GIET UNIVERSITY

MASTERS DEGREE PROGRAMME

M. Tech
POWER ELECTRONICS

Course Structure and Detailed Syllabi
for students admitted in
2019-20
Academic Session

ACADEMIC CURRICULA
2019 – 2021

I[ST] SEMESTER

Sl No	Core/Elective	Subject Code	Subject	L	T	P	C
1	PC 1	MPEPC1010	Electric Drive System	3	0	0	3
2	PC 2	MPEPC1020	Modeling and Analysis of Electrical Machines	3	0	0	3
3	PE 1	MPEPE1031	Advanced Power Electronic Circuits	3	0	0	3
		MPEPE1032	Optimal and Adaptive Control				
		MPEPE1033	Power Quality				
		MPEPE1034	Dynamics of Electrical Machine				
4	PE 2	MPEPE1041	Static VAR Controllers and Harmonic Filtering	3	0	0	3
		MPEPE1042	PWM converter and Applications				
		MPEPE1043	Power Semiconductor Devices & Modeling				
5	PC	MPEPC1150	Research Methodology and IPR	2	0	0	2
6	Lab I	MPEES1160	Electrical Drives Laboratory	0	0	4	2
7	Lab II	MPEES1171	Electrical Machines Laboratory	0	0	4	2
		MPEES1172	Power Quality lab				
8	Audit I	MPEAU1081	English for Research Paper Writing	2	0	0	0
		MPEAU1082	Disaster Management				
		MPEAU1083	Sanskrit for Technical Knowledge				
		MPEAU1084	Value Education				
Total				16	0	8	**18**

II[ND] SEMESTER

Sl. No	Core/Elective	Subject Code	Subject	L	T	P	C
1	PC 3	MPEPC2010	Power Electronic Converters	3	0	0	3
2	PC 4	MPEPC2020	Digital Control of Power Electronic and Drive Systems	3	0	0	3
3	PE 3	MPEPE2031	Switched Mode and Resonant Converters	3	0	0	3
		MPEPE2032	Industrial Load Modeling and Control				
		MPEPE2033	Advanced Digital Signal Processing				
4	PE 4	MPEPE2041	Advanced Microcontroller based Systems	3	0	0	3
		MPEPE2042	Distributed Generation				
		MPEPE2043	Smart Grids				
5	Mini Project	MPEES2150	Mini Project with Seminar	0	0	4	2
6	Lab III	MPEES2160	Power Electronics Laboratory	0	0	4	2
7	Lab IV	MPEES2171	Micro-controller Lab	0	0	4	2

		MPEES2172	Digital Signal Processing Lab (based on core 4)				
8	Audit II	MPEAU2081	Constitution of India	2	0	0	0
		MPEAU2082	Pedagogy Studies				
		MPEAU2083	Stress Management by Yoga				
		MPEAU2084	Personality Development through Life Enlightenment Skills				
Total				14		12	**18**

IIIRD SEMESTER

Sl. No	**Core/Elective**	**Subject Code**	**Subject**	L	T	P	C
1	PE 5	MPEPE3011	SCADA Systems and Applications	3	0	0	3
		MPEPE3012	FACTS and Custom Power Devices				
		MPEPE3013	HVDC				
2	OE	MPEOE3021	Business Analytics	3	0	0	3
		MPEOE3022	Industrial Safety				
		MPEOE3023	Operations Research				
		MPEOE3024	Cost Management of Engineering Projects				
		MPEOE3025	Composite Materials				
		MPEOE3026	Waste to Energy				
3	Major Project	MPEES3130	Phase-I Dissertation	0	0	20	10
Total				3	0	20	**16**

IVTH SEMESTER

Sl. No	**Subject Code**	**Subject Code**	**Subject**	L	T	P	C
1	Major Project	MPEES4110	Phase-II Dissertation	0	0	32	16
Total				0	0	32	**16**

SCHEME OF INSTRUCTION SUMMARY

SL. NO.	COURSE WORK - SUBJECTS AREA	CREDITS / SEMESTER				TOTAL CREDITS	%
		I	II	III	IV		
1	Professional Core (PC)	8	6			14	20.58
2	Professional Electives (PE)	6	6	3		15	22.05
3	Open Electives (OE)			3		3	4.41
4	Thesis Work , Seminar and VIVA-VOICE		2	10	16	28	41.17
5	LAB	4	4			8	11.77
	TOTAL	**18**	**18**	**16**	**16**	**68**	**100**

DISTRIBUTION OF CREDITS AND MARKS

Year	Semester	THEORY				PRACTICAL / THESIS/SEMINAR/VIVA VOICE			Total	
		No. of Subjects	Credits	ISA	ESA	No. of Labs/projects/seminar	Credits	ESA	Credits	Marks
I Year	I Sem	5	14	150	350	2	4	200	18	700
	II Sem	4	12	120	280	3	6	300	18	700
II Year	III Sem	2	6	60	140	1	10	100	23	300
	IV Sem			0	0	1	16	100	22	100
TOTAL		11	32	330	770	7	36	800	68	1800

I[ST] SEMESTER

Sl No	Core/Elective	Subject Code	Subject	L	T	P	C
1	PC 1	MPEPC1010	Electric Drive System	3	0	0	3
2	PC 2	MPEPC1020	Modeling and Analysis of Electrical Machines	3	0	0	3
3	PE 1	MPEPE1031	Advanced Power Electronic Circuits	3	0	0	3
		MPEPE1032	Optimal and Adaptive Control				
		MPEPE1033	Power Quality				
		MPEPE1034	Dynamics of Electrical Machine				
4	PE 2	MPEPE1041	Static VAR Controllers and Harmonic Filtering	3	0	0	3
		MPEPE1042	PWM converter and Applications				
		MPEPE1043	Power Semiconductor Devices & Modeling				
5		MPERD1150	Research Methodology and IPR	2	0	0	2
6	Lab I	MPEES1160	Electrical Drives Laboratory	0	0	4	2
7	Lab II	MPEES1171	Electrical Machines Laboratory	0	0	4	2
		MPEES1172	Power Quality lab				
8	Audit I	MPEAU1081	English for Research Paper Writing	2	0	0	0
		MPEAU1082	Disaster Management				
		MPEAU1083	Sanskrit for Technical Knowledge				
		MPEAU1084	Value Education				
Total				16	0	8	**18**

Subject Code	Subject Name	L	T	P	C	
MPEPC1010	ELECTRIC DRIVE SYSTEM	3	0	0	3	

Course Educational Objectives

CEO1	Understand Basic electrical drives and their analysis.
CEO2	Learn Design of controller for drives
CEO3	Understand Scalar control of electrical drives

Course Outcomes

Students will be able to:

CO1	Model and simulate electric drive systems
CO2	Design modulation strategies of power electronics converters, for drives application
CO3	Design appropriate current/voltage regulators for electric drives
CO4	Select and implement the drives for Industrial Process
CO5	Implement various variable speed drives in Electrical Energy Conversion System

SYLLABUS

Unit – I **[12 Hrs]**

- Dynamics of Electric Drives: Fundamentals of torque equation.
- Speed torque convention and Multi-quadrant operation, components of load torques.
- Classification of load torques steady state stability.
- Load equation, Speed control and drive classification.
- Close loop control of drives.

Unit - II **[10 Hrs]**

- DC motor Drives-Modelling of DC machines.
- Steady state characteristics with armature and speed control.
- Phase controlled DC motor drives, chopper controlled DC motor drives

Unit – III **[14 Hrs]**

- Poly-phase induction machines- Dynamic modelling of induction machines.
- Small signal equations, control characteristics of induction machines.
- Phase-controlled induction machines. Stator voltage control.
- Slip energy recovery scheme, frequency control and vector control of induction motor

Unit – IV **[10 Hrs]**

- Traction motor: Starting. Speed-Time characteristics. Braking.
- Traction motors used in practice.
- Industrial Drives-Digital Control of Electric Drives.
- Stepper motor. Servo motor and their Applications

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. G.K, Dubey, "Power semiconductor controlled Drives", Prentice Hall international, New Jersey,
1989.
2. R.Krishanam, “Electric motor drives modelling, analysis and control”, PHI-India-2009.
3. G. K. Dubey,“Fundamentals of electric Drives, Narosa Publishing House”, 2nd edition, 2011.
4. W. Leonhard, “Control of Electrical drives”, Springer, 3rd edition, 2001.
5. P.C. Krause –, “Analysis of Electric Machine”, Wiley-IEEE press 3rdedition.
6. K. Bose, “Modern Power Electronics and AC Drives”, Prentice Hall publication, 1st edition,
2001.

Subject Code	Subject Name	L	T	P	C	
MPEPC1020	**MODELING AND ANALYSIS OF ELECTRICAL MACHINES**	3	0	0	3	

Course Educational Objectives

CEO1	To understand the operation of an electrical machine mathematically.
CEO2	To understand how a machine can be represented as its mathematical equivalent.
CEO3	To develop mathematical model of AC & DC machines and perform transient analysis on them

Course Outcomes

Students will be able to:

CO1	Knowledge about the dynamic behavior rotating machines.
CO2	Able to understand equivalent circuit of synchronous machines.
CO3	To understand various practical issues of different machines

SYLLABUS

Unit – I **[12 Hrs]**

- Principles of Electromagnetic Energy Conversion.
- General expression of stored magnetic energy.
- Co-energy and force/torque, example using single and doubly excited system
- Basic Concepts of Rotating Machines-Calculation of air gap mmf and per phase machine inductance using physical machine data; Voltage and torque equation of dc machine.

Unit - II **[10 Hrs]**

- Three phase symmetrical induction machine and salient pole synchronous machines in phase variable form
- Application of reference frame theory to three phase symmetrical induction and synchronous machines
- Dynamic direct and quadrature axis model in arbitrarily rotating reference frames

Unit – III **[15 Hrs]**

- Determination of Synchronous machine dynamic equivalent circuit parameters
- Analysis and dynamic modelling of two phase asymmetrical induction machine and single phase induction machine.

Unit – IV **[8 Hrs]**

- Special Machines - Permanent magnet synchronous machine
- Surface permanent magnet (square and sinusoidal back emf type) and interior permanent magnet machines
- Construction and operating principle
- Dynamic modelling and self-controlled operation
- Analysis of Switch Reluctance Motors.
- Brushless D.C. Motor for space Applications
- Recent trends

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. Charles Kingsle,Jr., A.E. Fitzgerald, Stephen D.Umans, “Electric Machinery”, Tata McGraw Hill
2. R. Krishnan, “Electric Motor & Drives: Modelling, Analysis and Control”, Prentice Hall of India
3. Miller, T.J.E., “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press
4. P.C.Krause “Analysis of Electric Machine” Wiley IEEE Press 3rd Edition

Subject Code	Subject Name	L	T	P	C	
MPEPE1031	**ADVANCED POWER ELECTRONIC CIRCUITS**	3	0	0	3	

Course Educational Objectives

CEO1	Understand the operation of advanced power electronic circuit topologies.
CEO2	Understand the control strategies involved.
CEO3	Learn few practical circuits, used in practice.

Course Outcomes

Students will be able to:

CO1	Knowledge about analysis and design of Load Commutated CSI and PWM CSI
CO2	Learn analysis and design of series Inverters.
CO3	Acquire knowledge about analysis and design of Switched Mode Rectifiers,APFC, DC-DC converters &Resonant converters

SYLLABUS

Unit – I **[8 Hrs]**

- Boost type APFC and control.
- Three phase utility interphases and control-Buck, Boost, Buck-Boost SMPS Topologies

Unit - II **[6 Hrs]**

- Modes of operation –Push-Pull and Forward Converter Topologies - Voltage Mode Control.
- Half and Full Bridge Converters

Unit – III **[8 Hrs]**

- Flyback Converter.
- Introduction to Resonant Converters.
- Load Resonant Converter. Zero Voltage Switching Clamped Voltage Topologies

Unit – IV **[10 Hrs]**

- Resonant DC Link Inverters with Zero Voltage Switching.
- High Frequency Link Integral Half Cycle Converter
- Modelling and design of DC-DC Converters for various renewable energy conversions.
- Few power electronic circuits used in practice for controlling electric drives

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

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.

Subject Code	Subject Name	L	T	P	C	
MPEPE1032	**OPTIMAL AND ADAPTIVE CONTROL**	3	0	0	3	

Course Educational Objectives

CEO1	To know the operation of closed and open loop optimal control.
CEO2	Understand the adaptive control strategies
CEO3	Learn dynamic programming method.

Course Outcomes

Students will be able to:

CO1	Knowledge in the mathematical area of calculus of variation so as to apply the same for solving optimal control problems.
CO2	Problem formulation, performance measure and mathematical treatment of optimal control problems.
CO3	Acquire knowledge on solving optimal control design problems by taking into consideration the physical constraints on practical control systems
CO4	To obtain optimal solutions to controller design problems taking into consideration the limitation on control energy in the real practical world.

SYLLABUS

Unit – I **[10 Hours]**

- Optimal control problem – fundamental concepts and theorems of calculus of variations–Euler - Language equation and extremal of functional.

Unit - II **[8Hours]**

- Variational approach to solving optimal control problems.
- Hamiltonian and different boundary conditions for optimal control problem.

Unit – III **[10 Hours]**

- Linear regulator problem - Pontryagin's minimum principle.
- Dynamic programming - Principle of optimality and its application to optimal control problem.

Unit – IV **[12 Hours]**

- Hamilton-Jacobi-Bellman equation - model reference adaptive systems
- (MRAS) - Design hypothesis**.**
- Introduction to design method based on the use of Liapunov function.
- Design and simulation of variable structure adaptive model following control.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

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

Subject Code	Subject Name	L	T	P	C	
MPEPE1033	**POWER QUALITY**	3	0	0	3	

Course Educational Objectives

CEO1	Understand the different power quality issues to be addressed
CEO2	Understand the recommended practices by various standard bodies like IEEE, IEC, etc. on voltage & frequency, harmonics
CEO3	Understanding STATIC VAR Compensators

Course Outcomes

Students will be able to:

CO1	Acquire knowledge about the harmonics, harmonic introducing devices and effect of harmonics on system equipment and loads
CO2	develop analytical modeling skills needed for modeling and analysis of harmonics in networks and components
CO3	To introduce the student to active power factor correction based on static VAR compensators and its control techniques
CO4	To introduce the student to series and shunt active power filtering techniques for harmonics.

SYLLABUS

Unit – I **[13 Hours]**

- Introduction-power quality-voltage quality-overview of power
- Quality phenomena classification of power quality issues.
- Power quality measures and standards-THD-TIF-DIN-C-message weights.
- Flicker factor transient phenomena-occurrence of power quality problems
- Power acceptability curves-IEEE guides
- Standards and recommended practices
- Harmonics-individual and total harmonic distortion
- RMS value of a harmonic waveform
- Triplex harmonics. Important harmonic introducing devices.SMPS
- Three phase power converters-arcing devices saturable devices
- Harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.

Unit - II **[8Hours]**

- Modelling of networks and components under non-sinusoidal conditions
- Transmission and distribution systems
- Shunt capacitors-transformers. Electric machines.
- Ground systems loads that cause power quality problems.
- Power quality problems created by drives and its impact on drive.

Unit – III **[8 Hours]**

- Power factor improvement- Passive Compensation.
- Passive Filtering. Harmonic Resonance. Impedance Scan Analysis
- Active Power Factor Corrected Single Phase Front End
- Control Methods for Single Phase APFC.
- Three Phase APFC and Control Techniques
- PFC based on Bilateral Single Phase and Three Phase Converter

Unit – IV **[12 Hours]**

- Hamilton-Jacobi-Bellman equation - model reference adaptive systems (MRAS) - Design hypothesis.

- Introduction to design method based on the use of Liapunov function.
- Design and simulation of variable structure adaptive model following control

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. G.T. Heydt, "Electric power quality", McGraw-Hill Professional, 2007
2. Math H. Bollen, "Understanding Power Quality Problems", IEEE Press, 2000
3. J. Arrillaga, "Power System Quality Assessment", John wiley, 2000
4. J. Arrillaga, B.C. Smith, N.R. Watson & A. R.Wood ,"Power system Harmonic Analysis", Wiley, 1997

Subject Code	Subject Name	L	T	P	C	
MPEPE1034	**DYNAMICS OF ELECTRICAL MACHINES**	3	0	0	3	

Course Educational Objectives

CEO1	Learn Performance characteristics of machine.
CEO2	To understand the dynamics of the machine.
CEO3	To understand how to determine stability of machine.
CEO4	Learn the synchronous machine analysis.

Course Outcomes

Students will be able to:

CO1	Formulation of electro dynamic equations of all electric machines and analyze the performance characteristics
CO2	Knowledge of transformations for the dynamic analysis of machines
CO3	Knowledge of determination of stability of the machines under small signal and transient conditions
CO4	Study about synchronous machine

SYLLABUS

Unit – I **[6 Hours]**

- Stability.
- Primitive 4 Winding Commutator Machine. Commutator Primitive Machine.
- Complete Voltage Equation of Primitive 4 Winding Commutator Machine
- 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.

Unit - II **[10 Hours]**

- Three Phase Salient Pole Synchronous Machine.
- Parks Transformation- Steady State Analysis.

Unit – III **[6 Hours]**

- Large Signal Transient. Small Oscillation Equations in State Variable form
- Dynamical Analysis of Interconnected Machines.

Unit – IV **[6 Hours]**

- Large Signal Transient Analysis using Transformed Equations.
- DC Generator /DC Motor System.
- Alternator /Synchronous Motor System.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. D.P. Sengupta & J.B. Lynn," Electrical Machine Dynamics", The Macmillan Press

Ltd. 1980
2. R Krishnan "Electric Motor Drives, Modelling, 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

Subject Code	Subject Name	L	T	P	C	
MPEPE1041	**STATIC VAR CONTROLLER AND HARMONIC FILTERING**	3	0	0	3	

Course Educational Objectives

CEO1	Understand the various static converters
CEO2	Understand the static converter control strategies
CEO3	Understand the active and reactive power compensation and their control
CEO4	Understand harmonic filtering and its control design.

Course Outcomes

Students will be able to:

CO1	Acquire knowledge about the fundamental principles of Passive and Active Reactive Power Compensation Schemes at Transmission and Distribution level in Power Systems
CO2	To introduce the student to various single phase and three-phase Static VAR Compensation schemes and their controls
CO3	To develop analytical modeling skills needed for modeling and analysis of such Static VAR

SYLLABUS

Unit – I **[6 Hours]**

- Fundamentals of Load Compensation.
- Steady-State Reactive Power Control in Electric Transmission Systems.
- Reactive Power Compensation and
- Dynamic Performance of Transmission Systems
- Power Quality Issues: Sags, Swells, Unbalance, Flicker, Distortion.
- Current Harmonics. Sources of Harmonics in Distribution Systems and Ill Effects

Unit - II **[6 Hours]**

- Static Reactive Power Compensators and their control. Shunt Compensators.
- SVCs of Thyristor Switched and Thyristor Controlled types and their control,
- STATCOMs and their control.
- Series Compensators of thyristor Switched and Controlled Type and their Control.
- SSSC and its Control, Sub-Synchronous Resonance and damping.
- Use of STATCOMs and SSSCs for Transient and Dynamic Stability Improvement in Power System.

Unit – III **[10 Hours]**

- Converters for Static Compensation.
- Single Phase and Three Phase Converters and Standard Modulation Strategies (Programmed Harmonic Elimination and SPWM).
- GTO Inverters. Multi-Pulse Converters and Interface Magnetics.
- Multi-Level Inverters of Diode Clamped Type and Flying Capacitor Type and suitable modulation strategies (includes SVM).

- Multi-level inverters of Cascade Type and their modulation. Current Control of Inverters

Unit – IV **[8 Hours]**

- Passive Harmonic Filtering.
- Single Phase Shunt Current Injection Type Filter and its Control.
- Three Phase Three-wire Shunt Active Filtering and their control using p-q theory and d-q modelling.
- Three phase four wire shunt active filters.
- Hybrid Filtering using Shunt Active Filters.
- Dynamic Voltage Restorer and its control.
- Power Quality Conditioner
- Series Active Filtering in Harmonic Cancellation Mode.
- Series Active Filtering in Harmonic Isolation Mode

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. Ned Mohan et.al, "Power Electronics",John Wiley and Sons,2006.
2. G. Massobrio, P. Antognet," Semiconductor Device Modeling with Spice", McGraw-Hill, Inc., 1988.
3. B. J. Baliga," Power Semiconductor Devices",Thomson, 2004
4. V. Benda, J. Gowar, D. A. Grant," Power Semiconductor Devices. Theory and Applications",JohnWiley& Sons1994.

Subject Code	Subject Name	L	T	P	C	
MPEPE1042	**PWM CONVERTERS AND APPLICATION**	3	0	0	3	

Course Educational Objectives

CEO1	Understand the concepts and basic operation of PWM converters, including basic circuit operation and design
CEO2	Understand the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality.

Course Outcomes

Students will be able to:

CO1	Knowledge concepts and basic operation of PWM converters, including basic circuit operation and design
CO2	Learn the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality
CO3	Able to recognize and use the following concepts and ideas: Steady-State and transient modeling and analysis of power converters with various PWM techniques.

SYLLABUS

Unit – I **[9 Hours]**

- AC/DC and DC/AC power conversion
- Overview of applications of voltage source converters and current source converters.
- Pulse width modulation techniques for bridge converters
- Bus clamping PWM.Space vector based PWM.
- Advanced PWM techniques

Unit - II **[6 Hours]**

- Practical devices in converter.
- Calculation of switching and conduction power losses

Unit – III **[4 Hours]**

- Compensation for dead time and DC voltage regulation.
- Dynamic model of PWM converter. Multilevel converters.
- Constant V/F induction motor drives

Unit – IV **[8 Hours]**

- Estimation of current ripple and torque ripple in inverter fed drives.
- Line-side converters with power factor compensation
- Active power filtering. Reactive power compensation.
- Harmonic current compensation.
- Selective harmonic elimination PWM technique for high power electric drives

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

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 Hil

Subject Code	Subject Name	L	T	P	C	
MPEPE1043	**POWER SEMICONDUCTOR DEVICES AND MODELING**	3	0	0	3	

Course Educational Objectives

CEO1	Understand the concepts and basic operation of switching devices, including basic circuit operation and design
CEO2	Understand the steady-state and dynamic analysis of devices along with the applications like solid state drives and power quality

Course Outcomes

Students will be able to:

CO1	Apply knowledge of physics of semiconductor and electronic devices to develop and control power electronic systems..
CO2	Describe, analyze characteristics and compare various types of power semiconductor devices for theoretical and practical context
CO3	Identify and prioritize the use of power devices in various power electronic systems and control applications
CO4	Apply the concept of thermal design for various power electronic equipments.
CO5	Develop skills and apply the principles to explore the possibility of emerging power semiconductor devices in different areas.

SYLLABUS

Unit – I **[6 Hours]**

- Power Diodes: Basic Structure and I-V Characteristics . Breakdown Voltages and Control . On State Losses, Switching Characteristics . Turn on Transient . Turn off Transient . Reverse Recovery Transient . Schottky Diodes . Snubber Requirements for Diodes and Diode Snubbers.Modelling and simulation of Power Diodes..

Unit - II **[6 Hours]**

- Thyristors: a) Thyristors: - Basic Structure . V-I Characteristics . Turn on Process . On State operation . Turn off process, Switching Characteristics .Turn on Transient and di/dt limitations . Turn off Transient . Turn off time and dv/dt limitations . Ratings of Thyristors . Snubber Requirements and Snubber Design. Modeling and simulation of Thyristors. b)

Gate Turnoff Thyristor (GTO):. Basic Structure and Operation . GTO Switching Characteristics. GTO Turn on Transient. GTO Turn off Transient Minimum ON and OFF State times .Maximum Controllable Anode Current Overcurrent protection of GTOs Modeling and simulation of GTOs. c) Triacs: Basic Structure and operation . V-I Characteristics .

Unit – III **[10 Hours]**

- Transistors: a) Power BJTs: . Basic Structure and I-V Characteristics .Switching Characteristics. b) MOSFETs - Basic Structure . V-I Characteristics . Turn on Process . On State operation . Turn off process . Switching Characteristics Resistive Switching Specifications . Clamped Inductive Switching Specifications - Turn on Transient and di/dt limitations . Turn off Transient Turn off time . Switching Losses . Effect of Reverse Recovery Transients on Switching Stresses and Losses - dv/dt limitations . Gating Requirements Gate Charge - Ratings of MOSFETs. FBSOA and RBSOA Curves . Device Protection -Snubber Requirements . Modelling and simulation of Power MOSFETS

Unit – IV **[8 Hours]**

- Insulated Gate Bipolar Transistors (IGBTs):. Basic Structure and Operation .Latch up IGBT Switching Characteristics . Resistive Switching Specifications . Clamped Inductive Switching Specifications - IGBT Turn on Transient . IGBT Turn off Transient- Current Tailing - Ratings of MOSFETs. FBSOA and RBSOA Curves . Switching Losses - Minimum ON and OFF State times - Switching Frequency Capability - Overcurrent protection of IGBTs . Short Circuit Protection.

Unit – VI **[4 Hours]**

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Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. Giovanni Petrecca,. "Industrial Energy Management: Principles and Applications", TheKluwer international series -207,1999

2. Anthony J. Pansini, Kenneth D. Smalling,. "Guide to Electric Load Management", Pennwell Pub;(1998)

3. Handbook on Energy Audit and Environment Management , Y P Abbi and Shashank Jain, TERI, 2006

4. Handbook of Energy Audits Albert Thumann, William J. Younger, Terry Niehus, 2009.

Subject Code	Subject Name	L	T	P	C	
MPERD1150	**Research Methodology and IPR**	**2**	**0**	**0**	**2**	

Course Educational Objectives	
CEO1	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CEO2	Able to learn about Intellectual Property Right to be promoted among students in general & engineering in particular.
Course Outcomes	
Students will be able to:	
CO1	Understand research problem formulation.

CO2	Analyze research related information
CO3	Follow research ethics
CO4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO5	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.

SYLLABUS

Unit – I **[12 Hours]**

- 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
- Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit - II **[6 Hours]**

- Effective technical writing, how to write report, Paper a presentation and assessment by a review committee

Unit – III **[10 Hours]**

- 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.

Unit – IV **[8 Hours]**

- Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.
- New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science &
2. engineering students'"
3. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
4. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
5. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
6. Mayall , "Industrial Design", McGraw Hill, 1992.
7. Niebel , "Product Design", McGraw Hill, 1974.
8. Asimov , "Introduction to Design", Prentice Hall, 1962.
9. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New
10. Technological Age", 2016.
11. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

LABS

Subject Code	Subject Name	L	T	P	C	
MPEES1160	**Electrical Drives Laboratory**	**0**	**0**	**4**	**2**	

Course Educational Objectives	
CEO1	To impart industry oriented learning
CEO2	To evaluate the use of computer-based analysis tools to review the major classes of Machines and their physical basis for operation

Course Outcomes	
Students will be able to:	
CO1	Identify relevant information to supplement to the Electric Drives course.
CO2	Set up control strategies to synthesize the voltages in dc and ac motor drives.
CO3	Develop testing and experimental procedures applying basic knowledge in electronics, electrical circuit analysis, electrical machines and microprocessors
CO4	An ability to use standard methods to determine accurate modeling/simulation parameters for various general-purpose electrical machines and power electronics devices required for designing a system and solve drives related problems

LIST OF EXPERIMENTS

Study of Thyristor controlled D.C Drive.
2. Study of Chopper Fed DC Motor.
3. Study of A.C single phase motor speed control using TRIAC.
4. PWM inverter fed three phase induction motor control using PSPICE/MATLAB/PSIM software.
5. VSI/CSI fed induction motor drive analysis using MATLAB/PSPICE/PSIM software.
6. Study of V/f control operation of three phase induction motor.
7. Study of permanent magnet synchronous motor drive fed by PWM inverter using software.
8. Regenerative/ Dynamic breaking operatation for DC motor study using software.
9. Regenerative/ Dynamic breaking operatation for AC motor study using software.
10. PC/PLC based AC/DC motor control operation.

Text Book:
LAB MANUAL

Subject Code	Subject Name	L	T	P	C	
MPEES1171	**Electrical Machines Laboratory**	**0**	**0**	**4**	**2**	

Course Educational Objectives	
CEO1	To study the voltage regulation and characteristics of alternator
CEO2	To acquire knowledge of characteristics of synchronous motor

Course Outcomes	
Students will be able to:	
CO1	Acquire practical concept of synchronization of an alternator with infinite busbar
CO2	Apply the knowledge of alternator in generation field.
CO3	Implement the characteristics of three and single phase induction motors in different drives
CO4	Understand the concept and application of synchronous motor in various industrial field.
CO5	

LIST OF EXPERIMENTS

1. Load test on dc shunt motor to draw speed – torque and horse power – efficiency characteristics.
2. Field Test on dc series machines.
3. Speed control of dc shunt motor by armature and field control.
4. Swinburne's Test on dc motor.
5. Retardation test on dc shunt motor.
6. Regenerative test on dc shunt machines.
7. Load test on three phase induction motor.
8. No load and Blocked rotor test on three phase induction motor to draw (i) equivalent circuit and (ii) circle diagram. Determination of performance parameters at different load conditions from (i) and (ii).
9. Load test on induction generator.
10. Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics.
11. Conduct suitable tests to draw the equivalent circuit of single phase induction motor and determine performance parameters.
12. Conduct an experiment to draw V and _ curves of synchronous motor at no load and load conditions.

Text Book:

LAB MANUAL

Subject Code	Subject Name	L	T	P	C	
MPEES1172	**Power Quality lab**	**0**	**0**	**4**	**2**	

Course Educational Objectives	
CEO1	To learn the usage of passive elements in various Power quality issues
CEO2	To calculate the various parameters in Power quality

Course Outcomes	
Students will be able to:	
CO1	Apply power system fundamentals to the design of a system that meet specific needs.
CO2	Design a power system solution based on the power quality problem requirements and realistic Constraints
CO3	Develop a major design experience in power quality of a system that prepares them for engineering practice.

LIST OF EXPERIMENTS

1. To study the effect of non linear loads on power quality.
2. To demonstrate the voltage and current distortions experimentally.
3. To reduce the current harmonics with filters.
4. To study the voltage sag due to starting of large induction motor.
5. To study the capacitor switching transients.
6. To study the effect of balanced non-linear load on neutral current , in a three phase circuit
7. To study the effect of ground loop.
8. To study the effect of voltage flicker.
9. To calculate the distortion power factor.
10. Study the effect of harmonics on energy meter reading.
11. To study effect of voltage sag on electrical equipments.
12. To obtain the current harmonics drawn by power electronics interface using PSCAD

Text Book:

LAB MANUAL

AUDIT-1

Subject Code	Subject Name	L	T	P	C	
MPEAU1081	**English for Research Paper Writing**	**2**	**0**	**0**	**0**	

Course Educational Objectives

CEO1	Understand that how to improve your writing skills and level of readability
CEO2	Learn about what to write in each section
CEO3	Understand the skills needed when writing a Title

Course Outcomes

SYLLABUS

Unit – I **[8 Hours]**

- Planning and Preparation, Word Order, Breaking up long sentences,
- Structuring Paragraphs and Sentences, Being Concise and Removing
- Redundancy, Avoiding Ambiguity and Vagueness`
- Clarifying Who Did What, Highlighting Your Findings, Hedging and
- Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit - II **[4 Hours]**

- Review of the Literature, Methods, Results, Discussion, Conclusions, The
- Final Check

Unit – III **[4 Hours]**

- 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,

Unit – IV **[8 Hours]**

- 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
- useful phrases, how to ensure paper is as good as it could possibly be the
- first- time submission

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

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

Subject Code	Subject Name	L	T	P	C	
MPEAU1082	**Disaster Management**	**2**	**0**	**0**	**0**	

Course Educational Objectives

CEO1	learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response
CEO2	critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives
CEO3	develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CEO4	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

Unit – I **[8 Hours]**

Introduction

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

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.

Unit - II **[4 Hours]**

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

Unit – III **[4 Hours]**

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

Unit – IV **[8 Hours]**

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.

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.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

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.

Subject Code	Subject Name	L	T	P	C	
MPEAU1083	**Sanskrit for Technical Knowledge**	**2**	**0**	**0**	**0**	

Course Educational Objectives

CEO1	To get a working knowledge in illustrious Sanskrit, the scientific language in the world
CEO2	Learning of Sanskrit to improve brain functioning
CEO3	Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
CEO4	The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

COURSE OUTCOMES

CO1	Understanding basic Sanskrit language
CO2	Ancient Sanskrit literature about science & technology can be understood
CO3	Being a logical language will help to develop logic in students

SYLLABUS

Unit – I **[8Hours]**

- Alphabets in Sanskrit,
- Past/Present/Future Tense,
- Simple Sentences

Unit - II **[8 Hours]**

- Order
- Introduction of roots
- Technical information about Sanskrit Literature

Unit – III **[10 Hours]**

- Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-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.

Subject Code	Subject Name	L	T	P	C	
MPEAU1084	**Value Education**	**2**	**0**	**0**	**0**	

Course Educational Objectives

CEO1	Understand value of education and self- development
CEO2	Imbibe good values in students
CEO3	Let the should know about the importance of character

Course Outcomes

Students will be able to:

CO1	Knowledge of self-development
CO2	Learn the importance of Human values
CO3	Developing the overall personality

SYLLABUS

Unit – I **[4 Hours]**

- 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

Unit - II **[6 Hours]**

- 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

Unit – III **[8 Hours]**

- 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

Unit – IV **[8 Hours]**

- 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

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

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

IIND SEMESTER

Sl. No	Core/Elective	Subject Code	Subject	L	T	P	C
1	PC 3	MPEPC2010	Power Electronic Converters	3	0	0	3
2	PC 4	MPEPC2020	Digital Control of Power Electronic and Drive Systems	3	0	0	3
3	PE 3	MPEPE2031	Switched Mode and Resonant Converters	3	0	0	3
		MPEPE2032	Industrial Load Modeling and Control				
		MPEPE2033	Advanced Digital Signal Processing				
4	PE 4	MPEPE2041	Advanced Microcontroller based Systems	3	0	0	3
		MPEPE2042	Distributed Generation				
		MPEPE2043	Smart Grids				
5		MPEES2150	Mini Project with Seminar	0	0	4	2
6	Lab III	MPEES2160	Power Electronics Laboratory	0	0	4	2
7	Lab IV	MPEES2171	Micro-controller Lab	0	0	4	2
		MPEES2172	Digital Signal Processing Lab (based on core 4)				
8	Audit II	MPEAU2081	Constitution of India	2	0	0	0
		MPEAU2082	Pedagogy Studies				
		MPEAU2083	Stress Management by Yoga				
		MPEAU2084	Personality Development through Life Enlightenment Skills				
Total				14		12	**18**

Subject Code	Subject Name	L	T	P	C	
MPEPC2010	**POWER ELECTRONIC CONVERTERS**	**3**	**0**	**0**	**3**	

Course Educational Objectives

CEO1	Understand the concepts and basic operation of PWM converters, including basic circuit operation and design.
CEO2	Understand the steady-state and dynamic analysis of PWM converters along with the applications like solid state drives and power quality.

Course Outcomes

Students will be able to:

CO1	To give a systematic approach for transient and steady state analysis of all power electronic converters with passive and active loads.
CO2	To know and carry out transient and steady state analysis of different power converters of different types of loads and switching sequences.

SYLLABUS

Unit – I **[10 Hours]**

- Analysis of power semiconductor switched circuits with R, L, RL, RC loads
- D.C. motor load. Battery charging circuit.
- Single-Phase and Three-Phase AC to DC converters.
- Half controlled configurations-operating domains of three phase full converters and semi-converters. Reactive power considerations.

Unit - II **[6 Hours]**

- Analysis and design of DC to DC converters.
- Control of DC-DC converters: Buck converters, Boost converters, Buck-Boost converters, Cuk converters.

Unit – III **[8 Hours]**

- Single phase and three phase inverters.
- Voltage source and Current source inverters.
- Voltage control and harmonic minimization in inverters.

Unit – IV **[10 Hours]**

- AC to AC power conversion using voltage regulators.
- Choppers and cyclo-converters.
- Consideration of harmonics, introduction to Matrix converters.
- Design aspects of converters, Few practical applications

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. Ned Mohan, Undeland and Robbin, “Power Electronics: converters, Application and design”,John’s Wiley and sons. Inc, Newyork.
2. M.H.Rashid, “Power Electronics”, Prentice Hall of India 1994.

Subject Code	Subject Name	L	T	P	C	
MPEPC2020	**Digital Control of Power Electronic and Drive Systems**	**3**	**0**	**0**	**3**	

Course Educational Objectives

CEO1	To understand different control strategies
CEO2	To understand state space modeling of different converters
CEO3	To perform simulation of different power converters

Course Outcomes

Students will be able to:

CO1	To provide knowledge on modelling and simulation of power simulation circuits and systems.
CO2	The candidate will be able to simulate power electronic systems and analyse the system response.

SYLLABUS

Unit – I **[12 Hours]**

- Review of numerical methods.
- Application of numerical methods to solve transients in D.C.
- Switched R, L, R-L, R-C and R-L-C circuits. Extension to AC circuits
- Modelling of diode in simulation.
- Diode with R, R-L, R-C and R-L-C load with AC supply.
- Modelling of SCR, TRIAC, IGBT and Power Transistors in simulation.
- Application of numerical methods to R, L, C circuits with power electronic switches.
- Simulation of gate/base drive circuits, simulation of snubber circuits

Unit - II **[8 Hours]**

- State space modelling and simulation of linear systems
- Introduction to electrical machine modelling: induction, DC, and synchronous machines, simulation of basic electric drives, stability aspects.

UNIT 3 **[6 Hrs]**

- Simulation of single phase and three phase uncontrolled and controlled (SCR) rectifiers.
- Converters with self-commutated devices- simulation of power factor correction schemes.

UNIT 4 **[12 Hrs]**

- Simulation of converter fed DC motor drives.
- Simulation of thyristor choppers with voltage.
- Current and load commutation schemes.
- Simulation of chopper fed DC motor
- Simulation of single and three phase inverters with thyristors and self commutated devices.
- Space vector representation.
- Pulse-width modulation methods for voltage control.
- Waveform control. Simulation of inverter fed induction motor drives

REFERENCES

1. Simulink Reference Manual, Math works, USA

Subject Code	Subject Name	L	T	P	C	
MPEPE2031	**Switched Mode and Resonant Converters**	**3**	**0**	**0**	**3**	

Course Educational Objectives

CEO1	To understand different types of converters
CEO2	To understand different switch mode topologies & control methods
CEO3	To understand different resonant converter topologies.

Course Outcomes

Students will be able to:

CO1	Acquire knowledge about the principles of operation of non-isolated and isolated hard-switched DC-DC converters.
CO2	Acquire knowledge on various loss components in a switched mode converter and choice of switching frequency with a view towards design of such converters.

SYLLABUS

Unit – I **[12 Hours]**

- Buck, Boost, Buck-Boost SMPS Topologies.
- Basic Operation-Waveforms - modes of operation -switching stresses.
- Switching and conduction losses. Optimum switching frequency.
- Practical voltage, current and power limits - design relations.
- Voltage mode control principles.
- Push-Pull and Forward Converter Topologies - Basic Operation,
- Waveforms.
- Flux Imbalance Problem and Solutions
- Transformer Design. Output Filter Design. Switching Stresses and Losses.
- Forward Converter Magnetics. Voltage Mode Control.
- Half and Full Bridge Converters. Basic Operation and Waveforms.
- Magnetics, Output Filter, Flux Imbalance, Switching Stresses and Losses,
- Power Limits, Voltage Mode Control.

Unit - II **[8 Hours]**

- Classification of Resonant Converters. Basic Resonant Circuit Concepts.
- Load Resonant Converter, Resonant Switch Converter, Zero
- Voltage Switching Clamped Voltage Topologies.
- Resonant DC Link Inverters with Zero Voltage Switching.
- High Frequency Link Integral Half Cycle Converter.
- Fly back Converter- discontinuous mode operation, waveforms, control.
- Magnetics- Switching Stresses and Losses, Disadvantages - Continuous
- Mode Operation, waveforms, control, design relations.

Unit – III **[6 Hours]**

- Voltage Mode Control of SMPS- Loop Gain and Stability Considerations.
- Error Amp– frequency Response and Transfer Function.
- Trans-conductance Current Mode Control of SMPS.
- Current Mode Control Advantages, Current Mode Vs Voltage Mode.

Unit – IV **[14 Hours]**

- Current Mode Deficiencies.
- Slope Compensation.
- Study of a typical Current Mode PWM Control IC UC3842. Modeling of SMPS.
- Small Signal Approximation- General Second Order Linear Equivalent
- Circuits.

- Study of popular PWM Control ICs (SG 3525,TL 494,MC34060 etc.)
- DC Transformer, Voltage Mode SMPS Transfer Function.
- General Control Law Consideration.
- EMI Generation and Filtering in SMPS - Conducted and Radiated
- Emission Mechanisms in SMPS.
- Techniques to reduce Emissions, Control of Switching Loci.
- Shielding and Grounding, Power Circuit Layout for minimum EMI.
- EMI Filtering at Input and Output, Effect of EMI Filter on SMPS Control
- Dynamics. Introduction to Resonant Converters.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. Abraham I Pressman, "Switching Power Supply Design,". McGraw Hill Publishing Company, 2001.
2. Daniel M Mitchell, "DC-DC Switching Regulator Analysis," McGraw Hill Publishing Company-1988.
3. Ned Mohan et.al, "Power Electronics," John Wiley and Sons 2006.

Subject Code	Subject Name	L	T	P	C	
MPEPE2032	**Industrial Load Modeling and Control**	**3**	**0**	**0**	**3**	

Course Educational Objectives

CEO1	To understand the energy demand scenario
CEO2	To understand the modeling of load and its ease to study load demand industrially
CEO3	To know Electricity pricing models
CEO4	Study Reactive power management in Industries

Course Outcomes

Students will be able to:

CO1	Knowledge about load control techniques in industries and its application.
CO2	Different types of industrial processes and optimize the process using tools like LINDO and LINGO.
CO3	Apply load management to reduce demand of electricity during peak time.
CO4	Apply different energy saving opportunities in industries.

SYLLABUS

Unit – I **[12 Hours]**

- 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 Modeling.
- Electricity pricing – Dynamic and spot pricing –Models.
- Direct load control- Interruptible load control.
- Bottom up approach- scheduling- Formulation of loadmodels- Optimization and control algorithms - Case studies.

Unit - II **[6 Hours]** • Reactive power management in industries-controls-power quality impacts application of filters Energy saving in industries.
Unit – III **[10 Hours]** • Cooling and heating loads- load profiling- Modelling. • Cool storage-Types- Control strategies. • Optimal operation-Problem formulation- Case studies.
Unit – IV **[8 Hours]** • Captive power units- Operating and control strategies- Power Pooling- Operation models. • Energy banking-Industrial Cogeneration • Selection of Schemes Optimal Operating Strategies. • Peak load saving-Constraints-Problem formulation- Case study. • Integrated Load management for Industries
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//
Text Book: 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, New Delhi, 1995. 6. IEEE Bronze Book- "Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities", IEEE Inc, USA.

Subject Code	Subject Name	L	T	P	C	
MPEPE2033	**ADVANCED DIGITAL SIGNAL PROCESSING**	**3**	**0**	**0**	**3**	
Course Educational Objectives						
CEO1	To understand the difference between discrete-time and continuous-time signals					
CEO2	To understand and apply Discrete Fourier Transforms (DFT)					
Course Outcomes						
Students will be able to:						
CO1	Knowledge about the time domain and frequency domain representations as well analysis of discrete time signals and systems					
CO2	Study the design techniques for IIR and FIR filters and their realization structures.					
CO3	Acquire knowledge about the finite word length effects in implementation of digital filters.					
CO4	Knowledge about the various linear signal models and estimation of power spectrum of stationary random					
SYLLABUS						

Unit – I **[12 Hours]**

- 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
- Linear convolution using DFT
- Computation of DFT Design of IIR digital filters from analog filters
- Impulse invariance method
- Bilinear transformation method

Unit - II **[6 Hours]**

- 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

Unit – III **[10 Hours]**

- A/D conversion noise- Arithmetic round-off errors
- Dynamic range scaling
- Overflow oscillations and zeroInput limit cycles in IIR filters
- Linear Signal Models

Unit – IV **[12 Hours]**

- All pole, All zero and Pole-zero models
- Power spectrum estimation- Spectral analysis of deterministic signals.
- Estimation of power spectrum of stationary random signals
- Optimum linear filters
- Optimum signal estimation
- Mean square error estimation
- Optimum FIR and IIR Filters

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. Sanjit K Mitra, “Digital Signal Processing: A computer-based approach “,TataMc Grow-Hill Edition 1998

2. Dimitris G .Manolakis, Vinay K. Ingle and Stephen M. Kogon, “Statistical and Adaptive Signal Processing”, Mc Grow Hill international editions .-2000

Subject Code	Subject Name	L	T	P	C	
MPEPE2041	**ADVANCED MICROCONTROLLER BASED SYSTEMS**	**3**	**0**	**0**	**3**	

Course Educational Objectives

CEO1	To understand the architecture of advance microcontrollers
CEO2	To understand the applications of these controllers
CEO3	To get some introduction to FPGA.

Course Outcomes

Students will be able to:

CO1	To learn how to program a processor in assembly language and develop an advanced processor based system
CO2	To learn configuring and using different peripherals in a digital system
CO3	To compile and debug a Program
CO4	To generate an executable file and use it

SYLLABUS

Unit – I **[12 Hours]**

- Basic Computer Organization.
- Accumulator based processes-Architecture-Memory
- Organization-I/O Organization
- Micro-Controllers-Intel 8051, Intel 8056- Registers, Memories.
- I/O Ports, Serial Communication. Timers, Interrupts, Programming.

Unit - II **[8 Hours]**

- Intel 8051 – Assembly language programming-Addressing-Operations-
- Stack & Subroutines,Interrupts-DMA.

Unit – III **[12 Hours]**

- PIC 16F877- Architecture Programming.
- Interfacing Memory/ I/O Devices, Serial I/Oand data communication

Unit – IV **[8 Hours]**

- Digital Signal Processor (DSP) - Architecture – Programming,
- Introduction to FPGA
- Microcontroller development for motor control applications.
- Stepper motor control using micro controller.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. John.F.Wakerly: "Microcomputer Architecture and Programming", John Wiley and Sons 1981.
2. Ramesh S.Gaonker: "Microprocessor Architecture, Programming and Applications with the
8085", Penram International Publishing (India), 1994.
3. Raj Kamal: "The Concepts and Features of Microcontrollers", Wheeler Publishing, 2005.
4. Kenneth J. Ayala, "The 8051 microcontroller", Cengage Learning, 2004.
5. John Morton," The PIC microcontroller: your personal introductory course", Elsevier, 2005.
6. Dogan Ibrahim," Advanced PIC microcontroller projects in C: from USB to RTOS with the
PIC18F Series", Elsevier, 2008.
7. Microchip datasheets for PIC16F877

Subject Code	Subject Name	L	T	P	C	
MPEPE2042	**DISTRIBUTED GENERATION**	**3**	**0**	**0**	**3**	

Course Educational Objectives

CEO1	To understand renewable energy sources.
CEO2	To gain understanding of the working of off-grid and grid-connected renewable energy generation schemes.

Course Outcomes

Students will be able to:

CO1	To understand the planning and operational issues related to Distributed Generation.
CO2	To acquire knowledge about Distributed Generation Learn Micro-Grids

SYLLABUS

Unit – I **[12 Hours]**

- Need for Distributed generation.
- Renewable sources in distributed generation and current scenario in
- Distributed Generation.
- 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.

Unit - II **[8 Hours]**

- 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.

Unit – III **[10 Hours]**

- 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.

Unit – IV **[8 Hours]**

- 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.
- Transients in micro-grids, Protection of micro-grids, Case studies, Advanced topics.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. Power Generation – Planning and Evaluation",Marcel Decker Press.
2. M.GodoySimoes, Felix A.Farret, "Renewable Energy Systems – Design and Analysis with Induction Generators", CRC press.
3. Stuart Borlase. "Smart Grid: Infrastructure Technology Solutions" CRC Press

Subject Code	Subject Name	L	T	P	C	
MPEPE2043	**SMART GRIDS**	**3**	**0**	**0**	**3**	

Course Educational Objectives

CEO1	Able to understand the complete structure and design of smart grid
CEO2	Able to identify the different sensing devices used in the smart grid
CEO3	Able to identify the various smart appliances and measuring devices used in smart grid

Course Outcomes

Students will be able to:

CO1	Know what a function of smart grid is, what is the futuristic grid
CO2	Issues while implementing the smart grid approach.
CO3	Concept of Microgrid and distributed generation.

SYLLABUS

Unit – I **[12 Hours]**

- Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self-Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid ,CDM opportunities in Smart Grid, What is a Smart Grid?, The Smart Grid Enables the ElectriNetSM, Local Energy Networks, Electric Transportation, Low-Carbon Central Generation, What Should Be the Attributes of the Smart Grid?, Why Do We Need a Smart Grid?, Is the Smart Grid a "Green Grid"?

Unit - II **[8 Hours]**

- Sensing, Measurement, Control and Automation Technologies: Smart metering and demand-side integration, Introduction, Smart metering, Evolution of electricity metering, Key components of smart metering, Smart meters: An overview of the hardware used Signal acquisition, Signal conditioning, Analogue to digital conversion, Computation, Input/output, Communication, Communications infrastructure and protocols for smart metering, Home-area network, Neighborhood area network, Data concentrator, Meter data management system, Protocols for communications, Demand-side integration, Services provided by DSI, Implementations of DSI, Hardware support to DSI implementations, Flexibility delivered by prosumers from the demand side, System support from DSI

Unit – III **[10 Hours]**

- Smart Appliances, Automatic Meter Reading (AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Grid to Vehicle, Coordination of PHEV charging and discharging cycle, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.

Unit – IV **[8 Hours]**

- Smart Substations: Substation Automation equipment, Current transformers Voltage transformers, Intelligent electronic devices, Bay controller, Remote terminal units, Faults in the distribution system, Components for fault isolation and restoration, Fault location, isolation and restoration, Voltage regulation

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. Ali K., M.N. Marwali, Min Dai, "Integration of Green and Renewable Energy in Electric Power Systems", Wiley.

2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press.
3. JanakaEkanayake, N. Jenkins, K. Liyanage, J. Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley.
4. Jean Claude Sabonnadiere, NouredineHadjsaid, "Smart Grids", Wiley Blackwell.
5. Tony Flick and Justin Morehouse, "Securing the Smart Grid", Elsevier In

Subject Code	Subject	L	T	P	C	
MPEES2150	**Mini Project with Seminar**	**0**	**0**	**4**	**2**	

Course Educational Objectives	
CEO1	Able to acquire practical knowledge within the chosen area of technology for project
CEO2	Able to identify, analyze, formulate and handle electrical projects with a
CEO3	Able to contribute as an individual or in a team in development of technical projects
CEO4	Able to develop effective communication skills for presentation of project related
Course Outcomes	
CO1	Formulate a real world problem and develop its requirements
CO2	develop a design solution for a set of requirements
CO3	Test and validate the conformance of the developed prototype against the original requirements of the problem
CO4	Work as a responsible member and possibly a leader of a team in developing software
CO5	Express technical and behavioural ideas and thought in oral settings
CO6	Participate in and possibly moderate, discussions that lead to making decisions

LABS

Subject Code	Subject Name	L	T	P	C	
MPEES2160	**POWER ELECTRONICS LABORATORY**	**0**	**0**	**4**	**2**	

Course Educational Objectives	
CEO1	This course aims at obtaining characteristics of power electronic devices.
CEO2	To understand the commutation techniques used in power electronics circuits and to test different power electronics converters.
Course Outcomes	
Students will be able to:	
CO1	Elucidate the basic operation of various power semiconductor devices and passive components.
CO2	Analyze power electronics circuits
CO3	Apply power electronic circuits for different loads
CO4	Design various power electronic circuits

LIST OF EXPERIMENTS

1. To study V-I characteristics of SCR and measure latching and holding currents.
2. To study UJT trigger circuit for half wave and full wave control.
3. To study single-phase half wave controlled rectified with (i) resistive load (ii) inductive load with and without freewheeling diode.
4. To study single phase (i) fully controlled (ii) half controlled bridge rectifiers with resistive and inductive loads.
5. To study three-phase fully/half controlled bridge rectifier with resistive and inductive loads.
6. To study single-phase ac voltage regulator with resistive and inductiveloads.
7. To study single phase cyclo-converter.
8. To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor.
9. To study operation of IGBT/MOSFET chopper circuit.
10. To study MOSFET/IGBT based single-phase series-resonant

Text Book:
LAB MANUAL

Subject Code	Subject Name	L	T	P	C	
MPEES2171	**MICRO-CONTROLLER LAB**	**0**	**0**	**4**	**2**	

Course Educational Objectives	
CEO1	To become familiar with the architecture and Instruction set of Intel 8051 microcontroller
CEO2	To provide practical hands on experience with Assembly Language Programming.
Course Outcomes	
Students will be able to:	
CO1	Familiar with the architecture and Instruction set of Intel 8051 microcontroller
CO2	Interfacing of microcontroller to various applications
CO3	Study of microcontroller accessories
CO4	Initialize data to registers and memory using immediate, register, direct and indirect Addressing mode

LIST OF EXPERIMENTS

EXPERIMENTS ON ASSEMBLY PROGRAMMING

1. Write a program to multiplication and division using MUL and DIV instructions.
2. Write a program to transfer a block of data from internal memory to external memory.

3. Write a program to exchange two set of eight-byte data.
4. Write a program to find the sum of two numbers in decimal.
5. Write a program to convert decimal number to hexadecimal.
6. Write a program to add a number n, m number of times.
7. Write program to find the largest from a set of n numbers.
8. Write program for sorting the given set of numbers.

EXPERIMENTS ON 8051 INTERFACING

1. Write an assembly language program for generating a triangular wave.
2. Write a program to find the largest from a set of ten numbers and display it usingLEDs.
3. Write a program to for displaying the decimal numbers in 7 Segment display.
4. Write a program to read the DIP switches for displaying the reading using 7 Segment display.
5. Write a program to rotate the given motor in clockwise direction.
6. Write a program to rotate the given motor in anticlockwise direction.
7. Write a program to generate a square wave.
8. Write a program to display a message in LCD display.

Text Book:
LAB MANUAL

Subject Code	Subject Name	L	T	P	C	
MPEES2172	**DIGITAL SIGNAL PROCESSING LAB**	**0**	**0**	**4**	**2**	

Course Educational Objectives	
CEO1	To understand the key theoretical principles underpinning DSP in a design procedure through design examples and case studies
CEO2	To learn how to use a powerful general-purpose mathematical package such as MATLAB to design and simulate a DSP systems

Course Outcomes	
Students will be able to:	
CO1	Identify time domain and frequency domain sequences
CO2	Calculate the DFT of the time domain sequence
CO3	Apply the FFT algorithm to optimize the calculation process for DFT.
CO4	Determine the type of Filter to be used

LIST OF EXPERIMENTS

1.Introduction to Code Composer Studio-I
2.Introduction to Code Composer Studio-II
3.Introduction to the Addressing Modes
4. FFT and Bit Reversal Operation
5. FFT and its Applications
6. Audio Codec and its Applications
7. Real Time Data Exchange
8. IR filtering by interfacing Matlab with Code Composer Studio
9. Introduction to Interrupts
10. Digital communication using Binary Phase Shift Keying

Text Book:
LAB MANUAL

AUDIT -2

Subject Code	Subject Name	L	T	P	C	
MPEAU2081	**Constitution of India**	**2**	**0**	**0**	**0**	

Course Educational Objectives	
CEO1	Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective
CEO2	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.
CEO3	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

Course Outcomes	
Students will be able to:	
CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India
CO3	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

SYLLABUS

Unit – I **[8 Hours]**

- History of Making of the Indian Constitution:History`Drafting Committee, (Composition & Working)
- Philosophy of the Indian Constitution: Preamble Salient Features

Unit - II **[6 Hours]**

- **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.

Unit – III **[8 Hours]**

- **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

Unit – IV **[8 Hours]**

- **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
- 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

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

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.

Subject Code	Subject Name	L	T	P	C	
MPEAU2082	**Pedagogy Studies**	**2**	**0**	**0**	**0**	

Course Educational Objectives

CEO1	Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers
CEO2	Identify critical evidence gaps to guide the development

Course Outcomes

Students will be able to:

CO1	What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries
CO2	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
CO3	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy

SYLLABUS

Unit – I **[8 Hours]**

Introduction and Methodology:

- Aims and rationale, Policy background, Conceptual framework andterminology

- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions**.**
- Overview of methodology and Searching.
- Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- Curriculum, Teacher education.

Unit - II **[6 Hours]**

- 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.

Unit – III **[6 Hours]**

- Professional development: alignment with classroom practices and followup
- support
- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes

Unit – IV **[4 Hours]**

- **Research gaps and future directions**
- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

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
5. Educational Development, 33 (3): 272–282.
6. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education.Oxford and Boston: Blackwell.
7. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
8. www.pratham.org/images/resource%20working%20paper%202.pdf.

Subject Code	Subject Name	L	T	P	C	
MPEAU2083	**Stress Management by Yoga**	**2**	**0**	**0**	**0**	

Course Educational Objectives

CEO1	To achieve overall health of body and mind
CEO2	To overcome stress

Course Outcomes

Students will be able to:

CO1	Develop healthy mind in a healthy body thus improving social health also
CO2	Improve efficiency

SYLLABUS

Unit – I **[8 Hours]**

- Definitions of Eight parts of yog. (Ashtanga)
- Yam and Niyam.
- Do`s and Don't's in life.
- Ahinsa, satya, astheya, bramhacharya and aparigraha
- Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit - II **[6 Hours]**

- Asan and Pranayam
- Various yog poses and their benefits for mind & body
- Regularization of breathing techniques and its effects-Types of
- pranayam

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Text Book:

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

Subject Code	Subject Name	L	T	P	C	
MPEAU2084	**Personality Development through Life Enlightenment Skills**	**2**	**0**	**0**	**0**	

Course Educational Objectives

CEO1	To learn to achieve the highest goal happily
CEO2	To become a person with stable mind, pleasing personality and determination
CEO3	To awaken wisdom in students

Course Outcomes

Students will be able to:

CO1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
CO2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity
CO3	Study of Neetishatakam will help in developing versatile personality of students.

SYLLABUS

Unit – I **[8 Hours]**

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)

Unit - II **[6 Hours]**

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.

Unit – III **[8 Hours]**

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

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

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.

III[RD] SEMESTER

Sl. No	Core/Elective	Subject Code	Subject	L	T	P	C
1	PE 5	MPEPE3011	SCADA Systems and Applications	3	0	0	3
		MPEPE3012	FACTS and Custom Power Devices				
		MPEPE3013	HVDC				
2	OE	MPEOE3021	Business Analytics	3	0	0	3
		MPEOE3022	Industrial Safety				
		MPEOE3023	Operations Research				
		MPEOE3024	Cost Management of Engineering Projects				
		MPEOE3025	Composite Materials				
		MPEOE3026	Waste to Energy				
3	Major Project	MPEES3130	Phase-I Dissertation	0	0	20	10
Total				3	0	20	**16**

Subject Code	Subject Name	L	T	P	C	
MPEPE3011	**SCADA SYSTEMS AND APPLICATIONS**	**3**	**0**	**0**	**3**	

Course Educational Objectives

CEO1	To understand what is meant by SCADA and its functions.
CEO2	To know SCADA communication.
CEO3	To get an insight into its application.

Course Outcomes

Students will be able to:

CO1	Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their Typical applications**.**
CO2	Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system.
CO3	Knowledge about single unified standard architecture IEC 61850.
CO4	To learn about SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server.
CO5	Learn and understand about SCADA applications in transmission and distribution sector, industries etc.

SYLLABUS

Unit – I **[12 Hours]**

- Introduction to SCADA: Data acquisition systems, Evolution of SCADA,
- Communication technologies.
- Monitoring and supervisory functions, SCADA applications in Utility Automation,
- Industries SCADA

Unit - II **[8Hours]**

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

Unit – III **[10 Hours]**

- SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture –IEC 61850.

Unit – IV **[8 Hours]**

- SCADA Communication: various industrial communication technologies -wired and wireless methods and fiber optics. open standard communication protocols.
- SCADA Applications: Utility applications- Transmission and Distribution sector-operations, monitoring, analysis and improvement. Industries - oil, gas and water.
- Case studies, Implementation, Simulation Exercises

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. Stuart A. Boyer: "SCADA-Supervisory Control and Data Acquisition", Instrument Society of
AmericaPublications, USA,2004.
2. Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3, 60870.5 and
RelatedSystems", 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. Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electric power",PennWell 1999.

Subject Code	Subject Name	L	T	P	C	
MPEPE3012	**FACTS AND CUSTOM POWER DEVICES**	**3**	**0**	**0**	**3**	

Course Educational Objectives

CEO1	To learn the active and reactive power flow control in power system
CEO2	To understand the need for static compensators
CEO3	To develop the different control strategies used for compensation

Course Outcomes

Students will be able to:

CO1	Acquire knowledge about the fundamental principles of Passive and Active Reactive Power Compensation Schemes at Transmission and Distribution level in Power Systems
CO2	Learn various Static VAR Compensation Schemes like Thyristor/GTO Controlled
CO3	Reactive Power Systems, PWM Inverter based Reactive Power Systems and their controls
CO4	To develop analytical modeling skills needed for modeling and analysis of such Static VARSystems.

SYLLABUS

Unit – I **[12 Hours]**

- 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 –Phaseangle control. Reactive power compensation.
- Shunt andSeries compensation principles – Reactive compensation at transmission and distribution level .
- Static versus passive VAR compensator, Static shunt compensators: SVC and STATCOM - Operation and control of TSC, TCR and STATCOM -Compensator control.
- Comparison between SVC and STATCOM

Unit - II **[6 Hours]**

- 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

Unit – III **[6 Hours]**

- 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.

Unit – IV **[8 Hours]**

- 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.
- Voltage swells, sags, flicker, unbalance and mitigation of these problems by power

line conditioners- IEEE standards on power quality
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//
Text Book: 1. K R Padiyar, "FACTS Controllers in Power Transmission and Distribution", New ***1.*** AgeInternationalPublishers, 2007**.** 2. X P Zhang, C Rehtanz, B Pal, "Flexible AC Transmission Systems- Modelling and 3. Control",Springer Verlag, Berlin, 2006. 4. N.G. Hingorani, L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC 5. Transmission Systems", IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001. 4. K.S.Sureshkumar, S.Ashok , "FACTS Controllers & Applications", E-book edition, Nalanda 6. Digital Library, 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

Subject Code	**Subject Name**	**L**	**T**	**P**	**C**	
MPEPE3013	**HVDC**	**3**	**0**	**0**	**3**	
Course Educational Objectives						
CEO1	Understand state of the art HVDC technology.					
CEO2	Learn the Methods to carry out modeling and analysis of HVDC system frontier-area power flow regulation.					
Course Outcomes						
Students will be able to:						
CO1	To expose the students to the state of the art HVDC technology.					
CO2	Knowledge of modelling and analysis of HVDC system for inter-area power flow regulation					
CO3	Study of Neetishatakam will help in developing					
SYLLABUS						
Unit – I **[12 Hours]** • Development of HVDC Technology, DC versus AC Transmission, Selection of converter configuration. • Rectifier and Inverter operation, Digital Simulation of converters, Control of HVDC converters and Systems.						
Unit - II **[6 Hours]** • Individual phase control, Equidistant firing controls, Higher level controls. • Characteristics and non-characteristics harmonics filter design. Fault development and protection.						
Unit – III **[10 Hours]** • Interaction between AC-DC power systems. Over voltages on AC/DC side, multi-terminal HVDC systems, control of MTDC systems						
Unit – IV **[8 Hours]**						

- Modelling of HVDC systems, per unit system, Representation for power flow solution, representation for stability studies
- Introduction to relevant national and international standards, safe clearances for HV, Study regulations for HV tests, Digital techniques in HV measurements

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

1. J. Arrillaga, "High Voltage Direct Transmission", Peter Peregrinus Ltd. London, 1983.
2. K. R. Padiyar, "HVDC Power Transmission Systems", Wiley Eastern Ltd., 1990.
3. E. W. Kimbark, "Direct Current Transmission", Vol. I, Wiley Interscience, 1971.
4. Erich Uhlmann, "Power Transmission by Direct Current", B.S. Publications, 2004

Subject Code	Subject Name	L	T	P	C	
MPEOE3021	**BUSINESS ANALYTICS**	**3**	**0**	**0**	**3**	

Course Educational Objectives

CEO1	Understand the role of business analytics within an organization
CEO2	Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization
CEO3	To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
CEO4	To become familiar with processes needed to develop, report, and analyze business data

Course Outcomes

Students will be able to:

CO1	Students will demonstrate knowledge of data analytics
CO2	Students will demonstrate the ability of think critically in making decisions based on data and deep analytics
CO3	Students will demonstrate the ability to use technical skills in predicative and prescriptive odelling to support business decision-making
CO4	Students will demonstrate the ability to translate data into clear, actionable insights

SYLLABUS

Unit – I **[12 Hours]**

- 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.
- 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.

Unit - II **[6 Hours]**

- 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

Unit – III **[10 Hours]**

- 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

Unit – IV **[8 Hours]**

- Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.
- Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

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.

Subject Code	Subject Name	L	T	P	C	
MPEOE3022	**INDUSTRIAL SAFETY**	**3**	**0**	**0**	**3**	

SYLLABUS

Unit – I **[12 Hours]**

- 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.
- 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.

Unit - II **[6 Hours]**

- 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

Unit – III **[10 Hours]**

- Fault tracing: Fault tracing-concept and importance, decision treeconcept, 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.

Unit – IV **[8 Hours]**

- 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 importance

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

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

Subject Code	Subject Name	L	T	P	C	
MPEOE3023	**OPERATIONS RESEARCH**	**3**	**0**	**0**	**3**	

Course Educational Objectives

CEO1	Students should able to apply the dynamic programming to solve problems of discreet and continuous variables
CEO2	Students should able to apply the concept of non-linear programming

Course Outcomes

Students will be able to:

CO1	Students should able to carry out sensitivity analysis
CO2	Student should able to model the real world problem and simulate it

SYLLABUS

Unit – I **[12 Hours]**

- Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models
- Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit - II **[6 Hours]** • Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT
Unit – III **[10 Hours]** • Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.
Unit – IV **[8 Hours]** • Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//
Text Book: 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. Pannerselvam, Operations Research: Prentice Hall of India 2010 6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Subject Code	Subject Name	L	T	P	C	
MPEOE3024	**COST MANAGEMENT OF ENGINEERING PROJECTS**	**3**	**0**	**0**	**3**	
SYLLABUS						
Unit – I **[12 Hours]** • Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunitycost. • Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making						
Unit - II **[6 Hours]** • 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 nontechnical 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						
Unit – III **[10 Hours]** • 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.

Unit – IV **[8 Hours]**

- Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//

Text Book:

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.

Subject Code	Subject Name	L	T	P	C	
MPEOE3025	**COMPOSITE MATERIALS**	**3**	**0**	**0**	**3**	

SYLLABUS

Unit – I **[12 Hours]**

- 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.
- 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.

Unit - II **[6 Hours]**

- 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

Unit – III **[10 Hours]**

- Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds andprepregs – hand layup method – Autoclave method – Filament winding method – ompression moulding – Reaction injection moulding. Properties and applications.

Unit – IV **[8 Hours]**

- 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.
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//
Text Book: 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.

Subject Code	Subject Name	L	T	P	C	
MPEOE3026	**WASTE TO ENERGY**	**3**	**0**	**0**	**3**	

Course Educational Objectives	
CEO1	Understanding of problems of municipal waste, biomedical waste, hazardous waste, ewaste, industrial waste etc
CEO2	Knowledge of legal, institutional and financial aspects of management of solid wastes
CEO3	Understand engineering, financial and technical options for waste management

Course Outcomes	
Students will be able to:	
CO1	able to-do sampling and characterization of solid waste
CO2	analysis of hazardous waste constituents including QA/QC issues
CO3	economics of the onsite vs. offsite waste management options

SYLLABUS

Unit – I **[12 Hours]**

- Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications

Unit - II **[6 Hours]**

- 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.

Unit – III **[10 Hours]**

- 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

Unit – IV **[8 Hours]**

- 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.
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert//
Text Book: 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

Subject Code	Subject	L	T	P	C	
MPEES3130	Phase-I Dissertation	0	0	20	10	
Course Educational Objectives						
CEO1	Able to acquire practical knowledge within the chosen area of technology for project					
CEO2	Able to identify, analyze, formulate and handle electrical projects with a					
CEO3	Able to contribute as an individual or in a team in development of technical projects					
CEO4	Able to develop effective communication skills for presentation of project related					
Course Outcomes						
CO1	Formulate a real world problem and develop its requirements					
CO2	develop a design solution for a set of requirements					
CO3	Test and validate the conformance of the developed prototype against the original requirements of the problem					
CO4	Work as a responsible member and possibly a leader of a team in developing software					
CO5	Express technical and behavioural ideas and thought in oral settings					
CO6	Participate in and possibly moderate, discussions that lead to making decisions					

IVTH SEMESTER

Sl. No	Subject Code	Subject Code	Subject	L	T	P	C
1	Major Project	MPEES4110	Phase-II Dissertation	0	0	32	16
Total				0	0	32	**16**

Subject Code	Subject	L	T	P	C	
MPEES4110	**Phase-II Dissertation**	0	0	32	16	

Course Educational Objectives	
CEO1	Able to acquire practical knowledge within the chosen area of technology for project
CEO2	Able to identify, analyze, formulate and handle electrical projects with a
CEO3	Able to contribute as an individual or in a team in development of technical projects
CEO4	Able to develop effective communication skills for presentaton of project related
Course Outcomes	
CO1	Formulate a real world problem and develop its requirements
CO2	develop a design solution for a set of requirements
CO3	Test and validate the conformance of the developed prototype against the original requirements of the problem
CO4	Work as a responsible member and possibly a leader of a team in developing software
CO5	Express technical and behavioural ideas and thought in oral settings
CO6	Participate in and possibly moderate, discussions that lead to making decisions