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EE 741: COMPUTER AIDED POWER SYSTEM ANALYSIS

Full Marks: Theory =100
Sessional=75
Time=3 Hrs.

1. Network matrix :

Primitive network, bus incidence matrix, formation of Y-bus by singular transformation , networks with mutually coupled elements ,formation of Z-bus by matrix inversion , formation of Z-bus using the building algorithm – addition of a tree branch p to reference bus , addition of a link between buses p and q , addition of a link between bus p and reference bus .

2. Symmetrical components and unsymmetrical fault calculations:

Fortesque's theorem. Symmetrical components of an unbalanced 3- phase system: average power in terms of symmetrical components, sequence impedances, fault calculations, graphical method of determining swquence components, network equations. LG, LL, LLG faults. Effect of fault impedance on fault current. Sequence networks.

3. Fault and Contingency calculation:

Fault calculation using Z-bus and Ybus. Contingency analysis using Z-bus in superposition method, alternative method using Z-bus, use of Y-bus Table Factors for contingencies.

4. Load flow analysis :

Introduction , classification of buses , representation of transformers , Gauss Seidel iterative method using Ybus , N-R iterative method using Y-bus , approximation to the Jacobian in the NR method , Fast Decoupled L-F method , solution using Z-bus in the bus frame of reference . Calculation of power flows.

5. Power system stability:

Introduction. Dynamics of synchronous machine, swing equation. Power- angle curve. Steady- state and transient Stabilities. Equal area criterion. Calculation of power – angle curves for fault and post – fault conditions for various types of Fault; effect of reclosing. Numerical solution of swing equation.

Dynamic stability, automatic regulation, effect of excitation systems. Factors affecting stability.

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EE 742: Communication Engineering

Full marks: Theory=100
Sessional=75
Time=3 Hrs.

1. **Properties of Fourier transform:**

Response of LTI systems – transfer functions and frequency responses. Correlation and spectral density – correlation of power signals, correlation of energy signals.

2. **Random signal theory :**

Random variable – cumulative distribution function, probability distribution function, statistical averages, standard deviation, Gaussian and Rayleigh PDF. Random processes – ensemble averages and correlation, stationary and ergodic process.

3. **Noise:**

Sources and characteristics of different noise, thermal and shot noise, concept of white Gaussian noise. Noise temperature, noise bandwidth and noise figure.

4. **Analog communication :**

Linear CW modulation –AM-DSB, AM –DSB /SC,AM-SSB/SC signals and spectra , generation and detection of AM , Exponential CW modulation –PM and FM signals , generation and detection of AM , and FM , Super heterodyne receivers .Frequency division multiplexing.

5. **Signal to noise ratio for different analog communication schemes:**

6. **Pulse Coded Modulation:**

PCM generation and reconstruction, quantization noise, non uniform quantization and compounding, signal to quantizing noise power ratio, Time Division Multiplexing.

7. **Digital Communication:**

ASK, PSK, FSK

EE744: INSTRUMENTATION

L T P
(3 1 0)
Full marks: Theory =100
Sessional =75
Time=3 hours

1 .**Introduction:**

Generalized approach to measuring systems. Function descriptions. Transducers- Active and passive, primary and secondary transducers. Input- output configuration of measuring instruments and Instrument systems.

2**. Generalized performance characteristics of instruments:**

Static characteristics- Accuracy, Precision, Errors, Uncertainty and Bias. Static sensitivity. Linearity.

3. **Sensors :**

Resistive pots, Strain gauges, LVDTs, capacitive transducers, piezoelectric transducers, Hall Effect transducers. Digital shaft position encoder, Ultrasonic transducers, Seismic sensors.

4. **Process Instrument**:

Measurement of temperature (RTD, thermistors, thermocouples, pyrometers). Measurement of Force and Pressure (Bellows, Bourdon tubes, Load cells, Diaphragm etc). Level measurement.

5**. Servo Components:**

Synchros, DC and AC servomotors, Tachogenerators, Stepper Motor.

6**. Signal conditioning**:

D.C. And a. c. signal conditioning circuits. Operational amplifiers. Instrumentation amplifier. Amplitude Modulation and Demodulation. Bridge circuits. Analog to digital (A/D) and Digital to Analog (D/A) converters.

7. **Data transmission and Telemetry**:

Methods of data transmission. D.C. Telemetry systems. A.C. telemetry systems. Modulation- Amplitude modulation (A.M), Frequency modulation (F.M), Phase modulation, pulse amplitude modulation (PAM), Pulse duration modulation (PDM).

8. **Introduction to the optical, Ultrasonic, radio isotopes and laser based Instrumentation systems.**

Books/References:

1) Measurement System Application And Design: Doeblin.E.O. (Tata McGraw)

2) Electrical measurements and measuring instruments: swahney.A.K (Dhanpat Rai)

3) Instrumentation, Measurement and Analysis: Nakra, Choudhury (Tata McGraw)

EE 743: Operations Research

L T P
3 1 0

Max. Marks = 100
Sessional Marks= 75

1. **Introduction and history of OR**:

Definition, Characteristics and limitations of OR, phases of OR.

2. **Concepts in probability and statistics:**

Continuous and discrete variables. Arithmetic mean, median, mode, Concepts of different types of probability distributions & their applications.

3. **Fields of application of linear programming**:

Mathematical formulation of LP. Graphical and Simplex method of solution of LP problems. Duality in LP. Sensitivity analysis.

4. **Transportation problem**:

Initial solution, optimal solution, degeneracy, alternate solution; North-West corner method. Vogel's approximation method.

5. **Assignment problem-**:

6. Integer programming problem:

7. **Waiting line models:**

Introduction & history. Basic structure & classification of waiting line problems, Queuing models. Assembly line balancing problem.

8. **Dynamic programming:**

Structure and characteristics of dynamic programming; principles of optimality, dynamic programming models- probabilistic and deterministic.

9. **PERT/CPM:**

Books:

1. Introduction to Operations Research- Hiller & Liberman.
2. Operations Research- Askhedkar % Gupta.
3. -----Do----------Hira & Gupta.
4. Introduction to OR- Gillett.
5. Operations Research- H.A. Taha

EE 748: Project-I (0-6-0)

Max Marks: 100, pass Marks: 40

In this subject, a project work has to be taken up on a relevant topic to be decided by the student in consultation with the supervisor. The project is to be done in a group, which may consist of two, three or four students. The project may be software, hardware or a study type one.

The students have to submit a project proposal and/or justify the relevance of the topic in a project proposal seminar at the beginning of the semester, after approval of which only a student can take up that project. The students also have to give a presentation of their progress in a seminar. At the end, the students have to submit a report and present their works in a seminar. A viva-voce examination will also be held at the end of the semester.

The distribution of marks for the project is as follows:

Seminar: 25 Viva: 25 Report: 50

EE 747: Training (0-2-2)
Max Marks: 50

In this, every student has to undergo industrial training during summer vacation just after sixth semester) for a period of 4 weeks. For this, the student has to get prior approval from the department. At the end of the training, a student has to submit a report to the department, which will be evaluated by the faculty members of the department.

EE 745/IE753: Computer Networking (Elective)

4-1-0
Max Marks: 100
Sessional: 75
Time: 3 hours

Introduction to computer networks and layered architecture overview, Packet switching and fast packet switching.

Point to point protocols and Links: ARQ retransmission strategies. Selective repeat ARQ. Framing and standard data link control protocol-HDLC, SDLC, LAPD. Queuing models in communication networks.

Multi-access communication & multiple access protocols: ALOHA, slotted ALOHA, CSMA, CSMD/CD. Performance modeling & analysis.

Local area networks: Ethernet, Token ring, and FDDI. Design & analysis.

Internetworking issues: Bridges, Routers and Switched networks. Routing & Flow Control Algorithms in data networks.

Broadband Networks: ATM, Frame relay & gigabit Ethernet, Traffic management in ATM networks.

Security & reliability of Networks.

Books:

1) Data Networks, R G Gallager, PHI
2) Data & Computer Communication, W stallings, PHI.
3) Multiple Access Protocols, R Rom & M Sidi, Springer verlag.

EE 745/IE 753: Digital System Design (Elective) (4-1-0)

Max Marks: 100
Sessional: 75
Time: 3 hours

1. Counter Design: Changing the counter modulus; Decade counters; Pre-settable counters; Counter design as a synthesis problem.

2. Design of Sequential circuits: State machine design using Moore and Mealy model; State transition diagram and preparation of state synthesis table. Derivation of design equation from state synthesis table using Karnaugh map.
   Circuit implementation: flip-flop based approach and ROM based approach. State reduction techniques,Analysis of asynchronous Sequential circuits, Problems specific to asynchronous sequential circuits, Design issues related to asynchronous Sequential circuits.

3. D/A conversion and A/D conversion, Variable, Resistor Networks.
   Binary ladders. D/A converters, D/A accuracy and resolution.
   A/D converter – simultaneous Conversion.
   A/D converter – Counter method.
   Continuous A/D conversion.
   Dual- slope A/D conversion.
   A/D Accuracy and Resolution.

4. A simple Computer Design
   Building blocks, Register Transfer language, Macro and micro operations, Design of control unit, programming computer.

Books:

1) Digital Logic & Computer Design, M.Morris Mano. (PHI)
2) Digital Principles and Applications – Malvino, Leach and saha (Tata McGrow Hill)

EE 745: Non-Conventional Energy Sources (Elective)

4-1-0

Max Marks: 100
Sessional: 75
Time: 3 hours

1) Introduction to Non conventional energy sources:-
Importance, primary & secondary energy sources, limitations to primary sources, various sources of non-conventional energy, renewable energy.

2) Solar Energy:-
Solar radiation, solar radiation angles, local solar time, solar collector-flat plate collector & solar concentrator, solar heater-water heater & air heater, solar cooker, solar distillation, solar energy storage- sensible heat storage & latent heat storage.

3) Photovoltaic Energy Conversion:-
Photovoltaic effect, equivalent circuit & V-I characteristics of PV cell, types of solar cell & their characteristics, effect of temperature, light intensity, cell-area & series resistance on PV cell, solar cell array & module and their configurations, specifications of PV module, PV system & their components, isolated & grid connected PV systems.

4) Wind Energy:-
Wind energy conversion, wind turbine rotor -classification, characteristics & analysis of ideal wind turbine rotor, power co-efficient, air foils, lift & drag forces, blade shape for ideal rotor, generalized rotor design procedure , wind turbine_ subsystems, components, design, power curve prediction, electrical aspects of wind turbine, grid connected wind turbine, wind farms, site selection.

5) Fuel Cell:-
Introduction, energy conversion principles, types of fuel cell, components of a fuel cell, polarization.

6) Energy from bio-mass:-
Introduction, Bio-mass conversion technologies, bio-gas generations, classifications of bio-gas plants, selection of site for bio-gas plant, utilization of bio-gas, thermal gasification of bio-mass.

7) Geo thermal Energy:-
Sources and use of geo-thermal energy, geo-thermal power plants, applications.

8) Energy from the ocean:-
Tidal power, components of tidal power plants, generation of tidal power, estimation of energy & power, ocean thermal energy conversion (OTEC)_ introduction, types, plants & their specifications.

9) Magneto Hydro Dynamic Generation:-
Principles of MHD generation, MHD generator, equivalent circuits, MHD system.

10) Combined Operation utilizing more than one source, composite systems.

Books:

1) G.D. Rai, Non conventional energy sources, Khanna publishers.
2) Thomas Markvart, Solar Electricity, John Willy & Sons.
3) A.C.Baker, Tidal Power, Peter Peargrenus Ltd.
4) G.N.Tiwari, Solar Energy_Fundamentals, design, modeling & application, Narosa Publishing House.

EE 746: Illumination Engineering (Elective)

4-1-0

Max Marks: 100

Sessional: 75
Time: 3 hours

1) **Radiation:-** Wavelength, frequency & velocity. The radiation spectrum. Radiations from black bodies & other sources.

2) **Entities in the illumination system and their units:-** Luminous sources, illumination, intensity, brightness, other terms and units. The inverse square law. The cosine law. Solid angle relation ship. Luminosity, relationship between brightness & luminosity for a perfectly diffusing source, illumination standards.

3) **The eye & vision:-** The structure of the eye, accommodation, aberration of the eye, the rods & cones, visual acuity, glare, color & color response of the eye.

4) **Light Sources & Their Characteristics:-** Day light incandescent, electric discharge(low & high pressure), fluorescent, are amps and laser beams, color rendering, wiring, switching & control circuits. Starters & ballast.

5) **Light Control:-** Reflection & reflection factor, absorption, transmission & transmission factor. Control of light by luminaries.

6) **Illumination & measurement:-** Illumination from point sources, light units in a row, area illumination, polar curves. Linear & surface sources, flat linear source, flat-strip of short length. Illumination of a vertical source. Radiant energy detectors, PV cell, Photo-tubes, Photometry, Electro-photometry, Photo cells, Spectro-photometer, Colorimeters.

7) **General Illumination & Design calculation:-** Interior lighting of industrial, residential & commercial buildings. Effective utilizations of daylight. Daylight factor, Outdoor lighting, Street, rail/shipyards, airports, sports area. Lighting design for signaling, advertising & security.

Books:

1) Cotton.H, Principles of Illumination, Chapman & Hall.
2) Boast. W.S., Illumination Engineering, McGraw-Hill.
3) IES Lighting Handbook, Illumination Engineering Society, New York.

EE 746/IE 754: Modeling & Simulation (Elective)

Max Marks: 100
Sessional: 75
Time: 3 hours

System models-entities, attributes, states, activities. Types of models. Static & Dynamic Models.

Deterministic & stochastic activities. Principles used in modeling. System simulation-continuous & discrete event simulation languages_GPSS, GIMULA, CSMP, DYNAMO. Probability concepts in simulation-random number & random variate generation stochastic processes, Birth – Death process, parameter estimation & input-output validation, Queuing systems_M/M/1 and M/M/C queues. Bulk arrival & Bulk service system. Inventory control & forecasting. Evaluation & Validation of simulation experiments.

Books:

1) Payer, T.A. : Introduction to Simulation, McgrawHill.
2) Gordon, G : System Simulation, PHI.
3) Law, A.M & W.D. Kelton : Simulation Modelling & Analysis, McgrawHill.

E 746/IE 754: Microprocessor Based Instrumentation (Elective)

(4-0-2)
Max. Marks=100
Lab/Sessional=75

Microprocessor interfacing, methods of data transfer, DMA, synchronization, polling and interrupt, LSI support chips for micro-processor, IEEE-488 interface, RS-232 interface, dedicated I/O controllers, programmable peripheral controllers, transducer interfacing, actuator interfacing, micro-processor based measurement of pulse width, frequency, voltage, rpm, pH, pressure, temperature etc., obtaining device characteristics(semiconductor devices) with micro-processor, micro-processor based scanner, data- logger, alarm enunciators, PID controller,

programmable controller, analytical instruments such as gas chromatograph, Sequential control and interlock control, micro-processor based diagnostic systems.