EE 801 ELECTRICAL MACHINE DESIGN

Module I

D C Machines:- Output equation – main dimensions choice of specific electro magnetic loadings – choice of speed and number of poles. Design of armature conductors, slots and windings – design of airgap,field system, commutator,interpoles,compensating winding and brushes – Carter's co-efficient – real and apparent flux density. Design examples.

Module II

Transformers; - Single phase and Three phase transformers – output equation - main dimensions – specific electric and magnetic loadings – design of core, LV winding, HV winding – cooling of transformers – design of cooling tank and tubes. Temperature rise time curve – short time and continuous rating.

Module III

Alternators:- Salient pole and turbo alternators – output equation – main dimensions – choice of specific electric and magnetic loadings – choice of speed and number of poles – design of armature conductors, slots and winding – design of air-gap, field system and damper winding – prediction of open circuit characteristics and regulation of the alternator based on design data – design examples.

Module IV

Induction machines:- Output equation – main dimensions – choice of specific electric and magnetic loadings – design of stator and rotor windings, stator and rotor slots and air-gap of slip ring and squirrel cage motors – calculation of rotor bar and end ring currents in cage rotor – calculation of equivalent circuit parameters and prediction of magnetising current based on design data – design examples.

Reference:

Clayton & Hancock - *Performance and Design of DC Machines, ELBS.*
Sawhney - *Electrical Machine Design,* Dhanapath Rai.
Say M.G - *Performance and Design of AC Machines,* Pitman, ELBS.

Type for questions for University Exams

Question (1) - Eight short answer question of five marks with two questions from each of four modules

Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE 802: POWER SYSTEMS III

Module I

Circuit breakers – principles of operation – different types and their operations – ABCB – oil CB – SFC – vacuum CB- circuit breaker ratings – cause of over voltages – surges and traveling waves – voltage waves on loss less line – reflection and attenuation – protection against lightning – earth wires – lightning diverters – surge absorbers- arcing ground – neutral earthing – basic concepts of insulation levels and their selection – BIL – coordination of insulation.

Module II

Protective relays – protective zones – requirement of protective relaying – different types of relays and their applications – generalized theory of relays – protection scheme for generator – transformers, lines and bus bars - static relays amplitude and phase comparators – block diagrams of static relays – protection scheme for generators – transformers, lines and bus bars – microprocessor based protective relaying.

Module III

Electric traction: systems of traction – speed time curve – mechanics of traction – power supply – systems of current collection – electric heating – advantage of electric heating – resistance and induction are furnaces – construction and field of application of dielectric heating.

Module IV

Energy conservation in electric motors – lighting and electric heating systems – electrical energy auditing – instrumentation and general methodology – power quality problems – definitions – harmonics – sources – effects – total harmonic distortion (THD) – mitigation methods – passive filter design.

Reference:

Rao S.S - *Switch Gear protections*, Khanna.
Thomas & Browne Jr - *Circuit Interruption – Theory and Techniques*.
Soni, Gupta & Bhatnagar - *A Course in Electrical Power*, Dhanapat Rai.
Van.C Warrington A.R - *Protective Relays Vol.1 & 2*, Chappman & Hall.
Mason C.R - *Art and Science of Protective Relaying*, Wiley Eastern.
Ravindranath, Chander.M - *Power System Protection and Switchgear*, Wiley Eastern.
Haydt G.T - *Electric Power Quality*, Stars in circle publications.
Kazibwe W.E & Sendula M.H.- *Electric Power Quality*.

Type for questions for University Exams

Question (1) - Eight short answer question of five marks with two questions from each of four modules

Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE 803 ELECTRONIC INSTRUMENTATION

Module I

Transducers – definitions – classifications – resistance transducers- strains gauge – types – construction – temperature effect - circuitry, semi conductor strain gauge – load cell.
Resistance thermo meter – types – circuits – errors. Themistor – advantage of themistor.

Inductive transducers – LVDT – applications – LVDT load cell – LVDT pressure transducer – resolver – capacitive transducer – principle of operation – applications – capacitor microphone.
Piezoelectric transducer – materials – equivalent circuit – d, g, h, coefficients – thermocouple – principle – applications – magnetostrictive transducers – materials, applications, Hall effect transducer – application – elastic transducers (brief study) – Bourdon tubes – diaphragms – Bellows – Fibre Optics transducers – digital transducers – shaft encoder.

Module II

Signal conditioning – instrumentation amplifiers – differential amplifiers – filters – law and high pass, band pass and band rejection filters –transducer bridges – null type and deflection bridges – AC bridges using push pull transducers – general telemetry systems – sampling process – principles of time division and frequency division multiplexing, different types of modulation techniques as applied to telemetry (general idea)

Module III

Instrumentations systems – basic measuring systems – analog and digital data acquisition systems – generalized input-output configuration of measuring systems – dynamic characteristics.
Digital instruments – operating principles of DVM using successive approximation – V/F conversion and integrating principles – counter digital method for frequency, phase, time and period measurements – digital RLC meters – Q-meter – vector impedance meter – electronic multimeter.

Module IV

Display methods and devices – different types of display – display system building blocks – recorders – galvanometric recorders-pen driving systems – servo recorders – magnetic recorders – digital recorders – accuracy and precision – classification errors- combined errors etc.

Text Book

1. A.K Sawhney - *A course in electrical and electronic measurements and Instrumentation*, Dhanapath Rai & Co. 2001 eddition.
2. Ernest O.Doeblin - *Measurements systems application & design,* McGraw Hill International edition 1984.
3. Albert D. Helfric & William D. Cooper - *Modern Electronic Instrumentation & Measurements Techniques* (Prentice Hall)
4. Dr. S. Renganathan - *Transducers Engineering* (Allied Publishers Ltd. Delhi
5. K.B Kalaasen - *Electronic measurement and instrumentation*, Cambridge University press 1996.

Type for questions for University Exams

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Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

CS/EC/EE/EI 804A DIGITAL IMAGE PROCESSING

Module I

Digital image fundamentals: representation - elements of visual perception - simple image formation model - Image sampling and quantization - basic relationships between pixels – imaging geometry.
Review of matrix theory results: Row and column ordering - Toeplitz, Circulant and Block matrices. Review of Image transforms: 2D-DFT, FFT, Walsh, Hadamard, Haar, DCT and Wavelet transforms.

Module II

Image enhancement: Spatial domain methods: point processing - intensity transformations, histogram processing, image subtraction, image averaging; Spatial filtering- smoothing filters, sharpening filters. Frequency domain methods: low pass filtering, high pass filtering, homomorphic filtering. Generation of spatial masks from frequency domain specifications.
Image segmentation: Detection of discontinuities - point, line and edge and combined detection , Edge linking and boundary description - local and global processing using Hough transform – Thresholding - Region oriented segmentation - basic formulation, region growing by pixel aggregation, region splitting and merging - Use of motion in segmentation. Fundamentals of Representation and Description.

Module III

Image restoration: Degradation model - Diagonalization of circulant and Block circulant matrices - Algebraic approaches - Inverse filtering - Wiener filter - Constrained Least squares restoration - Interactive restoration - Geometric transformations.
Fundamentals of Colour image processing: colour models - RGB, CMY, YIQ, HIS - Pseudo color image processing - intensity slicing, gray level to color transformation.

Module IV

Image compression: fundamentals- redundancy: coding, inter pixel, psycho visual, fidelity criteria, Models, Elements of information theory, Error free compression- variable length, bit plane, lossless predictive, Lossy compression- lossy predictive, transform coding. Fundamentals of JPEG, MPEG & Fractal image compression techniques.

Text Book:

1. Gonzalez and Woods, *Digital Image Processing*, Pearson Education/ Prentice-Hall India Ltd., 2nd ed.

References:

1. Anil K. Jain, *Fundamentals of Digital Image Processing*, Pearson Education/ PHI Ltd, 2003.
2. Mark Nelson, Jean-Loup Gailly, *The Data compression Book*, BPB Publications, 2nd ed.
3. Pratt William K., *Digital Image Processing*, John Wiley & sons, 2nd ed.
4. Chanda & Majumdar, *Digital Image Processing and Analysis*, Prentice-Hall India Ltd, 2003.
5 M. Sonka, V. Hlavac, R. Boyle, *Image Processing, Analysis and Machine Vision*, Thomson Learning, 2006

EE 804 (B) RENEWABLE SOURCES OF ENERGY

Module I

Renewable and non-renewable sources of energy – brief review of conventional sources of energy – energy production and world energy consumption – green house effect and global warming. Solar energy option. Thermal conversion – design fabrication and performance of flat plate collectors – description of solar thermal devices (stills water heater, furnaces cookers and refrigerators) – Solar thermal power generation systems – thermal storage.

Module II

Photovoltaic conversion – conceptual description of photo voltaic effect – electrical characteristic of silicon PV cells and modules – solar cell material and prospects – Instruments for measurement of solar radiation – Empirical equations for predicting availability of solar radiation.

Module III

Wind energy – wind turbines – Horizontal axis and vertical axis with turbines – Power and energy from wind turbines – wind characteristics. Energy from oceans: wave energy – Physical principles – wave characteristics and wave power – wave energy technology. – fixed devices – floating devices

Module IV

Biomes – classification – biomass – conversion process – application – ocean thermal energy conversion systems – Tidal & wave power application – fuel cells – types – losses in fuel cell - application – MHD generators – application of MHD generation - micro and mini hybrid power.

References:

Renewable energy sources – John W, Twidell & Antony D. Wier – ELBS Publication

Renewable Energy - Power for sustainable Future – Edited by Godfrey Boyle – Oxford University Press in association with the Open University, 1996.

Applied solar Energy - Meinel A B and Meinel MP, Addison Wesley Publications.

Renewable and Novel energy sources – SL Sah, MI Publications, New Delhi, 1995.

Direct Energy Conversion – George Sutton – McGraw hill Publications.

Type for questions for University Exams

Question (1) - Eight short answer question of five marks with two questions from each of four modules

Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE 804 C : FLEXIBLE AC TRANSMISSION

Module 1

FACTS concepts and general system considerations: Power flow in AC systems - Definition of FACTS - Power flow control -Constraints of maximum transmission line loading - Benefits of FACTS Transmission line compensation- Uncompensated line - shunt compensation - Series compensation -Phase angle control.

Module 2

Static shunt compensators: SVC and STATCOM - Operation and control of TSC, TCR and STATCOM - Compensator control - Comparison between SVC and STATCOM.
Static series compensation: TSSC, SSSC -Static voltage and phase angle regulators - TCVR and TCPAR- Operation and Control -Applications.

Module 3

Unified Power Flow Controller: Circuit Arrangement, Operation and control of UPFC- Basic Principle of P and Q control- independent real and reactive power flow control- Applications - Introduction to interline power flow controller.

Module 4

Special purpose FACTS controllers - Thyristor controlled voltage limiter - Thyristor controlled voltage regulator - Thyristor controlled braking resistor - Thyristor controlled current limiter-
Custom Power - Compensation Devices - STS - SSC - SVR -Backup energy supply devices

Reference Books:

1. N.G. Hingorani, L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.

2. R. Sreeram Kumar (Ed) "Lecture Notes on Flexible AC Transmission Systems (FACTS)". Institution of Engineers (India), Calicut Local Centre, 2003.

3. K.S.Sureshkumar, S.Ashok , "FACTS Controllers & Applications", E-book edition, Nalanda Digital Library, NIT Calicut,2003

4. T.J.E. Miller. "Reactive Power Control in Electric Systems", JohnWiley & Sons, 1984.

Type for questions for University Exams

Question (1) - Eight short answer question of five marks with two questions from each of four modules

Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EB/EE 804(D) VLSI DESIGN

Module I.

VLSI process integration: - fundamental considerations in IC processing - NMOS and PMOS IC technology - CMOS IC technology - BiCMOS IC technology. - GaAs technology. Ion implantation in IC fabrication. The MOS device - (n - channel & p- channel) - capacitance of MOS structure - accumulation, depletion and inversion, threshold voltage, current equations - characteristics, channel pinch-off. Second order MOS device effects : short-channel effect, narrow width effect, sub-threshold current, device saturation characteristics.

Module II.

Switch logic- pass transistors and transmission gates, Gate logic-The basic inverter using NMOS-circuit - current equations - pull up to pull down ratio- transfer characteristics- Alternate forms of pull up. Basic NAND, NOR circuits. The CMOS inverter, characteristics – NAND, NOR and compound circuits using CMOS. Other forms of CMOS logic : pseudo CMOS, CMOS domino logic, n-p logic. Layout design of static MOS circuits – Layout rules - general principles & steps of lay-out design - use of stick diagrams - design rules - Layout examples of NAND and NOR.

Module III.

Basic circuit concepts: sheet resistance, area capacitance, delay unit, inverter delays – driving large capacitive loads, cascaded inverters, super buffers, BiCMOS drivers . Combinational circuits - clocked sequential circuit - drivers for bus lines. Scaling of MOS circuits: scaling models and scaling factors for device parameters.

Module IV.

Timing issues in VLSI system design: timing classification- synchronous timing basics – skew and jitter- latch based clocking- self timed circuit design - self timed logic, completion signal generation, self timed signaling–synchronizers and arbiters.

Text Books

Douglas A Pucknell, Kamran Eshraghian , *Basic VLSI Design*, P HI
Jan M. Rabaey, A. Chandrakasan, B. Nikolic *Digital Integrated Circuits- A Design perspective* 2/e, Pearson education

References

Thomas E. Dillinger , *VLSI Engineering* , PH International editions.
S M Sze, *VLSI Technology,PHI*
Weste and Eshraghian, *Principles of CMOS VLSI Design ,A Systems Perspective*,2/e, Pearson Education.
Mead & Conway , *Introduction to VLSI System Design*-Addison Wesley
Fabricius, *Introduction to VLSI Design,*Pearson
Charles H Roth Jr – *Fundamentals of Logic Design 4 Ed*, Jaico Publishers
Wayne Wolf:Modeern *VLSI Design Systems on Chip*-Pearson Education,2nd ed.,

Type for questions for University Exams
Question (1) - Eight short answer question of five marks with two questions from each of four modules
Question (2-5) - Two questions A & B of 15 Marks from each module with options to answer either A or B.

EE 805 PROJECT WORK

Each batch of students shall develop the project designed during the VII semester. The implementation phase shall proceed as follows:

For hardware projects, practical verification of the design, PCB design, fabrication, design analysis and testing shall be done.
For software projects, a proper front end (GUI) if applicable, shall be designed. A detailed algorithm level implementation, test data selection, validation, analysis of outputs and necessary trial run shall be done.
Integration of hardware and software, if applicable, shall be carried out.
A detailed project report in the prescribed format shall be submitted at the end of the semester. All test results and relevant design and engineering documentation shall be included in the report.
The work shall be reviewed and evaluated periodically

The final evaluation of the project shall be done by a team of minimum 3 internal examiners including the project guide and shall include the following.

Presentation of the work
Oral examination
Demonstration of the project against design specifications
Quality and content of the project report

Guidelines for evaluation:

Regularity and progress of work	30
Work knowledge and Involvement	100
End semester presentation and oral examination	50
Level of completion and demonstration of functionality/specifications	70
Project Report – Presentation style and content	50
Total	300 marks

Note: *Points (i) and (ii) to be evaluated by the respective project guide and the project coordinator based on continuous evaluation. (iii)-(v) to be evaluated by the final evaluation team comprising of 3 internal examiners including the project guide.*

EE 806 VIVA-VOCE

Each student is required to appear for a viva-voce examination at the end of the complete course work. The students shall produce the seminar report and project reports duly attested by the institutional authorities, before the examiners. The examination panel shall comprise of one internal examiner and one external examiner, both appointed by the University. The examiners shall evaluate the students in terms of their conceptual grasp of the course of study and practical/analysis skills in the field.