ACADEMIC REGULATIONS
PROGRAM STRUCTURE
and
DETAILED SYLLABUS

Master of Technology
(Power Electronics)

(Two Year Regular Programme)
(Applicable for the Batches admitted from 2014)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

Gokaraju Rangaraju
Institute of Engineering and Technology, Hyderabad
M. Tech. GR14 Regulations

Gokaraju Rangaraju Institute of Engineering & Technology 2014 Regulations (GR14 Regulations) are given hereunder. These regulations govern the programmes offered by the Department of Electrical and Electronics Engineering with effect from the students admitted to the programmes in 2014-15 academic year.

1. **Programme Offered:** The programme offered by the Department is M.Tech in Power Electronics, a two-year regular programme.

2. **Medium of Instruction:** The medium of instruction (including examinations and reports) is English.

3. **Admissions:** Admission to the M.Tech in Power Electronics Programme shall be made subject to the eligibility, qualifications and specialization prescribed by the Institute/University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in PGECET conducted by the APSCHE for M. Tech Programmes or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government from time to time.

4. **Programme Pattern:**
   a) Each Academic year of study is divided into two semesters.
   b) Minimum number of instruction days in each semester is 90.
   c) The total credits for the Programme is 88.
   d) All the registered credits will be considered for the calculation of the final percentage of marks.

5. **Award of M.Tech Degree:** A student will be declared eligible for the award of the M. Tech Degree if he/she fulfills the following academic requirements:
   a) A student shall be declared eligible for the award of M.Tech degree, if he/she pursues the course of study and completes it successfully in not less than two academic years and not more than four academic years.
   b) A Student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the date of admission, shall forfeit his/her seat in M.Tech course.
   c) The Degree of M.Tech in Power Electronics shall be conferred by Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, on the students who are admitted to the programme and fulfill all the requirements for the award of the degree.

6. Attendance Requirements

a) A student shall be eligible to appear for the end semester examinations if he/she puts in a minimum of 75% of attendance in aggregate in all the courses concerned in the semester.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in a semester may be granted. A committee headed by Dean (Academic Affairs) shall be the deciding authority for granting the condonation.

c) Students who have been granted condonation shall pay a fee as decided by the Academic Council.

d) A candidate shall get minimum required attendance at least in three (3) theory subjects in the semester to get promoted to the next semester. In order to qualify for the award of M.Tech Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

e) Students whose shortage of attendance is not condoned in any semester are detained and are not eligible to take their end examinations of that semester. They may seek re-registration for that semester when offered next with the academic regulations of the batch into which he/she gets re-registered.

7. Paper Setting, Evaluation of Answer Scripts, Marks and Assessment

a) Paper setting and Evaluation of the Answer Scripts shall be done as per the procedures laid down by the Academic Council of the College from time to time.

b) The following is the division of marks between internal and external evaluations.

Particulars	Internal	External	Total
Theory	40	60	100
Practical	40	60	100
Comprehensive Viva	--	100	100
Seminar	50	----	50
Project Work	Grade	-----	----
Project work & dissertation (Grading System)	------	Grade	----

c) Continuous Internal Evaluation and Semester End Examinations

The assessment of the student's performance in each course will be based on continuous internal evaluation and semester-end examinations. The marks for each of the component of assessment are fixed as shown in the following Table.

Assessment Procedure

S.No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Theory	40	Internal Exams & Continuous Evaluation	1. Mid-examinations: … 30 Marks (Two mid-semester examinations shall be conducted for 30 marks each for duration of 2 hours. Average of the two mid semester examinations shall be considered) 2. Tutorial: … … 5 Marks 3. Attendance: .. 5 Marks
		60	Semester-end examination	The semester-end examination is for a duration of 3 hours
2	Practical	40	Internal Exams & Continuous Evaluation	1) Lab Internal :15 marks 2) Record : 5 marks 3) Continuous Assessment : 15 marks 4) Attendance : 5 marks
		60	Semester-end examination	The semester-end examination is for a duration of 3 hours.

d) **Comprehensive Viva:** There shall be a Comprehensive Viva-Voce in II year I semester. The Comprehensive Viva-Voce will be conducted by the committee consisting of Head of the Department and two senior faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the student's understanding in various subjects he/she studies during the M.Tech course of study. The Comprehensive Viva-Voce is valued for 100 marks by the committee. There are no internal marks for the Comprehensive Viva-voce.

e) Seminar: There shall be three Seminar Presentations by the student, one each in the I,II and III semesters. For the seminar, the student shall collect the information on a specialized topic other than his/her project and prepare a technical report, showing his understanding over the topic, and

submit to the department, which shall be evaluated by a Departmental committee consisting of the Head of the department, seminar Supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.

f) **Project:** The work on the project shall be initiated in the beginning of the second year and the duration of the project is for two semesters (III & IV). Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the Project Review Committee (PRC).
   i) PRC shall be constituted with HOD as chair person, two senior faculty members and project supervisor.
   ii) Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects (theory and practical subjects).
   iii) A candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the PRC for its approval. Only after obtaining the approval of PRC the student can initiate the Project work.
   iv) If a candidate wishes to change his supervisor or topic of the project he/she can do so with approval of PRC. However, the PRC shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so, his date of registration for the project work starts from the date of change of supervisor or topic as the case may be.
   v) Project Work: The candidate should be continuously observed by the project supervisor. His performance is assessed by the PRC through a seminar and interim report. Full credits are awarded 'SAT' on satisfactory performance of the student. 'US' grade is given on unsatisfactory performance. If the performance is unsatisfactory, the PRC should redefined the project and the candidate is allowed to appear for the evaluation only after six months.
   vi) Project Work & Dissertation: A candidate shall submit status report (in a bound-form) in two stages at least with a gap of 3 months between them to the project supervisor.
   vii) A candidate is permitted to submit Project dissertation only after successful completion of theory and practical course with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of dissertation to the Head of the Department and shall make an oral presentation before the PRC along with project supervisor.
   viii) Student has to submit to the department three copies of the Project dissertation along with a soft copy on CD certified by the supervisor.
   ix) The dissertation shall be adjudicated by one examiner selected by the Controller of examination from the panel of 3 examiners as suggested

by Head of the Department, who are eminent in that field with the help of the concerned guide and head of the department.

x) If the report of the Examiner is not favorable, the candidate shall revise and resubmit the dissertation, in the time frame as described by PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected.

xi) If the report of the examiner is favorable, viva-voce examination shall be conducted by a board consisting of the supervisor, Head of the Department and the examiner who adjudicated the dissertation. The Board shall jointly report candidates work as:

A. Excellent
B. Good
C. Satisfactory
D. Unsatisfactory

Head of the Department shall coordinate and make arrangements for the conduct of viva-voce examination.

If the report of the viva-voce is unsatisfactory, the candidate will retake the viva-voce examination after three months. If he/she fails to get a satisfactory report at the second viva-voce examination, he/she will not be eligible for the award of the degree.

8. **Recounting of Marks in the End Examination Answer Books:** A student can request for re-counting of his/her answer book on payment of a prescribed fee.

9. **Re-evaluation of the End Examination Answer Books:** A student can request for re-evaluation of his/her answer book on payment of a prescribed fee.

10. **Supplementary Examinations:** A student who has failed in an end semester examination can appear for a supplementary examination, as per the schedule announced by the College/Institute.

11. **Malpractices in Examinations:** Disciplinary action shall be taken in case of malpractices during Mid/ End-examinations as per the rules framed by the Academic Council.

12. **Academic Requirements:**

a) A student shall be deemed to have secured the minimum academic requirements in a subject if he / she secures a minimum of 40% of marks in the Semester-end Examination and a minimum aggregate of 50% of the total marks in the Semester-end examination and Internal Evaluation taken together.

B) In order to qualify for the award of M.Tech Degree, the student shall

complete the academic requirements of passing in all the Courses as per the course structure including Seminars and Project if any.

c) In case a Student does not secure the minimum academic requirements in any course, he/she has to reappear for the Semester-end Examination in the course, or re-register for the same course when next offered or re-register for any other specified course, as may be required. However, one more additional chance may be provided for each student, for improving the internal marks provided the internal marks secured by a student are less than 50% and he/she failed finally in the course concerned. In the event of taking another chance for re-registration, both the internal and external marks obtained in the previous attempt are nullified. In case of re-registration, the student has to pay the re-registration fee for each course, when next offered.

13. **Award of Class:** After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of M. Tech Degree by JNTUH, he/she shall be placed in one of the following three classes:

Class Awarded	% of Marks Secured
First Class with Distinction	Marks ≥ 70%
First Class	60% ≤ Marks < 70%
Second Class	50% ≤ Marks < 60%

14. **Withholding of Results:** If the student has not paid dues to the Institute/ University, or if any case of indiscipline is pending against him, the result of the student (for that Semester) may be withheld and he/she will not be allowed to go into the next Semester. The award or issue of the Degree may also be withheld in such cases.

15. **Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities:** Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities shall be considered only on case-to-case basis by the Academic Council of the Institute.

16. **Transitory Regulations:** Students who have discontinued or have been detained for want of attendance, or who have failed after having undergone the Degree Programme, may be considered eligible for re-registration to the same or equivalent subjects as and when they are offered.

17. General Rules

a) The academic regulations should be read as a whole for the purpose of any interpretation.
b) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.
c) In case of any error in the above rules and regulations, the decision of the Academic Council is final.
d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute/ University.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
M.TECH (Power Electronics)

PE - M.Tech - I Year, I Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
PC	GR14D5036	Modern Power Electronics	3	40	60	100
PC	GR14D5037	Analysis Of Power Electronic Converters	3	40	60	100
PC	GR14D5038	Modern Control Theory	3	40	60	100
PC	GR14D5039	Power Electronic Control of DC Drives	3	40	60	100
		Elective I	3	40	60	100
PE	GR14D5040	Machine Modeling & Analysis				
	GR14D5041	HVDC Transmission				
	GR14D5042	Energy Conservation Systems				
		Elective II	3	40	60	100
PE	GR14D5043	Digital Control of Power Electronic Systems				
	GR14D5044	Solar and Wind Energy				
	GR14D5045	Special Machines				
LAB	GR14D5046	Electrical Systems Simulation Lab	2	40	60	100
SPW	GR14D5175	Seminar-I	2	—	—	—
		Total	**22**	**280**	**420**	**700**

PE - M.Tech- I Year, II Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
PC	GR14D5047	Power Electronic Control of AC Drives	3	40	60	100
PC	GR14D5048	Microcontrollers	3	40	60	100
PC	GR14D5049	Flexible AC Transmission Systems (FACTS)	3	40	60	100
PC	GR14D5050	Neural and Fuzzy Systems	3	40	60	100
		Elective III	3	40	60	100
PE	GR14D5051	Power Quality				
	GR14D5052	Digital Control Systems				
	GR14D5053	Dynamics of Electrical Machines				
		Elective IV	3	40	60	100
PE	GR14D5054	Advanced Digital Signal Processing				
	GR14D5055	Programmable Logic Controllers And Their Applications				
	GR14D5056	Reactive Power Compensation and Management				
LAB	GR14D5057	Power Converters Lab	2	40	60	100
SPW	GR14D5176	Seminar-II	2	—	—	—
		Total	**22**	**280**	**420**	**700**

PE - M.Tech - II Year, I Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
SPW	GR14D5178	Comprehensive Viva	2	—	100	100
SPW	GR14D5177	Seminar-III	2	50	—	50
SPW	GR14D5179	Project work	18	Grade		
		Total	**22**	**50**	**100**	**150**

PE - M.Tech - II Year, II Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
SPW	GR14D5180	Project work and Dissertation	22	Grade		

I-Year

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MODERN POWER ELECTRONICS

Course Code: GR14D5036 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Modern Power Semiconductor Devices: Modern power semiconductor devices-MOS turn Off Thyristor (MTO)-Emitter Turn Off Thyristor (ETO) Intergrated Gate Commutated thyristor (IGCTs)-MOS-controlled thyristors (MCTs)-Static Induction circuit comparison of their features.

Unit-II

Resonant Pulse Inverters: Resonant pulse inverters-series resonant inverters-series resonant inverters with unidirectional switches series resonant inverters with bidirectional Switches-analysis of half bridge resonant inverter - evaluation of currents and Voltages of a simple resonant inverter-analysis of half bridge and full bridge resonant inverter with bidirectional switches Frequency response of series resonant inverters-for series loaded inverter-for parallel loaded inverter-For series and parallel loaded inverters-parallel resonant inverters Voltage control of resonant inverters-class E inverter, Class F rectifier-numerical problems.

Resonant Converters: Resonant converters-Zero current switching resonant converters-L type ZCS resonant converter-M type ZCS resonant converter-zero voltage Switching resonant converters-comparison between ZCS and ZVS Resonant converters-Two quadrant ZVS resonant converters-resonant de-link Inverters evaluation of L and C for a zero current switching inverter Numerical problems.

Unit-III

Multilevel Inverters: Multilevel concept-Classification of multilevel inverters-Diode clamped multilevel inverter-principle of operation-main features improved diode Clamped inverter-principle of operation-Flying capacitors multilevel inverter principle of operation-main features.

Multilevel Inverters (CONTINUED): Cascaded multilevel inverter principle of operation-main features-Multilevel inverter applications-reactive power compensation-back to back intertie system adjustable drives -Switching device currents-delink capacitor voltage balancing-features of Multilevel inverters-comparisons of multilevel converters.

Unit-IV

DC Power Supplies: DC power supplies-classification-switched mode dc power

supplies-fly back Converter forward converter- push-pull converter-half bridge converter-Full bridge converter-Resonant dc power supplies-bidirectional power supplies-Applications.

Unit-V

AC Power Supplies: AC power supplies classification-switched mode ac power supplies-Resonant AC power supplies-bidirectional ac power supplies-multistage conversions-control circuits-applications.

Power Conditioners and Uninterruptible Power Supplies: Introduction-power line disturbances-power conditioners-uninterruptible Power supplies - applications.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Books

1. Power Electronics — Mohammed H. Rashid Pearson Education — Third Edition
2. Power Electronics — Ned Mohan, Tore M. Undeland and William P. Robbins — John Wiley and Sons Second Edition.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALYSIS OF POWER ELECTRONIC CONVERTERS

Course Code: GR14D5037 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Single Phase AC Voltage Controllers: Single phase AC voltage controllers with Resistive, Resistive-inductive and Resistive-inductive-induced e.m.f. loads - ac voltage controllers with PW Control - Effects of source and load inductances - Synchronous tap changers-Applications - numerical problems.

Unit-II

Three Phase AC Voltage Controllers: Three phase AC voltage controllers - Analysis of controllers with star and delta Connected Resistive, Resistive-inductive loads - Effects of source and load Inductances - applications - numerical problems.

CYCLOCONVERTERS: Single phase to single phase cycloconverters - analysis of midpoint and bridge Configurations - Three phase to three phase cycloconverters - analysis of Midpoint and bridge configurations - Limitations - Advantages - Applications- numerical problems

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Unit-III

Single Phase Converters: Single phase converters - Half controlled and Fully controlled converters -Evaluation of input power factor and harmonic factor - continuous and Discontinuous load current - single phase dual converters - power factor Improvements - Extinction angle control - symmetrical angle control - PWM -single phase sinusoidal PWM - single phase series converters - Applications -Numerical problems.

Three Phase Converters: Three phase converters - Half controlled and fully controlled converters -Evaluation of input power factor and harmonic factor - continuous and Discontinuous load current - three phase dual converters - power factor Improvements - three phase PWM - twelve pulse converters - applications -Numerical problems.

Unit-IV

D.C. To D.C. Converters: Analysis of step-down and step-up dc to dc converters with resistive and Resistive-inductive loads - Switched mode regulators - Analysis of Buck Regulators - Boost regulators - buck and boost regulators - Cuk regulators - Condition for continuous inductor current and capacitor voltage - comparison of regulators –Multi ouput boost converters - advantages - applications - Numerical problems.

Unit-V

Pulse Width Modulated Inverters (single Phase): Principle of operation - performance parameters - single phase bridge inverter -evaluation of output voltage and current with resistive, inductive and Capacitive loads - Voltage control of single phase inverters - single PWM - Multiple PWM - sinusoidal PWM - modified PWM - phase displacement Control - Advanced modulation techniques for improved performance - Trapezoidal, staircase, stepped, harmonic injection and delta modulation - Advantage - application - numerical problems.

Pulse Width Modulated Inverters (three Phase): Three phase inverters - analysis of 180 degree condition for output voltage And current with resistive, inductive loads - analysis of 120 degree Conduction - voltage control of three phase inverters - sinusoidal PWM - Third Harmonic PWM – 60 degree PWM - space vector modulation -Comparison of PWM techniques- harmonic reductions - Current Source Inverter - variable d.c. link inverter - boost inverter - buck and boost inverter - inverter circuit design - advantages -applications - numerical problems.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Books

1. Power Electronics - Mohammed H. Rashid - Pearson Education -Third Edition - First Indian reprint 2004.
2. Power Electronics - Ned Mohan, Tore M. Undeland and William P. Robbins -John Wiley and Sons - Second Edition.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MODERN CONTROL THEORY

Course Code: GR14D5038 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Mathematical Preliminaries: Fields, Vectors, Vector Spaces Linear combinations and Bases Linear Transformations and Matrices Scalar Product and Norms, Eigenvalues, Eigen Vectors and a Canonical form representation of linear operators, The concept of state State Equations for Dynamic systems, Time invariance and Linearity Non-uniqueness of state model State diagrams for Continuous-Time State models.

Unit-II

State Variable Analysis: Linear Continuous time models for Physical systems--Existence and Uniqueness of Solutions to Continuous- time State Equations Solutions of Linear Time Invariant Continuous-Time State EquationsState transition matrix and it's properties.

Controllability and Observability: General concept of controllability General concept of ObservabilityControllability tests for Continuous-Time Invariant Systems --Observability tests for Continuous-Time Invariant Systems Controllability and Observability of State Model in Jordan Canonical form Controllability and Observability Canonical forms of State model.

Unit- III

Non Linear Systems I: Introduction to Non Linear Systems - Types of Non-Linearities-Saturation-Dead-Zone - Backlash Jump Phenomenon etc; Singular Points-Introduction to Linearization of nonlinear systems, Properties of Non Linear systems-Describing function-describing function analysis of nonlinear systems-Stability analysis of Non-Linear systems through describing functions

NON LINEAR SYSTEMS-II: Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase- plane analysis of nonlinear control systems.

Unit-IV

Stability Analysis: Stability in the sense of Lyapunov, Lyapunov's stability and Lyapunov's instability theorems Stability Analysis of the Linear continuous time invariant systems by Lyapunov second method Generation of Lyapunov functions Variable gradient method Krasooviski's method.

State Feedback Controllers and Observers: State feedback controller design through Pole Assignment State observers: Full order and Reduced order.

Unit-V

Optimal Control: Introduction to optimal control - Formulation of optimal control problems-calculus of variations-fundamental -concepts, functionals, variation of functional-fundamental theorem of Calculus of variations-boundary conditions-constrained minimization-formulation using Hamiltonian method Linear Quadratic regulator.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Books

1. Modern Control System Theory by MGopal New Age International -1984
2. Modern Control Fngineering by Ogata:K Prentice Hall 1997

Reference Book

1. Optimal control by Kircks.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

POWER ELECTRONIC CONTROL OF DC DRIVES

Course Code: GR14D5039 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Controlled Bridge Rectifier (1-Φ) With Dc Motor Load: Separately exited DC motors with rectified single-phase supply – single phase semi converter and single phase full converter for continuous and discontinuous modes of operation – power and power factor.

Unit-II

Controlled Bridge Rectifier (3-Φ) With Dc Motor Load: Three-phase semi converter and three phase full converter for continuous and discontinuous modes of operation – power and power factor – Addition of freewheeling diode-Three-phase double converter.

Three Phase Naturally Commutated Bridge Circuit As A Rectifier Or As An Inverter: Three phase controlled bridge rectifier with passive load impedance, resistive load and ideal supply – Highly inductive load and ideal supply for load side and supply side quantities, shunt capacitor compensation, three phase controlled bridge rectifier inverter.

Unit-III

Phase Controlled Dc Motor Drives: Three phase controlled converter, control circuit, control modeling of three phase converter – Steady state analysis of three phase converter control DC motor drive – Two quadrant, three phase converter controlled DC motor dive – DC motor and load converter.

Current And Speed Controlled Dc Motor Drives: Current and speed controllers – current and speed feedback – Design of controllers – current and speed controllers – Motor equations – filter in the speed feedback loop speed controller – current reference generator – current controller and flow chart for simulation – Harmonics and associated problems – sixth harmonics torque

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Unit-IV

Chopper Controlled Dc Motor Drives: Principles of operation of the chopper – four-quadrant chopper circuit – chopper for inversion – Chopper with other power devices – model of the chopper –input to the chopper steady state analysis of chopper controlled DC motor drives – rating of the devices – Pulsating torque.

Closed Loop Operation Of Dc Motor Drives: Speed controlled drive system – current control loop – pulse width modulated current controller – hysterisis current controller – modeling of current controller – design of current controller.

Unit-V

Simulation of Dc Motor Drives: Dynamic simulations of the speed controlled DC motor drives – Speed feedback speed controller – command current generator – current controller.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Reference Books

1. Power Electronic and motor control – Shepherd, Hulley, Liang – II Edition, Cambridge University Press.
2. Electric Motor drives modeling, Analysis and control – R. Krishnan – I Edition, Prentice Hall India.
3. Power Electronic circuits, Drives and Applications – M. H. Rashid – PHI – I Edition – 1995
4. Fundamentals of Electric Drives – G.K. Dubey – Narosa Publications – 1995
5. Power Semiconductor drives – S.B. Dewan and A. Straughen.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE I
MACHINE MODELING AND ANALYSIS

Course Code: GR14D5040 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I
Basic concepts of Modeling –Conventions- transformations- Speed, voltages in armature- Basic Two-pole Machine representation of generalized machine, Kron's primitive Machine-voltage, current and Torque equations.

Unit-II
DC Machine Modelling: Mathematical model of separately excited D.C motor – Steady State analysis-Transient State analysis-Sudden application of Inertia Load-Transfer function of Separately excited D.C Motor- Mathematical model of D.C Series motor, Shunt motor-Linearization Techniques for small perturbations.

Unit-III
Reference frame theory Linear transformation-Phase transformation - three phase to two phase transformation (abc to αβ0) and two phase to three phase transformation αβ0 to abc - -Power equivalence.

Unit-IV Modeling of three phase Induction Machine Generalized model in arbitrary reference frame-Electromagnetic torque-Derivation of commonly used Induction machine models- Stator reference frame model-Rotor reference frame model-Synchronously rotating reference frame model-state space model with flux linkages as variables.

Unit-V
Modeling of Synchronous Machine Synchronous machine inductances – Mathematical model-transformation to the rotor's dq0 reference frame- Flux linkages in terms of winding currents-referring rotor quantities to the stator-voltage equations in the rotor's dq0 reference frame-electromagnetic torque-currents in terms of flux linkages-steady state operation- modeling of PM Synchronous motor, modeling of BLDC motor.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Text Books
1. Thyristor control of Electric Drives - Vedam Subramanian.
2. Analysis of electric machinery and Drive systems - Paul C.Krause, Oleg wasynezuk, Scott D.Sudhoff.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE I
HIGH VOLTAGE DC TRANSMISSION

Course Code: GR14D5041 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I
H.V.D.C. Transmission: General consideration, Power Handling Capabilities of HVDC Lines Basic Conversion principles, static converter configuration.

Unit-II
Static Powcr Converters: 3-pulse,6-pulse and 12-pulse converters, converter station and Terminal equipment, commutation process, Rectifier and inverter operation, equivalent circuit for converter-special features of converter transformers. Harmonics in HVDC Systems, Harmonic elimination, AC and DC filters.

Unit-III
Control of Hvdc Converters and Systems: Constant current, constant extinction angle and constant Ignition angle control Individual phase control and equidistant firing angle control DC power flow control. Interaction between HVAC and DC systems-Voltage interaction Harmonic instability problems and DC power modulation.

Unit-IV
Multi-terminal Dc Links and Systems: Series parallel and series parallel systems their operation and control. Transient over voltages in HVDC systems OVER voltages due to disturbances on DC side, over voltages due to DC and AC side line faults.

Unit-V
Converter Faults And Protection In Hvdc Systems: Converter faults, over current protection-valve group , and DC line protection Over voltage protection of converters, surge arresters.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Reference Books

1. I. E.W. Kimbark: Direct current Transmission. Wiely Inter Science —New York.
2. J. Arillaga HVDC Transmission Peter Peregrinus ltd. London UK 1983
3. KR Padiyar : High Voltage Direct current Transmission Wiely Eastern Ltd New Delhi— 1992.
4. E.Uhlman: Power Transmission by Direct Current . Springer Verlag, Berlin Helberg. 1985.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE I
ENERGY CONSERVATION SYSTEMS

Course Code: GR14D5042 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I
Photo voltaic power generation -spectral distribution of energy in solar radiation- solar cell configurations- voltage developed by solar cell- photo current and load current- practical solar cell performance- commercial photo voltaic systems- test specifications for PV systems- applications of super conducting materials in electrical equipment systems.

Unit-II
Principles of MHD power generation- ideal MHD generator performance- practical MHD generator- MHD technology. Wind Energy conversion: Power from wind- properties of air and wind- types of wind Turbines- operating characteristics.

Unit-III
Tides and tidal power stations- Modes of operation- tidal project examples- turbines and generators for Tidal power generation. Wave energy conversion: properties of waves and Power content- vertex motion of Waves- device applications. Types of Ocean thermal energy conversion systems Application of OTEC systems Examples..

Unit-IV
Miscellaneous energy conversion systems: coal gasification and liquefaction- biomass conversion- geothermal energy- thermo electric energy conversion- principles of EMF generation- description of Fuel cells- Co-generation and energy storage- combined cycle co-generation- energy storage. Global energy position and environmental effects: energy units- global energy position.

Unit-V
Types of Fuel cells-H2O2Fuel cells- Applications of fuel cells-Batteries- Description of Batteries- Battery application for large power. Environmental effects of energy conversion systems-pollution from coal and preventive measures steam stations and pollution- pollution free energy systems.

Teaching Methodologies

1. White board
2. PPT's
3. Seminars

Text Books

1. "Energy conversion systems" by Rakosh das Begamudre, New age international publishers, New Delhi - 2000.
2. Renewable Energy Resources by John Twidell and Tony Weir, second edition, Espon and Co.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE II
DIGITAL CONTROL OF POWER ELECTRONIC SYSTEMS

Course Code: GR14D5043 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I
Digital Control Systems: Concepts of digital control, structure of digital control system, discrete time systems: Sampling & reconstruction of signals, ZOH circuits, Introduction to z-transforms and inverse z- transforms and modeling of digital control systems.

Unit-II
Stability of Digital Control Systems and Design: Stability conditions, stability determination, nyquist criterion, phase margin and gain margin, z-domain root locus, z-domain P, PI, PID control design, frequency response design, and state space representation.

Unit-III
Digital Control Application in Power Electronic Circuits: The test case: single phase inverter, digital current mode control, requirements of digital controller, basic current control implementations: PI, Predictive controller.

Unit-IV
Extension to Three Phase Systems: Space vector modulation, rotating reference frame current controller, design of rotating reference frame PI current controller.

Unit-V
External Control Loops: Modeling of internal control loops, design of voltage controllers, large band width controllers, narrow band width controllers, applications of current controllers.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Text Books
1. Digital control in power electronics by Simone Buso, paolo Mattavelli
2. Digital control engineering analysis and design by M.Sam Fadali
3. Modern Control Fngineering by Ogata:K — Prentice Hall – 1997
4. Modern Power Electronics and AC Drives B K Bose — Pearson Publications 1edition.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE II
SOLAR AND WIND ENERGY

Course Code: GR14D5044 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Solar Radiation: Sun as Energy Source, Solar Radiation at The Earth's Surface, Solar Radiation Geometry, Solar Time and Equation of Time, Sun Earth angles, Sun path diagram, Sunshine hours, Measurement of Solar Diffuse, Global and Direct Solar Radiation, Equipments, Estimation of Solar radiation on horizontal and tilted Surfaces, Global Solar radiation data, Indian Solar Radiation data analysis.

Unit- II

Solar Cells: Conversion of Solar energy into Electricity - Photovoltaic Effect, Equivalent circuit of solar cell, Characteristic equation, Open circuit voltage, Short circuit current, Current density, Drift and Diffusion, Dark current, Fill factor, Maximum power point, Power density curve, JV characteristics of solar cell, Series resistance in solar cell, Shunt resistance in solar cell. Efficiency, Recombination, Quantum efficiency, Variation of efficiency with band-gap and temperature, Efficiency measurements, High efficiency cells, Recent developments in Solar Cells, Role of Nano-Technology in Solar cells.

Unit-III

Solar Photovoltaic System Design: Solar cell array system analysis and performance prediction, Shadow analysis: Reliability, Solar cell array design concepts, PV system design, Design process and optimization: Detailed array design, Voltage regulation, Maximum tracking, Quick sizing method, Array protection.

Unit -IV

Wind Energy Basics: Global circulation, Forces influencing Wind - Pressure gradient force and Coriolis force, Local and Regional Wind systems, Atmospheric Boundary Layer, Atmospheric Stability, Surface Wind, Characteristic variables of wind and other related atmospheric parameters, Wind Data.

Power In The Wind/ Measurement And Instrumentation: Power extracted from wind – stream tube model, linear momentum theory, power coefficient, Betz limit. Extreme winds calculation of theoretical power developed by the wind turbine. Concept of Measurement System, Anemometers, Wind sensing systems, Recording systems, Global Positioning System.

Unit-V

Wind Turbines And Sitting: Types, Rotor elements, Horizontal and vertical axis wind turbines, slip stream theory. Calculation of axial thrust and efficiency, Pitch and stall regulation, Lift and drag coefficients, thrust and torque calculations, Tip losses, Characteristics of horizontal axis wind turbines and power curve. Concepts of blade design, Wind pumps. Matching of pump and turbine characteristics. Basic approaches to Siting, Siting in homogeneous terrain and complex terrain.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Books/ Reference Books

1. SP Sukhatme, Solar Energy - Principles of thermal collection and storage, 2nd edition, Tata McGraw-Hill, New Delhi
2. DY Goswami, F Kreith and JF Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia
3. AL Fahrenbruch and RH Bube, Fundamentals of Solar Cells: PV Solar Energy Conversion, Academic Press, New York, 1983
4. T Bhattacharya, Terrestrial Solar Photovoltaic, Narosa Publishers Ltd, New Delhi LD Partain (ed), Solar Cells and their Applications, John Wiley and Sons, Inc, New York, 1995
5. HS Rauschenbach, Solar Cell Array Design Handbook, Van Nostrand Reinfold Company, New York, 1980
6. Meteorological Aspects of the Utilization of Wind as an Energy Source, Technical Note No 175, World Meteorological Organization
7. EH Lysen, Introduction to Wind Energy, CWD Report 82-1, Consultancy Services Wind Energy Developing Countries, May 1983
8. E Hau, Wind Turbines- Fundamentals: Technologies, Application, Economics, Springer -Verlag Berlin -Heidelbeg, 2000
9. T Burton, Handbook of Wind Energy, John Wiley and Sons

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE II
SPECIAL MACHINES

Course Code: GR14D5045 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Special Types of D.c Machines-I: Series booster-Shunt booster-Non-reversible boost-Reversible booster

Special Types Of Dc Machines-II: Armature excited machines—Rosenberg generator- The Amplidyne and Metadyne— Rototrol and Regulex-third brush generator-three-wire generator-dynamometer.

Unit-II

Stepper Motors: Introduction-synchronous inductor (or hybrid stepper motor)-Hybrid stepping motor-Construction-principles of operation- Energization with two phase at a time- essential conditions for the satisfactory operation of a 2-phase hybrid step motor - very slow - speed synchronous motor for servo control-different configurations for switching the phase windings-control circuits for stepping motors-an open-loop controller for a 2-phase stepping motor.

Unit-III

Variable Reluctance Stepping Motors: Variable reluctance (VR) Stepping motors, single-stack VR step motors, Multiple stack VR motors-Open-loop control of 3-phase VR step motor-closed-Loop control of step motor-discriminator (or rotor position sensor) transilator- major loop-characteristics of step motor in open-loop drive – comparison between open-loop position control with step motor and a position control servo using a conventional (dc or ac) servo motor- Suitability and areas of application of stepping motors-5- phase hybrid stepping motor - single phase - stepping motor, the construction, operating principle torque developed in the motor.

Unit-IV

Switched Reluctance Motor: Introduction – improvements in the design of conventional reluctance motors- Some distinctive differences between SR and conventional reluctance motors-principle of operation of SRM- Some design aspects of stator and rotor pole arcs, design of stator and rotor and pole arcs in SR motor-determination of $L(\theta)$-θ profile - power converter for SR motor-A numerical example –Rotor sensing mechanism and logic control, drive and power circuits, position sensing of rotor with Hall problems-derivation of torque expression, general linear case.

Permanent Magnet Materials And Motors: Introduction- Hysteresis loops and recoil line- stator frames (pole and yoke - part) of conventional PM dc Motors-Equivalent circuit of a PM-Development of Electronically commutated dc motor from conventional dc motor.

Unit-V

Brushless DC Motor: Types of construction – principle of operation of BLDM-sensing and switching logic scheme, sensing logic controller, lockout pulses –drive and power circuits, Base drive circuits, power converter circuit-Theoretical analysis and performance prediction, modeling and magnet circuit d-q analysis of BLDM -transient analysis formulation in terms of flux linkages as state variables-Approximate solution for current and torque under steady state –Theory of BLDM as variable speed synchronous motor (assuming sinusoidal flux distribution)-Methods or reducing Torque Pulsations, 180 degrees pole arc and 120 degree current sheet.

Linear Induction Motor: Development of a double sided LIM from rotary type IM-A schematic of LIM drive for electric traction development of one sided LIM with back iron-field analysis of a DSLIM fundamental assumptions.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Text Books

1. K.venkataratnam, “Special electrical machines” - University press.
2. R.k. Rajput ,“Electrical machines”-5th edition.
3. V.V. Athani,“ Stepper motor : Fundamentals , Applications and Design”-New ageInternational pub.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ELECTRICAL SYSTEMS SIMULATION LAB

Course Code: GR14D5046 L:3 T:0 P:0 C:3
I Year I Semester

Syllabus

1. Write program and simulate dynamical system of following models:
   (a)110 Model
   (b)State variable model
2. Also identify time domain specifications of each.
3. Obtain frequency response of a given system by using various methods:
   (a)General method of finding the frequency domain specifications.
   (b)Polar plot
   (c)Bode plot
4. Also obtain the Gain margin and Phase margin.
5. Determine stability of a given dynamical system using following methods.
   (a)Root locus
   (b)Bode plot
   (c)Nyquist plot
   (d)Liapunov stability criteria
6. Transform a given dynamical system from I/O model to state variable model and vice versa.
7. Obtain model matrix of a given system, obtain its diagonalizable form if exists or obtain Jordon Canonical form of system.
8. Write a program and implement linear quadratic regulator
9. Design a compensator for a given systems for required specifications.
10. Conduct a power flow study on a given power system.
11. Design a PID controller.
12. Conduct a power flow study on a given power system network using Guass-Seidel iterative method.
13. Develop a program to solve Swing Equation.
14. Develop a Simulink model for a single area load frequency problem and simulate the same.
15. Develop a Simulink model for a two-area load frequency problem and simulate the same.
16. 14 Design a controller for two-area power system and simulate the same.
17. PSPICE Simulation of Single phase full converter using R, Land E loads.
18. PSPICE Simulation of Three phase full converter using R, L and E loads.
19. PSPICE Simulation of Single phase AC Voltage controller using R L load.
20. PSPICE Simulation of Three phase inverter with PWM controller.
21. PSPICE Simulation of resonant pulse commutation circuit.
22. PSPICE Simulation of impulse commutation circuit.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

POWER ELECTRONIC CONTROL OF A.C. DRIVES

Course Code: GR14D5047 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Introduction to AC Drives: Introduction to motor drives-Torque production Equivalent circuit analysis-Speed-Torque Characteristics with variable voltage operation Variable frequency constant v/t operation — Variable stator current operation-Induction motor characteristics in constant torque and field weakening regions.

Unit-II

Control Of Induction Motor Drives At Stator Side: Scalar control — Voltage fed inverter control — Open loop volts/HZ control-speed control with slip regulation-speed control with torque and flux control-current controlled voltage fed inverter drive-current — fed inverter control-Independent current and frequency control-Speed and flux control in Current-Fed inverter drive Volts/Hz control of Current —fed inverter drive-Efficiency optimization control by flux program.

Unit-III

Control of Induction Motor Drive at Rotor Side: Slip power recovery drives-Static Kramer Drive-Phasor diagram-Torque expression- speed control of a Kramer Drive — Static Schreiber's Drive — modes of operation.

Vector Control of Induction Motor Drives: Principles of Vector control — Vector control methods — Direct methods of vector control —Indirect methods of vector control-Adaptive control principles — Self tuning regulator Model referencing control.

Unit-IV

Control of Synchronous Motor Drives: Synchronous motor and its characteristics-Control strategies-Constant torque angle control-Unity power factor control-Constant mutual flux linkage control.

Controllers: Flux weakening operation-Maximum speed-Direct flux weakening algorithm-Constant Torque mode controller-Flux Weakening controller-indirect flux weakening-Maximum permissible torque-speed control scheme-Implementation strategy speed controller design.

Unit-V

Variable Reluctance Motor Drive: Variable Reluctance motor drive-Torque production in the variable reluctance motor Drive characteristics and control principles-Current control variable reluctance motor service drive.

BRUSLILESS DC MOTOR DRIVES: Three phase full wave Brushless dc motor — Sinusoidal type of Brushless dc motor- current controlled Brushless dc motor Servo drive.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Reference Books

1. Electric Motor Drives Pearson Modeling. Analysis and control - R. Krishnan -Publications- I st edition-2002.
2. Modern Power Electronics and AC Drives B K Bose - Pearson Publications 1edition
3. Power Electronics and Control of AC Motors - MD Murthy and FG Turn Bull pergman Press (For ChapterS II, III. V) I edition
4. Power Electronics and AC Drives - BK Bose -Prentice Hall Eagle wood diffs New Jersey (for chapters II,III,V) – I st edition
5. Power Electronic circuits Devices and Applications - M H Rashid - P1-TI - 1995.
6. Fundamentals of Electrical Drives -0. K. Dubey- Narora publications- 1995 (for chapter II)
7. Power Electronics and Variable frequency drives - BK Bose - EE Press-Standard publications - 1 edition -2002.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MICROCONTROLLERS

Course Code: GR14D5048 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I
Introduction and 8051 Architecture: Introduction to micro controllers, comparing micro processors and micro controllers, 4,8,16 and 32 bit micro controllers, Development systems for Micro controllers, Architecture; Architecture of 8051, pin configuration of 8051 micro controller, hardware input pins, output pins ports and external memory, counters and timers, serial data input and output and interrupts.

Unit-II
Moving Data and Logical Operations: Introduction, Addressing modes, External Data moves, Code Memory Read-only Data Moves, PUSH and POP Op codes, Data Exchanges, Logical Operations; Byte-Level Logical Operations, Bit-Level Logical Operations, Rotate and Swap Operations.

Unit-III
Arithmetic Operations, Jump and Call Op codes: Introduction, Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic, Jump and Call op codes; The jump and call program range, Jumps, Calls and Subroutines, call and returns, Interrupts and Returns.

Unit-IV
8051 Microcontroller Design: Introduction, micro controller specification, micro controller Design, Testing the Design, Timing sub routines, Lookup Tables for the 8051, Serial Data Transmission.

Unit-V
Applications and Serial Data Communication: Introduction, Key boards, Displays, Pulse Measurement, D/A and A/D Conversions, Multiple Interrupts, Serial data Communication; Network Configurations, 8051 Data Communication Modes.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Text Books

1. "The Intel Microprocessors" Architecture Programming &Interfacing by Barry b Brey.
2. Advanceed Microprocessors by kenrith J Ayala, Thomsonb publishers.
3. Microcontrollers by kentrith J ayala, Thomson publishers.

Reference Books

1. Microprocessors & Interfacing Programming & Hard ware by DOUGLASV.Hall
2. Microprocessors & Microcontrollers by Prof. C.R.Sarma

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

FLEXIBLE AC. TRANSMISSION SYSTEMS

Course Code: GR14D5049 L:3 T:0 P:0 C:3
I Year II Semester

Unit -I
Facts Concepts: Transmission interconnections Power flow in an AC system, loading capability limits, Dynamic stability considerations, importance of controllable parameters basic types of FACTS controllers, benefits from FACTS controllers.

Unit-II
Voltage Source Converters: Single phase three phase full wave bridge converters transformer connections for 12 pulse 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source Converters, comparison of current source converters with voltage Source converters.

Unit-III
Static Shunt Compensation: Objectives of shunt compensation, midpoint voltage regulation voltage instability prevention, improvement of transient stability, Power oscillation damping, Methods of controllable var generation, variable impedance type static var generators switching converter type var generators hybrid var generators.

Unit-IV
SVC and Statcom: The regulation and Slope transfer function and dynamic performance, transient Stability enhancement and power oscillation damping operating point control and summary of compensator control.

Unit-V
Static Series Compensators: Concept of series capacitive Compensation improvement of transient stability, power oscillation damping Functional requirements GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC) and thyristor controlled series capacitor (TCSC) control schemes for GSC, TSSC and TCSC.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Text Books
1. "Understanding FACTS Devices' N.G. Hingorani and L.Guygi IEEE Press Publications 2000.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

NEURAL AND FUZZY SYSTEMS

Course Code: GR14D5050 L:3 T:0 P:0 C:3
I Year II Semester

Unit -I

Introduction to Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and- Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Unit-II

Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN - Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

Feed Forward Neural Networks: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Unit-III

Multilayer Feed Forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem
Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

Unit-IV

Self-organizing Maps (SOM) And Adaptive Resonance Theory (ART): Introduction, Competitive Learning, Vector Quantization, Self-Organized Learning Networks, Kohonen Networks, Training Algorithms, Linear Vector

Quantization, Stability-Plasticity Dilemma, Feed forward competition, Feedback Competition, Instar, Outstar, ART1, ART2, Applications.
Classical and Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

Unit-V
Fuzzy Logic System Components: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.
Applications:
Neural Network Applications: Process identification, Function Approximation, control and Process Monitoring, fault diagnosis and load forecasting.
Fuzzy Logic Applications: Fuzzy logic control and Fuzzy classification.

Teaching Methodologies:
1. White board
2. PPTs
3. Seminars

Text Books
1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
2. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.

Reference Books
1. Neural and Fuzzy Systems: Foundation, Architectures and Applications, - N. Yadaiah and S. Bapi Raju, Pearson Education
2. Neural Networks – James A Freeman and Davis Skapura, Pearson, 2002.
3. Neural Networks – Simon Hykins , Pearson Education
4. Neural Engineering by C.Eliasmith and CH.Anderson, PHI
5. Neural Networks and Fuzzy Logic System by Bork Kosko, PHI Publications

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE III
POWER QUALITY

Course Code: GR14D5051 L:3 T:0 P:0 C:3
I Year II Semester

Unit -I

Introduction: Introduction of the Power Quality (PQ) problem, Terms used in PQ: Voltage. Sag, Swell, Surges, Harmonics, over voltages, spikes, Voltage fluctuations, Transients, Interruption, overview of power quality phenomenon, Remedies to improve power quality, power quality monitoring.

Unit-II

Long Interruptions: Interruptions-Definition-Difference between failure, outage, Interruptions-causes of Long Interruptions-Origin of Interruptions-Limits for the Interruption frequency-Limits for the interruption duration-costs of Interruption-Overview of Reliability evaluation to power quality, comparison of observations and reliability evaluation.

Short Interruptions: Short interruptions-definition, origin of short interruptions, basic principle, fuse saving, voltage magnitude events due to re-closing, voltage during the interruption, monitoring of short interruptions, difference between medium and low voltage systems. Multiple events, single phase tripping-voltage and current during fault period, voltage and current at post fault period, stochastic prediction of short interruptions.

Unit- III

Voltage Sag Characterization-single Phase: Voltage sag-definition, causes of voltage sag, voltage sag magnitude, monitoring, theoretical calculation of voltage sag magnitude, voltage sag calculation in non-radial systems, meshed systems, voltage sag duration.

Voltage Sag-characterization-three Phase: Three phase faults, phase angle jumps, magnitude and phase angle jumps for three phase unbalanced sags, load influence on voltage sags.

Unit-IV

PQ Considerations in Industrial Power Systems: Voltage sag-equipment behaviour of Power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC Drives, adjustable speed DC drives and its operation, mitigation methods of DC drives.

Unit -V

Mitigation Of Interruptions And Voltage Sags: Over view of mitigation methods-from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods. System equipment interface voltage source converter, series voltage controller, shunt controller, combined shunt and series controller.

Power Quality and Emc Standards: Introduction to standardization, IEC Electromagnetic compatibility standards, European voltage characteristics standards, PQ surveys.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Reference Book

1. “Understanding Power Quality Problems” by Math HJ Bollen. IEEE Press

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE III
DIGITAL CONTROL SYSTEMS

Course Code: GR14D5052 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Sampling and Reconstruction: Introduction- sample and hold operations- Sampling theorem- Reconstruction of original sampled signal to continuous - time signal.

The Z – Transforms: Introduction- Linear difference equations- pulse response- Z-transforms- Theorems of Z Transforms- the inverse Z-transforms- Modified Z-Transforms.

Z-Plane Analysis of Discrete-time Control System: Z-Transform method for solving difference equations; Pulse transforms function- block diagram analysis of sampled — data systems- mapping between s-plane and z-plane: Primary strips and Complementary Strips.

Unit- II

State Space Analysis: State Space Representation of discrete time systems- Pulse Transfer Function Matrix solving discrete time state space equations- State transition matrix and it's Properties- Methods for Computation of State Transition Matrix-Discretization of continuous time state-space equations.

Controllability and Observability: Concepts of Controllability and Observability- Tests for Controllability and Observability. Duality between Controllability and Observability- Controllability and Observability conditions for Pulse Transfer Function.

Unit-III

Stability Analysis: Stability Analysis of closed loop systems in the Z-Plane.Jury stability test- Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion. Stability analysis using Liapunov theorems.

Unit-IV

Design Of Discrete Time Control System By Conventional Methods: Design of digital control based on the frequency response method-Bilinear Transformation and Design procedure in the w-plane. Lead, Lag and Lead-Lag compensators and digital PIP controllers. Design digital control through deadbeat response method.

Unit-V

State Feedback Controllers And Observers: Design of state feedback controller through pole placement - Necessary and sufficient conditions, Ackerman's formula. State Observers-Full order and Reduced order observers.

Linear Quadratic Regulators: Mim/Max principle. Linear Quadratic Regulators-Kalman filters- State estimation through Kalman filters- introduction to adaptive controls.

Teaching Methodologies:

1. White board
2. PPTs
3. Seminars

Text Books

1. Discrete-Time Control systems - K. Ogata, Pearson Education/PHI. 2nd Edition
2. Digital Control and State Variable Methods by M.Gopal, TMH

Reference Books

1. Digital Control Systems, Kuo, Oxford University Press, 2d Edition, 2003.
2. Digital Control Engineering, M.Gopal

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE III
DYNAMICS OF ELECTRICAL MACHINES

Course Code: GR14D5053 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Basic Machine Theory: Electromechanical Analogy — Magnetic Saturation — Rotating field theory — Operation of Inductor motor — equivalent circuit — Steady state equations of d.c. machines — operations of synchronous motor — Power angle characteristics.

Unit-II

Electrodynamical Equation and Their Solutions: Spring and Plunger system - Rotational motion — mutually coupled coils — Lagrange's equation —Application of Lagrange's equation solution of Electro dynamical equations.

Unit-III

Dynamics of DC Machines: Separately excited d. c. generations-stead state analysis-transient analysis-Separately excited d.c motors stead state analysis-transient analysis-interconnection of machines-Ward Leonard system of speed control.

Unit-IV

Induction Machine Dynamics: Induction machine dynamics during starting and braking-accelerating time-induction machine dynamic during normal operation-Equation for dynamical response of the induction motor.

Unit-V

Synchronous Machine Dynamics: Electromechanical equation-motor operation-generator operation-small oscillations-general equations for small oscillations-representation of the oscillation equations in state variable form.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Reference Books

1. Sen Gupta D.P and J.W "Electrical Machine Dynamics"Macmillan Press Ltd 1980.
2. Birnbhra P.S. "Generalized Theory of Electrical Machines" Khanna Publishers 2002.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE IV
ADVANCED DIGITAL SIGNAL PROCESSING

Course Code: GR14D5054 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I
Digital Filter Structures: Block diagram representation-Equivalent Structures-FIR and IIR digital filter Structures All pass Filters- tunable IIR Digital Sine-cosine generator- computational complexity of digital filter structures.

Unit-II
Digital Filter Design: Preliminary considerations. Bilinear transformation method of IIR filter design-design of Low pass highpass- Bandpass, and Band stop- IIR digital filters-Spectral transformations of hR filters-FIR filter design-based on Windowed Fourier series-design of FIR digital filters with least-mean square-error-constrained Least-square design of FIR digital filters.

Unit-III
Dsp Algorithm Implementation: Computation of the discrete Fourier transform-Number representation-Arithmetic operations-handling of overflow-Tunable digital filters-function approximation.

Unit-IV
Analysis of Finite Word Length Effects: The Quantization process and errors-Quantization of fixed-point and floating-point Numbers-Analysis of coefficient Quantization effects-Analysis of Arithmetic Round-off errors-Dynamic range scaling-signal-to-noise in Low-order IIR filters-Low-Sensitivity Digital filter-Reduction of Product round-off errors feedback-Limit cycles in IIR digital filter-Round-off errors in FFT Algorithms.

Unit-V
Power Spectrum Estimation: Estimation of spectra from Finite Duration Observations signals-Non-parametric methods for power spectrum estimation-parametric method for power spectrum Estimation-Estimation of spectral form-Finite duration observation of signals-Non-parametric methods for power spectrum estimation-Walsh methods-Blackman and torchy method.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Reference Books

1. Digital signal processing -sanjit K. Mitra-TMH second edition
2. Discrete Time Signal Processing-Alan V. Oppenheim, Ronald W, Shafer-PHI 1996 lEdition reprint
3. Digital Signal Processing principles- algorithms and Applications- john U Proakis-P111- 3rd edition 2002.
4. Digital Signal Processing- S Salivahanan. A. Vallavaraj C. Gnanapriya - TMH - 2nd reprint 2001.
5. Theory and Applications of Digital Signal Processing -Lourens R Rebinarand Bernold.
6. Digital Filter Analysis and Design Auntoniam - TMH.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE IV
PROGRAMMABLE LOGIC CONTROLLERS AND THEIR APPLICATIONS

Course Code: GR14D5055 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I
PLC Basics: PLC system, I/O modules and interfacing CPU processor programming equipment programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

Unit-II
PLC Programming: PLC Programming input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation.
Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

Unit-III
PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers PLC Functions Timer functions and industrial applications counters counter function industrial applications. Architecture functions, Number comparison functions, number conversion functions.

Unit-IV
Data Handling Functions: SKIP, Master control Relay Jump Move FIFO, FAL, ONS, CLR and Sweep functions and their applications.
Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axis and three axis Robots with PLC, Matrix functions.

Unit-V
Analog PLC Operation: Analog modules and systems Analog signal processing multi bit data processing, analog output application examples. PID principles position indicator with PID control, PID modules, PID tuning, PID functions.

Teaching Methodologies
1. White board
2. PPTs
3. Seminars

Reference Books

1. Programmable Logic Controllers — Principle and Applications by John W Webb and Ronald A Reiss Filth edition, PHI
2. Programmable Logic Controllers — Programming Method and Applications by JR Hackworth and ED Hackworth — Jr- Pearson, 2004.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE IV
REACTIVE POWER COMPENSATION AND MANAGEMENT

Course Code: GR14D5056 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Load Compensation: Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads- examples.

Unit-II

Steady-State Reactive Power Compensation In Transmission System: Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation –examples

Transient State Reactive Power Compensation In Transmission Systems: Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation –compensation using synchronous condensers – examples.

Unit-III

Reactive Power Coordination: Objective – Mathematical modeling – Operation planning – transmission benefits – Basic concepts of quality of power supply – disturbances- steady –state variations – effects of under voltages – frequency –Harmonics, radio frequency and electromagnetic interferences.

Unit-IV

Demand Side Management: Load patterns – basic methods load shaping – power tariffs- KVAR based tariffs penalties for voltage flickers and Harmonic voltage levels

Distribution Side Reactive Power Management: System losses –loss reduction methods – examples – Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks

Unit-V

User Side Reactive Power Management: KVAR requirements for domestic appliances – Purpose of using capacitors – selection of capacitors – deciding factors – types of available capacitor, characteristics and Limitations

Reactive Power Management in Electric Traction Systems and rre Furnaces: Typical layout of traction systems – reactive power control requirements – distribution transformers- Electric arc furnaces – basic

operations- furnaces transformer –filter requirements – remedial measures –power factor of an arc furnace.

Teaching Methodologies

1. White board
2. PPTs
3. Seminars

Reference Books

1. Reactive power control in Electric power systems by T.J.E.Miller, John Wiley and sons, 1982 (Units I to IV)
2. Reactive power Management by D.M.Tagare,Tata McGraw Hill,2004.(Units V toVIII)

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POWER CONVERTERS LAB

Course Code: GR14D5057 L:0 T:0 P:3 C:2
I Year II Semester

SYLLABUS

1. Speed Measurement and closed loop control using PMDC motor
2. Thyristorised drives for PMDC Motor with speed measurement and closed loop Control.
3. IGBT used single 4 quadrant chopper drive for PMDC motor with speed Measurement and closed loop control.
4. Thyristorised drive for 1Hp DC motor with closed loop control.
5. Three Phase input, thyristorised drive, 3 Hp DC motor with closed loop
6. Three Phase input IGBT, 4 quadrant chopper drive for DC motor with closed loop Control equipment.
7. Cyclo converter based AC Induction motor control equipment.
8. Speed control of 3 phase wound rotor Induction motor.
9. Single phase fully controlled converter with inductive load
10. Single phase half wave controlled converter with inductive