MAHATMA GANDHI UNIVERSITY

SCHEME AND SYLLABI

FOR

M. Tech. DEGREE PROGRAMME

IN

ELECTRICAL AND ELECTRONICS ENGINEERING

WITH SPECIALIZATION IN

POWER ELECTRONICS

(2013 ADMISSION ONWARDS)

SCHEME AND SYLLABI FOR M. Tech. DEGREE PROGRAMME IN ELECTRICAL AND ELECTRONICS ENGINEERING WITH SPECIALIZATION IN POWER ELECTRONICS

SEMESTER - I

Sl. No.	Course No.	Subjects	Hrs/week			Evaluation Scheme (Marks)					Credit (C)
						Sessional			ESE	Total	
			L	T	P	TA	CT	Sub Total			
1	MEEPE 101	Optimization Techniques	3	1	0	25	25	50	100	150	4
2	MEEPE 102	Advanced Power Semiconductor Devices	3	1	0	25	25	50	100	150	4
3	MEEPE 103	Power Converters	3	1	0	25	25	50	100	150	4
4	MEEPE 104	Modern Control Systems	3	1	0	25	25	50	100	150	4
5	MEEPE 105	Elective I	3	0	0	25	25	50	100	150	3
6	MEEPE 106	Elective II	3	0	0	25	25	50	100	150	3
7	MEEPE 107	Power Electronic Laboratory	0	0	3	25	25	50	100	150	2
8	MEEPE 108	Seminar I	0	0	2	50	0	50	0	50	1
Total			**18**	**4**	**5**	**225**	**175**	**400**	**700**	**1100**	**25**

Elective – I (MEEPE 105)		Elective – II (MEEPE 106)	
MEEPE 105-1	Special Electrical Machines and drives	MEEPE 106-1	High Voltage DC Transmission
MEEPE 105-2	Robotics and Automation	MEEPE 106 - 2	Power System Operation and Control
MEEPE 105-3	Power Quality	MEEPE 106 - 3	Advanced Power System Stability
MEEPE 105-4	Estimation theory	MEEPE 106 - 4	Analysis of AC Machines

L – Lecture, **T** – Tutorial, **P** – Practical

TA – Teacher's Assessment (Assignments, attendance, group discussion, Quiz, tutorials, seminars, etc.)

CT – Class Test (Minimum of two tests to be conducted by the Institute)

ESE – End Semester Examination to be conducted by the University

Electives: New Electives may be added by the department according to the needs of emerging fields of technology. The name of the elective and its syllabus should be submitted to the University before the course is offered.

MEEPE 101 OPTIMIZATION TECHNIQUES

Module 1: Linear programming

Statement and classification of optimization problems overview of optimization techniques, standard Linear programming – standard form of linear programming problems-definitions and theorems- simplex method – Revised simplex method-Duality and dual simplex method.

Module 2: Unconstrained one dimensional optimization techniques

Necessary and sufficient conditions –search methods (unrestricted Fibonacci and golden) – Interpolation methods (Quadratic, cubic and direct root methods)

Module 3: Unconstrained n dimensional optimization techniques

Direct search methods –Random search –pattern search and Rosen brooch's hill claiming method- Descent methods-Steepest descent, conjugate gradient, quasi Newton and DFE method.

Module 4: Constrained optimization Techniques and Dynamic Programming

Necessary and sufficient conditions –Equality and inequality constraints-Kuhn-Tucker conditions-Gradient projection method-cutting plane method- penalty function method(Interior and exterior). Dynamic Programming- Principle of optimality- recurrence relation – computational procedure- continuous dynamic programming.

References:

1. Rao,S.S.,`Optimization :Theory and Application' Wiley Eastern Press, 1978.
2. Dantzig, 'Optimization theory with applications', John Wiley and sons,1969
3. Dantzig, `Linear Programming and Extensions', Princetion University press, 1963.
4. Fox, R.L., `Optimization methods for Engineering Design', Addition Welsey, 1971.
5. Hadely, G., `Linear Programming', Addition-Wesley, 1962.
6. Gottfried, B.S., 'Introduction to Optimization Theory', John Weisman, Prentice Hall Inc., 1973.
7. Walsh, G.R., 'Methods of Optimization', John Wiley & Sons, 1979.
8. Beightier, C.S., `Phillips D.J., Wilde, D.J., `Foundation of Optimization', Prentice Hall of India, 1982.
9. Bazaara and Shetty, `Non-linear Programming'.

MEEPE 102 **ADVANCED POWER SEMICONDUCTOR DEVICES**

L	T	P	C
3	1	0	4

Module 1: Power switching devices overview

Power handling capability-(SOA); Device selection strategy- On state and switching losses- EMI due to switching- Power Diodes- Types, forward and reverse characteristics, switching characteristics-rating –Schottky diode

Module 2: Current Controlled Devices.

BJTs- Construction, static characteristics, switching characteristics- Negative temperature coefficient and secondary breakdown- Power Darlington- Thyristors- Physical and electrical principle underlying operating mode- Two transistor analogy –Effect of α and Ico on Ia- concept of latching-Gate and switching characteristics- Converter grade and inverter grade and other types, series and parallel operation-Comparison of BJT and Thyristor – Steady state and dynamic models of BJT and Thyristor.

Module 3: Voltage controlled Devices

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

Module 4: Firing and Protecting Circuits

Necessity of isolation-pulse transformer- optocoupler; Gate drive circuit for SCR, MOSFET, IGBTs and base driving for power BJT-overvoltage, over current and gate protections, Design of snubbers.

Thermal Protection: Guidance for heat sink selection- Thermal resistance and impedance-Electrical analogy of thermal components, heat sink types and design – Mounting types.

References:

1. B. W. Williams, “Power Electronics- Devices, Drivers, Applications and passive components”, Macmillan,(2/e)1992.

2. Rashid M.H., “Power Electronics Circuits, Devices and Applications”, Prentice Hall India, Third Edition, New Delhi 2004.

3. M.D. Singh and K B Khanchandani, “Power Electronics”, Tata McGraw Hill, 2001.

4. Mohan, Undeland and Robins, “Power Electronics- Concepts, Applications and Design”, John Wiley and sons, Singapore, 2000.

MEEPE 103 **POWER CONVERTORS**

L	T	P	C
3	1	0	4

Module 1: Analysis of switched circuits

Ideal models power switches –analysis of thyristor controlled half wave rectifier- R, L, RL, RC load circuits –load circuit with electromotive force.

Module 2: Controlled Rectifiers

Continuous and discontinuous modes of single phase half and full wave rectifiers – half controlled configurations- RL circuit with electromotive force. Effect of transformer leakage reactance- operating domains of three phase full converters and semi converters.

Module 3: DC- DC switch mode converters

DC- DC converter systems- control of DC-Dc converters. Buck converters- continuous and discontinuous modes. Boost converters- continuous and discontinuous modes. Buck Boost converters continuous and discontinuous modes. Cuk converters continuous and discontinuous modes. DC-DC converter comparison.

Module 4: Choppers and Inverters

Classification of DC chopper circuits- analysis of type A chopper and type B chopper- voltage, current and load commutation of choppers- step up chopper- pulse width modulated A.C. Choppers- Circuit topologies and Harmonic elimination methods. Invereters: Characteristics- output voltage and waveform control- bridge inverters – single phase and three phase versions- MOSFET, IGBT inverters, Mc Murray Inverters- Current source inverter with induction motor load.

Reference:

1. Ned Mohan, Undeland and Robbin, "Power Electronics: converters, Application and design" John Wiley and sons.Inc, Newyork, 1995.
2. Rashid M.H., "Power Electronics Circuits, Devices and Applications ", Prentice Hall India, New Delhi, 1995.

3. P.C Sen.," Modern Power Electronics ", Wheeler publishing Co, First Edition,

New Delhi, 1998.

4. M.D.Singh and K.B.Khanchandam,”Power Electronics”, Tata Mc Grew Hill Publishing Company, New Delhi, 1998

5. P.S.Bimbra, “ Power Electronics”, Khanna Publishers, Eleventh Edition, 2003

MEEPE 104 **MODERN CONTROL SYSTEMS**

L	T	P	C
3	1	0	4

Module 1:

Review of fundamental concepts of system's state-state space modeling of physical systems-diagonalization –controllable canonical form- observable canonical form-determination of STM-controllability and observability of linear time invariant systems- state feedback and pole placement-observer design-reduced order observer.

Module 2:

Non linear systems- describing functions for various types of non-linearities-describing function analysis of non-linear systems-closed loop stability- stability of limit cycles.

Module 3:

Phase plane analysis-Analytical methods for the construction of phase trajectory- Graphical methods-Isocline method-delta method-Analysis and classification of singular points.

Module 4:

Concept of stability-equilibrium points-stability by the method of Lyapunov-First method of Lyapunov- Sign definiteness of scalar function- Lyapunov's method for linear continuous time systems-Stability of nonlinear systems by the method of Lyapunov- -Krasovskii's theorem on Lyapunov's function-variable gradient method of constructing Lyapunov function.

References

1. Dr. K.P Mohandas, 'Modern Control Engineering', Snguine Technical Publications,2006.
2. Stefani,shahir, savand, Hestetter, 'Design of Feedback Control Systems' Oxford,2010.
3. Stanis law H Zak,'Systems and Control' ,Oxford,2002.
4. Ogata K, 'Modern Control Engineering' ,Prentice hall of India, 1981.
5. Gopal M, 'Modern Control Systems Theory' , Wiley Eastern Ltd. ,1990

MEEPE 105-1 SPECIAL ELECTRICAL MACHINES AND DRIVES

L	T	P	C
3	0	0	3

Module 1: Stepper Motors

Constructional features, principle of operation, modes of excitation, single phase stepping motors, torque production in variable Reluctance (VR) stepping motor, Dynamic characteristics, Drive systems and circuit for open loop control, Closed loop control of stepping motor, microprocessor based controller.

Module 2: Switched Reluctance Motors

Constructional features, principle of operation. Torque equation, Power controllers, Characteristics and control. Microprocessor based controller. Sensor less control..Synchronous Reluctance Motors-Constructional features: axial and radial air gap Motors. Operating principle, reluctance torque – Phasor diagram, motor characteristics.

Module 3: Permanent Magnet Brushless DC Motors

Commutation in DC motors, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motor, Square wave permanent magnet brushless motor drives, Torque and emf equation, Torque-speed characteristics, Controllers-Microprocessor based controller. Sensor less control.

Module 4: Permanent Magnet Synchronous Motors

Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power controllers, Torque speed characteristics, Self control, Vector control, Current control schemes. Sensor less control.

References:

1. Miller T J E, Switched Reluctance Motor and Their Control, Clarendon Press, Oxford, 1993.

2. Miller T J E, Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press, Oxford,1989.
3 Bose B K, Modern Power Electronics & AC drives, Pearson, 2002.
4 Athani V.V. “stepper motors – Fundamentals, Applications &Design” New Age International
5 Kenjo T, Sugawara A, Stepping Motors and Their Microprocessor Control, Clarendon

Press, Oxford, 1994.

6. Kenjo T, Power Electronics for the Microprocessor Age, Oxford University Press, 1990.

Ali Emadi (Ed), Handbook

MEEPE 105-2 ROBOTICS AND AUTOMATION

L	T	P	C
3	0	0	3

Module 1: Introduction

Geometric configuration of robots – Manipulators – Drive systems – Internal and external sensors-– End effectors – Control systems – Robot programming languages and applications – Introduction to robotic vision

Module 2: Robot Arm Kinematics

Direct and inverse kinematics – Rotation matrices – Composite rotation matrices – Euler angle-representation – Homogenous transformation – Denavit Hattenberg representation and various arm configurations.

Module 3: Robot Arm Dynamics

Lagrange – Euler formulation, joint velocities – Kinetic energy – Potential energy and motion-equations – Generalized D'Alembert equations of motion.

Module 4: Planning of Manipulator Trajectories

General consideration on trajectory planning joint interpolation & Cartesian path trajectories.-Control of Robot Manipulators-PID control computed, torque technique – Near minimum time control – Variable structure control – Non-linear decoupled feedback control – Resolved motion control and adaptive control.

References:

1. Fu K S, Gonazlez R C and Lee C S G, Robotics (Control, Sensing, Vision and Intelligence), McGraw-Hill, 1987.
2. Wesley, E Sryda, Industrial Robots: Computer Interfacing and Control. PHI, 1985.
3. Asada and Slotine, Robot Analysis and Control, John Wiley and Sons, 1986.
4. Philippe Coiffet, Robot Technology, Vol. II (Modeling and Control), Prentice Hall INC, 1981.
5. Saeed B Niku, Introduction to Robotics, Analysis, Systems and Applications, Pearson Education, 2002.

6. Groover M P, Mitchell Wesis, Industrial Robotics Technology Programming andApplications, Tata McGraw-Hill, 1986.
7. Sciavicco L, B Siciliano, Modeling & Control of Robot Manipulators, 2nd Edition,Springer Verlag, 2000.
8. Gray J O, D G Caldwell (Ed), Advanced Robotics & Intelligent Machines, The Institution of Electrical Engineers, UK, 1996.
9. Craig John J, Introduction to Robotics: Mechanics and Control, Pearson, 1989

MEEPE 105-3 **POWER QUALITY**

L	T	P	C
3	0	0	3

Module 1

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.

Module 2

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.

Modeling 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 drives

Module 3

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. static var compensators-SVC and STATCOM

Module 4

Active Harmonic Filtering-Shunt Injection Filter for single phase , three-phase three-wire and three-phase four-wire systems . d-q domain control of three phase shunt active filters uninterruptible power supplies-constant voltage transformers- series active power filtering techniques for harmonic cancellation and isolation . Dynamic Voltage Restorers for sag , swell and flicker problems. Grounding and wiring-introduction-NEC grounding requirements-reasons for grounding-typical grounding and wiring problems-solutions to grounding and wiring problems.

References:

1 .Heydt G.T, ELECTRIC Power Quality

2. Math H. Bollen, Understanding Power Quality Problems

3. Arrillaga J., .Power System Quality Assessment., John wiley, 2000

4. Arrillaga J, B.C. Smith, N.R. Watson & A. R.Wood ,.Power system Harmonic Analysis. , Wiley, 1997

5. Selected Topics in Power Quality and Custom Power, Course book for STTP, 2004, Ashok S.

6. Surya Santoso, H. Wayne Beaty, Roger C. Dugan, Mark F. McGranaghan, Electrical Power System Quality , MC Graw Hill, 2002

MEEPE 105-4 **ESTIMATION THEORY**

L	T	P	C
3	0	0	3

Module 1: Elements of Probability Theory

Random variables-Gaussian distribution-stochastic processes-characterizations and properties-Gauss-Markov processes-Brownian motion process-Gauss-Markov models

Module 2: Optimal Estimation for Discrete-time Systems

Fundamental theorem of estimation-optimal prediction

Module 3: Optimal Filtering

Weiner approach-continuous time Kalman Filter-properties and implementation-steady-state Kalman Filter-discrete-time Kalman Filter-implementation-sub-optimal steady-state Kalman Filter-Extended Kalman Filter-practical applications

Module 4: Optimal Smoothing

Optimal fixed-interval smoothing, optimal fixed-point smoothing, optimal fixed-lag smoothing stability-performance evaluation

References:

1. James S Meditch, Stochastic Optimal Linear Estimation and Control, McGraw-Hill, New York, 1969.
2. Jerry M Mendel ‘Lessons in Estimation Theory for Signal processing, Communication, and Control, Prentice-Hall Inc, New Delhi, 1995.
3. Mohinder S Grewal, Angus P Andrews, Kalman Filtering; Theory and Practice, Prentice-Hall Inc, Englewood Cliffs, 1993.
4. Grimble M J, M A Johnson, Optimal Control and Stochastic Estimation; Theory and Applications, Wiley, New York, 1988.
5. Peter S Meybeck, Stochastic Models, Estimation, and Control, Volume 1 & 2, Academic Press, New York, 1982.

6. Papoulis Athanasios, Probability, Random Variables, and Stochastic Process, 2nd Edition, McGraw-Hill, New York, 1984.
7. Frank L Lewis, Optimal Estimation, Wiley, New York, 1986.
8. Mcgarty J P, Stochastic Systems and State Estimation, John Wiley, New York, 1974.

L	T	P	C
3	0	0	3

MEEPE 106-1 HIGH VOLTAGE DC TRANSMISSION

Module 1: General aspects and converter circuits

Historical developments- HVAC and HVDC links-comparison-economic, technical performance-reliability-limitation-properties of thyristor converter circuits-assumptions-choice of best circuit for HVDC converters-transformer connections.

Module 2: Bridge converters-analysis and control

Analysis with gate control but no overlap-with overlap less than 60 degrees-operation of inverters-basic means of control-power reversal – desired features of control-actual control characteristics.

Module 3: Misoperation of converters and protection

Converter disturbance-by pass action in bridges-commutation failure-basics of protection-DC reactors-voltage and current oscillations-circuit breakers-over voltage protection.

Module 4: Harmonics, filters and converter charts

Characteristic and uncharacteristic harmonics-troubles due to harmonics harmonic filters – converter charts of direct current and voltage-active and reactive power. Interaction between a.c. and d.c. systems:voltage interaction-harmonic instabilities-d.c. power modulation –design considerations of thyristor converter m- transformers-smoothing reactions-overhead lines-cable transmission-earth electrodes-design of back to back thyristor converter system.

References:

1. Kimbark, E.W., ‘Direct Current Transmission-Voi.1’, Whley Interscience, New York, 1971
2. Arrilage, J., High Voltage Direct Current Transmission’, Peter Pereginver Ltd., London, U.K. 1983.
3. Padiyar, K.R., ‘HVDC Transmission Systems., Wiley Eastern Ltd., New Delhi, 1992.

MEEPE 106-2 **POWER SYSTEMS OPERATION AND CONTROL**

L	T	P	C
3	0	0	3

Module 1: Economic operation

Load forecasting-Method of last square curve fit-unit commitment-constraints in unit commitment solution methods-The economic dispatch problem of thermal units-Gradient method-Newton's method-Base point and participation factor method-Unit commitment versus economic dispatch.

Module 2: Hydro-thermal co-ordination

Hydroelectric plant models-scheduling problems-short term hydrothermal scheduling problem-gradient approach-Hydro units in series pumped storage hydro plants-hydro-scheduling using Dynamic programming and linear programming

Module 3: Automatic generation control (AGC)

Review of LFC and economic dispatch control (EDC) using the three modes of control viz. Flat frequency-tie-line control and tie-line bias control-AGC implementation-AGC features static and dynamic response of controlled two area system.

Module 4: MVAR control Power system Security

MVAR control – voltage monitoring- application of voltage regulator-synchronous condenser-transformer taps –static var compensators-Thyristor switched capacitors-Thyristor controlled reactors. Power system security: Factors affecting system security contingenecy analysis – linear sensitivity factors-AC power flow methods-contingency selection-concentric relaxation-bounding-security constrained optimal power flow-interior point alg9orithm-bus incremental costs.

References:

1. Allen J. Wood And Wollenberg B.F., 'Power Generation Operation and Control', John Wiley & Sons, NY, 1996
2. Kirchmayer L.K., 'Economic Operation of Power System', John Wiley & Sons, 1953
3. Nagrath, I.J. and Kothari D.P., 'Modern Power System Analysis, TMH, New Delhi, 1980

MEEPE 106-3 ADVANCED POWER SYSTEM STABILITY

L	T	P	C
3	0	0	3

Module 1: Power system stability considerations

Definitions-classification of stability-rotor angle and voltage stability-synchronous machine representation –classical model-load modeling concepts-modeling of excitation systems-modeling of prime movers.

Module 2:Transient stability

Swing equation-equal area criterion-solution of swing equation-Numerical methods-Euler method-Runge-Kutte method-critical clearing time and angle-effect of excitation system and governors-Multi machine stability –extended equal area criterion-transient energy function approach.

Module 3: Small signal stability

State space representation – eigen values- modal matrices-small signal stability of single machine infinite bus system – synchronous machine classical model representation-effect of field circuit dynamics-effect of excitation system-small signal stability of multi machine system.

Module 4: Voltage stability AND Stability

Generation aspects - transmission system aspects – load aspects – PV curve – QV curve – PQ curve – analysis with static loads – load ability limit - sensitivity analysis-continuation power flow analysis - instability mechanisms-examples. **Methods of improving stability:**

Transient stability enhancement – high speed fault clearing – steam turbine fast valving-high speed excitation systems- small signal stability enhancement-power system stabilizers – voltage stability enhancement – reactive power control.

References:

1. Kundur, P., 'Power System Stability and Control', McGraw-Hill International Editions, 1994.
2. Anderson, P.M. and Fouad, A.A., 'Power System Control and Stability', John Wiley, second edition .2003
3. Van Cutsem, T. and Vournas, C., 'Voltage Stability of Electric Power Systems'; Springer Science and Business Media 2008.

MEEPE 106-4 **ANALYSIS OF AC MACHINES**

L	T	P	C
3	0	0	3

Module 1: Introduction

Modeling of machines in terms of electrical and mechanical parameters-Electromagnetic coupling fields -Volt-ampere and force/torque – Displacement equations-Energy and co-energy-Principle of virtual work.

Module 2: Transformation theory

Stationary, moving and pseudo stationary coils- Primitive machines of iron-Conventional machines as transformed versions of the primitive machines-Transformation theory as applied to rotating electrical machines with a symmetrical winding on either stator or rotor -Active and passive transformation-Power invariancy.

Module 3: Modeling cylindrical rotor and salient pole synchronous machines Dynamic circuit formulation of different equations of performance - dqo transformation-Steady state and transient performance equations-Application to various kinds of faults, steady state, transient and sub-transient reactance and associated time constant-Stability of synchronous machines-Region of operation chart for non –salient pole and salient pole machines

Module 4: Modeling the m-n phase cylindrical rotor induction machine Transformation to axes fixed to stator-Fixed to rotor or moving at synchronous speed -Symmetrical components transformation and applications to unbalanced operation of 3 phase and 2 phase induction machine.

References:

1. Gibbs W.J, "Tensors in Electrical Machine Theory",Chapmaan and Hall, 1952.
2. David, White C & Herbert H Hoodsen," Lecture Mechanical Energy Conversion", John Wiley and Sons Inc, 1959.
3. Laithwaito, E.R, "Induction Machines for Special Purposes", Gerge Neunes Ltd, 1966.
4. Charles V Jones, "The Unified Theory of Electrical Machines", Butterworths, 1967.
5. Say M G, "Introduction to the Unified Theory Electromagnetic Machines", Pitman,1971 .

6. Bernard Atkins and Ronald G Harley, “The General Theory of Alternating Current Machines”, Chapman and Hall, 1978.

MEEPE 107 POWER ELECTRONICS LABORATORY

L	T	P	C
0	0	3	2

Objective: To develop practical skills in design of power electronic converters and applications to electric drives

To provide an opportunity to experience the theory portions covered in various subjects in the laboratory

LIST OF EXPERIMENTS

1. Single Phase Semi-converter with R-L load for continuous & discontinuous conduction modes
2. Single Phase Full-converter with R-L load for continuous & discontinuous conduction modes
3. Digital firing circuit
4. Three Phase Full-converter with R-L-E load
5. Controlled and Uncontrolled rectifier with different types of filters - continuous & discontinuous modes of operation
6. Transformer and Inductor design
7. Current & voltage commutated thyristorized chopper
8. MOSFET/ IGBT/Transistor based DC Choppers (Buck & Boost)
9. Half bridge square wave inverter
10. Single-phase Sine triangle PWM inverter
11. Single Phase AC Voltage Controller
12. Transfer function of armature controlled DC Motor
13. Microcontroller and DSP based control of dc-dc converters
14. Study of harmonic pollution by power electronics loads using power quality analyser.

MEEPE 108 **SEMINAR – I**

L	T	P	C
0	0	2	1

Each student shall present a seminar on any topic of interest related to the core / elective courses offered in the first semester of the M. Tech. Programme. He / she shall select the topic based on the references from international journals of repute, preferably IEEE journals. They should get the paper approved by the Programme Co-ordinator / Faculty member in charge of the seminar and shall present it in the class. Every student shall participate in the seminar. The students should undertake a detailed study on the topic and submit a report at the end of the semester. Marks will be awarded based on the topic, presentation, participation in the seminar and the report submitted