RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics & Instrumentation Engineering, VIII-Semester

EI801-Mechatronics

Unit 1:
Electrical Systems: Mathematical modeling of Electro Mechanical Systems, RLC Circuits, active and passive electrical circuits, PMDC Motor, Stepper motor, three phase squirrel cage induction motor, three phase permanent magnet synchronous motor, servo motor.

Unit 2.
Mechanical Systems: Introduction to various systems of units, mathematical modeling of mechanical systems, Newton's laws, moment of inertia, forced response and natural response, rotational systems, spring mass system, free vibration, spring mass damper system, mechanical systems with dry friction, work energy and power, passive elements and active elements an energy method for deriving equations of motion, energy and power transformers.

Unit 3:
Fluid and Thermal systems: Mathematical modeling of liquid level system: Resistance and capacitance of liquid level systems with interaction. Mathematical modeling of pneumatic systems: Resistance and capacitance of pneumatic systems, mathematical modeling of a pneumatic systems, liberalization of non-linear systems. Mathematical modeling of hydraulic systems: Hydraulic circuits, hydraulic servo-meter and mathematical model of hydraulic servo motor dashpots. Mathematical modeling of thermal systems: Thermal resistance and 7 thermal capacitance mathematical modeling of thermal systems.

Unit 4.
Design of Mechanical Elements: The phases of design, Design considerations, codes and standards, optimum design process, design variables, cost functions, design constraints, optimum design. Springs, rolling contact bearing, journal bearing, Spur and helical gear, bevel and worm gears, shafts, axes and spindles, Flexible Mechanical Elements, Belts, timing belts, chain and sprocket, flexible shafts, brakes, clutches, cams, four bar mechanism.

Unit 5:
Design of Hydraulic System: Hydraulic circuit design, Actuator design, selection of pumps, selection of valves, design of control circuits.

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Electronics & Instrumentation Engineering, VIII-Semester

Departmental Elective EI 802 (A) VLSI Technology

UNIT-1.

Crystal Growth and Wafer preparation: Wafer terminology, Different crystalline orientations ,CZ method, CMOS IC Design flow, Crystal Defects. Fabrication processes of FETs, MOSFETs, and BIMOS etc.

UNIT-2.

Layering: Epitaxial growth methods, Liquid phase epitaxy, Vapor phase epitaxy, Molecular beam epitaxy, Oxidation, Types of oxidation, Horizontal and vertical tube furnace for oxidation, Kinetics of oxidation, Thin film fabrication, Metallization; Physical Vapor Deposition, Sputtering.

UNIT-3.

Patterning: Lithography; Optical Lithography, Electron Lithography, X-ray Lithography, Ion Lithography. Photo masking steps, Resists. Doping: Diffusion; Diffusion Models, Ion Implantation; Implantation Equipment, Channelling.

UNIT-4.

VLSI process techniques and Integration: Floor planning, layout, Design rules, stick diagrams, Test generation, Logic simulation, Introduction to EDA tools. Contamination Control; Clean rooms, HEPA, ULPA Filters and Class numbers.

UNIT-5.

Subsystem Design: Data-paths; adder, Shift registers ALU, Memory; NVRWM, Flash memories,6-Transistor RAMs Dynamic RAM, Read Write Cycle, Latch up in CMOS Circuits.

TEXT BOOKS

1. Harold E. Smalley, Hospital Management Engineering – A guide to the improvement of hospital management system, Prentice Hall, 1982.
2. L. G. Redstone, Hospital and Health Care Facilities, McGraw Hill, 2002.
3. C. A. Caceras, Clinical Engineering, Academic Press, 1977.
4. J Davey and D Ali, Ward’s Anaesthetics Equipment’s, 6 th ed., Elsevier Health-UK, 2011.

REFERENCES

1. BIS, ISO Certification details. 2. Alexander Kusko, Emergency and Standby Power Systems, McGraw Hill, 1989.

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Electronics & Instrumentation Engineering, VIII-Semester

Departmental Elective EI 802 (B) Safety & Reliability

Unit-1

Reliability and safety definitions, Risk factor, Classification of failures and protective measures. Safety measurement, Preliminary hazard analysis, Subsystem fault hazard analysis, Common mode failures, codes and standards for safety.

Unit-2 : Reliability improvement

Redundancy element, Unit, and stand by optimization-cost trade off- Fault tree analysis-Constructions of Fault tree-Calculations of reliability from fault tree-reliability allocation-evaluation of reliability-test-O.C. curve specifying reliability acceptance test.

Unit-3

Definition of Quality-Quality control design-Product development cycle-Quality planning of manufacturing process-Process selection and control-Inspection and testing-Quality audit-Organizing for quality-Quality function-Quality engineering and quality control-Typical organization for quality : Small scale, Medium scale and Large scale organization.

Unit-4

Distribution, Markov modeling, Stress-strength approach to reliability design, Relationship between MTBF, hazard rate, failure rate, reliability.

Unit-5

Redundancy techniques, examples from Electrical, Nuclear, Chemical and Process Engineering, Elementary Analysis and Estimation techniques.

References:

- Jurian J.M., “Quality V Control Handbook”, McGraw Hill.
- Grant E.L., &Levenworth, “Statistical Quality Control”, McGraw Hill.
- Geedenko B.V., “Mathematical Methods of Reliability Theory”, Academic.
- Mann, Schafer R.E., &Singapurvala N.D., “Mehods for Statistical Analysis of Reliability and Life Date”
- Reigenbaum V., “Total Quality Control”, McGraw Hill.
- Trylot J.R., “Quality Control Systems-Procedures for Planning Quality Programs”.

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Electronics & Instrumentation Engineering, VIII-Semester

Departmental Elective EI 802 (C) Probability and statistics

UNIT I PROBABILITY AND RANDOM VARIABLES

Probability – The axioms of probability – Conditional probability – Baye‘s theorem – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO – DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTING OF HYPOTHESIS

Sampling distributions – Estimation of parameters – Statistical hypothesis – Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion – Contingency table (test for independent) – Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS

One way and Two way classifications – Completely randomized design – Randomized block design – Latin square design – 2, factorial design.

UNIT V STATISTICAL QUALITY CONTROL

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling.

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Electronics & Instrumentation Engineering, VIII-Semester

Open Elective EI 803 (A) Aeronautical Instrumentation

Unit 1.
Conventional Systems - Power assisted and fully powered flight controls - Power actuated systems – Engine control systems - Push pull rod system, flexible push full rod system - Components - Modern control systems - Digital fly by wire systems - Auto pilot system active control Technology, Communication and Navigation systems Instrument landing systems, VOR - CCV case studies.

Unit 2.
Hydraulic systems - Study of typical workable system - components - Hydraulic system controllers - Modes of operation - Pneumatic systems - Advantages - Working principles - Typical Air pressure system – Brake system - Typical Pneumatic power system - Components, Landing Gear systems - Classification – Shock absorbers - Retractive mechanism.

Unit 3.
Introduction-Qualitative and quantitative displays, basic T grouping of instruments, basics of Altitude Director Indicator (ADI) &Horizontal Situation Indicator. Air Data Instruments: Pneumatic type and air data computers, International Standard Atmosphere (ISA), combined pitot-static probe, separate static probe, air speed indicator, instantaneous vertical speed indicator.

Unit 4.
Flight Instruments and Navigation Instruments – Gyroscope - Accelerometers, Air speed Indicators – TAS, EAS- Mach Meters - Altimeters - Principles and operation - Study of various types of engine instruments - Tachometers - Temperature gauges - Pressure gauges - Operation and Principles.

Unit 5:
Directional Systems: Earths total magnetic field, horizontal and vertical components of total field direct reading compass and its limitations, fluxgate detector units. gyro stabilized direction indicating systems, Gyroscopic Flight Instruments: types of gyros-mechanical, ring laser gyros, fiber optic gyros and their limitations, basic mechanical gyro and its properties namely rigidity and precision, gyro horizon, direction indicator, turn and bank indicator.

Text Books:

1. Aircraft Instruments and Integrated Systems- EHJ Pallet, Longman Scientific & Technical, 1992.

Reference Books:

1. Aircraft Instrumentation and Systems -S. Nagabhushana& L.K. SudhaJK International
2. Aircraft Systems: Mechanical, electrical, and avionics subsystems integration – Ian Moir and Allan Seabridge, Third Edition, John Wiley & Sons, Ltd., 2008.

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Electronics & Instrumentation Engineering, VIII-Semester

Open Elective EI 803 (B) Standard Calibration

UNIT-I

Introduction to Measurement: Significance of measurement, Different methods of measurement, Classification of measuring instruments, Application of measurement systems, typical measurement schemes. Units and Standards: MKS, SI units of engineering parameters, Details of different standards-mass, length, time, frequency, temperature, EMF, ampere, sub standards and lab standards .

UNIT- II

Performance Characteristics: Definition of range, span, accuracy, precision, drift, sensitivity, reproducibility, repeatability, dead zone, resolution, hysteresis, threshold, zero error, noise, linearity, loading effect, static characteristics.

UNIT -III

Testing & Calibration of measurement setup: Dynamic Characteristics: Dynamic response; Transient response; speed of response, fidelity, measuring lag etc, Linear approximation, Introduction to compensation techniques. Significance of testing and calibration, Calibration curve, Standards for calibration, Different calibration procedures-primary, secondary, direct, indirect, routine calibration, Calibration setup:-pressure gauge, level etc. Calibration of Ammeter, Voltmeter and Wattmeter, Energy meter.

UNIT-IV

Analysis of Errors: Definition; Types of errors; Calculation methods of different errors; Gaussian curve; Precision Index; Variance; Standard deviation; Uncertainty in measurement, ChiSquare Test, Curve fitting methods. Galvanometers: D'Arsonaval Galvanometer—construction, Torque equation, Dynamic characteristic, Balastic Galvanometer—construction, working principle.

UNIT -V

Displays and Recorders: Indicating Instruments- Construction, Operating principle of spring control, gravity control and damping. Recorders- Working Principle of chart recorder, strip chart, circular chart, magnetic tape recorder, thermal recorders, printer. Electronic Display-LCD, LED, alphanumeric, storage Oscilloscope

Text Books:

1. B. C. Nakra., K. K. Chaudhry, ―Instrumentation, Measurement and Analysis‖, 4th Edition, McGraw Hill Education.
2. Albert D.Helfrick, William D.Cooper, ―Modern Electronic Instrumentation and Measurement Techniques‖, PHI India.

Reference Books:

1. E.O.Doebelin,Dhanesh N Manik, ―Measurement Systems‖,6th Edition, McGraw Hill Edu.
2. M.M.S.Anand, ―Electronic Instruments and Instrumentation Technology‖, PHI, 2005
3. A.K. Sawhney, PuneetSawhney – ―A course in Electrical and Electronic Measurements and Instrumentation‖.

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Electronics & Instrumentation Engineering, VIII-Semester

Open Elective EI 803 (C) Statistical Signal processing

Unit 1:

Review of random variables Distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Schwarz Inequality Orthogonalit principle in estimation, Central Limit theorem, Random processes, wide-sense stationary processes, autocorrelation and autocovariance functions, Spectral representation of random signals, Wiener Khinchin theorem Properties of power spectral density, Gaussian Process and White noise process. Random signal modelling: MA(q), AR(p) , ARMA(p,q) models.

Unit 2:

Parameter Estimation Theory Principle of estimation and applications, Properties of estimates, unbiased and consistent estimators, Minimum Variance Unbiased Estimates (MVUE), Cramer Rao bound, Efficient estimators; Criteria of estimation: the methods of maximum likelihood and its properties ; Baysean estimation : Mean square error and MMSE, Mean Absolute error, Hit and Miss cost function and MAP estimation.

Unit 3

Estimation of signal in presence of white Gaussian Noise Linear Minimum Mean-Square Error (LMMSE) Filtering: Wiener Hoff Equation, FIR Wiener filter, Causal IIR Wiener filter, Noncausal IIR Wiener filter, Linear Prediction of Signals, Forward and Backward Predictions, Levinson Durbin Algorithm, Lattice filter realization of prediction error filters.

Unit 4

Adaptive Filtering: Principle and Application, Steepest Descent Algorithm Convergence characteristics; LMS algorithm, convergence, excess mean square error, Leaky LMS algorithm;Application of Adaptive filters ;RLS algorithm, derivation, Matrix inversion Lemma, Intialization, tracking of nonstationarity.

Unit 5:

Kalman filtering: State-space model and the optimal state estimation problem, discrete Kalman filter, continuous-time Kalman filter, extended Kalman filter.

Spectral analysis: Estimated autocorrelation function, periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Blackman and Tukey method of smoothing periodogram, Prametric method, AR(p) spectral estimation and detection of Harmonic signals, MUSIC algorithm.

TEXT BOOKS:

1.Discrete Random Signals and Statistical Signal Processing, By Charles W. Therrien, Prentice Hall Signal Processing Series

REFERENCE TEXT BOOK:

1.M. H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley & Sons, Inc., 2.D.G. Manolakis, V.K. Ingle and S.M. Kogon: Statistical and Adaptive Signal Processing, McGraw Hill, 2000. 3.Monson H. Hayes, 'Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc, Singapore, 2002 4.J. G. Proakis et. al., Algorithms for Statistical Signal Processing, Pearson Education, 2002. 5.Simon Haykin: Adaptive Filter Theory, Prentice Hall, 1996.