PDPM

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, DESIGN & MANUFACTURING JABALPUR

Semester	Courses					
I	Math I Continuous Domain (NS101)	Physics I (NS102)	Fundamentals of Computing (IT101	Fundamentals of Electrical & Electronic (ES101)	Effective Communication (HS 101)	Engineering Literacy (ES102)
II	Math II Continuous & Discrete (NS103)	Physics II (NS104)	Engineering Graphics (DS101)	Data Structures & Algorithms (ES103)	Culture & Human Values (HS102)	IT Workshop (IT102)
III	Math III (NS205)	Engineering Drives and Devices (ES204)	Arts& Aesthetics (HS203)	Materials & Manufacturing Processes (MN201)	PC I (ME201, EC201, CS201	IT Workshop II (IT203)
IV	Open Elective I (ES 205)	Professional II (ME202 ,EC202, CS202	Professional III (ME203, EC203, CS203)	Professional IV (ME204, EC204, CS204)	Professional V (ME205, EC205, CS205	Professional Lab I (ME201,EC201,CS201)
V	Management Concepts & Techniques (MS302)	Professional II (ME202, EC202, CS202)	Professional VII/PE 0.1 (ME307, EC307, CS307)	Professional VII/PE 0.2 (ME308, EC308, CS308)	Engineering Design (DS 302)	Professional Lab II (ME302,EC302,CS302)
VI	Open Elective II (ES 306)	Professional VI (ME306, EC306, CS306	Professional Elect I (ME309, EC309, CS309)	Professional Elect II (ME310,EC310 ,CS310	Fabrication project (MN302)	Professional Lab III (ME303,EC303,CS303)
VII	PR401: PROJECT BASED INTERNSHIP + NP: PROFESSIONAL ONLINE COURSE (THROUGH NPTeL)					
VIII	Professional Elect III (ME411, EC411, CS411)	Professional Elect IV (ME412,EC412,CS412	Professional Elect V (ME413,EC413,CS413	Open Elective IV(HS 404)		Professional Lab IV (ME404L ,EC404L, CS404L)

Semester I (24 Hours/week) **Credits: 22**

NS 101 Mathematics for Continuous Domain (3 L + 1T)	4
NS 102 Physics I (2L + 1T + 2P)	4
IT 101 Fundamentals of Computing (2L + 3P)	4
ES 101 Fundamentals of Electrical & Electronics (3L + 2/3T +2x2/3P)	5
(A slot of 2 hours of Tutorial in week 1 to be followed by 2 weeks of lab of 2 hours per week)	
HS 101 Effective Communication (2L + 1T)	3
ES 102 Engineering Literacy (3P)	2

Semester II (24 Hrs/week) **Credits: 22**

NS 103 Mathematics for Continuous & Discrete Domain (3L +1T)	4
NS 104 Physics II (3L + 1T)	4
DS 101 Engineering Graphics (2L + 3P)	4
ES 103 Data Structures and Algorithms (3L + 2P)	5
HS 102 Culture & Human Values (2L + 1GD)	3
IT 102 IT Workshop I (3P) (Matlab 6 turns + SolidWorks 6 turns)	2

Semester III (24 Hrs/week) **Credits: 23**

NS 205 Mathematics for Discrete Domain / Mathematics III (3L + 1T)	4
ES 204 Engineering Drives and Devices (2L + 2P)	4
HS 203 Arts and Aesthetics (2L + 2P)	4
MN 201 Materials & Manufacturing Processes (3L + 3P)	5
Professional Course I: (3L + 1T)	4
ME 201 Thermodynamics [ME]	4
EC 201 Digital Electronics & Microprocessor Technology [ECE, CSE]	4
IT 203 IT Workshop II (3P)	2

a. OOPs with Java OR
b. (Matlab 6 turns + LabView 6 turns)) OR
c. (CATIA 6 turns + ADAMS or LabView 6 turns)

Semester IV (22 / 23 Hrs/wee k) **Credits: 22**

Open Elective I (3L OR 2L+2P) (Engineering Science) **4**

ES 205 a Applied Probability & Statistics /b Numerical Methods for engineers /c Data Communication/ f. Computer Graphics

Professional Course II: (3L+1T) 4

- ME 202 Solid Mechanics
- EC 202 Electronic Devices & Circuit (EDC)
- CS 202 Computer System Organization and Architecture (CSOA)

Professional Course III: (3L+1T) 4

- ME 203 Kinematics and Dynamics of Machines
- EC 203 Signals System & Network
- CS 203 Database Design and Management

Professional Course IV: (3L+1T) 4

- ME 204 Manufacturing Technology
- EC 204 Instrumentation & Measurement
- CS 204 Operating Systems

Professional Course V: (3L+1T) 4

ME 205 Fluid Mechanics and Heat Transfer
EC 205 Control Systems
CS 205 Language Theory

Professional Lab I(3P) 2

ME 201L Professional (ME) Lab I (3P)
EC 201L Professional (EC) Lab I (3P)
CS 201L Professional (CSE) Lab I (3P)

Semester V (21 Hours/weak) **Credits: 23**

MS 301 Management: Concepts and Techniques (3L) 4
DS 302 Engineering Design (2L + 4P) 5

Professional Course VI: (3L) 4

ME 306 Design of Mechanical Components
EC 306 Principle of Communication (3L)
CS 306 Design and Analysis of Algorithms

Professional Course VII/ Prof Elective0.1: (3L) 4

ME 307 a. Computer Aided Design, b. Computational Fluid Dynamic
c. IC Engines d. NC Machine Tools
EC 307 Fundamentals of Electromagnetic Theory(3L)
CS 307 Computer Network

Professional Course VIII/ Prof Elective0.2: (3L**)** 4

ME 307 a. Computer Aided Design, b. Computational Fluid Dynamic
c. IC Engines d. NC Machine Tools
EC 308 a. Linear Integrated Circuits, b. Digital Signal Processing
CS 308 Software Engineering

Professional Lab II (3P) 4

ME 202 L Professional (ME) Lab II (3P)
EC 202 L Professional (EC) Lab II (3P)
CS 202 L Professional (CSE) Lab II (3P)

Semester VI (21 Hours/week) **Credits: 22**

Open Elective II (3L OR 2L+2P) (Engineering Science) 4

ES 306 **a**. Mechatronics and Robotics;/b. Sensing Methods and Devices;/
c. Computer Graphics and Visualization;/d. Instrumentation and Measurements;/
e. Control Systems; /f. Signals, Systems and Networks/…

Open Elective III (3L) (Management Stream) 4

MS302 a. Systems Management/ b. Marketing Management/ c. Human Resource Management/
d. Business Models for Manufacturing/ e. Industrial Relations/ f. Operations Management/….

Professional Elective I: (3L) 4

ME 309 a. Finite Element Methods, b. Vibrations of Mechanical Systems
c. Computer Integrated Manufacturing, d. Advanced Heat Transfer
e. Advanced Manufacturing Processes and Technologies

EC 309 a**.** Analog IC Design, b**.** Antenna Theory and Design

CS 309 a. Microprocessors, b. Data Mining
c. Compiler Design, d. Computer Graphics

Professional Elective II: (3L**)** 4

ME 309 a. Finite Element Methods, b. Vibrations of Mechanical Systems
c. Computer Integrated Manufacturing, d. Advanced Heat Transfer
e. Advanced Manufacturing Processes and Technologies

EC 310 a. VLSI- IC Design, b. Image Processing

CS 310 a. Advanced Computer Architecture, b. Artificial Intelligence
c. Mobile Communication d. Object-Oriented Software Engineering

MN 302 Fabrication Project (6P) 4

Professional Lab III(3P) 2
ME 303L Professional (ME) Lab III (3P)
EC 303L Professional (EC) Lab III (3P)
CS 303L Professional (CSE) Lab III (3P)

Semester VII **Credits: 18**

PR 401 Project Semester 16
(25 weeks duration – starting from preceding summer vacations – to be carried out in reputed organization OR Research Laboratory OR Institute of repute) (The organization where the internship is to be carried out has to be approved by the Internship Board)

*NP Professional Online Course I: (Through NPTeL) S/X 2
(The students have to do one course on-line through NPTeL from the list of courses approved by Senate. The course will be a self-learning / reading course but the students have to appear in one examination at the end of the semester on the dates announced by Academic Office)

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*** NPTEL: The code will be 5 characters long.**
The first two characters will be NP representing NPTEL Course,
Third and Fourth characters will stand for discipline
01-20: CSE,
21-40: ECE,
41-60: ME,
61-80: DES
81-90 Natural Science including material science, micro and nano science
91 to 99: open to other disciplines (cross discipline), (80 series is reserved for Humanities)
Fifth and the last digit will represent the course series
a to z are series in a particular area (For example: different courses on Networking may be offered with series a, b, c,….so on)
CSE:NP 1-5 (Group), NP 6-10 (Group), NP 11-15 (Group), NP 16-20 (Group)
ECE: NP 21-25 (Control Group), NP 26-30 (Image Proc. Group), NP 31-35 (Communication Group)
NP 36-40 (VLSI Group)
ME: NP41-45: Design Group, NP46-50: Manufacturing Group, NP51-55: Thermal Group, NP56-60: Other Specialized (including Mechatronics) Group

NP01a	INTERNET TECHNOLOGY	2
NP01b	INFORMATION THEORY AND CODING	2
NP01c	PRINCIPLE OF PROGRAMMING LANGUAGES	2
NP01d	INTRODUCTION TO PROBLEM SOLVING & PROGRAMMING	2
NP06a	MICROCONTROLLER AND MICROPROCESSOR	2
NP21a	Digital Control system	2
NP26a	IMAGE PROCESSING	2
NP27a	MULTIRATE SIGNAL PROCESSING	2
NP31a	WIRELESS COMMUNICATION	2
NP31b	COMMUNICATION NETWORK	2
NP36a	CMOS VLSI Design	2
NP36b	MEMS and Microsystems	2
NP41a	MATERIAL SELECTION AND DESIGN	2
NP42a	MECHANICAL MEASUREMENTS AND METROLOGY	2
NP46a	REFRIGERATION AND AIR CONDITIONING	2
NP56a	ROBOTICS	2

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Semester VIII (12 Hrs/week) **Credits: 18**

Professional Elective III: (3L) 4

ME 311 a. Automobile Engineering, b. Micro-Electromechanical Systems
c. Design of Mechanical Systems d. Rapid Product Development Technologies
d. Fracture and Fatigue e. Energy Conversion Devices
f. Computer Aided Geometric Design

EC 311 a. RF & Microwave Engineering b. Power Electronics
CS 311 a. Advanced Computer Networks b. Programming Language Design c. Real Time Systems
d. Natural Language Processing e. Empirical Software Engineering

Professional Elective IV: (3L) 4

ME 311 a. Automobile Engineering, b. Micro-Electromechanical Systems
c. Design of Mechanical Systems d. Rapid Product Development Technologies

d. Fracture and Fatigue e. Energy Conversion Devices
f. Computer Aided Geometric Design

EC 312 **a.** Digital Communications, b**.** Advanced Semiconductor Devices & Application

CS 312 a. Advance Microprocessors, b. Machine Learning, c. Network Security
d. Distributed and Fault Tolerant Systems, e. Image Processing
f. Computational Geometry

Professional Elective V: (3L) 4

ME 311 a. Automobile Engineering, b. Micro-Electromechanical Systems
c. Design of Mechanical Systems d. Rapid Product Development Technologies
d. Fracture and Fatigue e. Energy Conversion Devices
f. Computer Aided Geometric Design

EC 313 a. Pattern Recognition, b. Optical & Wireless Communication
c. Microcontroller & Embedded Systems

CS 313 a. Embedded Systems, b. Pattern Recognition, c. Wireless Communication
d. Software Testing and Validation, e. Open-Source Software Development
f. Advanced Algorithms

Open Elective IV (3L) (Humanities & Social Sciences) 4

HS 404 a. Professional Ethics / b. Engineering Economics / c. Industrial Psychology/
d. Industrial Sociology/…

Professional Lab IV (3P) 2
ME 404L Professional (ME) Lab IV (3P)
EC 404L Professional (EC) Lab IV(3P)
CS 404L Professional (CSE) Lab IV (3P)

Total Credits: 170

Course Detail

Natural Science(NS)

NS 101 Mathematics for Continuous Domain I

1. Calculus of Functions of One Variable: Real Numbers, Functions, Sequences, Limit and Continuity, Differentiation : Review, Successive differentiation, Chain rule and Libnitz Theorem, Rolle's and Mean Value Theorems, Maxima/ Minima, Curve sketching, Linear and Quadratic approximations, Error estimates, Taylor's Theorem, Newton and Picard Methods, The Riemann Integral, Approximate Integration, Natural Logarithm, Exponential function, Relative growth rates, L'Hospital's rule, Geometric applications of Integrals, Infinite series, Tests of convergence, Absolute and Conditional convergence, Taylor and Maclaurin series.

2. Calculus of Functions of Several Variables: Scalar fields, Limit and Continuity, Partial derivatives, Chain rules, Implicit differentiation, Web gradient, Directional derivatives, Total differential, Tangent planes and Normals, Maxima, Minima and Saddle points, Constrained maxima and minima, Double Integrals, Applications to areas and volumes, Change of variables.

3. Vector Calculus: Vector fields, Divergence and Curl, Line Integrals, Green's Theorem, Surface Integrals, Divergence Theorem, Stoke's Theorem and applications.
Evaluvation Schedules

NS 102 Engineering Physics I

Coordinate systems, elements of vector algebra in plane polar, cylindrical, spherical polar coordinate systems; frames of references, relative velocity and accelerations; Newton's law and applications (to include friction, constraint equations, rough pulleys), line integrals, gradient, curl, conservative forces, potential, work-energy theorems, energy diagrams; Conservation of linear momentum and collisions, variable mass problem; Central forces, gravitation; motion in non-inertial frames, centrifugal and Coriolis forces; Conservation of angular momentum and elementary rigid body dynamics; Special theory of relativity.

NS 103 Mathematics for Continuous & Discrete Domain

Linear Algebra: Review of Matrices Algebra, Solution of Matrices Equation, Row reduced Echelon form, Determinant, Kramer's rule, Vector spaces, subspaces, basis, Orthogonal basis, Gram-Schmidt orthogonalization, Linear Operators, Matrix representation, Rank, Solution of Linear equations using matrices (invertibility, null space etc.), Eigenvalues, eigenvectors, diagonalisability, Symmetric systems, Positive definite.

Complex Analysis: Review of complex numbers and operations, Functions of a Complex Variable, Analytical functions, Cauchy-Reimann equations, Elementary functions, Confonnal mapping, Contour integrals, Cauchy's Theorem, Residue Theorem, Power series, Taylor and Laurent series, zeros, poles, essential singularities, evaluation of integrals.

NS 104 Physics II

Part A:
Electrostatic: Coulomb's Law, Electric field & electrostatic potential, Work and Energy in electrostatic field, Gauss law & its applications, Curl of E, Laplace's and Poisson's equations, Dipoles & multipoles, Force and torque on dipoles, Polarization, Bound charges & electric displacement.

Magnetostatics: Electric Current, Magnetic field & Current density, Ampere's law & its applications, Biot-Savart law, Curl and divergence of B, Magnetic dipoles, Magnetization, Magnetic susceptibility, Ferro-, para- and dia- magnetism, Faraday's law, Energy in magnetic field.

Electrodynamics: Lorentz force, Maxwell's equations. Poynting theorem, Electromagnetic potentials, Electromagnetic (EM) waves & their propagation in different media.

Part B:
Introduction to quantum mechanics, Planck's theory, Thermal radiation (Black bodies, Stefen Boltzmann etc), Photoelectric effect, Compton effect, Dual nature of EM radiation, matter waves, de Broglie waves, wave-particle duality, Uncertainty principle, Heisenberg microscope, Properties of matter (phase and group velocity). Schrodinger equation, probabilistic interpretation of wave function, admissibility conditions for wave function. One dimensional problems: particle in a box, potential well, potential barrier and quantum tunneling. Periodic potential in one dimension.

Text Books:
1. INTRODUCTION TO ELECTRODYNAMICS: D.J. GRIFFITHS
2. QUANTUM PHYSICS: EISBERG & RESNICK
3. CONCEPT OF MODERN PHYSICS: BEISER

NS 205 Mathematics for Continuous & Discrete Domains

Abstract Algebra: Introduction of Sets, Axioms of Set Theory, Operations, Functions, Relations, Algebraic structures, Group, Properties of Groups, Symmetric Group, Permutation, Subgroup, Cosets and Lagrange's Theorem, Homomorphism and Isomorphism of groups, Automorphism and Normal Subgroup, First and Second Isomorphism Theorem, Ring, Integral Domain, Field, Skew field, Ideal, Polynomial Ring, Ring homomorphism.
Graph Theory: Introduction of Graph, Bipartite Graph, Tree and Spanning Tree, Matrices representations of Graph, Adjacency Matrix, Incidence Matrix, and Isomorphism of Graphs.
Recurrence Relations: Linear Recurrence relations with constant coefficients, Backward Tracking and Forward Chaining Method, Non- Homogeneous Recurrence Relations, Homogeneous Solutions, Particular Solutions, Generating Functions, Solutions by Generating Functions.

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Information Technology(IT)

IT 101 Fundamentals of Computing

Concept of Programming Languages, A quick overview of OS-Windows/Linux, Writing, compiling and running the program on Linux/Windows, The Compiler, Program Builder, Debugging: types of errors and debugging techniques, Problem solving aspects, Introduction to Algorithms and flow charts, Data structures in C, Variables, Variables names, I/O, The standard Input/Output file, Formatted inputs/Output, Expressions and Operators, connectors, control statements, Functions: Scope of Function variable, Modifying function arguments, Pointers, Array, String, Structures and Unions, file handling, File redirection, file pointers, advantages of using multi files, organization of data in each file, compiling multi-file programs, The Preprocessor, Library Functions and Low level programming.

IT 102 IT Workshop I

AutoCAD (4 turns):
Introduction to 3D Wireframe/Solid Modeling, Modeling of Primitive 3D Solids, Modeling of unique 3D Solids by Extrusion, Revolution, Sweeping and Lofting, 3D Operations and Solid Editing
Matlab (8 turns):
Basics: Mathematics, Data Analysis, Programming, Graphics, Creating GUI
Toolboxes - Curve Fitting: Data fitting, Preprocessing data, post processing data, Using library functions for Data fitting, Symbolic Math: Calculus, Linear Algebra, Simplifications, Solutions of Equations, Matlab Compiler: Programs involving control statements, data structure etc., User defined functions, Simulink: building a model, running a model, setting Simulink preferences

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Engineering Science(ES)

ES 101 Fundamentals of Electrical & Electronic

1. D.C. Circuits
Ohm's law, Kirchoff's laws, Nodal Analysis, Mesh Analysis, Superposition Theorem, Source Transformations, Thevnin's and Norton's Theorems, star/delta transformation, maximum power transfer theorem, transients.
2. A.C. Fundamentals
Single phase EMF generation, average and effective values of sinusoids, Solution of series and Parallel Circuits, power and power factor, Resonance in series and parallel circuits, steady state analysis for sinusoidal excitation: Sinusoids, Three phase connections: star and delta.
3. Magnetic Circuit
Mmf, Magnetising force, Magnetic flux and flux density, permeability, Reluctance and permeance, B-H curve, Simple magnetic circuits, Hysteresis and eddy current loss.
4. Transformer:
Single-phase transformer
Construction, principle of operation, emf equation, phasor diagram on no-load and full-load, losses and efficiency, open and short circuit test, auto transformer
5. D. C. Machines
D. C. Generator
Construction, emf equation, various types and characteristics
D. C. Motor
Principle, torque and speed formula, types and their characteristics, Speed control
6. Semiconductor Diode
Semiconductor Diode and its V-I characteristics, Rectifier circuit, Various types of diodes, zener diode, PiN Diode, Light emitting diode, gun diode
7. Semiconductor Bipolar Junction transistor: Working principle, Transistors in CC, CE, and CB configurations, transistor biasing, V-I characteristics and load line concept with Quiescent point, Transistor H parameter.

Textbooks:

1. Toro, Del V., Electrical Engineering Fundamentals, Printice Hall of India, 1994.
2. Millman, Jacob and Halkias, Christos C., Integrated Electronics: Analog and Digital Circuits and Systems, Mc Graw Hill, 2004
3. Boylestad, Robert L., and Nashelsky, Louis, Electronics Device and Circuit Theory, Ninth Edition, Printice Hall of India, 2005

ES102 Engineering literacy

E1. Sound Equipments working principle
E2. Incandescent Bulb / CFL / LED / energy meter calculation
E3. Testing of Earthing, concept of breadboard, polarity etc
E4. Fuse Specifications, Circuit Breakers, UPS, Surge Protector and Line Filter
E5. Automobile Features 4 stroke Petrol / Diesel Engine
E6. Automobile Transmission System
E7. Study of Mechanical Measurement Tools
E8. RC Aero-model Study
E9. Computer Connectors and Peripherals
E10. CPU, RAM, Motherboard and Motherboard connector
E11. SMPS, CD ROM, HDD
E12. Types of Batteries, specifications and applications

ES 103 Data Structures and Algorithms

Notion of Algorithm, Space and Time Complexity, Analyzing algorithms
Static & Dynamic Memory Management, Arrays, Stacks, Queues, Linked Lists
Trees, Binary Trees, Tree Traversals, Applications of Binary Trees
Graphs and their representations, Graph Traversal Algorithms, Minimum Spanning Tree, Shortest Paths
Searching Algorithms: Sequential Search, Binary Search
Sorting Algorithms: Quick sort, Merge sort, insertion sort, Selection sort, Heap & Heap sort
Binary Search Tree, Balanced Tree, AVL Tree
Files, Indexing: Hashing, Tree Indexing: B-tree
Basic Algorithm Design Paradigms: Divide & Conquer, Greedy method, Dynamic Programming, Back tracking, Branch and Bound [Discussion with the help of some example which are already discussed].

Text book: 1. Horowitz, Sahni, Fundamentals of Data Structures, Galgotia.
2. Cormen et al., Introduction to Algorithms, Second Edition, Printice Hall of India 2014.

References: 1. Fundamentals of Computer Algorithms by Ellis Horowitz, Sartaj Sartaj Sahni, Rajasekaran, Galgotia.
2. Data Structures Using C And C++, 2 Edition, Augenstein Moshe j., Tenenbaum Aaron M., Langsam Yedidyah, Publisher: Prentice-Hall(2009)
3. The C Programming language, Kernigham & Ritchie

ES 204 Engineering Drives and Devices

Introduction to Electrical/Electronic Drives: Induction Motor and Drive circuits for motor control (PWM control circuit/PWM regulator).
Display Devices, CRO and Various specifications and Measurements, LCD Display
Basic Electronic Devices, Special purpose diodes& applications, Zener Diode, LED, Photodiode. Bipolar semiconductor devices, BJT, Biasing of BJT, BJT as switch, Power transistor, SCR, UJT, Phototransistor, Opto-coupler working principle and application
Thermal & Electrical equivalent circuit analogy, Heat-sink design using thermal resistance

Vehicle Engineering:
Clutch: single plate, multi plate, cone clutch.
Gears: type of gears: spur and helical and applications.
Belt drive: types, power transmitted, creep.
Gear Train: velocity ratio, mechanical advantage, Gear Train: sliding mesh, constant mesh, synchromesh and epicyclic gear trains.
Automatic transmission system, universal joints, propeller shaft, differential. Steering system: steering linkages, steering mechanism, under and over steering.
Brakes: types and function, mechanical, hydraulic, vacuum, air and power brakes, brake shoes and lining materials.

Internal Combustion Engines: IC engine parts and their functions, 4-stroke engine basics, mechanical cycle working, CI vs SI engines, 2-stroke engine, working through mechanical cycle, Petrol vs Diesel as fuels of ICE. Compression ratio, Fuel injection system: evolution, spark plug, ignition system, Advanced fuel injection system like MPFI, etc.

HVAC: Working principle, purpose of refrigeration and air conditioning. Refrigerator Parts and their working. Laboratory

Experiment 1:Overview of CRO
Experiment 2: Diode Clipper and Clamper circuit
Experiment 3: Voltage regulator (Zener and Series Voltage regulator using power transistor)
Experiment 4: PWM based Motor control
Experiment 5: SCR/UJT Characteristics
Experiment 6: Photo diode Characteristics and Study of Opto-coupler & its application

ES 205a Applied Probability and Statistics

Probability Module: Basic Set Operations, Algebra and Sigma algebra, Measurable Space, Measure, Measurable Function, Probability Measure, Random Variable, Function of Random Variable, Probability Mass Function, Probability Density Function, Cumulative Probability Distribution Function, Independent Event, Expectation, Variance, Covariance, Correlation, Conditional Probability Measure, Law of Total Probability, Baye's Formula, Baye's Theorem, Function of Several Variables, Joint and Marginal Distribution Function, Moments, Moments Generating Function, Characteristic Function, Inversion Theorem, Uniqueness Theorem, Important Statistical Inequalities,
Mode of Convergence, Convergence in Law, Convergence in Measure, Convergence in rth Mean, Almost Sure Convergence, Weak Law of Large Numbers, Strong Law of Large Numbers, Center Limit Theorem.
Statistics Module: Estimation-Point Estimation, Properties of Estimation: Unbaisedness, Consistency, Sufficiency, Efficiency. Method of Estimation: Method of moments, Maximum Likelihood Estimation. Interval Estimation, Confidence Interval.
Inference-Testing of Hypothesis: Different type of Hypothesis, Acceptance Region, Critical Region, Test function, Type-I and Type-II Errors, Level of Significance, Power of the Test, Uniformly Most Powerful Test ,Neyman-Person's Lemma.
Exact Sampling Distribution-
Chi-Square Distribution, Chi-Square test for goodness of fit,Student's t− Distribution, t−test for single mean, t−test for difference of means, Paired t−test for difference of means, F-distribution, F−test for equality of population variance.

ES 205b Numerical Methods for Engineers

Approximation and round off errors, interpolation by polynomials, the solution of nonlinear equations and iterative methods, systems of equations and unconstrained optimization, data fitting and least squares approximation. Backward, Forward and Central difference relations and their uses in Numerical differentiation and integration. Numerical solution of differential equations by Euler, Modified Euler, Runge-Kutta and Predictor-Corrector methods. Stability of numerical methods.

ES 205c Data Communication

1. Overview Of Data Communications
Data and Signals, Data representation, Line coding, Signal encoding
• Data transmission
• Analog Transmission
• Digital Transmission
o Parallel and Serial Transmission
o Asynchrony and Synchronous Transmission
o Simplex, half duplex andfull duplex
• RS232
• DTE, DCE
• Null Modem
2. Multiplexing and Switching
• TDM, FDM, WDM
• Bandwidth Utilization: Multiplexing and Spreading

• Cct. Switching &packet Switching
3. Modulation Techniques
• A to D & D to A
• Modems
• Using Telephone and Cable Networksfor Data Transmission
• PSTN, Dialup & FAX working
• ISDN&ATM
4. Brief of OSI Model
5. Error Detection and Correction
• Parity checking
• Cheksum error detection
• CRC
• Block parity
• Hamming code
6. Encryption and Compression basics
7. Information Theory Coding
• Information Measures, Review probability theory, Random variables, Processes, Mutual Information, Entropy, Uncertainty, Shannon's theorem, redundancy, Huffman Coding, Discrete random Variable. Gaussian random variables, Bounds, Linear block codes, cyclic codes, BCH codes, Reed-Solomon codes, Space time codes, concatenated codes, turbo coding and LDPC codes.

ES 205f Computer Graphics:

The objective of the course is to introduce computer graphics hardware, algorithms, and software; and development of practical skills using graphics libraries and tools.
Conceptual Framework of an Interactive Graphical Simulation System, Graphics Architectures, The fundamentals of input, display, and hardcopy devices. Scan conversion of basic geometric primitives, Filling Algorithms, Character Generation, and antialiasing techniques.
2D and 3D Geometrical Transformations, Viewing Transformations, Windowing and 2D line and polygon clipping. Graphical User Interfaces, Interactive Input Methods, Texture generation and Rendering, Basic Modelling concepts through curves and surfaces, Visual Realism, Algorithms for Visible Surface Determination, Illumination Models, Shading models, Color Models. Introduction to Animation. The course would include programming practices using C/C++ and standard graphics libraries like OpenGL.

Text Book:

Hearn, Donald and Baker, Pauline M., "Computer Graphics", Pearson Education.

References:

1. Hill, F.S., Jr., "Computer Graphics Using OpenGL", Second Edition, PHI
2. Foley, James J., Van Dam, Andries, Feiner, Steven K., Hughes, John F., "Computer Graphics, Principles and Practice", Pearson Education.
3. Wright, Richard S and Sweet, Michael, "OpcnGL Super Bible", Techmedia, ew Delhi

ES 306a Mechatronics & Robotics

Introduction **:** Definition of Mechatronics, Mechatronics in design and manufacturing. Comparison between Traditional and Mechatronics approach. Integration of electronics, controls and information technology with mechanical engineering.

Sensors and Actuators for Mechanical Systems: Basic principles, characteristics and selection issues for data conversion devices, sensors, transducers, actuators used in mechatronic systems. Microprocessors and controllers. Drives: Stepper motors, DC/AC servos, solenoids, Mechanical, hydraulic and pneumatic actuators. Piezoelectric sensors and actuators, Shape memory alloys. Design and fabrication of Mechatronics systems.

Signal Processing: Integration of actuators and sensors in digital systems, DSP controllers, embedded controllers, and fuzzy logic controllers.

Programmable Logic Controllers: Hardware components and Programming of PLCs. Applications.

Robotics: Fundamentals of robotics, definition and classification of ROBOTS and manipulators, motion and degrees of freedom, motion categories, uses, field of applications, Robot Arm Kinematics: Direct and Inverse, Robot arm dynamics, Manipulator trajectories, control of robot manipulators. Introduction to sensing and vision in robotics.

ES 306c Computer Graphics and Visualization

Conceptual Framework of an Interactive Graphical Simulation System, Graphics Hardware: Display devices, input devices, Display technologies, Basic raster graphics algorithms for drawing 2D primitives; 2D and 3D Geometrical Transformations: scaling, translation, rotation, reflection, Viewing Transformations: parallel and perspective projection, Windowing and 2D/3D clipping: line clipping, Polygon clipping, Hiddenline /surface removal methods, A brief idea about Illuminations model, shading: Gouraud, Phong, Basic modelling concepts through curves and surfaces, Fundamentals of visualization.

ES 306d Instrumentation and Measurement

Basic terminologies (range, span, settling time dead zone, input impedance),
Static and Dynamic characteristics, 1st order and second order instruments with step, ramp and sinusoidal input! output characteristics. Strain gauge,derivation of gauge factor, strain gauge rosette, unbalanced wheatstone bridge, different types of load cells and their frequency response, and its date transmission. LVDT, phase compensation, phase sensitive demodulation, thermistor and it~ linearization, RTD, its construction, three wire and four wire method Muller bridge
Thermocouple, their relative comparison, cold junction compensation using AD590, grounder thermocouple, potentiometer as displacement sensor, Capacitance as displacement and leve transducer, push pull arrangement, Pressure transducer [Bourdon gauge, diaphragm gauge (metal anr semiconductor) etc], all vacuum gauges, photo electric transducer and its application, Liquid in glas thermometer, pressure spring thermometer, venturimeter, Orifice meter, pitot tube, Rotameter, Wei1 electromagnetic flowmeter, Hot wire anemometer, its phase compensation and expression 0 volumetric flow rate or velocity in each case, Variable reluctance displacement sensor tachogenerator, turbine flowmeter. Measurement of viscosity, conductivity and pH of a liquic Flapper nozzle system and Control Valves.

ES-306: Time Frequency Analysis

Theory: Basics of Fourier Analysis, Spectral Theory, Fundamentals of Time Frequency Analysis, Instantaneous Frequency and the Complex Signal, Uncertainty Principle, The eed for Time-Frequency Analysis, Gabor Transform, The Short-Time Fourier Transform/Spectrogram, Time-Frequency Localization, Continuous Wavelet Transform/Scalogram, Multiresolution Analysis, Quadratic Time Frequency Transform, Wigner- Ville Distribution, Signal Processing Applications.
Practical: Basic of MATLAB, Implementation of discrete signal, DSP mathematical problem solving by using MATLAB, Frequency domain analysis, Time frequency algorithm implementation, basic filter designing.

Text Book:

1. S. Mall at, A Wavelet Tour of Signal Processing (3rd edition), Academic Press, 2008, ISBN: 978-0123743701.
2. Leon Cohen, Time-Frequency Analysis, Prentice Hall; 1994, ISBN: 978-0135945322.
3. B. Boashash, Time-Frequency Signal Analysis and Processing: A Comprehensive Reference, Elsevier Science, 2003, ISBN-13: 978-0080443355.
4. R. M. Rao and A. S. Bopardikar, Wavelet Transforms: Introduction to Theory& Applications, Prentice Hall, 1998, ISBN-13: 978-020163463

Reference:
IEEE International Symposium on Time-Frequency and Tirne-ScaleAnaiysis,
(Pub!. TH4788 or ISBN 0-7803-0805-0)

ES 306e Control Systems

Basic concepts and system representation: Terminology and basic structure-feedback control theory-multivariable systems,Modeling of physical systems, time-domain, frequency-domain and state-variable models; block diagram, signal flow graph and Mason's gain formula; time and frequency response of first and second order systems; control system characteristics: stability, sensitivity, disturbance rejection and steady-state accuracy; stability analysis: Routh-Hurwitz test, relative stability, root locus, Bode and Nyquist plots; Concepts of state variables and state model – state models for linear continuous – time systems – Solution of state equations – Concepts of controllability and observability, Pole placement by State Feedback, The z-transform and Inverse z-transform, Pulse Transfer Function, z- and s-domain Relationship, Stability.

Back

Humanities & Social Sciences(HS)

HS 101 Effective Communication

General Introduction: Why English?; The purpose of communication; Communication through body language, listening, speaking, reading and writing; Phonetics: Air speech mechanism; Classification of vowel sounds; Classification of consonant sounds; Accent, Pronunciation, Intonation; Problems of Tense; Use of Verbs; Proverbs and Idioms; Vocabulary, Technical Vocabulary; Punctuation; Comprehension; Expansion; Definition, Scope and Significance of technical writing; Features of technical style; Mechanics of technical writing: Equation, Abbreviation, Numerals, Figures, Charts, Tables, and Graphs etc. Report writing, Essentials of technical report writing; Non-formal reports and its format; Formal reports and its format; Different kinds of reports: Progress Report, Feasibility Report, and Trouble Report; Committee Report.; Annual Report; Business Correspondence - Introduction; Elements of a good letter; Format of a letter; Letter of Enquiry; Letter for placing orders; Letter of complaint and its Reply; New Trends in Business Communication; Job Application; Preparation of Curriculum Vitae/Resume; Preparation of Notices, Agenda, Minutes; Tender Notices; Interviews; Essentials of Group Discussions; Presentation.

HS102 Culture & Human Values

The syllabus comprises of excerpts from the writings of great masters like Swami Vivekananda, Mahatma Gandhi, Chanakya, Rabindranath Tagore, Dr. S. Radhakrishnan, H.E. Dr. APJ Kalam, Carl Sagan, Gurunanak Dev, Wordsworth, O. Henry, Maupassant and many others. The wisdom of the philosophical texts would be brought to them through the Reading Material prepared specifically for the students. It is expected that their English communication and general awareness would improve through this discursive and interactive method.

HS 203 Arts & Aesthetics

Principles of Analysis of Art; Art and perception; what is style; Style in Painting; Colour; Psychology of Color, Perception & Design; Space Illusion; Painting; Sculpture; Style in Sculpture; Architecture; Style in Architecture; Space in Architecture; Printmaking; Photography & Film; POP Art - Comics, Advertisements etc; Performing Art, Photography & Film; Art in Design; Methodology of Criticism & Appreciation.
Studio Assignments: To familiarize students with various 2-D & 3-D media works. 2-D Exercises to familiarize 2-D Space Concept, Color, texture, form, composition in pencil drawing & sketches& oil pastel, Collage, Graffito, Printmaking- to familiarize with basic printmaking techniques rubbing, stencil, mixed media, screen printing, 3-D Exercises: to familiarize 3-D space concept, solid geometry forms, Sculpture.

Back

Design(DS)

DS 101 Engineering Graphics

Lines, Lettering, Sketching, Principle of Dimensioning, Orthographic Projection: Projection of Points, Lines, Planes, Auxiliary Views, Projection of Solids, Sections of Solids, Intersections of solids and development of lateral surfaces of simple solids, Isometric Projections, Oblique and Perspective Projection.

DS302 Engineering Design

1. Introduction to Engineering Design - Importance of Design, Design Philosophy, History of Design, Design Paradigm, the Design Process, Good Design, Engineering Analysis, Design phases, Product and Process Cycle.
2. Need Identification and Problem Definition - Identifying customer needs, Benchmarking, Quality Function Deployment, Engineering Design Specification
3. Concept Design - Creativity and Problem Solving, Functional requirements, Product Component Decomposition, Product Function Decomposition, Conceptual Decomposition, Generating Design Concepts, Product Form and Geometry, Product Aesthetics, Evaluating alternative Concepts, Theory of Inventive Problem Solving, Axiomatic Design, Concept Evaluation Methods, Decision Making.
4. Embodiment Design - Introduction, Product Architecture, Configuration Design, Parametric Design, Best Practices, Industrial Design, Human Factors Design, Design For X (DFX) - Function, Assembly, Manufacture, Environment, Robustness, Reliability, Recyclability, etc.
5. Materials Selection - Performance Characteristics of Materials, the Material Selection Process, Economics of Materials, Material Selection Methods.
6. Selection of Manufacturing Processes - Manufacturing Processes, Costs of Manufacturing, Process Selection.
7. Building and Testing Prototypes - Building Traditional Prototypes, Building Rapid Prototypes, Testing Prototypes, Testing Product Usability.
8. Design for Failure, Safety and Tolerance - Failure Modes and Effects Analysis, Design for Safety, Tolerance Design.
9. Human Factors Design - Sensory input limitations - Sight, Hearing, Touch, Kinesthetic, Vestibular, Human Decision Making Limitations, Physical Size Limitations, Workspace Consideration.
10. Detail Design - Making Detail Design Decisions, Detail Drawings, Bill of Materials, Communicating
Design and manufacturing Information, Product Packaging, Product Data Management, System Level Design, Final Design Review.
Lab / Studio Sessions
The course DS 302 Engineering Design is meant to nurture creativity, innovation and ideas. It is a precursor to the course Project - II (Fabrication Project) where the students have to properly fabricate the product so that it have the proper finishing and packaging, ready to be launched into the market. The focus ofthis course would be on artifact design (and may be for a few cases on technology design) The laboratory classes of the course would include doing the market survey, identifying need assessment, motivation, and define objective of the design. This would be followed by concept generation and evaluation, embodiment design and detailed designing of the product with the end output a "functional" model. The end output must be in resonance with the customer requirement that has to be ensured. The course also requires preparation of a product catalog / brochure presenting the highlights of the product generated

Back

Electronics & Communications Engineering(EC)

EC 201 Digital Electronics & Microprocessor Technology

Analysis of digital logic families: TTL, MOS, CMOS Inverters, Interfacing between logic and families; various logic functions and their implementation; Bistable circuits: R-S, J-K, D and PLA; Design of synchronous sequential circuits. Microprocessor based systems: Number systems, Arithmetic operations in integer and floating-point numbers. ASCII code; General micro-processor organization, Memory interfacing, Assembly language and bus signals of 8086 processor; Interrupts and their applications; Serial and Parallel Ports; DMA and its controller, 8253 Timer; 8259 interrupt controller.

EC 203 Signals Systems and Networks [3-1-0-4]

Module1: Classification of Signals & Systems
Continuous and discrete time signals: Classification of Signals: Periodic aperiodic, even / odd, energy and power signals, Deterministic and random signals, complex exponential and sinusoidal signals, periodicity: properties of discrete time complex exponential unit impulse - unit step impulse functions, Transformation in independent variable of signals: time scaling, time shifting. Systems: Definition, Classification: linear and non linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.
Module2: Linear Time Invariant (LTI) Systems
Time-Domain representation & Characterization of LTI systems, Impulse response representation, Convolution integral & Convolution sum, properties of LTI systems, Stability criteria for LTI systems, Elements of Continuous time & Discrete-time LTI systems. LTI-DT systems -Characterization using difference equation
Module3: Frequency Analysis of Signals and Systems
Fourier representation of Signals, Continuous -time Fourier series and their properties, Application of Fourier series to LTI systems, Fourier Transform & its properties, Applications of Fourier Transform to LTI systems, Discrete-time Fourier Transform & its properties. Circular Convolution, Relationship to other transforms.
Module 4: Laplace Transform
Introduction & Definition, Region-of- convergence, Properties of Laplace transform, Inverse Laplace Transform, Applications of Laplace Transform in analysis of LTI systems, Unilateral Laplace transform & its applications to solve differential equations, Analysis of Electric circuits
Module 5: Z-Transform
The Z-Transform, Region-of-convergence, properties of Z-Transform, Inverse Z-Transform, Transform Analysis of Discrete-time LTI systems, Unilateral Z-Transform & its applications to LTI systems described by difference equations

EC-204 Instrumentation and Measurement

Basic terminologies (range, span, settling time dead zone, input impedance),
Static and Dynamic characteristics, 1 st order and second order instruments with step, ramp and sinusoidal input! output characteristics. Strain gauge, derivation of gauge factor, strain gauge rosette, unbalanced wheatstone bridge, different types of load cells and their frequency response, and its data transmission. LVDT, phase compensation, phase sensitive demodulation, thermistor and its linearization, RTD, its construction, three wire and four wire method Muller bridge,
Thermocouple, their relative comparison, cold junction compensation using AD590, grounded thermocouple, potentiometer as displacement sensor, Capacitance as displacement and level transducer, push pull arrangement, Pressure transducer [Bourdon gauge, diaphragm gauge (metal and semiconductor) etc], all vacuum gauges, photo electric transducer and its application, Liquid in glass thermometer, pressure spring thermometer, venturi meter, Orifice meter, pitot tube, Rotameter, Weir, electromagnetic flowmeter, Hot wire anemometer, its phase compensation and expression of volumetric flow rate or velocity in each case, Variable reluctance displacement sensor, tachogenerator, turbine flowmeter. Measurement of viscosity, conductivity and pH of a liquid.
Flapper nozzle system and Control Valves.

EC 205 Control Systems [3-1-0-4]

Basic concepts and system representation: Terminology and basic structure-feedback control theory-multivariable systems,Modeling of physical systems, time-domain, frequency-domain and state-variable models; block diagram, signal flow graph and Mason's gain formula; time and frequency response of first and second order systems; control system characteristics: stability, sensitivity, disturbance rejection and steady-state accuracy; stability analysis: Routh-Hurwitz test, relative stability, root locus, Bode and Nyquist plots; Concepts of state variables and state model – state models for linear continuous – time systems – Solution of state equations – Concepts of controllability and observability, Pole placement by State Feedback, The z-transform and Inverse z-transform, Pulse Transfer Function, z- and s-domain Relationship, Stability

5. Topic V: Part programming including projects for hands on experience

Process planning and flow chart for part programming. Cut planning, Part programming formats for turning and milling, G & M Codes, Interpolations, Canned Cycles and Subprograms, Tool Compensations Absolute and incremental programming, fixed zero/floating zero, Linear and Circular Interpolation, Development of a CNC part program, Canned Cycles, Single Turning, Single Facing, Multiple Turning, Multiple Facing, Pattern Repeating, Peck Drilling, Single Threading, cycles for simplifying programming. Cutter Radius Compensation, Tool length compensations, Tool Nose Radius Compensations, Tool offsets, Canned Cycles for milling, Continuous Drilling, Peck Drilling, Subprogram call, Mirroring and Pocketing cycles

EC 306 Principles of Communications [3-0-0-4

Introduction to Communication Systems: Communication network and channel, Difference between Analog and Digital type of signal and Communication, Classification of Signals and systems, Fourier series, Fourier transform and its Properties and examples.

Amplitude modulation (Linear modulation): Modulation, Amplitude Modulation and Double Sideband Modulation. Single-Sideband and Vestigial-Sideband Modulations. Implementation of AM Modulators and demodulators.

Effect of Noise on Amplitude Modulation System: Effect of noise on linear modulation systems (Base-band systems, DSB-SC AM, SSB AM, Conventional AM).

Angle Modulation: Basic definition, Phase modulation, frequency modulation, relationship between frequency and phase modulation, bandwidth of FM signal, Narrowband and wideband frequency modulation, Transmission bandwidth of FM signal, Generation and detection of angle modulation.

Effect of Noise on Angle Modulation System: Noise in frequency modulation systems, threshold effect in FM system performance, threshold improvement in FM Discriminators, Noise in phase-modulated system, comparison of analog modulation system

Effect of Noise on Angle Modulation System: Noise in frequency modulation systems, threshold effect in FM system performance, threshold improvement in FM Discriminators, Noise in phase-modulated system, comparison of analog modulation system.

Pulse Modulation: Sampling of band-limited signals and band pass signals, Types of Analog pulse modulation, quantization

EC 307 Fundamental of Electromagnetic Theory [3-0-0-4]

EM WAVES:
Review of vector and coordinate systems, review Electrostatic and Magnetostatics, Maxwell's equations for static and time varying fields, Boundary conditions, Propagation of uniform plane waves in perfect dielectric and lossy medium, Wave velocity and impedance, Reflection and refraction.
Transmission Lines:

Introduction of Transmission lines,Transmission line parameters and equations, Solution for lossless lines, Reflection and Transmission coefficients at junctions, VSWR, Introduction to Smith Chart.
Waveguides:
Introduction of Waveguides, Waveguides Modes, Solution of Wave Equations in Rectangular and Cylindrical waveguides for TM and TE, Wave propagation in Waveguide , Power Transmission and losses.
Antenna and Radiation:
Radiation fundamentals, the half-wave dipole antenna. Antenna performance parameters, two element array, linear arrays, multiplication of patterns, antennas for various applications, Propagation of radio waves (introduction).

EC 308a Linear Integrated Circuits

Basic Information of Op-Amp, Ideal Op-amp, FET Op-amp Monolithic IC operational amplifiers, specifications, frequency compensation, slew rate and methods of improving slew rate. Application of Operational Amplifiers, Analysis of four quadrant and variable transconductance multipliers, Voltage controlled Oscillator, Closed loop analysis of PLL, AM, PM and FSK modulators and demodulators. Frequency synthesizers, Compander ICs, analog to digital and digital to analog to digital convertors, and special function ICs.
Text Books:
1. Ram Gayakwad (Aug 24 1999), "Op-Amps and Linear Integrated Circuits", Prentice Hall, Fourth edition.
2. Roy D. Choudhury (1992-06), "Linear Integrated Circuits", John Wiley & Sons.
3. Thomas L. Floyd, Floyd, Buchla(1998), "Basic Operational Amplifiers and Linear Integrated Circuits", Prentice Hall.
Reference Books:
1. Willam D.Stanley , "Op-Amps and Linear Integrated Circuit", Merrill,Third edition
2. Jack Winzer, "Linear Integrated Circuits ",Saunders College Publishing, First Edition
3. Robert F. Coughlin, "Operational Amplifiers and Linear Integrated Circuits" Prentice Hall, Sixth Edition.

EC 308b Digital Signal Processing

Module1: Frequency Analysis of LTI Systems
Frequency domain Characteristics of LTI Systems, Correlation functions and spectra at output of LTI systems, LTI Systems as frequency selective filters: ideal filters, all pass filters, comb filters, inverse system, classification based on phase response: minimum phase, maximum phase, and mixed phase system, Finite Impulse Response (FIR) Filters: Linear phase FIR filters- Frequency response of linear phase FIR filters – Location of the zeros of linear phase FIR filters.

Module2: Discrete Fourier Transform and Computation
DFT and its properties, Relation between DTFT and DFT, Linear filtering methods using DFT: Linear filtering as DFT, Filtering of long sequences: Overlap-add and save methods
Frequency analysis of signals using DFT, FFT computations using Decimation in time and Decimation in frequency algorithms, radix 2-Butterfly structure, implementation of DFT as linear filtering: Goertzel algorithm, and Chirp algorithm

Module 3: Design of Digital Filters
FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping - Frequency transformation.

Module 4: Realization of Digital Filters
FIR & IIR filter realization: Direct form-I, direct form-II, and Parallel & cascade forms. Finite word length effects in FIR and IIR digital filters: Quantization, round off errors and overflow errors, Overview of DSP processors

Module 5: Application of signal processing
Applications of digital signal processing: Speech Processing: speech analysis, speech coding, subband coding, ECG processing.

EC309a Analog IC Design

Introduction to analog design: importance of analog design, Op-amp application circuits and characteristics: Transistor-level view of a two-stage op-amp, Review of CMOS process technology and device characteristics, DC bias solution principles using the two-stage op-amp as an example, Device small-signal models using the two-stage op-amp as an example: common-source, common-drain stages, differential amplifier, CMRR, body effect.
Negative feedback systems and stability: amplifier using an integrator. Frequency and time domain behavior, Negative feedback amplifier realization - Finite DC gain; increasing DC gain; Negative feedback systems with multiple poles and zeros in the forward path - Stability analysis: Nyquist criterion; Loop gain-Bode plot and time domain interpretation;
Frequency response of amplifier, type of noise and their representation in circuits, feedback topologies and two port network model loading in different type feedback topologies.
Fully differential opampdesign: Differential and common mode half circuits; miller compensated opampsingle stage oparnp; differential feedforward compensated opamp. Phase locked loop: Frequency multiplier-Phase locked loop, Jitter & Phase noise; Leeson's model of phase noise of YCOs – Continuous time approximation; PLL transfer functions; Reference feed through spurs; LC oscillators.

1. Text Book: Design of anlog CMOS IC : Tata Me graw Hill edition by Behzad Razavi

EC309b Antenna Theory & Design [3-0-0-4]

Fundamental Concepts: Radiation mechanism, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, bandwidth, quality factor, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, reciprocity theorem, vector potentials for electric and magnetic current sources.

Radiation from Wires and Loops: Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

Aperture and Reflector Antennas: Huygens ‘Principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Broadband Antennas: Log-periodic and Yagi antennas, Biconical antenna, Bow-Tie antenna, Frequency independent antennas, Spiral antennas.

Antenna Arrays: Analysis of uniformly spaced Two-element and N-element linear arrays with uniform and non-uniform amplitudes excitation, extension to planar arrays, synthesis of antenna arrays.

Microstrip Antennas: Basic characteristics of microstrip antennas, feeding techniques, methods of analysis, design of rectangular and circular patch antennas, microstrip antenna arrays and feed networks, basics of active antennas.

EC 310a VLSI IC Design

Property of si crystal structure. Introduction to Device Fabrication (BJT and MOS): Analysis of MOS structure. Nano scale CMOS and scaling issues, NMOS and CMOS advance processing technology; MOS inverter : Static and switching characteristics; MOS capacitor; Layer in VLSI design; Design rule and technology interface; stick diagrams and layout design; propagation delay, fanout consideration; CMOS latch-up; scaling; Combination MOS logic, Pass transistor/transimission gate, primitive logic, complex logic gate sequential MOS logic, Latches and ip-ops, Dynamic Logic circuits; Clocking issues; CMOS subsystem design.

EC310b Image Processing

Digital Image Fundamentals; Image Enhancement in Spatial Domain: Gray Level Transformation, Histogram Processing, Spatial Filters; Image Transforms: Fourier Transform and their properties, Fast Fourier Transform, Other Transforms; Image Enhancement in Frequency Domain; Color Image Processing; Image Restoration; Image Compression; Morphological operators; Image Segmentation: edge detection, Hough transform, region based segmentation; Representation and Description.

Text Book:

R. C. Gonzalez and R. E. Woods, Digital Image Processing, Third Edition, Pearson, 2012

References:

1. M Sonka, V Hlavac, and R Boyle, Image Processing, Analysis, and Machine Vision, Third Edition, Thomson Engineering, 2007. \) P~}.JJ
2. W. K. Pratt, Digital Image processing, Third Edition, John Wiley & Sons Inc, 2001. \ ~
3. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson Education, 2006.

EC 311a RF and Microwave Engineering [3-0-0-4]

Waveguides and Resonators:
Review of EM Theory: Wave propagation through waveguides - rectangular, circular, elliptical, cutoff frequency, modes, group and phase velocities. Power Transmission and losses in Waveguides. Excitation of various modes in Waveguides, Microwave cavities – Rectangular and Circular Cavity Resonators. Semi-circular Cavity Resonators, Q factor of a Cavity Resonators
Microwave Components:
Microwave Hybrid Circuits –Waveguide Tees and Scattering Matrices. Magic Tee and Hybrid Rings (Rat-race circuits) and their Scattering matrices. Waveguide Corners, Bends and Twists, irises, windows, Directional couplers. Two-hole Directional Couplers, S-matrix of a Directional Coupler. Circulators and Isolators.
Microwave Devices and Measurements:
Microwave Transistor; Tunnel Diode; Varacter Diode; Schottky Diode; Gunn diode, IMPATT diodes. Klystron, Magnetron, Traveling Wave Tubes. Measurement of power, frequency and wavelength, Measurement of impedance, SWR, attenuation, Q of cavity and noise factor.
Microwave Integrated circuits:
Microstrip and strip lines slot and coplanar lines, planar circuits, passive elements, components and devices, Analytical methods associated with MIC theory, MMIC Fabrication Techniques, Printed Antennas, Future trend in MICs.

EC 311b Power Electronics

Introductions: Pawar semi semiconductor devices, Types of power electronic circuits and design of P Powerelectronics equipment, Applications of Power electronics Power

Semiconductor Diodes and Circuits: Diode Characteristics, Power Diode Types, Series and Parallel connected diodes, Diodes with different types of loads(R, RC, RL, LC, RLC Loads), Free wheeling diodes

Diode Rectifiers: Single phase half wave rectifier, Single phase full wave rectifier, Single phase full wave rectifier with RL Load, Three phase Bridge rectifier, Three phase Bridge rectifier with RL Load
DC-DC Converters: Principles of step-down chopper and operation, Principle of step-up chopper and operation, classification of choppers

Thyristors: Thyristor Characteristics, Thyristor Turn on and Turn off, Two-transistor model of Thyristor, Thyristor types, Series and Parallel operation of Thyristor
Controlled Rectifiers: Principle of phase controlled converter operation, Single phase full-converters, Single phase semi-converter, Principle of three phase half wave Converters, Three phase full converters, Three phase Semi-converter

Inverters: Single phase series resonant inverter, Single phase bridge inverters, Three phase bridge inverters, Voltage control of inverters

AC Voltage Controllers: Principle of On-Off and phase controls, Single phase ac voltage controller with resistive load, Single phase ac voltage controller with inductive load, Three phase ac voltage controllers , Single phase Cyclo Converters, Three phase Cyclo Converters
Some Applications

EC-312a Digital Communications [3-0-0-4]

Review of Analog communication and modulation techniques: Sampling Theory, Nyquist criterion, Fourier transform, Introduction to AM, FM and PM, Noise effects in AM, FM and PM.

Pulse modulation techniques : Introduction to digital communication system, PAM, PWM, PPM; Modulation and Demodulation; its spectral analysis and effects of noise. Pulse Code Modulation, Quantization, SNR, Probability of error for PCM, DPCM, DM, ADM; Modulation and Demodulation; Inter-symbol Interference, Eye Diagram.

Digital Pass Band Transmission and Reception: Introduction to Pass band Transmission model: Generation, Detection, Signal space diagram, Error performance – Coherent and Non-coherent detection systems, bit error probability and Power spectra of BPSK, QPSK, FSK and MSK schemes, Differential phase shift keying, Comparison of Digital modulation systems using a single carrier – Carrier and symbol synchronization.

Information theory and error control coding : Communication channel, Channel matrix, Channel capacity, Discrete memory less channels, Linear block codes - Cyclic codes - Convolutional codes – Maximum likelihood decoding of convolution codes-Viterbi Algorithm, Trellis coded Modulation

Overview of spread spectrum : Pseudo-noise sequences: a notion of spread spectrum: Direct sequence spread spectrum, Frequency hop spread spectrum, Maximum length and Gold codes.

EC-312b Advance Semiconductor Device & Application

Human visual system and image perception, colour vision, colour representation ; image sampling & quantization; 2-D systems; image transforms; image coding; statistical models for image representation; image enhancement, restoration & reconstruction. Image analysis using multiresolution techniques, Stereo imaging like camera model, Image compression, segmentation, reconstruction from projections, morphology and some descriptors.

EC 313a Pattern Recognition

Introduction, various shape approximations, compactness, Gabor filter, LPF, HPF.
Baye 's theorem, error approximation, parametric and nearest neighbor classifier,
Gradient Descent method. Supervised Classification (Baye 's, Decision Tree, KNN),
clustering, unsupervised Classification (K-Means, Spanning Tree, Graph)

EC 313b: Optical and Wireless Communication

Unit-I
Fiber and Types: Basic Optical Communication System, Optical fiber types, propagation modes, transmission and attenuation, Dispersion, Numerical Aperture, PMD, Non-linear Characteristics of Fiber etc.

Source and Detectors: Double Hetro-junction and homo-junction injection lasers structure & Characteristics. Drawback and advantages of LED, DHLED, LED structures and characteristics. P-n photodiode, p-i-n and avalanche photodiodes, LED and laser drive circuits, Regenerative repeater, optical power budgeting.

Multiplexing Strategies: OTDM, Subcarrier, OFDM, WDM, OCDM, Hybrid Multiplexing. Optical Fiber network evolution, Wavelength division multiplexed networks(CWDM & DWDM), Network Elements of DWDM Network (Transponders, Optical Amplifiers- EDFA & Raman, Optical Multiplexer, OADM, ROADM),Optical network transmission modes, layers and protocols, Wavelength routing network, Optical switching networks, Automatically Switched Optical Network (ASON).

Unit-II
Introduction to wireless communication systems: 1G, 2G and 3G wireless systems. Cordless system, Wireless local loop, mobile IP and WAP, Wireless networks.

Fundamentals of cellular systems: Concept of frequency reuse, Hand-off strategies, Co-channel and Adjacent channel interference, Cell splitting, Sectoring, Channel assignment strategies, Trunking and Grade of service.

Mobile Radio propagation Models: Large scale and small scale propagation models.
Concepts of spread spectrum communication: FHSS, DSSS, and CDMA. Overview of satellite communication systems.

EC611 Image Processing
Digital Image Fundamentals; Image Enhancement in Spatial Domain: Gray Level Transformation, Histogram Processing, Spatial Filters; Image Transforms: Fourier Transform and their properties, Fast Fourier Transform, Other Transforms; Image Enhancement in Frequency Domain; Color Image Processing; Image Restoration; Image Compression; Morphological operators; Image Segmentation: edge detection, Hough transform, region based segmentation; Representation and Description.

EC 634: Advanced VLSI Design and Technology

Introduction to MOSFET from designer's viewpoint; Analysis of MOS structure. ano scale CMOS and scaling issues from designer's viewpoint, NMOS and CMOS Advanced processing technology; MOS inverter : static and switching characteristics; MOS capacitor; Layers in VLSI design; Design rules and technology interface; Stick diagrams and Layout design; Propagation delay, Fan-out consideration; CMOS Latch-up; Scaling; Combinational MOS logic, Pass-transistors /transmission gates, primitive logic gates, complex logic gates; Sequential MOS logic. Latches and flipflops; Dynamic logic circuits; Clocking issues; CMOS subsystem design.
Lab Session: Introduction to Veri log / Cadence

EC 302(V Sem) professional lab

1-Study of Microwave Bench & Its Components
2-Operation of Microwave Bench as Transmission Line & reading frequency from Frequency Meter.
3-Verification of Frequency Measurement with slotted section.
4-Low & High VSWR Measurement using double minima method.
5- Calculating and Reflection Coefficient Impedance of an SS Tuner using Microwave Bench.
6- Measurement of the gain and Polar Pattern of the Horn Antenna.

EC 404(VII Sem) professional lab

1-Study of Microwave Bench & Its Components
2-Operation of Microwave Bench as Transmission Line & reading frequency from Frequency Meter.
3-Verification of Frequency Measurement with slotted section.
4-Low & High VSWR Measurement using double minima method.
5- Calculating Impedance of an SS Tuner using Microwave Bench.
6-Determination of Standing Wave Ratio and Reflection Coefficient.
7-Microwave Measurements using Gun Oscillator
   a) Study of I-V Characteristics of Gun Diode
   b) Frequency and Wavelength Measurement
8- Microwave Measurements using Horn Antenna .
   a) Measurement of the gain and Polar Pattern of the Horn Antenna.
   b) Measurement of Phase shift and Dielectric Constant.
9-Study of E-Plane Tee, H-Plane Tee and Magic Tee .
10-Study of Directional Coupler, Isolator & Attenuator.

Back

Manufacturing(MN)

MN 201 Materials and Manufacturing Processes

Materials:
Overview of Materials and their applications; Bonding in materials, Crystalline and Amorphous structures of solids, Miller indices in crystalline materials, Defects in crystalline materials, Single crystals and Poly-crystals. Diffusion in solids; Phase Diagrams of engineering materials systems; Solidification; Diffusion-assisted and diffusion less solid-state phase transformations, Applications and Properties of Ceramic, Polymers and also of their Composite Materials. Band gap in solids, effective mass and electrical conduction in metals (KP model), Magnetic materials and their properties.

Manufacturing Processes:
Introduction: Introduction to Manufacturing, Historical Perspective, Importance, etc. Mechanical Properties in Design& Manufacturing.

Casting: Fundamentals of Casting process, features of casting, Casting Processes, Classification, Significances.

Metal Forming: Hot & Cold Working, Bulk Deformation Processes like Rolling, Forging, Extrusion and Drawing, Sheet Metal forming (Shearing & Drawing operations).
MACHINING: Machining, Mechanism of machining, Chip formation, Temperature, Tool Wear, Tool Life, Machining Processes.Brief introduction to Single Point and Multi-point Cutting Operations, Introduction to Grinding & Finishing.

Metal Roining: Fundamentals of Welding, Classification of welding processes, Introduction to Gas & Arc Welding, Ultrasonic Welding, Friction Welding, Resistance Welding, Brazing, Soldering, and Adhesive Bonding.

Polymers: Polymer products manufacturing, Extrusion, Injection molding, Blow Molding, Thermoforming, Compression Molding, and Transfer Molding.

Modern Manufacturing Processes: Introduction to Rapid Prototyping, classification and various RP processes; Introduction to various unconventional machining processes and their classification; Introduction to automation, Flexible Manufacturing Systems and CNC.

Manufacturing Of Electronic Devices: Manufacturing of Semiconductor Devices and Silicon Wafers, Device Fabrication Techniques, Surface Films Depositions, Lithography, Etching, Process Integration and Packaging. Printed Circuit Boards and Techniques for micro / nano fabrication.

Back

Mechanical Engineering(ME)

ME 201 Thermodynamics

Introduction to Thermodynamics, Systems, Properties, State of a system. Thermodynamic Equilibrium, Processes; Zeroth law of thermodynamics, Ideal Gas, Work and Heat Transfer, Principles of Energy Conversion, Energy Interactions, First Law, Energy Transport Mechanisms, Point and Path Function, Internal Energy. First Law applied to various Processes; Constant Volume, Constant Pressure, Isothermal, Reversible- adiabatic, etc.; Applications of First Law to Flow and Non-flow Processes.
Second Law of Thermodynamics, Kelvin-Planck and Clausius statements; Carnot theorem; Available Energy, Entropy, Heat Engine, Heat Pump.

Applications: Gas Power Cycles, Otto, Diesel and Brayton; Vapour Power Cycles, Rankine Cycle, Power Plant Operation; Refrigeration Cycles.

ME 202 Solid Mechanics

Introduction: Free body diagram revisited, Notion of stress and strain, Mechanical
properties, Deformation of axial members, Compatibility, Statically indeterminate problems, Design considerations, Thermal effects, Strain energy, Dynamic loads.

Stress: Stress at a point – matrix of stress / stress tensor, Equilibrium of a body – differential equations of equilibrium, Different states of stress – uniaxial, biaxial, plane stress, etc., Transformation of plane stress; Principal stresses and maximum shear stress, Mohr's circle

Strain: Strain at a point – matrix of strain / strain tensor, Different states of strain – uniaxial, plane strain, etc., Transformation of plane strain; Principal strains, Mohr's circle for plane strain
Mechanical properties: Generalized Hooke's law, Eastic modulus, bulk modulus,
Relationship between different elastic constants.

Bending: Relation between transverse loads, shear and bending moments, Shear and bending moment diagrams, Pure bending – beams with symmetric cross-sections, Beams with composite cross-section, Shear stresses in beams, Deflections in beams: Double Integration method, method of superposition, introduction to area moment method.

Torsion: Torsional moment diagrams, Torsion formula for circular cross-sections, Maximum normal and shear stresses, Angle of twist.
Elastic stability: Notion of stability of equilibrium, Euler buckling, Members with eccentric loading, Initially imperfect columns, Beam-columns.

ME 202 Kinematics and Dynamics of Mechanical Systems

Kinematics: Kinematic pair, diagrams and inversion. Displacement, velocity and acceleration of planar linkages. Dimensional synthesis for motion, path and function generation.

Dynamics: Cam profile synthesis. Gears, Dynamic force analysis, flywheel, inertia forces and balancing of rotating and reciprocating machines.

ME 204 Manufacturing Technology

Machining and Mechanics of Metal Cutting (14): Introduction to orthogonal & oblique cutting; chip formation mechanism; heat generation and cutting tool temperature, tool geometry - ASA, ORS, NRS and relationships, selection of tool angles. Cutting tool materials; tool wear, tool life and machinability; surface finish; cutting fluids. Merchant's circle diagram, coefficient of friction, stress, strain and strain rate, shear angle, Lee and Shaffer's Relationship; friction in metal cutting-sticking & sliding.

Material Removal Processes (08): Basic operations of turning; shaping, slotting and planing; drilling and boring; milling; Introduction to multi-point cutting tools: twist drill, helical milling cutter. Practical machining operations with machining parameters, force magnitudes, power consumption, material removal rate, time per pass.

Cutting Force Measurement (02): Basic Methods of measurement, axially loaded members, cantilever beam, rings and octagon, dynamometer requirements, machine tool dynamometers.
Economics of Machining (04): Cutting parameters for minimum production cost criteria; maximum production and profit rate criterion. Restrictions on cutting conditions (power, speed, force and vibration, surface finish).

Metal Forming (10): Introduction to stress, strain, stress-strain relationships, Mechanics of Forming Processes: Rolling, Forging, Drawing, Deep Drawing, Extrusion, Punching and Blanking.
Casting (04):Design of riser, runner and gating system; mechanism and analysis of solidification.

ME 205 Fluid Mechanics and Heat Transfer

Fundamental concepts: Continuum models, characteristics of fluids. Fluid Statics, hydrostatic pressure, forces on submerged surfaces. Integral Analysis, Fundamental laws, systems and control volumes, conservation of mass, momentum equation and the first law of thermodynamics.

Differential Analysis of fluid flow: Flow Kinematics, Types of flow, Flow field, velocity, acceleration, stream function, vorticity. Incompressible inviscid flow, Euler's and Bernoulli's equation. Dimensional analysis and similitude. Flow in conduits and pipes – Incompressible viscous flow, fully developed flow in pipes, head loss, major and minor losses, Flow measurement, pipeline networks. Boundary layers and flow over objects. Introduction to Compressible Flow - speed of sound, stagnation properties. Steady state-one-dimensional compressible flow - basic equations for isentropic flow, adiabatic flow with friction.

Heat Transfer: Introduction, Conduction: Fourier's Law, One dimensional heat transfer with and without heat generation, Transient conduction, Through Composite walls.
Extended Surfaces: Heat transfer from finned surfaces, Fin Efficiency, Effectiveness. Convection: Free and forced convection, Flow and thermal boundary layer eqations, laminar flow through circular pipe, constant heat flux and constant wall temperature conditions, Overall heat transfer coefficient. Heat exchangers.

Thermal Radiation: Radiation properties, Plank's Law, Kirchoff's law, Heat exchange between two surfaces.

ME 306 Design of Mechanical Components

Introduction, Design of Cotter and Knuckle Joint, Design of Thick and Thin cylinders, Design of Shafts, Keys and Coupling, Design of Bolted and Welded Joints, Design of Springs, Selection of Bearings, Design and Selection of Gears and Belts, Design of Clutches and Brakes, Design for variable loading.

ME 307a Computer Aided Design

Introduction: Objective, scope, overview, CAD software, mathematical background, applications
Transformations: Rotation, translation, scaling, reflection, shear and combined transformations in 2D and 3D, computer-aided assembly
Projections: Orthographic, axonometric, oblique and perspective projections
Curves: Parametric representation of analytic curves, representation of synthetic curves- Hermite/ Ferguson, Bezier, B-spline, rational curves, NURBS/NUBS, curve manipulations, Analytical properties
Surfaces: Surface representation, parametric representation of analytic surfaces- plane, ruled, surface of revolution etc., representation of synthetic surfaces- Hermite, Bezier, B-spline, coons, sculptured etc., surface manipulations, curves on surfaces, surface with irregular boundaries, analytic properties, application in reverse engineering, design of turbine blades etc.
Solids: Introduction, representation of solids, fundamentals of solid modeling, solid representation schemas (B-rep, CSG, Sweep, ASM etc), solid manipulations, solid modeling-based applications in manufacturing and assembly (CNC machining, Rapid prototyping).
Advanced Topics: Geometric modeling using point clouds, CAD/CAM data exchange

ME 307c IC Engines

Introduction:
1. Basic Definitions:
2. Brief History Of The Engine:
3. Definitions Of Various Terms Used in Engines:
4. Classification of Engines – Defferent Type of Engines:

I Based on applications:
1. Basic Engine Design:
2. Operating Cycle:
3. Working Cycles (Strokes):
4. Valve/Port Design:
5. Fuel used: Conventional Fuels — Alternate fuels
6. Mixture Preparation:
7. Method of Ignition:
8. Type of Charge: Homogenous and Stratified
9. Combustion Chamber Design
10. Load Control:
11. Cooling:

II Thermodynamics Of Cycles THERMODYNAMICS OF CYCLES \
1. Air Standard Cycles
2. Variable Specific Heat Calculations
3. The Air Standard Engine
4. Fuel Air cycles
5. Real Cycles:
6. Computer Simulation

III. Fuels
1. Properties of fuels and their measurement
2. Requirements of fuels for the petrol engine
3. Requirements of fuels for the diesel engine
4. Conventional Fuels for the petrol and diesel engines
5. Alternative fuels for the petrol and diesel engines. Necessity for alternatives fuels, requirements for alternative fuels

IV. Intake system(Manifold design)
1. Intake and exhaust processes in a four stroke cycle engine
2. Volumetric efficiency

V. Fuel metering in a spark ignition engine
1. Mixture requirements in an SI engine
2. Principle of carburetion
3. Fuel injection in a spark ignition (Petrol) engine, MPFI

VI. Combustion in the spark ignition engine
1. The basic combustion process
2. Analysis of cylinder pressure data
3. Ignition
4. Abnormal combustion
5. In cylinder

VIII. Combustion in the compression ignition engine
1. The basic combustion process
2. Analysis of cylinder pressure data
3. Fuel injection
4. In cylinder motion

X. Engine emissions – formation and control
1. Nature and sources of engine emissions
2. Mechanism of pollutant formation in engines
3. Emission control strategies
4. Instruments for measuring exhaust emissions
5. Emission System: Muffuler and Catelytic converter

XI. Engine testing and performance characteristics
1. Measurement techniques
2. Performance factors and ratings
3. Types of performance tests
4. Performance characteristics of SI engines
6. Performance characteristics of engines
7. Heat balance

XII. Cooling systems

Need. Variation of gas temperature. Piston temperature distribution. Theory of engine heat transfer and correlation. Parameters affecting engine heat transfer. Air-cooled systems. Types of water-cooling systems. Radiators. Fans. Correlation for the power required for engine cooling.

XII. Lubrication systems

Causes of engine friction. Function of lubrication. Mechanism of lubrication. Journal bearing lubrication. Types of lubrication systems. Lubrication of engine components.

XIII. Supercharging and Turbocharging

Supercharger, Supercharging methods for SI engines, Turbocharging in CI engines, Supercharged Engine performance evaluation

ME 307d NC Machine Tools

1. Topics I: Introduction to NC Machine tools and terminology Types of automation, Programmed Automation, History of Numerical Control, Components of NC: Punched Tape, MCU, Processing Unit, Axis Designation, Application of Numerical Control, Advantages, & Disadvantages.

2. Topics II: Hardware aspects of NC Machine tools
   CNC Hardware Basics Machines Structure, Guidways: Requirements, types and design features, Actuation systems: Ball Screws, Modern CNC Systems Indexable carbide tools, Modular Tooling & Tool Presetting, Machining Centers, Automatic tool changers, Cutting tools and process parameter selection based on machining capacity, accuracy and surface finish, various Process planning issues.

3. Topic III: Control aspects of NC Machine tools including Drives
   NC Motion Control: PTP, Straight cut, Contouring, Velocity relationships using independent motors: position control and its significance, Block Diagram of CNC operations, Positioning System: Open loop and Closed loop System, Precision in NC Positioning: Control resolution, Accuracy, Repeatability. Actuation systems: Servo and Stepper Motors control, Feedback devices: Encoder, Optical grating, Resolvers, Inductosyn.

4. Topic IV: Adaptive machining
   Fundamentals of Adaptive Control Including In-process Measurement Utilisation Technology of NC Machine Tools from Aspect of Machining Accuracy.

ME 309a Finite Element Methods

Objective of the Course, Basic Steps in FEM Formulation, General Applicability of the Method.
1 -D Elements, Basis Functions and Shape Functions.
Convergence Criteria, assembly, imposition of boundary conditions.
Variational Functional, Ritz Method.
Natural Coordinates, Numerical Integration, Solvers.
Alternate Formulation: Weighted Residual Method, Galerkin Method.
Problems with C1 Continuity: Beam Bending, Connectivity and Assembly of C1 Continuity Elements.
2-D Elements (Triangles and Quadrilaterals) and Shape Functions.
Sub-parametric, Iso-parametric and Super-parametric Elements.
Free Vibration Problems, Formulation and solution of Eigen Value Problem.

ME 309b Vibrations of Mechanical Systems

Introduction: Types of vibrations, S.H.M, principle of super position applied to
Simple Harmonic Motions, Beats. Fourier theorem and simple problems. Single degree
Of freedom systems and Simple problems.
Undamped free vibrations –. Introduction, undamped free vibration – natural frequency of free vibration, stiffness of spring elements, effect of mass of spring.
Damped free vibrations: Single degree freedom systems, different types of damping,
concept of critical damping and its importance, study of response of viscous damped systems for cases of under damping, critical and over damping, Logarithmic decrement.
Forced Vibration: Single degree freedom systems, steady state solution with
viscousdamping due to harmonic force, solution by complex algebra. Concept of response, Reciprocating and rotating unbalance, vibration isolation – transmissibility ratio. Energy dissipated by damping, sharpness of resonance, base excitation.

Vibration measuring instruments: Accelerometer and vibrometers. Whirling of shafts with and without air damping. Discussion of speeds above and below critical speeds.
Systems with two degrees of freedom: Introduction, principal modes and normal modes of vibration, co-ordinate coupling, generalized and principal co-ordinates, free vibration in terms of initial conditions. Geared systems. Forced Oscillations – Harmonic excitation. Applications: (a) Vehicle suspension (b) Dynamic vibration absorber (c) Dynamics of Reciprocating Engines.
Continuous Systems: Introduction, vibration of string, longitudinal vibration of rods, torsional vibration of rods, Euler's equation for beams, simple problems, M D OF
systems. Introduction, Influence co-efficient, Maxwell reciprocal theorem.
Numerical methods for Multi degree Freedom Systems: Dunkerley's equation.
Orthogonality of principal modes, Holzer's method, Geared and branched systems,
Rayleigh's method, Stodola method.
Vibration monitoring and analysis: Introduction, Machinery signatures, Selection of
Transducers and signal conditioning. Analysis Techniques, Machine failure modes,
Measurement location, Vibration severity criteria, vibration frequency analysis. Introduction to optical vibration monitoring, Introduction to holographic interferometry, holographic vibration analysis, Introduction to speckle metrology and its applications to vibration monitoring. Case studies.

ME 309c Computer Integrated Manufacturing

Fundamental blocks of Automation in Manufacturing Systems; Computer processes monitoring and control, off-line use of computers.
Various Manufacturing Systems - Batch, Mass, Group, Cellular and Flexible manufacturing systems;
Classification and coding and Group Technology.
Fundamentals of Numerical Control - Direct numerical control (DNC) and computer numerical control (CNC), adaptive control of manufacturing processes. Classification of NC systems, Manual and computer aided programming,
Computer Aided Process Planning.
Automated Material Handling Systems
Flexible Manufacturing System: Introduction and analysis.
Rapid Prototyping, Tooling and Manufacturing Technologies.
Concurrent Engineering.

ME 309d Advanced Heat Transfer

Background/Fundamentals: Preliminaries on the Scalar, Vector and Tensor Analysis, Preliminaries on First and Second Laws of Thermodynamics, Line to Surface and Surface to Volume Integrals.

Introduction and Basic Equations: Reynolds Transport Theorem; Integral equations to Differential Equations (using Generalized Approach), Derivation of Mass, Momentum and Energy Equations, Introduction to Compressible and Incompressible Flows, and Incompressible Fluid.

Conduction Heat Transfer:Derivation of Generalized One-dimensional Heat Conduction Equation from Integral Equation, One Dimensional Steady Conduction with and without Heat Generation, Fin Analysis and Optimization of Fin Dimensions, Insulation Thickness.
Unsteady Conduction – Lumped Analysis Two dimensional steady conduction, Analytical Methods (Separation of Variables and Methods of Superposition), Numerical Methods. One- and Multi-Dimensional Unsteady Conduction, Analytical Methods (Separation of Variables and Methods of Superposition), Numerical Methods.

Radiation Heat Transfer: Basic ideas, spectrum, basic definitions. Laws of radiation, black body radiation, Planck's law, Stefan Boltzman law, Wien's Displacement law, Lambert cosine law.
Radiation exchange between black surfaces, shape factor. Radiation exchange between gray surfaces – Radiosity-Irradiation method, Parallel plates. Enclosures (non-participating gas).Gas radiation.

Convection Heat Transfer: Important Dimensionless Numbers; Concepts of velocity boundary layer and thermal boundary layer, displacement thickness, momentum thickness and energy thickness. Derivation of velocity boundary layer and thermal boundary layer equations.

External Flows: Flow over a Flat Plate; Blasius Solution: Temperature distribution over a flat plate boundary layer (derivation of the ordinary differential equations from the partial differential equations), Numerical Solution (shooting technique), Analytical Solution (Series Solution, principles of similarity and the similarity solution of velocity boundary layer, Approximate Method: (Karman-Pohlhausen Method) for flow over a heated flat plate. Solution of Momentum Integral equations.

Internal Flows: Fully developed flows through pipes and ducts (analytical solution), Thermally fully developed conditions (for uniform wall heat flux and uniform wall temperature cases); Heat transfer through a circular tube for hydrodynamically developed and thermally developed flow with uniform wall heat flux boundary condition, Heat transfer through a circular tube for hydrodynamically developed and thermally developed flow with uniform wall temperature boundary condition.

Graetz Problem: Heat transfer through a circular tube for hydrodynamically developed and thermally developing flow with uniform wall heat flux boundary condition.

Free Convection: Analytical, Approximate and Numerical solutions for flow over a heated vertical plate.

Heat Exchangers: Types of heat exchangers, LMTD approach – parallel, counter-flow, NTU approach – parallel and counter flow heat exchangers.

ME 309e Advanced Manufacturing Processes and Technologies

1. Unconventional Machining Processes (20L): Electron Beam Machining (EBM), Plasma Arc Machining, (PAM), Laser Beam Machining (LBM),Abrasive Jet Machining (AJM), Water Jet Cutting(WJM), Ultrasonic Machining (USM), ElectroChemical Machining (ECM), Electric Discharge Machining (EDM), Wire EDM.

2. Assembly (06): Jigs and fixtures, principles of location and clamping, synthesis of simple jigs and fixtures. Principles of assembly, engineering, theory of dimensional chains, fully interchangeable and selective assembly.

3. Metrology (04): Limits, fits and tolerance; Automated inspection and CMM; Selection of manufacturing processes for a given product.

4. High speed machining (02): Introduction and Concepts of HSM; Issues related to HSM; Comparison with conventional manufacturing processes

5. Finishing Processes (04): Introduction to finishing process, Grinding, Lapping, Honing, Super Finishing.

6. Precision Manufacturing Processes (02): Introduction to micro-fabrication processes and M4 processes; concept of accuracy, errors, influence of dimensional wear on accuracy.

ME 311b Micro-Electromechanical Systems

Introduction to MEMS: Multidisciplinary Nature of Micro Systems
Working Principles and Applications: Sensors, Actuators, Micro-accelerometer
Scaling Laws in Miniaturization: Scaling in geometry, dynamic forces (Trimmer Force Scaling Vector), Electrostatic Forces, Electricity, Electromagnetic Forces Materials for MEMS: Single Crystal Silicon, Poly-silicon, Quartz, Polymers MEMS Fabrication Processes: Substrates and Wafers, Bulk, Surface, LIGA Microsystems Design: Design Processes, Micro Pressure Sensor and Micro Accelerometer

ME 311d Rapid Product Development Technologies

Overview of Rapid Product Development: Product Developing Cycle, Components of RPD, Classification of manufacturing processes.
Preprocessing: Solid Modeling, Data exchange formats, STL file format, RP Preprocessing.
Rapid Prototyping (RP): Introduction to RP, Need of RP; Basic Principles of RP, Steps in RP, Process chain in RP in integrated CAD-CAM environment, Advantages of RP, Classifications of different RP techniques, Selection of RP processes, Issues in RP, Emerging trends.
RP Techniques: Solid RP, liquid RP techniques and Powder RP Techniques - Process Technology and Comparative study of Selective laser sintering, Selective powder binding, etc.
Rapid Tooling (RT): Introduction to RT, Indirect RT processes – silicon rubber molding, epoxy tooling, spray metal tooling and investment casting. Direct RT processes – laminated tooling, powder metallurgy based technologies, welding based technologies, direct pattern making, emerging trends in RT.
Reverse Engineering: Geometric data acquisition, 3D reconstruction.
Applications and case studies: Engineering applications, Medical applications
Special Topic on RP, Programming in RP, Modelling, Slicing, Internal Hatching, Surface Skin Fills, Support Structure. Overview of the algorithms for RP&T and Reverse Engineering.

ME 311e Energy Conversion Devices

General outline of energy conversion devices, Hydraulic machines: Pumps and Turbines Steam Turbines: Basics and analysis; Gas Turbines: Basics and analysis; Non-conventional systems: Renewable energy – sources and features, Hybrid energy systems, Distributed energy systems and dispersed generation, Micro Hydel, Bio mass, Fuel Cell.

ME-649 Advanced Machining Process

Advanced Metal Cutting and Grinding [9 hours]
Modelinz of cuttinz process: Review of cutting mechanism; Cutting force model; Oblique Cutting; Temperature analysis (Finite Difference Method); Wear model; Evaluation of surface quality; Cutting processes for producing various shapes
Gear machininz: Hobbing. Modelinz ofgrindinz process: Grinding force model; Temperature analysis; Wheel life model.
Introduction o[finishinz process: Machining mechanism in finishing: Honing, Lapping, Super finishing, etc.

icro-Nano Precision Machining [8 hours]
troduction to nano-precision mechanical manufacturinz: M4 processes
Nano-precision cutting: Machine & tool; Brittle / ductile transition; Ductile mode cutting of brittle materials
Nano-precision grindinz: Machine & grinding wheel; Truing & dressing; Cutting edge evaluation; Applications to extremeoptics
Nano-precision polishinz: Conventional polishing; Non-conventional polishing; Plane honing; Field-assisted fine finishing

Unconventional Machining Processes: [25 hours]
Electric Discharge Machining (EDM); Electron Beam Machining (EBM); Plasma Arc Machining (PAM); Laser Beam
Machining (LBM); Ultrasonic Machining (USM); Abrasive Jet Machining (AJM); Water Jet Cutting (WJc), Abrasive
Water Jet Machining (AWJM); Electro-Chemical Machining (ECM); Chemical Machining (CHM)

Back

Computer Science & Engineering(CS)

CS 202 Computer System Organization and Architecture (CSOA)

Introduction:
Functional components and operational concepts of a computer Performance of a computer
Memory Subsystem:
Semiconductor memories:
1) SRAM and DRAM cells
2) Internal organization of a memory chip
3) Organization of a memory unit
4) Structure of Larger Memories
Read-Only Memories, Cache Memories:
1) Concept, Mapping methods, Caches in commercial processors Memory management unit:
1) Concept of virtual memory
2) Address translation
3) Hardware support for memory management
Secondary storage:
1) Hard Disks
2) RAID (Redundant Array of Inexpensive Disks)
3) Optical Disks
4) Magnetic Tape Systems
Representation of Instructions: Computer Arithmetic Machine Instructions, Operands
Instruction Sets:
1) Addressing Modes
2) Instruction Formats
3) Instruction set architectures:
– CISC and RISC architectures.
Processing Unit: Organization of a processor:
1) Registers
2) ALU and Control Unit
3) Data path in a CPU
4) Instruction cycle
5) Instruction Pipelining
Organization of a control unit:
6) Control Unit Operations
7) Hardwired control unit
8) Microprogrammed control unit
Input/Output Subsystem: Access of I/O devices, I/O control mechanisms:
1) Program controlled I/O,
2) Interrupt controlled I/O, and
3) DMA controlled I/O,
I/O Interfaces:
1) Serial port, Parallel port
2) PCI bus, SCSI bus, USB bus, FireWire and InfiniBand.
Introduction to Multiprogramming and Multiprocessing

CS 203 Database and Management

Evolution of Database Management Systems; Database System Architecture; Entity Relationship Modeling and Design; Data Models: Relational, Hierarchical, Network; Relational Model: Algebra, Calculus, Normal Forms; Structured Query Language; Transaction Processing: Concurrency Control and Recovery; Database Security and Authorization; Introduction to Client Server and Distributed Databases

CS 204 Operating Systems

Operating systems for mainframe and desktops: A Historical Overview, Batch OS, Multiprogramming OS, Time sharing OS, Multiprocessor and Distributed systems, Clustered systems, Real Time Systems.
Operating system structure: OS services, system calls, System programs, System structure, Virtual machines.
Process Management: Process concept, Process scheduling, Operations on processes, Threads.
CPU Scheduling: Scheduling Criteria, Scheduling algorithms, Multiprocessor scheduling, Real time scheduling, Thread scheduling.
Inter process communication: Cooperating processes, The Critical Section problem, Two tasks solutions, Semaphores, Classical synchronization.
Deadlocks: Characterization, Methods for handling deadlocks, Prevention, avoidance and detection, Recovery.
Memory management: Background, swapping, Contiguous memory allocation, Paging and segmentation, Virtual memory, Demand paging, Page replacement, thrashing.
File system management: File concept, Access method, Directory structure, File System mounting, File sharing, Allocation methods, Protection.
Mass storage structure and management: Disk structure, Disk scheduling and management, Swap space management, RAID structure.
Protection and Security: Goals, Domain of protection, Access matrix, Capability based systems, Security problems, User authentication, Program threats and system threats

CS 205 Language Theory

Introduction of Automata, Computability, and Complexity; Mathematical notations and terminology; Finding proofs and types of proofs.
Finite Automata and regular languages: Formal definitions, Designing finite automata, Deterministic finite automata, Non-deterministic finite automata, Equivalence of NFAs and DFAs, finite automata with ε-transition; regular expressions and languages, Properties of Regular languages, conversion of RE to FA and vice versa.Pumping Lemma.
Push down Automata and Context free languages: Context free grammars, Designing context free grammar, Ambiguity in CFG and its removal, Chomsky normal form

Push down Automata: formal definition, graphical notations, Languages accepted by PDA, Equivalence of PDA and CFG, Non-context free languages, Pumping Lemma for CFGs.

Turing Machines and Computability: Formal definition of Turing machines with examples, Graphical notations, Variants of Turing machines, Church-Turing thesis, Hilbert's problem.

Decidability, undecidability and reducibility: Decidable languages; Decidable problems concerning regular languages and context free languages, The halting problem, Post correspondence problems, Undecidable problems, Mapping reducibility, Decidability of logical theories, Turing reducibility.

Computational Complexity & NP-Completeness: The class P, The class NP, Reductions, The class NP-Complete, Dealing with NP-Completeness.

CS307 Computer Networks

Introduction, History and Development of Computer Networks, Networks Topologies. Physical Layer: Theoretical Basis, Transmission Media, Wireless Transmission, Digital Transmission, Switching. MAC Layer: Aloha Protocols, Local Area Networks -- Ethernet, Wireless LAN, Broadband Wireless. Bluetooth Data link layer: Sliding Window Protocols. Network Layer: Routing Algorithms, Congestion Control Algorithms, Internetworking -- Bridges and Routers. Transport Layer, Application Layer . Use of TCP/IP Protocol Suite as Running Example. Network Security.

CS 306 Design and Analysis of algorithms

Review of basic concepts; Worst case and average case analysis: big oh; small oh, omega and theta notations

Advanced data structures: Search Trees: TRIE; B+ Trees, Binomial Trees, Red-Black trees
Paradigms of Algorithms with suitable examples: divide and conquer; greedy paradigm; dynamic programming; backtracking; branch and bound; Examples can be taken from sorting, searching, selection, graph theory String processing algorithms, algebraic algorithms

Lower Bound Theory: Maximum finding, Minimum & Maximum Finding, Sorting
Hard problems and approximation algorithms: Problem classes P, NP, NP-hard and NP-complete, deterministic and nondeterministic polynomial-time algorithms. Approximation algorithms for some NP-complete problems

CS308 Software Engineering

Housekeeping
The Software Problem Introduction to Software Engineering, Modeling Complexity
SDLC, Software process, Software process models, CMM Other Processes
Software Requirements gathering, analysis, and specifications,
Software Project Planning, Estimation, Scheduling,
Risk Management, Quality Management, Software Configuration Management, Project Plan
Object-Oriented and Function-Oriented Analysis Modeling, Use cases, Use case modeling, System and Subsystem Design, Design goals, Object Design, and Specifying Interfaces Design Patterns Software Testing, Unit testing, Integration testing, System testing, Regression testing Black-box and White-box techniques, Static Techniques like code inspections, static analysis and dynamic analysis OO-Modeling, UML and OCL

CS 309c Compiler Design

Introduction: Model of a compiler, translators, interpreters, assemblers, languages, types of compilers.
Finite Automata and Regular Expressions: Finite automata, non-deterministic and deterministic finite automata, Acceptance of strings by NDFA and DFA, Transforming NDFA to DFA, minimization/Optimization of a DFA, related algorithm, Regular sets and regular expression. Obtaining regular expression from finite automata, lexical analyzer design.
Context-Free Grammar and Syntax Analysis: Syntax analysis, CFG, derivation of a parse tree, reduction of grammar, useless grammar symbols, Elimination of null and unit productions, elimination of left recursion Regular grammar, Right linear and left linear grammar. Parsing, Top-Down and Bottom-up parsing, general parsing strategies. Brute-force approach, recursive descent parser and algorithms, simple LL(1) grammar, LL(1) with null and without null rules grammars, Bottom-up parsing- Handle of a right sentential form, Shift-reduce parsers, operator precedence parsing.
Symbol Table Management: Symbol table contents, organization for non- block structured language-unordered, ordered, and tree-structured and hash symbol tables. Organization for block structured languages-stack symbols tables. Stack-implemented tree structured stack implemented hash structured symbol tables.
Syntax-Directed Definitions and Translations: Specification of translations, implementation of translation specified by syntax-directed definition, L-attributed definitions, and syntax-directed translation schemes, intermediates code generation, representing three-address statement, translation schemes for programming language constructs.
Code Optimization, Code Generation, Error Handling: Code Optimization: Definition, Loop optimization, Elimination of local and global common sub Expressions, Loop Unrolling, Loop Jamming.
Code Generation: Definition, machine model, code generation methods, peephole optimization. Error Handling- Error recovery, recovery from various phase and parsing.

CS 309d Computer Graphics

Conceptual Framework of an Interactive Graphical Simulation System, Raster Scan and Random Scan Displays, Graphics Architectures, The fundamentals of input, display, and hardcopy devices.
Scan conversion for geometric primitives (This will include Line, Circle, Ellipse and Other Curves Generation Algorithms, Filling Algorithms and Character Generation), Attributes of output primitives and antialiasing techniques, 2D and 3D Geometrical Transformations and Viewing Transformations, Windowing and 2D clipping: line clipping, Polygon clipping.
Graphical User Interfaces, Interactive Input Methods, Texture generation and Rendering, Basic Modelling concepts through curves and surfaces, Visual Realism, Algorithms for Visible Surface Determination, Illumination Models, Shading models, Color Models.
Discrete and Continuous Systems, Graphical Modeling and simulation of discrete events and continuous motion, Animation: Concept and Techniques.

CS 310a Advanced Compuetr Architecture

Redundant Binary Expression, IEEE Standard 754, SRT Algorithm, Newton-Raphson Method, and Goldschmidt Method
Processor Organization, Instructions and Addressing, Instruction Controller, Structure of Arithmetic and Logic Units, Memory Hierarchy and Control, Peripheral Devices and Input/Output Control
Microprocessor Design Trends and Pipeline Control, Cache Design and its Performance Effects, Out-of-Order Execution Mechanisms, Branch Prediction Mechanisms, Multi-Processor and Cache Coherence

CS 310b Artificial Intelligence

Introduction to AI, Agents and environments. Problem solving by search; uninformed search, informed ("heuristic") search, constrained satisfaction problems, adversarial search, Knowledge representation and reasoning;
Bayesian Reasoning, Introducing Bayesian Networks, Inference in Bayesian networks, Application of Bayesian Networks,
Statistical Learning methods
Naïve Bayes Models, Learning with hidden variables-EM algorithm, Instance Based learning- Nearest neighbor models, Kernel model, Nural nets.

CS 310c Mobile Communication

Introduction, Wireless Networks, Wireless VS Wired Networks, Mobile Devices, Mobile Applications, Mobile Environment and limitations, Wireless transmission, Multiplexing, Modulation, Spread spectrum, Cellular networks overview, Cellular Concept, Frequency Reuse, Channel Allocation, Call Setup, Cell Handoffs, Location Management. Medium Access Control – Hidden & exposed, near & far terminal problem, SDMA, FDMA, TDMA, CDMA,

GSM-Basics, GSM-Air Interface, GPRS- Network Architecture**.** Wireless LANs, 802.11 System & Protocol Architecture, Mobile IP, Mobile transport layer

CS 310d Object Oriented Software Engineering

Introduction to Object-Orientation
Identify Objects and Classes, Attributes, Methods,Object Relationships like Association, Aggregation and Composition Inheritance, Polymorphism and Dynamic Binding Interfaces
Unified Modeling Language (UML)
Use Case Diagram, Class diagrams, State transition diagrams, Object diagrams, Interaction diagrams, Activity diagrams, Package diagram, Component diagram, Deployment diagram
Object Constraint Language (OCL)
Requirement analysis, SRS, Use case modeling, Identification of domain objects and interactions modeling, Object Design (problem domain), Subsystem design, goals, Architectural patterns, Object design (solution domain)
Methodologies for object-oriented analysis and design (OOAD),Design patterns, Common design patterns. Creational, Structural and Behavioural patterns
Coding and Refactoring
Object-Oriented Unit, Integration and System Testing
Software Maintenance
Reverse Engineering

CS 312b Machine Learning

Decision tree learning, pruning, overfitting, Occam's razor, Naive Bayes, Conditional independence, Bayes rule, Bayesian classifiers, Perceptrons and linear classifiers, Logistic regression, Generative and discriminative classifiers, maximizing conditional data likelihood, MLE and MAP estimates, Statistical Estimation, PAC Learning, Bayes nets, Representation and Inference, Inference and Learning from fully observed data, Learning from partly unobserved data, EM, Mixture of Gaussians. Hidden Markov Models, Support vector machines, Semi-supervised learning, Dimensionality reduction, feature selection, PCA, Artificial neural networks, Nearest neighbor methods , Reinforcement Learning.

CS 312c Network Security

Issues of security in wireless networks
Probable attacks and points of attack in wireless networks
Security in radio networks of GSM, CDMA, and 3G.
Processes of ciphering in mobile networks such as GSM
Security of wireless network at core layer
Security measures in wireless network
Security protocols such as WEP (Wired Equivalent Privacy), WPAv1 (Wi-Fi Protected Access), TKIP Temporal Key Integrity Protocol), EAP(Extensible Authentication Protocol, LEAP (Lightweight Extensible Authentication Protocol,,)PEAP (Protected Extensible Authentication Protocol), End-to-end encryption (Using SSL, SSH https etc) Security issues in wireless adhoc networks Effect of security on QoS and services.

CS 312e Image Processing

Human visual system and image perception, colour vision, colour representation ; image sampling & quantization; 2-D systems; image transforms; image coding; statistical models for image representation; image enhancement, restoration & reconstruction. Image analysis using multiresolution techniques, Stereo imaging like camera model, Image compression, segmentation, reconstruction from projections, morphology and some descriptors.

CS 313b Pattern Recognition

Introduction, various shape approximations, compactness, Gabor filter, LPF, HPF.
Baye 's theorem, error approximation, parametric and nearest neighbor classifier,
Gradient Descent method. Supervised Classification (Baye 's, Decision Tree, KNN),
clustering, unsupervised Classification (K-Means, Spanning Tree, Graph) .

CS 313f Software Testing And Validation

Introduction, Fundamentals of software testing, Types of Testing, Testing Criteria, Functional Testing, Regression Testing, Metrics Driven Testing, Testing Tools, Test Procedures and Management, Model based software testing Structural Testing, Non-functional Testing, Test driven development, Web applications testing, Services testing, Security testing

Back

Management Science(MS)

MS 301 Management: Concepts & Techniques

Definition of management
Supply chain management (SCM):What is SCM?; basic concepts – decisions in a SC; the importance of the SC; enablers of the SC performance – 1. communication and IT, 2. 3P logistics providers, 3. interfirm coordination; SC strategy – customer service and cost trade-offs – 1. order delivery LT, 2. SC responsiveness, 3. delivery reliability, 4. product variety; SC performance measures; achieving strategic fit; SC drivers – 1. inventory, 2. transportation, 3. facilities, 4. information; SC obstacles; SC components – 1. inbound SC, 2. inhouse SC, 3. outbound SC; distribution network design; channel management; the bullwhip effect.
Operations management (OM):Facilities location – transportation model; Inventory planning and control – inventory planning for independent demand items; types of inventory; inventory costs; inventory control for deterministic demand items – the EOQ model; handling uncertainty in demand – 1. Q system, 2. P system; selective inventory control – ABC classification; Planning and control of operations – demand forecasting; linear programming
Financial management (FM):Financial decisions in a firm – 1. capital budgeting, 2. capital structure, 3. working capital management; goal of financial management – 1. profit maximization, 2. wealth maximization; financial statements – 1. balance sheet, 2. profit & loss account; analyzing financial performance – financial ratios – 1. liquidity ratios, 2. leverage ratios, 3. turnover ratios, 4. profitability ratios, 5. valuation ratios; the time value of money; risk and return; techniques of capital budgeting; working capital policy
Marketing management (MM):(1) Marketing strategy – what is marketing?; company orientations toward the marketplace – 1. production concept, 2. product concept, 3. selling concept, 4. marketing concept, 5. holistic marketing concept; developing a marketing strategy – 1. selecting a target market, 2. marketing demographics, 3. total market approach, 4. market segmentation approach, 5. global marketing strategies, 6. designing a marketing mix (product, price, distribution, promotion); understanding buyer behavior – 1. consumer buying behavior, 2. organizational buying behavior; marketing research

(2) Product strategies – products – 1. consumer products, 2. industrial products; product line and product mix; managing the product mix; the product life cycle; extending the product life cycle; pricing strategies – objectives of pricing; factors in pricing decisions; pricing methods – 1. cost oriented pricing, 2. demand oriented pricing – break even analysis, 3. competition oriented pricing; promotion strategies – the role of promotion; the promotion mix – 1. advertising, 2. personal selling, 3. sales promotion, 4. publicity
Managing organizations:
(1) Management and leadership: Introduction, what is management?, what is leadership?, a variety of objectives, management functions, levels of management, what do managers do with their time?, core management skills
(2) Organizational design and team work: Introduction, why organize?, organizing fundamentals, principles of organizing, how to organize a business
Human resources practices:
(1) Human relations and motivation: Motivation and performance, human resource management and relations, theories of management and needs
(2) Managing human resources: Introduction, the work of human resource management, human resource planning, recruitment and selection, training and employee development, compensation and benefits, contemporary workplace issues, Job design

Back

Electives in Modular Form(EMF)

Elective in Modular Form(EM)

EM 601a Advanced Topic in Computer Architecture

Introduction to Machine Architecture, Instruction Pipelining and Parallel Processing, Parallel Processing and Pipelining, Multiprocessor Architecture, Multiprocessor Architecture: Shared Memory Systems, Multiprocessor Architecture: Synchronization

Text Book: Nicholas Carter and Raj Kamal- "Computer Architecture", Schaum Series TMH Edition, 2006
Reference:
John P. Hayes, Computer Organization and Architecture, TMH

EM 663a Principles of Programming Languages

Declarative, explicit state, object oriented, relational programming models. Concurrency - declarative, message passing, shared-state.
Text Book:
1. Peter van Roy, Seif Haridi, Concepts, Techniques, and Models of Computer Programming, Prentice Hall of India, 2005.

EM 664a Wireless Protocols & Mobile Communication

Introduction, Wireless Networks, Wireless VS Wired Networks, Mobile Devices, Mobile Applications, Mobile Environment and limitations, Wireless transmission, Multiplexing, Modulation, Spread spectrum. Cellular networks overview, Cellular Concept, Frequency Reuse, Channel Allocation, Call Setup, Cell Handoffs, Location Management. Medium Access Control – Hidden & exposed, near & far terminal problem, SDMA, FDMA, TDMA, CDMA,
GSM-Basics, GSM-Air Interface, GPRS- Network Architecture
Wireless LANs, 802.11 System & Protocol Architecture, Mobile IP, Mobile transport layer

Text Books
1. J Schiller , Mobile Communications Pearson Education, 2ed., 2003
2. W. Stalling, Wireless Communications & Networks, Pearson Education,

Reference Books:
3. T.S. Rappaport, Wireless Communications Principles and Practice, Printice Hall of India 2ed. 2005

EM 561a Biometrics

Basic Image Processing Algorithms, Authentication, System Errors, Performance Testing, Selection of Biometrics, Uni-modal Biometrics System, Multi-modal Biometrics System

EM 603a Optimization Technology for Compiler Design

Introduction to compiler optimization, Optimization methods and optimization objectives, Optimization algorithms, Control flow graph, Data flow analysis, Available equation, Loop detection, Variable dead or alive analysis, Instruction scheduling, Register assignment, Array element dependence analysis, Loop conversion,
Text book:
Ikuo Nakata: Compiler construction and optimization, Asakura-shoten, 1999. (in Japanese)

EM601b Advanced Computer Architecture

Introduction, different models of multiprocessor systems, SIMD, MIMD, MISD, SISD. Memory hierarchy and their organization, performance law, interconnection networks, multi computing, pipelining (Scalar and Vector).

EM664b Advanced Wireless Communication Technologies

Introduction to communication system, Different generation of wireless communication, access techniques, cellular concepts – propagation models, fading, interface, handoffs, wireless channel models & assignments, GSM, WLAN

EM667a Neural Networks

Introduction to neurons, artificial neuron, perceptron model, activation functions, learning algorithms: Supervised and unsupervised, single layer neural network, feed forward, feedback networks, RBF-NN, Hopfield networks.

EM668a Information Architecture

Information Architecture (IA) introduction, Path towards IA and business, Architecture for communications, Mini Project.

EM668b Quantitative Methods in Software Engineering

Introduction Software Engineering, Evaluations in Software Engineering
Analytical: Proof oriented; proving properties of abstract objects.
Empirical: Survey, Case studies, Controlled Experiments
Assessment in software engineering, Data Analysis and Hypothesis Testing, Experimental Software Engineering, Data collection methods in Software Engineering

Back

Advanced Data Engineering Technologies

This course focuses on advanced technologies related to the data engineering for manipulating a large amount of data. It includes algorithms, data structures, architecture, and mechanisms for handling various types of large scale databases, such as data warehouse technologies, on line analytical processes technologies, advanced indexing methods, parallel and distributed relational database operations, data placement and storage systems, database related technologies in the cloud computing, data mining applications for various searches, and XML related technologies.

Data Mining

Recent technological advances allow us to collect massive amount of data. The next and current problems move to efficient utilization of the huge data. The intent of this course is to focus on the introduction of current problems in the huge data analysis and fundamental algorithms and statistical methods for analyzing the data.

Distributed Computing using Hadoop

Introduction to cloud, introduction to HDFS, MapReduce, Word count example walk-though, Lab: Example walk though and practice examples, Next Generation Sequencing Example, Lab: If required. (Advanced topics) Hadoop Architecture, ecosystem, Schedulers, workflow engines etc.

Data Communications (EMF)

Overview Of Data Communications

Data and Signals, Data representation, Data transmission, Digital Transmission, Analog Transmission, Signal encoding, Brief of OSI Model, Bandwidth Utilization: Multiplexing and Spreading, Cct. Switching & packet Switching, Using Telephone and Cable Networks for Data Transmission

Line coding & Interfaces

RS232, Null Modem, DTE, DCE

Multiplexing

TDM, FDM, WDM

Modulation Techniques

A to D & D to A Modems

Error Detection and Correction

Parity checking, Cheksum error detection, CRC, Block parity, Hamming code

PSTN, Dialup & FAX working

ISDN & ATM

Information theory

Graph Algorithms (EMF)

1. BFS and DFS with applications (2hrs)

2. Matching in bipartite graphs (2hrs)

3. Max flow and min s-t cut in graphs (2hrs)

4. Eulerian and Hamiltonian graphs (2 hrs)

5. Vertex and edge coloring, independence number and perfect graphs (2hrs)

Wireless Networks (EMF)

1. Basics of Wireless Network
2. Issues in Wireless Network such as standardization, spectrum, interconnectivity
3. Evolution of Wireless Networks
4. Wireless Network need and architecture
5. Issues in Mobile network such as mobility, power control, rate control & QoS.
6. Protocols in wireless networks
7. Comparison of Wireless Network such GPRS,3G, LTE
8. Introduction to wireless security
9. Introduction to wireless adhoc networks
10. Introduction to Wireless sensor network.

Wireless Security (EMF)

1. Issues of security in wireless networks
2. Probable attacks and points of attack in wireless networks
3. Security in radio networks of GSM, CDMA, and 3G.
4. Processes of ciphering in mobile networks such as GSM
5. Security of wireless network at core layer
6. Security measures in wireless network
7. Security protocols such as WEP (Wired Equivalent Privacy), WPAv1 (Wi-Fi Protected Access),TKIP (Temporal Key Integrity Protocol), EAP(Extensible Authentication Protocol, LEAP (Lightweight Extensible Authentication Protocol,,)PEAP (Protected Extensible Authentication Protocol),
8. End-to-end encryption (Using SSL, SSH https etc)
9. Security issues in wireless adhoc networks
10. Effect of security on QoS and services.

Visual Cryptography (EMF)

Introduction, Visual Secret Sharing (VSS), definition and construction, Naor and Shamir's (k,n) VSS, Contrast and pixel expansion, Contrast bounds, Visual Cryptography for multiple secrets, XOR based Visual Cryptography, Data hiding schemes, Reversible data hiding schemes, Brief introduction to colour images, Some recent trends.
Prerequisite: Basic knowledge of programming in MATLAB
Outcome: The student should be able to understand the concept and importance of Visual Cryptography (VC) and implement visual secret sharing schemes for secure image and data communication. The student will have an exposure to some of the most recent trends followed in VC.
Text Book: Stelvio Clemato and Ching-Yung Yang, Visual Cryptography and Secret Image Sharing, CRC Press, 2012.

Introduction to Cloud Computing (EMF)

Prerequisite: basic knowledge of Java Programming, Computer Networks, and Operating Systems

What is cloud computing?
Introduction to Servlet and JSP (Lab)
How Cloud Computing is different from Grid Computing?
Introduction to IaaS, PaaS and SaaS.
Introduction to Amazon AWS (Elastic Compute, S3, Elastic IP, EBS, RDS)
Introduction to Google App Engine for Java (Lab Assignments)
SaaS brief overview
Hadoop a brief Introduction
Writing a Map Reduce Task
Introduction to Elastic Map Reduce

Design of Extensible Applications in Java (EMF)

Prerequisite: basic knowledge of Java Programming, Computer Networks, and Operating Systems

Introduction to Modularity and extensible application
Design of Simple Car Vendor application for Airport
Introduction to Java Service Loader and Reflection (Include 3hours of Lab)
Using Reflection to design Car Vendor Application
Introduction to Eclipse Plugin Development
Re-Writing the Car Vendor Application Using Eclipse Plugin Architecture (3 hours of Lab)
Writing Extensible Plugins

Dependable Computing (EMF)
Introduction, Error Detection, Recovery, Distributed Systems, Evaluation

EM667 a Neural Networks (EMF)

Introduction to neurons, artificial neuron, perceptron model, activation functions, learning algorithms: Supervised and unsupervised, single layer neural network, feed forward, feedback networks, RBF-NN, Hopfield networks

Parallel Processing (EMF)
1. Introduction (What is parallel processing? Why needed?)
2. HPC Architecture
2.1. History of Supercomputers and trends
2.2. Classification of Parallel Architecture (From CPU to System)
2.3. Memory Architecture (Shared, Distributed)

3. Computational Models
4. Parallel Algorithms
4.1 Serial vs. Parallel Algorithms
4.2 Hardware Realization and Examples of special-purpose Processors

5. Parallel Programming Languages
5.1. Relations between Parallel Languages and Architecture
5.2. Parallel Language for Shared-memory Architecture - OpenMP
5.3. Parallel Languages for Distributed-memory Architecture – Message Passing Interface

6. Application Areas for the Large Scale Scientific Computations/Simulations
7. Grid Computing and cloud

EM667 a Network Computing (EMF)

Introduction to Network Computing
Advent of Cluster Computing and its Applications
Advanced Analysis of Transport Protocol
- TCP Window Management
- TCP Congestion Control
Storage Area Network
Introduction to Cloud Computing
Data Processing Framework in Cloud Computing
Wireless Network Protocols
Mobile Network Computing
Sensor Network and its Data Analysis

Optimization Techniques (EMF)

Classical Optimization method
Single variable optimization; Multi variable optimization with no constraints (semi-definite case, saddle point), with equality constraints (solution by direct substitution, method of constrained variation, method of Lagrange multipliers), with inequality constraints (Kuhn-Tucker conditions, constraint qualification); Convex programming problem

NLP: One dimensional minimization methods (Brief Introduction only)
Elimination methods: Interval halving method; Fibonacci method; Golden section method
Interpolation method: Direct root methods (Newton method, quasi-Newton method, secant method)

NLP: Unconstrained optimization techniques
Direct search methods: Univariate; Pattern directions; Hooke and Jeeves' method; Powell (conjugate directions).
Indirect search methods: Gradient of a function; Steepest descent (Cauchy); Conjugate gradient (Fletcher-Reeves); Newton's; Marquardt; Quasi-Newton (Variable metric); Davidon-Fletcher-Powell.

NLP: Constrained optimization techniques
Direct methods: Sequential linear programming; Feasible directions (basic approach); Feasible directions (Zoutendijk's method); Rosen's gradient projection; Generalized reduced gradient;
Indirect methods: Penalty function method (basic approach); Interior penalty function method; Convex programming; Exterior penalty function;

Integer programming (IP)
Integer linear programming: Graphical representation; Gomory's cutting plane; Bala's algorithm for 0-1 programming
Integer nonlinear programming: Integer polynomial programming; Branch and bound method.

Other optimization techniques
Genetic algorithms
Simulated annealing
Ant Colony Optimization
Particle Swarm Optimization

DS 542: Product Design - II

The main weightage of this course is on design projects. At the end there will be a comprehensive presentation along with working/mock up models, software modelling/rendering, design drawing and a detailed report.
The course intends in developing an understanding of:
Metaphors and forms.
Product expressions by analysing elements and principles of design
Form exploration in Product Design
Expressions in Form like soft, hard, warm, cold, precise, gross, delicate, strong, fragile, rugged etc.
Design Methodology in Detail
Design solution to problems related to the individual and social application of the product, its form, production variables and technological process.
Step by step analysis of the product design and development process applicable to a case example.
Product Service Systems (PSS) thinking and Design
Problem solving using a Systems-based approach - Using knowledge and creativity to develop Product service system (considered as a blend of products, communication strategies, services and spaces used by profit and non-profit enterprises, institutions, associations, etc.) -based solutions to problems that we're currently facing in our communities, organizations, or even personal lives

ES-306 Time Frequency Analysis

Theory: Basics of Fourier Analysis, Spectral Theory, Fundamentals of Time Frequency Analysis, Instantaneous Frequency and the Complex Signal, Uncertainty Principle, The eed for Time-Frequency Analysis, Gabor Transform, The Short-Time Fourier Transform/Spectrogram, Time-Frequency Localization, Continuous Wavelet Transform/Scalogram, Multiresolution Analysis, Quadratic Time Frequency Transform, Wigner- Ville Distribution, Signal Processing Applications.
Practical: Basic of MATLAB, Implementation of discrete signal, DSP mathematical problem solving by using MATLAB, Frequency domain analysis, Time frequency algorithm implementation, basic filter designing.
Text Book:
I. S. Mall at, A Wavelet Tour of Signal Processing (3rd edition), Academic Press, 2008, ISBN: 978-0123743701.
2. Leon Cohen, Time-Frequency Analysis, Prentice Hall; 1994, ISBN: 978-0135945322.
3. B. Boashash, Time-Frequency Signal Analysis and Processing: A Comprehensive Reference, Elsevier
Science, 2003, ISBN-13: 978-0080443355.
4. R. M. Rao and A. S. Bopardikar, Wavelet Transforms: Introduction to Theory& Applications, Prentice
Hall, 1998, ISBN-13: 978-020163463
Reference:
IEEE International Symposium on Time-Frequency and Tirne-ScaleAnaiysis,
(Pub!. TH4788 or ISBN 0-7803-0805-0)
@)~01

EC-313(a) Pattern Classification

Introduction/definition of pattern recognition, Overview of supervised vs. unsupervised learning techniques, Clustering overview (categories, proximity measures, etc.), Probabilistic clustering approaches, Multivariate analysis techniques, Principal Components Analysis, Multidimensional scaling, Linear Discriminant Analysis, Two class classification, Multiclass classification, Image analysis techniques, Feature selection and generation.

TextBook:

1. Pattern Classification, 2nd Edition by Duda, Hart, and Stork; published by John Wiley, 200 I.
2. Pattern Recognition Sergios Theodoridis and Konstantinos Koutroumbas Academic Press; 3 edition(March 10, 2006) ISBN-I 0: 0123695317 ISBN-13: 978-0123695314
3. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Inte II igence. 2003.
4. Bishop, C. M. Neural etworks for Pattern Recognition. Oxford University Press. 1995.
5. Hastie, T.,Tibshirani, R. and Friedman, 1. The Elements of Statistical Learning. Springer. 2001

DS-559 Visual Design

• Visual Perception
Study of human visual perception
Relation of visual perception to visual design applications
• Visual Language
Study of visual language / syntactics
Exploration of elements and principles of visual design
Understanding visual structure and visual interest
Study of aesthetics in visual images
• Typography Design
History, classification, anatomy and usage of various letterforms
Theoretical and applicable principles of letterforms
• Information Graphics
~~
oOj • Interactive Experience Design
Study of visual display of quantitative information
Syntactic and semantic aspects of information graphics
Application of information graphics in different contexts
Study of man-machine relationships
Interaction design, user interface design, website design, motion graphics
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\ -1- r: , and scree~ based narrative design, video game design
Exploration of digital media for communication
Methodology of design for interactive media and user experience
• New Media Design
Basics of Virtual / Augmented / Mixed Reality and their applications
Virtual communities and web based media
New media Design / Cross media communication
Future of visual communication media

EM675a Geometric Transforms and Motion Analysis

A hierarchy of geometric transformations: Euclidean/Similarity/ AffinelProjective, with invariance and applications to morphing and mosaicing.
Motion analysis: robust hierarchical optical flow computation, a popular tracking algorithm, Particle Filtering
The course will cover both the mathematical basis of all of these methods, as well as point to practical applications of the same.
EM605f Coding Theory
Basic concept of codes and finite fields, Linear codes, Bounds on the size of codes, cyclic codes, Basics of BCH codes and Reed-Soloman codes.
Reference: Fundamentals of Error-correcting Codes by William Cary Huffman, Vera Pless.

EM675b Document Image Processing and Compression

Introduction to Digital Document Image Processing, Types of conventional and digital documents, Problems to solve, Applications.
/
Preprocessing of document images, Noise cleaning and binarization, skew detection and correction, Layout analysis and text block detection
Printed Text recognition in images, Line, word and character detection, feature selection and extraction, Character classification, Post-processing
Handwritten text processing, line and word segmentation, feature identification
Data compression, RLC coding, Huffman coding, Arithmatic coding and LZ coding.

EM675c Fundamentals of Image Reconstruction

One dimensional signal processing, Fourier analysis, two-dimensional Finite Fourier Transform, Line Integrals and projections, Projection data collection geometries, Measurement of projection data, Fourier transform based image reconstruction methods, Series Expansion based image reconstruction methods.

EM606b Introduction to Data Mining and Big Data Analysis

Part I: Basics of Data Mining
- Basics of Probability, Statistics
- Data acquisition, transformation, visualization, modelling
- Classification: Linear Regression, Logistics Regression, Naive Bayes
- Clustering: K-means, Association Rule Mining, Hidden Markov Model
Part II: Big Data Analytics
- Big Data Extensions to data mining.

EC611 Image Processing

Digital Image Fundamentals; Image Enhancement in Spatial Domain: Gray Level Transformation, Histogram Processing, Spatial Filters; Image Transforms: Fourier Transform and their properties, Fast Fourier Transform, Other Transforms; Image Enhancement in Frequency Domain; Color Image Processing; Image Restoration; Image Compression; Morphological operators; Image Segmentation: edge detection, Hough transform, region based segmentation; Representation and Description.

EC 612 Pattern Recognition

Object Recognition: Structural Approaches, Model-based Approaches, Appearance and Shapebased Approaches, Probabilistic Paradigms.
Pattern Analysis: Clustering: K-Means; Gaussian Mixture Model (GMM); Classification Discriminant Function, Supervised, Semi-supervised, Unsupervised; Classifiers: Bayes, KNN,
ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.
Some Applications based on the techniques discussed.

Back

CS302L-Professional Lab2 Course Contents

Lab Session on =-Network Topology, Transmission media, Wireless Transmission, Digital Transmission,
Local Area Networks -- Ethernet, Broadband, Wireless LAN, Layer 3 Devices, Routers, Application Layer Protocols, TCP/IP, Network & Cyber Security.
Lab Session on =-Simulation of Sliding Window Data Link Protocols, Establishing a TCP/JP connection
through sockets, Client-server application for chat through sockets, HTML Server Implementation through Socket Programming.

CS509 Software Modeling: Techniques and Tools

Abstract:
Successful software development is inherently complex task involving complexities from both problem and solution domains. The task gets further involved as change being the nature of the development. Perhaps the most important idea that helps in meeting out the challenges is the power of abstraction that comes with models. Many modeling techniques have been proposed and used to demonstrate how good are these models in modeling certain aspects of software and help in solving certain software engineering problems. However, one has to be careful in using these models as the same abstraction can also become a limitation under certain context. In this course, we review various modeling techniques abstracting out the different perspectives/aspects of the software under development. In this process, we critically analyze their usability and other related issues including their limitations for problem solving. We conclude by identifying some of the challenges that are still faced by the modeling community and suggest future course of possible actions.
Details:
Software Engineering Challenges, Managing Complexity, modeling perspectives, modeling and analysis of software artifacts - information modeling, functional modeling, behavior modeling, Model-Driven Engineering (MDE), Domain modeling, Design patterns, PIM, PSM, Model transformation, code generation, reverse engineering
Modeling tools like UMl, OCl, CFG, dataflow, Petri-nets, applications, strengths and limitations, automated tool support.

DS558 Visual Ergonomics

Characteristics of the human eye, scanning and detection, color spectrum, legibility of text, icon usage, movement pattern of eye in reading, information system design in space and application, chunking of information, Stroop effect, use of metaphors, color blind population and considerations for them, information
design in public places, information design with reference to emergent situation, symbol comprehension
test, ergonomic issues in design of signage, maps, application, ergonomics in designing of logo, symbols,
mascots etc. Ergonomic issues in designing labels and information on packaging.

CSE:Parallel Algorithm

Paradigms of parallel processing:
Parallel computational models; Performance metrics; Parallel programming; Complexity measure of parallel algorithms
Semi-numerical and non-numerical algorithms:
Combinatorial algorithms; Searching algorithms; Sorting algorithms; Graph algorithms
Numerical algorithms:
Algorithms for linear algebraic equations; Issues offactorization; Implementation of classical iterative Methods

Text Book:

1. S.G. Akl, "The Design and Analysis of Parallel Algorithms", Prentice-Hall, ISBN 13: 9780132000734
2. S.G. Akl, "Parallel Computation", Prentice-Hall, 1997

Reference book:

1. Joseph Jaja, "Introduction to Parallel Algorithms", amazon, ISB -13: 978-0201548563
2. Sayed H Roosta, "Parallel Processing and Parallel Algorithms", Springer, ISBN: 978-1-4612-7048-5
3. Barry Wilkinson and Michael Allen, "Parallel Programming", Pearson education, [S8 - 8 I -317-0239-1
4. E.H. D'Hollander, G.R. Joubert, F.J. Peters,and U Trottenberg, "Parallel Computing: Fundamentals, Applications and new directions", Elsevier, ISBN 978-0-444-82882-8
5. D. B. Kirk and W. W. Hwu, "Programming massively parallel processor: a hands on approach", Elsevier, ISBN: 978-0-12-381472-2
6. R.K. Ghosh, Phalguni Gupta and Rajat Moona, "Foundation of Parallel Processing", Narosa Publication, lSBN: 8173190321, 9788173190322
7. Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, Dror Maydan and Jeff McDonald, "Parallel Programming in OpenMP", Elsevier, ISBN: 978-1-55860-671-5
8. J. Sanders and E. Kandrot, "CUDA by Examples", Addison-Wesley, ISBN: 978-0-13-138768-3

EM594(a): Ergonomics in Information Design

Cognitive ergonomics in information design, information processing, human characteristics and its pertinence in information design, presenting information in different formats, information overload, ergonomic issues in password, cognitive issue in information design in digital and print medium

EM601d Parallel Processing (EMF)

1. Introduction (What is parallel processing? Why needed?)
2. HPC Architecture
2.1. History of Supercomputers and trends
2.2. Classification of Parallel Architecture (From CPU to System)
2.3. Memory Architecture (Shared, Distributed)
3. Computational Models
4. Parallel Algorithms
4.1 Serial vs. Parallel Algorithms
4.2 Hardware Realization and Examples of special-purpose Processors
5. Parallel Programming Languages
5.1. Relations between Parallel Languages and Architecture
5.2. Parallel Language for Shared-memory Architecture - OpenMP
5.3. Parallel Languages for Distributed-memory Architecture - Message Passing Interface
6. Application Areas for the Large Scale Scientific Computations/Simulations
7. Grid Computing and cloud

EM674a Visual cryptograPhi (EMF 2 credits)

Introduction, Visual Secret Sharing (VSS), definition and construction, Naor and Shamir's (k,n) VSS, Contrast and pixel expansion, Contrast bounds, Visual Cryptography for multiple secrets, XOR based Visual Cryptography, Data hiding schemes, Reversible data hiding schemes, Brief introduction to colour images, Some recent trends.
Prerequisite: Basic knowledge of programming in MA TLAB
Outcome: The student should be able to understand the concept and importance of Visual Cryptography (VC) and implement visual secret sharing schemes for secure image and data communication. The student will have an exposure to some of the most recent trends followed in VC.
Text Book: Stelvio Clemato and Ching- Yung Yang, Visual Cryptography and Secret Image Sharing, CRC Press, 2012.

EMF60 Visual Cryptography: Techniques and Trends

Introduction, Visual Secret Sharing (VSS), definition and construction, Naor and Shamir's (k,n) VSS, Contrast and pixel expansion, Contrast bounds, Visual Cryptography for multiple secrets, XOR based Visual Cryptography, Data hiding schemes, Reversible data hiding schemes, Brief introduction to colour images, Some recent trends.
Prerequisite: Basic knowledge of programming in MATLAB
Outcome: The student should be able to understand the concept and importance of Visual Cryptography (VC) and implement visual secret sharing schemes for secure image and data communication. The student will have an exposure to some of the most recent trends followed in Vc.

DES-504 DESIGN PARADIGM

(I) Introduction to Design Paradigm: Recognizing Design Paradigm; Paradigm as Metaphor; Design & Nature; The Human Body; Where Does Form Come Form? Simple Shape Analysis- The Platonic Solids, Ball, Sheet, Tube, etc. Concept of Enclosure; Bending & Flexing; Bigger & Smaller; Binary Relation; Multiple Object Relations; Objects with in Objects; Multi-function Objects
(II) Design Paradigm & Practice; In this module students will be encouraged to make conceptual project proposal and possible applications
(III) Related Studio Projects

EM 682c: Business Decision Analysis: Techniques & Application

1) Decision Analysis in Inventory Management: Multi-criteria ABC Analysis
2) Decision Analysis in Supplier selection: AHP, TOPSIS MCDM Techniques
3) Interpretive Structural Modeling in Decision Analysis (ISM)
4) Decision Analysis under conflicting objectives: Goal Programming (GP)
5)DEA

EM 661c: Innovation, Marketing and Consumption

Innovation:
Different theories on creativity and the creative process
Creativity, Innovation: Individual, Society and the context
Generating Innovative Ideas
Marketing New Products
Understanding Market
Diffusion of Innovation and Consumer Biases
Market Segmentation and Targeting:
Product Positioning
Promotion and Advertising
Branding
Insight to Marketing Strategy
Consumer Behaviour
Understanding Consumer Behaviour
Measuring Customer Preferences
Project Presentations
Text Books:
1. Singh, Ramendra, Case Studies in Marketing Management, Pearson Education, Pearson Education
2. Majumdar, Ramanuj, Consumer Behaviour: Insights from Indian Market, PHI Learning Pvt Ltd

EM682d: SECURITY ANALYSIS, DERIVATIVES AND PORTFOLIO MANAGEMENT

Financial Markets, Investment Alternatives, Risk and Return, Portfolio Theory and Capital Asset Pricing Theory and Arbitrage Pricing Theory, Efficient Market Hypothesis, Security Analysis an Valuation, Valuation of Equity and Fixed Income Securities, Fundamental Analysis, Technical Analysis, Investment Strategies, Derivatives, Options and Properties of Stock Options, Futures, Swaps, Binomial Trees, Black Scholes Model, Estimating Volatility and Correlations, Hedging and Portfolio Management.

EM684c : ENTREPRENEURSHIP AND MANAGEMENT

1. Basic way of evaluating a business proposal
2. Basics of Marketing - Opportunity Recognition, Product Planning, Market Analysis, SWOT Analysis, Writing a Marketing plan
3. Basics of Financial Planning - Capital budgeting, revenue r~cognition, components of cost, Income statement, asset liability statement, cash flow evaluation, financial ratios and evaluating criteria.
4. Case Study based discussion and solving the case study through a marketing plan and financial plan.
5. MRP-I, MRP-II, and MRP-III
6. Inventory Management
7. Quality Management

EM 684d: FINANCIAL MANAGEMENT AND ECONOMIC ANALYSIS

1. An overview of Financial Management and Financial Environment
The corporate life cycle, the financial markets, Cost of Money and interest rates, Economic Factors that influence Interest Rate Levels
2. Time Value of Money
Future Value and of Annuity, Present Value and of Annuity, Cash Flow Streams
3. Financial Statement, Cash Flow, Economic Value
Financial Statements, Balance Sheet & Income Statement, Cash Flow, Balance Sheet, Income Tax, Depreciation
4. Cost of Capital, Project Financing
Cost of Capital, Evaluating Cash Flows, Comparison ofNPV and IRR, Capital budgeting Risk analysis
5. Working Capital Management
Cash Conversion Cycle, Cash Management and Cash budget, Inventory and Receivables Management, Short Term Financing
6. Managerial Economics- Micro and Macro
Supply and Demand Analysis, Consumer Behaviour - concept of demand curve, Production and Cost Analysis, Market structure - Monopoly, oligopoly and pricing
Basic Macroeconomic overview - GDP, NDP, BOP, Money Supply, Balance of payments, Fiscal Policy, monetary Policy and Interest Rate Structure

EM 683a: SUPPLY CHAIN MANAGEMENT

- Production-Consumption Cycle
- Introduction to Supply Chain Management (SCM)
- Inventory Management in SCM
- Distribution Network in SCM
- Logistics and Transportation in SCM
- Information and Communications in SCM

Text Book: S. Chopra, P. Meindl, Supply Chain Management: Strategy, Planning and Operations, Prentice Hall, New Jersey, 2007.

EM684b Engineering Economics

1. Basic Economic problems
2. Nature of economics
3. Some basic concepts/terms of economics
4.Role of state in economic activities
5.Failure of market
6. Failure of government
7. Basic economic laws:
Law of demand
Law of supply
Law of diminishing marginal utility
Law of diminishing returns(law of variable proportions}
8. Market structures
9. Concept of national income
10. Cost Analysis

EM666b MEMS & micro-nano-fabrication

Microelectromechanical systems (MEMSs) have been widely used as a key components of devices for information technology, biotechnology, nanoscience and industry. MEMSs consists of miniaturized elements, and realize sensing and actuation performance. In this class, the fundamental of microelectromechanical systems (MEMSs), fabrication technologies, design of MEMSs, elements of MEMSs, and example of MEMSs will be presented as follows.

1. Fundamental of MEMSs
2. Fabrication technologies of MEMSs
3. Elements ofMEMSs
4. Design ofMEMS I
5. Design ofMEMS II
6. Resonators
7. Accelerometers
8. Pressure sensors
9. Integrated systems
10. Nanoelectromechanical systems
11. Exercise
12. Summery

MESS1 b: Ultra Micro Precision Machining Including Electronics Components

1. Introduction ofNano-Precision Machining
2. Nano-Precision M4 processes
3. Nano-Precision Grinding
3.1 Fundamental of grinding
3.2 Grinding processes
3.3 Truing and dressing
3.4 Truing and dressing for ultra-fine grit diamond wheels
3.5 Nano-precision aspherical grinding
4. Nano-Precision Polishing
4.1 ERF -assisted fine finishing
4.2 MRF-assisted fine finishing
5. Powder Jet Machining
5.1 Abrasive jet machining (AJM)
5.2 Powder jet deposition (PJD)
6. Conclusions

EM624b Design and Control of Redundant Robots

Objectives:
Redundant robots which have redundant degrees-of-freedom can generate intelligent, flexible and complicated motions. The design and motion control methods based on kinematics dynamics analyses will be explained with several examples.
Outline:
1. Introduction
1.1 Redundancy
1.2 Flexibility of motion and structure
1.3 Advantages and issues to be solved
2. Optimum control of serial redundant manipulator
2.1 Kinematic analysis
2.2 Optimization method
2.3 Optimum motion control on dexterity as an objective function
3. Synthesis of redundant closed-loop mechanisms
3.1 Synthesis using virtual pairs
3.2 Examples of synthesis
3.3 Motion control of spatial parallel manipulator with redundancy
3.4 Analysis and control of serial/parallel hybrid manipulator
4. Motion control of redundant robot based on reflex motion of each link
4.1 Stimuli from environment and reflex motion
4.2 Trajectory generation of redundant serial robot based on reflex motion
4.3 Maze escape of a snake robot
5. Design and control of redundant overactuator mechanism
5.1 Design of network-structure robot
5.2 Control of network-structure robot
5.3 Control of over actuator mechanism with elastic elements
6. Concluding remarks

ME-548 Fault Diagnosis and Prognosis for Engineering Systems

Introduction, Systems approach to condition based maintenance/ prognostics health management, Signal processing and database management systems, Fault diagnosis and prognosis, Fault diagnosis and prognosis performance metric

Introduction
Historical Perspective, Diagnostic and Prognostic System Requirements, Designing in Fault Diagnostic and Prognostic Systems, Diagnostic and Prognostic Functional Layers.
System approach to condition based maintenance prognostics health management
Introduction, Trade Studies, System CBM Test-Plan Design, Performance Assessment, CBM/PHM Impact on Maintenance and Operations, Sensors, Sensor Placement.

SIGNAL PROCESSING AND DATABASE MANAGEMENT SYSTEMS
Signal Processing in CBM/PHM, Signal Preprocessing, Signal Processing, Vibration Monitoring and Data Analysis, Real-Time Image Feature Extraction and Defect/Fault Classification, The Virtual Sensor, Fusion or Integration Technologies, Usage-Pattern Tracking.

FAULT DIAGNOSIS AND PROGNOSIS
The Diagnostic Framework, Historical Data Diagnostic Methods, Data-Driven Fault Classification and Decision Making, Dynamic Systems Modeling, Physical Model-Based Methods, Model-Based Reasoning, Case-Based Reasoning (CBR), Other Methods for Fault Diagnosis, A Diagnostic Framework for Electrical/Electronic Systems, Vibration-Based Fault Detection and Diagnosis for Bearings.

Model-Based Prognosis Techniques, Probability-Based Prognosis Techniques, Data-Driven Prediction Techniques.

FAULT DIAGNOSIS AND PROGNOSIS PERFORMANCE METRICS
Introduction, CBM/PHM Requirements Definition, Feature-Evaluation Metrics, Fault Diagnosis Performance Metrics, Prognosis Performance Metrics, Diagnosis and Prognosis Effectiveness Metrics, Complexity/Cost-Benefit Analysis of CBM/PHM Systems

Professional Elective II: ME 416 Vibrations of Mechanical Systems [3-1-0-4]
Prerequisite: #

Introduction: Types of vibrations. Single degree of freedom systems and Simple problems. Formulation- Newton's second law, Energy method and Principle of virtual work.
Undamped free vibrations -. Introduction, undamped free vibration - natural frequencyof free vibration, stiffness of spring elements, effect of mass of spring.
Damped free vibrations: Single degree freedom systems, different types of damping, concept of critical damping and its importance, study of response of viscous damped systems for cases of under damping, critical and over damping, Logarithmic decrement.
Forced Vibration: Single degree freedom systems, steady state solution with viscousdamping due to harmonic force, solution by complex algebra. Concept of response, Reciprocating and rotating unbalance, vibration isolation - transmissibility ratio. Energy dissipated by damping, sharpness of resonance, base excitation.
Systems with two degrees of freedom: Introduction, principal modes and normal modes of vibration, co-ordinate coupling, generalized and principal co-ordinates, free vibration in terms of initial conditions. Geared systems. Forced Oscillations - Harmonic excitation. Applications: (a) Vehicle suspension (b) Dynamic vibration absorber (c) Dynamics of Reciprocating Engines.
Multi Degrees of freedom systems: Introduction, Influence co-efficient, Maxwell reciprocal theorem, Automobile vehicle suspension, coupling, Vibration absorbers, Orthogonality of principal modes, Various numerical methods for solution of multi degree of freedom systems, Holzer's method, Rayleigh's method.
Vibration monitoring and analysis: Introduction, Accelerometer and vibrometers. Machinery signatures, Selection of Transducers and signal conditioning. Analysis Techniques, Machine failure modes, Measurement location, Vibration severity criteria, vibration frequency analysis. Case studies.

ES-601 Biomedical Engineering

Unit-I: Structures & Properties of Biomolecules
Basic ideas on structures and functions of nucleic acids, proteins and carbohydrates, Biomolecular forces, DNA-Protein interaction, protein folding, Mechanisms of enzyme action and regulation.
Unit-II: Disorders and Diseases
DNA & protein modifications by free radicals, oxidative stress & radiation. Disorders in DNA and Proteins, Mutatgenesis, Carcinogenesis and aging.
Cancer initiation, promotion, & progression, Growth factors, growth factor receptors & signal transduction, Protein misfolding and aggregation, Neurodegenerative disorders, Alzheimer's disease, Parkinson's disease, Prion disease.
Unit-III: Disease Control & Therapy
Enzymatic DNA repair, Chemical drug design by targeting protein-inhibitor binding, Anti-cancer chemotherapy, Molecular target therapy, Gene therapy.
Unit-IV: Biomaterials and Bio-nanotechnology
Biocompatibility, Interactions with cellular components, Examples and applications. Molecular nanotechnology, Bio-nanomaterial & applications

EM-605(d) Path Planning Algorithms

Path planning introduction. Shortest path problems, constrained path planning, quickest path planning, Dijkstra's algorithm, A * algorithm and 0* algorithm.
Path planning in unknown and known environment, bug algorithms, road map based methods, generalized Voronoi diagram, cell decomposition methods.

EM-591(a) Design Engineering

Fundamental Units and Basic Calculations in Hydraulics. Fluid Theory, Properties of Hydraulic Fluids, Basic Technology for Hydraulic Component Design. Basic Design Idea. Various Hydraulic Components and Functions. Hydraulic Equipments. Design Specifications. The Applications of Oil Hydraulic Power. Considerations of Key Points for Equipment Designs. Hydraulic Power Applications. New Development Tendencies.

EM-591(f) Industrial & Aesthetic Attributes in Concept Design

High value added product design. Passenger car design improvement method in a quantitative manner. Understanding of Taper Tack by lecture and real samples.
Food package design from an aesthetic viewpoint and evaluation method.
Understanding the aesthetic design effect on customer purchasing motivation.
Investigation of aesthetic design examples and discussions on what is the definition of "aesthetic design".
Design of product variants from functional and aesthetic viewpoints. Analysis methods of designer's thought process during design activities.

EM-595(a) Evaluation of Product Design

Introduction to "Kansei engineering" and the industrial products. Usefulness of products. Basic program for Science and Technology in Japan. Kansei value creation, Utility and usability, Kansei value.
Research method of "Kansei engineering". Examples of research: Brain-wavebased Motion Control System for a Mechanical Pet, Comparison of the impression of the space between virtual environment and real enviromnent, Evaluation of Comfortable Spaces for Women using a Virtual Enviromnent, Measurement of Excitement Feeling Generated by Interactive Systems using Biological Signals, etc. Differences between evaluation by questionnaire and evaluation by biological signals. Measurement ofEEG.
Introduction to "Kawaii". Experiments of Shapes and Colors, Study on Kawaii Colors of Virtual Objects, Relation between Kawaii Feeling and Biological Signals

ME-649 ADVANCED MACHINING PROCESSES

Advanced Metal Cutting and Grinding [9 hours]
Modelinz of cuttinz process: Review of cutting mechanism; Cutting force model; Oblique Cutting; Temperature analysis
(Finite Difference Method); Wear model; Evaluation of surface quality; Cutting processes for producing various shapes
Gear machininz: Hobbing.
Modelinz ofgrindinz process: Grinding force model; Temperature analysis; Wheel life model.
Introduction o[finishinz process: Machining mechanism in finishing: Honing, Lapping, Super finishing, etc.
icro-Nano Precision Machining [8 hours]
troduction to nano-precision mechanical manufacturinz: M4 processes
Nano-precision cutting: Machine & tool; Brittle / ductile transition; Ductile mode cutting of brittle materials
Nano-precision grindinz: Machine & grinding wheel; Truing & dressing; Cutting edge evaluation; Applications to extreme
optics
Nano-precision polishinz: Conventional polishing; Non-conventional polishing; Plane honing; Field-assisted fine finishing
Unconventional Machining Processes: [25 hours]
Electric Discharge Machining (EDM); Electron Beam Machining (EBM); Plasma Arc Machining (PAM); Laser Beam
Machining (LBM); Ultrasonic Machining (USM); Abrasive Jet Machining (AJM); Water Jet Cutting (WJc), Abrasive
Water Jet Machining (AWJM); Electro-Chemical Machining (ECM); Chemical Machining (CHM)

EC414 Optical and Wireless Communications

Basic Optical Communication System, Optical fiber types, propagation modes, transmission and attenuation,
Dispersion and pulse broadening,
Requirement for optical source, Double Hetro-junction and homo-junction injection lasers structure & Characteristics. Drawback and advantages of LED, DHLED, LED structures and characteristics.
P-n photodiode, p-i-n and avalanche photodiodes, LED and laser drive circuits, Regenerative repeater, optical
power budgeting.
Multiplexing Strategies: OTDM, Subcarrier, OFDM, WDM, OCDM, Hybrid Multiplexing. Optical Fiber network
evolution, Wavelength division multiplexed networks, Optical network transmission modes, layers and
protocols, Wavelength routing network, Optical switching networks.
Antennas, Line-of-Sight Transmission, Fading in the Mobile Environment, Signal Encoding Techniques.
Concept of Spread Spectrum, Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum, CodeDivision Multiple Access.
Satellite Parameters and Configurations, Capacity Allocation-Frequency Division. Capacity Allocation-Time
Division.
Principles of Cellular Networks, First Generation Analog, Second Generation TDMA, Second Generation
CDMA, Third Generation Systems.
Cordless Systems and Wireless Local Loop, Mobile IP and Wireless Access Protocol, Wireless LAN Technology,
Infrared LANs, Spread Spectrum LANs, Narrowband Microwave LANs.

ME521 Quantitative techniques in logisticsmanagement

Inventory control of independent demand items, MRP, Scheduling, Vehicle routing and transportation problems, facility location models.

EM601(f) Data Mining

Recent technological advances allow us to collect massive amount of data. The next and current problems move to efficient utilization of the huge data. The intent of this course is to focus on the introduction of current problems in the huge data analysis and fundamental algorithms and statistical methods for analyzing the data.

ES203 Numerical Methods

Root finding problem for transcendental and polynomial equations - methods and analysis.
• Interpolation: Lagrange, divided difference, Hermite and Spline interpolation, Inverse interpolation. Approximation - Least squares and minimax approximation.
• Numerical differentiation, Numerical integration - Trapezoidal Rule, Simpson Rules, Newton-Cotes and Gauss quadratures.
• Numerical methods (direct and iterative) for solving linear systems with error analysis.
• Numerical methods for initial problems: Euler, Modified Euler, Runge-Kutta and Predictor-Corrector methods
• Numerical methods by finite difference for boundary value problems
• Stability of numerical methods. Eigen values and eigen vectors for linear algebraic systems.

DS:577-Design Workshop II

The idea of the course is to give exposure and hands on training to the students on 3D product modeling
using Introduction to the geometry of platonic solids and study of their inter-relationships.
Familiarizing a wide variety of concepts, materials, tools, and fabrication techniques vital to product design.
Materials like Wood, Poly urethane foam (PUF), fiber reinforced plastic (FRP), Scrap metal sculpture in
steel using welding techniques are explored. Student projects will be based on conceptual problems and
solutions incorporating these materials. Students will be evaluated for their skill and ability in the innovative
use of materials, processes and use of digital tools in developing solutions for their project

NS601 :NUMERICAL SOLUTION TO PD

(1) Classification of PDEs, Finite difference approximations to partial derivatives.
(2) Parabolic equations in one and two space dimensions - explicit and implicit formulae. Consistency, stability and convergence.
(3) Elliptic equations in two space dimensions-explicit and implicit formulae. Consistency, stability and
convergence.
(4) Hyperbolic equation, explicit / implicit schemes, method of characteristics. Solution of wave equation.
(5) Solution ofI order Hyperbolic equation. Von Neumann stability.
(6) Conservation laws, Weak solutions & shocks

EC311 VLSI Design and Testing

Introduction to MOSFET from designer's viewpoint; VLSI design Flow;
FPGA Architecture, MaS capacitor/resistor; Scaling Methodologies in transistors, SCE's;
Interconnect scaling, Interconnects: resistances, capacitances, Inductances, Interconnect modeling.
MaS inverter: static and switching characteristics; VTe's; Propagation delay, Fan-out consideration
Combinational MaS logic Circuits: Pass-transistors/transmission gates, primitive logic gates, complex logic gates;
Sequential MaS logic Circuits: latches and flip-flops.
Introduction to :VLSI testing.

NS601 NUMERICAL SOLUTION TO PDE

(1) Classification of PDEs, Finite difference approximations to partial derivatives.
(2) Parabolic equations in one and two space dimensions - explicit and implicit formulae. Consistency, stability and convergence.
(3) Elliptic equations in two space dimensions-explicit and implicit formulae. Consistency, stability and
convergence.
(4) Hyperbolic equation, explicit / implicit schemes, method of characteristics. Solution of wave equation.
(5) Solution of I order Hyperbolic equation. Von Neumann stability.
(6) Conservation laws, Weak solutions & shocks.

ME547 Mechanical Vibrations and Condition Monitoring [3-0-0-4]

Review of Free and forced vibrations of single degree of freedom system. Vibration isolation and transmissibility, Vibration measuring instruments.
Multi Degrees of freedom systems, Introduction, Influence co-efficient, Maxwell reciprocal theorem,Automobile vehicle suspension, coupling, Vibration absorbers, Various numerical methods for solution of multi degree of freedom systems.
Whirling of shafts with and without air damping. Discussion of speeds above and below critical speeds.
Vibration of Continuous Systems: Introduction, vibration of string, longitudinal vibration of rods, torsional vibration of rods, Euler's equation for beams, simple problems.
Non-linear vibration, PhasePlane, Conservative systems, Stability of equilibrium.The Duffing Osci lIator.
Introduction to condition monitoring of machinery, Condition monitoring methods, Types and Benefits of Vibration Analysis. Vibration Signals from Rotatingand Reciprocating Machines.
Signal Classification, Stationary and Cyclostationary signals.

CS611 Open Source Software Development

Abstract:
In current context of software development projects, open source movement has come a long way from
the FSF(free software movement) started by Stallman. Today all categories of software projects, right from core web servers, to latest technologies like Clouds, leverage open source phenomenon, which can
prove itself to be an equal force like the conventional proprietary software development methods. This course is intended to provide participants with an all-round perspective of the methods, techniques and technical dimensions of open source software development, alongside practical hands on projects on three key application dimensions of open source: 1. LAMP (Linux Apache MySQL,PHP stack) for Web
application development
2. Open source software Engineering stack - Eclipse, Junit, Jmeter, SoapUI for software development lifecycle
3.0pen source enterprise private cloud set up involving Eucalyptus set up.
Details:
Part 1: Basics, Methods of Open source Software development
This part covers the basics of open source philosophy and difference between Free software movement and Open source software. License models of open source including GPL/LGPL, Apache, BSD, and Creative Commons license models. Emerging software development model called Open source development life cycle model (detailed processes including distributed peer review, check in procedures,
version control, bug tracking and package management)
Part 2: LAMP stack
This will cover The popular stack of software on open source for creating web applications. It will be a
case study with a project to build an enterprise grade web site.
Concepts covered: Linux Operating System installation, Packages concept in Linux (rpm)
Apache Web Servers and installation
MySQL database installation and basics
PhP - basic modules of the language
Applying LAMP for a case study. (group wise project)
Part 3: Overview of software engg tools
-IDE s (Eclipse with notion of plugin)
-Design tools (argoUML for UML)
-Test Tools (Junit for unit testing, JMeter for perf testing, soapUI for web services testing) (will include
basis of using these tools in terms of setting scripts and environments) Used for case study example in Part 2.
Part 4: Private Cloud with eucalyptus
Concept of Cloud Computing in brief
Private cloud constituents
Installation of Private cloud with Eucalyptus
(a case study with a subset of part 2 example exposed as a private scalable cloud service)

ME414 Design of Mechanical System [3-0-0-4]

Design for strength, rigidity, stiffness, reliability and manufacturing: Theory of failures – Special consideration while designing for rigidity. Effect of hollow section on rigidity, methods for improving rigidity. Reliability considerations in design.
Design for Manufacturing: General design principles for manufacturability - strength and mechanical factors, design consideration for casting, machining and assembly.

Limits, fits, and tolerances: Types of tolerances and fits, design considerations for interference fits, Geometric tolerances - Assembly limits -Datum features - Tolerance stacks, interchangeability and selective assembly.
Fatigue consideration in design: Variable load - basic concept; load or stress variations- different patterns Cyclic stressing/straining - materials response and the origin of fatigue failure. Stress life relations; S-N curve-fatigue strength and endurance limit. Factors influencing fatigue and endurance strength modification factors, Effect of stress concentration and fatigue stress concentration definition. Effect of mean stress - Goodman and Soderberg's relations. Design approach to fatigue - design for infinite life and finite life Design of members under combined (steady and variable) loading conditions.
Design of IC Engine Parts: Piston, Piston Ring, Cylinder and cylinder lining, Connecting rod, Crankshaft.
Design of Transmission Devices: Design of speed gear box – Aims of speed regulation, stepped and stepless drive, intermediate spindle speeds, speed diagram, structural (Ray) diagram, speeds in G.P., kinematic arrangement of gears, calculation of number of teeth, deviation diagram, selection of module, check for dynamic load and wear. Shaft design. Selection of bearing and seals. Design of housing.

Text Books:

1. Mehta, N. K., Machine Tool Design and Numerical Control, Tata McGraw Hill.
2. Norton, Robert L., Machine Design: An Integrated Approach, Third Edition, Pearson Education, 2005.

CS-404 : Professional (CSE) Lab IV (3P)

Advance DB Advance Queries, Stored Procedures, Functions, Triggers, Cursors, Isolation Levels, Deadlocks, Storage Engines, Security (Users and Permissions), Partitioned Tables, Dynamic SQL, SQL and XML, Command Line utility, Backup and Restore.
Web Application Development-./~,.~ .
Introduction, user controls, Master Pages, Themes and Caching, Events and States, Server controls, Input Validation and Site Navigation, Web Controls, Data bound controls and Database connectivity, creating complete Website.

TextBook: Lab Notes and slides

References: Online references will be provided.

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The academic load and the credit for a given course are decided by the following calculation:
Academic Load: **AL** = 3.0 x **L** + 1.0 x **T** + 1.5 x **P** + 0.0 x **D**
(**L**: Lecture Hours, **T**: Tutorial Hours, **P**: Practice Hours, and **D**: Discussion Hours)

Proposed Table

Academic Load **AL**	Course Weightage or **Units**
≤ 06	2
> 06 - ≤ 08 / (06, 08]	3
(08, 11]	4
(11, 13]	5
>13	6

Guidelines used for Course Category Classification and Numbering

NS Natural Science
ES Engineering Science
IT Information Technology
DS Design
MN Manufacturing
MS Management Science
HS Humanities & Social Sciences
CS Computer Science & Engineering
EC Electronics & Communications Engineering
ME Mechanical Engineering
PR Project
NP NPTEL
EM Elective in Modular Form

Grading

A+ = 10, A = 9.0, B+ = 8.0, B = 7.0, C+ = 6.0,
C = 5.0, D+ = 4.0, D = 3.0, F = 2
S=Satisfactory X=Non-Satisfactory, I=Incomplete

Summary of Courses

Semester / Course Type	Core (NS / ES/ IT/ DS/ MN)	Professional CSE/ ECE / ME	Humanities & Management	Total Courses in each semester	Credits
I	5	-	1	6	22
II	5	-	1	6	22
III	4	1	1	6	23
IV	1	5	-	6	22
V	1	4	1	6	23
VI	2	3	1	6	22
VII	Project Semester + 1 Profession Online Course (through NPTeL)				18
VIII	-	4	1	5	18
Total	18	17	6	41	170

Summary of Credits

Semester	Core (NS / ES/ IT/ DS/ MN)	Professional CSE/ ECE / ME	Humanities & Management	Total Credits
I	19	-	3	22
II	19	-	3	22
III	15	4	4	23
IV	4	18	-	22
V	5	14	4	23
VI	8	10	4	22
VII	-	18	-	18
VIII	-	14	4	18
Total	70	78	22	170

Summary of Theory and Lab Component

Semester / Course Type	Theory Courses without Lab component	Theory Courses with Lab component	Pure Lab Courses	Total Courses in each semester	Electives	
					Open	Prof
I	2	3	1 (Engineering Literacy)	6	-	-
II	3	2	1 (IT Workshop I)	6	-	-
III	2	3	1 (IT Workshop II)	6	-	-
IV	4/5	1/-	1 (Professional Lab)	6	1	-
V	4	1	1 (Professional Lab)	6	-	-
VI	3/4	1/-	2 (Professional Lab + Fabrication Project)	6	2	2
VII	Project Semester + 1 Profession Online Course (through NPTeL)					
VIII	4	-	1 (Professional Lab)	5	1	3
Total	22 / 24	9 /11	8	41	4	5

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