learning tasks.

MODULE II: ANN Paradigms **12 Periods**

Multi – layer perceptron using Back propagation Algorithm-Self – organizing Map – Radial Basis Function Network – Functional link, network – Hopfield Network.

MODULE III: Fuzzy Logic **12 Periods**

A: Introduction – Fuzzy versus crisp – Fuzzy sets - Membership function – Basic Fuzzy set operations – Properties of Fuzzy sets

B: Fuzzy Cartesian product –Operations on Fuzzy relations. Fuzzy logic – Fuzzy Quantifiers-Fuzzy Inference-Fuzzy Rule based system-Defuzzification methods.

MODULE IV: Genetic Algorithms **12 Periods**

Introduction-Encoding –Fitness Function-Reproduction operators-Genetic Modeling –Genetic operators-Crossover-Single – site crossover-Two point crossover –Multi point crossover- Uniform crossover – Matrix crossover-Crossover Rate-Inversion & Deletion –Mutation operator –Mutation –Mutation Rate-Bit-wise operators-Generational cycle-convergence of Genetic Algorithm.

MODULE V: Applications Of AI Techniques **12 Periods**

Load forecasting – Load flow studies – Economic load dispatch – Load frequency control – Single area system and two area system – Small Signal Stability (Dynamic stability), Reactive power control – speed control of DC and AC Motors.

TEXT BOOKS

1. S.Rajasekaran and G.A.V.Pai, **"Neural Networks, Fuzzy Logic & Genetic Algorithms"**, PHI, New Delhi, 2003.

REFERENCES

1. P.D.Wasserman, Van Nostrand Reinhold, **"Neural Computing Theory & Practice",** New York, 1989.
2. Bart Kosko, **"Neural Network & Fuzzy System",** Prentice Hall, 1992.
3. G.J.Klir and T.A.Folger, **"Fuzzy Sets,Uncertainty and Information",** PHI, Pvt.Ltd,1994.

4. D.E.Goldberg, Addison Wesley, **"Genetic Algorithms",** 1999.

E-RESOURCES

1. https://aitopics.org/
2. ieeexplore.ieee.org/document/10029/
3. www.nptelvideos.in/2012/11/artificial-intelligence-prof-p-dasgupta.html

Course Outcomes

At the end of the course, students will be able to

1. Concept of artificial neuron models, architectures, learning process, and learning techniques of artificial neutron models.
2. Algorithms like Back propagation algorithm, self organizing map, radial networks.
3. Concept of fuzzy based system, analogy between fuzzy and crisp sets, basic fuzzy set operations, and rule based systems, Defuzzification methods.
4. Genetic modeling, fitness function reproduction operators.
5. Apply the Intelligence techniques to real Power Systems.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
Cos	**Program Outcomes (POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**3**	**3**	**3**	
CO2	**3**	**1**			**3**	**1**
CO3	**2**	**1**	**2**	**3**	**2**	
CO4	**2**			**2**		**2**
CO5	**3**		**1**	**3**	**2**	**3**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72421	DIGITAL CONTROL SYSTEMS (Open Elective II)	L	T	P
Credits: 3		2	2	-

Prerequisites: Nil

Course Objectives:
To enhance the knowledge of modeling and design of Digital control systems. To emphasis on using control system design tools for analysis of controlled system during its discrete-time implementation.

MODULE I: Introduction **12 Periods**

Block Diagram of typical control system- advantages of sampling in control systems – examples of discrete data and digital systems – data conversion and quantization – sample and hold devices – D/A and A/D conversion – sampling theorem – reconstruction of sampled signals –ZOH.

Z-transform: Definition and evaluation of Z-transforms – mapping between s-plane and z-plane – inverse z-plane transform – theorems of the Z-transforms –limitations of z-transform –pulse transfer function – pulse transfer function of ZOH –relation between G(s) and G(z) – signal flow graph method applied to digital systems.

MODULE II: State Space Analysis **12 Periods**

State space modeling of digital systems with sample and hold – state transition equation of digital time in variant systems – solution of time in variant discrete state equations by the Z-Transformation – transfer function from the state model – Eigen values – Eigen vector and diagonalization of the A-matrix – Jordan canonical form. Computation of state transition matrix-Transformation to phase to variable canonical form-The state diagram – decomposition of digital system – Response of sample data system between sampling instants using state approach. Stability : Definition of stability – stability tests – The second method of Liapunov.

MODULE III: Time Domain Analysis **12 Periods**

A: Comparison of time response of continuous data and digital control systems-correlation between time response and root locus j the s-plane and z-plane – effect of pole-zero configurationin the z-plane upon the maximum overshoot and peak time of transient response.

B: Root loci for digital control systems – steady state error analysis of digital control systems – Nyquits plot – Bode plot-G.M and P.M.

MODULE IV: Design **12 Periods**

The digital control design with digital controller with bilinear transformation – Digital PID controller Design with deadbeat response-Pole placement through state feedback-Design of full order state observer-Discrete Euler Lagrange Equation – Discrete maximum principle.

MODULE V: Digital State Observer **12 Periods**

Design of - Full order and reduced order observers. Design by max. principle : Discrete Eulerlanguage equation-discrete maximum principle.

TEXT BOOKS

1. K. Ogata, **"Discrete-Time Control systems",** Pearson Education/PHI, 2nd Edition.
2. M.Gopal, **"Digital Control and State Variable Methods"**, TMH.

REFERENCES

1. Kuo, **"Digital Control Systems"** , Oxford University Press, 2nd Edition,2003.
2. M.Gopal, **"Digital Control Engineering"**, John Wiley & Sons Australia, Limited, 1988.

E-RESOURCES

1. http://nptel.ac.in/courses/108103008/
2. https://www.electrical4u.com/digital-data-control-system/

Course Outcomes

At the end of the course, students will be able to

1. Understand the concept of A/D and D/A conversion and Z transforms.
2. Analyze State space modeling of digital systems.
3. Comprehend the time domain analysis.
4. Design different digital controllers.
5. Design the digital state observer.

CO-PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Program Outcomes (POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2		3	2	2	
CO2	3		2	2	3	
CO3	2		3	2	2	
CO4	3		2	2	3	
CO5	2		3	2	2	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72422	POWER SYSTEMS LAB-II	L	T	P
Credits: 2		-	-	4

Course Objectives:
To enhance the knowledge of power system protection by studying the characteristics of various relays. To emphasis the performance of transmission line model and transformer.

List of Experiments:

1. Determination of Equivalent circuit of a 3-Winding Transformer.
2. Determination of Sequence Impedances of a Cylindrical Rotor Synchronous Machine.
3. Determination of Sequence Impedances of Three Phase Transformer
4. Characteristics of Over Current Relays
   i) IDMT Electromagnetic Relay (7051 A).
5. Characteristics of Percentage biased Differential Relay.
   i) Electromagnetic Relay (7054 A).
6. Characteristics of Microprocessor based Over Voltage Relay (7053 B).
7. Characteristics of Under Voltage (UV) Microprocessor based relay (7052 B).
8. Characteristics of Static Negative sequence Relays (7055B).
9. Performance and Testing of Transformer Protection System.
10. Performance and Testing of Transmission Line Model.

Course Outcomes

At the end of the course, students will be able to

1. Determine the equivalent circuit of three winding transformer.
2. Determine the sequence impedances of synchronous machine and three phase transformer.
3. Determine the characteristics of various relays.
4. Emphasis the performance of transmission line model
5. Emphasis the performance of transformer.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	Program Outcomes(POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		3	2	3	2
CO2	2		2	2	2	1
CO3	3		3	2	3	2
CO4	2		2	2	2	2
CO5	3		3	2	2	3

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. IISemester		
Code:	**SEMINAR-II**	**L**	**T**	**P**
Credits:2		**-**	**-**	

Course Objectives: To promote deeper understanding the basic concepts, physical mechanism behind the processes, participate in scientific analysis and comprehensive of scientific writing of verbal presentation. This course is to introduce post graduate student to ideas, methods and techniques that can improve the content and presentation of scientific seminars.

Course Outcomes:

At the end of the course, students will be able to

1. Write technical documents to the standards.
2. Give oral presentation on technical and general topics.
3. Express ideas clearly with examples.
4. Identify the research opportunities related to their area.
5. Communicate effectively.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak						
COs	**Program Outcomes(POs)**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**1**	**3**		**1**		**3**
CO2		**2**			**2**	**3**
CO3	**2**	**3**	**2**	**2**		**1**
CO4	**2**	**3**	**2**	**2**	**1**	**3**
CO5		**3**	**1**		**2**	**2**

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72424	COMPREHENSIVE VIVA-VOCE	L	T	P
Credits: 6		-	-	-

Course Objectives: To refresh the technical content at finishing stage of the program.

Course Outcomes:

At the end of the course, students will be able to

1. Illustrate the fundamental concepts in power systems.
2. Comprehend the technical knowledge in Power Systems and its allied fields.
3. Apply and analyze Power Systems concepts in its allied fields
4. Prepare for the global and overall view on the subject.
5. Enhance the communication and presentation skills.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	Program Outcomes(POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	3	2	3	3	3
CO2	2	2		2	2	3
CO3	2	3	3	3	3	2
CO4	2	2	2	1		1
CO5	2		2		2	

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72425	PROJECT WORK - I	L	T	P
Credits: 16		-	-	-

Course Objectives: To utilize basic knowledge and advance techniques to make product/process using experimentation and/or simulation and expose to others as document and oral presentation.

Course Outcomes:

At the end of the course, students will be able to

1. Identify the problem statement and prepare the abstract for the proposed project.
2. Generate the latest information related to the project from various literature survey
3. Specify the techniques implemented or to be implemented
4. Design the necessary parameters of the selected project as per the infrastructure requirement.
5. Correlate the Simulation/ experimental results with theoretical/designed data

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	Program Outcomes(POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	3	2	3	3	3
CO2	1	2		2	2	3
CO3		3	3	3		2
CO4	2	2	2			3
CO5	2	3	2		2	3

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72426	PROJECT WORK - II	L	T	P
Credits: 6		-	-	-

Course Objectives: To utilize science and engineering to make product/process using innovative techniques, predict the results and prepare technical documents.

Course Outcomes:

At the end of the course, students will be able to

1. Execute and validate the Model
2. Explain the results obtained in Project work I
3. Summarize the ultimate finding of the project
4. Detailed presentation of work carried out.
5. Summarize the work completed in the form of technical document

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	Program Outcomes(POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	3	2	3	3	3
CO2	1	2		2	2	3
CO3		3	3	3		2
CO4	2	2	2			3
CO5	2	3	2		2	3

2017-18 Onwards (MR-17)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	M.Tech. II Semester		
Code: 72427	PROJECT VIVA-VOCE	L	T	P
Credits: 16		-	-	-

Course Objectives: To effectively present the project outcomes to the examination panel

Course Outcomes:

At the end of the course, students will be able to

1. Identify project goals, constraints, deliverables, performance criteria, control needs and requirements.
2. Illustrate the Implemented concepts, tools and techniques adopted in the projects.
3. Comprehend the results obtained by the simulation/experimentation.
4. Justify the problem statement with the obtained results and observations.
5. Utilize technology tools for communication, collaboration, information management, and decision support.

CO-PO Mapping (3/2/1indicatesstrengthofcorrelation)3-Strong,2-Medium,1-Weak						
COs	Program Outcomes(POs)					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	3	2	3	3	3
CO2	2	2		2	2	3
CO3	2	3	3	3	3	2
CO4	2	2	2	1		1
CO5	2		2		2	