SCHOOL OF ENGINEERING AND TECHNOLOGY
(SCHEME OF INSTRUCTION AND EVALUATION OF M.TECH (PEDR)
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
I YEAR – I SEMESTER (2019-20)

THEORY

S.No	Course Code	Course Title	Hours per Week			Credits	Evaluation					Total Marks
							Internal (30Marks)			External (70 Marks)		
							Assignment	Test				
			L	T	P		Max. Marks	Duration	Max.	Duration	Max.	
1	19MEET01	Power Electronic Control of DC Drives	3	0	0	3	5	2	25	3	70	100
2	19MEET02	Modern Power Semiconductor Devices	3	0	0	3	5	2	25	3	70	100
3		Elective-I	3	0	0	3	5	2	25	3	70	100
4		Elective-II	3	0	0	3	5	2	25	3	70	100
5	19MBST01	Research Methodology and IPR	2	0	0	2	5	2	25	3	70	100

PRACTICALS

S.No	Course Code	Course Title	Hours per Week			Credits	Evaluation					Total Marks
							Internal (40 Marks)			External (60 Marks)		
							Continuous	Test				
			L	T	P		Max. Marks	Duration	Max.	Duration	Max.	
6	19MEEP01	Digital Control Systems Lab	0	0	4	2	20	2	20	3	60	100
7	19MECP02	Signal Processing Lab	0	0	4	2	20	2	20	3	60	100
		Total	**14**	**0**	**8**	**18**						**700**

SCHOOL OF ENGINEERING AND TECHNOLOGY
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I YEAR – II SEMESTER (2019-20)

THEORY

S.No	Course Code	Course Title	Hours per Week			Credits	Evaluation					Total Marks
							Internal (30Marks)			External (70 Marks)		
							Assignment	Test				
			L	T	P		Max. Marks	Duration	Max.	Duration	Max.	
1	19MEET08	Power Converters	3	0	0	3	5	2	25	3	70	100
2	19MEET09	Power Electronic Control of AC Drives	3	0	0	3	5	2	25	3	70	100
3		Elective-III/MOOCS	3	0	0	3	5	2	25	3	70	100
4		Elective-IV	3	0	0	3	5	2	25	3	70	100

PRACTICALS

S.No	Course Code	Course Title	Hours per Week			Credits	Evaluation					Total Marks
							Internal (40 Marks)			External (60 Marks)		
							Continuous	Test				
			L	T	P		Max. Marks	Duration	Max.	Duration	Max.	
5	19MEEP02	Power Converters Lab	0	0	4	2	20	2	20	3	60	100
6	19MEEP03	Electrical Systems Simulation Lab	0	0	4	2	20	2	20	3	60	100
7	19MEES01	Term Paper Cum Seminar	0	0	4	2	40				60	100
		Total	**12**	**0**	**12**	**18**						**700**

SCHOOL OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
II YEAR – I SEMESTER (2019-20)

THEORY

S.No	Course Code	Course Title	Hours per Week			Credits	Evaluation					Total Marks
							Internal (30Marks)			External (70 Marks)		
							Assignment	Test				
			L	T	P		Max. Marks	Duration	Max.	Duration	Max.	
1		Elective-IV	3	0	0	3	5	2	25	3	70	100
2		Open Elective	3	0	0	3	5	2	25	3	70	100

PRACTICALS

S.No	Course Code	Course Title	Hours per Week			Credits	Evaluation					Total Marks
							Internal (40 Marks)			External (60 Marks)		
							Continuous	Test				
			L	T	P		Max. Marks	Duration	Max.	Duration	Max.	
7	19MEEV01	Comprehensive Viva	0	0	0	2	40	0	0	0	60	100
8	19MEEJ01	Project Work Phase-I	0	0	20	10	*100	0	0	0	0	100
		Total	**6**	**0**	**24**	**18**						**400**

***As per Regulation-R19, 14.4, Table2**

SCHOOL OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
II YEAR – II SEMESTER (2019-20)

S.No	Course Code	Course Title	Credits	Internal Evaluation		External Evaluation		Total Marks
				Guide	Internal Committee	External Dissertation	Viva	
	19MEEJ02	Project Work Phase-II	16	20	20	30	30	100

SCHOOL OF ENGINEERING AND TECHNOLOGY
SRI PADMAVATHI MAHILA VISVAVISYALAYAM
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

LIST OF ELECTIVES (2019-20)

ELECTIVE - I

S.No	Course	Course Title
1	19MEET03	Digital Control Systems
2	19MEET04	Electrical Traction & Control
3	19MEET05	Mathematics for Electrical Engineering
4	19MCST07	Wireless Sensor Networks

ELECTIVE - II

S.No	Course	Course Title
1	19MECT02	Advanced Digital Signal Processing& Algorithms
2	19MECT24	RFID Systems
3	19MEET06	Renewable Energy Systems
4	19MEET07	Special Machines

ELECTIVE - III

S.No	Course	Course Title
1	MOOCS	

ELECTIVE - IV

S.No	Course	Course Title
1	19MMET13	Robotics
2	19MEET12	FACTS and HVDC
3	19MEET13	Solar & Energy Storage Systems
4	19MEET14	Power Quality

ELECTIVE - V

S.No	Course	Course Title
1	19MEET15	SCADA Systems and
2	19MEET16	FACTS and CustomPower
3	19MEET17	Neural Network & Fuzzy Logic
4	19MEET18	Smart Grid

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

LIST OF OPEN ELECTIVES (2019-20)

S.No	Course Code	Course Title
1	19MBST02	English For research Paper Writing
2	19MBST02	Business Analytics
3	19MMET22	Advanced Operations Research
4	19MECT22	Advanced Embedded Systems
5	19MCST18	Information retrial systems
6	19MEET19	Solar Energy Utilization

SYLLABUS

M.Tech
I Year I Semester

M.Tech
I Year I Semester

S.No	Course Code	Course Title
1	19MEET01	Power Electronic Control of DC
2	19MEET02	Modern Power Semiconductor
3		Elective-I
4		Elective-II
5	19MBST01	Research Methodology and IPR
6	19MEEP01	Digital Control Systems Lab
7	19MECP02	Signal Processing Lab

M.Tech
I Year I Semester

ELECTIVE - I

S.No	Course	Course Title
1	19MEET03	Digital Control Systems
2	19MEET04	Electrical Traction & Control
3	19MEET05	Mathematics for Electrical Engineering
4	19MCST07	Wireless Sensor Networks

ELECTIVE - II

S.No	Course	Course Title
1	19MECT02	Advanced Digital Signal Processing& Algorithms
2	19MECT24	RFID Systems
3	19MEET06	Renewable Energy Systems
4	19MEET07	Special Machines

19MEET01: POWER ELECTRONIC CONTROL OF DC DRIVES

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To understand steady state operation and transient dynamics of a motor load system.
2. To study and analyze the operation of the converter / chopper fed DC drive, both Qualitatively and quantitatively.
3. To acquire knowledge on current and speed controllers for a closed loop DC motor drive
4. To import knowledge on modeling and simulation of Dc Drives.

Course Outcomes

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

CO1. Analyze the performance of single phase and three phase controlled Rectifier fed DC Motor.
CO2. Explain the operation of the converter / chopper fed DC drive
CO3. Design the current and speed controllers for a closed loop DC motor drive.
CO4. Analyze the Modeling and control of DC Drives
CO5. Estimate the performance of DC Drives by using Simulation

UNIT I

Single-Phase Controlled Rectifier Fed DC Motor

Separately excited DC motors with rectified single –phase supply – single-phase semi converter and single phase full converter for continuous and discontinuous modes of operation – power and power factor.

UNIT II

Three-Phase Controlled Rectifier Fed DC Motor

Three-phase semi converter and Three phase full converter for continuous and discontinuous modes of operations – power and power factor - Addition of Freewheeling diode – Three phase double converter. Three phase controlled bridge rectifier with passive load impedance, resistive load and ideal supply – Highly inductive load and ideal supply for load side and supply side quantities, shunt capacitor compensation, three phase controlled bridge rectifier inverter.

UNIT III

Chopper Controlled DC Motor Drives

Principle of operation of the chopper – Four – quadrant chopper circuit – Chopper for inversion –Chopper with other power devices – model of the chopper– steady state analysis of chopper controlled DC motor drives – rating of the devices – Pulsating torque.

UNIT IV

Modeling and Control of DC Drives

Control modeling of three phase converter –Steady state analysis of three phase converter control DC motor drive – Two quadrants, three phase converter controlled DC motor drive – DC motor and load, converter. Current and speed controllers - Current and speed feedback – Design of controllers – Current and speed controllers – Motor equations – filter in the speed feedback loop speed controller – current reference generator – current controller and flow chart for simulation

UNIT V

Simulation of DC Motor Drives

Dynamic simulations of the speed controlled DC motor drives – Speed feedback speed controller– command current generator – current controller.

Closed loop operation: Speed controlled drive system – current control loop – pulse width modulated current controller – hysteresis current controller – modeling of current controller –design of current controller.

Text Books

1. R. Krishnan,"Electric Motor Drives Modelling, Analysis, And Control",Prentice Hall India Learning Private Limited, 2002.
2. Gopal K. Dubey ,"Fundamentals of Electrical Drives", 2nd Edition, Narosa, 2002.

Reference

1. SBDewan and A Straughen,"Power Semiconductor drives",wileyindiaedition,2009.
2. P.C Sen, John Wiley and Sons, "Thyristor DC Drives", New York, 1991.
3. BimalK. Bose,"Power Electronics and Variable Frequency Drives: Technology and
4. Applications",wileyindiapvt ltd-2010.

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M	L	M	M	H	H	M	-
CO2	-	M	L	M	M	M	H	M	-
CO3	-	-	H	M	H	M	M	H	-
C04	M	H	H	M	H	M	M	M	-
C05	M	H	H	M	L	M	M	M	-

19MEET02: MODERN POWER SEMICONDUCTOR DEVICES

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To Import Knowledge on Basics of Power Semiconductor devices.
2. To understand the static and dynamic characteristics of current controlled power Semiconductor Devices.
3. To understand the static and dynamic characteristics of voltage controlled power Semiconductor Devices.
4. To Analyze control and firing circuit for different devices.
5. To Study the selection of devices for Thermal Protection.

Course Outcomes

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

CO1. Analyze the Basic Concept of Power Semiconductor Devices.
CO2. Demonstrate the static and dynamic characteristics of current controlled power Semiconductor Devices.
CO3. Understand the static and dynamic characteristics of voltage controlled power SemiconductorDevices.
CO4. Identify Various Means of Control & Firing Circuits for different devices.
CO5. Design and analyze the Thermal Protection systems.

UNIT I

Introduction

Power switching devices overview – Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Device selection strategy – On-state and switching losses – EMI due to switching - Power diodes -Types, forward and reverse characteristics, switching characteristics – ratings.

UNIT II

Current Controlled Devices

BJT's – Construction, static characteristics, switching characteristics; Negative temperature co-efficient and secondary breakdown; Power Darlington - Thyristors –Physical and electrical principle underlying operating mode,–concept of latching; Gate and switching characteristics; converter grade and inverter grade and other types; series and parallel operation; comparison of BJT and Thyristor –steady state and dynamic models of BJT &Thyristor.

UNIT III

Voltage Controlled Devices

Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs - Basics of GTO, MCT, FCT, RCT and IGCT.

UNIT IV

Firing and Protecting Circuits

Necessity of isolation, pulse transformer, optocoupler – Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT. - Over voltage, over current and gate protections; Design of snubbers.

UNIT V

Thermal Protection

Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour –phase cooling; Guidance for hear sink selection – Thermal resistance and impedance -Electrical analogy of thermal components, heat sink types and design – Mounting types.

Text Books

1. MD Singh and K.B Kanchandani,"Power Electronics" ,Tata McGraw Hill, 2005.
2. Ned Mohan", Power electronics", 2nd Edition, Wiley, 2013.

References

1. W.Shepherd, L.N.Huley and D.T.W.Liang,"Power Electronics and motor control", 2015
2. P S Bimbhra,"Power electronics", khanna publishers-2018.
3. Undeland, Robbins, Mohan ,"'Power Electronics: Converters Applications and Design", Wiley India pvt ltd- edition 2007

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	H	-	-	-	M	H	M	-
CO2	M	-	-	-	-	H	M	M	-
CO3	M	-	H	-	-	M	M	H	-
C04	-	M	-	-	-	-	M	-	-
C05	M	-	-	-	-	-	M	-	-

19MEET03: DIGITAL CONTROL SYSTEMS

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To equip the students with the basic knowledge of discretization.
2. To impart knowledge on Z-Transforms for Discrete system analysis.
3. To learn the stability analysis of digital control system.
4. To familiarize the design concepts of the controller and observer for digital controlsystems.

Course Outcomes

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

CO1. Obtain discrete representation of LTI systems.
CO2. Acquire knowledge on Z-Transforms in discrete time analysis.
CO3. Analyze stability of open loop and closed loop discrete-time systems.
CO4. Describe and analyze digital controllers.
CO5. Design state feedback and output feedback controllers.

UNIT I

Introduction:

Digital Control Systems, quantization and quantization error, Z-transform, Z-transform of elementary functions, properties of Z-transform, Inverse Z-transform, Z-transform method for solving difference equations, problems.

UNIT II

Z plane Analysis of Discrete time control:

Introduction, Impulse Sampling and data hold, obtaining the Z transform by the convolution integral method, pulse transfer function, realization of digital controllers and digital filters, problems.

UNIT III

Design of Digital Control Systems by Conventional Methods:

Introduction, Mapping between S plane and Z plane, Stability Analysis of Closed loop systems in the Z-Plane, transient and steady response analysis, Design based on Root Locus and frequency response methods.

UNIT IV

State Space Analysis:

Introduction, State Space representation of digital systems, solving discrete time-state space equations, pulse transfer function matrix, discretization of continuous time state space equations, Pulse Transfer Function Matrix, Lyapunov stability analysis.

UNIT V

Pole Placement and State Observers Design:

Introduction, Controllability, Observability, useful transformations of state space analysis and design, Design through pole placement, state observer, Error Dynamics of Full order state observer, Effects of the addition of the observer on a closed loop system.

Text Books

1. K. Ogata, “Digital Control Engineering”, Prentice Hall, Englewood Cliffs, 1995.
2. M. Gopal, “Digital Control Engineering”, Wiley Eastern, 1988.

Reference Books

1. G. F. Franklin, J. D. Powell and M. L. Workman, “Digital Control of Dynamic Systems”,
2. Addison-Wesley, 1998.
3. B.C. Kuo, “Digital Control System”, Holt, Rinehart and Winston, 1980.

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	-	-	-	-	H	-	-
CO2	H	-	-	-	-	-	H	-	-
CO3	M	H	-	-	-	-	H	M	-
C04	M	H	-	-	-	-	H	M	-
C05	-	H	-	-	-	-	H	-	-

19MEET04: ELECTRICAL TRACTION AND CONTROL

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives
1. To distinguish different traction systems and latest trends in traction systems
2. To differentiate services of traction systems based on speed time curve
3. To understand different types of traction motor controls
3. To use various traction systems auxiliaries
4. To explain distribution traction systems

Course Outcomes
After completion of the course the student will able to
CO1. Design&Analyzedifferent types of traction motor controls
CO2. Describe the basic concepts of different traction systems
CO3. Understand the working of traction distribution systems.
CO4. Analyze the various traction systems auxiliaries
CO5. Differentiate services of traction systems based on speed time curve.

UNIT I

Traction Systems and Latest Trends
Present scenario of Traction/ Transportation – High speed traction, Metro , Latest trends in action-Metro, monorail, Magnetic levitation Vehicle, Steam, diesel, diesel-electric, Battery andelectric traction systems, General arrangement of D.C.A.C.singlephase,3phase,Composite systems, Choice of traction system - Diesel- Electric or Electric.

UNIT II

Mechanics of Train Movement
Analysis of speed time curves for main line, suburban and urban services, Simplified speed time curves, Relationship between principal quantities in speed time curves, Requirement of tractive effort, Specific energy consumption and Factors affecting it.

UNIT III

Traction Motors and Their Control
Features of traction motors, Significance of D.C. series, motor as traction motor, A. C. Traction motors-single phase and three phase, Linear Induction Motor, Comparison between different traction motors, Series-parallel control, Open circuit, Shunt and bridge transition, Pulse Width Modulation control of induction motors, Types of electric braking system.

UNIT IV

Electric Locomotives and Auxiliary Equipment
Important features of electric locomotives, Different types of locomotives, Current collecting equipment, Coach wiring and lighting devices, Power conversion and transmission systems, Control and auxiliary equipment.

UNITV

Feeding and Distribution System

Distribution systems pertaining to traction (distributions and feeders), Traction sub-station requirements and selection, Method of feeding the traction sub- station.

Text Books

1. H. Partab," Modern Electric Traction",DhanpatRai and Sons, New Delhi, 2017.
2. J. Upadhyay, S. N. Mahendra,"Electric Traction",DhanpatRai and Sons, New Delhi, 2000.

Reference

1. Sir Isaac Pitman and son's LTD,"Electric Traction" Hand Book R. B. Brooks. London.
2. A.T. Dover Mac millan,"Electric Traction", DhanpatRai and Sons, New Delhi, 2005.

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	L	-	M	-	-	H	L	L
CO2	H	M	-	L	-	-	H	L	-
CO3	H	M	-	L	-	-	H	L	-
C04	H	H	-	-	-	-	H	-	-
C05	L	H	-	-	M	-	H	-	-

19MEET05: MATHEMATICS FOR ELECTRICAL ENGINEERING

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives
1. To learn the concepts of matrix theory
2.Tounderstand the concepts of calculus of variations
3. To impart basic knowledge onrandom variables
4.Toexplain concepts of linear programming

Course Outcomes
After completion of the course the student will able to
CO1. Analyze generalized Eigen vectors and factorization methods
CO2. Describe the basic concepts of functional dependent and independent variables
CO3. Understand the probability functions
CO4. Explain the various linear programming methods and solutions
CO5. Illustrate concepts of Fourier series

UNIT I

Matrix Theory
The Cholesky decomposition - Generalized Eigen vectors, Canonical basis - QR factorization - Least squares method - Singular value decomposition.

UNIT II

Calculus of Variations
Concept of variation and its properties – Euler's equation – Functional dependent on first and higher order derivatives – Functional dependent on functions of several independent variables – Variation problems with moving boundaries – problems with constraints - Direct methods: Ritz and Kantorovich methods.

UNIT III

One Dimensional Random Variables
Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

UNIT IV

Linear Programming
Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models

UNIT -V

Fourier series
Fourier Trigonometric series: Periodic function as power signals – Convergence of series – Even and odd function: cosine and sine series – Non-periodic function: Extension to other intervals - Power signals: Exponential Fourier series – Parseval's theorem and power spectrum – Eigen value problems and orthogonal functions – Regular Sturm-Lowville systems – Generalized Fourier series.

Text Books

1. Richard Bronson, "Matrix Operation", 2nd Edition, Schaum's outline series, McGraw Hill, 2011.
2. Gupta.A.S, "Calculus of Variations with Applications",Prentice Hall of India Pvt. Ltd., New Delhi,1997.

Reference

1. Andrews L.C. and Phillips R.L,"Mathematical Techniques for Engineers and Scientists", Prentice Hall of India Pvt.Ltd, New Delhi, 2005.
2. Oliver C. Ibe, "Fundamentals of Applied Probability and Random Processes, Academic Press, (AnImprint of Elsevier), 2010.
3. Taha, H.A., "Operations Research, An introduction", 10^{th} edition, Pearson education, New Delhi, 2010.

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	L	-	-	-	H	L	-
CO2	H	L	-	-	-	-	H	L	-
CO3	H	-	-	L	-	-	H	M	-
C04	L	-	H	-	H	-	H	M	-
-C05	H	-	-	L	M	-	H	M	-

19MCST07: WIRELESS SENSOR NETWORKS

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Basics of wireless sensor networks and various sensor network architecture
2. Different types of Sensors and Sensing Techniques.
3. MAC protocols and Case studies.
4. Knowledge on Routing protocols of Sensor Networks
5. Security issues.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand fundamental concepts in the area of Wireless Sensor Networks.
CO2. Determine knowledge in applications of Wireless Sensor Networks.
CO3. Illustrate the MAC Protocols for Wireless Sensor Networks and case study.
CO4. Analyze the concept of Routing techniques
CO5. Identify the Security challenges and issues in sensor networks.

UNIT I

Introduction to Wireless Sensor Networks: Motivations, Applications, History and Design factors, Performance Metrics, Anatomy of Sensor Node

Sensor Network Architecture: Layered, Clustered, OSI Based, Cross Layer Architecture.

UNIT II

Sensing Techniques: Types of Sensors, Sensing Coverage, High-Level Sensors, Human as a Sensor, Actuators, sensor calibration, Detecting Errors

Designing and Deploying WSN Applications: Early WSN Deployments, General Problems, General Testing & Validation, Requirements Analysis, Top-Down Design Process, Bottom-up Implementation Process.

UNIT III

Medium Access Control Protocols for WSN: Introduction, Fundamentals, Performance Requirements,Schedule-Based Protocols, Random Access-Based Protocols, Sensor-MAC Case Study.

UNIT IV

Scheduling and Data Management: Survey on Data Routing in Wireless Sensor Networks, Data Centric Protocols: SPIN, Directed Diffusion, REAR, Rumor Routing

Hierarchical Routing: LEACH, Energy Efficient Weight-Clustering Algorithm in WSN, Self-Organizing Protocol

Location-Based Protocols, **QoS-Aware Protocols**: SPEED, MSPEED, Real-Time Power-Aware Routing.

UNIT V

Security: Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security.

Text Book

1. Anna Forster," Introduction to Wireless Sensor Networks", Wiley-IEEE Press,2016

Reference Books

1. KazemSohraby, Daniel Minoli and TaiebZnati, "Wireless Sensor Networks:Technology, Protocols, and Applications", John Wiley & Sons, Inc., 2007.
2. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, "Wireless Sensor Network Technologies for the Information Explosion Era", springer 2010.
3. W. Dargie and C. Poellabauer, "Fundamentals of Wireless Sensor Networks –Theory and Practice", John Wiley & Sons, Inc., 2010.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1					L	
CO2	H					
CO3				L		
CO4	H					
CO5					H	

19MECT02: ADVANCED DIGITAL SIGNAL PROCESSING AND ALGORITHMS

Credits - 3 **Sessional Marks: 30**
L: T: P: 3:0:0 **University Exam Marks: 70**

Course Objectives

1.The objective is to learn DSP Architecture, digital filters, power estimation technique in DSP, advanced architectures and processor of DSP.
2.To give an exposure to the various fixed point & a floating point DSP architectures and to develop applications using these processors.
3.To give students practice in applying DSP theory to real-world situations, and DSP programming

Course Outcomes

CO1. Analyze and process signals in the discrete domain
CO2. Design filters to suit specific requirements for specific applications
CO3. Perform statistical analysis and inferences on various types of signals
CO4. Design multi rate signal processing of signals through systems, Compile and solve the digital signal processing problems using MATLAB.
CO5. Analyze binary fixed point and floating-point representation of numbers and arithmetic operations

UNIT I

Lti Discrete-Time Systems In The Transform Domain Types of Linear-Phase transfer functions, Simple digital filters, Complementary Transfer Functions, Inverse Systems, System identification, Digital Two-Pairs, Algebraic Stability Test.

UNIT II

Digital Filter Structure And Design All pass filters, Tunable IIR Digital filter, IIR tapped Cascaded Lattice Structures, FIR Cascaded lattice Structures, Parallel All pass realization of IIR Transfer Functions, State Space Structures, Polyphase Structures, Digital Sine-Cosine generator, Computational Complexity of Digital filter Structures, Design of IIR filter using pade' approximation, Least square design methods, Design of computationally Efficient FIR Filters.

UNIT III

DSP Algorithms Fast DFT algorithms based on Index mapping, Sliding Discrete Fourier transform, DFT Computation Over a narrow Frequency Band, Split Radix FFT, Linear filtering approach to Computation of DFT using Chirp Z-Transform.

UNIT IV

Analysis Of Finite Word Length Effects The Quantization Process and errors, Quantization of fixed-point Numbers, Analysis of Coefficient quantization effects, A/D conversion Noise Analysis, Analysis of Arithmetic Round of errors, Dynamic range scaling, Signal to Noise ratio in Low-order IIR Filters, Low sensitivity Digital filters, Reduction of Product Round off Errors using error feedback, Limit cycle in IIR Digital filters, Round of errors in FFT algorithms.

UNIT V

Applications Of Digital Signal Processing Dual Tone Multi-frequency Signal Detection, Spectral Analysis of Sinusoidal Signals, Spectral Analysis of Nonstationary Signals, Musical Sound Processing, Over Sampling A/D Converter, Over Sampling D/A Converter, Discrete –Time Analytic Signal generation.

Textbooks

1. Digital Signal Processing by Sanjit K Mitra, Tata MCgraw Hill Publications.

References

2. Digital Signal Processing Principles, Algorithms,Applications By J G Proakis, D G Manolokis,PHI.
3. Discrete-Time Signal Processing by A V Oppenhiem, R W Schafer , Pearson Education Asia.

Course Outcomes-Program Outcomes -Program Specific Outcomes- (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M	H	L			H	M	
CO2	H	M	M	L			M	H	
CO3	M	H					M	L	H
CO4	H	M				L		L	M
CO5	M	H	M				H	M	

19MECT24: RFID SYSTEMS

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1.Explain the components, operation, and application of RFID technology
2.Understand the privacy implications with using RFID.
3.Differentiate across threat categories
4.Describe different security recommendations to secure RFID
5.Familiarity with real-world examples of how RFID has been exploited

Course Outcomes

CO1.The ability to apply the operating principle of RFID systems, the operation of each component of the RFID system

CO2.The ability to apply the two fundamentally different design approaches for delivering power from reader to tag: magnetic induction and electromagnetic wave capture.

CO3.The ability to present the operating principle of active tags, passive tags, semi-active tags, stationary readers, handheld readers.

CO4.The ability to search for documents, research the problems of RFID technology.

CO5.The ability to valuate strengths and weaknesses of RFID systems with existing technology when applied.

UNIT I

Understanding RFID Technology Introduction, RFID Technology, The elements of an RFID system, Coupling, Range and penetration, RFID Applications, Verichip and Mark of the Beast.

UNIT II

A History of EPC Introduction ,The Distributed intelligent systems, Meanwhile at Procter and Gamble, ”Low-cost” RFID protocols, ”Low cost” Manufacturing, The software and the Network, Privacy, Harnessing the juggernaut, The Six Auto-ID Labs ,The evolution of the Industry, The Creation of EPC global.

UNIT III

RFID and Global privacy policy Introduction, Definitions of privacy, Definitions of personal information, History of current privacy paradigm, Mapping the RFID Discovery process, Functions and Responsibilities for chips, Readers and Owners, privacy as a Fundamental Human Right, Constitutional Rights

UNIT IV

RFID, Privacy and Regulation Introduction, Understanding RFID privacy threats, RFID and the United states Regulatory Landscape: Introduction, Current state of RFID policy, Individuals, Business, Government, Miscellaneous, Integrity and security of the system, Government Access, Health Impact, Labour impact.

UNIT V

ApplicationsRFIDpaymentsatExxonMobil, ExxonMOBILcorporation, Transforming the Battlefield with RFID, Logistics and the Military, RFID in the Pharmacy, CVS and Auto-ID, Project Jump Start, RFID in the store.

Text Books

1.RFID Applications, Security and privacy, simsonGarfinkel and Beth Rosenberg, pearson Education.
2.Radio Frequency Identification by Stevenshepard, Mcgraw-Hill professional,1 Edition

Course Outcomes-Program Outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M					H		
CO2	L	M		H			H	L	
CO3	M	H					H		
CO4		L	M	H			H	L	
CO5	L	M			L	H	M		H

19MEET06: RENEWABLE ENERGY SYSTEMS

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. Understand the various forms of Renewable energy resources.
2. Learn the present energy scenario and the need for energy conservation
3. Explain the concept of various forms of renewable energy
4. Outline division aspects and utilization of renewable energy sources for both domestics and Industrial application
5. Analyze the environmental aspects of renewable energy resources.

Course Outcomes

At the end of this course, students will demonstrate the ability to

CO1. Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.

CO2. Know the knowledge on basic physics of solar power generation and the Performancecharacteristics.

CO3. Know about the methods of Solar power Storage and understand the applications of solar Energy.

CO4. Acquire theknowledge on basic physics of Biomass power generation and the Performanceanalysis and testing.

CO5. Get the knowledge on basic physics of Wind power generation and the performance analysisand Control strategies.

UNITI

Introduction:

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT II

Electrical Machines for Renewable Energy Conversion:

Review of reference theory fundamentals-principle of operation and analysis: induction generator (IG), Permanent magnet synchronous generator (PMSG), squirrel cage induction generator (SCIG) and doubly-fed induction generator (DFIG).

UNIT III

Power Converters:

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing

Wind: three phase AC voltage controllers- AC-DC-AC converters, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT IV

Analysis of Wind and PV Systems:
Stand-alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECS Grid Integrated solar system

UNIT V

Hybrid Renewable Energy Systems:
Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

Text Books

1. G.D.Rai "Non Conventional Energy sources", Khanna Publishers, Newdelhi, 1999.
2. G.N.Tiwari and M.K.Ghosal, "Renewable energy resources, Basic Principles and Applications", Narosa Publishing house, Newdelhi.

Reference Books

1. S.N.Badra, D.Kastha and S.Banerjee "Wind electrical Systems", Oxford university press, Newdelhi.
2. M.V.R.koteswaraRao "Energy resources Conventional &Non conventional" BS publications-Hyderabad, 2004.
3. Gilbert M.Masters "Renewable and Efficient electric power systems" Wiley interscience Publications,
   2004.

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	H	-	-	M	-	H	-	-
-CO2	H	-	-	-	M	M	H	-	-
CO3	-	-	-	-	-	M	M	-	-
C04	H	M	-	-	--	-	H	-	-
C05	H	M	-	-	-	-	H	M	-

19MEET07: SPECIAL MACHINES

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To impart knowledge on the theory of travelling magnetic field and applications of linear Motors
2. to study the performance and control of stepper motors, and their applications.
3. To learn about brush less dc motor.
4. To know the theory of operation and control of switched reluctance motor.

Course outcomes

At the end of this course, students will able to

CO1. Explain the theory of travelling magnetic field and applications of linear motors.
CO2. Understand the basic theories of stepper motors.
CO3. Analyze the performance and control of stepper motors, and their applications
CO4. Get knowledge on Brushless DC motor and Permanent magnet motor performance
CO5. Discuss the Switched mode reluctance motor operation and characteristics.

UNIT I

Permanent Magnet Brushless Dc Motors

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Characteristics and control.

UNIT II

Permanent Magnet Synchronous Motors

Principle of operation – EMF and Torque equations - Phasor diagram - Power controllers –Torque speed characteristics – Digital controllers – Constructional features, operating principle and characteristics of synchronous reluctance motor.

UNIT III

Switched Reluctance Motors

Constructional features –Principle of operation- Torque prediction–Characteristics Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

UNIT IV

Stepper Motors

Constructional features –Principle of operation –Types- Permanent magnet stepper motor, Variable reluctance stepper motor, Hybrid synchronous stepper motor–Torque predictions – Linear and Non-linear analysis – Characteristics – Drive circuits – Closed loop control –Applications

UNIT V

Other Special Machines

Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear motor – Applications

Text Books

1. VVAthani, "Stepper Motors Fundamentals, Applications, and Design", New Age International, 1997.
2. TJE Miller, "Brushless Permanent-Magnet and Reluctance Motor Drives" Clarendon Press Oxford, 2010.
3. R.Krishnan,"Switched Reluctance Motor Drives" CRC Press, 2001.

Reference Books

1. K.Venkatarathnam,"Special electrical machines", University press, New Delhi 2009.
2. E.G.janardhan,"Special electrical machines", PHI learning private limited, 2014

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	-	-	-	-	-	-	-
CO2	H	-	-	-	-	-	-	-	-
CO3	-	H	-	-	-	-	-	H	-
C04	H	-	-	-	--	-	-	-	-
C05	H	-	-	-	-	-	-	M	-

19MBST01: RESEARCH METHODOLOGY AND IPR

Credits – 2 **Sessional Marks: 30**
L: T:P::2:0:0 **University Exam Marks: 70**

Course Objectives

1. To gain familiarity in order to obtain insights into selected area of research.
2. To acquaint procedures and techniques used to find the results of a research problem.
3. To familiarize methods for data analysis and design.
4. To know the steps to collect information about IPR.
5. To implementIPR protection strategies and other facilities provided by R &D in case of new innovation.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand the research problem formulation

CO2. Analyze research related information

CO3. Follow research ethics

CO4. Understand that today's world is controlled by computer, information technology but tomorrow world will be ruled by ideas, concept and creativity.

CO5. Understand that when IPR would take such important place in growth of individuals and nation, it is needless to emphasise the need of information about intellectual property rights to be promoted among students in general and engineering in particular.

CO6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R&D, which leads to creation of new and better products, and intern brings about economic growth and social benefits.

UNITI

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNITII

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNITIII

Design and Analysis of Experiments: Introduction to ANOVA with examples; Factorial design: 2^n design; Taguchi method: Introduction and application of taguchi method for optimization of process.

UNITIV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

UNITV

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology, Patent information and databases, Geographical Indications

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc, Traditional knowledge Case Studies, IPR and IITs.

Text Book

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students".

Reference Books

1. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
2. Ranjit Kumar, "Research Methodology: A Step by Step Guide for beginners",2 nd Edition
3. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
4. Mayall, "Industrial Design", McGraw Hill, 1992.
5. Niebel, "Product Design", McGraw Hill, 1974.
6. Asimov, "Introduction to Design", Prentice Hall, 1962.
7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
8. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

MEEP01: DIGITAL CONTROL SYSTEMS LAB

Credits – 2 **Sessional Marks: 40**
(L: T: P :: 0:0:4) **University Practical Exam Marks: 60**

Course Objectives:
1. To gain strong knowledge on MATLAB software.
2. To learn the stability analysis of digital control system using MATLAB software.
3. To study about Z-Transforms usage in MATLAB software.

Course Outcomes:
At the end of this course, students will be able to
CO1. Obtain discrete representation of LTI systems.
CO2. Acquire knowledge on Z-Transforms in discrete time analysis.
CO3. Determine the stability analysis of digital control system using MATLAB software.
CO4. Implement different operations and techniques using MATLAB software.

LIST OF EXPERIMENTS

1. Discretization
2. Solving Differential Equations
3. Inverse Z-Transforms
4. Jury Stability Test
5. Transient response Characteristics
6. Design and simulation of a State feedback system
7. Transfer function from state equation
8. Controllability and Observability
9. Stability analysis of a given system using
   (i) Root Locus (ii) Bode Pot (iii) Lyapunov Stability
10. Implementation of a Full order and minimum order observer
11. Integration of a Polynomial
12. Derivative of Polynomial
13. Linear Equations
14. State Transition Matrix

Course Outcomes-Program outcomes -Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M	L	L	-	M	H	M	L
CO2	H	-	-	M	-	-	M	H	-
CO3	-	-	H	M	-	-	L	H	-
C04	M	-	H	L	-	-	L	H	-

M.Tech
I Year II Semester

S.No	Course Code	Course Title
1	19MEET08	Power Converters
2	19MEET09	Power Electronic Control of AC Drives
3		Elective-III/MOOCS
4		Elective-IV
S.No	**Course Code**	**Course Title**
5	19MEEP02	Power Converters Lab
6	19MEEP03	Electrical Systems Simulation Lab
7	19MEES01	Term Paper Cum Seminar

19MECP02: SIGNAL PROCESSING LAB

Credits – 2 **Sessional Marks: 40**
(L: T: P :: 0:0:4) **University Practical Exam Marks: 60**

Course Objectives

1. Develop simple algorithms for signal processingapplications.
2. WriteprogramstoperformcomputationinsignalprocessingusingMATLA

B 3.To design and test digital filters for signalprocessingapplications.

Course Outcomes

After completion of the practical course the student will be able to CO1. Analyze and process signals in the discrete domain CO2.Ability to identify the signals using MATLAB

CO3. Design and analyse offilterfunctionsto suit to a forSpecificapplication.
CO4.Able to use matlab tools signal processing applications.

CO5.Develop andanalyzethe filters on various types of signals operations.

LIST OF EXPERIMENTS USING MATLAB

1. BilinearTransformations
2. Impulse InvariantTransformations
3. Filter functionoperation
4. Design of Filter low passFilter
5. DesignandAnalysisofButterworthLowpassfilter,Highpassfilte r and Band passfilter
6. DesignandtestingofChebysevType1LowpassFilter,Highpassfilterand Band passfilter.
7. DesignandtestingofChebysevType2LowpassFilter,Highpassfilterand Band passfilter.
8. ComparisionofFIRandIIRLowpassFilterCharacteristics,
9. ComparisionofFIRandIIRHighpassFilterCharacteristics
10. ComparisionofFIRandIIRBandpassFilterCharacteristics

Course Outcomes-Program Outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M		M		L	H		L
CO2		M	H		M			H	L
CO3			L		M	L	H		L
CO4	L	M	M				H	M	L
CO5	H	M					H	M	L

M.Tech
I Year II Semester

ELECTIVE - III

S.No	Course	Course Title
1	MOOCS	

ELECTIVE - IV

S.No	Course	Course Title
1	19MMET13	Robotics
2	19MEET12	FACTS and HVDC
3	19MEET13	Solar & Energy Storage Systems
4	19MEET14	Power Quality

19MEET08: POWER CONVERTERS

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To impart basic knowledge of phase controlled converter operations in power electronic Engineering.
2. To provide knowledge on switched mode dc-dc converters.
3. To prepare students to analyses and design different power converter circuit.
4. To introduce the inverters and multilevel inverters
5. To know the design consideration of resonant pulse inverters

Course Outcomes

After completion of the course the student will able to

CO1. Analyze and design phase controlled rectifiers.
CO2. Describe the basic concepts of Choppers and switching mode regulators
CO3. Understand the working of inverters and multilevel inverters.
CO4. Apply the various methods of firing and harmonic reduction techniques.
CO5. Implement various methods of resonant inverters.

UNIT I

Phase Controlled Rectifiers

Introduction-Principles of phase controlled converter operations-single phase full converters-single phase dual converters-principle of operation of three phase-Half-wave & Full wave converters with RL load-Three phase dual converters-twelve-pulse converters. Numerical problems.

UNIT II

Switched Mode DC-DC Converters

Introduction-Principle of Step-up & step-down operation-performance parameters-Converters Classification-Switching mode regulators-Analysis of Buck-Boost-Buck Boost-Cuk Regulators- Multi output Boost Converters. Numerical Problems.

UNIT III

Inverters

Introduction-Principle of operation-Performance Parameters-single phase bridge inverters-Three phase Bridge inverter-180 Degree,120 Degree Conduction-Voltage Control of single phase inverters-Advanced Modulation Techniques-Voltage control of three phase inverters-Harmonics Reduction-Current Source Inverter-Variable DC link Inverter-Boost Inverter-Inverter Circuit Design. Numerical Problems.

UNIT IV

Multilevel Inverters:

Multilevel concept-Types of Multi level Inverters-diode clamped-flying capacitor-cascade type multilevel inverters-Comparison of multilevel inverters-application of multilevel inverters-reactive power compensation-back to back intertie system-adjustable drives-switching device currents-dc link capacitor Voltage balancing-features of multilevel inverters. Numerical Problems.

UNIT-V

Resonant Pulse Inverters:
Introduction-Series Resonant Inverters-Frequency Response of series-resonant Inverter-Parallel Resonant Inverters-Voltage control of resonant inverters-Class E resonant Rectifier Class E resonant Inverter-Zero Current Switching Resonant Converters-Zero Voltage Switching Resonant Converters-Comparison between ZCS & ZVS resonant Converters-Two Quadrant ZVS resonant Converters-Resonant DC link Inverters Numerical Problems.

Text Books

1. Rashid, "Power Electronics: Devices Circuits and Applications", 4th Edition, Pearson Education, 2017.
2. BimalK.Bose,"Modern Power Electronics and AC Drives",2nd Edition, Pearson Education, 2005.

References

1. P.C Sen"Modern Power Electronics",1st Edition, Wheeler publishing Company, New Delhi-2005.
2. Mohan, "Power Electronics: Converters Applications and Design" Wiley Indiapvt ltd- edition 2007.
3. R. Krishnan,"Electric Motor Drives Modelling, Analysis, and Control", Prentice Hall India Learning Private Limited, 2002.

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	-	H	M	L	-	-	H	M	L
CO2	H	L	-	-	-	M	H	L	-
CO3	H	M	L	L	-	-	H	-	L
C04	L	L	-	H	--	-	M	L	-
C05	H	-	L	M	-	-	H	L	-

19MEET09: POWER ELECTRONIC CONTROL OF AC DRIVES

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To impart basic knowledge of Ac motor drives- Torque production and speed control methods
2. To prepare students to analyses CSI and VSI fed induction motor drive, Kramer Drive and StaticScherbius Drive.
3. To provide knowledge on speed control scheme of synchronous motor drives.
4. To introduce the special machines drives.
5. To know about brushless dc motor drives.

Course Outcomes

After completion of the course the student will able to

CO1. Understand speed control methods of Ac motor drives
CO2. Describe the basic concepts of Stator and rotor side speed control methods.
CO3. Analyze the speed control scheme of synchronous motor drive.
CO4. Apply the various methods of flux Controllers for synchronous motor drive.
CO5. Describe various drives like Variable Reluctance Motor and brushless dc motor Drives.

UNIT I

Introduction:

Introduction to motor drives- Torque production- Equivalent circuit analysis- Speed-Torque Characteristics with variable voltage operation, Variable frequency operation constant V/f operation- Variable Stator Current operation- Induction motor characteristics in constant torque and field weakening regions**.**

UNIT II

Stator Side Control of Induction Drives:

Scalar Control- VSI fed induction motor drive control- Open loop Volts/Hz control – speed control slip regulation- speed control with torque and flux control- CSI fed induction motor drive – Independent current and frequency control – speed and flux control in current fed inverter drive- Volts/Hz control of current fed inverter drive- Efficiency maximization through optimal flux Control.

UNIT III

Rotor Side Control of Induction Drives:

Slip power recovery drives- Static Kramer Drive- Phasor diagram- Torque expression – speed control of Kramer Drive- Static Scherbius Drive- modes of operation.

UNIT IV

Control of Synchronous Motor Drives:

Synchronous motor and its characteristics- Control strategies – Constant torque angle control- Unity power factor control- Constant mutual flux linkage control.

Controllers: Flux Weakening operation- Maximum speed – Direct flux weakening algorithm- Constant Torque mode controller- Flux Weakening Controller- indirect flux weakening – Maximum permissible torque- speed control scheme – Implementation strategy speed controller design.

UNITV

Variable Reluctance Motor Drive:

Variable Reluctance Motor Drive- Torque production in the Variable Reluctance Motor Drive – characteristics and control principles – Current control Variable Reluctance Motor Servo Drive

Brushless Dc Motor Drives: Three Phase full wave Brushless DC motor- Sinusoidal type of Brushless DC motor- Current controlled Brushless Dc Motor Servo Drives.

Text Books

1. B K Bose, "Power Electronics and AC Drives",1st Edition, Pearson Education India (for chapters I, II, IV) , 2015.
2. R. Krishnan,"Electric Motor Drives Modelling, Analysis, and Control", Prentice Hall India Learning Private Limited, 2002.

References

1. MH Rashid, "Power Electronics Circuits, Devices and Applications", PHI, 2nd Edition, 2010.
2. P.C Sen"Modern Power Electronics", 1st Edition, Wheeler publishing Company, New Delhi-2005.
3. Undeland, Robbins, Mohan,"Power Electronics: Converters Applications and Design" Wiley India pvt ltd- edition 2007.

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	-	-	-	-	M	H	L
CO2	H	-	-	-	-	-	H	M	L
CO3	-	H	-	-	-	-	H	M	-
C04	-	H	-	-	-	-	-	H	-
C05	H	-	-	-	-	-	L	M	H

19MMET13– ROBOTICS

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

COURSE OBJECTIVES

To expose the students to the following:

1. Basics of automation and brief history of robot and applications.
2. Kinematics and dynamics of robots.
3. Robot drive system and control systems.
4. Various Sensors and their applications in robots.

COURSE OUTCOMES

After successful completion of course the student should be able to

CO1 Gain knowledge with the automation and brief history of robot and applications.
CO2 Familiarize with the kinematic and dynamic motions of robot.
CO3 Have good knowledge about robot end effectors.
CO4 Explain the principles of various Sensors and their applications in robots.
CO5 Able to represent in matrix form and solve problems.

UNIT – I

Fundamentals of Robots: Introduction, definition of robot, classification of robots, History of robotics, robotcomponents, degree of freedom, robot joints, robot coordinates, reference frames, programming modes, robot characteristics, robot work space, robot languages, advantages, disadvantages and applications of robots.

UNIT – II

Robot control systems –Different types of controllers, On-Off , Proportional, Integral, Proportional andDerivative (PD), Proportional and Integral (PI) Controllers, PID controllers – Analysis of robot joint axis – open loop and closed loop control systems – servo and non servo controlled robots

UNIT – III

Robot Actuators: Introduction, characteristics of Actuating systems-weight, power to weight ratio, operatingpressure, stiffness Vs compliance, comparison of actuating systems, hydraulic devices, pneumatic devices, Electric motors-DC motorcar motors, Brushless DC motors, direct Drive electric motors, servomotors, stepped motors.

Robot sensors: Introduction, sensor characteristics, Position sensors-potentiometers, encoders, LVDT,Resolvers, time of travel displacement sensor, Velocity sensors-Encoders, Tachometers, differentiation of position signal, Accelerating sensors, force and pressure sensors-piezoelectric, force sensing resistor, strain gauges, Torque sensors, light and infrared sensors, touch and tactile sensors, sensors, inductive proximity sensors, capacitive proximity sensors, eddy current proximity sensors, sniff sensors.

UNIT – IV

Matrix transformations: Introduction, robots as a mechanisms, matrix representation-representation of a pointin a space, representation of a vector in space, representation of a frame at the origin of a reference frame, representation of a frame in a reference frame, representation of a rigid body. Homogeneous transformation matrices, representation of a pure translation, pure rotation about an axis, representation of combined transformations, transformations relative to the rotating, inverse of transformation matrices.

Robot kinematics: Forward and inverse kinematics of robots-forward and inverse kinematic equations forposition, forward and inverse kinematic equations for orientation, forward and inverse kinematic equations for position and orientation, Denavit-Hartenberg (D-H) representation of forward kinematic equations of robots, The inverse kinematic solution and programming of robots, Degeneracy and Dexterity, simple problems with D-H representation.

UNIT – V

Dynamic analysis and forces: Introduction, Lagrangian mechanics, Effective moments of inertia, dynamicequations for multi-degree of freedom robots-kinetic energy, potential energy, the Lagrangian, robots equations of motion, static force analysis of robots.

Trajectory planning: Introduction, path Vs trajectory, basics of trajectory planning, joint space trajectoryplanning-third order polynomial trajectory planning, fifth order polynomial trajectory planning, Cartesian-space trajectories.

Text Books

1. Saeed B. Niku, "Introduction to Robotics" – Analysis, System, Applications by PHI Publications
2. Mikell P. Groover& Mitchell Weiss -Roger N. Nagel,NicholasG.Odrey "Industrial Robotics" –,– McGraw Hill, 1986 .

Reference Books:

1. RachidManseur, "Robot Modeling and Kinematics" –Firewall Media Publishers (An imprint of Laxmi Publications Pvt. Ltd., New Delhi)
2. H. Asada and J.J.E. Slotine John Willey &Sons."Robot Analysis and Control"
3. Robert J. Schilling, "Fundamentals of Robotics", Analysis and control, Prentice Hall, 1990.
4. Mohsen shahinpoor, "A robot Engineering text book" –Harper & Row Publishers,1987.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO – PO – PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H			H	M			M	L	L
CO2			L	M	M	H	M	H	M	M
CO3	L		M	L	H	M	L	L	H	
CO4	M			L		H	M	M	L	M
CO5			L	M	L	L	H	H	M	L

19MEET12: FACTS and HVDC

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To understand the fundamentals of FACTS Controllers.
2. Toknow the importance of controllable parameters and types of controllers and their benefits.
3. To Import Knowledge on voltage and phase angle regulators.
4. ToStudy HVDC Transmission systems.
5. To Understand the Control Aspects of HVDC Systems.

Course Outcomes

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

CO1. Choose proper FACTS Controller for the Specific Application based on requirements.
CO2. Analyze the control circuits of Shunt controller, Series Controller and combined controller.
CO3. Choose appropriate voltage regulator for particular applications.
CO4. Compare EHVAC and HVDC system and to describe various types of DC Links.
CO5. Describe various methods for the control of HVDC Systems and to perform power flow analysis in AC/DC systems

UNIT I

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

UNIT II

Static Series Compensators:Objectives of Series Compensation, GTO thyristor- controlled series capacitors (GCSC), thyristor switched series capacitor (TSSC).and thyristor controlled series capacitor (TCSC), Sub synchronous Characteristics, Basic Operating control schemes for GCSC, TSSC and TCSC, Static Synchronous Series Compensators (SSSC).
Static shunt compensators:Objectives of shunt compensation, Methods of controllable VAR generation, Static VAR compensators: SVC and STATCOM, Comparison between SVC and STATCOM

UNIT III

Objectives of Voltage and Phase angle Regulators, Voltage and Phase angle regulation, Power flow control by phase angle regulators, Real and Reactive Loop Power Flow control, Improvement of Transient stability and Power oscillation damping with phase angle regulators.
Unified Power Flow Controller (UPFC):Basic Operating Principles, Independent real and reactive power flow control, Comparison of UPFC to Series compensators and Phase angle Regulators

UNIT IV

Introduction to HVDC

Introduction- comparison of AC and DC transmission-application of DC transmission-description of DC transmission system-planning for HVDC transmission- modern trends in DC transmission, Different configuration of HVDC scheme.

Analysis of HVDC Converters

Pulse number- choice of converter configuration – simplified analysis of Graetz circuit converter bridge characteristics – characteristics of twelve pulse converter, Different faults occurred in converter, Protection against over voltage, over current.

UNIT V

HVDC System Control

General principles of DC link control- converter control characteristics – System control hierarchy – firing angle control – current and extinction angle control – starting and stopping of DC link – power control-higher level controllers – telecommunication requirements. Harmonics and Filters : Introduction- generation of harmonics- design of AC filters- DC filters- carrier frequency and RI noise.

Text Books

1. K.R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Publishers, New Delhi, Copyright 2007.
2. K.R.Padiyar, "High Voltage Direct current Transmission", New Age International (P) Limited, Publishers, New Delhi, Reprint 2005.

References

1. J.Arrillaga, "Flexible Power Transmission The HVDC Options", John Wiley & Sons Ltd,2007.
2. S.Kamakshaiah, V.Kamaraju,"H.V.D.C.Tranmission", Tata McGraw Hill,2011.
3. Hingorani, L.Gyugyi, 'Concepts and Technology of Flexible AC Transmission System', IEEEPress New York, 2000 ISBN –078033 4588.

Course Outcomes-Program outcomes-Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	L	-	-	-	H	-	-
CO2	-	H	-	L	-	-	-	H	-
CO3	H	-	L	-	-	-	H	-	-
C04	H	-	-	H	-	-	H	-	-
C05	H	-	L	-		-	H	-	-

19MEET13: SOLAR & ENERGY STORAGE SYSTEMS

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To Import Knowledge on solar cells and its Characteristics.
2. To understand the Performance of PV System when connected to grid.
3. To Describe standalone PV Systems and its importance.
4. To Provide an insight in to the various modes of energy storage systems.
5. To Demonstrate various applications of solar and energy storage systems.

Course Outcomes

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

CO1. Estimate and analyze the performance characteristics of Solar cells
CO2. Demonstrate an understanding of standalone PV systems design and protection
CO3. Select and Analyze suitable PV Systems for Grid Connection.
CO4. Identify Various Means of Energy Storage and Demonstrate Knowledge on energy storage modes.
CO5. Analyze various applications of solar and energy storage systems.

UNIT I

Introduction

Characteristics of Sunlight - Semiconductors and P-N junctions – PV cell- PV cell characteristics - behavior of solar cells- solar cell characteristics -cell properties - PV cell interconnection

UNIT II

Stand Alone PV Systems

Solar modules - storage systems - Power conditioning and regulation – protection – stand-alone PV systems design – sizing - International PV programs

UNIT III

Grid Connected PV Systems

PV systems in buildings - design issues for central power stations – safety - Economic aspect Efficiency and performance –International PV programs

UNIT IV

Energy Storage Systems

Impact of intermittent generation –Battery energy storage –Solar thermal energy storage-pumped hydroelectric energy storage

UNIT V

Applications

Water pumping –Battery chargers - solar car – direct - drive applications – space - Telecommunications.

Text Books:

1. James M. Eyer, Joseph J. Iannucci and Garth P. Corey “, “Energy Storage Benefit and Market Analysis”, Sandia National Laboratories, 2004.
2. The Electrical Energy Storage by IEC Market Strategy Board.
3. Edward T. Glasby,”Storage & Reliability of Electricity (Energy Science, Engineering and Technology)”, Nova Science Publications, 2011.

Reference Book:

1. “Jim Eyer, Garth Corey”, Energy Storage for the Electricity Grid: Benefits and
2. Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010
3. Adam Stienecker,”Hybrid Energy Storage Systems”VDMVerlag , 2009.
4. J K Kaldellis,”Stand-Alone and Hybrid Wind Energy Systems: Technology, Energy Storage and Applications”, Woodhead Publishing Series in Energy, 2010.

Course Outcomes-Program outcomes-Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	-	-	-	H	M	-	H	-
CO2	H	-	-	L	-	M	H	-	-
CO3	H	-	-	L	-	M	M	H	-
C04	H	-	-	L	-	M	H	-	-
C05	H	-	-	L	-	M	M	H	-

19MEET14: POWER QUALITY

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1 To introduce the basic concepts of power quality and its issues.
2. Analysis and mitigation of power quality issues.
3. Study of basic concepts, different types, and applications of FACTS controllers in power system.

Course Outcomes

After completion of the course the student will able to

CO1. Describe the power quality issues.
CO2. Analyze the voltage disturbances and suggest suitable mitigating techniques.
CO3. Understand the working principles of FACTS devices and their operating Characteristics.
CO4. Estimate the effect of shunt and series reactive compensation.
CO5. Apply the concepts in solving problems of simple power systems with FACTS Controllers.

UNIT I

Introduction:

Introduction – Characterization of Electric Power Quality: Transients, short duration andlong duration voltage variations, Voltage imbalance, waveform distortion, Voltagefluctuations, Power frequency variation, Power acceptability curves – power qualityproblems: poor load power factor, Nonlinear and unbalanced loads, DC offset in loads,Notching in load voltage, Disturbance in supply voltage – Power quality standards.

UNITII

Non-Linear Loads:

Single phase static and rotating AC/DC converters, Three phase static AC/DCconverters, Battery chargers, Arc furnaces, Fluorescent lighting, pulse modulateddevices, Adjustable speed drives.

UNIT III

Measurement and Analysis Methods:

Voltage, Current, Power and Energy measurements, power factor measurements anddefinitions, event recorders, Measurement Error – Analysis: Analysis in the periodicsteady state, Time domain methods, And Frequency domain methods: Laplace's, Fourier andHartley transform – The Walsh Transform – Wavelet Transform.

UNIT IV

Analysis and Conventional Mitigation Methods:

Analysis of power outages, Analysis of unbalance: Symmetrical components of phasorquantities, Instantaneous symmetrical components, Instantaneous real and reactivepowers, Analysis of distortion: On–line extraction of fundamental sequence componentsfrom measured samples – Harmonic indices – Analysis of voltage sag: DetotitEdisonsag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis ofvoltage flicker, Reduced duration and customer impact of outages, Classical load Balancing problem: Open loop balancing, Closed loop balancing, current balancing,Harmonic reduction, Voltage sag reduction.

UNIT V

Power Quality Improvement:

Utility-Customer interface –Harmonic filters: passive, Active and hybrid filters –Custompower devices: Network reconfiguring Devices, Load compensation using DSTATCOM,Voltage regulation using DSTATCOM, protecting sensitive loads using DVR, UPQC –control strategies: P-Q theory, Synchronous detection method – Custom power park –Status of application of custom power devices.

Text Books

1. ArindamGhosh, "Power Quality Enhancement Using Custom Power Devices", Springer Publishers, 2012.
2. R. C. Dugan, "Electrical Power Systems Quality", Tata McGraw Hill Education, 2012.

References:

1. G.T.Heydt "Electric Power Quality", 2nd edition, Stars in a Circle Publications,2009.
2. Derek A. Paice, "Power electronic converter harmonics", 2ndEdition, IEEE Press, 1996.
3. Jos Arrillaga, R. Watson. John,"Power system harmonics",2ndEdition, Wiley & Sons Ltd, 2000.
4. T. J. E. Miller, "Reactive Power Control in Electric Systems", John Wiley and Sons, New York,1983.

Course Outcomes-Program outcomes-Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M	-	L	-	-	H	-	-
CO2	H	-	-	-	M	-	H	-	-
CO3	H	M	-	-	-	-	H	M	-
C04	M	H	-	-	-	-	H	L	-
C05	H	H	-	L	-	-	M	-	H

19MEEP02:POWER CONVERTERS LAB

Credits – 2 **Sessional Marks: 40**
(L: T: P :: 0:0:4) **University Practical Exam Marks: 60**

Course Objectives:

1. To gain strong knowledge on Matlab software.
2. To learn the working concepts of different power converters using Matlab software.
3. Tolearntheconceptsof different Inverters in Matlab software.

Course Outcomes:

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

CO1. Acquire simulationknowledge on single phase converters .
CO2. Acquire simulation knowledge on three phase converters
CO3. Acquire knowledge on different types of dc to dc converters.
CO4. Acquire knowledge on Voltage source and current source inverters

LIST OF EXPERIMENTS

1. Single phase fully controlled converter with L loads
2. Three phase fully wave converter with R and RL loads
3. Series resonant inverter
4. Parallel resonant inverter
5. Buck- Boost converter
6. Cuk converter
7. Single phase dual converter
8. Two quadrant ZVS resonant converter
9. Three phase bridge inverter with 180 conduction
10. Current source inverter

Course Outcomes-Program outcomes-Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	-	-	-	-	M	H	-
CO2	H	M	-	-	-	-	M	H	-
CO3	H	-	-	M	-	-	M	H	-
C04	H	-	-	M	-	-	M	H	-

19MEEP03: ELECTRICAL SYSTEMS SIMULATION LAB

Credits – 2 **Sessional Marks: 40**
(L: T: P :: 0:0:4) **University Practical Exam Marks: 60**

Course Objectives

1. To get the knowledge on simulation of 1-Φ, 3- Φ, full, half converters with different types of Loads and Inverters
2. To get the knowledge on simulation of A.C voltage controller, speed control of PMSM, induction motor, separately excited D.C motor

Course Outcomes

At the end of this course students will be able to

CO1. Understand how to model and simulate 1-Φ, 3- Φ, full and half converters with different Types of Loadsusing Matlabsimulink
CO2. Acquire knowledge on simulation of Inverters using Matlabsimulink
CO3. Gain knowledge on speed control of PMSM, Induction motor, separately excited D.C motor using Matlabsimulink

LIST OF EXPERIMENTS

1. Simulation of single phase full converter with RLE load
2. Simulation of three phase full converter with RLE load
3. Simulation of three phase inverter 180 degree mode
4. Simulation of open loop control of PMSM using matlabsimulink
5. Simulation of induction motor with closed loop constant V/F control using matlabsimulink
6. Simulation of speed control of separately excited DC motor using matlabsimulink
7. Modelling and simulation of single phase half wave rectifier with R and RL load
8. Modelling and simulation of single phase full wave rectifier with R and RL load
9. Modelling and simulation of single phase AC voltage controller with R and RL load

Course Outcomes-Program outcomes -Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	H	-	-	-	-	M	H	-
CO2	L	M	H	-	-	-	M	H	-
CO3	-	M	H	-	-	-	M	H	--

19MEES01: TERM PAPER CUM SEMINAR

Credits – 2 **Sessional Marks: 40**
L:T:P::0:0:4 **University Exam Marks: 60**

Course Objectives

To expose the students to the following:
1. Identify, understand and discuss current, real-time issues.
2. Improve oral and written communication skills.
3. Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
4. Apply principles of ethics and respect in interaction with others.

Course Outcomes

After successful completion of course the student should be able to
CO1. Acquire in-depth knowledge in the chosen seminar topic.
CO2. Analyse critically the chosen seminar topic for arriving at conclusions.
CO3. Understand the impact of seminar output in the context of environmental sustainability.
CO4. Develop communication skills for preparing and presenting seminar report.
CO5. Develop skills for continuous learning to improve knowledge and competence in the chosen field of seminar.

Course Outcomes-Program outcomes -Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	-	-	H	-	L	H	M	L
CO2	-	M	-	-	H	L	M	H	L
CO3	H	-	-	M	-	L	-	M	H
C04	-	M	H	-	-	L	M	H	L
CO5	-	-	-	L	M	H	L	H	M

M.Tech
II Year I Semester

S.No	Course Code	Course Title
1		Elective-V
2		Open Elective
3	19MEEJO1	Project Work Phase-I
4	19MEEV01	Comprehensive Viva

ELECTIVE - V

S.No	Course Code	Course Title
1	19MEET15	SCADA Systems And Applications
2	19MEET16	FACTS and CustomPower Devices
3	19MEET17	Neural Network & Fuzzy Logic
4	19MEET18	Smart Grid

OPEN ELECTIVES

S.No	Course Code	Course Title
1	19MBST02	English For research Paper Writing
2	19MMET22	Advanced Operations Research
3	19MECT22	Advanced Embedded Systems
4	19MCST18	Information retrial systems
5	19MEET19	Solar Energy Utilization

19MEET15: SCADA SYSTEM AND APPLICATIONS

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To understand the fundamentals of automations and various automation systems in industries
2. Todetermine hardware and software requirements of PLC and SCADA
3. To understand the safety requirements and design safety of instrumented systems
4. To use various SCADA system architectures
5. To design any application based on these systems

Course Outcomes

After completion of the course the student will able to

CO1. Define automation, its importance, expectations from automation and application in Industries
CO2. Describe the SCADA architecture, communication in SCADA
CO3. Understand the working of PLC, I/O Modules of PLC, Basics of PLC
CO4. Analyze the various standard communication protocols.
CO5. Develop any application based on SCADAs

UNITI

Introduction to SCADA: Data acquisition systems, Evolution of SCADA, Communication technologies.

UNIT II

Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries SCADA`

UNIT III

Industries SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems

UNIT IV

SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture –International Electro-Technical Comission's (IEC))IEC 61850.

UNIT-V

SCADA Communication: various industrial communication technologies -wired and wireless methods and fiber optics. Open standard communication protocols.

SCADA Applications: Utility applications- Transmission and Distribution sector-operations, monitoring, analysis and improvement. Industries - oil, gas and water.Case studies, Implementation, Simulation Exercises.

Text Books

1. Stuart A. Boyer, “SCADA-Supervisory Control and Data Acquisition”, Instrument Society of America Publications, USA, 2004.
2. Gordon Clarke, Deon Reynders, “Practical Modern SCADA Protocols: DNP3, 60870.5 and
3. Related Systems”, Newness Publications, Oxford, UK, 2004.
4. William T. Shaw, “Cyber security for SCADA systems”, Penn Well Books, 2006.

Reference

1. David Bailey, Edwin Wright, “Practical SCADA for industry”, Newness, 2003.
2. Wiebe, Penn Well “A guide to utility automation: AMR, SCADA, and IT systems for electric Power”, 1999.

Course Outcomes-Program outcomes -Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	M	-	-	-	M	H	-
CO2	H	-	-	M	-	-	M	H	-
CO3	H	-	M	L	-	-	H	M	-
C04	-	H	M	-	L	-	-	H	M
C05	-	H	M	-	-	-	-	H	-

19MEET16: FACTS AND CUSTOM POWER DEVICES

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives
1. TocontrolReactive power flow in Power Systems
2. TounderstandReactive power compensation at transmission and distribution level.
3. To compare and contrast various compensators of reactive power
4. To Import Knowledge on the operation of various custom power devices.
5. Introduction to Modeling and analysis of FACTS

Course Outcomes
After completion of the course the student will be able to
CO1. Analyze the Compensation and control of real and reactive power
CO2. Explain the operation of static series compensators and its Control.
CO3. Enhance Power Quality Using Custom Power Devices
CO4. Modeling and analysis of FACTS devices.
CO5. Describe the operation of static shunt compensators and its applications.

UNIT I

Reactive power flow control in Power Systems – Control of dynamicpower unbalances in Power System. Power flow control -Constraints of maximum transmission line loading –Benefits of FACTS Transmission line compensation. Uncompensated line -Shunt compensation - Series compensation – Phase angle control.Reactive power compensation.ShuntandSeries compensation principles – Reactive compensation attransmission and distribution level.

UNIT II

Static versus passive VAR compensator, Static shunt compensators: SVC and STATCOM - Operation and control of TSC, TCR and STATCOM - Compensator control.Comparison between SVC and STATCOM.

UNIT III

Static series compensation: TSSC, SSSC -Static voltage and phase angle regulators – TCVR and TCPAR Operation and Control –Applications, Static series compensation – CSC, TSSC, TCSC and Static synchronousseries compensators and their Control.

UNIT IV

SSR and its damping Unified Power Flow Controller: Circuit Arrangement, Operation and control of UPF. Basic Principle of P and Q control- Independent real and reactive power
flow control- Applications.

UNITV

Introduction to interline power flow controller.Modeling and analysis of FACTS Controllers – Simulation of FACTS controllers Power quality problems in distribution systems, harmonics.Loads that create harmonics, modeling, harmonic propagation, series and parallel resonances, mitigation of harmonics, passive filters, active filtering – shunt, series and hybrid and their control.

Text Books

1. ArindamGhosh, "Power Quality Enhancement Using Custom Power Devices", 2nd Edition, Springer Publishers, 2012.
2. K.R. Padiyar,"FACTS Controllers in Power Transmission and Distribution",2ndEdtion, New Age International (P) Limited Publishers, second edition, 2016.

Reference Books

1. "Understanding FACT Concepts and Technology of Flexible AC Transmission Systems", byNarain G. Hingorani, Wiley Publishers, 2011.
2. K.R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Publishers, New Delhi, Copyright 2007.

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	H	-	-	L	-	M	H	L
CO2	H	-	-	-	L	-	H	-	L
CO3	H	-	-	-	L	-	H	-	L
C04	M	H	-	-	L	-	M	H	L
C05	H	-	-	-	L	-	H	-	L

19MEET17: NEURAL NETWORK AND FUZZY LOGIC

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives:

1. To know the Importance of AI techniques in engineering applications
2. To familiarize with the concepts of Artificial Neural networks and Biological Neural Network.
3. To study the ANN approach in various Electrical Engineering problems.
4. To impart knowledge on Fuzzy Logic and Its use in various Electrical Engineering Applications

Course Outcomes:

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

CO1. Discuss the concepts of Artificial Neural networks
CO2. Acquire the adequate knowledge about feedback networks.
CO3. Explain the learning rules and control applications of Neural Networks.
CO4. Understand the concept of fuzziness, fuzzy set theory and gain the comprehensive Knowledge of fuzzy logic control and adaptive fuzzy logic
CO5. Design of fuzzy systems for real time applications

UNIT I

Biological neuron Vs artificial neuron, structure and activation functions – Neural network architectures –learning methods, stability and convergence .Single layer networks –Mcculloh–pitts neuron model, Perceptron training and algorithm, delta learning, Windrow-Hoff learning rules, limitations, Adeline and modification.

UNIT II

Multilayer networks, architectures and modeling, BP algorithm, radial basis functions. Unsupervised Learning-Winner take all learning, out star learning, Counter propagation networks, self-organizing networks-Kohonen.

UNIT III

Grossberg, Hamming NET, MAXNET, Hopfield networks, recurrent and associative memory, BAM and ART architectures Fuzzy sets and systems – geometry of fuzzy sets – theorems – fuzzy and neural function estimators

UNIT IV

Measures of Fuzziness – Classical measures of uncertainty – measures of Dissonance –confession specificity – knowledge base defuzzification.

UNIT-V

Application to load forecasting, load flow, fault detection-unit commitments, LF control – economic dispatch, Neuro-Fuzzy controllers.

Text Books:

1. Jacek M Jurada, "Introduction to artificial Neural Systems", Jaico Publications.
2. S.Rajashekaran , G.A.VijayaLakshmiPai,"Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and applications'',PHI,2013.

Reference Books:

1. Hans-JurgenZimmermann,"Fuzzy Set TheoryanditsApplications" ,4th,Kluwer AcademicPublishers,2006.
2. S.N. Sivanandam& S.N. Deepa ,"Principles of soft Computing", 3rdEdition,Wiley India Pvt.Ltd,2018.

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	-	-	L	M	-	H	-	-
CO2	H	-	-	L	M	-	H	-	-
CO3	H	-	-	L	M	-	H	-	-
C04	H	-	-	L	M	-	H	-	-
C05	-	H	-	L	M	-	-	H	-

19MEET18:SMART GRID

Credits - 3 **Sessional Marks: 30**
L: T: P:: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To Impart Knowledge on Basic definitions, aims and main functions of Smart Grids.
2. To identify the main characteristics, structures and functions of power systems And electricity market.
3. To Learn about the role of actors in electricity distribution and electricity Market.
4. To summarize the main point of distributed energy resources from network point Of view and ICT solutions for Smart Grids.

Course Outcomes

At the end of this course, students will demonstrate the ability to

CO1. Understand the challenging issues and architecture of smart grid.
CO2. Explain the communication and wide area monitoring in smart grid.
CO3. Analyze rudimentary management issues in smart grid.
CO4. Acquire the knowledge in computational intelligence and security issues in smart grids.
CO5. Describe the role of power electronics and energy storage in smart grid.

UNIT-I

Introduction to Smart Grid:

Evolution of Electric Grid, Concept, Definitions and Need for smart grid drives, Smart grid drives, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient &Self-Healing Grid, present development & International Policies in Smart Grid, Diverse Perspectives from experts and global Smart Grid initiatives.

UNIT-II

Smart Grid Technologies:

Technology Drivers, Smart energy resources, Smart substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT-III

Smart Meters and Advanced Metering Infrastructure:

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit (PMU),Intelligent Electronic Devices(IED) & their application for monitoring & Protection.

UNIT-IV

Power Quality Management In Smart Grid:
Power Quality & EMC in Smart Grid, Power Quality issues of Grid Connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web Based Power Quality Monitoring, and Power Quality Audit.

UNIT-V

High Performance Computing For Smart Grid Applications:
Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over power line (BPL), IP based protocols, Basics of web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Text Book:

1. JanakaEkanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins ,"Smart Grid",Student Edition , Wiley Publications, 2012.
2. James Momoh, "Smart Grid: Fundamentals of Design and Analysis", Wiley, IEEE Press., 2012.

Referance Books:

1. A.B.M.ShawkatAli,"Smart Grid",Springer London Ltd.
2. M.D. FadlullahZubair,"Evalution of Smart Grid",Springer International Publishing AG.

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M	-	H	-	-	H	M	L
CO2	H	-	M	L	-	-	H	M	M
CO3	-	H	H	M	-	-	H	M	-
C04	-	-	L	M	H	-	M	H	L
C05	H	-	L	M	-	-	H	M	-

19MEEJO1: PROJECT WORK PHASE -I

Credits – 10 **Sessional Marks: 40**
L:T:P::0:0:20 **University Exam Marks: 60**

Course Objectives

To expose the students to the following:

1. To understand and analyse the relative problems associate with energy conservation, environmental protection and societal problems to finding a suitable solution.
2. To create a optimal solution and/or a workable prototype for the problems.
3. To introduce students to the vast array of literature available for various research challenges in the field of Electrical Engineering.
4. To create awareness among the students of the characteristics of several domain areas where Electrical Engineering can be effectively used.
5. To enable students to use concepts of Electrical Engineering in creating a solution for practical problems.
6. To improve the team building, communication and management skills of the students.

Course Outcomes

After successful completion of course the student should be able to

CO1. Acquire in-depth knowledge in the core and/or interdisciplinary area of project topic.
CO2. Undertake research and solve real world problems in the project domain.
CO3. Apply appropriate techniques, resources and modern software tools necessary for implementing the project work.
CO4. Use project results for sustainable development of the society.
CO5. Engage in continuous learning to improve knowledge and competence in the chosen subject area of project.
CO6. Function effectively as individual and a member in the project team.

Course Outcomes-Program outcomes -Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	-	-	H	-	L	M	H	L
CO2	-	M	-	H	-	L	-	M	H
CO3	-	-	H	-	-	L	M	H	L
CO4	-	-	-	M	-	H	-	M	H
CO5	-	-	-	L	M	H	H	M	-
CO6	-	-	-	L	H	M	-	-	H

19MEEV01: COMPREHENSIVE VIVA

Credits – 2 **Sessional Marks: 40**
L:T:P::0:0:4 **University Exam Marks: 60**

Course Objectives
To expose the students to the following:
1. Identify, understand and discuss current, real-time issues.
2. Improve oral and written communication skills.
3. Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
4. Apply principles of ethics and respect in interaction with others.

Course Outcomes
After successful completion of course the student should be able to
CO1. Prepare comprehensively to answer questions from all the courses of three semesters..
CO2. Attain Oral Presentation skills by answering questions in precise and concise manner
CO3. Gain confidence and inter-personal skills.

Course Outcomes-Program outcomes- Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	-	H	L	-	-	H	L	-
CO2	-	M	-	-	H	L	H	-	M
CO3	-	-	-	H	M	L	-	-	H

M.Tech
II Year II Semester

S.No	COURSE CODE	COURSE TITLE
1	19MEEJ02	PROJECT PHASE-II

19MEEJO2: PROJECT WORK PHASE -II

Credits – 16 **Sessional Marks: 40**
L:T:P::0:0:32 **University Exam Marks: 60**

Course Objectives

To expose the students to the following:

1. To understand andanalyse the relative problems associate with energy conservation, environmental protection and societal problems to finding a suitable solution.
2. To create a optimal solution and/or a workable prototype for the problems.
3. To introduce students to the vast array of literature available for various research challenges in the field of Electrical Engineering.
4. To create awareness among the students of the characteristics of several domain areas where Electrical Engineering can be effectively used.
5. To enable students to use concepts of Electrical Engineering in creating a solution for practical problems.
6. To improve the team building, communication and management skills of the students.

Course Outcomes

After successful completion of course the student should be able to

CO1. Acquire in-depth knowledge in the core and/or interdisciplinary area of project topic.
CO2. Undertake research and solve real world problems in the project domain.
CO3. Apply appropriate techniques, resources and modern software tools necessary for implementing the project work.
CO4. Use project results for sustainable development of the society.
CO5. Engage in continuous learning to improve knowledge and competence in the chosen subject area of project.
CO6. Function effectively as individual and a member in the project team.

Course Outcomes-Program outcomes-Program specific outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	M	-	-	H	-	L	H	M	L
CO2	-	M	-	H	-	L	-	M	H
CO3	-	-	H	-	-	L	-	H	M
CO4	-	-	-	M	L	H	L	M	H
CO5	-	-	-	L	M	H	-	M	H
CO6	-	-	-	-	H	M	-	-	H