CS302    THEORY OF COMPUTATION    3-0-0-6

Pre-requisites : CS203, CS301

Syllabus : Formal Logic: proof systems for propositional and first-order logic; consistency; completeness; compactness. Computability: primitive recursive functions; Godelization; Church's thesis. Review of models of computations, time and space bounded computations. Classes P, NP, polynomial reducibilities, NP-completeness.

Texts :  

References :  

CS346     COMPILERS     3-0-0-6

Pre-requisites : CS201, CS301

Syllabus : Overview of different phases of a compiler : front-end; back-end. Lexical analysis: finite automata; DFA construction and minimization; automatic tools. Syntax analysis: context free grammars; top down and bottom up parsing techniques; construction of efficient parsers; syntax-directed translation; automatic tools. Semantic analysis: declaration processing; type checking; symbol tables; error recovery. Intermediate code generation: run-time environments; translation of language constructs. Code generation: Flow-graphs; register allocation; code-generation algorithms. Introduction to code optimization techniques.

Texts :  
References:


CS347 COMPILERS LABORATORY 0-0-3-3

Pre-requisites: CS202

Syllabus: Programming assignments to build a compiler for a subset of a C-like programming language, using tools such as Lex and Yacc.

CS348 COMPUTER NETWORKS 3-0-2-8

Pre-requisites: CS201, CS343


Texts:

References:


CS362 COMPUTER GRAPHICS 3-0-2-8

Pre-requisites: CS204

Syllabus: Introduction: organization of an interactive graphics system. Scan conversion, filling, clipping, antialiasing, geometrical transformations, viewing, hidden line and hidden surface removal, representation of curves and surfaces, solid modeling, illumination and shading. Graphical user interfaces and Interactive input methods.

The laboratory work will involve programming with standard graphics libraries like OpenGL.

Texts:

References:

### Programme: B.Tech. in Electrical Engineering (Semester VI)

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**Total L-T-P-C**: 15-0-10-40

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**EE 304 Design Laboratory**

A student has to do an electronic hardware mini-project in broad areas like communication, electronic systems design, control and instrumentation, computer, power systems and signal processing. The project involves laying down the specifications, design, prototyping and testing. The project must have major hardware modules involving active discrete components and integrated circuits.

**Text/References:**

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**EE 321 DSP Laboratory**

Familiarisation of DSP development environments, basic experiments on signal addition, multiplication, vector operations; sampling and quantization; periodic waveform generation; pseudo-random sequence and white noise generation; correlation and convolution; design and implementation of finite impulse response (FIR) and infinite impulse response (IIR) filters. Real-time filtering of signals like speech/audio/biomedical, implementation of basic digital modulation schemes.

The experiments are to be done on ADSP 21XX/TMS320C6XXX DSP Trainer Kit.

**Texts/References:**
1. ADSP 21XX Family User’s Manual ([www.analog.com](http://www.analog.com)).
EE 340      Electromagnetic Theory      3-0-0-6


Texts:


References:


EE 351      Advanced Control Systems      3-0-0-6

Frequency response design: Design of lag, lead, lag-lead and PID controllers, the Nyquist criterion, analysis and design, relative stability and the Bode diagram, closed-loop response, sensitivity, time delays; Root locus design: construction of root loci, phase-lead and phase-lag design, PID controller design; Modern design: controllability and observability, state feedback with integral control, reduced order observer; Optimal control design: Solution-time criterion, Control-area criterion, Performance indices, Zero steady state step error systems; Modern control performance index: Quadratic performance index, Ricatti equation; Digital controllers: Use of z-transform for closed loop transient response, stability analysis using bilinear transform and Jury method, deadbeat control, Digital control design using state feedback; On-line identification and control: On-line estimation of model and controller parameters.
EE 322 Mathematical Methods in Electrical Engineering 3-0-0-6

Topics in matrix theory: Elementary canonical forms: digitalisation, triangulation, primary and secondary decompositions, Jordan canonical forms and applications. Introduction to optimization theory: The optimization problem and illustrative examples; necessary and sufficient conditions for optima; convex sets, convex functions, optima of convex functions; constrained minimization- linear and non-linear constraints, equality and inequality constraints, optimality conditions, Karush Kuhn Tucker optimality conditions; unconstrained optimization- steepest descent, Newton and quasi Newton methods, conjugate direction methods. Calculus of variation- The method of variations in problems with fixed boundaries, Variation of a functional, Euler’s equation, functionals involving derivatives of higher order, optimal control as a problem of variational calculus.

Texts/References:


EE 360 Embedded Systems 3-0-0-6

Introduction: Introduction to embedded systems with examples, embedded system design & modeling with unified markup language (UML). ARM processor fundamentals: Introduction to microprocessors and microcontrollers, 8-bit and 16-bit, von Neumann and Harvard architectures, CISC and RISC architectures, open source core (LEOX), ARM versions, ARM instruction set: programming model, assembly language, Thumb instruction set, memory organization, data operations and flow control. CPUs: Input/output mechanisms, isolated and memory mapped IO; interrupts and real time operations, ARM interrupts vectors, priorities and latency; supervisor modes, exceptions, traps, co-processors; cache memory and memory management. Embedded Platforms: CPUs: bus protocols, system bus configuration, USB and SPI buses, DMA, ARM bus; memory devices: memory device configuration, ROM, RAM, DRAM; I/O devices: timers, counters, ADC & DAC, keyboards, displays and touch screens. Processes and Operating Systems: multiple tasks and multiple processes; process abstraction; context switching: cooperative multitasking, preemptive multitasking, process and object-oriented design; operating systems and RTOS; scheduling policies; inter-process communication. Networks: distributed embedded architectures: networks abstractions, hardware and software architectures; networks for embedded systems:I2C bus, CAN bus; examples. Case studies: Inkjet printer, telephone exchange, etc.

Texts:


References:


EE 361 Embedded Systems Laboratory 0-0-3-3

Familiarization with ARM microcontroller development environment, assembler, compiler, simulator, debugger and JTAG; Experiments on simple I/O, registers and memory usage; Experiments on waveform generation, switch based I/O, polled and interrupt I/O, finite state machine for embedded systems (switch debounce filter, elevator, sequence detector etc.). Experiments are to be performed on ARM microcontroller kit.

Text/References:

Programme: B.Tech. in Mechanical Engineering (Semester VI)

### Sixth Semester

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Total L-T-P-C: 16-4-6-46

### ME-306 Manufacturing Technology-II (3 1 0 8)

**Pre-requisites:** Nil

Metal Cutting: mechanics, tools (material, temperature, wear, and life considerations), geometry and chip formation, surface finish and machinability, optimization; Machine tool: generation and machining principles, Setting and Operations on machines: lathe, milling (including indexing), shaping, slotting, planing, drilling, boring, broaching, grinding (cylindrical, surface, centreless), thread rolling and gear cutting machines; Tooling: jigs and fixtures, principles of location and clamping; Batch production: capstan and turret lathes; CNC machines; Finishing: microfinishing (honing, lapping, superfinishing); Unconventional methods: electro-chemical, electro-discharge, ultrasonic, LASER, electron beam, water jet machining, Rapid prototyping and rapid tooling.

**Texts:**


### ME 307 Machine Design (3 1 0 8)

**Pre-requisites:** Nil

Design of Gears; Lubrication and Wear consideration in Design; Design and selection of Bearings: Hydrodynamic lubrication theory, Hydrostatic and Hydrodynamic bearings (e.g., journal), Rolling Element Bearings; Systems Approach to Design: Decision Making, Simulation of mechanical systems using CAD tools, Sensitivity analysis of design parameters, Value Analysis and Value Addition to designed components and systems; Exercises of mechanical systems design with examples; Overview of Optimization in Design; Reliability and Robust Design; Communicating the Design.

**Texts:**


**ME308    Dynamics of Machinery    (2 1 0 6)**

**Pre-requisites: Nil**

Static and dynamic force analysis; Flywheel; inertia forces and their balancing for rotating and reciprocating machines; Gyroscope and gyroscopic effects; Governors: types and applications; Cam dynamics: analysis of cam and follower, jump phenomenon; Vibrations of one degree of freedom systems; Free and Forced vibrations;

Transverse and torsional vibrations of two and three rotor systems; critical speeds; Vibration isolation and measurements; two-degree of freedom systems; Geared system; Introduction to Multidegree of Freedom System: normal mode vibration, coordinate coupling, forced harmonic vibration, vibration absorber (tuned, and centrifugal pendulum absorber), vibration damper; Properties of vibrating system, flexibility matrix, stiffness matrix, reciprocity theorem, eigenvalues and eigenvectors, orthogonal properties of eigenvectors, modal matrix, Rayleigh damping, Normal mode summation.

**Texts:**


**ME-309    Control Systems    (3 1 0 8)**

**Pre-requisites: Nil**

Feedback systems, mathematical modelling of physical systems; Laplace transforms, block diagrams, signal flow graphs, state-space models; Time domain analysis: performance specifications, steady state error, transient response of first and second order systems; Stability analysis: Routh-Hurwitz stability criterion, relative stability; proportional, integral, PI, PD, and PID controllers; Lead, lag, and lag-lead compensators; Root-locus method: analysis, design; Frequency response method: Bode
diagrams, Nyquist stability criterion, performance specifications, design; State-space methods: analysis, design; Physical realizations of controllers: hydraulic, pneumatic, and electronic controllers.

Texts:


**ME-311 Mechanical Engineering Laboratory – III (0 0 4 4)**

Theory of machines: Static and dynamic balancing (multi-plane) of rotary systems, gyroscope, governors, whirling of shafts, simple and compound pendulums, determination of moment of inertia using trifilar suspension, torsional vibration; Metrology: Use of various metrological tools like slip, angle gauge, feeler, taper, fillet, thread gauges, estimation of internal dimensions; CNC machine trainer, CNC coding; Turbomachinery: Centrifugal and positive displacement pumps, Pelton and propeller turbines.

**ME-322 Applied Thermodynamics – II (2 1 0 6)**

Pre-requisites: Nil


Texts:


Theories of Development: Classical, Modernization, World System, Dependency, Structure-Agency Integration, Colonial, and Third-World Perspectives

Themes and Perspectives: Rural Development, Gender and Development, Public Health, Sustainable Development, Action Research, (Mal)development- Anomie, Alienation, and Fragmented Identities, Urban Migration, Social Movements, Humanizing Development through Right-Based Approach (Right to Education, Information, Food, etc.)

Text and references: