Minutes of the meeting of the Senate of MNNIT, Allahabad held on 23.07.2009 (Thursday) at 3.30 p.m. in the Conference Room of the Institute.

Following members were present:

1.	Prof. A B Samaddar	Director / Chairman
2.	Prof. S.K. Agrawal	Member
3.	Prof. Satya Sheel	"
4.	Prof. A.K. Misra	"
5.	Prof. T. N. Sharma	"
6.	Prof. V.K. Nema	"
7.	Prof. R.K. Srivastava, CED	"
8.	Prof. Raghuvir Kumar	"
9.	Prof. R. C. Mehta	"
10.	Prof. P. K. Mishra	"
11.	Prof. Sudarshan Tiwari	"
12.	Prof. Nirjhar Roy	"
13.	Prof. Triloki Nath	"
14.	Prof. Rakesh Mathur	"
15.	Prof. S.K. Duggal	"
16.	Prof. Dinesh Chandra	"
17.	Prof. Vineeta Agarwal	"
18.	Prof. R. K. Srivastava, MED	"
19.	Prof. Peetam Singh	"
20.	Prof. Rajeev Tripathi	"
21.	Prof. M.M. Gore	"
22.	Prof. Rakesh Narain	"
23.	Prof. Anuj Jain	"
24.	Prof. Geetika	"
25.	Prof. R.K. Singh	"
26.	Prof. H. N. Kar	"
27.	Prof. P.K. Dutta	"
28.	Prof. A.K. Sachan	"
29.	Prof. P. P. Sahay	"
30.	Prof. M. D. Singh	"
31.	Prof. A. K. Singh	"
32.	Prof. A. D. Bhatt	"
33.	Sri Sarvesh K Tiwari	Registrar/ Secretary

Special Invitee

1.	Dr. R. K. Tripathi	Dy Dean (A.A.)

The Chairman extended welcome to the members of the Senate especially new member, Prof. A. D. Bhatt, MED who was attending the Senate meeting for the first time and thanked them for taking their time out to attend the meeting.

Following resolutions were passed:

1. **To confirm the minutes of the meeting of the Senate held on 10.02.2009 and emergent meeting of the Senate held on 24.02.2009 and 22.05.2009.**

   The Senate confirmed the minutes of its meeting held on 10.02.2009 and its emergent meetings held on 24.02.2009 and 22.05.2009 without any observation.

2. **To consider the mercy appeal of students of various department.**

   (i) The Senate considered the mercy appeal of Ms. Bora Susismita Jogendranath, (Registration No. 2002845) B.Tech. IT for allowing her, extension of one year, after the completion of maximum period of seven (07) years and approved the same as a special case. She was allowed to register in the odd semester of 2009-10.

   (ii) The Senate considered the mercy appeals of other students of different departments and programmes on various grounds and referred the same to the Sub-Committee of the Senate on urgent academic matters constituted in its meeting held on 24.08.2006, for making its recommendation to the Chairman, Senate.

3. **To consider the proposal of Department of Electrical Engineering.**

   (a) The Senate considered the proposal of the Department of Electrical Engineering for revision in structure of courses of existing programmes of the department and approved the same. The revised course structure as approved by the Senate in enclosed here as Annexure-I.

   (b) The Senate considered the proposal of the Department of Electrical Engineering for starting a new M.Tech. programme – M.Tech. Electrical Engineering (Energy Recourses and Systems) and approved the same in principle. The Senate suggested that a workshop may be organized preferably with outside experts and modifications, if any, passed in the workshop may be incorporated, with the approval of Chairman Senate, before starting the programme.

   (c) The Senate considered the proposal of the Department of Electrical Engineering for provision of one external examiner for M.Tech. Thesis Board, and agreed for the same in principle. The Senate desired that revised composition of M.Tech. Thesis Board should be proposed through SPGC and put up in the next Senate meeting for consideration.

4. **To consider the proposal of various departments for starting new elective courses:**

   (a) The Senate considered the proposal of the Department of Computer Science and Engineering for starting two new elective courses for M.Tech. programmes of the department, namely, Multimedia System (CS382) and Service Oriented Architecture (CS381), and resolved that details of the proposed course be circulated to all the Senate members for observations, if any. If no observations are received within one week, then the same may be put up to the Chairman, Senate for approval.

(b) The Senate considered the proposal of the Department of Civil Engineering for starting a new professional elective course "Limit State of Design of Steel Structures" for B.Tech. final year and M.Tech. 1st year programmes of the department and approved the same.

The course structures and syllabus of the new course as approved by the Senate in enclosed herewith as Annexure – II.

(c) The Senate considered the proposal of the Department of Mechanical Engineering for revision of course structure and syllabus of the M.Tech. Programme in Product Design and Development, offered by the department and approved the same.

(d) The Senate considered the proposal of the Department of Physics for revision of course structure and syllabus of the course offered by the department for B.Tech. 1st year of all the branches. After discussion it has been resolved that the following committee may look into the revised course, in light of the courses offered by other departments for B.Tech. IInd and IIIrd semester onwards and submit its recommendations to the Chairman, Senate for consideration.

(i) Prof. Sudarshan Tiwari
(ii) Prof. Dinesh Chandra
(iii) Prof. Anuj Jain
(iv) Prof. P. P. Sahay
(v) Prof. N. D. Pandey

5. **To place the following reporting matter:**

The Senate noted the approval accorded by the Chairman, Senate / Chairman, SPGC on the following matters:

(a) Recommendation of the Ph.D. Oral Boards of the different department of the following students:

S. No.	Name	Reg. No.	Department
1.	Mr.Samir Saraswati	2002RME03	MED
2.	Mr.Dharmendra	2002RCE02	CED
3.	Mr.Amit Rai Dixit	2004RME03	MED
4.	Mr. Sumit Gandhi	2004RAM01	AMD
5.	Mr. Ravi Kant	2006RME02	MED
6.	Mr. Dilip Kumar Kothari	2004REL02	ECED
7.	Mr. Dileep Singh	2004RMS02	SMS
8.	Mr. D.Seshachalam	2003REE01	ELE
9.	Mr. Anil Kumar Mishra	2004RAM04	AMD

(b) Appointment of Prof. Harnath Kar as Chairman, SPGC w.e.f. 10.07.2009 for a period of one year. The Senate welcomed the appointment and acknowledged the services rendered by outgoing Chairman SPGC, Prof. Rajeev Tripathi.

(c) Course Structure and Syllabus of the M.Tech. (Biotechnology) Programme of the Department of Applied Mechanics. Approved course structure and syllabus is enclosed as Annexure – III.

(d) Extension of one year granted to Mr. Manoj Kumar Khurana (Registration No. 2003RME03), a Ph.D. student of Mechanical Engineering Department to complete his thesis work.

(e) Extension of one year granted to Mr. Vallurupalli Murali Mohan (Registration No. 2003RME02), a Ph.D. student of Mechanical Engineering Department to complete his thesis work.

(f) The Senate also noted the approval accorded by the Chairman SPGC for change of registration of Mr. Sumat Kumar (Registration No. 2008RPH02), a Ph.D. student of Department of Physics from Full time to off campus.

6. **To consider the recommendations of the Committee constituted by the Senate to review the procedure for the award of Gold Medal amongst the students having a tie.**

The Senate considered the recommendation of the committee constituted by the Senate to review the procedure for the award of Gold Medals amongst the students having a tie and approved the same. The recommendation of the committee as approved by the Senate is enclosed here as Annexure – IV.

7. **The Senate considered the recommendation of the committee constituted by the Senate to review the provision of the Summer Semester.**

The Senate considered the recommendation of the committee constituted by the Senate to review the Summer Semester and resolved that the same committee with the inclusion of Prof. A. D. Bhatt as a member may study the system in place at IIT Roorkee, IIT Kharagpur, IIT Delhi, IIT Kanpur and any of the NITs and submit its recommendations considering the system/practices prevailing at these institutions.

8. **Any other matter with the permission of the Chair.**

The Senate considered the following matters with the permission of the Chair:

(a) The Senate considered the request of Mr. Brijesh Singh (2003RME01), an off campus Ph.D. student of Department of Mechanical Engineering for extension of one academic session to complete the research work and approved the same.

(b) The Senate considered the request of Sri Sanjeev Rai, Lecturer, Department of Electronics and Communication Engineering for transfer of Ph.D. registration along with course credits completed at NIT Silchar to MNNIT Allahabad and approved the same. Official transcript of the grades and credits earned by Mr. Rai alongwith the syllabus should be considered by DPGC. Recommendations of DPGC through SPGC may be sent to Dean (Academic Affairs) for record of the candidate.

The meeting concluded with a vote of thanks to the Chair.

Approved

(A B Samaddar) 04/9/9
Director/ Chairman, Senate

04/09/09
(Sarvesh K Tiwari)
Registrar/Secretary

Confirmed
(Chairman, Senate) 28/10/9

ANNEXURE-I

DEPARTMENT OF ELECTRICAL ENGINEERING
MNNIT Allahabad

Summary of the changes in the extsing M.Tech course structure

As per the meeting of Department Post Graduate Committee (DPGC) & Departmental Faculty Members held on 07/05/2009 at 3:30 PM, following are the summary of corrections in the existing M.Tech –Electrical, course structure for the specialization in Control & Instrumentation, Power System and power Electronics & ASIC Design.

1. Term Project has been removed from both first and second semester.
2. All the courses are now of 4-credit.
3. For Elective courses, there is a compulsory Seminar requiremnt.
4. Industrial Electronics has been shifted in the first semester and Industrial drive in the 3rd semester for the M. Tech Part-time students.
5. Virtual Instrumentation has been introduced in the Electve-II & III in the 2nd Semester.
6. Robo-modelling & Control is introduced in the Electve-II & III in the 2nd Semester of M. Tech-Control & Instrumentation.
7. Robotics Vision is introduced in the 1st Semester Elective for all the above Specializations.
8. For M. Tech (C&I), Digital Control System in place of Electrical Drives has been introduced in the first semester as a core course.
9. Similarly, For M. Tech (Power System), Flexible AC Transmission System has been introduced in place of Electrical Drives in the first semester as a core course.
10. For M.Tech (PE & ASIC Design), Electrical Drives shall continue to be the core course in the first semester.
11. Two courses out of three, i.e., Electrical Drives, Digital Control., System and Flexible AC Transmission System, have been included in the list of Elective-I course (as applicable).
12. The syllabus for many subjects has been updated.

26/05/09

(Dr. Rajesh Gupta)
Convener DPGC

M.Tech. (Electrical Engineering)

With specializations
In
Control & Instrumentation
Power Electronics & ASIC Design
Power Systems

Course Structure & Scheme of Evaluation

(Effective from the session: 2009-2010)

MNNIT, Allahabad (Deemed University)

M.TECH (Electrical Engineering)
Specialization: Control & Instrumentation
(Effective from the session 2009-2010)

First Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Core Subjects											
• EE 901 Applied System Theory	3	0	2	4	15	15	10	40	10	10	100
• EE910 Digital Control System	3	0	2	4	15	15	10	40	10	10	100
• EE903 Industrial Electronics	3	0	2	4	15	15	10	40	10	10	100
• Elective – I*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	13	0	6	16							400

Second Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Hard Core Subjects											
• EE 904 Optimal and Adaptive Control	3	0	2	4	15	15	10	40	10	10	100
• EE905 Industrial Instrumentation	3	0	2	4	15	15	10	40	10	10	100
Soft Core Subjects											
• Elective – II*	4	0	0	4	20	20	20	40	-	-	100
• Elective – III*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	14	0	4	16							400

Summer Internship/Summer Projects/Entrepreneurial Skill development Training

	L	T	P	C	End Sem. Exam	Total Marks
• EE975 Summer Internship/Summer Projects/Entrepreneurial Skill development Training* (6-8 weeks)	0	0	0	4	100	100
	0	0	0	4		100

* At the end of second semester, every student will go for above programme during the summer vacation

Third Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE980 State of Art Seminar	0	0	0	4	100	100
• EE991 Thesis	0	0	0	8	-	-
	0	0	0	12		100

Fourth Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE991 Thesis (continuation of third semester thesis)	0	0	0	16	-	-
	0	0	0	16	-	-

Elective I

- EE921 Control Techniques in Power Electronics
- EE922 Microprocessor and Micro-controller based systems
- EE923 Robotics Vision
- EE924 Optimization Techniques
- EE925 Digital System Simulation
- EE926 Expert Systems
- EE927 Power Semiconductors
- EE928 Digital Signal Processing
- EE911 Flexible AC Transmission Systems
- EE902 Electrical Drives

Elective II & III

- EE930 Industrial Process Control
- EE931 Non Linear Systems
- EE932 Neuro-Fuzzy Control Systems
- EE933 Biomedical Instrumentation
- EE934 Robot Modeling and Control
- EE935 Process Automation
- EE936 CAD of Control
- EE937 System Identification & Estimation
- EE938 Robust Control Systems
- EE939 Stochastic Control System
- EE940 Reliability Engineering
- EE941 Advanced Digital Design
- EE942 Simulation of Modern Power Systems
- EE943 Distribution Automation
- EE944 SCADA of Power Systems
- EE952Virtual Instrumentation

M.TECH (Electrical Engineering)
Specialization: Power Electronics & ASIC Design
(Effective from the session 2009-2010)

First Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Core Subjects											
• EE 901 Applied System Theory	3	0	2	4	15	15	10	40	10	10	100
• EE902 Electrical Drives	3	0	2	4	15	15	10	40	10	10	100
• EE903 Industrial Electronics	3	0	2	4	15	15	10	40	10	10	100
• Elective – I*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	13	0	6	16							400

Second Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Hard Core Subjects											
• EE 906 Advanced Power Electronics	3	0	2	4	15	15	10	40	10	10	100
• EE907 ASIC Design	3	0	2	4	15	15	10	40	10	10	100
Soft Core Subjects											
• Elective – II*	4	0	0	4	20	20	20	40	-	-	100
• Elective – III*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	14	0	4	16							400

Summer Internship/Summer Projects/Entrepreneurial Skill development Training

	L	T	P	C	End Sem. Exam	Total Marks
• EE975 Summer Internship/Summer Projects/Entrepreneurial Skill development Training* (6-8 weeks)	0	0	0	4	100	100
	0	0	0	4		100

*** At the end of second semester, every student will go for above programme during the summer vacation**

Third Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE980 State of Art Seminar	0	0	0	4	100	100
• EE991 Thesis	0	0	0	8	-	-
	0	0	0	12		100

Fourth Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE991 Thesis (continuation of third semester thesis)	0	0	0	16	-	-
	0	0	0	16	-	-

Elective I

- EE921 Control Techniques in Power Electronics
- EE922 Microprocessor and micro-controller based systems
- EE923 Robotics Vision
- EE924 Optimization Techniques
- EE925 Digital System Simulation
- EE926 Expert Systems
- EE927 Power Semiconductors
- EE928 Digital Signal Processing
- EE911 Flexible AC Transmission Systems
- EE910 Digital Control System

Elective II & III

- EE904 Optimal & Adoptive Control
- EE905 Industrial Instrumentation
- EE930 Industrial Process Control
- EE931 Non Linear Systems
- EE932 Neuro-Fuzzy Control Systems
- EE940 Reliability Engineering
- EE941 Advanced Digital Design
- EE942 Simulation of Modern Power Systems
- EE943 Distribution Automation
- EE944 SCADA of Power Systems
- EE945 CAD of Power Electronics
- EE946 Active Power Conditioning
- EE947 Computer Aided Circuit Analysis
- EE948 Information Theory
- EE949 Power System Stability & Control
- EE952 Virtual Instrumentation

M.TECH (Electrical Engineering)
Specialization: Power System
(Effective from the session 2009-2010)

First Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Core Subjects											
• EE 901 Applied System Theory	3	0	2	4	15	15	10	40	10	10	100
• EE911 Flexible AC Transmission Systems	3	0	2	4	15	15	10	40	10	10	100
• EE903 Industrial Electronics	3	0	2	4	15	15	10	40	10	10	100
• Elective – I*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	13	0	6	16							400

Second Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Hard Core Subjects											
• EE 908 Economic Operation of Power System	3	0	2	4	15	15	10	40	10	10	100
• EE909 Power System Protection	3	0	2	4	15	15	10	40	10	10	100
Soft Core Subjects											
• Elective – II*	4	0	0	4	20	20	20	40	-	-	100
• Elective – III*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	14	0	4	16							400

Summer Internship/Summer Projects/Entrepreneurial Skill development Training

	L	T	P	C	End Sem. Exam	Total Marks
• EE975 Summer Internship/Summer Projects/Entrepreneurial Skill development Training* (6-8 weeks)	0	0	0	4	100	100
	0	0	0	4		100

*** At the end of second semester, every student will go for above programme during the summer vacation**

Third Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE980 State of Art Seminar	0	0	0	4	100	100
• EE991 Thesis	0	0	0	8	-	-
	0	0	0	12		100

Fourth Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE991 Thesis (continuation of third semester thesis)	0	0	0	16	-	-
	0	0	0	16	-	-

Elective I

- EE921 Control Techniques in Power Electronics
- EE922 Microprocessor and micro-controller based systems
- EE923 Robotics Vision
- EE924 Optimization Techniques
- EE925 Digital System Simulation
- EE926 Expert Systems
- EE927 Power Semiconductors
- EE928 Digital Signal Processing
- EE911 Flexible AC Transmission Systems
- EE910 Digital Control System

Elective II & III

- EE904 Optimal & Adoptive Control
- EE905 Industrial Instrumentation
- EE930 Industrial Process Control
- EE931 Non Linear Systems
- EE932 Neuro-Fuzzy Control Systems
- EE940 Reliability Engineering
- EE941 Advanced Digital Design
- EE942 Simulation of Modern Power Systems
- EE943 Distribution Automation
- EE944 SCADA of Power Systems
- EE945 CAD of Power Electronics
- EE946 Active Power Conditioning
- EE947 Computer Aided Circuit Analysis
- EE948 Information Theory
- EE949 Power System Stability & Control
- EE952 Virtual Instrumentation

M.TECH (Electrical Engineering)
Specialization: Power System
(Effective from the session 2009-2010)

First Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Core Subjects											
• EE 901 Applied System Theory	3	0	2	4	15	15	10	40	10	10	100
• EE911 Flexible AC Transmission Systems	3	0	2	4	15	15	10	40	10	10	100
• EE903 Industrial Electronics	3	0	2	4	15	15	10	40	10	10	100
• Elective – I*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	13	0	6	16							400

Second Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Hard Core Subjects											
• EE 908 Economic Operation of Power System	3	0	2	4	15	15	10	40	10	10	100
• EE909 Power System Protection	3	0	2	4	15	15	10	40	10	10	100
Soft Core Subjects											
• Elective – II*	4	0	0	4	20	20	20	40	-	-	100
• Elective – III*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	14	0	4	16							400

Summer Internship/Summer Projects/Entrepreneurial Skill development Training

	L	T	P	C	End Sem. Exam	Total Marks
• EE975 Summer Internship/Summer Projects/Entrepreneurial Skill development Training* (6-8 weeks)	0	0	0	4	100	100
	0	0	0	4		100

*** At the end of second semester, every student will go for above programme during the summer vacation**

Third Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE980 State of Art Seminar	0	0	0	4	100	100
• EE991 Thesis	0	0	0	8	-	-
	0	0	0	12		100

Fourth Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE991 Thesis (continuation of third semester thesis)	0	0	0	16	-	-
	0	0	0	16	-	-

Elective I

- EE921 Control Techniques in Power Electronics
- EE922 Microprocessor and micro-controller based systems
- EE923 Robotics Vision
- EE924 Optimization Techniques
- EE925 Digital System Simulation
- EE926 Expert Systems
- EE927 Power Semiconductors
- EE928 Digital Signal Processing
- EE910 Digital Control System
- EE902 Electrical Drives

Elective II & III

- EE904 Optimal & Adoptive Control
- EE931 Non Linear Systems
- EE932 Neuro-Fuzzy Control Systems
- EE937 System Identification & Estimation
- EE940 Reliability Engineering
- EE941 Advanced Digital Design
- EE942 Simulation of Modern Power Systems
- EE943 Distribution Automation
- EE944 SCADA of Power Systems
- EE946 Active Power Conditioning
- EE949 Power System Stability & Control
- EE950 Power System Planning
- EE951 Energy Management Systems
- EE952 Virtual Instrumentation

M.TECH (Electrical Engineering) part-time
Specialization: Control & Instrumentation
(Effective from the session 2009-2010)

First Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Core Subjects											
• EE 901 Applied System Theory	3	0	2	4	15	15	10	40	10	10	100
• EE903 Industrial Electronics	3	0	2	4	15	15	10	40	10	10	100
	6	0	4	8							200

Second Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Hard Core Subjects											
• EE 904 Optimal and Adaptive Control	3	0	2	4	15	15	10	40	10	10	100
• EE905 Industrial Instrumentation	3	0	2	4	15	15	10	40	10	10	100
	6	0	4	8							200

Summer Internship/Summer Projects/Entrepreneurial Skill development Training

	L	T	P	C	End Sem. Exam	Total Marks
• EE975 Summer Internship/Summer Projects/Entrepreneurial Skill development Training* (6-8 weeks)	0	0	0	4	100	100
	0	0	0	4		100

*** At the end of second semester, every student will go for above programme during the summer vacation**

Third Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
• EE910 Digital Control System	3	0	2	4	15	15	10	40	10	10	100
• Elective – I*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	7	0	2	8							200

Fourth Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Soft Core Subjects											
• Elective – II*	4	0	0	4	20	20	20	40	-	-	100
• Elective – III*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	8	0	0	8							200

Fifth Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE980 State of Art Seminar	0	0	0	4	100	100
• EE991 Thesis	0	0	0	8	-	-
	0	0	0	12		100

Sixth Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE991 Thesis (continuation of fifth semester thesis)	0	0	0	16	-	-
	0	0	0	16	-	-

Elective I

- EE921 Control Techniques in Power Electronics
- EE922 Microprocessor and Micro-controller based systems
- EE923 Robotics Vision
- EE924 Optimization Techniques
- EE925 Digital System Simulation
- EE926 Expert Systems
- EE927 Power Semiconductors
- EE928 Digital Signal Processing
- EE911 Flexible AC Transmission Systems
- EE902 Electrical Drives

Elective II & III

- EE930 Industrial Process Control
- EE931 Non Linear Systems
- EE932 Neuro-Fuzzy Control Systems
- EE933 Biomedical Instrumentation
- EE934 Robot Modeling and Control
- EE935 Process Automation
- EE936 CAD of Control
- EE937 System Identification & Estimation
- EE938 Robust Control Systems
- EE939 Stochastic Control System
- EE940 Reliability Engineering
- EE941 Advanced Digital Design
- EE942 Simulation of Modern Power Systems
- EE943 Distribution Automation
- EE944 SCADA of Power Systems
- EE952 Virtual Instrumentation

M.TECH (Electrical Engineering) part-time
Specialization: Power Electronics and ASIC Design
(Effective from the session 2009-2010)

First Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Core Subjects											
• EE 901 Applied System Theory	3	0	2	4	15	15	10	40	10	10	100
• EE903 Industrial Electronics	3	0	2	4	15	15	10	40	10	10	100
	6	0	4	8							200

Second Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Hard Core Subjects											
• EE 906 Advanced Power Electronics	3	0	2	4	15	15	10	40	10	10	100
• EE907 ASIC Design	3	0	2	4	15	15	10	40	10	10	100
	6	0	4	8							200

Summer Internship/Summer Projects/Entrepreneurial Skill development Training

	L	T	P	C	End Sem. Exam	Total Marks
• EE975 Summer Internship/Summer Projects/Entrepreneurial Skill development Training* (6-8 weeks)	0	0	0	4	100	100
	0	0	0	4		100

*** At the end of second semester, every student will go for above programme during the summer vacation**

Third Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
• EE902 Electrical Drives	3	0	2	4	15	15	10	40	10	10	100
• Elective – I*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	7	0	2	8							200

Fourth Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Soft Core Subjects											
• Elective – II*	4	0	0	4	20	20	20	40	-	-	100
• Elective – III*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	8	0	0	8							200

Fifth Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE980 State of Art Seminar	0	0	0	4	100	100
• EE991 Thesis	0	0	0	8	-	-
	0	0	0	12		100

Sixth Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE991 Thesis (continuation of fifth semester thesis)	0	0	0	16	-	-
	0	0	0	16	-	-

Elective I

- EE921 Control Techniques in Power Electronics
- EE922 Microprocessor and micro-controller based systems
- EE923 Robotics Vision
- EE924 Optimization Techniques
- EE925 Digital System Simulation
- EE926 Expert Systems
- EE927 Power Semiconductors
- EE928 Digital Signal Processing
- EE911 Flexible AC Transmission Systems
- EE910 Digital Control System

Elective II & III

- EE904 Optimal & Adoptive Control
- EE905 Industrial Instrumentation
- EE930 Industrial Process Control
- EE931 Non Linear Systems
- EE932 Neuro-Fuzzy Control Systems
- EE940 Reliability Engineering
- EE941 Advanced Digital Design
- EE942 Simulation of Modern Power Systems
- EE943 Distribution Automation
- EE944 SCADA of Power Systems
- EE945 CAD of Power Electronics
- EE946 Active Power Conditioning
- EE947 Computer Aided Circuit Analysis
- EE948 Information Theory
- EE949 Power System Stability & Control
- EE952 Virtual instrumentation

M.TECH (Electrical Engineering) part-time
Specialization: Power System
(Effective from the session 2009-2010)

First Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Core Subjects											
• EE901 Applied System Theory	3	0	2	4	15	15	10	40	10	10	100
• EE903 Industrial Electronics	3	0	2	4	15	15	10	40	10	10	100
	6	0	4	8							200

Second Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Hard Core Subjects											
• EE908 Economic Operation of Power System	3	0	2	4	15	15	10	40	10	10	100
• EE909 Power System Protection	3	0	2	4	15	15	10	40	10	10	100
	6	0	4	8							200

Summer Internship/Summer Projects/Entrepreneurial Skill development Training

	L	T	P	C	End Sem. Exam	Total Marks
• EE975 Summer Internship/Summer Projects/Entrepreneurial Skill development Training* (6-8 weeks)	0	0	0	4	100	100
	0	0	0	4		100

*** At the end of second semester, every student will go for above programme during the summer vacation**

Third Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
• EE911 Flexible AC Transmission Systems	3	0	2	4	15	15	10	40	10	10	100
• Elective – I*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	7	0	2	8							200

Fourth Semester

	L	T	P	C	Mid sem Exam I	Mid sem ExamII	TA	End sem. Exam	PRACTICAL TA	PRACTICAL Exam	Total Marks
Soft Core Subjects											
• Elective – II*	4	0	0	4	20	20	20	40	-	-	100
• Elective – III*	4	0	0	4	20	20	20	40	-	-	100
*Seminar per week											
	8	0	0	8							200

Fifth Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE980 State of Art Seminar	0	0	0	4	100	100
• EE991 Thesis	0	0	0	8	-	-
	0	0	0	12		100

Sixth Semester

	L	T	P	C	End Sem. Exam	Total Marks
• EE991 Thesis (continuation of fifth semester thesis)	0	0	0	16	-	-
	0	0	0	16	-	-

Elective I

- EE921 Control Techniques in Power Electronics
- EE922 Microprocessor and micro-controller based systems
- EE923 Robotics Vision
- EE924 Optimization Techniques
- EE925 Digital System Simulation
- EE926 Expert Systems
- EE927 Power Semiconductors
- EE928 Digital Signal Processing
- EE910 Digital Control System
- EE902 Electrical Drives

Elective II & III

- EE904 Optimal & Adoptive Control
- EE931 Non Linear Systems
- EE932 Neuro-Fuzzy Control Systems
- EE937 System Identification & Estimation
- EE940 Reliability Engineering
- EE941 Advanced Digital Design
- EE942 Simulation of Modern Power Systems
- EE943 Distribution Automation
- EE944 SCADA of Power Systems
- EE946 Active Power Conditioning
- EE949 Power System Stability & Control
- EE950 Power System Planning
- EE951 Energy Management Systems
- EE952 Virtual instrumentation

Syllabus: M.Tech (Electrical Engineering)

EE 901 Applied System Theory:

Vector spaces, linear subspaces,eigenvalue and eigenvectors, matrix inversion formulas, invariant subspaces, vector norms and matrix norms, Singular value decomposition(SVD),semi definite matrices, singular values,H_2,H_∞ and L_p spaces and norms for transfer matrices, small gain theorem.
Linear systems, similarity transformations, canonical forms, controllability and observability, pole placement and observer based controllers, digital systems, Lyapunev theorem, non linear systems, state space realization of transfer matrices.
Mathematical models of different physical systems, state space averaged models for power converters, dynamic model of induction motor, modeling of turbine generator.

References:

Chin-Tseng Chen - Linear system theory and design
T.Kaileth - Linear system theory
Sage - Large scale systems methodology
M.Gopal - Modern control system theory
K.Ogata - System dynamics
Ben Noble - Applied Linear algebra
K.Zhou and J.C.Doyle - Essentials of Robust Control (Prentice Hall)
Jeffery B.Burl - Linear Optimal Control (Addison-Wesley)
M.Vidyasagar - Non-linear systems Analysis (Prentice Hall)
M.H.Rashid - Power Electronics Handbook (Academic Press)

EE 902 Electrieal Drives:

Review of classical speed control methods for induction motor, synchronous motors and De motors, Generalized machine modeling using space vectors, vector control of induction motor and synchronous motors. Applications of solid state controller such as choppers, rectifiers, inverters & cycloconverters in drive system and their performance characteristics, Closed loop control of solid state De drives. DC motor, stepping motor and variable reluctance motor drives. AC and DC motor drives in transportation system & traction.

References:

J.M.D.Murphy - Power electronics control of Ac motors, Perganon Press, Newyork
P.C.Sen - Thyristor DC drives, Wiley Inter Science Publication
G.K.Dubey - Fundamentals of electric drives, Narosa Publishing House
B.K.Bose - Thyristor AC drives, Wiley Inter Science Publication
V.Subramanayam - Thyristor control of electric drives, Tata McGraw Hill Publication
S.B.Dewan - Thyristorized power controller drives, Wiley Inter Science Publication

EE 903 Industrial Electronics:

Power Semiconductor devices, BJT, MOSFET, IGBT, GTO and MCT, Introduction to repetitively switched power circuits for ac-to-dc, dc-to-ac and dc-to-dc conversion and/or regulation of voltage or current in high power applications: power supplies, motor controls and power amplifiers, control techniques, analysis and design, Forced communication, synchronous link converters, DC-AC converters, buck, boost, buck-boost, cuk, flyback configuration, resonant converters,PWM inverters, active filters.

References:

M.H.Rashid - Power Electronics
M.H.Rashid - Power Electronics Handbook (Academic Press)
M.Mohan, T.M.Undeland - Power Electronics, Converters, Application and Design
P.C.Sen - Power Electronics
G.K.Dubey, A.Joshi & Doradla - Thyristorized Power Controller

EE 904 Optimal and Adaptive Control:

Review of system synthesis methods-performance criterion for optimal design-analytic design techniques, Use of computers in optimal design, review of calculus of variations, Maximum principle dynamic programming and optimal estimation techniques-the adaptive control problem-computational methods based on linearization-the identification problem-gradient methods for adaptive control-periodic perturbation-systems-peak holding systems-signal synthesis-adaptive control-learning systems-practical applications of adaptive control.

References:

Brown Martin - Adaptive control systems
Narendra S.Kumpati - Advances in adaptive control
A.P.Sage - Optimal System Control
Kirk - Linear Optimal Control Theory

EE 905 Industrial Instrumentation:

Review of transducers for strain ,temperature, pressure, flow etc., Signal conditioning design-Specification, error considerations; Selection & design of typical subsystems; Instrumentation amplifiers, MUX, sample and hold, active filters; Data converters ADCs & DACs; Design of data instrumentation systems, Data flow and graphical programming techniques, Virtual Instrumentation (VI) ,advantages, VIs and Sub-VIs, Data acquisition methods, DAQ hardware, PC hardware; Structure, Operating Systems, ISA, PCI, USB, PCMICA buses, Instrumentation buses, IEEE488.2, Serial interfacing-RS 232C, RS 422, RS 423, RS 485, CAMAC, VXI, SCXI, PXI, Sensors and Transducers, Interfacing signal conditioning, Serial analysis techniques, Networking methods and their applications in instrumentation.

References:

Sonde	-	Introduction to telemetry
Hoeschele	-	ADC & DAC
Hnatek	-	Handbook of ADCs & DACs
Considine	-	Handbook of control
D.Patranbis	-	Principle of industrial instrumentation
Ronald L.Krutz	-	Interfacing techniques in digital design

EE 906 Advanced Power Electronics:

Analysis and design of switch mode dc-to-dc converters, Basic Converters topologies: buck, boost and buck/boost and transformer-couples derivatives. Closed-loop converter control pulse width modulation, Limitations of semiconductor components as characterized by their behavior under clamped inductive switching, Properties of magnetic materials and their influence on design of high-frequency inductors and transformers. Example applications, Advanced control and modulation techniques for inverters and rectifiers; simulations of transients, simulation tools: SABER, PSPICE, and MATLAB-SIMULINK; simulations of converters, inverters and cyclo-converters etc.

EE 907 ASIC Design:

Design of digital application, specific integrated circuits (ASICs) based on hardware description languages (Verilog, VHDL) and CAD tools, Emphasis on design practices and underlying algorithms, Introduction to deep sub-micron design issues like interconnections and low power and to modern applications including multi-media, wireless, Telecommunications and computing, Controller.

Laboratory: Simulation of digital design on View logic using Spice and VHDL programming, ASIC design using View-logic package.

EE 908 Economic Operation of Power System:

Steady state operation, Real & reactive power balance and their effects on systems operation, incremental fuel costs, optimum operating strategies, optimum dispatch neglecting losses, development of loss formulae, optimal load flow including real and reactive power control, optimal operation of hydro-thermal systems, Automatic generation and control including single and multiple area cases, Real time control, power system security, contingency evaluation and state estimation, energy control centers, Computer control of interconnected power systems, multi area economic dispatch computer system, supervisory control and data acquisition systems (SCADA).

References:

L.K.Kirchmayr	-	Economic control of interconnected systems, J.Wiley Publications
Robert H. Miller & James H. Malinowski	-	Power system operation, TMH Publications

EE 909 Power System Protection:

Protective relaying – Basic schemes of protection, types of relays, relays as comparators, general theory of phase and amplitude comparators, static relays, differential overcurrent, distance relaying schemes using static circuit, multi impact comparators to obtain composite characteristics on the R-X diagram, Digital techniques in power system protection, Various CTs, PTs, C.V.T.s – their behaviours under transients conditions, Travelling waves relays.

References:

T.S.M.Rao	-	Static Relays
Patric, Basmeti	-	Power system protection
L.P.Singh	-	Digital protection
A.R.Van, C.Warrington	-	Protection relaying Vol I & II
RVINGRA Moge	-	Relaying & circuit breakers

EE 910 Digital Control System:

Introduction and historical development of computer controlled systems, components of digital control, sample & hold, Z-transform and difference equations, translation of analog design-approximations, realization of z-transform function, Digital PID, Jury's stability, closed loop transfer function of sampled data-control systems, state-space representation of computer-controlled systems, Lyapunov-stability analysis, pole-placement and observer design, dead-beat control, architecture, interfacing devices and control using microcomputer, microprocessor, micro-controller and DSP-based control system, programming technique for real time control, Quantisation error.

References:

Astron & Wittenmark	-	Computer controlled systems
M.Gopal	-	Digital control and state space methods (TMH)
G.H.Hostetter	-	Digital Control System
Stuart Bennette	-	Real time control system
W.Forsythe & R.M.Goodall	-	Digital control
Katz	-	Digital control

EE 921 Control Techniques in Power Electronics:

State space modelling and simulation of linear systems, discrete time models, conventional controllers using small signal models, variable structure and sliding mode control, hysterisis and ramp comparison controllers, output and state feedback switching controllers, Linear Quadratic Controller (LQR), Deadbeat controller, Structure and control of following power converters: single phase H-bridge and three phase inverter, multilevel inverters, PWM for inverters,. Implementation of Power Electronics Controllers: analog and digital controllers, DSP implementation, ASIC's and embedded controller, FPGA's and Virtual Instrumentation

N. Mohan and others	Power Electronics, Converters, Applications and Design
M. H. Rashid (ed)	Power Electronics Handbook
M. P. Kazmierkowski and others	Control in Power Electronics (Selected Problems)
D. O. Neacsu	Power Switching Converters (Medium and High Power)
H. Sira-Ramirez and others	Control Design Techniques in Power Electronics Devices
A. Ghosh and G. Ledwich	Power Quality Enhancement using Custom Power Devices

EE 922 Microprocessor & micro-controller based systems:

Introduction to the general structure of advanced microprocessors and microcontrollers, Discussions on architectures, instruction sets, memory hierarchies, pipelining and RISC principles, interfacing to input and output devices, user interface design, real-time systems, and table-driven software, single chip microcomputers, Interrupt structures, Parallel/serial I/O, Analog I/O, DMA operations, Peripheral controllers, Laboratory based experiments and projects with theses devices.

EE 923 Robotics Vision:

Overview, computer imaging systems, lenses, Image formation and sensing, Review of open source Image processing Packages, Image analysis, preprocessing, Binary image analysis, Edge detection, Edge detection performance, Hough transform, Segmentation, Morphological filtering, Fourier and Orthogonal Image transforms, Feature extraction, shape, histogram, color, spectral, texture, Feature analysis, feature vectors, distance /similarity measures, data preprocessing, Pattern classification, character classification, pedestrian and face recognition/detection

References:

R.C.Gonzalez & P.Wintz	Digital Image Processing
B.K.P.Horn	Robot Vision
D.H.Ballard & C.M.Brown	Computer Vision
R.C.Gonzalez and M.G.Thomason	Syntactic Pattern Recognition:An introduction
P.A. Devijver and J. Kittler	Pattern Recognition: A Statistical Approach
W. K. Pratt	Digital Image Processing
A.K. Jain	Fundamentals of Digital Image Processing
R.O. Duda and P.E. Hart	Pattern Classification and Scene Analysis

EE 924 Optimization Technique:

Introduction to optimization-classification.
Linear programming – Problem in two variable-graphical solution – Formulation of LP problems in more than two variables- standard form simplex method-simple-Algorithm special cases-2 phases method- Duality and Dual LP problems-10.
Application of LP in Transportation problem-Balanced and unbalanced transportation problems-Use of North West corner rule-Least cost coefficient method-Vogel approximation method.
Non-linear programming problem – philosophy of numerical methods, various elimination method for one dimensional problems- unconstrained and constrained optimisation, Non linear programming problems, Use of univariate method –

Pattern search method – Steepest descent method-Davidon, Fletcher Power method – cutting plane method , Penalty function-Derivative free method, Finite differential and method of sum of squares and non-linear equations-comparison of methods.
Classical optimization techniques – single variable problem-multivariable optimisation with constraints and without constraints Necessary and sufficient conditions.
Basics ideas of Feometric programming-Dynamic programming and Integer programming.

References:
S.S.Rao - Optimization theory and application
L.S.Srinath - Linear programming theory and application
Leunberger, D - Linear & non linear programming, 2nd ed. Addition –Wesley1984
Schirisieer A. - Theory of linear and integer programming, John Wiley and sons1986

EE 925 Digital System Simulation:

Introduction to digital system simulation, continuous and discrete system simulation, Queueing system simulation, A PERT network simulation, Inventory control system simulation and forecasting techniques, Design and evaluation of experiments on system simulation, system simulation languages with particular reference to GPSS, SIMULA & Continuous system simulation languages (CSSLs), Introduction to system models.
Approximation of functions: Linear regression, polynomial regression, Fitting of exponential and trigonometric functions, Taylor Series, Chenyshev series and rational functions approximations.
Differentiation and Integration: Formulae for numerical differentiation, numerical integration, Simpson's rule.

EE 926 Expert System:

Introduction, Expertise and Henristic knowledge, knowledge based systems, Structure of knowledge based systems, Logic and automated reasoning, Predicate logic ,logical inference, Resolution, Truth maintenance systems, Rule based reasoning, Forward chaining , Backward chaining, Rule based architectures, conflict resolution schemes, Associative networks, Frames and Objects, uncertainty management, Baynesian approaches, Certainty factors, Dempeter-Shefer theory of Evidence, Fuzzy sets and Fuzzy logic, knowledge Acquisition search strategies and matching techniques.

References:
Peter Jackson - Introduction to expert systems
Archino J.Gonzalez & Douglas & Dankel - The Engg. of knowledge based systems
Dan W. Patterson - An introduction to Artificial Intelligence and Expert systems
Sasikumar et al. - Rule based expert systems
Kowalik - Knowledge based problem solving
Roth - Building expert systems

EE 927 Power Semiconductor:

Introduction to the physics of semiconductors, PN junctions, Power BJT and MOS field Effect Transistors, IGBT, MCT, Thyristor family, Physics of operation, their characteristics, circuit models, SPICE and small signal modeling and analysis, Snubber and protection circuit, Models for metal semiconductor contacts and hetero junctions, MOSFET-quantum theory of 2DEG, gradual channel approximation, charge control models, BSIM model, Second-order effects.

EE 928 Digital Signal Processing:

Digital signals & z-transform, DFT- Walsh- Hadamard transforms, discrete convolution and correlation, FFT algorithms, Digital filters-flow graph and Matrix representation, IIR and FIR filter design, Signal processing algorithm, waveform generation, Quadrature signal processing, Signal detection , modulation techniques, frequency translation, over ranging, Issues involved in DSP processor design-speed, cost, accuracy, pipelining, parallelism, quantization error, etc., Key DSP hardware elements - Multiplier, ALU, Shifter, Address Generator, etc., Software development tools-assembler, linker and simulator, Applications using DSP Processor - spectral analysis.

References:
A.V.Oppenheim & Schfar - Digital Signal Processing
Bateman & Yates - Digital Signal Processing Design
A.Antoniou - Digital Filters Analysis and Design

EE 911 Flexible AC Transmission System:

Introduction to FACTS, challenges and needs, Power Flow in AC transmission line, Power flow control, Description and definition of FACTS controllers, Static power converter structures, Voltage-sourced and current-sourced converters, Converter output and harmonic control, power converter control issues, Shunt Compensation: SVC, STATCOM, Operation and control, Configurations and applications, Series Compensation: TCSC, mitigation of sub-synchronous resonance.

SSSC, Combination of shunt-series compensation: UPFC, Power flow studies, operational constraints, IPFC, UPQC, other FACTS Controllers: TCPAR, TCBR etc.

References:

N.G.Hingorani	-	FACTS
K.R. Padiyar		FACT's Controllers in Transmission & Distribution
V. K. Sood		HVDC and FACTS Controllers: Applications of Static Converters in Power Systems

EE 930 Industrial Process Control:

Introductory concepts, process and controller characteristics, closed loop automatic control systems, controlling elements, final control elements, project based study of different processes, modern industrial process control, multivariable control, self adaptive approaches, computer control & DDC algorithms for process loop tunings, Hierarchical control, microprocessor based process control application.

References:

Patranabis	-	Principle of process control
Harriott	-	Process control
Shinskey	-	Process control systems

EE 931 Nonlinear System:

Introduction, differential equations, behavior and difficulties of non-linear parameter systems, different techniques for solving non-linear control problems, common physical non linearities, Phase plane method, sinusoidal describing function method, limit cycle, jump resonance, random input, describing function, perturbation method, dither signal, Lyapunov stability criterion, Lure's V functions, Popov criterion, Aizerman's problem, stability in small functional analysis.

References:

M.Vidyasagar	-	Non-linear system
D.Graham and others	-	Analysis of Non-linear systems
N.Minorsky	-	Theory of non-linear control systems
P.A.Cook	-	Non-linear dynamical system

EE 932 Neuro-Fuzzy Control System:

Neural networks: Introduction, artificial neuron model, Hopfields model, energy functions, perceptrons, multiplayer network, Back propagation, re-current networks, supervised and unsupervised learning, principle component analysis, ART, hardware & software realization of ANN, modelling, identification, prediction and control using neural network controllers, Basics off sets and fuzzy arithematics, crisp sets, operation, relation and composition of sets, Fuzzy control systems, Fuzzy logic, software and hardware application to closed loop control, Fuzzification and defuzzification methods, Fuzzy controllers.

References:

Simon Hykin	-	Neural Network
N.K.Bose	-	Neural Network
M.T.Hagan	-	Neural Network Design
D.T.Pham and X Liu	-	Neural network for identification, prediction and control, springer-Verlog
E.H.Mamlani and F.R.Gaines	-	Fuzzy sets, Academic Press
B.Kosko	-	Neural Network and Fuzzy control
T. Ross	-	Fuzzy Logic

EE 933 Biomedical Instrumentation:

The need to study biomedical instrumentation, Biological amplifiers and their interfacing with electrodes for activity monitoring, solid state transducers for flow, pressure, temperature and other physiological parameters and related instrumentation for long term use, Low power consuming circuits specially for implantable pacemakers, drift problem and its compensation, Telemetry of biological signals, Digital signal processing and imagery construction suitable for scanning for example CAT, PET, NMR and ultrasonics with a special reference to instrumentation principle, Brief study of respiratory and nervous system, physiotherapy and electrotherapy equipments, LASER applications in biomedical field.

References:

Buestein E	-	Introduction to biomedical electronics
Cromwel L.	-	Biomedical instrumentation and measurement

EE934 Robot Modeling and Control:

Robotics system components, coordinate frames, different orientation descriptions, free vectors, translation, rotation and relative motion , Homogeneous transformations, Link coordinate frames, Denavit-Hartenberg convention, Joint and End-

effector Cartesian space, Forward kinematics transformations of position, Inverse kinematics of position, Trigonometric equations, Closed-Forum Solutions, Workspace, Lagrangian formulation, Model properties, Newton-Euler equations of motion, Simulations, Computed torque control, Approximated CT control, Digital Control, Flexible link robots with actuators, Rigid link, Electrically driven robot arms, Backstepping design.

References:

1. Introduction to Robotics, Mechanics & Control — John J. Craig
2. Adaptive Control of mechanical manipulators — John J. Craig
3. Neural Network Control of Robot manipulators & NLS — F.L. Lewis, S. Jagannathan & A. Yesildirek
4. Control of Robot Manipulators — F. L.. Lewis, Abdallah C.T., and Dawson D.M.,

EE 935 Process Automation:

Hierarchical conceptual design of process, typical case study related to processes such as heat exchangers, distillation column, dryers, blenders, reactors, their dynamics, control schemes, interfacing with computers, Case studies for chemical, metallurgical, cement, papers etc. considered in detail (any two).

References:

- Sivan - Chemical Process Industries
- Thomas E. Martin - Process Control

EE 936 CAD of Control:

Requirement of interactive computing, modes, graphical quality, Line drawing, solid area graphics and three dimensional display, Scaling and transformation, Comparison of languages in terms of structured programming, Interactive use of languages, portability, Program evaluation, CAD of SISO systems, system specification, nyquist, inverse nyquist, bode and root locus plots, Development of software for graphic display of these plots, Design of compensators, software development for simulation.
CAD of MIMO systems: stability, integrity, software development for optimal control, simulation of MIMO systems.

References:

- Karl J. Astrom - Computer controlled systems-theory and design
- Ramamoorthy - Computer aided design-electrical equipment
- M.Gopal - Digital control and State space methods

EE 937 System Identification & Estimation:

Introduction, random variables and stochastic processes, stochastic static models, the identification problem, classical methods of identification of transfer functions models, least square estimator, recursive least square, minimum variance algorithm, stochastic approximation and maximum likelihood method, Kalman-filters for state estimation and LQG for optimal control problem, Gauss Markov, Model for vector random processes.

References:

- Pictor Fykhoff - Trends and progress in system identification
- Raman K. Mehra & D.G.Lainiotis - System identification Advanced and Case studies
- G.N.Sarodos - Stochastic Processes, estimation and control, Wiley Interscience publication
- K.J.Astrom - Introduction to Stochastic Processes, Academic Process

EE 938 Robust Control System:

Linear Quadratic Regulators: return ratio & difference, sensitivity function. Kalman's optimality condition. Gain/phase margins, robustness to time delay and nonlinearity. Characterization of sensitivity. Kharitonov theorem robustness. Singular values - properties, application in stability, robustness and sensiti-vity. Robustness of discrete time LQR systems.

References:

- K.Jhou & J.C.Doyle - Essentials of Robust Control
- J.B.Burl - Linear optimal Control

EE 939 Stochastic Control System:

Wiener processes; Markov chains & processes; Filtering, prediction & smoothing. Least squares, Minimum variance, ML and Minimax estimates, error bounds. Kalman and Wiener filters. Optimal control in presence of uncertainty. Synthesis of regulators and terminal controllers, Effect of noisy components on optimal control law. Partially characterised systems.

References:

- Goong Chen, Shih Hsun Hsu — Linear Stochastic Control Systems
- Jon H Davis — Foundations of deterministic and stochastic control
- Jiongmin Yong, Xun Yu Zhou — Stochastic Controls

EE 940 Reliability Engineering:

Principles, Concepts and Definitions of Reliability Engineering, Common Tools for Improving R&M; (Maintainability Engineering), Basic Reliability Calculations, Predictions and Estimation, Apportionment Methods; (Reliability Measures, Static Rel Models); Review of Probability Concepts, Discrete & Continuous Models, Life Distributions; Exponential Distribution; Weibull Distribution, Basics of reliability & Empirical Reliability Measures, Part Selection and Derating, Reliability Plots and Model Selection, Reliability Testing & Planning; (Success/Failure Testing Schemes), Failure Mode & Effect Analysis/Fault Tree Analysis, Design Review Procedures (one session), Reliability Growth Management (one session), Life Cycle Costing

<u>References:</u>

Lloyd and Lipow	Reliability: Management, Methods, and Mathematics
O'Connor	Practical Reliability Engineering
Kapur & Lamberson	Reliability in Engineering Design
Lewis	Introduction to Reliability Engineering

EE 941 Advanced Digital Design:

Design principles for complex digital systems, Iteration, top-down/bottom-up, divide and conquer, and decomposition, Description techniques, including block diagrams, register transfer and hardware description languages, Consideration of transmission line effects on digital systems, Synchronous design, state machine design, Design for testability, PALs, FPGAs, standard cells, timing considerations, fault vectors and fault grading.

EE 942 Simulation of Modern Power System:

Power system deregulation, static and dynamic modeling, Load flow and stability studies, electromagnetic phenomenon, Insulation and partial Discharge, Elementary linear graph theory, modeling of power system components, multiterminal representations in bus admittance and impedance matrix forms, Algorithms for generating various network matrices, load flow and short circuit studies, Emphasis on digital computer programs. Exposure to use of PSCAD, ETAP power station and Matlab software.

EE 943 Distribution Automation:

Distribution system planning – Tools for distribution system planning and design.
Substation Automation – Data acquisition from field devices and supervisory control of field devices, Fault location, Fault isolation, service restoration, substation reactive power control
Feeder level Automation- -Data acquisition from Field devices at feeder level, supervisory control of field devices, Fault location, Fault isolation, service restoration, Feeder reconfiguration, feeder reactive power control.
Customer level Automation- automatic meter reading, Remote programming of time-of-use (TOU) meters, Remote service connect / disconnect, Automated customer claims analysis
Control hierarchy and control centre architecture, RTU's , IEDs, PLCs, Use of GPS and GIS systems for Asset/Facilities management.
Cost benefit analysis of Distribution Automation schemes, Review of distribution automation roadmaps of prominent utilities in Europe and US, Review of distribution automation in Indian utilities.

<u>References:</u>

Mary S. Nardone	Direct Digital Control Systems: Application · Commissioning, Kluwer.
Dr. Klaus-Peter Brand and others	Substation Automation Handbook

EE 944 SCADA of Power System:

Supervisory control and data acquisition systems (SCADA), Distributed Control System used in real time power systems, SCADA and operating systems. Data loggers and data display system. Remote control instrumentation. Disturbance recorders. Area and Central Control station instrumentation. Frontiers of future power system instrumentation including microprocessor based systems, sequence of events recording (SOE), Dynamic Data Exchange (DDE) module, ETAP (Electrial Transients Analyzer Program), energy management system (EMS), substation RTU, RTDS system

EE 945 CAD of Power Electronics:

Introduction to simulation method for power electronic converter system , Modeling of Elements, Computer simulation of state equation, Order reduction for simulation study , Eigenvalue analysis, Participation factor, Sequential methods of simulation, Modern trends in CAD methods.

EE 946 Active Power Conditioning:

Concept of nonlinear loads and electric power conditioning, Power quality problem causes and conventional mitigation methods, Capacitor banks, harmonic filter design, resonance problems, Hybrid and active power filters for harmonic compensation, , Reference current generation, DSTATCOM, DVR, and UPQC: Modeling, structure and control, switched hysterisis control, state-space modeling, UPS-modeling and control, EMI and EMC, Distributed generation, solar and wind power conversion, standalone and grid interface applications and control

References:

A. Ghosh and G.Ledwitch	Power Quality Enhancement Using Custom Power Devices
G. J. Walkileh	Power Systems Harmonics
IEEE Standard 519-1992	IEEE recommended practices and requirements for harmonic control in electrical power systems
M. H. Rashid (ed)	Power Electronics Handbook

EE 947 Computer Aided Circuit Analysis:

Steady state and transient analysis of circuits with emphasis on circuit theory and computer methods, Consideration of many analysis techniques, including linear nodal, signal flow graph, state equation, time-domain and functional simulation and analysis of sampled data systems, Sensitivity and tolerance analysis, macro-modeling of large circuits and non linear circuit theory.

EE 948 Information Theory:

Shannon's mathematical theory of communication, 1948-present, Entropy, relative entropy, and mutual information for discrete and Continuous random variables. Shannon's source and channel coding theorems. Mathematical models for information sources and communication channels, including memory-less, first order Markov, ergodic, and Gaussian, Calculation of capacity-cost and rate-distortion functions, Kolmogorov complexity and universal source codes, Network information theory, including multi-user data compression, multiple access channels, broadcast channels, and multiterminal networks.

EE 949 Power System Stability and Control:

Review of conventional methods for the stability evaluation of multi-machine power systems and the modeling of components, Lyapunov stability theory, Mathematical models, state space models in COA and MAR frames. Lyapunov functions for reduced and structure preserved energy systems regions UEP and PEBS techniques. Stability regions with realistic models for load and machines.

References:

M.A.Pai	Power system stability analysis by direct method of Lyapunov,
M A Pai, D P Sen Gupta, K R Padiyar	Small Signal Analysis of Power System

EE952 Virtual Instrumentation:

Introduction, Virtual instrumentation (VI) advantages, Graphical programming techniques, Data flow programming , VI's and sub VI's, Structures, Arrays and Clusters, Data acquisition methods, File I/O, DAQ hardware, PC hardware: operating systems, Instrumentation buses, ISA, PCI, USB, PXI, Instrument control, Data communication standards, RS-232C, GPIB, Real time operating systems, Reconfigurable I/O, FPGA.
Virtual Instrumentation Lab: Familiarization with Lab VIEW Programming, Lab VIEW Functions & Debugging, Advance Lab VIEW Functions, Data Acquisition, VI Applications.

References

S. Gupta & J. John	Virtual Instrumentation Using Lab VIEW
Robert Bishop	Lab VIEW 7 Express Student Edition
www.ni.com	Lab VIEW User Manual
www.ni.com	Lab VIEW RT User Manual
www.ni.com	Lab VIEW FPGA Module User Manual
Leonard Sokoloff	Application Lab VIEW
Nesimi Ertugrul	Lab VIEW For Electrical Circuits, Machine Drives and Labs
John Essick	Advances Lab VIEW Labs
Gary Johnsons	Lab VIEW Graphical Programming.

ANNEXURE-II

PROFESSIONAL ELECTIVE
DESIGN OF STEEL STRUCTURES (LIMIT STATE DESIGN)

3L: 2T:0P
Credit: 4

GENERAL CONSIDERATIONS
Introduction, Advantages and disadvantages of steel as a structural material, Stress-strain curve for mild steel, Rolled steel sections, Loads, Dead loads, Live loads , Environmental loads, Seismic Forces, Snow and rain loads, Erection Loads, Design philosophies, Minimum thickness of structural members.

INTRODUCTION TO LIMIT STATE DESIGN
Introduction to limit states for steel design, Limit states of strength, Limit states of serviceability, Action (Loads), Methods of determining action effects, Design criteria.

SIMPLE CONNECTIONS – RIVETED, BOLTED AND PINNED CONNECTIONS
Introduction, Riveted connections, Patterns of riveted joints, Bolted connections, Types of bolts and bolted joints, Load transfer mechanism, Failure of bolted joints, specifications for bolted joints, Bearing-type connections, Prying action, Tensile strength of plate, Efficiency of the joint, Combined shear and tension, Slip-critical connections, Combined shear and tension for slip-critical connections, Working load design, Pin connections.

SIMPLE WELDED CONNECTION
Introduction, Types and symbols, Welding Process, Weld defects, Inspection of welds, Assumptions in the analysis of welded joints, Design of groove welds, Design of fillet welds: applied to the edge of a plate or section, for truss members, Design of intermittent fillet welds, Plug and slot welds, Stresses due to individual forces, Combination of stresses, Failure of welds, Distortion of welded parts, Fillet weld vs butt weld, Welded jointed vs bolted and riveted joints.

TENSION MEMBERS
Introduction, Types of tension members, Net sectional area, Effective net area, Types of failure, Design strength of tension members, Slenderness ratio, Displacement, Design of tension member, Lug angles, Splices, Gusset plate, Working load design.

COMPRESSION MEMBERS
Introduction, Effective length, Slenderness ratio, Types of sections, Types of buckling, Classification of cross sections, Column formula, Design Strength, Design of axially loaded compression members, Built-up columns (latticed columns), Encased column, Splices, Working load design.

BEAMS
Introduction, Types of sections, Behaviour of beam in flexure, Section classification, Lateral stability of beams, Lateral-torsional buckling, Bending strength of beams, Shear stress, Bearing stress, Web buckling and web crippling, Lintels, Purlins, Shear centre, Built up beams, Holes in beam, Working load design.

BEAM-COLUMNS
Introduction, General behaviour, Interaction of load and moment, Design strength of beam-columns, Working load design.

COLUMN BASES
Introduction, Design of column bases and caps for concentric and eccentric loadings.

ANNEXURE-III