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Shivaji University, Kolhapur

Syllabus Structure and Syllabus of
Electrical & Electronics Engineering
(Third Year (Semester V and VI)

(To be introduced from the academic Year 2012-13)
(i.e with effect from June 2012) onwards

(Subject to the modifications will be made from Time to Time)

Shivaji University, Kolhapur

Syllabus Structure of Third Year (Semester V)
Electrical & Electronics Engineering
Scheme of Teaching and Examination

T.E.-Part-I (SEM- V)

Sr. No.	Subject	Teaching scheme (Hrs)				Examination Scheme (Marks)				
		L	T	P	TOTAL	THEORY	TW	POE	OE	TOTAL
1	ELECTRIC MACHINE-II	4	--	2	6	100	25	50	--	175
2	POWER SYSTEMS ANALYSIS	4	--	2	6	100	25	--	25	150
3	ELECTROMAGNETIC ENGINEERING	4	1	--	5	100	25	--	--	125
4	CONTROL SYSTEM	3	--	2	5	100	25	-	--	125
5	POWER ELECTRONICS	4	-	2	6	100	25	25	--	150
6	MINI PROJECT	--	--	2	2	-	50	-	25	75
	TOTAL	19	1	10	30	500	175	75	50	800

Shivaji University, Kolhapur

Syllabus Structure of Third Year (Semester VI)
Electrical & Electronics Engineering
Scheme of Teaching and Examination

T.E.-Part-II (SEM- VI)

Sr. No.	Subject	Teaching scheme (Hrs)				Examination Scheme (Marks)				
		L	T	P	TOTAL	THEORY	TW	POE	OE	TOTAL
1	POWER SYSTEM STABILITY AND CONTROL	4	--	2	6	100	25	--	--	125
2	ELECTRICAL DRIVES AND CONTROL	4	--	2	6	100	25	50	--	175
3	MICROCONTROLLER AND ITS APPLICATIONS	4	--	2	6	100	25	50	--	175
4	COMMUNICATION ENGINEERING	3	1	--	4	100	25	--	--	125
5	DIGITAL SIGNAL PROCESSING	3	1	2	7	100	25	25	--	150
6	SEMINAR	--	--	2	2	-	50	--	--	50
	TOTAL	18	2	10	30	500	175	125	--	800

*Seminar should be based on the topic related with Final year project

** Student should undergo minimum 15 days industrial training during summer/winter vacation and submit the report attested by the competent authority from concerned industry which will be evaluated in fist semester of final Year Engineering.

SEMISTER – V
1. ELECTRIC MACHINES II

Teaching Scheme: Examination Scheme:
Lect.: 4 hr/week   Theory: 100 Mark
Practical: 2 hr/week   Term Work: 25 Mark
                                           POE: 50 Mark

Objectives:
- To study of 3 phase and 1 phase AC motors.

SECTION –I

1. SYNCHRONOUS GENERATOR: Construction, Principle of operation, EMF equation, leakage reactance, armature reaction, armature resistance and reactance, field excitation system, damper winding.   (5)

2. THREE PHASE WINDING: Single layer, double layer, Integral and fractional slot winding, distribution factor, pitch factor, Elimination of harmonics voltage.
                                                                                  (4)

3. PERFORMANCE OF SYNCHRONOUS GENERATOR: Calculation of voltage regulation by synchronous Impedance method, Zero power factor method, MMF method, experimental setup for above method, rating, efficiency and losses, method of synchronizing. , synchronizing power, hunting, damping operation single and infinite bus, power angle equaction, short circuit ratio and its significance.   (6)

4. SYNCHRONOUS MOTOR: Method of starting, phasor diagram, torque and torque angle equation , V –curves and experimental setup, hunting and damping , synchronous condenser.
                                                                                  (4)

SECTION – II

5. SINGLE PHASE INDUCTION MOTOR: Review of Types, Construction, Principle of Operation. Phasor diagram, equivalent circuit, Experimental determination of Parameters, application.   (5)

6. THREE PHASE INDUCTION MOTOR:
A] Construction, Principle of operation, phasor diagram, equivalent circuit, analysis based on approximate equivalent circuit,, Torque equation, speed equation, speed torque curve, No load test, Blocked rotor test, and circle diagram, starting and types of starter, ratio of Starting torque to full load torque.   (6)

B] Slip ring Induction Motor**:** Effect of increase in rotor resistance,

Starting, speed control of motor. Double Cage Induction Motor (D.C.I.M.): Construction, Characteristics and Equivalent circuit.   (4)

C] Speed control of Induction Motor: Change of supply frequency (constant torque i.e. constant v/f and constant v variable f i.e. constant power operation), pole Changing, cascading, Injection of EMF in secondary ,constant torque operation   (4)

D] Application and Testing: Testing as per I.S.S., Industrial applications
of induction Motor. Synchronous Induction Motor: Construction, Circle diagram, Phasor diagram   (4)

TOTAL NUMBER OF HOURS: 42

TERM WORK:
A) Minimum Eight experiments based on above syllabus.
B) Ten MATLAB exercises on software based analysis.

LIST OF EXPERIMENTS:
1. No load and Blocked rotor test on induction motor and performance of I.M. from circle diagram.
2. Speed control of Induction Motor by stator voltage control.
3. Speed control of Induction Motor by rotor resistance control.
4. Speed control of Induction Motor by pole changing method.
5. Speed control of Induction Motor by Constant V/F and constant V and Variable F.
6. Determination of voltage regulation of alternator using Synchronous Impedance method.
7. Determination of voltage regulation of alternator using MMF method.
8. Determination of voltage regulation of alternator using Zero power factor method.
9. Synchronization of alternator with bus bar.
10. Parallel operation of alternator.
11. V-Curves of Synchronous motor.
12. Speed control of three phase synchronous motor.

References:-
1. Electrical Machine -3/E –S.J.Chapman –Mc Graw Hill
2 .Performance and design of A.C.Machines – M.G.Say
3 .Performance and design of A.C Commutator motors –O.E.Taylor.
4 .Theory of A.C. Machines – Langsdorf

02. Power System Analysis

Teaching Scheme: Examination Scheme:

Lectures: 04 Hours/Week   Paper: 100 Marks

Practical: 02 Hours/Week   T.W.: 25 Marks

                                                         OE: 25 Marks

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Objectives:
- To study the power system and analysis of these equipments.
- study the load flow analysis.

SECTION - I

1. Power System Components: **(04 Hrs.)**

Single line diagram of power system, Brief Description of Power system elements such as, Synchronous Machine, Transformer, Bus bar, Circuit Breaker, isolator, CT, PT.

2 A.C. Distribution Systems: **(06 Hrs.)**

Primary and Secondary systems, Overhead and Underground systems, Connection scheme of distribution system, Radial system, Ring main system, Interconnected systems, feeders and distributors, AC distribution calculations, overview of Distribution Automation, Numericals expected.

3 Design Aspects of Overhead Transmission Lines: **(08 Hrs.)**

Main components of over head lines, conductor materials, line supports, insulators, types of insulators, potential distribution over suspension insulators, string efficiency, methods of improving string efficiency, corona, factors affecting corona, important terms, advantages and disadvantages of corona, methods of reducing corona effect, sag in over head lines and sag calculations, Numerical expected.

4. Characteristics and Performance of Transmission Line: **(09 Hrs.)**

Short, medium and long lines, Voltages and currents at sending and receiving end of line, ABCD constants, Sending end and receiving power circle diagrams, universal power circle diagram, voltage and current waves, surge impedance loading of transmission line, Complex Power flow through transmission line, Power transmission capability, Ferranti effect, tuned power lines, methods of voltage control, voltage regulators, tap changing transformers, booster transformers, synchronous phase modifiers, Numericals expected.

SECTION - II

5. Short Circuit Analysis-1   **(6hrs)**

Per-Unit System of Representation. Per-Unit equivalent reactance network of a three phase Power System, Numerical Problems. Symmetrical fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, Numerical Problems.

6. Short Circuit Analysis-2   **(9hrs)**

Symmetrical Component Theory: Symmetrical Component Transformation, Positive, Negative and Zero sequence components: Voltages, Currents and Impedances. Sequence Networks: Positive, Negative and Zero sequence Networks, Numerical Problems.

Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without fault impedance, Numerical Problems.

7. Load Flow Analysis: **(09 Hrs.)**

Network Model Formulation, Formation of Bus Admittance Matrix, Power Flow Equations, Gauss Seidal method, Newton-Raphson method, Decoupled and Fast decoupled Methods, Comparison of Load Flow Methods, Numericals expected.

8. Power Factor Improvement: -   **(02 Hrs.)**

Causes and disadvantages of Low power factor, power factor improvement using Static Capacitors, synchronous condensers, phase advancers, Numericals expected.

<u>TOTAL NUMBER OF HOURS: 48</u>

TERM WORK:

Term work should consist of following:

1. Two drawing sheets based on above theory
2. Minimum 8 exercises based on topics like ABCD constants, Load Flow Analysis using mathematical software like MiPower, PSIM, EMTP, ETAP,MATLAB.
3. Hand written Technical Report (after visiting sub-station):

Technical report should consist of following theoretical and practical aspects of Sub- stations

• Type of Sub-station and its location,
• Major components of sub-station and their functions,
• Different Bus bar arrangements (Single and Duplicate bus bar Systems)

Ratings and make of sub-station equipment should be included in study.

References:-

1. Elements of Power System Analysis, by W.D. Stevenson (Jr.) and John J Grainger, 4th Edition, McGraw Hill International.
2. Modern Power System Analysis by I. J. Nagrath, D. P. Kothari, 5th Edition, Tata McGraw Hill Publishing Co. Ltd., 2005.
3. Power System Analysis and Design by J.D.Glover and M.Sarma, 4th Edition, Brooks/ Cole Publishing.
4. Power System Analysis by Grainger John J and W D Stevenson Jr. McGraw Hill,1994
5. Power system Analysis-by John J Grainger William D Stevenson, TMC Companies, 4th edition
6. Power System Analysis by Hadi Saadat – TMH Edition 3rd edition..
7. Modern Power System Analysis by I.J.Nagaraj and D.P.Kothari, Tata McGraw Hill

SEMISTER – V
03. Electromagnetics

Teaching Scheme: Examination Scheme:
Lectures: 4 Hours /Week Paper: 100 Marks
Tutorial: 1 Hours /Week

Objectives:
- The subject Electromagnetics will make the students familiar with the relation between electric and magnetic field.
- To study the different electromagnetic laws.
- To study Transmission line Basic Theory

SECTION I
1. Vector Analysis: (05 Hrs)
Introduction, Coordinate systems and Transformations, Differential Length, Area and Volumes, Vector calculus. Numericals expected.

2. Electrostatics: (10 Hrs)
Coulomb's law, Electric field intensity due to point Charge, line charge, surface charge and volume charge distribution, Electric flux density, Gauss's law and Divergence theorem, Energy, potential energy and work done, potential gradient, dipole and its electric field, dipole movement, energy density in electrostatic field. Numericals expected.

3. Conductor, Dielectrics and Capacitance: (8 Hrs)
Current and current density, Continuity equation of current, properties of conductors, boundary conditions, Energy stored in capacitors, Poisson's and Laplace's equations, Capacitance between parallel plates and co-axial cable using Laplace's equation, Numericals expected.

SECTION II
4. Magnetostatics: (10Hrs)
Biot Savert's law and its vectorial form, Magnetic field due to infinitely long current carrying conductor, Ampere's circuital law, Application to co-axial cable. Curl operator, Magnetic flux density, Stoke's theorem. Scalar and vector magnetic potential, Lorentz's force equation. Energy stored in magnetic field, boundary conditions. Numericals expected.

5. Time varying fields: (08 Hrs)
Faraday's law, Maxwell's equations (Differential, Integral, Phasor forms), Uniform plane waves, Representation of wave motion in conductor and free space, perfect dielectrics Pointing theorem and power density, Propagation in good conductor and Skin effect, Numerical expected.

6. Transmission line and Radiation: **(07 Hrs)**

Transmission Line: Impendence matching, single and double stub transmission line, Introduction to Smith Chart. Radiation: Radiation resistance, Radiation pattern, Calculation of radiation resistance for Short dipole, Short monopole and Quarter wave monopole, antennas directivity, Reciprocity between Transmitting and receiving antennas, Hertzian dipole, Vector retarded potential.

TOTAL NUMBER OF HOURS: 48

TERM WORK:

Minimum 10 assignments based on above syllabus.

References:-

1. Engineering Electromagnetic, W. Hayt, Tatat McGraw Hill (7th Edition)
2. Electromagnetic field theory fundamental, Guru and Hizirogli,, Thomson Publication
3. Electromagnetic, J.D. Kraus, McGraw Hill, 4th Edition
4. Electromagnetic Engineering, by Mathew sadiku-4th Edition oxford university press

SEMISTER – V

04. Control Systems

Objective:

In this course it is aimed to introduce to the students the principles and applications of control systems in everyday life. The basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems and also deals with the different aspects of stability analysis of systems in frequency domain and time domain.

SECTION - I

1. INTRODUCTION   (6hrs)

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems

2. TRANSFER FUNCTION REPRESENTATION   (6hrs)

Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples - Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

3. TIME RESPONSE ANALYSIS   (6hrs)

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

SECTION – II

4. STABILITY ANALYSIS IN S-DOMAIN   (6hrs)

The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability
Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root locus.

5. FREQUENCY RESPONSE ANALYSIS   **(08 hrs)**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots, Polar Plots-Nyquist Plots-Stability Analysis.

6. CLASSICAL CONTROL DESIGN TECHNIQUES   **(4hrs)**

Compensation techniques –Lag, Lead, Lead-Lag Controllers design in frequency Domain.

                                                    TOTAL NUMBER OF HOURS: 36

TERMWORK:

A) Any Eight of the following

1. Time response of Second order system.
2. Characteristics of Synchros.
4. Effect of feedback on DC servo motor.
5. Transfer function of DC motor.
6. Effect of P, PD, PI, PID Controller on a second order systems
7. Lag and lead compensation – Magnitude and phase plot
8. Transfer function of DC generator
9. Temperature controller using PID
11. Characteristics of AC servo motor

B) Detail Study of LTI Viewer

References:-
1. Control System Engineering, Norman S. Nise, 5th Edition, John Wiley and Sons.
2.Control Systems Engineering, I.J. Nagrath and M. Gopal, 5th Edition, Anshan Publishers.
3.Feedback Control Dynamic system, Franklin Powel 5th Edition Pearson Education.
4. Modern Control system, Dorf and Bishop, 8th Edition Adison Wesley Longman.
5. Modern Control Engineering, Eastern Economy, K. Ogata, 4th Edition.
6. Control System Principles and Design, M. Gopal, Tata Mc Graw Hill 3rd Edition.

05. Power Electronics

Teaching Scheme :   Examination Scheme:

Lectures: 4 Hours /week   Paper: 100 Marks

Practical: 2 Hours/week   T.W.: 25 Marks

                                                 POE: 25 Marks

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Objectives:

With the advent of semiconductor devices, revolution is taking place in the power transmission distribution and utilization. This course introduces the basic concepts of power semiconductor devices, converters and choppers and their analysis.

SECTION – I

1. POWER SEMI CONDUCTOR DEVICES   (5 hrs)

Thyristors – Silicon Controlled Rectifiers (SCR's) – BJT – Power MOSFET – Power IGBT and their characteristics and other thyristors – Basic theory of operation of SCR – Static characteristics – Turn on and turn off methods- Dynamic characteristics of SCR - Turn on and Turn off times -Salient points

2. DEVICES AND COMMUTATION CIRCUITS   (5hrs)

Two transistor analogy – SCR - UJT firing circuit —– Series and parallel connections of SCR's – Snubber circuit details – Specifications and Ratings of SCR's, BJT, IGBT - Numerical problems – Line Commutation and Forced Commutation circuits.

3. SINGLE PHASE CONTROLLED CONVERTERS   (9 hrs)

Phase control technique – Single phase Line commutated converters – Midpoint and Bridge connections – Half controlled converters with Resistive, RL loads and RLE load– Derivation of average load voltage and current -Active and Reactive power inputs to the converters without and with Freewheeling Diode –Numerical problems

Fully controlled converters, Midpoint and Bridge connections with Resistive, RL loads and RLE load– Derivation of average load voltage and current – Line commutated inverters -Active and Reactive power inputs to the converters without and with Freewheeling Diode, Effect of source inductance – Derivation of load voltage and current – Numerical problems.

SECTION - II

4. THREE PHASE LINE COMMUTATED CONVERTERS   (5 hrs)

Three phase converters – Three pulse and six pulse converters – Midpoint and bridge connections average load voltage With R and RL loads – Effect of Source inductance–Dual converters (both single phase and three phase) - Waveforms –Numerical Problems.

5. AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS   **(7hrs)**

AC voltage controllers – Single phase two SCR's in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – Derivation of RMS load voltage, current and power factor wave forms – Firing circuits -Numerical problems -Cyclo converters – Single phase midpoint cyclo converters with Resistive and inductive load (Principle of operation only) – Bridge configuration of single phase cyclo converter (Principle of operation only) – Waveforms

6. CHOPPERS   **(8hrs)**

Choppers – Time ratio control and Current limit control strategies – Step down choppers Derivation of load voltage and currents with R, RL and RLE loads- Step up Chopper – load voltage expression Morgan's chopper – Jones chopper

7. INVERTERS   **(9hrs)**

Inverters – Single and three phase inverters – Basic series inverter – Basic parallel Capacitor inverter bridge inverter – Waveforms – Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray – Bedford inverters - Voltage control techniques for inverters Pulse width modulation techniques – Numerical problems.

                                     TOTAL NUMBER OF HOURS: 48

Term Work:
Minimum 8 experiments to be performed from the following List.
  1. SCR/TRIAC/ DIAC/ MOSFET/IGBT Characteristics.
2. Triggering circuits and phase control circuits for SCRs/MOSFET Driver Circuits and Boot strap circuits.
3. Single phase FW bridge converter feeding DC motor.
4. Three Phase Converter (HW and FW bridge).
5. Non circulating Dual Converter.
6. Single phase AC Voltage Regulator
7. Jones/ Morgan Chopper.
8. Single phase / three phase Inverter with Resistive/Induction Motor load.
9. Simulation of Converter / Chopper using SPICE/MATLAB.
10. Simulation of PWM Inverter using SPICE/MATLAB.

REFERENCE BOOKS:
"Thyristorised Power controller", G. K. Dubey and others, Wiley Eastern Ltd.
Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998
Power Electronics – by Vedam Subramanyam, New Age International (P) Limited, Publishers
Power Electronics - by V.R.Murthy, 1stedition -2005, OXFORD University Press
Power Electronics-by P.C.Sen, Tata Mc Graw-Hill Publishing
"Modern Power Electronics & A.C. drives", by B.K. Bose Publisher: Prentice hall of India Pvt. Ltd.

SEMISTER – V
6. Mini project

Objectives:

The mini project work is intended to develop skill of electrical hardware assembly, electronics PCB design and assembly for small gadgets amongst the students. This skill may become useful during their final year project.

Term work:

1) A Group of not more than 03 students should work to design builds and tests a small electrical /electronics hardware project in the relevant field.

2) A Group is required to summit Technical project report with demonstration of necessary hardware.

01. Power System Stability and Control

Teaching Scheme: Examination Scheme:

Lectures: 4 Hours /week   Paper: 100 Marks

Practical: 2 Hours/week   T.W.: 25 Marks

Objective:

This subject deals with Economic operation of Power Systems, Hydrothermal scheduling and modeling of turbines, generators and automatic controllers. It emphasizes on single area and two area load frequency control and reactive power control and stability studies

SECTION - I

1. Power System Steady State Stability Analysis Elementary concepts of Steady State, Dynamic and Transient Stabilities.   (8hrs)

Description of: Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of Steady State Stability and Methods to improve steady state stability.

2. Power System Transient State Stability Analysis   (9hrs)

Derivation of Swing Equation. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation.- Solution of Swing Equation: Point-by-Point Method. Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers

3. Economic Operation of Power Systems   (7hrs)

Optimal operation of Generators in Thermal Power Stations, - heat rate Curve – Cost Curve – Incremental fuel and Production costs,   input-output characteristics, Optimum generation allocation with line losses neglected. Optimum generation allocation including the effect of transmission line losses – Loss Coefficients, General transmission line loss formula.

SECTION - II

4. Hydro-Thermal Scheduling   (7hrs)

Optimal scheduling of Hydrothermal System: Hydroelectric power plant models, scheduling problems-Short term hydrothermal scheduling problem.

5. Load Frequency Control Necessity of keeping frequency constant.   (10hrs)

Definitions of Control area – Single area control – Block diagram representation of an isolated power system – Steady state analysis – Dynamic response – Uncontrolled case.
Load frequency control of 2-area system – uncontrolled case and controlled case, tie-line bias control Proportional plus Integral control of single area and its block diagram representation, steady state response – Load Frequency Control and Economic dispatch control.

6. Reactive Power Control   (7hrs)
Overview of Reactive Power control – Reactive Power compensation in transmission systems – advantages and disadvantages of different types of compensating equipment for transmission systems; load compensation – Specifications of load compensator, Uncompensated and compensated transmission lines: shunt and Series Compensation.

TERMWORK:

List of Experiments:

The laboratory exercise consists of (minimum 06 exercises based on following):

1. Determination of sequence n/w of synchronous m/c.
2. Determination of sequence n/w of Induction motor.
3. Solution to load flow problem using GS, NR and FD method using software.
4. Component analysis and component synthesis using various software tools.
5. Fault analysis of various faults like LG, LLG and LL faults.
6. Stability using Equal area criteria.
7. Stability using swing curve plot.
8· Modeling and Simulation of Problems based on theoretical data. This simulation is to be carried out using software like PS CAD, ETAP, EMTP, and MATLAB.

References:-
1. Power system stability by Anderson and foud

2. Power system stability by prabha kundor.

3. Power system dynamics stability and control K.R.padiyar.

4. Elecrtical Energy system by O.I.Elgerd

5. Computer Techniques in Power System Analysis by M.A.Pai, TMH Publications.

6. Modern Power system Analysis – by I.J.Nagrath & D.P.Kothari: Tata McGraw-Hill Publishing company, 2nd edition.

SEMISTER – VI
02. ELECTRICAL DRIVES AND CONTROL

Teaching Scheme: Examination Scheme:
Lectures: 4 Hours/Week   Papers =100 marks
Practical: 2 hours/week   TW= 25 Marks
                                                      POE=50 Marks

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Objective: This course is an extension of Power Electronics applications to AC and DC drives. Control of DC motor drives with single phase and three phase converters and choppers are given in detail. The control of AC motor drives with variable frequency converters and variable voltage are presented.

SECTION- I

1. Introduction to Electrical Drives: **(4** hrs**)**
Types of the electrical drives, parts of the electrical drives, criteria for selections choice of electrical drives, selection of motor rating determinations for various types of duty ratio. Selection of converter rating.

2. Control of DC motors by Single phase Converters and three phase Converters   **(10hrs)**
Introduction to Thyristor controlled Drives, Single Phase semi and fully controlled converters connected to d.c separately excited and d.c series motors – continuous current operation – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics- Problems on Converter fed d.c motors.
Three phase semi and fully controlled converters connected to d.c separately excited and d.c series motors – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems.

3. Four Quadrant operation of DC Drives   **(5hrs)**
Introduction to Four quadrant operation – Motoring operations, Electric Braking – Plugging, Dynamic and Regenerative Braking operations. Four quadrant operation of D.C motors by dual converters – Closed loop operation of DC motor (Block Diagram Only)

4. Control of DC motors by Choppers   **(5hrs)**
 Single quadrant, Two –quadrant and four quadrant chopper fed dc separately excited and series excited motors – Continuos current operation – Output voltage and current wave forms – Speed torque expressions – speed torque characteristics – Problems on Chopper fed d.c Motors – Closed Loop operation (Block Diagram Only)

SECTION II

5. Control of Induction Motor through Stator Side (11hrs)

Variable voltage characteristics-Control of Induction Motor by Ac Voltage Controllers –
Waveforms – speed torque characteristics.
Variable frequency characteristics-Variable frequency control of induction motor by Voltage source
and current source inverter and cyclo converters- PWM control – Comparison of VSI and CSI
operations – Speed torque characteristics – numerical problems on induction motor drives – Closed
loop operation of induction motor drives (Block Diagram Only)

6: Control of Induction motor of Rotor side (5hrs)

Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive
– their performance and speed torque characteristics – advantages applications – problems

7: Control of Synchronous Motors (7hrs)

Separate control & self control of synchronous motors – Operation of self controlled synchronous
motors by VSI and CSI cyclo-converters. Load commutated CSI fed Synchronous Motor – Operation
– Waveforms – speed torque characteristics – Applications – Advantages and Numerical Problems
– Closed Loop control operation of synchronous motor drives (Block Diagram Only), variable
frequency control, Cyclo converter, PWM, VFI, CSI

TERM WORK:

Minimum 08 experiments to be performed from the list given below:

1. Study of torque-speed characteristics of separately excited DC motor for constant torque operation
2. Study of torque-speed characteristics of separately excited DC motor for constant power operation
3. Study of torque-speed characteristics of DC series motor using chopper.
4. Three phase induction motor speed control using slip power recovery scheme.
5. V/f Control of induction motor in closed loop operation with variable load condition.
6. Modeling of separately excited DC machine.
7. Study of commercially available DC drive.
8. Study of BLDC (Brushless DC) Drive
9. Simulation of chopper fed DC drive using MATLAB/SIMULINK.
10. Simulation of variable frequency induction motor drive using MATLAB/SIMULINK
11. Simulation of three phase converter fed separately excited DC motor control using
MATLAB/SIMULINK.

References:

1. Fundamentals of Electric Drives – by G K Dubey Narosa Publications
2. Power Electronic Circuits, Devices and applications by M.H.Rashid, PHI.
3. Modern Power Electronics and AC Drives by B.K.Bose, PHI.
4. Thyristor Control of Electric drives – Vedam Subramanyam Tata McGraw Hill Publilcations.
5. A First course on Electrical Drives – S K Pillai New Age International(P) Ltd. 2ndEditon
6. Power Electronics converter application By N. Mohan T.M. udeland & W.P.Robbins,jhon Wiley
& sons

SEMISTER – VI
03. Microcontroller and Its Applications

Teaching Scheme: Examination Scheme:
Lectures: 4 Hours /Week   Paper: 100 Marks
Practical: 2 Hours/Week   T.W: 25 Marks
                                                          POE: 50Marks

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Objectives:

Section I

Unit I :Introduction to MCS 51 Family of Microcontrollers   (6Hrs)
Introduction to Intel 8051 family and varients of MCS 51 by Other manufacturers like Atmel, NXP(Philips), Siemens, Cygnal, ADM etc
Architecture, Pin Out and pin functions, Memory Organisation, Program Memory, Data Memory, SFRs, PSW, Addressing Modes, Instruction Set, CPU Timing, Oscillator, Machine cycle, Interrupt structure,

Unit II: Hardware Description (peripherals)   (8Hrs)
I/O Ports structure, Timers and Counters, various operating modes with detailed block diagrams, Serial Communication Port (Detailed block diagrams not expected). Use of related SFRs, Assembly language programming for use of peripherals,

Unit III: Interfacing and Applications   (8 Hrs)
Interfacing of RAM, ROM, ADC (ADC0809), DAC, LCD, Keys. Assembly Language programming for use of interfaces

Section II

Unit IV: Philips 89V51RD2 (4 Hrs)
Study Additional features of P89V51RD2, ISP or IAP capability, 6/12 clock machine cycle, Expanded RAM, Duel DPTR, PCA, Concept (Not with detailed timing diagrams) of I2C

Unit V: Review of ANSI C   (4Hrs)
ANSI C Language fundamentals, Data Types, Main Function, Function definitions, Statements, Loops, Arrays,

Unit VI: Embedded C   (6Hrs)
Difference between C and embedded C, Advantages of use of Embedded C, Extensions to C language for use as Embedded C, additional Data types, bit, sbit etc, defining and accessing SFRs and Peripherals in embedded C, defining and using interrupt functions, using assembly language code in embedded C.
Note: Use of Keil , SPJ or Pinnacle C compiler is expected

Unit VII: Application programming in Embedded C case studies   (8Hrs)
    a.   LCD interface

b. Realy interface
    c. ADC interface
    d. Serial communication

Referances
    1. 89C51 microcontroller data sheets by Atmel
    2. Philips 89V51RD2 Data Manual
    3. Let us C
    4. Keil C51 users help manual (for Embedded C)
    5. The 8051 microcontroller and embedded systems by mazidi and mazidi
    6. 8051 microcontroller by Ayala

Term Work
Minimum 10 experiments should be conducted. 5 experiments on simulator and 5 experiments on hardware (Microcontroller development boards), and should have at least 4 programms in Embedded C.
Experiments may be based on following

    a. Data handling with various addressing modes
    b. Various Arithmetic and logical operations
    c. Boolian operations with logical input and output through port pins
    d. Handling PORT I/Os
    e. ADC, DAC, LCD, relays etc interface
    f. Serial communication with PC
    g. Period and frequency measurement using timers
    h. Square wave generation of different duty cycle
    i. Use of peripherals with interrupts

Note: Use **Keil** or SPJ or Pinnacle 8051 complier debugger. Use P89V51RD2 development boards with ISP that can be programmed through compiler debugger software.

SEMISTER – VI
4. Communication Engineering

Teaching Scheme: Examination Scheme:
Lectures: 3 Hours /Week   Paper: 100 Marks
Tutorial: 1 Hours/Week   T.W.: 25 Marks

Objectives:
- To introduce basic concepts of Communication Engineering
- To study the basics of analog and digital communication.

SECTION I

1. Introduction to Signals: **(04Hrs.)**
Overview of electrical communication, Size of a signal, classification of signals, signal operations, unit impulse function, signals and vectors, correlation, orthogonal signal sets, Fourier series.

2. Analysis and Transmission of Signals: **(05 Hrs.)**
Fourier transform, signal transmission through a linear system, ideal and practical filters, signal distortion over a communication channel, signal energy, signal power, numerical computation of Fourier transform.

3. Amplitude Modulation: **(05 Hrs.)**
Base-band and carrier communication, amplitude modulation -DSB, AM, AM, SSB, VSB, carrier acquisition, super heterodyne AM receiver, television.

4. Angle Modulation: **(04 Hrs.)**
Concept of instantaneous frequency, band-width of angle modulated waves, generation of FM waves, demodulation of FM, Interference in angle modulated systems, FM receiver.

SECTION II

5. Sampling and Pulse Code Modulation: **(04 Hrs.)**
Sampling theorem, pulse-code modulation, differential pulse code modulation, delta modulation.

6. Digital Data Transmission: **(06 Hrs.)**
Basic digital communication system, line coding, pulse shaping, scrambler, regenerative repeater, detection-error probability, M-array communication, digital carrier systems digital multiplexing.

7. Information theory and coding   **(08 Hrs.)**
Cellular telephone, spread spectrum systems, transmission media, public, switched telephone network.Measure of information, source encoding error free communication over a noisy channel, channel capacity of a discrete memory less channel, practical, communication Systems in light of Shannon's equation, linear block codes.

TOTAL NUMBER OF HOURS: 36

TERM WORK:

Term work is based on assignments and tutorials.

References:-

1. Modern Digital and Analog Communication systems B.P. Lathi, 3rd Edition, Oxford University Press 1998.
2. Communication Electronics, L.F. Frangel, Tata McGraw Hill 2002
3. Contemporary Communication systems using MATLAB, J.G. Proakis, Salahi

SEMISTER – VI
05. Digital Signal Processing

Teaching Scheme: Examination Scheme:
Lecture: 3 Periods/week   Theory Paper: 100 Marks
Tutorial: 1 Hrs. /week   T.W.: 25 Marks
Practical: 2 Hrs. /week   POE: 25 Marks

Objectives:
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SECTION – I

1. Digital Signals and Systems: **(06 Hrs.)**
DSP system concept, properties of DSP system, types of systems, Interconnection of DSP systems, Recursive and Non recursive system, Some elementary signals and their responses Case study: Realization of an Analog second-order differentiator.

2. The Discrete Fourier Transform and Fast Fourier Transform: **(08Hrs.)**
DFT, Relation between DFT and Z-transform, Properties of DFT, Linear Convolution Circular Convolution-DFT, FFT Algorithms, Use of DFT as Linear Filtering, DIT (Decimation in time), DIF (Decimation in frequency), Implementation aspects, Fast convolution signal segmentation (overlap save algorithm overlap-add algorithm), Correlation-Circular correlation, DFT property of circular correlation, Spectrum analysis, Case study: electrocardiogram data compression.

3.Realization of Digital Linear System: **(04 Hrs.)**
Filter categories, IIR direct form structures, cascade, parallel realization, FIR filter realization, Different Forms of Realization (Direct and its Transposed, Series, Parallel, lattice)

SECTION- II

4.. FIR Filter Design: **(09 Hrs.)**
Characteristics of FIR filter, Properties of FIR filter, Digital network for FIR Filter,Windowing method, Filter design using Kaiser Window, Hanning, Hamming, Barlett, Blackman, Frequency sampling method, Linear FIR filters and types. Case Study: Low Pass, High Pass, Band Pass and Band stop Filters.

5. IIR Filter Design: **(09Hrs.)**
Impulse Invariant Technique, Bilinear transformation, Frequency band transformation, Analog filter approximation, (Butterworth, Chebyshev, Elliptic), (sin x)/x Digital Correction, Filter. Quantization and Rounding Problems, quantization of the signal, effects of Finite Word length on stability and frequency response, arithmetic errors. Case study: Digital Filters for FSK Modem.

TOTAL NUMBER OF HOURS: 36

TERM WORK:

Minimum 08 experiments based on above syllabus should be performed out of which Minimum four experiments consists use of MATLAB.

References:

1. Digital Signal Processing, S.K. Mitra TMH
2. Digital Signal Processing Principles, Algorithms and Applications, G, Proakis.
3. Discrete Time Signal Processing, A. V. Oppenheim and R. W. Schafer (PHI)
4. Digital Signal Processing, A System Design Approach., D. Defatta.
5. Introduction to Digital Signal Processing, Johnny R. Johnson.

Teaching Scheme: Examination Scheme:
Practical: 2 Hours/week   T.W.: 50 Marks

Termwork:

Seminar should be preferably based on the topic related to Final year project
and submit seminar report as a part of Term work.