Study Scheme & Syllabus of

Master of Technology Electrical Engineering

M. Tech. Electrical Engineering

Batch 2018 onwards

By

Board of Study Electrical Engineering

Department of Academics

IK Gujral Punjab Technical University

I.K. Gujral Punjab Technical University
M. Tech. Electrical Engineering

Master of Technology in Electrical Engineering/

(M. Tech Electrical Engineering)

It is a Post Graduate (PG) Programme of 2 years duration (4 semesters)

Additional Lectures/Tutorials: Need based additional Lectures/Tutorials may be introduced of any Course, however, the Credits of the course will not change.

Courses & Examination Scheme:

First Semester

Course Code	Course Type	Course Name	L	T	P	Marks Distribution		Total Marks	Credits
						Internal	External		
MTEE-101-18	Core 1 Theory	Power System Analysis	3	0	0	40	60	100	3
MTEE-102-18	Core 2 Theory	Power System Dynamics-I	3	0	0	40	60	100	3
MTEE-103X-18	Elective -I	Professional Elective-I	3	0	0	40	60	100	3
MTEE-104Y-18	Elective-II	Professional Elective-II	3	0	0	40	60	100	3
MTRM-101-18	--	Research Methodology and IPR	2	0	0	40	60	100	2
MTEE-105-18	Practical/ Laboratory 1	Power System Steady State Analysis Lab	0	0	4	60	40	100	2
MTEE-106-18	Practical/ Laboratory 2	Power System Dynamics lab	0	0	4	60	40	100	2
MTA-10X-18	Audit-I	Audit course-I	2	0	0	00	00	Satisfactory/ Non-satisfactory	Non-Credit
--	**Total**	--	**16**	**0**	**8**	**320**	**380**	**700**	**18**

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Professional Elective/Audit	Course Code	Course Name	L	T	P	Marks Distribution		Total Marks	Credits
						Internal	External		
PE1	MTEE-103A-18	Advanced Power Electronics Circuits	3	0	0	40	60	100	3
	MTEE-103B-18	Digital Control	3	0	0	40	60	100	3
	MTEE-103C-18	Renewable Energy Systems	3	0	0	40	60	100	3
	MTEE-103D-18	Engineering Optimization	3	0	0	40	60	100	3
PE2	MTEE-104A-18	PWM Converter and Applications	3	0	0	40	60	100	3
	MTEE-104B-18	Electric Power Distribution System	3	0	0	40	60	100	3
	MTEE-104C-18	SCADA System & its Applications	3	0	0	40	60	100	3
	MTEE-104D-18	Optimal & Adaptive Control	3	0	0	40	60	150	3
Audit-I	MTA-101-18	English for Research Paper Writing	2	0	0	00	00	Satisfactory/ Non-satisfactory	Non-Credit
	MTA-102-18	Disaster Management	2	0	0	00	00	Satisfactory/ Non-satisfactory	Non-Credit
	MTA-103-18	Sanskrit for Technical Knowledge	2	0	0	00	00	Satisfactory/ Non-satisfactory	Non-Credit
	MTA-104-18	Value Education	2	0	0	00	00	Satisfactory/ Non-satisfactory	Non-Credit

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Second Semester

Course Code	Course Type	Course Name	L	T	P	Marks Distribution		Total Marks	Credits
						Internal	External		
MTEE-201-18	Core 3 Theory	Power System Dynamics-II	3	0	0	40	60	100	3
MTEE-202-18	Core 4 Theory	Digital Protection of Power System	3	0	0	40	60	100	3
MTEE-203X-18	Elective -I	Professional Elective-III	3	0	0	40	60	100	3
MTEE-204Y-18	Elective-II	Professional Elective-IV	3	0	0	40	60	100	3
MTPR-101-18	--	Mini Project with Seminar	0	0	4	60	40	100	2
MTEE-205-18	Practical/ Laboratory 3	Power System Protection Lab	0	0	4	60	40	100	2
MTEE-206X-18	Practical/ Laboratory 4	Lab Elective 4	0	0	4	60	40	100	2
MTA-10Y-18	Audit-II	Audit Course-II	2	0	0	00	00	Satisfactory/ Non-satisfactory	Non-Credit
--	**TOTAL**	--	**14**	**0**	**12**	**340**	**360**	**700**	**18**

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Professional Elective/Audit	Course Code	Course Name	L	T	P	Marks Distribution Internal	External	Total Marks	Credits
PE3	MTEE-203A-18	Advance Control System	3	0	0	40	60	100	3
	MTEE-203B-18	Advanced Digital Signal Processing	3	0	0	40	60	100	3
	MTEE-203C-18	Dynamics of Electrical Machines	3	0	0	40	60	100	3
	MTEE-203D-18	Smart Grids	3	0	0	40	60	100	3
PE4	MTEE-204A-18	Distributed Generation	3	0	0	40	60	100	3
	MTEE-204B-18	Robust Control	3	0	0	40	60	100	3
	MTEE-204C-18	AI Techniques	3	0	0	40	60	100	3
	MTEE-204D-18	Industrial Load Modeling & Control	3	0	0	40	60	100	3
Lab4	MTEE-206A-18	Power Electronics Applications to Power Systems	0	0	4	60	40	100	2
	MTEE-206B-18	Smart Grids Lab	0	0	4	60	40	100	2
	MTEE-206C-18	Artificial Intelligence Lab	0	0	4	60	40	100	2
Audit-II	MTA-105-18	Constitution of India	2	0	0	00	00	Satisfactory/ Non-satisfactory	Non-Credit
	MTA-106-18	Pedagogy Studies	2	0	0	00	00	Satisfactory/ Non-satisfactory	Non-Credit
	MTA-107-18	Stress Management by Yoga	2	0	0	00	00	Satisfactory/ Non-satisfactory	Non-Credit
	MTA-108-18	Personality Development through Life Enlightenment Skills	2	0	0	00	00	Satisfactory/ Non-satisfactory	Non-Credit

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Third Semester

Course Code	Course Type	Course Name	L	T	P	Marks Distribution		Total Marks	Credits
						Internal	External		
MTEE-301X-18	PE5	Professional Elective-V	3	0	0	40	60	100	3
MTOE-301X-18	OE	Open elective	3	0	0	40	60	100	3
MTEE-302-18	Major Project	Phase-I Dissertation	0	0	20	60	40	100	10
	TOTAL		**6**	**0**	**20**	**140**	**160**	**300**	**16**

Professional/ Open Elective	Course Code	Course Name	L	T	P	Marks Distribution		Total Marks	Credits
						Internal	External		
PE5	MTEE-301A-18	FACTS and Custom Power Devices	3	0	0	40	60	100	3
	MTEE-301B-18	Modeling and Control of Distributed Parameter System	3	0	0	40	60	100	3
	MTEE-301C-18	Dynamics of Linear Systems	3	0	0	40	60	100	3
	MTEE-301D-18	Energy Conversion Processes	3	0	0	40	60	100	3
OE	MTOE-301A-18	Business analytics	3	0	0	40	60	100	3
	MTOE-301B-18	Industrial Safety	3	0	0	40	60	100	3
	MTOE-301C-18	Operations Research	3	0	0	40	60	100	3
	MTOE-301D-18	Cost Management of Engineering Projects	3	0	0	40	60	100	3
	MTOE-301E-18	Composite	3	0	0	40	60	100	3

		Materials							
	MTOE-301F-18	Waste to Energy	3	0	0	40	60	100	3

Fourth Semester

Course Code	Course Type	Course Name	L	T	P	Marks Distribution		Total Marks	Credits
						Internal	External		
MTEE-401-18	Major Project	Phase-II Dissertation	0	0	32	60	40	100	16

Total Marks of M. Tech Program: 1800

Total Credits of M. Tech Program: 68

Syllabus of

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MTEE-101-18 **POWER SYSTEM ANALYSIS-I** **L T P**

Internal Marks: 40 **3 0 0**

External Marks: 60

Total Marks: 100

Course Objectives:-

Students will be able to:

1. Study various methods of load flow and their advantages and disadvantages
2. Understand how to analyze various types of faults in power system
3. Understand power system security concepts and study the methods to rank the contingencies
4. Understand need of state estimation and study simple algorithms for state estimation
5. Study voltage instability phenomenon

Syllabus

Units	Content	Hours
1	Load flow: Overview of Newton-Raphson, Gauss-Siedel, fast decoupled methods, convergence properties, sparsity techniques, handling Q-max violations in constant matrix, inclusion in frequency effects	8
2	AVR in load flow, handling of discrete variable in load flow, Fault Analysis: Simultaneous faults, open conductor faults, generalized method of fault analysis	8
3	Security Analysis: Security state diagram, contingency analysis, generator shift distribution factors	6
4	line outage distribution factor, multiple line outages, overload index ranking	6
5	Power System Equivalents: WARD REI. equivalents, State Estimation: Sources of errors in measurement Virtual and Pseudo, Measurement, Observability, Tracking state estimation, WSL method, bad data correction	8
6	Voltage Stability: Voltage collapse, P-V curve, multiple power flow solution, continuation power flow, optimal multiplies load flow, voltage collapse proximity indices	8

Suggested reading

1. J.J. Grainger &W.D.Stevenson, “Power system analysis ”, McGraw Hill ,2003
2. A. R. Bergen & Vijay Vittal , “Power System Analysis” ,Pearson , 2000
3. L.P. Singh , “Advanced Power System Analysis and Dynamics”, New Age International, 2006
4. G.L. Kusic, “Computer aided power system analysis” ,Prentice Hall India, 1986
5. A.J. Wood, “ Power generation, operation and control” , John Wiley, 1994
6. P.M. Anderson, “Faulted power system analysis” , IEEE Press , 1995

Course outcomes- Students will be able to:

1. To calculate voltage phasors at all buses , given the data using various methods of load flow
2. Able to calculate fault currents in each phase
3. Rank various contingencies according to their severity
4. Estimate the bus voltage phasors given various quantities viz. power flow, voltages, taps , CB status etc
5. Estimate closeness to voltage collapse and calculate PV curves using continuation power flow

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MTEE-102-18 **POWER SYSTEM DYNAMICS-I** **L T P**

Internal Marks: 40 **3 0 0**

External Marks: 60

Total Marks: 100

Course Objectives:- Students will be able to:
1. Study of system dynamics and its physical interpretation
2. Development of mathematical models for synchronous machine
3. Modeling of induction motor

Syllabus

Unit	Content	Hours
1	Synchronous Machines: Per unit systems, Park's Transformation (modified), Flux-linkage equation	8
2	Voltage and current equations, Formulation of State-space equations, Equivalent circuit	8
3	Sub-transient and transient inductance and Time constants, Simplified models of synchronous machines	6
4	Small signal model: Introduction to frequency model	8
5	Excitation systems and Philips-Heffron model, PSS Load modeling	8
6	Modeling of Induction Motors, Prime mover controllers	6

Suggested reading:-

1. P. M. Anderson & A. A. Fouad "Power System Control and Stability", Galgotia , New Delhi, 1981
2. J Machowski, J Bialek & J. R W. Bumby, "Power System Dynamics and Stability", John Wiley & Sons, 1997
3. P.Kundur, "Power System Stability and Control", McGraw Hill Inc., 1994.
4. E.W. Kimbark, "Power system stability", Vol. I & III, John Wiley & Sons, New York 2002

Course Outcomes: Students will be able to:

1. Understand the modeling of synchronous machine in details
2. Carry out simulation studies of power system dynamics using MATLAB-SIMULINK, MI POWER
3. Carry out stability analysis with and without power system stabilizer (PSS)
4. Understand the load modeling in power system

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MTEE-103A-18 ADVANCED POWER ELECTRONIC CIRCUITS L T P

Internal Marks: 40 3 0 0

External Marks: 60

Total Marks: 100

Course Objectives:
Students will be able to:
1. Understand the operation of advanced power electronic circuit topologies.
2. Understand the control strategies involved.
3. Learn few practical circuits, used in practice.

Syllabus

Units	Content	Hours
1	Boost type APFC and control.	8
2	Three phase utility interphases and control-Buck, Boost, Buck-Boost SMPS Topologies.	8
3	Modes of operation –Push-Pull and Forward Converter Topologies - Voltage Mode Control. Half and Full Bridge Converters.	6
4	Flyback Converter. Introduction to Resonant Converters. Load Resonant Converter. Zero Voltage Switching Clamped Voltage Topologies.	8
5	Resonant DC Link Inverters with Zero Voltage Switching. High Frequency Link Integral Half Cycle Converter.	8
6	Modelling and design of DC-DC Converters for various renewable energy conversion. Few power electronic circuits used in practice for controlling electric drives.	6

Suggested reading

1. Rashid “Power Electronics” Prentice Hall India 2007.

2. G.K.Dubey et.al “Thyristorised Power Controllers” Wiley Eastern Ltd., 2005, 06.

3. Dewan&Straughen “Power Semiconductor Circuits” John Wiley &Sons., 1975.

4. G.K. Dubey& C.R. Kasaravada “Power Electronics & Drives” Tata McGraw Hill., 1993

5. Cyril W Lander “Power Electronics” McGraw Hill., 2005.

6. B. K Bose “Modern Power Electronics and AC Drives” Pearson Education (Asia)., 2007

7. Abraham I Pressman “Switching Power Supply Design” McGraw Hill Publishing Company.,

2001.

Course Outcomes:

Students will be able to:

1: Knowledge about analysis and design of Load Commutated CSI and PWM CSI

2: Learn analysis and design of series Inverters.

3: Acquire knowledge about analysis and design of Switched Mode Rectifiers, APFC, DC-DC converters & Resonant converters

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MTEE-103B-18 **DIGITAL CONTROL** **L T P**

Internal Marks: 40 **3 0 0**

External Marks: 60

Total Marks: 100

Course Objectives:
Students will be able to:
1. To familiarize the student with the concept of discretization
2. Introduction to discrete-time system representations and digital control
3. Learn to design controller for digital systems

Syllabus

Units	Content	Hours
1	Introduction to discrete-time systems	8
2	Frequency domain approach – Analysis and discretization Time domain approach, analysis and discretization State space formulation for discretized systems	8
3	Engineering aspects of computer controlled systems	6
4	Sampled data systems Control of Sampled data systems	8
5	Concept of differential sampling, Closed loop analysis of differentially sampled systems Control design based on differential sampling	8
6	Recent applications of Digital Control	3

Suggested reading

1. K. Ogata, "Discrete-time Control Systems', Ed. 2, Prentice-Hall, 1995.

2. Benjamin C. Kuo, "Digital Control Systems", Ed. 2, Oxford Uiversity Press, 1999

Course Outcomes

Students will be able to

1. Model digital filters and systems

2. Analyse digital systems in time domain and frequency domain

3. Model and analyse digital systems in state space representation

4. Design controllers for digital systems in state space representation

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MTEE-103C-18 **RENEWABLE ENERGY SYSTEM** **L T P**

Internal Marks: 40 **3 0 0**

External Marks: 60

Total Marks: 100

Course Objectives:- Students will be able to:
1. Study of system dynamics and its physical interpretation
2. Development of mathematical models for synchronous machine
3. Modeling of induction motor

Syllabus

Unit	Content	Hours
1	Introduction, Distributed vs Central Station Generation, Sources of Energy such as Micro-turbines, Internal Combustion Engines.	8
2	Introduction to Solar Energy, Wind Energy, Combined Heat and Power, Hydro Energy, Tidal Energy, Wave Energy, Geothermal Energy, Biomass and Fuel Cells.	8
3	Power Electronic Interface with the Grid	6
4	Impact of Distributed Generation on the Power System, Power Quality Disturbances	8
5	Transmission System Operation, Protection of Distributed Generators	8
6	Economics of Distributed Generation, Case Studies	6

Suggested reading

1. Ranjan Rakesh, Kothari D.P, Singal K.C, "Renewable Energy Sources and Emerging Technologies", 2nd Ed. Prentice Hall of India, 2011
2. Math H. Bollen, Fainan Hassan, "Integration of Distributed Generation in the Power System", July 2011, Wiley-IEEE Press
3. Loi Lei Lai, Tze Fun Chan, "Distributed Generation: Induction and Permanent Magnet Generators", October 2007, Wiley- IEEE Press.
4. Roger A. Messenger, Jerry Ventre, "Photovoltaic System Engineering", 3rd Ed, 2010
5. James F. Manwell, Jon G. McGowan, Anthony L Rogers, "Wind energy explained: Theory Design and Application", John Wiley and Sons 2nd Ed, 2010

Course Outcomes:- Students will be able to:

1. Knowledge about renewable energy
2. Understand the working of distributed generation system in autonomous/grid connected modes
3. Know the Impact of Distributed Generation on Power System

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MTEE-103D-18 **ENGINEERING OPTIMIZATION** **L T P**

Internal Marks: 40 **3 0 0**

External Marks: 60

Total Marks: 100

Course Objectives:

Students will be able to:

1. To understand the need for optimization and different techniques involved and also constraints.
2. To know Linear/Non-linear Programming.
3. To understand the importance of optimization to solve Engineering problems
4. To know genetic algorithm for Engineering Optimization

Syllabus

Units	Contents	Hours
1	Concepts of optimization: Engineering applications Statement of optimization Problem, Classification - type and size of the problem Classical Optimization Techniques: Single and multi variable problems- Types of Constraints Semi definite case-saddle point	8
2	Linear programming: Standard form-Geometry of LP problems-Theorem of LP Relation to convexity - formulation of LP problems - simplex method and algorithm Matrix form- two phase method. Duality dual simplex method- LU Decomposition	8
3	Sensitivity analysis. Artificial variables and complementary solutions-QP Engineering Applications: Minimum cost flow problem Network problems-transportation, assignment & allocation, scheduling Karmarkar method-unbalanced and routing problems.	8
4	Nonlinear programming: Non linearity concepts-convex and concave functions non-linear programming-gradient and Hessian. Unconstrained optimization First & Second order necessary conditions- Minimisation & Maximisation Local & Global convergence- Speed of convergence	6
5	Basic decent methods: Fibonacci & Golden section search – Gradient methods – Newton Method-Lagrange multiplier method - Kuhn-tucker conditions Quasi-Newton method- separable convex programming- Frank and Wolfe method, Engineering applications Nonlinear programming-Constrained optimization: Characteristics of constraints -Direct methods- SLP, SQP-Indirect methods. Transformation techniques-penalty function-Langrange multiplier methods checking convergence- Engineering applications	8
6	Dynamic programming: Multistage decision process- Concept of sub optimization and principle of optimality Computational procedure- Engineering applications. Genetic algorithms-Simulated Annealing Methods - Optimization programming, tools and Software packages	6

Suggested reading

1. David G Luenberger, "Linear and Non Linear Programming", 2nd Ed, Addison-Wesley Pub. Co., Massachusetts, 2003

2. W.L. Winston, "Operation Research-Applications & Algorithms",2nd Ed., PWS-KENT Pub. Co., Boston, 2007

3. S.S.Rao, "Engineering Optimization", 3rd Ed., New Age International (P) Ltd, New Delhi, 2007

4. W.F. Stocker, "Design of Thermal Systems", 3rd Ed., McGraw Hill, New York. 1990

5. G.B. Dantzig, "Linear Programming and Extensions" Princeton University Press, N.J., 1963.

6. L.C.W. Dixton, "Non Linear Optimization: theory and algorithms" Birkhauser, Boston, 1980

Course Outcomes:

1: Apply optimization techniques to typical engineering problems

2: Learn the concepts and techniques of nonlinear and unconstrained optimization

3: Acquire knowledge on direct and indirect methods for constrained optimization

4: Learn the application of dynamic programming and genetic algorithms for engineering Optimization

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MTEE-104A-18 PWM CONVERTERS AND APPLICATION L T P

Internal Marks: 40 3 0 0

External Marks: 60

Total Marks: 100

Course Objectives:
Students will be able to:
1. Understand the concepts and basic operation of PWM converters, including basic circuit operation and design.
2. Understand the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality.

Syllabus

Units	Content	Hours
1	AC/DC and DC/AC power conversion Overview of applications of voltage source converters and current source converters.	6
	Pulse width modulation techniques for bridge converters Bus clamping PWM. Space vector based PWM. Advanced PWM techniques	6
2	Practical devices in converter. Calculation of switching and conduction power losses.	4
3	Compensation for dead time and DC voltage regulation. Dynamic model of PWM converter. Multilevel converters. Constant V/F induction motor drives.	8
4	Estimation of current ripple and torque ripple in inverter fed drives. Line-side converters with power factor compensation	8
5	Active power filtering. Reactive power compensation. Harmonic current compensation. Selective harmonic elimination PWM technique for high power electric drives	8

Suggested reading

1. Mohan, Undeland and Robbins, “Power Electronics: Converters, Applications and Design”,

John’s Wiley and Sons.

2. Erickson RW, “Fundamentals of Power Electronics”, Chapman and Hall.

3. Vithyathil. J, “Power Electronics: Principles and Applications”, McGraw Hill.

Course Outcomes: Students will be able to:

1. Knowledge concepts and basic operation of PWM converters, including basic circuit operation

and design

2. Learn the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality

3. Able to recognize and use the following concepts and ideas: Steady-State and transient modelling and analysis of power converters with various PWM techniques.

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MTEE-104B-18 ELECTRICAL POWER DISTRIBUTION SYSTEM L T P

Internal Marks: 40 3 0 0

External Marks: 60

Total Marks: 100

Course Objectives:-Students will be able to:
1. Learning about power distribution system
2. Learning of SCADA System
3. Understanding Distribution Automation

Syllabus

Unit	Content	Hours
1	Distribution of Power, Management, Power Loads, Load Forecasting Short-term & Long-term, Power System Loading, Technological Forecasting.	8
2	Advantages of Distribution Management System (D.M.S.), Distribution Automation: Definition, Restoration / Reconfiguration of Distribution Network, Different Methods and Constraints, Power Factor Correction.	8
3	Interconnection of Distribution, Control & Communication Systems, Remote Metering, Automatic Meter Reading and its implementation.	8
4	SCADA: Introduction, Block Diagram, SCADA Applied To Distribution Automation, Common Functions of SCADA, Advantages of Distribution Automation through SCADA.	8
5	Calculation of Optimum Number of Switches, Capacitors, Optimum Switching Device Placement in Radial, Distribution Systems, Sectionalizing Switches – Types, Benefits, Bellman's Optimality Principle, Remote Terminal Units, Energy efficiency in electrical distribution & Monitoring.	6
6	Maintenance of Automated Distribution Systems, Difficulties in Implementing Distribution, Automation in Actual Practice, Urban/Rural Distribution, Energy Management, AI techniques applied to Distribution Automation.	6

Suggested reading

1. A.S. Pabla, " Electric Power Distribution", Tata McGraw Hill Publishing Co. Ltd., Fourth Edition.
2. M.K. Khedkar, G.M. Dhole, "A Text Book of Electrical power Distribution Automation", University Science Press, New Delhi
3. Anthony J Panseni, "Electrical Distribution Engineering", CRC Press
4. James Momoh, "Electric Power Distribution, automation, protection & control", CRC

Course Outcomes:-Students will be able to:

1. Knowledge of power distribution system
2. Study of Distribution automation and its application in practice
3. To learn SCADA system

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MTEE-104C-18 **SCADA SYSTEMS AND APPLICATIONS** **L T P**

Internal Marks: 40 **3 0 0**

External Marks: 60

Total Marks: 100

Course Objectives:
Students will be able to:
1. To understand what is meant by SCADA and its functions.
2. To know SCADA communication.
3. To get an insight into its application.

Syllabus

Unit	Content	Hours
1	Introduction to SCADA: Data acquisition systems, Evolution of SCADA, Communication technologies	6
2	Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries SCADA	8
3	Industries SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems	6
4	SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture -IEC 61850.	6
5	SCADA Communication: various industrial communication technologies -wired and wireless methods and fiber optics. open standard communication protocols.	6
6	SCADA Applications: Utility applications- Transmission and Distribution sector- operations, monitoring, analysis and improvement. Industries - oil, gas and water, Case studies, Implementation, Simulation Exercises	8

Suggested reading

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 Related Systems", Newnes Publications, Oxford, UK,2004
3. William T. Shaw, "Cybersecurity for SCADA systems", PennWell Books, 2006
4. David Bailey, Edwin Wright, "Practical SCADA for industry", Newnes, 2003
5. Michael Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electric power", PennWell 1999

Course Outcomes:- Student will be able to

1. Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their typical applications
2. Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system
3. Knowledge about single unified standard architecture IEC 61850
4. Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their typical applications
5. Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system
6. Knowledge about single unified standard architecture IEC 61850
7. To learn about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server
8. Learn and understand about SCADA applications in transmission and distribution sector, industries etc

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MTEE-104D-18 **OPTIMAL AND ADAPTIVE CONTROL** **L T P**

Internal Marks: 40 **3 0 0**

External Marks: 60

Total Marks: 100

Course Objectives:
Students will be able to:
1. To know the operation of closed and open loop optimal control.
2. Understand the adaptive control strategies.
3. Learn dynamic programming method.

Syllabus

Units	Content	Hours
1	Optimal control problem – fundamental concepts and theorems of calculus of variations–Euler - Language equation and extremal of functional	5
2	Variational approach to solving optimal control problems. Hamiltonian and different boundary conditions for optimal control problem	8
3	Linear regulator problem - Pontryagin's minimum principle	6
4	Dynamic programming - Principle of optimality and its application to optimal control problem.	6
5	Hamilton-Jacobi-Bellman equation - model reference adaptive systems(MRAS) - Design hypothesis	8
6	Introduction to design method based on the use of Liapunov function. Design and simulation of variable structure adaptive model following control.	8

Suggested reading

1. Donald E. Kirk, "Optimal Control Theory, An introduction", Prentice Hall Inc., 2004

2. A.P. Sage, "Optimum Systems Control", Prentice Hall, 1977

3. HSU and Meyer , "Modern Control, Principles and Applications", McGraw Hill, 1968

4. Yoan D. Landu, "Adaptive Control (Model Reference Approach)", Marcel Dekker. 1981

5. K.K.D.Young, "Design of Variable Structure Model Following Control Systems", IEEE Transactions on Automatic Control, Vol. 23, pp 1079-1085, 1978.

Course Outcomes:

Students will be able to:

1. Knowledge in the mathematical area of calculus of variation so as to apply the same for solving optimal control problems.

2. Problem formulation, performance measure and mathematical treatment of optimal control problems.

3. Acquire knowledge on solving optimal control design problems by taking into consideration the physical constraints on practical control systems.

4. To obtain optimal solutions to controller design problems taking into consideration the limitation on control energy in the real practical world.

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MTRM-101-18 **RESEARCH METHODOLOGY AND IPR** **L T P**

Internal Marks: 40 **3 0 0**

External Marks: 60

Total Marks: 100

Course Objectives:- Students will be able to:
1. To understand research problem formulation and research ethics
2. To understand about control of information technology
3. To understand the need of IPR & its protection

Syllabus

Unit	Content	Hours
1	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	8
2	Effective literature studies approaches, analysis Plagiarism, Research ethics	4
3	Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee	6
4	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	8
5	Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications	4
6	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.	6

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992

6. Niebel , "Product Design", McGraw Hill,
   1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Course Outcomes:

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

1. Understand research problem formulation. Analyze research related information
2. Follow research ethics
3. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
5. 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 in turn brings about, economic growth and social benefits.

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EEPS-105-18 POWER SYSTEM STEADY STATE ANALYSIS LAB L T P

Internal Marks: 60 0 0 4

External Marks: 40

Total Marks: 100

Course Objectives:-

Students will be able :

1. To understand power system problems
2. To understand how to analyze the power system load flow studies, forecasting & unit Commitment.
3. To understand the role of power electronic devices.

Syllabus

Sr. No.	List of Experiments
1	Power Systems & Power Electronics Lab
2	Computer Simulation Lab
3	Simulation of IGBT Inverters.
4	Simulation of Thyristor Converters.
5	Transient Stability Studies.
6	Short Circuit Studies.
7	Load Flow Studies
8	Load Forecasting and Unit Commitment

Course Outcomes:- Students will be able to

1. Understand the power system operational problems.
2. Apply the load flow methods, fault analysis techniques and unit commitment of units.
3. Applications of power electronic devices in power system.

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EEPS-106A-18 **POWER SYSTEM DYNAMICS LAB** **L T P**

Internal Marks: 60 **0 0 4**

External Marks: 40

Total Marks: 100

Course Objectives:-Students will be able :

1. To understand the stability analysis for single machine system
2. To understand the stability analysis for single machine system using models.
3. Development of simulink model for excitation system using MATLAB.

Syllabus

Sr. No.	List of Experiments
1	To develop a MATLAB program to study small signal stability analysis of single machine infinite bus system using classical machine model.
2	To develop a MATLAB program to study small signal stability analysis of single machine infinite bus system using Type B1 model.
3	To develop a simulink model of IEEE type 1(1968) excitation system using MATLAB.
4	To develop a MATLAB program to study small signal stability analysis of single machine infinite bus system using Type B1 –effect of excitation system.
5	To develop a MATLAB program to study small signal stability analysis of single machine infinite bus system using Type B1 machine model with simple excitation system- effect of PSS.

Course Outcomes:- Students will be able to

1. Do stability analysis for small signal stability
2. Analyze the single machine system using models
3. Simulink models considering excitation systems

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MTA-101A-18 **ENGLISH FOR PAPER WRITING** **L T P**

Internal Marks: 00 **2 0 0**

External Marks: 00

Total Marks: 00

Course Objectives:- Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title

Syllabus

Units	Contents	Hours
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing, Redundancy, Avoiding Ambiguity and Vagueness	4
2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction	4
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	4
5	skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	4
6	useful phrases, how to ensure paper is as good as it could possibly be the first time submission	4

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Course Outcome:- Students will be able to learn

1. Improve writing and readability levels for English
2. How to write and what write according to section
3. Skills in title writing

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MTA-101B-18 **DISASTER MANAGEMENT** **L T P**

Internal Marks: 00 **2 0 0**

External Marks: 00

Total Marks: 00

Course Objectives: -Students will be able to:
1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Syllabus

Units	Contents	Hours
1	Introduction, Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
2	Repercussions Of Disasters And Hazards: Economic Damage, Loss of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts	4
3	Disaster Prone Areas In India, Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4
4	Disaster Preparedness And Management Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	4
5	Risk Assessment , Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co- Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	4
6	Disaster Mitigation, Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4

Suggested readings:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

Course Outcome:- Student will be able

1. Know, how to reduce disaster risk and humanitarian response.
2. Policy and practice for disaster risk reduction
3. Understand the practical relevance of conflict situations and standards of humanitarian response in that situation
4. Planning, programming and strength and weakness of disaster risk management

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MTA-101C-18 **SANSKRIT FOR TECHNICAL EDUCATION** **L T P**

Internal Marks: 00 **2 0 0**

External Marks: 00

Total Marks: 00

Course Objectives:-Students will be able to:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Syllabus

Units	Content	Hours
1	Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	8
2	Order Introduction of roots Technical information about Sanskrit Literature	8
3	Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	8

Suggested reading

1. "Abhyaspustakam" – Dr. Vishwas, Sanskrit-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Outcome:- Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

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MTA-101D-18 **VALUE EDUCATION** **L T P**

Internal Marks: 00 **2 0 0**

External Marks: 00

Total Marks: 00

Course Objectives:- Students will be able to:

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Syllabus

Units	Content	Hours
1	Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism, Moral and non- moral valuation. Standards and principles, Value judgements	4
2	Importance of cultivation of values, Sense of duty. Devotion, Self-reliance, Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity, Patriotism, Love for nature, Discipline	6
3	Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature	6
4	Character and Competence –Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively	6

Suggested reading

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

Course outcomes:-Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

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MTEE-201-18 **POWER SYSTEM DYNAMICS-II** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives:-Students will be able to:
1. Study of power system dynamics
2. Interpretation of power system dynamic phenomena
3. Study of various forms of stability

Syllabus

Unit	Content	Hours
1	Basic Concepts of Dynamic Systems and Stability Definition, Small Signal Stability (Low Frequency Oscillations) of Unregulated and Regulated System	8
2	Effect of Damper, Flux Linkage Variation and AVR	6
3	Large Signal Rotor Angle Stability, Dynamic Equivalents And Coherency, Direct Method of Stability Assessment, Stability Enhancing Techniques, Mitigation Using Power System Stabilizer	8
4	Asynchronous Operation and Resynchronization, Multi-Machine Stability	6
5	Dynamic Analysis of Voltage Stability, Voltage Collapse	6
6	Frequency Stability, Automatic Generation Control, Primary and Secondary Control, Sub-Synchronous Resonance and Counter Measures	8

Suggested reading

1. P. Kundur, "Power System Stability and Control", McGraw Hill Inc, 1994
2. J. Machowski, Bialek, Bumby, "Power System Dynamics and Stability", John Wiley & Sons, 1997
3. L. Leonard Grigsby (Ed.); "Power System Stability and Control", Second edition, CRC Press, 2007
4. V. Ajjarapu, "Computational Techniques for voltage stability assessment & control"; Springer, 2006

Course Outcomes:- Students will be able to:

1. Gain valuable insights into the phenomena of power system including obscure ones.
2. Understand the power system stability problem.
3. Analyze the stability problems and implement modern control strategies.
4. Simulate small signal and large signal stability problems.

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MTEE-202-18 DIGITAL PROTECTION OF POWER SYSTEM L T P
Internal Marks: 40 3 0 0
External Marks: 60
Total Marks: 100

Course Objectives:- Students will be able to:
1. Study of numerical relays
2. Developing mathematical approach towards protection
3. Study of algorithms for numerical protection

Syllabus

Unit	Content	Hours
1	Evolution of digital relays from electromechanical relays, Performance and operational characteristics of digital protection	6
2	Mathematical background to protection algorithms, Finite difference techniques	6
3	Interpolation formulae, Forward, backward and central difference interpolation, Numerical differentiation, Curve fitting and smoothing, Least squares method, Fourier analysis, Fourier series and Fourier transform, Walsh function analysis	8
4	Basic elements of digital protection, Signal conditioning: transducers, surge protection, analog filtering, analog multiplexers, Conversion subsystem: the sampling theorem, signal aliasing, Error, sample and hold circuits, multiplexers, analog to digital conversion, Digital filtering concepts, The digital relay as a unit consisting of hardware and software	8
5	Sinusoidal wave based algorithms, Sample and first derivative (Mann and Morrison) algorithm, Fourier and Walsh based algorithms	8
6	Fourier Algorithm: Full cycle window algorithm, fractional cycle window algorithm, Walsh function based algorithm, Least Squares based algorithms, Differential equation based algorithms, Traveling Wave based Techniques, Digital Differential Protection of Transformers, Digital Line Differential Protection, Recent Advances in Digital Protection of Power Systems	8

Suggested reading

1. A.G. Phadke and J. S. Thorp, “Computer Relaying for Power Systems”, Wiley/Research studies Press, 2009
2. A.T. Johns and S. K. Salman, “Digital Protection of Power Systems”, IEEE Press,1999
3. Gerhard Zeigler, “Numerical Distance Protection”, Siemens Publicis Corporate Publishing, 2006
4. S.R. Bhide “Digital Power System Protection” PHI Learning Pvt.Ltd.2014

Course Outcomes:- Students will be able to:

1. Learn the importance of Digital Relays
2. Apply Mathematical approach towards protection
3. Learn to develop various Protection algorithms

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MTEE-203A-18 **ADVANCE CONTROL SYSTEM** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives:- Students will be able to:
1. The course provides glimpses into the advanced methods of modeling and analysis of the dynamical systems.
2. The course is a strong step in inculcating the research aptitude in the students

Syllabus

Unit	Content	Hours
1	Math Modelling of Dynamical Systems: Newtonian and Lagrangian approaches, Concept of dynamical state of a system, Concept of equilibrium point, linearization of non-linear model	6
2	Review of Linear Algebra concepts: Field, Vector space, linear combination, linear independence, bases of a vector space, representation of any vector on different basis, matrix representation of a linear operator, change of basis, rank, nullity, range space and null space of a matrix. Eigen value and Eigen vector of a matrix, similarity transform, Diagonalisation	6
3	Modern Control Analysis: Concept and computation of systems modes, controllability theorem and its proof, Observability theorem and its proof, Controllable and observable subspaces	8
4	Stability Analysis: Stability of linear systems, stability types and their definitions for any general system, Stability of an equilibrium point, Lyapunov stability theory for LTI systems, Quadratic forms and Lyapunov functions	8
5	Modern Control Design: Converting the math model to controllable canonical form and its use for pole placement, Concept of linear observer and its design, Design of reduced order observer, Compensator design using separation principle, Poles of compensator, Open loop and close-loop systems	8
6	Optimal Control Theory: Introduction to the philosophy of optimal control, formulation of optimal control problem, different performance criterion, Linear quadratic regulator (LQR) and optimum gain matrix, Riccati equations, conceptual models and statistical models for random processes, Kalman filter	8

Suggested reading

1. Bernard Friedland, "Control System Design: An Introduction to State-Space Methods", Dover Publications, Inc. Mineola, New York, 2012
2. Thomas Kailath, "Linear Systems", Prentice-Hall Inc., New Jersey, 1986
3. M. Gopal, "Modern Control System Theory", , New Age International (P) Limited, New Delhi,2000

Course Outcomes: Students will be able to

1. Apply the concepts of linear algebra and their applications to control system
2. Analyze the system dynamics and Lyapunov stability theory
3. Design linear quadratic controller

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MTEE-203B-18 ADVANCED DIGITAL SIGNAL PROCESSING L T P
Internal Marks: 40 3 0 0
External Marks: 60
Total Marks: 100

Course Objectives: -Students will be able to:
1. To understand the difference between discrete-time and continuous-time signals
2. To understand and apply Discrete Fourier Transforms (DFT)

Syllabus

Unit	Content	Hours
1	Discrete time signals, Linear shift invariant systems- Stability and causality, Sampling of continuous time signals- Discrete time Fourier transform- Discrete Fourier series- Discrete Fourier transform, Z transform-Properties of different transforms.	8
2	Linear convolution using DFT, Computation of DFT Design of IIR digital filters from analog filters, Impulse invariance method, Bilinear transformation method.	8
3	FIR filter design using window functions, Comparison of IIR and FIR digital filters, Basic IIR and FIR filter realization structures, Signal flow graph representations Quantization process and errors, Coefficient quantisation effects in IIR and FIR filters.	8
4	A/D conversion noise- Arithmetic round-off errors, Dynamic range scaling, Overflow oscillations and zero Input limit cycles in IIR filters, Linear Signal Models.	8
5	All pole, All zero and Pole-zero models, Power spectrum estimation- Spectral analysis of deterministic signals, Estimation of power spectrum of stationary random signals.	6
6	Optimum linear filters, Optimum signal estimation, Mean square error estimation, Optimum FIR and IIR Filters.	6

Suggested reading

1. Sanjit K Mitra, "Digital Signal Processing: A computer-based approach ",Tata Mc-Graw-Hill Edition1998
2. Dimitris G. Manolakis, Vinay K. Ingle and Stephen M. Kogon, "Statistical and Adaptive Signal Processing", Mc Grow Hill international editions. -2000

Course Outcomes:- Students will be able to:

1. Knowledge about the time domain and frequency domain representations as well analysis of discrete time signals and systems
2. Study the design techniques for IIR and FIR filters and their realization structures.
3. Acquire knowledge about the finite word length effects in implementation of digital filters.
4. Knowledge about the various linear signal models and estimation of power spectrum of stationary random signals
5. Design of optimum FIR and IIR filters

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MTEE-203C-18 DYNAMICS OF ELECTRICAL MACHINES L T P
Internal Marks: 40 3 0 0
External Marks: 60
Total Marks: 100

Course objective: -Students will be able to-
1. Learn Performance characteristics of machine
2. To understand the dynamics of the machine
3. To understand how to determine stability of machine
4. Learn the synchronous machine

Syllabus

Unit	Content	Hours
1	Stability, Primitive 4 Winding Commutator Machine, Commutator Primitive Machine, Complete Voltage Equation of Primitive 4 Winding, Commutator Machine.	8
2	Torque Equation Analysis of Simple DC Machines using the Primitive Machine Equations, The Three Phase Induction Motor, Transformed Equations, Different Reference Frames for Induction Motor Analysis Transfer, Function Formulation.	8
3	Three Phase Salient Pole Synchronous Machine, Parks Transformation, Steady State Analysis.	8
4	Large Signal Transient, Small Oscillation Equations in State Variable form, Dynamical Analysis of Interconnected Machines.	8
5	Large Signal Transient Analysis using Transformed Equations, DC Generator /DC Motor System.	6
6	Alternator /Synchronous Motor System.	6

Suggested reading

1. D.P. Sengupta& J.B. Lynn," Electrical Machine Dynamics", The Macmillan Press Ltd. 1980
2. R Krishnan "Electric Motor Drives, Modeling, Analysis, and Control", Pearson Education., 2001
3. P.C. Kraus, "Analysis of Electrical Machines", McGraw Hill Book Company,1987
4. I. Boldia& S.A. Nasar,,"Electrical Machine Dynamics", The Macmillan Press Ltd. 1992
5. C.V. Jones, "The Unified Theory of Electrical Machines", Butterworth, London. 1967

Course Outcomes: - Students will be able to:

1. Formulation of electrodynamic equations of all electric machines and analyze the performance characteristics
2. Knowledge of transformations for the dynamic analysis of machines
3. Knowledge of determination of stability of the machines under small signal and transient conditions
4. Study about synchronous machine

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MTEE-203D-18 **SMART GRIDS** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives: Students will be able to:
1. Understand concept of smart grid and its advantages over conventional grid.
2. Know smart metering techniques.
3. Learn wide area measurement techniques.
4. Understanding the problems associated with integration of distributed generation & its solution through smart grid.

Syllabus

Units	Content	Hours
1	Introduction to Smart Grid, Evolution of Electric Grid. Concept of Smart Grid, Definitions, Need of Smart Grid. Concept of Robust &Self-Healing Grid, Present development & International policies in Smart Grid	6
2	Introduction to Smart Meters, Real Time Prizing, Smart Appliances. Automatic Meter Reading (AMR). Outage Management System (OMS). Plug in Hybrid Electric Vehicles(PHEV). Vehicle to Grid, Smart Sensors. Home & Building Automation, Smart Substations, Substation Automation, Feeder Automation	8
3	Geographic Information System (GIS). Intelligent Electronic Devices (IED) & their application for monitoring &protection, Smart storage like Battery, SMES, Pumped Hydro. Compressed Air Energy Storage. Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU).	6
4	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	8
5	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 Audit	8
6	Advanced Metering Infrastructure (AMI), Home Area Network (HAN). Neighbourhood Area Network (NAN), Wide Area Network (WAN). Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication. Wireless Mesh Network. Basics of CLOUD Computing &Cyber Security for Smart Grid. Broadband over Power line (BPL). IP based protocols	8

Suggested reading

1. Ali Keyhani, “Design of smart power grid renewable energy systems”, Wiley IEEE,2011.
2. Clark W. Gellings, “The Smart Grid: Enabling Energy Efficiency and Demand Response”, CRC Press, 2009.
3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, “Smart Grid: Technology and Applications”, Wiley 2012.
4. Stuart Borlas’e, “Smart Grid: Infrastructure, Technology and solutions “CRC Press.

5. A.G.Phadke , "Synchronized Phasor Measurement and their Applications",Springer.

Course Outcomes: Students will be able to:
1. Appreciate the difference between smart grid & conventional grid.
2. Apply smart metering concepts to industrial and commercial installations.
3. Formulate solutions in the areas of smart substations, distributed generation and wide area measurements.
4. Come up with smart grid solutions using modern communication technologies

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MTEE-204A-18 **DISTRIBUTED GENERATION** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives: Students will be able to:
1. To understand renewable energy sources.
2. To gain understanding of the working of off-grid and grid-connected renewable energy generation schemes.

Syllabus

Units	Content	Hours
1	Need for Distributed generation. Renewable sources in distributed generation and current scenario in Distributed Generation	6
2	Planning of DGs. Sitting and sizing of DGs optimal placement of DG sources in distribution systems. Grid integration of DGs Different types of interfaces, Inverter based DGs and rotating machine based interfaces. Aggregation of multiple DG units.	8
3	Technical impacts of DGs. Transmission systems Distribution Systems De-regulation Impact of DGs upon protective relaying. Impact of DGs upon transient and dynamic stability of existing distribution systems, Steady-state and Dynamic analysis.	6
4	Economic and control aspects of DGs Market facts. Issues and challenges Limitations of DGs, Voltage control techniques. Reactive power control, Harmonics Power quality issues, Reliability of DG based systems.	8
5	Introduction to micro-grids. Types of micro-grids: autonomous and non-autonomous grids Sizing of micro-grids. Modeling & analysis of Micro-grids with multiple DGs. Micro-grids with power electronic interfacing units.	8
6	Transients in micro-grids, Protection of micro-grids, Case studies, Advanced topics	8

Suggested reading

1. H. Lee Willis, Walter G. Scott, "Distributed Power Generation – Planning and Evaluation", Marcel Decker Press.
2. M.Godoy Simoes, Felix A.Farret, "Renewable Energy Systems – Design and Analysis with Induction Generators", CRC press.
3. Stuart Borlase. "Smart Grid: Infrastructure Technology Solutions" CRC Press

Course outcomes: Students will be able to:
1. To understand the planning and operational issues related to Distributed Generation.
2. Acquire Knowledge about Distributed Generation Learn Micro-Grids

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MTEE-204B-18 **ROBUST CONTROL** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives: Students will be able to:
1. Introduction to control techniques with greater emphasis on robustness to modeling uncertainty
2. Introduction to parameter variations, and presence of disturbances and noise

Syllabus

Units	Content	Hours
1	Modeling of uncertain systems, Signals and Norms	6
2	Lyapunov theory for LTI systems	8
3	Passive systems – frequency domain Passive systems – time domain	8
4	Robust Stability and performance, Stabilizing controllers – Coprime factorization	6
5	LQR, LQG problems, Ricatti equations and solutions, Ricatti equation solution through LMI	8
6	H-infinity control and mu-synthesis, Linear matrix inequalities for robust control	**8**

Suggested reading

1. L. Fortuna, M. Frasca (Eds.), "Optimal and Robust Control", CRC Press, 2012
2.K. Zhou, J. C. Doyle and K. Glover, "Robust and Optimal Control", Prentice Hall, 1996
3.J. C. Doyle, B. A. Francis and A. R. Tannenbaum, "Feedback Control Theory", Macmillan, 1992

Course Outcomes: Students will be able to
1. Understand LTI systems and its applications
2. Apply Lyapunov theorem for any stability problem
3. Design passive systems in frequency and time domain

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MTEE-204C-18 **ARTIFICIAL INTELLIGENCE TECHNIQUES** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives:-Students will be able to:
1.Understanding fuzzy logic, ANN
2.Understanding GA & EP

Syllabus

Units	Content	Hours
1	Biological foundations to intelligent Systems, Artificial Neural Networks, Single layer and Multilayer Feed Forward NN LMS and Back Propagation Algorithm, Feedback networks and Radial Basis Function Networks	8
2	Fuzzy Logic, Knowledge Representation and Inference Mechanism Defuzzification Methods.	8
3	Fuzzy Neural Networks, some algorithms to learn the parameters of the network like GA.	8
4	System Identification using Fuzzy and Neural Network.	6
5	Genetic algorithm, Reproduction cross over, mutation, Introduction to evolutionary program.	8
6	Applications of above mentioned techniques to practical problems.	6

Suggested reading

1. J M Zurada , "An Introduction to ANN",Jaico Publishing House
2. Simon Haykins, "Neural Networks", Prentice Hall
3. Timothy Ross, "Fuzzy Logic with Engg. Applications", McGraw. Hill
4. Driankov, Dimitra, "An Introduction to Fuzzy Control", Narosa Publication
5. Golding, "Genetic Algorithms", Addison-Wesley Publishing Com

Course Outcomes: - Students will be able to:

1. Learn the concepts of biological foundations of artificial neural networks
2. Learn Feedback networks and radial basis function networks and fuzzy logics
3. Identifications of fuzzy and neural network
4. Acquire the knowledge of GA

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MTEE-204D-18 INDUSTRIAL LOAD MODELING AND CONTROL L T P
Internal Marks: 40 3 0 0
External Marks: 60
Total Marks: 100

Course Objectives:- Students will be able to
1. Understand the energy demand scenario
2. Understand the modeling of load and its ease to study load demand industrially
3. Know Electricity pricing models
4. Study Reactive power management in Industries

Syllabus

Unit	Content	Hours
1	Electric Energy Scenario-Demand Side Management-Industrial Load Management, Load Curves-Load Shaping Objectives-Methodologies-Barriers, Classification of Industrial Loads- Continuous and Batch processes -Load Modelling.	4
2	Electricity pricing – Dynamic and spot pricing –Models, Direct load control- Interruptible load control, Bottom up approach- scheduling-Formulation of load models, Optimization and control algorithms, Case studies.	6
3	Reactive power management in industries-controls, Power quality impacts-application of filters Energy saving in Industries.	4
4	Cooling and heating loads, Load profiling- Modeling, Cool storage-Types-Control strategies, Optimal operation, Problem formulation, Case studies.	4
5	Captive power units- Operating and control strategies, Power Pooling-Operation models, Energy banking, Industrial Cogeneration.	4
6	Selection of Schemes Optimal Operating Strategies-Peak load Saving, Constraints, Problem formulation- Case study, Integrated Load management for Industries.	4

Suggest Reading

1. C.O. Bjork " Industrial Load Management - Theory, Practice and Simulations", Elsevier, the Netherlands,1989
2. C.W. Gellings and S.N. Talukdar,. Load management concepts. IEEE Press, New York, 1986, pp. 3-28
3. Y. Manichaikul and F.C. Schweppe ," Physically based Industrial load", IEEE Trans. on PAS, April 1981
4. H. G. Stoll, "Least cost Electricity Utility Planning", Wiley Interscience Publication, USA, 1989.
5. I.J.Nagarath and D.P.Kothari, .Modern Power System Engineering., Tata McGraw Hill publishers, NewDelhi, 1995
6. IEEE Bronze Book- "Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities", IEEE Inc, USA

Course Outcomes:- Student will be able to:

1. Knowledge about load control techniques in industries and its application
2. Learn different types of industrial processes and optimize the process using tools like LINDO and LINGO
3. Apply load management to reduce demand of electricity during peak time
4. Apply different energy saving opportunities in industries

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MTEE-205-18 **POWER SYSTEM PROTECTION LAB** **L T P**
Internal Marks: 60 **0 0 4**
External Marks: 40
Total Marks: 100

Course Objectives:-Students will be able : 1. To understand power system protection through feeders. **2.** To understand the transformer protection, reverse power and induction relay.	
Syllabus	
Sr. No.	**List of Experiments**
1	Introduction to Power System Protection
2	Impact of Induction Motor Starting on Power System
3	Modelling of Differential Relay using MATLAB
4	Radial Feeder Protection
5	Parallel Feeder Protection
6	Principle of Reverse Power Protection
7	Differential Protection of Transformer
8	To the study time Vs. voltage characteristics of over voltage induction relay

Course Outcome;- Student will be able

1. Understand the performance of protection relays with feeders
2. Modelling of relay and understand principle of different relays.

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MTEE-206A-18 POWER ELECTRONICS APPLICATIONS TO POWER SYSTEMS

	L	T	P
Internal Marks: 60	**0**	**0**	**4**

External Marks: 40

Total Marks: 100

Course Objectives:-Students will be able :

1. To understand and analyze the performance of thyristor, converters and inverters
2. Applications of power electronics in operation of power system.

Syllabus

Sr. No.	**List of Experiments**
1	Study of three phase line commutated thyristor converter circuit
2	To study the performance of three phase variable frequency drive
3	Switching characteristics of MOSFET and IGBT
4	Performance analysis of Buck and Boost converter
5	Study of three phase PWM and non PWM inverter

Course Outcome:- Student will be able to

1. Understand and analyze the performance of converters and inverters as power electronics application.
2. Performance analysis of drive

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MTEE-206B-18 **SMART GRIDS LAB** **L T P**
Internal Marks: 60 **0 0 4**
External Marks: 40
Total Marks: 100

Course Objectives:-Students will be able :

1. To understand smart grid structure
2. Understand the microgrid
3. Understand power quality issues in smart grid.

Syllabus

Sr. No.	**List of Experiments**
1	To study the components of smart grid.
2	To analyze the geographic information system for smart grid.
3	Formation of microgrid and protection and control of grid.
4	Understand power quality issues in grid connected renewable energy sources
5	Performance analysis of smart meters.

Course Outcome:- Student will be able **to:**

1. To understand structure of smart grid and micro grid
2. Power quality issues for grid connected renewable sources

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MTEE-206C-18 **ARTIFICIAL INTELLIGENCE LAB** **L T P**
Internal Marks: 60 **0 0 4**
External Marks: 40
Total Marks: 100

Course Objectives:-Students will be able :

1. To understand applications of artificial intelligence technqiues
2. Designing of control system using these techniques.
3. Customization of controlling variables.

Syllabus

Sr. No.	**List of Experiments**
1	Write A Program For Best First Search.
2	Write A Program to Generate the output for A* Algorithm.
3	Write a Program To Show the Tic Tac Toe Game for 0 and X.
4	Write A Program For Expert System By Using Forward Chaining.
5	Comparing the Search Methods.
6	Implement the Greedy Search Algorithm.
7	Implement the min-max Algorithm.
8	Adding a Heuristic.

Course Outcome:- Student will be able to:

1. Increase in efficiency of system using these techniques.
2. Develop a comparison with basic controlling techniques and hence, draw a conclusion.

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MTA-105-18 **CONSTITUTION OF INDIA** **L T P**
Internal Marks: 00 **2 0 0**
External Marks: 00
Total Marks: 0

Course Objectives: Students will be able to

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus

Units	Content	Hours
1	History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working).	4
2	Philosophy of the Indian Constitution: Preamble, Salient Features.	4
3	Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.	4
4	Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.	4
5	Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.	4
6	Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.	4

Suggest Reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes: Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

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MTA-106-18 **PEDAGOGY STUDIES** **L T P**
Internal Marks: 00 **2 0 0**
External Marks: 00
Total Marks: 00

Course Objectives: Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
1. Identify critical evidence gaps to guide the development.

Syllabus

Units	Content	Hours
1	Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions**,** Overview of methodology and Searching.	4
2	Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.	2
3	Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change, Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies.	4
4	Professional development: alignment with classroom practices and follow up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.	4
5	Research gaps and future directions, Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.	2

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

6. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes: Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

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MTA-107-18 **STREE MANAGEMENT BY YOGA** **L T P**
Internal Marks: 00 **2 0 0**
External Marks: 00
Total Marks: 00

Course Objectives: Students will be able to:

1. To achieve overall health of body and mind
2. To overcome stress

Syllabus

Units	Content	Hours
1	Definitions of Eight parts of yog. (Ashtanga).	4
2	Yam and Niyam, Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	2
3	Asan and Pranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Types of pranayama.	4

Suggestedreading

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

Course Outcomes:- Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

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MTA-107-18 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

	L	T	P
	2	0	0

Internal Marks: 00
External Marks: 00
Total Marks: 00

Course Objectives: Students will be able to:

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Syllabus

Units	Content	Hours
1	Neetisatakam-Holistic development of personality, Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's), Verses- 71,73,75,78 (do's).	8
2	Approach to day to day work and duties, Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.	8
3	Statements of basic knowledge, Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68, Chapter 12 -Verses 13, 14 15, 16, 17, 18, Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39, Chapter18 – Verses 37,38,63.	8

Suggested reading

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes: Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.

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MTEE-301A-18 FACTS AND CUSTOM POWER DEVICES L T P
Internal Marks: 40 3 0 0
External Marks: 60
Total Marks: 100

Course Objectives:
Students will be able to:
1. To learn the active and reactive power flow control in power system
2. To understand the need for static compensators
3. To develop the different control strategies used for compensation

Syllabus

Unit	Content	Hours
1	Reactive power flow control in Power Systems – Control of dynamic power 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, Shunt and Series compensation principles – Reactive compensation at transmission and distribution level.	6
2	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.	8
3	Static series compensation: TSSC, SSSC -Static voltage and phase angle regulators – TCVR and TCPAR Operation and Control –Applications, Static series compensation – GCSC, TSSC, TCSC and Static synchronous series compensators and their Control.	6
4	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.	6
5	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.	6
6	Voltage swells, sags, flicker, unbalance and mitigation of these problems by power line conditioners- IEEE standards on power quality.	6

Suggest Reading

1. K R Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age InternationalPublishers, 2007
2. X P Zhang, C Rehtanz, B Pal, “Flexible AC Transmission Systems- Modelling and Control”,
3. N.G. Hingorani, L. Gyugyi, “Understanding FACTS: Concepts and Technology of Flexible ACTransmission Systems”, IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.

4. K.S.Sureshkumar ,S.Ashok , "FACTS Controllers & Applications", E-book edition, Nalanda DigitalLibrary, NIT Calicut,2003
5. G T Heydt , "Power Quality", McGraw-Hill Professional, 2007
6. T J E Miller, "Static Reactive Power Compensation", John Wiley and Sons, Newyork, 1982.

Course Outcomes: - Students will be able to:

1. Acquire knowledge about the fundamental principles of Passive and Active Reactive Power Compensation Schemes at Transmission and Distribution level in Power Systems.
2. Learn various Static VAR Compensation Schemes like Thyristor/GTO Controlled Reactive Power Systems, PWM_Inverter based Reactive Power Systems and their controls.
3. To develop analytical modeling skills needed for modeling and analysis of such Static VAR Systems.

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MTEE-301B-18 MODELING AND CONTROL OF DISTRIBUTED PARAMETER SYSTEM

L	T	P
3	0	0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Course Objectives

1. Introduction to modeling, analysis and control of distributed parameter systems
2. Introduction to finite discretization

Syllabus

Unit	Content	Hours
1	Overview: Motivation and examples (wave propagation, fluid flow, network traffic, electromagnetism)	6
2	Modeling of Distributed Parameter Systems: Parabolic and Hyperbolic. PDEs, Analytic and Numerical Solution of PDEs	8
3	Lyapunov stability of DPS, Boundary control and Observer Design of DPS	8
4	Finite Difference discretization of DPS, Finite Element discretization of DPS, Boundary Elements discretization of DPS	8
5	Reduction of discretized models	4
6	Applications: Control of systems with time delays, control of fluid flow, network control	8

Suggested reading

1. Miroslav Krstic and Andrey Smyshlyaev, “Boundary Control of PDEs: A Course on Backstepping Designs”, SIAM, 2008
2.Panagiotis D. Christofides, Birkhauser”Nonlinear and Robust Control of PDE Systems”, 2001
3.Hassan K. Khalil “Nonlinear Systems”, Third Edition, Prentice Hall 2002

Course Outcomes: Students will be able to

1. Able to mathematically model a distributed parameter system
2. Able to obtain numerical solutions for distributed parameter system
3. Able to reduce the complexity of discretized models

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MTEE-301C-18 **DYNAMICS OF LINEAR SYSTEMS** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives:-Students will be able to:
1. To understand the linear system and its functions
2. To understand the stability analysis of linear systems and implement the same in MATLAB

Syllabus

Units	Content	Hours
1	State variable representations of systems, transfer function and transfer function matrix, solutions of state equations.	8
2	Observability and controllability, minimal realization of MIMO systems, analysis of linear time varying systems, the concepts of stability.	8
3	Lyapunov stability analysis, Lyapunov function and its properties, controllability by state variable feedback.	6
4	Ackerman's Formula - stabilisation by output feedback, asymptotic observers for state measurement, observer design.	6
5	State space representation of discrete systems, solution of state equations, controllability and observabilty stability analysis using Lyapunov method.	6
6	State feedback of linear discrete time systems, design of observers - MATLAB Exercises.	8

Suggested reading

1. Thomas Kailath, "Linear Systems", Prentice Hall Inc., Englewood Cliffs, N.J. 1980.
2. K. Ogata, "State Space Analysis of Control Systems", Prentice Hall Inc., Englewood Cliffs, N.J., 1965.
3. K. Ogata, "Modern Control Engineering, (second edition)" , Prentice Hall Inc., Englewood Cliffs, N.J., 1990
4. M.Gopal, "Digital Control and State Variable Methods", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997
5. C.T. Chen, "Linear System Theory and Design", New York: Holt Rinehart and Winston ,1984
6. R.C. Dorf, and R. T. "Bishop, Modern Control Systems", Addison Wesley Longman Inc., 1999.

Course Outcomes:- Students will be able to:

1. To learn linear system modeling, analysis and design so as to obtain the ability to apply the same to engineering problems in a global perspective
2. Knowledge on carrying out detailed stability analysis of both linear and nonlinear systems
3. Design observers and controllers for linear systems
4. Acquire knowledge of discrete time linear systems modeling, analysis and design
5. Develop and utilize modern software tools for analysis and design of linear continuous and discrete time systems

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MTEE-301D-18 **ENERGY CONVERSION PROCESSES** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives:- Students will be able to

1. Analysis of different energy system like solar
2. Understand design aspects of MHD generators
3. Understand Fuel cell & their applications

Syllabus

Unit	Content	Hours
1	Basic science of energy conversion. Indirect verses direct conversion	4
2	Physics of semiconductor junctions for photovoltaic and photo-Electro chemical conversion of solar energy. Fabrication and evaluation of various solar cells in photovoltaic power generation systems	4
3	Technology and physics of thermo-electric generations. Thermal-electric materials and optimization studies	4
4	Basic concepts and design considerations of MHD generators Cycle analysis of MHD systems	6
5	Thermonic power conversion and plasma diodes. Thermo dynamics and Performance of fuel cells and their applications.	4
6	Advanced topics in Energy Conversion Process	4

Suggest Reading

1. S. S. L. Chang, "Energy Conversion", Prentice Hall, 1963. 16
2. S. W. Angrist, "Direct Energy Conversion", Pearson, 1982
3. R. J. Rosa, "Magneto hydrodynamic Energy Conversion", Springer, 1987
4. V. S. Bagotsky, "Fuel Cell Problems and Solutions", John Wiley & Sons, 2009

Course Outcomes:- Student will be able to:

1. Have knowledge about Physics of semiconductor junctions for photovoltaic and photo-electro chemical conversion
2. Carry out Cycle analysis of MHD systems
3. Know Different thermo-electric processes of electric materials and their efficient use

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MTOE-301A-18 **BUSINESS ANALYTICS** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives:-Students will be able to:
1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
4. To become familiar with processes needed to develop, report, and analyze business data.
5. Use decision-making tools/Operations research techniques.
6. Mange business process using analytical and management tools.
7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Syllabus

Units	Content	Hours
1	Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics, Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.	9
2	Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	8
3	Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.	9
4	Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	10
5	Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information,	8

	Utility and Decision Making.	
6	Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	4

Suggested reading

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

Course Outcome:-

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modelling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights.

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MTOE-301B-18 **INDUSTRIAL SAFETY** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives:-Students will be able to:

1. Understand about industrial safety and maintenance engineering
2. Learn possible ways of prevention from wear and tear and methods of fault tracing
3. Understand periodic maintenance.

Syllabus

Units	Content	Hours
1	Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.	8
2	Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.	8
3	Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.	8
4	Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.	8
5	Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and	8

	importance.	

Suggested reading:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

Course Outcome:- Student will be able to:

1. To know about industrial safety and ways of prevention of wear and tear
2. Learn about fault identification and periodic maintenance
3. To get knowledge about all safety measures

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MTOE-301C-18 **OPERATIONS RESEARCH** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives:-Students will be able to:

1. To learn the optimization techniques
2. How to formulate LPP and handling of Nonlinear programming
3. How to do the scheduling and sequencing of models.

Syllabus

Units	Content	Hours
1	Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models.	8
2	Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming.	8
3	Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT.	8
4	Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.	8
5	Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation.	8

Suggested reading

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Panner selvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Course Outcomes: Student should be able to

1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

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MTOE-301D-18 COST MANAGEMENT OF ENGINEERING PROJECTS **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives:-Students will be able to

1. To get knowledge about cost concept and cost management process
2. To know about meaning and process of project execution
3. To learn quantitative techniques and cost planning

Syllabus

Units	Content	Hours
1	Introduction and Overview of the Strategic Cost Management Process.	6
2	Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.	6
3	Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team : Role of each member. Importance Project site : Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.	10
4	Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.	10
5	Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.	8

Suggested reading:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Course Outcomes: Student should be able to

1. Understand cost management process
2. To execute project considering cost factor
3. To manage planning of cost and learn about the techniques

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MTOE-301E-18 **COMPOSITE MATERIALS** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives:-Students will be able to:

1. To understand composite materials and their reinforcement
2. Manufacturing of matrix

Syllabus

Units	Content	Hours
1	Introduction, Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.	8
2	Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.	8
3	Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.	8
4	Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.	8
5	Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.	8

Suggested text book reading:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

Suggested reference reading:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.

4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Course Outcome:- Student will be able to

1. Learn about composite materials and their process of reinforcement
2. Understand about strength and manufacturing of matrix

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MTOE-301F-18 **WASTE TO ENERGY** **L T P**
Internal Marks: 40 **3 0 0**
External Marks: 60
Total Marks: 100

Course Objectives:-Students will be able to:

1. Understand classification of waste and about energy from waste
2. Process of biomass waste conversion to energy
3. To understand biomass waste properties.

Syllabus

Units	Content	Hours
1	Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.	8
2	Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.	8
3	Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.	8
4	Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.	8
5	Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.	8

Suggested reading:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Course Outcome:- Student will be able to

1. Know about the energy in biomass waste
2. Understand the biomass fuel conversion process for energy
3. Know about biomass waste properties