DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO. ACAD / NP /MCA/B.E. Elect. & Electr./98/2012

It is hereby notified for the information of all concerned that, on the recommendations of the Faculty of Engineering & Technology the **Academic Council at its meeting held on 06-07-2012 has accepted the Revised Syllabi of M.C.A. First Year & B.E. Electrical and Electronics Engineering** under the Faculty of Engineering & Technology **as appended herewith**

This is effective from the academic year 2012-2013 and onwards.

All concerned are requested to note the contents of this circular for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO. ACAD/ NP/ MCA/B.E.
ELECT. & ELECTR.ENGG./2012/
20678-99
A.C.S.S. I.No.85

Date:- 03-08-2012.

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Director,
Board of College and
University Development.

Copy forwarded with compliments to :-

1] The Principals, affiliated concerned Colleges,
Dr. Babasaheb Ambedkar Marathwada University.

Copy to :-

1] The Controller of Examinations,
2] The Superintendent, [Engineering Unit],
3] The Superintendent, [Eligibility Unit],
4] The Record Keeper,
Dr. Babasaheb Ambedkar Marathwada University.

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S/030812/-*

Dr BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

Revised Structure and Syllabus of

B.E.
ELECTRICAL & ELECTRONICS ENGINEERING

EFECTIVE FROM - 2012-13 & ONWARDS

Teaching scheme for BE Part- I

COURSE STRUCTURE FOR B. E. (Electrical and Electronics Engg)

Sr. No.	Subject	Theory Hr/wk	Pract. Hr/wk	Total Hr/wk	Theory Mark	Pract. Mark	TW Mark	Total Mark
1	VLSI Design	4	2	6	100	50	_	150
2	Electric Drives	4	2	6	100	50	_	150
3	Utilization of Electrical Energy & Special Machine	4	2	6	100	50	_	150
4	Switch Gear Protection	4	2	6	100	_	25	150
5	Elective-I	4	_	4	100	_	25	100
6	Project	_	2	2	_	_	50	50
	Total	**20**	**10**	**30**	**500**	**150**	**100**	**750**

Elective - I

1 Advanced Digital signal processing
2 Power system protection
3 Neural Network & Fuzzy Logic Control

Teaching scheme for BE Part- II

Sr. No.	Subject	Theory Hr/wk	Pract. Hr/wk	Total Hr/wk	Theory Mark	Pract. Mark	TW Mark	Total Mark
1	Embeded system	4	2	6	100	50	_	150
2	Energy Conservation & Management	4	2	6	100	_	50	150
3	Control System-II	4	2	6	100	50	_	150
4	Elective-II	4	_	4	100	_	50	150
5	Project	_	6	6	_	50	100	150
	Total	**16**	**12**	**28**	**500**	**150**	**100**	**750**

Elective - II

1 Advanced Drives
2 Digital Image Processing
3 Non Conventional Energy Sources

VLSI DESIGN

Teaching Scheme
Lecture: 4 Hrs/week
Practical: 2 Hrs./Week

Exam Scheme
Paper: 100 Marks
Practical: --
Term Work: --50 Marks

Topics and Contents **Hours**

1 .MOS Devices: **06**
Introduction to MOST,I-V characteristics of NMOS and PMOS, second order effects-CLM, Body bias, short channel effects-VT roll off, DIBL, Mobility degradation, Transfer characteristics of CMOS inverter, Detailed analysis of CMOS inverter with parasitic.

2 .CMOS Design: **08**
CMOS logic families-static, dynamic including their timing analysis and power consumption, CPL, Pass transistor logic, Transmission gate, circuits using CPL and pass transistor logic.

3 .Fabrication and Layout: **06**
Basic CMOS technology, self aligned CMOS process, Nwell, P well, Twin tub, Layout of CMOS inverter, Design rules, Verification of layout

4. Introduction to VHDL: **06**
Introduction, EDA Tool-VHDL, Design flow, Introduction to VHDL, Elements of VHDL, Modelling styles-sequential, structural, and data flow modeling ,sequential and concurrent statements

5. Circuit Design Using FPGA &CPLD: **06**
Function, Procedures, Attributes, Test benches, synthesizable and no synthesizable statements, packages and configurations. The state diagram, Modeling in VHDL with examples such as counters, registers and bidirectional bus. Introduction, study of architecture of CPLDs and FPGAs

6 .Testability: **06**
Need of design for testability, introduction to fault coverage, Testability, Design for tsatability, controllability, absorbability, stuck at fault model,stuck open and stuck short faults, Boundary scan check, JTAG technology, TAP controller, and TAP controller state diagram, scan path,Full and partial scan.

Practical Exam:

The practical exam will be of three hours duration. It will consist of one experiment conducted during the course and oral exam based on the syllabus.

Text Books:

1 N.Weste and K.Eshranghian,Principles of CMOS VLSI Design,Addison weslay.
2 J.Rabaey,Digital Integrated Circuits:A Design perspective,PHI
3 D.Perry,VHDL,2nd edition,TMH,1995.
4 Kang S.M,CMOS Digital Integrated Circuits,TMH 3rd 2003.
5 Bushnell Agrawal,Essentials of Electronic Testing for Digital memory and mixed signal VLSI circuits,Kulwar academec publisher.

Reference Books:

1 Boyee and Baker,CMOS,EEE Press.
2 Xilinx FPGA/CPLD data book.
3 VHDL Primer,Addison weslay Longman,2000,J Bhaskar.

ELECTRICAL DRIVES

Teaching Scheme
Lecture: 4 Hrs/week
Practical: 2 Hrs. / Week

Exam Scheme
Paper: 100 Marks
Practical: 50 Marks
Term Work: --

Topics and Contents **Hours**

1 Introduction: **13**
Solid state controlled electric drive-Concept, elements and salient features, power converter motor system, closed loop control of electric drives, sensing of speed and current, review of power converter circuits, performance parameters
Permanent Magnet Machines:
Unique features of PM Machines, Permanent magnet materials, Power limitations of PM machines, Permanent magnet d.c. machines, Permanent Magnet synchronous Machines, Applications of Permanent magnet machines.

2 Control of D. C. Drives: **11**
Control of d.c. separately and series excited motor drives using controlled converters (single phase and three phase) and choppers, static Ward-Leonard, control scheme, power factor improvement, solid state electric braking scheme, closed loop control schemes.

3 Control of A. C. Motor Drives: **11**
Control of three phase induction motor drive using a.c. voltage controllers, cyclo converters. Voltage source and current source inverters; concept of field oriented control, slip power controlled slip ring induction motor drives, closed loop control schemes, self controlled synchronous motor drives, brushless dc motor drive, switched reluctance motor drive.

4 Microprocessor Control of Electric Drive: **05**
Functions of microprocessor in electric drive control, salient features of microprocessor control, microprocessor based control schemes for d.c. induction and synchronous motor drives, applications.

Practical Exam:
The practical exam will be of three hours duration. It will consist of one experiment conducted during the course and oral exam based on the syllabus.

Text Books:
1. G. K. Dubey, "Power Semiconductor controlled Drives", Narosa Publications, 1999
2. J. M. D./ Mruphy & I. G. Turnbull, "Power Electronic Control of a.c. motors", Pergamon Press.

Reference Books:
1. B. K. Bose, "Power Electronics and ac Drives", Peasrson, 2002
2. S. B. Dewan & G. R. Stemon & A. Straughen, "Power semiconductor Drives", Wiley Inter Science
3. V. Subrahmanyam, "Thyristor Control of Electric Motors", Tata McGraw Hill
4. P. C. Sen, "Thyristor dc Drives", Wiley International

UTILIZATION OF ELECTRICAL ENERGY AND SPECIAL TYPES OF MACHINES

Teaching Scheme
Lecture: 4 Hrs/week
Practical: 2 Hrs. / Week

Exam Scheme
Paper: 100 Marks
Practical: 50Marks
Term Work: --

Topics and Contents **Hours**

1. Illumination Engineering: **05**
Nature of light, units, sensitivity of the eye, luminous efficiency, glares. Production of Light; Incandescent lamps, arc lamps gas discharge lamps- fluorescent lamps-polar curves, effect of voltage variation on efficiency and life of lamps, methods of calculations, factory lighting, flood lighting and street lighting.

2. Heating and welding: **08**
Electrical heating-advantages, methods and application, resistance over general construction, design of heating elements, efficiency and losses control. Induction heating: core type furnaces, core less furnaces and high frequency eddy current heating, dielectric heating: principle and special applications, arc furnaces: direct arc furnaces, Indirect arc furnaces, electrodes, power supply and control. Different methods of electrical welding and electrical equipment for them. Arc furnaces transformer and welding transformers.

4. Electric Traction: **09**
System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking-plugging rheostatic braking and regenerative braking.
Mechanics of train movement. Speed-time curves for different services-trapezoidal and speed time curves – calculations of tractive effort, power, specific energy consumption for given run, effect of varying acceleration and braking retardation, adhesive weight and braking retardation and coefficient of adhesion.

5. Special Machines 1: **10**
AC commutator motors, Schrage motors, universal motors - torque, phasor diagram and performance characteristics. Two –phase servomotor, analysis – using symmetrical components, torque – speed curve, drag cup rotor. DC servomotor. Reluctance motor. Hysteresis motor. DC tachometer. AC tachometer.

6. Special Machines 2: **08**
Synchros and control transformers. Linear induction machines, description of LIM's, propulsiom and levitation systems, mechanical handling equipment, strip tension winding.

Text Books

1.Utilization of electrical energy by J.B.Gupta. Kataria publication, Ludhiana.
2.A text book of electric power by Dr S.L.Uppal, Khanna Publications Delhi.
3.Electical Machinery by Nagrath Kothari.

TERM WORK

Term work marks will be given on the analysis of the mini project made according to the syllabus.

SWITCHGEAR AND PROTECTION

Teaching Scheme
Lecture: 4 Hrs/week
Practical: 2 Hrs. / Week

Exam Scheme
Paper: 100 Marks
Practical: 50 Marks
Term Work: --

Topics and Contents **Hours**

1. Circuit Breakers : **05**
Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages.- Restricting Phenomenon, Average and Max. RRRV, Numerical Problems. Current Chopping and Resistance Switching. CB ratings and Specifications : Types and Numerical Problems .Auto reclosures.

2. Circuit Breakers : **05**
Description and Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

3. Electromagnetic and Static Relays: **07**
Principle of Operation and Construction of Attracted armature, Balanced Beam, induction Disc and Induction Cup relays. Relays Classification: Instantaneous, DMT and IDMT types. Application of relays: Over current/ Under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays. Universal torque equation, Distance relays: Impedance, Reactance and Mho and Off-Set Mho relays, Characteristics of Distance Relays and Comparison. Static Relays: Static Relays verses Electromagnetic Relays.

4. Generator Protection: **05**
Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected.

5. Transformer Protection: **05**
Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CT s Ratio, Buchholtz relay Protection.

6 .Feeders and Bus-Bar Protection: **05**
Protection of Lines: Over Current, Carrier Current and Three-zone distance relay protection using Impedance relays. Translay Relay.Protection of Bus bars – Differential protection.

7. Neutral Grounding: **03**
Grounded and Ungrounded Neutral Systems.- Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance - Arcing Grounds and Grounding Practices.

8. Protection against over voltages: **05**

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters. Insulation and Coordination -BIL, Impulse Ratio, Standard Impulse Test Wave, Volt-Time Characteristics and Insulation Co-ordination

Practical Exam:

The practical exam will be of three hours duration. It will consist of one experiment conducted during the course and oral exam based on the syllabus.

List of Experiments:

1. Determination of drop out factor of an instantaneous over current relay.
2. Determination of operating characteristic of IDMT relay.
3. Determination of operating characteristic of differential relay.
4. Study and operation of gas actuated protective relay.
5. Study and operation of static over current relay.
6. Determination of transmission line parameters using MATLAB.
7. Analysis of power system faults (Symmetrical & Asymmetrical) using MATLAB.
8. Study of SF6 circuit breaker
9. Protection simulation study of generator, Transformer, Feeder

TEXT BOOKS :

1. Switchgear and Protection – by Sunil S Rao, Khanna Publlishers
2. Power System Protection and Switchgear by Badari Ram , D.N Viswakarma, TMH Publications

REFERENCES :

1. Fundamentals of Power System Protection by Paithankar and S.R.Bhide.,PHI, 2003.
2. Power System Protection : Static Relays – by T S Madhav Rao Tata McGraw-Hill, 2nd edition
3. Art & Science of Protective Relaying – by C R Mason, Wiley Eastern Ltd.
4. Electrical Power Systems – by Cl Wadhwa, New Age international (P) Limited, Publishers,

ADVANCED DIGITAL SIGNAL PROCESSING
(ELECTIVE-I)

Teaching Scheme
Lecture: 4 Hrs/week
Practical: 2 Hrs/week

Exam Scheme
Paper: 100 Marks
Practical: --
Term Work: 50 Marks

Topics and Contents **Hours**

1 Random Signals: **06**
Characterization of random signals: review of deterministic signals, random signals, correlation function, power spectra, DT random signals, time averages for DT random process. Filters in sampling rate alteration systems, digital filter banks and their analysis and applications, multi level filter banks, estimations of spectra from finite – duration observation of signals. sample rate conversion using poly-phase filter structures, Efficient D/A conversion in Hi-Fi systems.

2 Adaptive filters: **08**
Need of adaptive filters, adaptive filters as noise cancellation, configuration of adaptive filters, main components of adaptive filters, Adaptive Algorithms: LMS adaptive algorithms, recursive least square algorithms, Adaptive filtering of ocular artifacts from the human EEG, adaptive telephone echo cancellation.

3 Linear prediction and optimum linear filters: **06**
Lattice structures, innovation representation of random process, rational power spectra, AR, MA & ARMA, forward & backward linear prediction, Wiener filter for filtering and prediction, Solution of the normal equation- Levinson - Durbin algorithm.

4 Power Spectrum Estimation: **08**
Estimation of Spectra From Finite duration observation of signals, Estimation of autocorrelation and power spectrum of random signal, Non parametric methods for power spectrum estimation- Bartlett window and Welch method.

5 Architectures for DSP: **06**
Basic Generic Architectures for DSPs, Harward Architecture, Introduction to SHARC, Pipelining, MAC, special Instructions, on chip memory, Fixed and Floating point DSPs, Selection of DSPs, case study of TMS320c54XX, Implementation of Basic DS algorithms, like FIR, IIR Filters.

6 Applications of DSP using MATLAB: **06**
Mobile communication, medical, image processing, Acoustic Noise Canceler, Dynamic range compression, LPC analysis and synthesis, SSB modulation, Radar tracking implementation

Text Books:-
1. E. C. Ifleachor and B. W. Jervis, "Digital Signal Processing- A Practical Approach", 2nd Edition, Pearson education.
2. John G. Proakis,Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", Pearson education.
3. Avtar Singh, S. Srinivasan, "Digital Signal Processing Implementation using DSP, Microprocessors with examples from TMS 320C54XX", Thomas Publication.
B.E._ETC09.doc - 13 - 13
4. Rabinar, Gold, "Speech Signal Processing".

Reference Books:
1. P. P. Vaidyanathan, "Multirate Systems and filter banks", PHI.
2. B. Venkatramani, M. Bhaskar, "Digital Signal Processors, Architecture, Programming & Applications", TMH.
3. "A Handbook of Digital Image Processing", IEEE Press.
4. Simon Haykins, "Adaptive Filter Theory", 4th Edition, Pearson Education, 2002,
5. "Texas Manual for DSP Processors & Starter kit".

TERMWORK: Term work will consist of record of minimum 8 experiments based on the syllabus.

POWER SYSTEM PROTECTION
(ELECTIVE-I)

Teaching Scheme
Lecture: 4 Hrs/week
Practical:2Hrs/week

Exam Scheme
Paper: 100 Marks
Practical: --
Term Work: 50Marks

Topics and Contents **Hours**

1. Introduction: **04**
Protective schemes, desirable qualities of protective relaying, definitions and terms used in relaying, C.T., P.T., summation transformers.

2. Relays: **10**
Classification of relays, construction, working principle, characteristics and application of electromagnetic relay setting, differential relay – induction type earth fault relay, directional relay, distance relay, differential relay, Tran slay relay, negative sequence relay & electro- thermal relay, introduction to static relay & computer based relaying.

3. Protective Schemes: **14**
1. Alternator: Stator faults, unbalanced loading, overloading, prime mover failure, over voltage, restricted earth fault protection, rotor fault protection, merz-price earth fault protection.
Transformers: Harmonic restraint, over current & unrestricted earth fault, restricted earth fault, frame leakage protection, Buchholz relay, Merz- Price Protection.
Induction Motor: Protective circuits for single phasing preventer, ground fault, phase fault & phase reversal protection. Protecion schemes for feeder, Bus bar & transmission lines using Differrntial, Distance (impedence) & Carrier current protection.
2. Protection Against Lighting: Protection of power station & subtraction against direct strokes, protection of transmission lines against direct strokes, protection against traveling waves, rod gap lighting arresters, L.A. ratings, locations & effect of cables, surge absorber, Peterson coil

4. Circuit Breaker: **12**
1. Arc phenomenon arc interruption, different arc interruption theories, current zero interruption, recovery volatage, restriking voltage RRRV. Resistive switching, current chopping, interruption of capacitive current.
2. Classification of circuit Breakers: Construction & working principle of air break, air blast, minimum oil, sf6, vacuum circuit breakers, MCB,ELCB,
Rating & selection of C.B., standard ratings & applications of circuit breakers

Text Books:

1. Switching & protection by Sunil S. Rao.
2. Power system engineering by A.C. Chakraborti, Soni Gupta Bhatangar.
3. Power system protection & switching by Badri Ram, D.N. Vishwakarma.
4. Fundamentals of power system protection by V.G. Paithankar & S.R. Bhide.

Reference Books:

1. Switchgear & protection by Ravindranath & M. Chander.
2. The art & science of protective relaying by C.R. Mason.

TERMWORK: Term work will consist of record of minimum 8 experiments based on the syllabus.

ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGIC
(ELECTIVE-1)

Teaching Scheme
Lecture: 4 Hrs/week
Practical: 2Hrs/week

Exam Scheme
Paper: 100 Marks
Practical: --
Term Work: --50 Marks

Topics and Contents **Hours**

1. Introduction: **06**
Biological Neural Networks, Characteristics of Neural Networks, Models of Neuron, Basic Learning Rules, Stability & Convergence

2. Supervised Learning Neural Networks: **06**
Adaptive networks, Adaline and madaline, Single layer and multi layer Perceptrons Radial basis function networks, Modular neural networks

3. Feedback Neural Networks: **06**
Analysis of linear auto adaptive feed forward networks, Analysis of pattern storage Networks, Stochastic Networks & Stimulated Annealing, Boltzman machine

4. Unsupervised Learning Networks: **06**
Competitive learning, Kohonen self-organizing maps, Learning vector Quantization Principal component analysis of Hebbian Learning, Adaptive Resonance Theory

5. Architectures for Pattern Recognition: **06**
Associative memory, Pattern mapping, Stability – Plasticity dilemma, ART, temporal patterns, Pattern visibility: Neocognitron

6. Applications of Neural Networks: **05**
Pattern classification, Associative memories, Optimization, Applications in Image Processing, Applications in decision making

7. Fuzzy Set Theory: **05**
Introduction to Fuzzy Set with Properties, Fuzzy Relations, Fuzzy Arithmetic, Fuzzy Logic, Applications and Fuzzy Control

Text Books

1. B. Yegnanarayana, "Artificial Neural Networks", PHI
2. James A Freeman, David M Skapura, "Neural Networks-Algorithms, Applications and Programming Techniques,"

Ref. Books

1. Haykin, "Neural Network a comprehensive Foundation", PHI
2. Mohan, Ranka, "Elements of Artificial Neural Networks", Penram International
3. Anderson, "An introduction to Artificial Neural Networks", Prentice Hall
4. William J Palm III, "Introduction to MATLAB 7 for Engineers," TMH
5. G. J. KLIR, B. Yuan, "Fuzzy Set Theory", 1997 PHI.
6. W. Petryez "Fuzzy Sets Engineering" , CRL Press 1995.

TERMWORK: Term work will consist of record of minimum 8 experiments based on the syllabus.

PROJECT PART-I

Practical: 4 Hrs. /Week **Practical Exam: 50 Marks**

The project work will be carried out by a batch of at the most 3 students (preferably 2 students) working on a topic related to the electronics and allied fields. The topic may be from one of the following.

1. Laboratory work involving constructional theoretical and design aspects of the project/ system.
2. Modification aspect of existing electronics systems.
3. It can be practical need of the industry, which should involve system design aspect.
4. Survey of latest development in Electronics and allied fields. It shall consist of the term work in the form of hand written typed report not less than 25 pages. This should include the literature survey technical details related data that is collected & design that are required for project work part-I. The candidate shall give a seminar on the subject chosen above in the presence of Guide and External examiner preferably from industry or the university.

EMBEDDED SYSTEMS

Teaching Scheme
Lecture: 4 Hrs/week
Practical: 2 Hrs. / Week

Exam Scheme
Paper: 100 Marks
Practical: 50 Marks
Term Work: --

Topics and Contents **Hours**

1. Embedded system Introduction: **08**
Introduction to Embedded System, History, Design challenges, optimizing design metrics, time to market, applications of embedded systems and recent trends in embedded systems, embedded design concepts and definitions, memory management, hardware and software design and testing, communication protocols like SPI, I2C, CAN etc

2. System Architecture: **12**
Introduction to ARM core architecture, ARM extension family, instruction set, thumb Instruction set, Pipeline, memory management, Bus architecture, study of on-chip peripherals like I / O ports, timers, interrupts, on-chip ADC, DAC, RTC modules, WDT, PLL, PWM, USB, I2C, SPI, CAN etc. Use 2148 /2368/2378 as reference micro-controllers

3. Interfacing and Programming: **10**
Basic embedded C programs for on-chip peripherals studied in system architecture. Need of interfacing, interfacing techniques, interfacing of different displays including Graphic LCD, interfacing of input devices including touch screen etc, embedded communication using SPI,I2C, GSM modem for AT command study etc.

4. Real Time Operating System Concept: **10**
Architecture of kernel, task scheduler, ISR, Semaphores, mailbox, message queues, events, memory management, RTOS services in contrast with traditional OS. Introduction to Ucos II RTOS, study of kernel structure of Ucos II, synchronization in Ucos II, Inter-task communication in Ucos II, memory management in Ucos II, porting of RTOS.

Text/Reference Books:

1. Rajkamal - Embedded Systems, TMH.
2. David Simon - Embedded systems software primer, Pearson
3. Steve Furber - ARM System-on-Chip Architecture, Pearson
4. Jean J Labrose - MicroC / OS-II, Indian Low Price Edition
5. DR.K.V.K.K. Prasad - Embedded / real time system, Dreamtech
6. Iyer, Gupta - Embedded real systems Programming , TMH
7. Steve Heath - Embedded System Design , Neuwans
8. ARM System Developers Guide – Andrew Sloss

Practical Exam: The practical exam will be of three hours duration. It will consist of one experiment conducted during the course and oral exam based on the syllabus.

ENERGY CONSERVATION AND MANAGEMENT

Teaching Scheme
Lecture: 4 Hrs/week
Practical: 2 Hrs. / Week

Exam Scheme
Paper: 100 Marks
Practical: --
Term Work: 50 Marks

Topics and Contents **Hours**

1. Energy scenario: **06**
Introduction, energy problems, energy use trends in developing countries, prospects of changes in energy supply, strategies for sustainable development, finite fossil reserve, Energy and environment, Need for renewable and energy efficiency, Energy conservation principles, Energy conservation in industries, generation, transmission and distribution, household, commercial sectors, transport, agriculture.

2. Energy Audit: **06**
Energy flow diagram, strategy of energy audit, comparison with standards, considerations in implementing energy with conservations programmes, instruments for energy audit, energy audit of illumination system, energy audit of electrical system, energy audit of heating ventilation and air conditioning systems, energy audit of compressed air system, energy audit of building, energy audit of steam generation, distribution and utilization system, economic analysis. Bench marking, energy conservation Act 2001.

3. Demand side management: **06**
Scope of demand side management, evolution of DSM concept, DSM concept, DSM planning and implementation, load management as a DSM strategy, Application of load control, end use energy conservation, tariff options for DSM, customer acceptance, implantation issues, implementation strategies, DSM and environment, case studies of DSM, maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses.

4. Energy efficiency in electrical utility: **06**
Losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors. Compressed Air systems: Types of air compressors, compressor efficiency, Efficient compressor operation, compressed air systems component, capacity assessment, leakage test, factors effecting the performance and saving opportunities. HVAC and refrigeration systems, Vapor compression refrigeration cycle refrigerants, coefficient of performance, capacity factors affecting refrigeration and air conditioning systems performance and saving opportunities. Vapor absorption refrigeration systems, principle types, saving potential, fan and Blower, types, performance evaluation.

5. Captive power generations: **06**

Types of captive power plants, financing of captive power plants, captive power plants in India, energy banking, energy wheeling cogeneration : cogeneration technologies, industries suitable for cogeneration, allocation of costs. Sale of electricity to utility, impact of pricing of cogeneration, electric power plant reject heat, agricultural uses of waste heat, use of power plant reject heat for west water treatment, integrated energy system, Potential of cogeneration in India.

Books

1. B.R.Gupta, "Generation of Electrical Energy" S.Chand Publication.
2. S.Rao & Dr.B.B.Parulekar, " Energy Technology: Non-conventional,Renewable and Conventional" Khanna Publishers
3. Frank Kreith and George Burmeister, "Energy Management & Conservation" Amazon Publishers
4. Beggs and Clive, "Energy Management Supply and Conservation"Wal Mart Publishers
5. K.Bhattacharya, MHJ Bollen, J.E.Dalder, "Operation of Restructured Power System" Kluwer Academic Publications
6. Electricity Act 2003
7. Energy Conservation Act 2001

TERMWORK: Term work will consist of record of minimum 8 experiments out of the following list.

CONTROL SYSTEMS II

Teaching Scheme
Lecture: 4 Hrs/week
Practical: 2 Hrs. / Week

Exam Scheme
Paper: 100 Marks
Practical: 50 Marks
Term Work: --

Topics and Contents **Hours**

1. Control system design: **10**
Frequency response: Lag compensation, lead compensation, Lag-Lead Compensation State Variable Analysis and Design: State space representation of continuous and discrete systems solving the time –invariant state equation, state transition matrix., eigen values and eigen vectors, controllability and observability criteria for time invariant systems, pole placement using state variable feedback , design of state observers.

2. Digital Control Systems: **08**
Introduction to discrete time systems, the Z transform and the inverse Ztransform, pulse transfer function, time response of sampled data systems, stability using Jury criterion, bilinear transformation, frequency response, root locus

3. Non Linear Control Systems: **08**
Characteristics of non linear systems, linearizing techniques, design of non linear control system using describing function concepts and phase plane techniques, Liapunov's stability criterion

4. Introduction to optimal control: **04**
Process Control, Feed forward, ratio, cascade. DDC, Supervisory

5. Industrial Controllers: **10**
PID controllers, tuning methods, pneumatic and hydraulic controllers. ISE, IATE Programmable Logic Controllers: Introduction to PLC, Constructional features, Working principle and applications Intelligent Controllers: Fuzzy logic controller, Introduction to Neural Networks

Books

1. I.J. Nagrath M Gopal, Control Systems Engineering, New Age Publishers Fourth Edition.
2. Benjamin Kuo , Digital Control system, Oxford
3. K. Ogata, Modern Control System , Prentice Hall
4. Lee Stoline , Applied Non –Linear System, Prentice Hall
5. M. Gopal, Digital Control Systems, New Age Publishers Fourth Edition
6.J.Stephanpoulis, Chemical Process Control: An Introduction to theory and Practice, PrenticeHall
7. Norman Nice, Control System Engineering, New Age Publishers

Practical Exam:

The practical exam will be of three hours duration. It will consist of one experiment conducted during the course and oral exam based on the syllabus.

List of experiment:

1. Lag Lead Compensation
2. Relay control system
3. Computer aided programme to find out Controllability, Linearization, PID controller
4. Matlab program on Fuzzy Logic Controller
5. Modeling of systems (any hydraulic, pneumatic etc)
6. Study of a process control system
7. Study of PID controller
8. DC position control system
9. Study of supervisory controller
10. Study of DDC
11. Study of SCADA.

ADVANCED DRIVES
(ELECTIVE-II)

Teaching Scheme
Lecture: 4 Hrs/week
Practical: 2 Hrs/week

Exam Scheme
Paper: 100 Marks
Practical: --
Term Work: 50 Marks

Topics and Contents **Hours**

1. Review of electric motors & Solid state converters: **06**
Speed control techniques of DC, Induction & synchronous motor, Converters, inverters, chopper and cycloconverter operation, Effects of power electronic equipments on load side & supply side.

2 .Review of closed loop controllers, sensors & transducers: **04**
PI, PID, Variable structure. AC, DC & Pulse tacho-generators.

3. DC Drives: **06**
Converter & chopper fed DC drive, Reversing, Starting, Regenerative breaking , Four quadrant operation, High power application.

4. AC Drive: **06**
Inverter & cycloconverter fed drive, Vector control, Sensor less operation, Linear electrical motor concept, Synchronous motor drive

5. Special Drives: **06**
Switched reluctance & permanent magnet brushless DC Operation, Converters, Characteristics & Control, PLC based drives.

6. Servo drives & stepper motor: **06**
AC & DC Servomotor, Stepper motor, Control techniques, Controllers, Micro stepping, Sensor less operation.

7. Power Quality & energy Conservation: **06**
Line Side pollution, standards, Harmonic elimination techniques in converter, Filters, Energy efficient electric motors, Pay back periods, Energy conservation through sold state control.

References:

1.Ned Mohan, T.M. Undeland, W.P. Robbins, Power Electronics-Converters, Applications and design", John Wiley & Sons.
2.J.M.D. Murphy, F.O. Turnbull, "Power Electronic Control of AC motors", Pergamon Press.

TERMWORK: Term work will consist of record of minimum 8 experiments based on the syllabus.

DIGITAL IMAGE PROCESSING
(ELECTIVE-II)

Teaching Scheme
Lecture: 4 Hrs/week
Practical: 2 Hrs. / Week

Exam Scheme
Paper: 100 Marks
Practical: --
Term Work: 50 Marks

Topics and Contents **Hours**

1. Digital Image Fundamentals: **04**
Elements of visual perception, Image sampling & Quantization, Some basic relationships between pixels, color fundamentals, color models, pseudo color image processing

2. Image Enhancement: **06**
Basic grey level transformations, histogram processing, enhancement using arithmetic and logic operations, spatial filtering – smoothing and sharpening filters. Smoothing and sharpening frequency domain filters

3. Morphological Image Processing: **06**
Neighborhood concepts, adjacency and distance measures, dilation & erosion, opening & closing operations, basic morphological operations such as region filling, thinning, thickening, skeletons, pruning for binary and gray scale images.

4. Image Segmentation: **08**
Detection of discontinuities, edge linking and boundary detection, thresholding, region based segmentation, use of watersheds, image representation- chain codes, boundary descriptors & regional descriptors

5. Image Transforms & compression: **10**
Coding, inter pixel and psycho visual image redundancy, fidelity criteria, Error free compression 2-D Discrete Fourier Transform, Discrete Cosine Transform – its application in Baseline JPEG , Walsh Hadamard Transform, Fast Walsh Transform, sub band coding Haar Transform – it's application as a Wavelet, multi resolution expansions, 1-D Wavelet Transform, Fast Wavelet Transform; Introduction to Gabor Transform, Introduction to Radon Transform

6. Image Processing Applications: **06**
Applications of transforms in fingerprinting, Medical applications such as tumor detection, Magnetic Resonance Imaging analysis using transforms, Morphological applications.

Text Books:

1. Gonzalez, Woods, 'Digital Image Processing' – PHI , 2nd edition
2. Milan Sonka 'Image Processing , Analysis & Machine Vision' Thomson Publication.

Reference Books:-

1. Pratt W.K. , ' Digital Image Processing', John Wiley, 2001
2. Jain A.K., ' Fundamentals of Digital Image Processing', PHI, 1997

TERMWORK: Term work will consist of record of minimum 8 experiments out of the following list.

List of Practicals:

1. Image negation, power Law correction
2. Histogram mapping & equalization, stretching
3. Image smoothing, sharpening
4. Edge detection – use of Sobel, Prewitt and Roberts operators
5. Morphological operations on binary images
6. Morphological operations on Gray scale images
7. Pseudo coloring
8. Chain coding
9. Image statistics
10. DCT/IDCT computation
11. Transform application assignment.

RENEWABLE ELECTRICAL POWER SYSTEMS
(ELECTIVE-II)

Teaching Scheme
Lecture: 4 Hrs/week
Practical: 2 Hrs. / Week

Exam Scheme
Paper: 100 Marks
Practical: --
Term Work: --50 Marks

Topics and Contents **Hours**

1. Distributed Generation: **06**
Distributed Generation with Fossil Fuels, Concentrating Solar Power (CSP) Technologies, Biomass for Electricity, Micro-Hydropower Systems, Fuel Cells, Electrical Characteristics of Real Fuel Cells, Types of Fuel Cells, Hydrogen Production

2. Wind Power Systems: **06**
Historical Development of Wind Power, Types of Wind Turbines, Power in the Wind, Impact of Tower Height, Maximum Rotor Efficiency, Wind Turbine Generators, Speed Control for Maximum Power, Average Power in the Wind, Simple Estimates of Wind Turbine Energy, Specific Wind Turbine Performance Calculations, Wind Turbine Economics

3 .The Solar Resource: **06**
The Solar Spectrum, The Earths Orbit, Altitude Angle of the Sun at Solar Noon, Solar Position at Any Time of Day, Sun Path Diagrams for Shading Analysis, Solar Time and Civil (Clock) Time, Sunrise and Sunset, Clear Sky Direct-Beam Radiation, Total Clear Sky Insolation on a Collecting Surface, Monthly Clear-Sky Isolation, Solar Radiation Measurements, Average Monthly Isolation

4 .Photovoltaic Materials and Electrical Characteristics: **06**
The PV I–V Curve under Standard Test Conditions (STC), Impacts of Temperature and Insolation on I –V Curves, Shading Impacts on I–V
Curves, Crystalline Silicon Technologies, Thin-Film Photovoltaic

5. Photovoltaic Systems: **06**
Current–Voltage Curves for Loads, Grid-Connected Systems, Grid-Connected PV System Economics, Stand-Alone PV Systems, PV-Powered Water Pumping

Books
1. Gilbert M. Masters, Renewable and Efficient Electric Power Systems, Wiley-IEEE Press August 2004
2. Power Generation Renewable by PEP (Professional Engineering Publishers) Wiley publications
3. Thomas Ackermann, Wind Power in Power Systems, Wiley publications

TERMWORK: Term work will consist of record of minimum 8 experiments based on the syllabus.

PROJECT PART II

Practical: 6 Hrs/week

Practical Exam:100 Marks
Term Work : 50Marks

Term Work :

Project part II will be continuation of project part I undertaken by the candidates in the first term.The term work shall consist of a typed report of about 60 pages on the work carried out by a batch of students in respect of the project assigned during the first term part I and second term part II.

Practical Exam:

It shall consist of an oral exam based on the report submitted by the candidates and the demonstration of the fabricated design project.The said examination will be conducted by a panel of two examiners consisting of preferably the guide working as a senior and other external examiner preferably from industry or the university.

Note:

The candidate must bring the project part-I report and the final report completed in all respect while appearing for practical examination of the project.