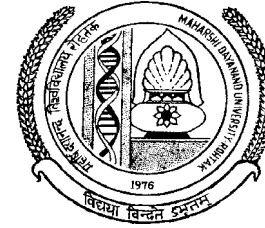


Maharshi Dayanand University
Rohtak



**Syllabus and Courses of Reading for
M.Tech. (Electrical Engineering)
Examination**

Session 2011-12

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Rohtak-124 001 (Haryana)

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**SCHEME OF STUDIES & EXAMINATIONS FOR MASTER OF
TECHNOLOGY IN ELECTRICAL ENGINEERING
(INSTRUMENTATION & CONTROL)
SEMESTER-I**

Course No.	Course Title	Teaching Schedul			Marks			Credits			Duration of Exam
		L	T	P	Sessional	Exam	Total	Sessional	Exam	Total	
MEIC-501	Modern Control Theory	4	-	-	50	100	150	2	4	6	3
MEIC-503	Industrial Electronics	4	-	-	50	100	150	2	4	6	3
MEIC-505	Micro Controllers	4	-	-	50	100	150	2	4	6	3
MEIC-507	Optimal Control Theory	4	-	-	50	100	150	2	4	6	3
MEIC-509	Intelligent Instrumentation	4	-	-	50	100	150	2	4	6	3
MEIC-511	Micro-controllers & Instrumentation Lab	-	-	3	50	50	100	2	2	4	3
	Total	20	-	3	300	550	850	12	22	34	

Note :

1. The paper setter shall set each theory paper of 100 marks covering the entire syllabus. However, the examiner shall evaluate the performance of the student in the theory paper finally by assigning one of grades out of A+,A,B,C,D&E. The Examination of Practical courses shall also be evaluated on the basis of these grades.
2. The Sessionals of Theory/Practical Courses shall also be evaluated on the basis of these grades.
3. The Grading System is defined at the end of the Scheme of Studies & Examinations.

SEMESTER-II

Course No.	Course Title	Teaching Schedul			Mark			Credits			Duration of Exa
		L	T	P	Sessional	Exam	Total	Sessional	Exam	Total	
MEIC-502	Fuzzy Control Theory	4	-	-	50	100	150	2	4	6	3
MEIC-504	Nonlinear Control Systems	4	-	-	50	100	150	2	4	6	3
MEIC-506	Discrete Data systems & control	4	-	-	50	100	150	2	4	6	3
MEIC-508	Electric Drives & control	4	-	-	50	100	150	2	4	6	3
MEIC-	Elective-1	4	-	-	50	100	150	2	4	6	3
MEIC-510	Process control Lab	-	-	3	50	50	100	2	2	4	3
	Total	20	-	3	300	550	850	12	22	34	

Note :

1. The paper setter shall set each theory paper of 100 marks covering the entire syllabus. However, the examiner shall evaluate the performance of the student in the theory paper finally by assigning one of grades out of A+, A, B, C, D & E. The Examination of Practical courses shall also be evaluated on the basis of these grades.
2. The Sessionals of Theory/Practical Courses shall also be evaluated on the basis of these grades.
3. The Grading System is defined at the end of the Scheme of Studies & Examination & will be supplied by the University to the examiner(s).

SEMESTER-III

Course No.	Course Title	Teaching Schedul			Marks			Credits			Duration of Exam
		L	T	P	Sessional	Exam	Total	Sessional	Exam	Total	
MEIC-601	Artificial Neural Networks based control	4	-	-	50	100	150	2	4	6	3
MEIC-603	Random Processes in Estimation & control	4	-	-	50	100	150	2	4	6	3
MEIC-	Elective-II	4	-	-	50	100	150	2	4	6	3
MEIC-605	Advanced Control Systems Lab	4	-	-	50	100	150	2	4	6	3
MEIC- 607	Dissertation (Phase-1)	4	-	-	50	100	150	2	4	6	3
MEIC-621	Seminar	-	-	3	50	50	100	2	2	4	3
	Total	20	-	3	300	550	850	12	22	34	

Note :

- The paper setter shall set each theory paper of 100 marks covering the entire syllabus. However, the examiner shall evaluate the performance of the student in the theory paper finally by assigning one of grades out of A+,A,B,C,D&E. The Examination of Practical courses shall also be evaluated on the basis of these grades.
- The Sessionals of Theory/Practical Courses shall also be evaluated on the basis of these grades.
- The Grading System is defined at the end of the Scheme of Studies & Examination.

SEMESTER-IV

Course No.	Course Title	Teaching Schedul			Marks			Credits			Duration of Exam
		L	T	P	Sessional	Exam	Total	Sessional	Exam	Total	
MEIC-602	Dissertation	-	-	20	150	600	750	6	24	30	3
	Total	-	-	20	150	600	750	6	24	30	-

Note :

- Sessionals of Dissertation course shall be evaluated on the basis of grades out of A+,A,B,C,D&E
- The Dissertation shall be evaluated through an exam. by a Committee of Examiners consisting of Head of the Department, Dissertation supervisor and one External Examiner. The evaluation shall be based upon the above grades.
- The Grading System is defined at the end of the Scheme of Studies & Examination

List of Electives-I		List of Electives-II	
MEIC-512	Industrial Transducers	MEIC-609	Adaptive & Robust Control
MEIC-514	Embedded Systems Design	MEIC-611	Robotics & Automation
MEIC-516	Software Engineering	MEIC-613	Genetic Algorithms in control
		MEIC-615	Advanced Digital Signal Processing
		MEIC-617	Parameter Estimation & System Identification

M.D. University, Rohtak
Scheme of Studies & Examinations for
Master of Technology in Electrical Engg.

The Performance of the student of M.Tech shall be graded on the basis of percentage of marks and corresponding grades as mentioned below :

A)					
Marks		Grades		Marks	
85	≥	A ⁺	≥	100	
75	≥	A	<	85	
60	≥	B	<	75	
50	≥	C	<	85	
40	≥	D	<	50	
00	≥	E	<	40	
Letter Grades		Performance		Division	
A ⁺		Excellent		First	
A		Very Good		First	
B		Good		First	
C		Fair		Second	
D		Pass		Third	
E		Repeat		Fail	

Note : The Candidate who have passed all the semesters examination in the first attempt obtaining at the 75% marks in aggregate shall be declared to have passed in the first division with Distinction mentioned in the degree.

B) Actual percentage of Marks Obtained and Corresponding grades should be mentioned on detailed marks certificate of student. To obtain 'D' grade a student must have secure at least 40% marks in each subject of the semester Examination.

C) Student who earned an 'E' grade or less than 40% marks in any subject shall have reappear in that subject.

M.D.UNIVERSITY,ROHTAK (HARYANA)
SCHEME OF STUDIES & EXAMINATION FOR MASTER OF
TECHNOLOGY COURSE IN ELECTRICAL ENGG.
SEMESTER-I 2011-12

Sl No	Course No	Subject	Teaching Schedule			Examination Schedule (Marks)			Duration of Exam (Hours)	
			L	P	Total	Class	Theory work	Practical		Total
1	MTCST-101	Theory of Computation	4	0	4	50	100	0	150	3
2	MTCST-102	Object Oriented Systems	4	0	4	50	100	0	150	3
3	MTCST-103	Data Structures and Algorithms	4	0	4	50	100	0	150	3
4	MTCST-104	Advanced Database Management System	4	0	4	50	100	0	150	3
5	MTCST-105	Software Engineering	4	0	4	50	100	0	150	3
6	MTCST-106	DSA Lab	0	2	2	50	0	50	100	3
7	MTCST-107	ADBMS Lab	0	2	2	50	0	50	100	3
		TOTAL	20	4	24	350	500	100	950	

Note :

- The paper setter shall set each paper of 100 marks covering the entire syllabus. However, the examiner shall evaluate the performance of the student in the theory paper finally by assigning one of the grades out of 'A', A,B,C,D & E. The Examination of practical courses shall also be evaluated on the basis of three grades.
- The Sessionals of Theory and Practical courses shall also be evaluated on the basis of these grades.
- The Grading System is defined at the end of the Scheme of Studies & Examinations

MEIC-501 MODERN CONTROL THEORY

L	T	P	Marks	Credits
4	-	-	Exam. : 100	4
			Sessions : 50	2
			Total : 150	6
Duration of Exam. : 3 hrs.				

Review of matrices and linear vector space including semi-group, group, rings and fields; State variable modeling of continuous and discrete time systems; Linearization of state equations; Transformation of state variable; Conversion of state variable models of transfer functions, invariance property; Conversion of transfer functions to canonical state variable modes; solution of state equations of linear time-invariant and time-varying systems. Controllability and observability of dynamical systems. Minimal realization of linear systems and canonical forms. Lyapunov's stability theory for linear dynamical systems.

Text Books :

1. M.Gopal, 'Modern Control Theory', Wiley International.

Reference Books :

1. K.Ogata, 'Modern Control Engg.', PHI
2. B.C. Kuo, 'Automatic Control System', PHI
3. M.Gopal, 'Control Systems-Principles & Design', Tata McGraw-Hill Pub. Co., New Delhi.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator & cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-503 INDUSTRIAL ELECTRONICS

L	T	P	Marks	Credits
4	-	-	Exam. : 100	4
			Sessions : 50	2
			Total : 150	6
Duration of Exam. : 3 hrs.				

1. Introduction to Industrial Electronics**2. Power Electronic Devices & Photo Electric Devices :**

Review of Power electronics devices, LCD, Photomultipliers Photodetectors, Optocouplers; Lasers.

3. Digital Circuits : Binary numbers, Gates and Counters, Multiplexers and demultiplexers, Memory circuits, logic families and interfacing.**4. Introduction to rectifiers & Inverters :** Review of rectifiers circuits. Introduction to Motor Control, Basic Control Devices. Servo Mechanisms Introduction to AC & DC Drives.**5. Relays and timers :** Basic construction of AC relays, Reed relay, Solid state relay, UJT/SCR time delay relay, AC time delay relay, Integrated circuit timers.**6. Industrial Heating & Welding :** Induction heating theory, High frequency power source for induction heating, Applications, Dielectric heating, Welding circuits.**7. Industrial Transducers :** Position and displacement measurement, Strain gauges, Velocity and acceleration, Force and Flow transducers, Pressure measurement, Level measurement, Temperature transducers & Signal conditioning.**8. Industrial Circuit :** Battery Charges, Temperature Control Circuit, Proximity detector, Emergency lighting system, Ac voltage regulators, Fan regulators/Lamp dimmers, Servo drives, Switched Mode Power Supply (SMPS), UPS, Electro-optical shaft encoder.**9. Automation & Robotics :** Programmable controllers, A typical system, Programming terminals, input/output track, Counters and dc timers, Some simple Programs, Robots, Machine vision.**10. Power System Applications :** SAVS, SCADA

TEXT BOOKS :

1. S.N. Biswas, 'Industrial Electronics' Dhanpat Rai & Co.(P), Ltd.
2. A.K.Sawhney, 'Electrical & Electronics Measurement & Instrumentation', Dhanpat Rai & Co (P) Ltd.
3. Schuler, C.A. and McNamee, W.L.'Industrial Electronics and Robotics', McGraw Hill Int Ed.

REFERENCE BOOKS

1. V.Subrahmanyam, 'Electric Drives-Concepts & Applications' THM, N.Delhi.

NOTES:

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator & cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to examiner of answer books.

MEIC-505 MICRO CONTROLLERS

L	T	P	Marks	Credits
4	-		Exam. : 100	4
			Sessions : 50	2
			Total : 150	6
			Duration of Exam. : 3 hrs.	

1. **Introduction : 8051**, Comparison with microprocessor, pin diagram explanation, internal diagram 8051.
2. **Instruction set** : Addressing more data transfer instruction, logical, arithmetic instruction, bit instruction, branching instruction.
3. **Timers** : Control Word, more of timers, simple programming generation of square wave.
4. **Serial Interface** : Introduction, Control world, Simple Programming, generation of waveforms using interrupt, serial interface using interrupt.

5. **Interrupts** : Introduction, Control word, Simple Programming generation of waveforms using interrupt, serial interface using interrupt.
6. **Applications** : Interfacing of memory, intelligent LCD, 8255, ADC, DAC, LED display.
7. **Advance Micro Controllers** : Architecture, features of 80196, Instruction Set.

TEXT BOOKS

1. B.S.Chhabra, 'Micro controllers and its Applications' Dhanpat Rai Pub. Co., India.
2. Scott Mackenzie, '8051 mC', PHI, Englewood Cliffs, New Jersey.
3. Myke Predko, 'Programming and Customizing the 8051 Microcontroller', Tata McGraw-Hill Pub. Co. Ltd., New Delhi.

REFERENCE BOOKS

1. K.J.Ayala, '8050 mC Architecture Programming and Applications', Penram International Publishers India.
2. MYke Predko, 'Programming and Customizing the 8051 Microcontroller', Tata McGraw-Hill Pub Co. Ltd., New Delhi.

- Note** :
1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
 2. Use of scientific calculator will be allowed in the Exam. However, paper, programmable calculator and cellular phone etc. will not be allowed.
 3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-507 OPTIMAL CONTROL THEORY

L	T	P	Marks	Credits
4	-		Exam. : 100	4
			Sessions : 50	2
			Total : 150	6
			Duration of Exam. : 3 hrs.	

1. **Calculus of variation** : Fundamental concepts. Functionals of a

single function; Functions involving several independent functions; Constrained extrema.

- 2. Pontryagin's Minimum Principles :** Necessary conditions for optimal control; Linear regular problems, Pontryagin's minimum principle and state inequality constraints; Minimum time problems; Minimum control effort problems.
- 3. Dynamic Programming :** The optimal control law, The principle of optimality; Dynamic programming applied to a routing problem; Functional equation of dynamic programming; Recurrence relation of dynamic programming; Computational procedure for solving control problems; Characteristics of Dynamic programming solution; Analytical results for discrete Linear regulator problems; The Hamilton-Jacobi-Bellman equation; Continuous Linear regulator problems.
- 4. Numerical techniques for finding optimal controls and trajectories :** Two point boundary value problems; The method of steepest descent; variation of extremals.

TEXT BOOKS :

1. Donald E.Kirk, 'Optimal Control Theory', Pub: Prentice Hall Inc., Englewood Cliffs, New Jersey.

REFERENCE BOOKS

1. Frank. L. Lewis, 'Optimal Control', John Wiley & Sons.
2. Andrew P. Sage & Chelsea C. White II, 'Optimum Systems Control', Pub.: Prentice Hall, Englewood Cliffs, N.J.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-509 INTELLIGENT INSTRUMENTATION

L	T	P	Marks	Credits
4	-		Exam. : 100	4
			Sessions : 50	2
			Total : 150	6
			Duration of Exam. : 3 hrs.	

- 1. Introduction :** Definition of intelligence and of an intelligent instrumentation system; features characterizing intelligence and features of intelligent instrumentation. components of intelligent instrumentation; Block diagram of an intelligent instrumentation systems.
- 2. Smart Sensors :** Primary sensors; Excitation; Amplification; Filters; Converters; Compensation (Nonlinearity : look up table method; polygon interpolation, polynomial interpolation, cubic spline interpolation, Approximation and regression; Noise and interference; Response time; drift; Cross sensitivity); Information coding/Processing; Data communication; Standards for smart sensor interface; The automation.
- 3. Interfacing Instruments & Computers :** Basic issues of interfacing; Address decoding; Data transfer control; A/D converter; D/A converter, Other interface considerations.
- 4. Software Filters (Digital Filters) :** Description of Spike Filter, Low pass filter, High pass filter etc.
- 5. Recent Trends in Sensor Technologies :** Introduction; Film sensors (Thick film sensors, Thin film sensors); Semiconductor IC technology-standard methods; Microelectronic-mechanical systems (Micro-machining, some application examples); Nano-sensors.

TEXT BOOK

1. Alan S. Morris, 'Principles of measurement & Instrument', PHI.

REFERENCE BOOKS

1. D. Patranabis, 'Sensor's & Transducers', PHI, 2003.
2. Roman Kuc, 'Introduction to Digital Signal Processing', McGraw Hill Introduction Edition n'York.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-511 MICRO-CONTROLLERS INSTRUMENTATION LAB

L	T	P	Marks	Credits
4	-		Exam. : 50	2
			Sessions : 50	2
			Total : 100	4
Duration of Exam. : 3 hrs.				

(A few experiments may be designed and included in this list depending upon the infrastructure available in the institute)

1. Write an ALP to generate 10 KHz frequency square wave.
2. Write an ALP to generate 10 KHz & 100 KHz frequency using interrupt.
3. Write an ALP & interface intelligent LCD display.
4. Write an ALP for mC and HLL for PC (VB/C++/VC++) to demonstrate/implement serial interfacing.
5. Write an ALP & interface LED display.
6. Write an ALP & interface traffic light.
7. Write an ALP to interface one mC with other using serial/parallel communication.
8. Write an ALP to switch ON alarm when mC receive interrupt
9. Minor project (any one)
 - a) μ C as temperature controller
 - b) μ C to interface stepper motor

10. Write an ALP to explore the capabilities of 8096.
11. Write an ALP to explore the capabilities of 68HC11
12. To write a program for Spike Filter & test it under simulation.
13. To design a Low-pass Software filter & test it under simulation.
14. To design a High-pass Software filter & test it under simulation.

Note : The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner.

MEIC-502

IIInd Semester FUZZY CONTROL THEORY

L	T	P	Marks	Credits
4	-		Exam. : 50	2
			Sessions : 50	2
			Total : 100	4
Duration of Exam. : 3 hrs.				

1. **Introduction:** Fuzzy control from an industrial perspective, knowledge-based controllers, knowledge representation in KBC's.
2. **The Mathematics of Fuzzy Control :** Vagueness, fuzzy logic versus probability theory, fuzzy sets, their properties and operations on fuzzy sets, fuzzy relations and operations on fuzzy relations, the Extension Principle, Fuzzy propositions, the Compositional Rule of Inference, Different implications, Representing a set of rules.
3. **FKBC Design Parameters :** The FKBC architecture, choice of variables and content of rules, Derivation of rules, choice of membership functions, choice of scaling factors, choice of fuzzification procedure, choice of defuzzification procedure, comparison and evaluation of defuzzification methods.
4. **Nonlinear fuzzy Control :** The Control Problem, The FKBC as a Non-Linear Transfer Element. Types of FKBC such as PID-like FKBC, Sliding Mode FKBC, Sugeno FKBC.
5. **Adaptive Fuzzy Control :** Design and Performance Evaluation, Approaches to Design such a membership function tuning using gradient descent, membership function tuning using performance criteria, the self organizing controller, model based controller.

- 6. Stability of Fuzzy Control Systems :** The State space approach, Stability and robustness indices, input-output stability, circle criterion, the conicity criterion.

TEXT BOOKS :

1. D. Driankov, H. Hellendoorn & M.Reinfrank, 'An Introduction to FUZZY Control', Pub: Narosa Pub. House, New Delhi.
2. R. Palm, D. Driankov & H. Hellendom, 'Model Based Fuzzy Control', Springer Verlage.

REFERENCE BOOKS :

1. Abraham Kandel & Gidon Ingholz, 'Fuzzy Control Systems', Narosa Book Distributors Pvt. Ltd., New Delhi.
2. Bart Kosko, 'Neural Network & Fuzzy System', PHI
3. Timothy Ross, 'Fuzzy Logic with Engineering Applications', TMH.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-504 NONLINEAR CONTROL SYSTEMS

L	T	P	Marks	Credits
4	-		Exam. : 50	2
			Sessions : 50	2
			Total : 100	4
			Duration of Exam. : 3 hrs.	

- 1. Introduction:** Nonlinear components such as dead based, backlash, relay, saturation and coupled non-linearities. Difficulties in nonlinear modeling and control.

2. **Phase-Plane-Analysis :** Phase portraits of 2nd order systems, method of isoclines, phase portrait of 2nd order system with non-linearities, limit cycles, singular points.
3. **Describing Function Analysis :** Definition, limitations, use of DF for stability analysis, DF of ideal relay, relay with hysteresis, dead zone, saturation, coulomb friction, backlash etc.
4. **Qasilineaqrization techniques :** Perturbation methods.
5. **Stability Analysis :** Various notion of stability, stability techniques of Lyapunov and Popov.
6. Functional analysis techniques for stability of nonlinear systems.
7. Basic issues of variable structure control.

TEXT BOOKS

1. J.E. Slotine & W.P. Li, 'Applied nonlinear Control', Prentice Hall, USA.
2. M.Gopal, 'Modern Control Theory', Wiley International.

REFERENCE BOOKS :

1. Isidori, 'Nonlinear Dynamical System', Springer Verlag.
2. Cook, Peter A, 'Nonlinear Dynamical System', Prentice Hall Int. (UK) Ltd.
3. Vidyasagar M. 'Non Linear System Analysis', Prentice Hall, Englewood Cliffs, N.J.
4. Mohler, R.R., 'Non linear systems-Vol. I: Dynamics and Control', Englewood Cliffs, N.J. : Prentice Hall.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-506 DISCRETE DATA SYSTEMS & CONTROL

L	T	P	Marks	Credits
4	-		Exam. : 50	2
			Sessions : 50	2
			Total : 100	4
Duration of Exam. : 3 hrs.				

- 1. Introduction:** What are sampled data and Digital Control System? Importance of Sampling in Control System. A Survey of the Methods of Analysis and Synthesis of Sampled-Data System.
- 2. The Sampling Process :** Introduction, Mathematical Analysis of the Sampling Process, Mathematical Description of the Ideal Sampling Process-The Ideal Sampler, Summary.
- 3. Reconstruction of Sampled Signals :Introduction,** Data Reconstruction by Polynomial extrapolation, the Zero Order Hold, The First Order Hold, The Fractional Order Hold, The Exponential Hold.
- 4. The Z-Transform Theory :** Definition of the Transform, Evaluation of z-Transform, Mapping of the S-Plane into the Z-Plane, The Inverse Z-Transformation, Theorems of the Z-Transform, The Pulse Transfer Function, Limitations of the Z-transform Method, response of Open Loop Sampled Data Systems between sampling instants, Theorem of the Modified Z-Transforms.
- 5. Block Diagram, Signal Flow Graph and Matrix Representation of Sampled Data Systems :**Block Diagram Analysis and Transfer Functions of closed Loop Sampled Data Systems, Signal Flow Graphs of Sampled Data Systems, Modified Z-Transform of Outputs of Closed Loop Sampled Data Systems, Transmission Matrix of Sampled Data Systems, The State-Variable Approach.
- 6. Time Response Analysis :** System characteristics equation, Time response, Mapping S-plane into Z-plane, Steady state accuracy, Stability Techniques, Bi-linear transformation Routh-Hurwitz criterion, Jury stability test, Root locus, Nyquist criterion, Bode diagram, Interpretation of frequency response, Closed loop frequency response.

- 7. Digital Controller Design :** Introduction to controller design, Control System specification, Compensation, phase lag compensator, phase lead compensator, phase lead design procedure, lag lead compensator, PID controllers, Analysis and design of Digital Control Systems using root locus and transform techniques.
- 8. Digital & Hybrid Simulation of sampled data systems.**

TEXT BOOKS :

1. M.Gopal-Digital Control & State Variable Methods, Pub. TMH.
2. Chartles L. Philips & H. Troy Nagle, 'Digital Control System Analysis and Design' Pub. Prentice Hall International.

REFERENCE BOOKS :

1. K.Ogata, 'Discrete Time Control System; Pub. Prentice Hall International.
2. M.Gopal, 'Control System-Principles & Design', Tata McGraw-Hill Pub. Co., New Delhi.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-508 ELECTRIC DRIVES & CONTROL

L	T	P	Marks	Credits
4	-		Exam. : 50	2
			Sessions : 50	2
			Total : 100	4
Duration of Exam. : 3 hrs.				

- 1. Electrical Drives :** Introduction, advantages, choice of electrical drives, status of ac and dc drives.
- 2. Dynamics of Electrical Drives :** Fundamental torque equations,

multi-quadrant operation, equivalent values of drive parameters, load torque components, types of loads steady state stability, load equalization.

3. **Control of Electrical Drives :** Modes of operation, closed loop control of drives, sensing of current and speed.
4. **Selection of motor power rating :** Heating and cooling, determination of motor rating, continuous, short time and intermittent duties, load equalization and determination of moment of inertia of the flywheel.
5. **DC Motor Drives :** Speed-torque characteristics of different types of dc motors, starting, types of braking, transient analysis, speed control methods, static control of dc motors. Converter fed dc drive & chopper fed dc drive.
6. **Induction Motor Drives :** Characteristics, analysis and performance starting methods, braking methods, transient analysis, methods of speed control, vector control. Static control techniques- stator frequency control, stator voltage control, rotor resistance control, Static Scherbius system & static Kramer system.
7. **Traction Drives :** Nature of traction load, important features of traction drives, static control of traction drives; comparison between ac and dc tractions.

TEXT BOOKS :

G.K. Dubey, 'Fundamental of Electrical Drives' Narosa Publishing House.

REFERENCE BOOKS

1. G.K. Dubey, 'Power Semiconductor controlled drives' Prentice Hall.
2. V.Subrahmaniyam, "Electric Drive-concepts and Applications', Pub : TMH, New Delhi.
3. Leonard, W., 'Control of electric Drives' Pub: Springer Verlag, New York, 1985.
4. Bose B.K., 'Power Electronics & A.C. Drives, Prentice-Hall Inc. Englewood Cliffs, 1986.
5. Kusko, A, 'Solid State DC Motor Drives, The M.I.T. Press, 1969, Cambridge Mass & London.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-510 PROCESS CONTROL LAB

L	T	P	Marks	Credits
-	-	3	Exam. : 50	2
			Sessions : 50	2
			Total : 100	4
			Duration of Exam. : 3 hrs.	

(A few experiments may be designed and included in this list depending upon the infrastructure available in the institute)

1. To implement PI Temperature Control on Computerized Pilot Plat. (Two tank coupled system) or on a kit or under simulation.
2. To implement PID Temperature Controller on computerized Pilot Plant. (Two tank coupled system) or on a kit or under simulation.
3. To implement PID Temperature Contorller on computerized Pilot Plant (Two tank coupled system) or on a kit on under simulation.
4. To implement PID Level Controller on Pilot or on a kit or under simulation.
5. To control the pressure of Hydraulic System.
6. To control the pressure of Pneumatic System
7. To study & evaluate parametric disturbance response on Pilot Plant or on a kit or under simulation.
8. To study & evaluate load disturbance response on Pilot Plant or on a kit or under simulation.
9. To study vector control of induction motor.

10. To implement chopper control of DC motor.
11. To study the characteristics & implement speed control of stepper motor.

Note : The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner.

MEIC-512 INDUSTRIAL TRANSDUCERS

L	T	P	Marks	Credits
-	-	3	Exam. : 100	4
			Sessions : 50	2
			Total : 100	4
Duration of Exam. : 3 hrs.				

Transducer Fundamentals : Transducer terminology, principles, design and performance characteristics, criteria for transducer selection, smart sensors. Resistive transducers; Inductive transducers; capacitive transducers, piezoelectric transducers; semiconductor and other sensing structure. Displacement transducers; tachometers and velocity transducers; accelerometers and gyros; strain gauges; force and torque transducers; flow meters and level sensors; pressure transducers; sound and ultrasonic transducers. Phototubes and photodiodes; sound and photoconductive cells. photoemission, photo electromagnetic detectors pressure actuated photoelectric detectors, design and operation of optical detectors, detector characteristics. Transducer Performance: Electrical tests, measurement units, measurement of voltage, current, frequency, impedance, noise, loading errors, resolution and threshold tests. Calibration, dynamic tests, environmental test, life test. Application of transducer; displacement, velocity, acceleration, force, stress, strain, pressure and temperature measurement. Angular and linear velocity, acceleration, force, stress, strain, pressure and temperature measurement. Angular and linear encoders. Radar, laser and sonar distance measurement. Tachometers. Viscometer and densitometers.

TEXT BOOK :

E.O. Debeblin, 'Electronics Instrumentation & Measurement', Mc. Graw Hill.

REFERENCE BOOK :

D.V.S. Murti, 'Transducers & Instrumentation', PHI

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-514 EMBEDDED SYSTEM DESIGN

L	T	P	Marks	Credits
4	-		Exam. : 100	4
			Sessions : 50	2
			Total : 100	4
Duration of Exam. : 3 hrs.				

1. **Introduction to embedded System :** What are Embedded Systems, When & Why we require Embedded System.
2. Processor And Memory Organization.
3. Devices and buses for devices Network.
4. Device Drivers and interrupts Servicing Mechanism.
5. Programming Concepts and Embedded Programming in C and C++
6. Program Modeling Concepts in Single and Multiprocessor systems Software-Development Process.
7. Software Engineering Practices in Embedded Software Development Process.
8. Inter Process Communication and synchronization of Processes, ask and Threads.

9. Introduction to Real Time Operating Systems (RTOS). What is RTOS, is Windows-NT a RTOS, RTOS features. Real Time Operating System Programming Tools : Microc/OS-Li and Vxworks.

TEXT BOOKS :

1. Raj 'Kamal, 'Embedded Systems : Architecture & Programming', Pub.: TMH, New Delhi.
2. Iyer & Gupta, 'Programming Embedded Systems', Pub.: TMH, New Delhi.

REFERENCE BOOKS :

1. K.J. Ayala, '8051 mC Architecture Programming & Applications', Penram International Publishers India.
2. Brown, 'Digital System Desig.'

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-516 SOFTWARE ENGINEERING

L	T	P	Marks	Credits
4	-		Exam. : 100	4
			Sessions : 50	2
			Total : 100	4
			Duration of Exam. : 3 hrs.	

1. **Introduction :** Software defn., chrs., components, role; software crisis, myths, paradigms, generic view of software engg.

2. **Computer System Engg.:** Hardware, software, human & database consideration, system analysis; system specification; system definition review.
3. **Software Project Planning :** Project planning objectives, software scope, resources, metrics for software productivity & quality software project estimation;
4. **Requirement Analysis fundamentals:** Requirements analysis. Analysis principles, object-oriented analysis; software prototyping; specification (principles, representation, outline, review).
5. **Requirement analysis methods :** Requirements analysis methodologies; Data structured systems development; Jackson system development. Automated tools; Data-base requirements.
6. **Software Design Fundamentals :** Design process; Design fundamentals; Effective modular design; procedural design; Design documentation.
7. **Software Testing Techniques :** Software testing fundamentals, while box testing', Basis path testing; Loop testing; Black path testing; Loop testing; Black box testing; proof of correctives; Automated testing tools.

TEXT BOOK :

1. Roger S. Pressman, 'Software Engineering-A Practitioner's Approach', McGraw Hill Int. Edi. (Comp. Sc & Series) New York, New Delhi.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

3rd Semester
MEIC-601 ARTIFICIAL NEURAL NETWORKS
BASED CONTROL

L	T	P	Marks	Credits
4	-		Exam. : 100	4
			Sessions : 50	2
			Total : 100	4
Duration of Exam. : 3 hrs.				

1. **Introduction** : Overview, History of NN development.
2. **Fundamental Concepts** : Biological neurons & their artificial models, Models of ANN, Learning & adaptation NN learning rules.
3. **Single Layer Perception Classifiers** : Classification model; features & Decision regions; Discriminant functions; Linear machine and minimum distance classification; Training and classification using the discrete perception algorithm and example.
4. **Multilayer Feed forward Networks** : Lk linearly inseparable pattern classification; Delta learning rule for multilayer perception, Generalized delta learning rules; Error back-propagation training Learning factors.
5. **Single layer feedback networks** : basic concepts of dynamical systems; Mathematical foundations of discrete time and gradient-type Hop field networks; Example solutions of optimization problems such as Traveling.
6. **Applications of ANN to control systems** : Process identification, Non-dynamic learning control, inverted pendulum neuro-controller.

TEXT BOOKS

1. J.M.Zurada, 'Artificial Neural System' west Publishing Co., Y.York. Also Jaico Pub. House, Bombay.
2. Simon haykin, 'Neural Networks-A Comprehensive Foundation', Prentice Hall, Upper Saddle River, New Jersey 07458.

REFERENCE BOOKS :

1. Y.Yegnanarayana, 'Artificial Neural Networks', PHI

2. Junhong Nie & Derek Linkens, 'fuzzy Neural Control', PHI.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-603 RANDOM PROCESSES IN ESTIMATION & CONTROL

L	T	P	Marks	Credits
4	-		Exam. : 100	4
			Sessions : 50	2
			Total : 100	4
Duration of Exam. : 3 hrs.				

1. **Introduction to random variable and random process** : Overview, limitations of deterministic control & processes.
2. **Probability & Axioms** : Definition, axioms of probability, conditional probability.
3. **Repeated Trials** : Combined experiments, Bernoulli trials, asymptotic theorems, Poisson theorem, Baye's theorem & Statistics.
4. **Random variables** : Distribution & density functions, conditional distributions, total probability & Baye's theorem. Mean & variance, moments, charactersitic functions of two random variables, moments & conditional statistics.
5. **Application of Wieners theory in the compensator design** : For feedback control systems. Wieners theory of optimization Gauss Markov model for vector random processes. Kalman filterig and prediction for discrete time and continuous time systems. Minimum variance control.

TEXT BOOKS :

1. Athanasios Papoulis, 'Probability, Random variables and Stochastic Processes' Pub., Mc Graw Hill Book Co.
2. J.S. Meditch. 'Stochastic optimal linear estimation and Control' Pub.:

REFERENCE BOOKS

1. Y Viniotis, 'Probability & Random Processes'. THM
2. Donald G. Childers, 'Probability & Random Processes Using MATLAB, TMH, Singapore.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-605 ADVANCED CONTROL SYSTEMS LAB

L	T	P	Marks	Credits
-	-	3	Exam. : 50	2
			Sessions : 50	2
			Total : 100	4
Duration of Exam. : 3 hrs.				

(A few experiments may be designed and included in this list depending upon the infrastructure available in the institute)

1. To implement fuzzy controller for temperature or level control on pilot plant/simulation kit or in MATLAB Toolbox.
2. To introduce non liner elements such as backlash, hystensis etc. and to see their their effect on second order PID control.
3. To introduce nonlinear elements such as backlast hysteresis, etc & to see their effect on PH control of 2nd order system.

4. To introduce nolineaqr elemens such as backlash hysteresis etc. & to see their effect on PID control of 2nd order system.
5. To implement fuzzy controller on 2nd/3rd order system.
6. To implement a simple Neural Network.

Note : The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner.

MEIC-607**DISSERTATION (PHASE-1)**

L	T	P	Marks	Credits
-	-	4	Sessions : 150	6
			Total : 150	6

Every student will carry out dissertation under the supervision of a Supervisor(s). The topic shall be approved by a Committee constituted by the Head of the concerned Dept.

Every student will be required to present two seminar talks, first at the beginning of the Dissertation(Phase-I) to present the scope of the work and to finalize the topic, and second towards the end of the semester, presenting the work carried out by him/her in the semester. The committee constituted will screen both the presentations so as to award the sessional grades out of A,A(-), B,(B-),C(C-), D and F. A student scoring 'F' grade shall have to improve this grade before continuing his/her dissertation in the 4th semester failing which he/she shall have to repeat the Dissertation (Phase-I) next time in the regualr 3rd semester.

MEIC-609 ADAPTIVE & ROBUST CONTROL

L	T	P	Marks	Credits
-	-	4	Exam. : 100	4
			Sessions : 50	2
			Total : 150	6
Duration of exam. : 3 hrs.				

1. **What is Adaptive Control :** Introduction, Adaptive Schemes. Adaptive Control Theory, Application, Conclusion.
2. **Why Adaptive Control :** Introduction, when is constant-gain feedback insufficient? Robust Control, The Adaptive Control Problem, Conclusion.

3. **Real time parameters Estimation** : Introduction, Least squares and regression models, estimating parameters in Dynamical systems, experimental conditions, Properties of Recursive estimators, Implementation Issues, Conclusions.
4. **Model-Reference Adaptive Systems** : Introduction, The MRAS problem, The Gradient approach, MRAS based on stability theory, Direct MRAS for general linear systems, MRAS for partially known system, conclusions.
5. **Self Tuning Regulation** : The basic idea, Indirect self tuning regulators, Direct self tuning regulators, Unification of direct self-tuning regulators, Linear quadratic STRs, Adaptive Predictive Control, A priori Knowledge in STR, Conclusion.
6. **Stability, convergence & Robustness** : Introduction, Global stability, convergence, Averaging, An example of Averaging analysis, Robustness, Stochastic averaging, Parameterization, Instability mechanism, Universal stabilizers, conclusions.
7. **Stochastic Adaptive Control** : Introduction, Problem formulation, Dual Control, Sub-optimal strategies, Examples, Conclusions.
8. **Auto Tuning** : Introduction, PID Control, Transient Response Methods, Methods based on relay feedback, Conclusions.

TEXT BOOK :

Kari John Astrom & Bjorn Wittenmark, 'Adaptive Control', Addison-Wesley Publishing Company.

REFERENCE BOOKS :

Shankar Sastry and Marc Bodson, 'Adaptive Control: Stability, Convergence & Robustness', Pub.: Prentice Hall, Englewood Cliffs, N.J.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-611 ROBOTICS & AUTOMATION

L	T	P	Marks	Credits
4	-		Exam. : 100	4
			Sessions : 50	2
			Total : 150	6
			Duration of exam. : 3 hrs.	

1. **Introduction** : History, Classification, major components, fixed v/s flexible automation, applications.
2. **Spatial Descriptions and Transformation** : Descriptions mappings, operators, transformation arithmetic.
3. **Manipulator Kinematics** : Link description, connection, conversion, kinematics, actuator space, joint space and Cartesian space.
4. **Inverse Manipulator Kinematics** : Solvability, notion of manipulator subspace when $n=6$; algebraic v/s geometric, algebraic solution, reparability and accuracy.
5. **Linear control of Manipulators** : Control law partitioning, trajectory following control, disturbance rejection, continuous v/s discrete time control, modeling & control of a single joint.
6. **Nonlinear Control of Manipulator** : Nonlinear, time varying MIMO systems, Control problem for manipulators, practical consideration, Lyapunov stability analysis, criterion based control systems, adaptive control.

TEXT BOOK :

John J. Graig, 'Introduction to Robotics : Mechanics & Control' International Students Edition, Addison Wesley Reading Massachusetts.

1. Richard D. Kjafter, et al, 'Robotics Engineering. An integrated approach,' PHI, New Delhi.
2. Ben Zion Sandler, 'Robotics Designing the Mechanics for Automated Machinery', Prentice Hall, Englewood Cliffs.
3. Gordon M. Mair, 'Industrial Robotics' Prentice Hall, New York.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-613 GENETIC ALGORITHMS IN CONTROL

L	T	P	Marks	Credits
4	-		Exam. : 100	4
			Sessions : 50	2
			Total : 150	6
Duration of exam. : 3 hrs.				

1. **Introduction :** Overview, History of evolutionary computation, Search spaces & Fitness landscapes, elements of genetic algorithms, comparison of GAS and traditional search methods.
2. **Fundamental Concepts of GAs :** Typical example to illustrate GAs work. Simple computer exercise.
3. **Problem Solving Using GAs:** Evolving computer programs, data analysis & prediction, evolving neural networks, simple computer exercise.
4. **Implementation of GAs:** Suitability of GA for typical problems, encoding a problem for a GA, adepting the encoding, selection methods, Genetics operators, Parameters for GAs.

TEXT BOOKS :

1. Davis L (Ed), 'Handbook of Genetic Algorithms', New York : Van Nostrand, Reinhold.

2. Goldberg D.E., 'Genetic Algorithms in Search optimization & machine Learning', Reading MA : Addison-Wesley Pub. Co.

REFERENCE BOOK:

Michalewics, Zbigniew, 'Genetic Algorithms+ Data Structure =Evolution Programs', Berlin: Springer=Verlag.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-615 ADVANCED DIGITAL SIGNAL PROCESSING

L	T	P	Marks	Credits
4	-		Exam. : 100	4
			Sessions : 50	2
			Total : 150	6
Duration of exam. : 3 hrs.				

1. **Introducing to DSP :** Signal classification frequency domain representation, time domain representation, representation of sequences by Fourier transform & Fourier series, properties of Fourier transform, discrete time random signals, energy and power theorems.
2. **Discrete-Time Systems :** Classification, properties, time invariant system, finite impulse response (FIR) system, infinite impulse response (IIR).
3. **Sampling of Time Signals :** Sampling theorem, application, frequency domain representation of sampling, reconstruction of

band limited signal from its samples, discrete time processing of continuous time signals, changing the sampling rate using discrete time processing.

4. Basics of Digital Filtering : Fundamentals of digital filtering, design techniques of digital filter, various types of digital filters, analysis of finite word length effects in DSP, multirate digital signal processing, DSP algorithm implementation consideration. Applications of DSP.
5. Discrete Fourier Transforms and FFT with applications.
6. Multirate Digital Signal Processing
7. DSP Processors

TEXT BOOK :

1. Alon V. Oppenheim, 'Digital Signal Processing', Pub:
2. Roman Kuc, 'Introduction to Digital Processing Mc Graw Hill Introduction Edition N. York.

REFERENCE BOOKS

1. Johnny R. Johnson, 'Introduction to Digital Signal Processing' PHI.
2. Lonnie C. Ludeman, 'Fundamental of Digital Signal Processing', Hoepwer & Row Publisher, New York.
3. Salivahanan, 'Digital Signal processing' Tata Mc-Graw Hill Pub.
4. Maurice Bellanger, 'Digital Processing of Signal-Theory & Practice' Pub John wiley & sons, N. York.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.
2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-617 PARAMETER ESTIMATION & SYSTEM IDENTIFICATION

L	T	P	Marks	Credits
4	-		Exam. : 100	4
			Sessions : 50	2
			Total : 150	6
Duration of exam. : 3 hrs.				

1. **Introduction** : Review of stochastic process, Models and model classification, the identification problem, some fields of applications.
2. **Identification** : Classical methods of identification of impulse response and transfer function models, model learning techniques. Linear least square estimator (L.S.E), properties of L.S.E., generalized and weighted least square and instrumental variable method.
3. **On-Line identification** : Deterministic gradient algorithm, recursive least squares, minimum variance algorithm, stochastic gradient approximation method and maximum likelihood method. Simultaneous state and parameter estimation, Extended Kalman filter, Two stage identification methods.
4. **Non-linear identification** : Quasi-linearisation, invariant imbedding, numerical identification methods.

TEXT BOOK :

1. Lennart Ljung & Torsten Soderstrom, 'Theory & Practice of Recursive Identification', Pub : The MIT Press, Cambridge, Massachusetts.

REFERENCE BOOKS :

1. Jerry M. Mendel, 'Discrete Techniques of parameter Estimation', Pub Marcel Dekker.
2. Eykhoff, 'System Identification', Pub.

Note :

1. In the semester exam., the examiner will set 8 questions in all covering the entire syllabus. Students will be required to attempt any five questions.

2. Use of scientific calculator will be allowed in the Exam. However, pager, programmable calculator and cellular phone etc. will not be allowed.
3. The Scheme of awarding the grades to a student in the course will be supplied by the Univ. to the examiner of answer books.

MEIC-621**SEMINAR**

L	T	P	Marks	Credits
-	-	1	Sessions : 150	6
			Total : 150	6

Every student will be required to present a seminar talk on a topic approved by the Dept. except on his/her dissertation. The committee constituted by the Head of the Deptt will evaluate the presentation and will award one of the grades out of A, (A-) B, (B-), C(C-)D and F.

A student who is awarded the 'F' grade will be required to repeat the seminar on the same topic.

4th Semester**MEIC-510 ELECTRIC DRIVES & CONTROL**

L	T	P	Marks	Credits
-	-	20	Exam. : 150	6
			Sessions : 600	24
			Total : 750	30
			Duration of Exam. : 3 hrs.	

The Dissertation Phase-I will be continued as Dissertation in 4th Semester.

The award of sessional grades out of A⁺, A, B, CD & E will be done by an internal committee constituted by Head of the Dept. This assessment shall be based on presentation(s), report etc. before this committee, In case a student scores 'E' grade in the sessional, he/she shall have to improve the dissertation work and present the same before this committee, failing which he/she will not be allowed to submit the dissertation.

At the end of the semester, every student will be required to submit three bound copies of his/her Master's dissertation to the office of the concerned Department. Out of these, one copy will be kept for Department record and one copy shall be for the supervisor. a copy of the dissertation will be sent to the external examiner by mail by the concerned department, after his/her appointment and intimation from the University Dissertation will be evaluated by a committee of examiners consisting of the Head of the Department, dissertation supervisor(s) and one external examiner. There shall be no requirement of a separate evaluation report on the Masters Dissertation from the external examiner.

The external examiner shall be appointed by the University from a panel of examiners submitted by the respective Head of the Dept. to the Chairman, Board of Studies. In case the external examiner so appointed by the Univ, does not turn up, the Director/Principal of the concerned college, on the recommendation of the concerned Head of the Dept., shall be authorized, on behalf of the Univ. to appoint an external examiner from some other institution.

The student shall defend his/her dissertation through presentation before this committee and the committee will award one of the grades out of A⁺, A, B, C, D & E, A student scoring 'E' grade in the exam shall have to resubmit his/her dissertation after making all corrections/improvements and this dissertation shall be evaluated as above.

Note :

The Scheme of awarding the Grades to a student in the course will be supplied by the university to the examiner(s).