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<td>Introduction to Vedic Darshan</td>
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TITLE: Advanced Steel Design
CREDITS: 4
TYPE-WHEN: Spring-2013
FACULTY NAME: Chenna Rajaram & Ramancharla Pradeep Kumar
PRE-REQUISITE: 
OBJECTIVE: To get exposure of steel design

COURSE TOPICS:
- Introduction and design approach
- Multistory buildings
- Industrial buildings
- Transmission towers
- Bridges
- LRFD method

PREFERRED TEXT BOOKS:

*REFERENCE BOOKS:
1. Structural steel design hand book – Roger
2. Steel structures controlling the behavior through design – Englekirk Robert
3. Ductility of seismic resistant steel structures – Gioncu and victor
4. Bridge engineering: seismic design – Chen
5. Principles of structural design – Chen

*PROJECT: Mini projects will be given during the course for each topic.

GRADING:
Mini projects (4-6) : 40%
Mid sem (1) : 30%
End sem (1) : 30%

TITLE: Advances in Database Systems
CREDITS: 4
TYPE-WHEN: Advances elective
FACULTY NAME: Kamalakar Karlapalem
PRE-REQUISITE: Database Management Systems, Operating Systems

OBJECTIVE: The students learn about current research topics in database systems. They get to cover 3-5 sub topics at depth, and do a course project.

COURSE TOPICS:
1 week - overview of database systems and key ideas
5 weeks - Distributed database systems - key concepts and ideas
4 weeks - column store and related material, issues in cloud database systems and current state of art
4 weeks - recent topics in Query Processing.

REFERENCE BOOKS:
Research papers and OZsu & Valudirez Distributed Databases Systems text book.

PROJECT: Studentts have to present one/two research papers. And work on either an implementation project, or a research paper.

GRADING:
Exams/Assignments : 40%
Research Paper/Project : 60%

OUTCOME: Know current state of art in database systems. Be prepared to do research in this area.

REMARKS: This is a course based on research papers. The students are expected to read and understand each research paper. It is not a light course.

TITLE: Advances in Robotics and Control
OBJECTIVE: With the advent of novel mechanisms in robotics such as quad copters, fixed wing aircrafts, Google car, humanoid robots and a renewed interest in manipulators due to emergence of personal robotics the need to model and control such robot mechanisms can not be articulated better. This course strives to fill up the vacuum existing in the robotic curricula by addressing issues related to above. Simultaneously, the course objective is also to bring to the table advanced concepts in control systems and their application to the popular domain of robotics.

COURSE TOPICS:

**Actuators in Robotics:** Different types of Actuators, Dynamic Model of DC Motor from First Principle, Transfer function of DC Motor, Speed Control of DC Motor, Position Control of DC Motor, Servos.


**Control of Non Holonomic Systems:** Introduction to Non Holonomic (NH) Systems, Modelling Examples NH Systems, Control Properties of NH Systems, NH Motion Planning, Feedback Control of NH Systems, Asymptotic Tracking.

**Review of Kinematics and Dynamics of Manipulators:** DH Parameter, Forward Kinematics

**Trajectory Tracking of Manipulators:** Feedback Linearization, Trajectory Generation, Tracking and Control.

**Quad-rotor Modelling and Control:** Introduction to Quad-rotors (QR), First Principles Model of QR, Nonlinear Model Simulation of QR, Model Linearization, Control Strategies for QRs, Static Position Reference Controller, Dynamic Position and Velocity Reference Controllers, Linear State Feedback Control of QR, Optimal Control of QR.

**PREFERRED TEXT BOOKS:**

*REFERENCE BOOKS:
1. Modern Control Theory, Katsuhiko Ogata, Pearson Education, 2002

*PROJECT:

**GRADING:** 2 Mid Semester Exams, 6 Assignments, and End Semester Exam

**OUTCOME:** Students on successful completion of the course get acquainted with the control schemes applied to the field of Robotics.

**REMARKS:**

**TITLE:** Algorithms in Bioinformatics
OBJECTIVE:
The discipline of Mathematical Biology is a well-established one. The study of population dynamics, a dominant part of this discipline, for example, began more than 200 years back. Computational Biology or Bioinformatics (the dividing line is somewhat hazy) however is a relatively new discipline. The origins of this discipline can be traced to the need for efficient computational tools to analyse the vast amounts of data that biologists started generating using high-throughput technologies, like microarray analysis, for example.

For computer scientists, the gates were opened to a treasure-trove of problems to which to apply sophisticated algorithmic tools and facilitate new insights into the biological problems. Leading examples of this symbiosis are BLAST, a sophisticated tool for searching in DNA databases and the sequencing of the human genome.

In this course, we shall explore the algorithmic tools that have been used to solve problems arising in DNA sequence comparison, restriction site mapping, genome rearrangement, DNA sequence assembly, construction of evolutionary trees, motif-finding etc. Each of these problem domains will be used to highlight the application of a particular algorithmic tool.

While opening an window into the world of biology, this course will also help in consolidating your grasp of the algorithmic tools you learnt about in a purely algorithms course, while at the same time convincing you of the practical utility of these tools.

COURSE TOPICS:

**Algorithms and Data Structures:** Notion of an algorithm; asymptotic notation and algorithm analysis; algorithm design tools: greedy, divide-and-conquer, dynamic programming etc.; the suffix tree data structure

**Molecular Biology Primer:** Cell structure; chromosomes; genes; DNA, RNA, proteins; structure of a DNA molecule; analyzing DNA: copying, cutting and pasting, measuring length; genetic code, protein manufacture: transcription and translation

**Exhaustive Search:** Restriction sites and restriction mapping; regulatory motifs and motif-finding

**Greedy Algorithms:** Genome rearrangement and sorting by reversals: greedy and approximation algorithms for reversal sort; greedy approach to motif-finding

**Dynamic programming Algorithms:** Global alignment; local alignment; semi-global alignment; gap penalty; scoring function; multiple alignment; gene prediction

**Divide-and-Conquer Algorithms:** Space-efficient sequence alignment; block alignment and the Four-Russians speed-up; constructing alignments in sub-quadratic time

**Graph Algorithms:** Graphs; DNA sequencing; protein sequencing and Identification

**Combinatorial Pattern Matching:** Exact pattern matching; approximate pattern matching; BLAST

**Clustering and Trees:** Gene expression analysis; hierarchical and k-means clustering; evolutionary trees: distance-based reconstruction, character-based reconstruction


**REFERENCE BOOKS:**

**PROJECT:**

**GRADING:**
- Midterm 1 : 20%
- Midterm 2 : 20%
Final Exam : 40%
Assignments : 20%

OUTCOME:
(a) The students will consolidate their understanding of algorithms and data structures by applying the skills learned in these courses to problems from a completely new domain
(b) Expose the students to a burgeoning field of research

REMARKS:

TITLE: Antennas and Propagation
CREDITS: 4 (2-0-2-4)
WHEN: Spring Semester 2013
FACULTY NAME: Chakrapani Bommaraju
PRE-REQUISITE: Electromagnetic Theory and Applications

OBJECTIVE:
To introduce and/or enhance the mathematical and physical perspective of electromagnetic radiation and wave propagation.

COURSE TOPICS:
Antenna Concept, Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Half Power Beam Width, Antenna Efficiency, Beam Efficiency, Bandwidth, Input Impedance, Polarization, Current Distribution, Near Field to Far Field Approximation, and Wide Banding.


PREFERRED TEXT BOOKS:

PROJECT:
Each student is expected to design, simulate and validate one of the antennas mentioned in the course.

GRADING:
Lab Assignments (20%), Project (30%), Midterm Examination (25%), Final Examination (25%).

Please note the above mentioned midterm examination will be held approximately after 8 weeks of lectures and may not coincide with institute’s midterm examination schedule.

GRADE DISTRIBUTION

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075% < Grade B <= 085%; 085% < Grade A- <= 090%; 090% < Grade A <= 100%.

OUTCOME:
After completing the course one should be able to understand, design and simulate various types of antennas.

REMARKS:
Equal emphasis is placed on both the theory and simulations in designing the course. Antenna fundamentals are taken care in classes where as lab sessions provide students with computational perspective and emphasize their theoretical understanding.

This course will be the basis for upcoming BTP projects and Research Assistant Positions in the upcoming semester(s).

**TITLE** : Artificial Neural Networks  
**CREDITS** : 3-1-0-4  
**TYPE-WHEN** : Elective to be offered in the next semester  
**FACULTY NAME** : B. Yegnanarayana  
**PRE-REQUISITE** : Meant only for 6th semester and above. Preferably PG and research scholars  
**OBJECTIVE** : The course is a first course on the subject, highlighting the basics of ANN


**PREFERRED TEXT BOOKS** : B.Yegnanarayana, Artificial Neural Networks, Prentice-Hall India, 1999  
J.M.Zurada, Introduction to Artificial Neural Systems, 1992  

**REFERENCE BOOKS** : Simon Haykin, Neural Networks A comprehensive foundation, Pearson and Prentice-Hall, 1999

**PROJECT**:

**GRADING** : Midsem exam 1: 20%, Midsem exam 2: 20%, Assignments: 10% Final Exam (oral or written): 50%

**OUTCOME** : I hope they will get some idea of basics of ANN, and the need of ANN for solving pattern recognition problems

**REMARKS**:

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**TITLE** : Basic Maths 2  
**Course Code** : MA5003  
**Faculty Name** : Mrs. Shanti Karlapalem  
**Credits** : 3-0-0-4

**Course Description**:

1. Propositional Calculus:  
   - propositions  
   - truth tables, propositional equivalences, implications, tautological implications, tautological equivalences, rules of inference, arguments and proofs
2. Predicate Calculus:
   - arguments and proofs

3. Graph Theory:
   - types of graph, complete graph, cycles, wheel, bipartite graph, representation of graphs, isomorphic graphs, path, representation of graph with adjacency matrix, Hamilton path and Euler path, Dijkstra's algorithm, planar graph, shortest path algorithm.

4. Markov Processes:
   - stochastic matrix, regular matrix, transition matrix of a Markov process, state distributions.

Text Book:

Reference Book: Introduction to logic - Irving M. Copi, Carl Cohen
2. Discrete Maths - Kenneth H. Rosen
3. Probability - Schaum's series

Projects (if any)

Mandatory Tutorials

Grading: Assignments - 25% Surprise test - 5% Midterm exams (1&2) - 30% (15% each) Final exam - 40%

Outcome:

Remarks:

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**TITLE**: Classical and Quantum Information Security

**Course Code**: 3-1-0-4

**CREDITS**: 3-1-0-4

**TYPE-WHEN**: UG3, UG4, M.Tech., M.S., Ph.D.

**FACULTY NAME**: Dr. Indranil Chakrabarty, Dr. Kannan Srinathan

**PRE-REQUISITE**: Knowledge of Linear Algebra, Quantum Mechanics, Classical Information Theory (partly), Quantum Information (partly)

**OBJECTIVE**: Quantum information security is an emerging field at the crossroads of physics, mathematics, computer science, communication and technology. It promises to revolutionize our abilities to compute and communicate in a privacy-preserving manner. The basic purpose of this course is to develop the foundations of the field of quantum information security among the students so that they can pursue their research in this field.

**COURSE TOPICS:**

1. Classical Information: Entropy, Binary Entropy, Joint Entropy, Conditional Entropy, Relative Entropy, Mutual Information, Jensen Inequality, Fano's Inequality, Data Processing Inequality, Source Coding, Asymptotic Equipartition Theorem, Data Compression, Kraft Inequality, Optimal Codes, Huffman Code, Shannon-Fano-Elias Code, Optimality of Codes, Channel Capacity, Noiseless Binary Channel, Channel Coding Theorem, Symmetric Channel, Binary Symmetric channel.

2. Classical Information Security: Shannon's perfect secrecy, computational approach to information security, fundamental primitives like secret sharing, oblivious transfer, bit-commitment, zero-knowledge proofs, pseudorandom number generators, and secure multi-party computation.

3. Quantum Information: Quantum Entropy, Properties, Subadditivity of Quantum Entropy, Araki-Leib Strong Inequality, Subadditivity, Quantum Source Coding, Holevo Bound, Quantum Channel, Quantum Channel Capacity, Data Compression, Benjamin-Schumacher theorem, Classical Information over Noisy Quantum Channel, Quantum Information over Noisy Quantum Channel, Entanglement as a physical resource.

PREFERRED TEXT BOOKS:

*REFERENCE BOOKS:
3. Lectures on Quantum Information (Physics Textbook)---D. Brub, G. Leuchs, WILEYVCH.

*PROJECT: Each student has to submit a project to be decided upon by the faculty concerned. They have to submit the project before the end of the semester 50% of the total grading will come from the project.

GRADING:
- Major Project : 50%
- Midsems : 15%
- Endsem : 35%

OUTCOME: Students would be able to appreciate the applications of quantum mechanics in a variety of practical problems relevant to information security.

REMARKS:

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**TITLE**: Communication Networks

**CREDITS**: 3-1-0-4

**TYPE-WHEN**: Spring

**FACULTY NAME**: Dr. Jayashree Ratnam

**PRE-REQUISITE**: None

**OBJECTIVE**: Understand basic mechanisms, methodologies, protocols adopted in a communication network and analyze their performance behaviour

**COURSE TOPICS**:


Digital Transmission-Multiplexing methodologies (time/ frequency/ wavelength/ statistical), Standard digital hierarchies- pleisochronous and synchronous (PDH/SDH); Network Interfaces and Devices

Networking Mechanisms: Multiple Access, Scheduling, Switching, Routing, Flow Control; Standard Protocols and Algorithms

Network Taxonomy: Circuit, Packet and Label Switched Networks; Wide Area-/ Metropolitan Area-/Local Area and Access Networks;

Network Design Issues: Resource Provisioning, Resilience (Protection and Restoration), Traffic Engineering and their Performance Metrics

Modeling and Performance Analysis: Queuing Theory, Voice traffic and Erlang formulae; Poisson and Self-similar traffic modeling; Delay and Throughput analyses of networks supporting real-time and non-real-time traffic;

Network Architectures and Evolution: SONET/SDH, ATM & MPLS, B-ISDN, IEEE 802.3 (Ethernet), Broadband Access – Fiber to the Premises

**PREFERRED TEXT BOOKS**:

- Jean Walrand and Pravin Varaiya, “High Performance Communication Networks”.

William Stallings, "ISDN & Broadband ISDN, Frame Relay & ATM.
Optical Networks: A Practical Perspective by Rajiv Ramaswami and Kumar Sivarajan, Morgan Kaufmann Publishers

*REFERENCE BOOKS:
Some Relevant Tutorial/Survey Papers from IEEE Journals

*PROJECT:

GRADING:
1. Periodic Assignments/Case Study Papers/ Quiz: 10 marks
2. Mid-term Examinations: 50 marks (20+20)
3. End Semester Examination: 40 marks

OUTCOME:

REMARKS:

TITLE : Communication Theory-I
CREDITS : 3-1-0-4
TYPE-WHEN : (Spring 2013)
FACULTY NAME : K R Sarma
PRE-REQUISITE : Signals and Systems, Probability Theory and Random Processes

COURSE TOPICS :
1. Introduction
2. Analog Modulation - Amplitude modulation and demodulation, Double Sideband Suppressed Carrier (DSBSC) modulation and demodulation, Single sideband modulation and demodulation, Vestigial Sideband modulation.

Frequency modulation: Frequency modulation and phase modulation, Relation between phase and frequency modulation, Spectrum of FM and PM signal, Narrow band and Wide Band FM, FM generation, Indirect method of FM generation. FM demodulation


5. Detection Theory - Binary hypothesis testing, M-ary hypothesis testing, Waveform Detection


Books:

GRADING
Assignment – 10%
Quizzes – 10%
2-Mid terms examinations – 40%
End term examination – 40%

OUTCOME: On successful completion of this course, students should be able to demonstrate a theoretical understanding and problem solving skills of analog and digital communication theory.
TITLE: Computational Linguistics 2: Semantics, Pragmatics and Discourse
CREDITS: 3-0-0-4
TYPE-WHEN: 
FACULTY NAME: Radhika M + Lakshmi Bai + Soma Paul
PRE-REQUISITE: NLP-1 or CL-1

OBJECTIVE: To introduce the students to the basic concepts of structure of texts, meaning in text and contextual interpretation of text.

COURSE TOPICS:
SEMATICS
- Background for studying word meaning and sentence meaning, Sentence meaning and propositional content, Reference and Sense, Entailment, Contrariety, Contradiction, Transitivity, Symmetry, Reflexivity.
- Word meaning and sentence meaning, content word and grammatical word, Contextual variation.
- Semantic classes for categorizing words: Verb alternation, Accomplishment, Achievement, Activity, Noun alternation, Mass vs Count, Adjective alternation;
- Lexical semantic relations - Synonymy, Antonymy, Hyponymy and lexical inheritance, Meronymy; Lexical ambiguity.
- Formal representation of natural language.

PRAGMATICS AND DISCOURSE: Pragmatics and Discourse analysis as a study of context dependent aspects of meaning context, text and relevance.

Discourse analysis: Structure of text and coherence; exchange structure and conversational analysis; turn taking; deixis; anaphora; discourse connectives and relations.

Pragmatics: Meaning beyond textual context; entailment and inference; conversational implicature, conventional implicature and presupposition; co operative interaction and Gricean maxims; speech act theory; language as action, performatives, direct and indirect speech acts and felicity conditions; Reference;

SEMINARS: Students will be expected to read research papers on various topics and present in class.

PROJECT: Students will do one term project which will include issues related to semantics, pragmatics and discourse.

PREFERRED TEXT BOOKS:

GRADING: HA10, Seminar 10, Mid Sem 25, Project 20, End Sem 35

OUTCOME: Students will have a good understanding of semantic and contextual analysis of texts which will enable them in building text processing tools and systems.

TITLE: Computer Aided Drug Design (CADD)
CREDITS: 4
TYPE-WHEN: Elective
FACULTY NAME: Dr. U. Deva Priyakumar

PRE-REQUISITE: Molecular architecture or Advanced biomolecular architecture or equivalent. Those who are interested in taking the course and do not have one of these prerequisites, please talk to the course instructor.

OBJECTIVE: This course aims to introduce principal concepts in drug design, and specifically the role of computational models. Various methods that are used in computer aided drug design would be discussed, and the basic principles to understand these methods will also be taught.
COURSE TOPICS:
Course overview and Introduction (What to expect for the next 15 weeks)
Introduction to few computational methods
- Potential energy surface
- Force Field parameters
- Conformational analysis
- Energy calculations using molecular mechanics
- Free energy of binding
- Basics of chemical bonding
Drug design
- Drug
- Traditional drug design
- Drug-receptor interactions
- Biological activity and various measures
- Importance of computational methods in drug design
Databases - biomolecules & small molecules
Ligand based drug design
- Structure activity relationship
- Quantitative structure activity relationship (2D & 3D methods)
- QSAR parameters
- QSAR validation
- Pharmacophore based models
Structure based drug design
- Docking
- Discussion of various common algorithms
- Protein flexibility in docking
- Scoring functions
- De novo drug design
Molecular similarity analysis
ADME-T prediction
Advanced topics in drug design (Student Seminars)


*REFERENCE BOOKS: Material will be given from time to time

*PROJECT:

GRADING: Exams □ 40% (10 + 10 + 20); Assignments □ 40%; Lab Assignment □ 10%; Seminars/Quiz □ 10%

OUTCOME: Understanding of the basic principles involved in computer aided drug design and, to be able to appreciate the utility of the techniques in pharmaceutical industry.

REMARKS:

TITLE: Computer and Scripting 2
CREDITS: 4
TYPE-WHEN: Spring Semester (2013)
FACULTY NAME: (TBD)
PRE-REQUISITE: Basic Python skills
OBJECTIVE: The course is designed for students with basic python programming skills to get a better understanding of Object Oriented Programming and its applications.

COURSE TOPICS: Python.
- Functions
- Data Structures
- Classes
- Modules
- Data Bases (Mysql)

REFERENCE BOOKS:
(1) Programming Python, 4th edition – O'Reilly
(2) Python online tutorials

**GRADING:**
- Assignments - 20%
- Mid 1 - 10%
- Mid 2 - 10%
- Lab Exams 1 – 10%
- Lab Exam 2 - 15%
- End Exam - 35%

**TITLE** : Computer Vision
**CREDITS** : 3-1-0-4
**TYPE-WHEN** : 
**FACULTY NAME** : Pjn
**PRE-REQUISITE** : Computer Graphics or Image processing

**OBJECTIVE** : Relationship between computer vision, graphics and Image processing. Camera model: Imaging process 3D to 2D projection and loss of information, calibrated and uncalibrated vision systems. Limitations of popular cameras and methods to overcome them. Multiple view geometry and imaging systems. Algebraic constraints, reconstruction, view synthesis. Recognition of objects from appearance, shape, partial view, occlusion, etc., Analysis of video, motion and recognizing dynamic activities.

**PREFERRED TEXT BOOKS** : Forsytn and Ponce’ Computer Vision: a modern approach, Pearseen Education Inc.

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**TITLE** : Concurrent Data Structures
**CREDITS** : 3-1-0-4
**TYPE-WHEN** : 
**FACULTY NAME** : R. Govindarajulu
**PRE-REQUISITE** : 

**OBJECTIVE** : The objective of this course is to provide an overview of the challenges involved in designing concurrent data structures and a summary of relevant work for some important data structure classes. A few popular data structures that illustrate key design issues are chosen for implementation in the laboratory sessions.

**COURSE TOPICS** :
1. Concurrent Objects - Concurrency and Correctness; Quiescent Consistency, Sequential Consistency; Linearizability
2. Spin Locks and Contention - Test-and-Set Locks; Exponential Backoff; Queuelocks
3. Monitors and Blocking Synchronization - Monitor Locks and Conditions; Readers – Writers Locks Semaphores
4. Linked Lists: The Role of Locking - List-based Sets; Course-grained Synchronization, Fine-grained Synchronization, Optimistic Synchronization
5. Concurrent Queues - A Bounded Partial Queue; An unbounded Total Queue; An unbounded Lock-Free Queue
6. Concurrent Stacks - Unbounded Lock-free Stack; Elimination; The Elimination Backoff Stack
7. Counting, Sorting and Distributed Coordination - Shared Counting; Software Combining; and Counting Networks
8. Transactional Memory - Transactions and Atomicity; Software Transactional Memory;

*Hardware Transactional Memory*

The proliferation of commercial shared-memory multiprocessor machines has brought about significant changes in the art of concurrent programming. The advent of Multicore architectures has produced a renaissance in the study of highly concurrent architectures. Shared-memory multiprocessors are systems that concurrently execute multiple threads of computation which communicate and synchronize through data structures in shared memory. The efficiency of these data structures is crucial to performance, yet designing effective data structures for multiprocessor machines is an art currently mastered by a few. By most accounts, concurrent data structures are far more difficult to design than sequential once because threads executing concurrently may interleave their steps in many ways, each with a different and potentially unexpected outcome. Furthermore, new challenges
arise in designing scalable concurrent data structures that continue to perform well as machines that execute more and more concurrent threads become available.

**PREFERRED TEXT BOOKS:**


*PROJECT:* Recent research Papers will be discussed. There are laboratory sessions dealing with the practice of concurrent programming in Java. The number of students that can register for this course is 20.

**GRADING (Tentative):** Laboratory Assignments: 20%, Exams: 40%, Project: 40%
CREDITS : 4
TYPE-WHEN : Spring 2013
FACULTY NAME : Dr. Shobha Oruganti
PRE-REQUISITE : Calculus

OBJECTIVE : To understand the basic concepts of elementary differential equations, to learn to solve certain forms of first order and second order differential equations and applications. To learn Fourier Series, learn some methods to solve problems in partial differential equations and boundary value problems.

COURSE TOPICS :
1. First order ODEs
2. Second order ODEs
3. Higher order ODEs
4. Systems – Phase planes
5. Laplace Transforms
6. Series Solutions
7. Fourier Series
8. Partial differential equations and Boundary value problems

PREFERRED TEXT BOOKS:
George F. Simmons, Differential Equations With Applications and Historical Notes
Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley

*REFERENCE BOOKS:

*PROJECT:

GRADING:
50% for 2 Tests and final exam
25% for assignments
25% for quizzes

OUTCOME:
Upon successful completion of the course the student must be able to
1. Solve first order differential equations using the techniques of separation of variable, integrating factors, power series and Laplace transforms. Understand the existence and uniqueness
2. Use Euler’s method to approximate solutions for first order ODEs
3. Find general and particular solutions of second order linear ODEs using the techniques of undetermined coefficients, variation of parameters, power series and Laplace transforms.
4. Solve homogeneous first order systems of linear ODEs
5. Use direction fields, phase lines and phase portraits to qualitatively analyze the solutions to differential equations.
6. Fourier Series

REMARKS:

TITLE : DIGITAL HUMANITIES PROJECTS
Course Code : HSS481
Credits : 3-0-0-4
Type-When : Humanities Elective, Monsoon 2011
Instructors : CEH Faculty
Pre-Requisit : Instructor’s Consent

OBJECTIVE: Digital Humanities is an upcoming field at the junctions and crossroads of Humanities and computational technologies. Fusion of these two knowledge domains would be a natural pursuit for CS/ECE student interested in humanities. Aim of the course is to promote individual course-length research engagement with a specific project in Digital Humanities. Each registered student will have different project depending on student’s interest and instructor’s advice. Students registering for the course, within 15 days of the commencement of semester, will have to explicitly define computational
COURSE TOPICS: Project topic will depend on student’s specific interest in Humanities/CS and would primarily be suggested by student through discussions with instructors. Project topics could stem from continued interest in issues picked up from previous Humanities courses but which deserve a course length attention. Or even fresh interesting ideas can be suggested. Following are the indicative areas where digital humanities projects can be formulated –

9. Computational Ontology – Ontologies of history, geography, gestures, manners etc.; film ontology; ontological search on sports videos; etc.
10. Arts Computing – Feature-determination of the works of art; narrative computing; modeling dance/martial arts; animation scripting etc.
11. Culture Computing – Semantic Wiki; Web resources of culture and extraction; manuscript editor; documentation and corpus study; heritage computing etc.
12. Socionity – Social/community applications; Crowd sourcing of web content with mobile; village server; community server; Voice web etc.
13. E-governance – ontology of the constitution; district information modeling; integration of judicial orders, executive decrees and legislative bills into digital constitutional framework etc.
14. Any other interesting ideas.

REFERENCE BOOKS: Suggested reading to each student will depend on their chosen topics.

PROJECT: Student is expected to put in about 120 hours of work on their project. Project outcome should be targeted as publications and/or applications.

GRADING:
Project formulation 5%
1st mid-term presentation and report: 10%
2nd mid-term presentation and report: 15%
Final Project: 70%

OUTCOME: At the end of the course software product will be produced and desirable outcome is perhaps a research paper.

REMARKS: Please meet instructors before final add/drop date to finalize topics of independent studies. Detailed project proposal will have to be submitted by students thereafter.
Lamport’s algorithm, Ricart-Agarwala Algorithm
Sughal’s dynamic information – Structure Algorithm
Quorum-based mutual exclusion Algorithm
Maekawa’s Algorithm

**Deadlock detection in Distributed Systems:**
Models of deadlocks, Knapp’s classification of distributed deadlock detection algorithms. Mitchell and Merrit’s algorithm for single resource model

**Consensus and agreement algorithm:**
Problem definition. Agreement in a failure-free system (synchronous or asynchronous). Agreement in (message-passing) synchronous system with failures. Agreement in asynchronous message passing systems with failures.

**Reference Books**


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**COURSE TOPICS:**
Introduction to earthquake engineering
*Seismology:* Origin of earthquakes, Plate tectonics, Seismic waves, Magnitude and intensity, Measurement of earthquakes, Characteristics of earthquakes, Response of structures, Concept of earthquake resistant design, Seismic code Provisions for design of buildings, Non-engineered constructions, Post-earthquake evaluation of structures & Retrofitting, Ductile detailing, Special topics

**PREFERRED TEXT BOOKS:** Paulay & Priestley; D.J. Dowrick; Bruce A. Bolt

**REFERENCE BOOKS:**

**PROJECT:**
1. Assignments (5) 20 marks 2. Mid-Semester Exams (2) 30 marks 3. Project (1) 20 marks 4. End-Semester Exam (1) 30 marks

**OUTCOME:**

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**COURSE TOPICS:**
(4) Introduction to seismology
(5) Characteristics of earthquakes
(6) Response of structures
(7) Concept of earthquake resistant design
(8) Seismic code Provisions for design of buildings
(9) Non-engineered constructions
(10) Post-earthquake evaluation of structures & Retrofitting
(11) Vulnerability assessment
(12) Principles of disaster management
(13) Special topics

PREFERRED TEXT BOOKS:
*REFERENCE BOOKS:
1. Bruce A. Bolt: Earthquake
2. Paulay & Priestley: Earthquake resistant design of structures
3. Earthquake Engineering: Farzad Naiem

*PROJECT: Mini Project on some topics mentioned above

GRADING:
40 marks: Assignments (4) + Mini project
30 marks: Mid-Semester Exams (1)
30 marks: Project and presentation (1)

OUTCOME:
Understanding of earthquake disaster management and ability to work towards reducing risk.

REMARKS: Limited to 35 students only.

TITLE: Education and Self
CREDITS: 3-0-0-4
TYPE-WHEN: Humanities, Spring 2013
FACULTY NAME: Tejinder Walia, Soma Paul

PRE-REQUISITE: None

OBJECTIVE/DESCRIPTION: This course is meant to help the students explore meaning and significance of education. For this reason, it is important for them to get to the origin, the philosophical perspectives, and the historical contexts that led to the present education system. In addition, they have to deliberate on the alternatives. Otherwise the field of education remains one dimensional, it does not do justice to the richness of human consciousness. The mainstream education, at least at present, remains largely concentrated on the outward movement. The inward movement, the understanding of the one who is learning, the one who is acquiring knowledge of the ‘other’, remains primarily neglected. The emphasis here has largely been on imparting information; even knowledge is about the objects outside. In this context, it may help to attend to the traditional Indian mode of education i.e., Vidya, that refers to any study that does not include knowledge of self, as Avidya. Certain perspectives of psychology have related to the inner dimensions, concentrating largely on the mind. These explorations have concentrated on the psycho-therapeutic value but have shied away from that aspiration of the consciousness that seeks unity and yearns for completeness. If all the aspects of human consciousness are not attended to, there remains a sense of incompleteness.

Let’s try and share with the students a more comprehensive vision of education that relates to the Self - the one who seeks.

COURSE TOPICS

Unit one
Dialogues on Education

- A dialogue on what is education.
- ‘Education’ and ‘Vidya’
- Two approaches of learning and teaching. The related History and philosophy of education.

Assignments: To initiate dialogues on “education” with school teachers and parents of school going children. To prepare open ended questions on the basis of the above section and interview students,
teachers, and parents.


Unit Two
Exploring relationship between self and education

Part One - First Week of Feb
- A dialogue on what is self.
- Notion of self in Western philosophy & psychology and the related education.

Part Two
- Notion of self in Indian traditions and the related education.
- Psychology of the self and education - the traditional Indian approach.

Assignments: To develop model curriculum of a subject of one’s choice integrating knowledge of self (and inward movement) in it. To interact with school students and teachers through storytelling, enacting, and dialogues.


Unit Three
Integrating education and self Alternatives in Education.
Those who tried to integrate education with self:
- Arise and Awake Swami Vivekananda
- Sri Aurobindo Ghosh Integral Education
- Shantiniketan Gurudev Rabindranath Tagore
- Nai Talim Mahatama Gandhi
- Freedom from the conditionings Sri J. Krishnamurt
- Other experiments
We will invite educationists associated with such alternative education to interact with parents, teachers and students.

Final Assignment: Case histories of selected schools in the light of the course ‘Education and self’. Interviews, presentations and documenting. The preparation of the final assignment would start from the beginning of the semester and students will be assigned some designed subtasks which they are required to submit at the end of every month.

Grading : Assignments = 75%
Mid sem exams I and II = 25%

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TITLE : Design and Engineering of Scientific Equipment
COURSE CODE:
Note: Please use course code for previously existing course
CREDITS : 4
TYPE-WHEN : Spring 2013
INSTRUCTOR/S: Kavitha Vemuri (Principal Instructor).
Project Consultants & Domain Experts: Prabakar Bhimalapuram, Shubhajit Roy Chowdhury, Rambabu Kalla, Deva Priyakumar, Tapan Kumar Sau, Azeemuddin Syed

PRE-REQUISITE: None

OBJECTIVE : Design-to- product

We believe the current generation students, even at the level of undergraduates*, with their social awareness and with their unique power of imaginations are ideally suited to address and find solutions to some of most challenging problems. We invite any student with the ‘can do’ attitude, with ability and confidence to learn and work across disciplines, and care about sharing/teaching/using their abilities with co-students. The aim of the course is to have students productize their ideas with the discipline of product development processes offers; the outcome expectation is of an equipment which is properly calibrated, and standardized so that it can be used right-away in field/lab setting measurements.
The essence of engineering requires identification, design, prototyping and productizing an idea is the essence of engineering. It would purely be activity-based learning and will span multiple domains. At least 6 faculty members with expertise in engineering, sciences and computer sciences will be guiding each team. At the identification phase, ideas are brainstormed, social and technology impact is evaluated and basic scientific principles are understood. A design of the idea is evolved from observations, visualizations, refining and scoping – requiring use of fundamental CAD like tools. Building the prototype is a laboratory exercise.

Products prototyped can be sent to competitions like:

   (1) http://www.techpedia.in/award/
   (2) (*) see "Engaging Undergraduates in Global Health Technology Innovation" by Rebecca Richards-Hortum, Lauren Vestewig Gray and Maria Oden, Science 336, 430 (27 April 2012). Posted on the course website http://wiki.ccnsb.iiit.ac.in/wiki/index.php/EWP-S2k12].

**PROJECT:**

1) Form a group of at least one CND student (Science), one ECE/ECD student and one CSE/CSD student
2) Brainstorm for ideas. A tentative list to guide students understands the level of difficulty, usefulness criteria will be provided at the end of first week of semester. (A small list is provided now, which is supposed to be representative but not limiting).
3) Selection of a project from the several from the brainstorming session
4) Literature survey for the science/engineering background
5) Design: Preliminary one, then its theoretical/numerical analysis for stability, robustness, and error/s. Feasibility of the design to match requirements.
6) Prototype (for ex. bread-boarding for electrical circuits)
7) Final product, field testing and specification sheet for the product.
8) Discussion of the product features: success, failures, discussion of limitations of the product in the field. Pointers for improvement of the product for future.

**COURSE TOPICS**

Idea-design-prototype-productize

As per the idea, domain knowledge will be provided. For example: if the project is to build a EM
wave analyzers, the faculty will explain EM theory and electronics part.

PREFERRED TEXT BOOKS:

*REFERENCE BOOKS:

Based on requirement: books on design principles, materials and strengths, electronic circuits etc., will be used as reference.

*PROJECT:

Examples of products:

a) Bio-fluid analyzer
b) Spectrophotometer and analyzer
c) Microfluidic equipment: analyzer/controllers etc.
Etc...

GRADING:

1) 20% Idea - concept
2) 20%: Quizzes
3) 60%: Product

(Each individual contribution in a team will be graded individually for 30%)

OUTCOME:

At the end of the cycle, a student should have understood product conceptualization, building a complete product and testing the same.

REMARKS:

The aim of the members involved in this course is to get students motivated to identify and solve some real-life problems. While many other projects do the same, the differentiator would be the multi-disciplinary approach and the stress on actually having a working product prototype as final outcome.

TITLE: FOUNDATIONS FOR Offshore Structures
CREDITS: 4 credits
TYPE-WHEN: Spring 2013
FACULTY NAME: Dr Neelima Satyam D
PRE-REQUISITE: ---

Basic Soil properties, correlation between engineering parameters, geotechnical investigation, bore log.

Pile foundation: Jacket main piles, skirt piles, driven piles, drilled and grouted piles, steel and concrete piles, axial capacity, point bearing and skin friction, factor of safety, lateral load on piles, p-y,t-z and q-z curves, pile group effect, scour around piles, seabed subsidence and design of piles against seabed
movement, negative skin friction, cyclic degradation, main pile to jacket connections, skirt pile to jacket connections, API PA 2A provisions.

Pile Installation: Minimum pile wall thickness, pile handling stresses, static and dynamic stresses, pile stickup, stress during stick up, wave and current loads, hammer selection. pile driving stresses, wave equation analysis, pile driving fatigue, API RP 2A guidelines.

Pile Testing: Working load test, ultimate load test, pile monitoring during driving, pile integrity testing, high strain dynamic testing, rebound method.

Special Foundations: Mud-mats: bearing capacity, sliding stability, over-turning stability, short term and long term settlements, factor of safety; Bucket foundation; Suction anchors; Gravity foundation.

References:  
3. Foundation analysis and design by J.E.Bowies,McGraw-Hill,1988fd  

GRADING:  
Attendance 10%  
Assignment 20%  
Mid Exams 30%  
Final examination 40%

OUTCOME:  
Understanding of the behaviour of marine clays for the design of foundations for offshore structures.

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Title : **GANDHIAN THOUGHT**  
Course Code : HSS464  
Credits : 3-0-0-4  
Type-When : Humanities Elective, Spring 2013  
Faculty Name : Nand Kishore Acharya  
Pre-Requisite : None

OBJECTIVE: The course deals with the in depth analysis of Gandhian philosophy with its various socio-political dimensions and its relevance to the present scenario.

COURSE TOPICS: National and International background leading to emergence of Gandhian Thought. Concept of Truth and Non-violence, Positive Non-violence – Ends and Means  

PREFERED TEXT BOOKS: See Reference books.

REFERENCE BOOKS:  
1. Hind Swaraj - M. K. Gandhi  
3. Selections from Gandhi – N. K. Bose  
4. Gandhi – Louis Fisher  
5. Gandhi: A Biography – B. R. Nanda  
7. Gandhian Viee of Life – C. S. Shukla  
8. Mahatma Gandhi: Life and Thoughts – Kriplani  
9. Sabhyata Ka Vikalp (Hindi) –Nand Kishore Achara  
10. Satyagraha Ki Samskriti (Hindi) – Nand Kishore Acharya  
11. Studies on Gandhi – ed. V. T. Patil

GRADING:
1st Mid-term – 30%
2nd Mid-term – 50%
Term Paper – 20%

OUTCOME: The completion of the course will enable the student to appreciate the relevance of Gandhian ideas and inspire him/her to work for a just and humanitarian non-violent society.

REMARKS: Films and Literary pieces etc. may also be used to understand Gandhi and his mission.

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**TITLE**: GENERAL AND STRUCTURAL CHEMISTRY

**CREDITS**: 3-1-0-4

**TYPE-WHEN**: Core for CND /Open elective for others: Spring 2013

**FACULTY NAME**: Abhijit Mitra + Harjinder Singh

**PRE-REQUISITE**: None

**OBJECTIVE**: Help students to understand basic principles of chemistry from a cross disciplinary point of view.

**COURSE TOPICS**:
1. Atomic Structure and Periodicity: The importance of chemical principles, introduction to atomic structure and need for quantum mechanics, periodic classification of elements, outer electronic configuration, periodicity in properties, classification into metals, non-metals and insulators.
2. Chemical Bonding and Shapes of Compounds: Structure and bonding, VSEPR theory, molecular orbital theory, shapes of molecules, hybridization, dipole moment, ionic solids and lattice energy.
3. Classification of elements: Main Group Elements (s and p blocks): Chemistry with emphasis on group relationship and gradation in properties; structure of electron deficient compounds of main group elements and application of main group elements.
5. Rare gas: Structure and bonding in rare gas compounds.
6. Acid-base equilibrium: Hard-Soft Acid Bases (HSAB theory), Chemical and biological buffers.
7. Basic Concepts in Organic Chemistry and Stereochemistry: Electronic (resonance and inductive) effects, Optical isomerism in compounds containing one and two asymmetric centers, designation of absolute configuration, conformations of cyclohexanes, aromaticity and Huckel’s rule.
8. Equilibria, rates and mechanism of chemical reactions: Control of equilibria and rate of reactions, enthalpy and entropy, intermediates and transition states, role of solvent and catalyst, how mechanism of reactions are discovered.
9. Coordination chemistry: Nomenclature, Isomerism in coordination compounds, splitting of orbitals in various ligand fields, Crystal field and ligand field theories, MO theory of coordination compounds.

**PREFERRED TEXT BOOKS**:

**REFERENCE BOOKS**:

**GRADING**:
Assignments, Project* and Quizzes - 60%
Exams - 40% [2 midterm (10 + 10) + Endsem (20)]
OUTCOME: Students would be 'chemenabled' to appreciate current research in natural (physical and biological) sciences.

REMARKS: For CND students this will be a core prerequisite course and hence, need to be fine tuned after assessing the abilities and the potentials of the CND students. The grading plan may accordingly be modified, after a couple of weeks, to accommodate a project. Non-CND students will be selected on the basis of their interest in CNS as a domain in general, and in 'chemistry' in particular. A personal interview will be conducted before accepting the enrollment of non-CND students.

TITLE: General Theory of Relativity: An Introduction

COURSE TOPICS:
1. Very brief recap of Newtonian mechanics.
2. Concept of metric, positive definite and non-positive definite metrics, signature of metric.
3. Propagation of light and material particles, derivation of Minkowski metric.
5. Geodesics, geodesic deviation.
6. Derivation of Einstein's equations for the gravitational field, standard tests of the theory.
7. The Schwarzschild solution as a model for orbits in the solar system, perihelion precession of Mercury.
8. The Schwarzschild solution as a black hole, the geometry of the black hole, Penrose diagrams, trajectories of particles and causal structure.
9. If time permits, black hole mechanics/thermodynamics.

PREFERRED TEXT BOOKS:
The material for the course will be spread over many books to enable non-“basic physics” students to grasp the essentials.


A more advanced, geometric approach in:


A “non-geometric” approach in:

○ Schaum's series on Tensors.

*REFERENCE BOOKS:

*PROJECT:

GRADING:
The weightage would be: 1st mid-sem : 30%
2nd mid-sem: 30%
Final exam: 40%

OUTCOME:
Motivated students should be able to continue on to more specialized parts of gravity, including its application to the early Universe (cosmology) and perhaps even its quantization and problems therein.

REMARKS:
Course Title : Green Buildings
Credits : 4
Type/ When : Engineering Elective/ winter 2012-13
Faculty name : Vishal Garg
Prerequisite : Nil

Objective:
1. To understand impact of building on environment and human beings
2. To understand the concept of high performance green buildings and sustainability
3. To understand various green building rating systems such as LEED NC, LEED O&M, GRIHA, ASHRAE Standard 189.1 – Standard for the Design of High Performance Green Buildings
4. To apply the learning by case study: Evaluate IIIT campus for green building design and operations

Course Topics:
- Conventional building impacts
- Introduction to Green Buildings
- Impacts of building construction, operation and disposal
- The green building process and assessment
- Ecological design
- Sustainable sites and landscaping
- Energy efficiency in buildings
- Renewable energy
- Water conservation
- Sustainable and alternative materials
- Indoor environmental quality
- Construction Operations and Building Commissioning
- Certification Systems
- Sustainable Operations
- Economic issues and future directions in green building

Project work: Each student will evaluate an aspect of the IIIT campus from the point of view of a rating system and will submit his/her assessment and recommendations.

Site Visits:
Site visit(s) to building(s)/campus(es) in Hyderabad which are designed or operated in sustainable manner. Students will have to submit their individual site visit reports.

Preferred Text Books:
2. The Integrative Design Guide to Green Building: Redefining the Practice of Sustainability, Bill Reed, John Wiley and Sons
5. LEED Reference Guide for Green Building Operations and Maintenance

Reference Books:
4. Green Building Fundamentals (2nd Edition), Mike Montoya, Pearson Education
5. Fundamentals of Integrated Design for Sustainable Building, Marian Keeler, Bill Burke, John Wiley and Sons

Grading:
Mid-term exams = 10%+10%
Report on Site Visit(s) = 5%
Attendance in the Invited lectures/seminars = 5%
Project work and presentation = 5%
End semester Exam = 50%
Outcome:
Students will get an overview of green building design and operations. They will also understand various rating systems and will apply these to evaluate sustainability of the campus.

Remarks:
1. Maximum 30 students will be permitted to register for the course.
2. Course will be heavy and would need lot of reading.
3. There will be several lectures from various experts besides the regular class hours. Students are expected to attend them.

Title : Art and Medium -2 (HSS Skills)
Credits : 2-0-0-2
When : Spring, 2013
Faculty Name : Sharmistha Kar
Pre-requisite : None

Objective : A thoughtful observation on Visual art practice emphasizing on execution

Course topics:
- Experiencing paper in three dimensional formats
- Collage with readymade and available materials
- Explanation of the techniques and visual example of both the method through slide presentation
- Knowing Origami (17th c. Traditional Japanese art form) and executing it through different organic forms.
- Kirigami as another form practice
- ‘Paper Mache’ or paper pulp in different forms, for instance pen stand, lamp shade etc.
- ‘Paper Mache’ Human figure, doll making
- ‘Paper Mache’as low relief composition
- ‘Paper Mache’ mask making
- An Introduction on masks of India and West in art and social practice
- Painting as scroll format by using paper and cloth

Useful Links:  http://archive.org/stream/compositionserie00dowauoft#page/n5/mode/2up

Reference books:
- WESLEY DOW, ARTHUR, Composition, DOUBLEDAY, PAGE & COMPANY, GARDEN CITY, NEW YORK, 1913

Grading for the semester:
- Class performance-25%
- Assignments (two-written and practical) - 25%
- Concluding outcome as display of the work of art=25%
- Theory exam=25%

TITLE : Information Retrieval and Extraction
CREDITS : 3-1-0-4
TYPE-WHEN :
FACULTY NAME : Vasudeva Varma and Prasad Pingali
PRE-REQUISITE :
OBJECTIVE :

COURSE TOPICS : Search, Information Retrieval, Information Extraction - An Introducion (Function of an IR system, Kinds of IR systems, Components of an IR system, Problems in designing an IR system., The nature of unstructured and semi-structured text). Role of Language Processing in Search, IR and IE, Role of Machine Learning in Search, IR and IE, Modeling documents for IR purpose - Vector model, term weighing, Similarity measures, text collections and issues, Text processing and Indexing Techniques (Preliminary stages of text analysis and document processing, tokenization, stemming, lemmatization, stop words, phrases), Data Structures for IR and IE, distributed and Parallel IR (Advanced Indexing, query expansion, Postings size estimation, merge sort, dynamic indexing, positional indexes, n-gram indexes, Index compression, Web Based Search, Page Ranking, LSI, Evaluation of IR and IE Systems, Ontologies and Categorization, Named Entity Recognition,
Personalization, Question Answering, Summarization Cross Lingual Information Retrieval, Other applications and Conclusions,

PREFERRED TEXT BOOKS:


*PROJECT: There are no home assignments. This is a project Intensive course. Groups will have project deliverables every alternate week. Project Deliverable: Finalize the project, Preliminary study and requirements Specification document, Architecture and D

GRADING: Project - 80% (Evaluated every alternate week) Take Home Exam - 20%

OUTCOME:

REMARKS:

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<tr>
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<tr>
<td>TYPE-WHEN</td>
<td>Spring</td>
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<tr>
<td>FACULTY NAME</td>
<td>Shatrunjay Rawat</td>
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<tr>
<td>PRE-REQUISITE</td>
<td>Basic understanding of Computer Networks and Operating Systems</td>
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<td>OBJECTIVE</td>
<td>To learn how to evaluate and enhance information security of IT infrastructure and organizations</td>
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The course will be primarily driven by class room discussions and assignments.

PREFERRED TEXT BOOKS: No single text book. Required study material will be identified as course progresses.

REFERENCE BOOKS: RFCs; Various Acts/Laws and Standards; Security Guideline documents of Operating Systems

PROJECT: TBD

GRADING: Based on class participation, presentations, assignments, Mid/End Sem exams, Viva, etc.

OUTCOME: Understanding of security needs and issues of IT infrastructure. Have basic skills on security audit of networks, operating systems and application software.

REMARKS:

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<th>Internals of Application Servers</th>
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<tr>
<td>FACULTY NAME</td>
<td>Dr. Ramesh Loganathan</td>
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<td>OBJECTIVE</td>
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| COURSE TOPICS | Understand essence of middlewares and distributed object technology. J2EE Technology and Architecture overview. J2EE App Server architecture. Lifecycle of a J2Eeapplication-
Objective: The objective of the course is to familiarize the students with available web-based bioinformatics resources (databases and tools), how to use them for analysis and extract information from them. The various analyses that can be performed on genomic sequences, viz., pairwise and multiple sequence alignments, sequence-based database search, comparative genomics, gene prediction, pattern search and identifying polymorphisms such as SNPs and repeats, etc., will be covered in the course. Apart from web-based exercises, the students will be required to develop algorithms for global and local pairwise sequence and compare results with the web-based tool.

Course Description:
- Lectures: 28
- Tutorials: Biological Resources & Web-based tools
- Mid-term Exams: 2
- Final Exam & Lab Exam
- Weekly Assignments
- Project: Implementing DP for global and local alignments

Week: 1 - 3
I. Introduction (5 Lectures)

- Overview - Bioinformatics and Systems Biology
- Gene and Genome structure
- Gene Technology - Restriction Endonucleases, Cloning vectors
- DNA sequencing - PCR, cDNA and Whole Genome sequencing
- Major Bioinformatics Resources - NCBI, EBI, ExPASy
- Open Access Bibliographic Resources and Literature Databases - PubMed, PubMed Central, Public Library of Sciences, etc.
- Data Retrieval Systems - text-based database search tools - Entrez, SRS, DBGET

Week 4 - 7
II. BioDatabases (8 Lectures)

The biological information contained in the databases, data formats, biological relevance of this information, information extraction and web-based tools for data analysis:

- Primary Nucleotide Databases - GenBank, EMBL, DDBJ
- Protein Databases - SwissProt, SP+TREMBL, PIR, MIPS
- Genome Databases - Human (GDB), Mouse (MGD), Yeast (SGD), Drosophila (Flybase), Microbial Genome Resource (CMR, TIGR), GOLD
- Genome Browsers - Ensembl, UCSC, NCBI Map Viewer
Week 8 - 10

III. Sequence Alignment (6 Lectures)
Basic concepts of sequence alignment, sequence similarity, identity and homology, scoring matrices, sequence-based database searches, need for multiple sequence alignment, will be covered in this module.

(a) Pairwise Alignment
- Dot Plots - visual comparison of two sequences
- Sequence alignment by dynamic programming (DP) algorithm
- Types of pairwise alignments - Global, Local and Overlap alignments
- Scoring matrices for nucleotides and proteins - identity, transitions/ transversions, PAM and BLOSUM matrices
- For indels - Linear and Affine scores
- Sequence-based Database Search tools - BLAST, Fasta

(b) Multiple Alignment
- Introduction to multiple alignment of sequences
- Dynamic programming algorithm
- Web-based tool - ClustalX

Week 11 - 12

IV Gene Prediction (4 Lectures)
- Gene structure in prokaryotes and eukaryotes
- Computational issues in gene prediction
- Gene Prediction approaches
  - Open Reading Frames, GC content
  - Homology search
  - Signal-based methods
  - Content-based methods
  - Markov models
- Sequence patterns and Profiles
  - Basic concepts and definitions - patterns, motifs, profiles and their representations
  - Identifying regulatory elements, e.g., promoters, GC content, etc.
  - Profile-based searches using PSI-BLAST

Week 13 - 14

VI Repeat Sequences (2 Lectures)
- Tandem and Interspersed Repeats, Palindromes, SINEs and LINEs, segmental duplications
- Repeats database: Tandem repeats database, RepBase, TRIPS
- Identifying Tandem Repeats by dynamic programming algorithm
- Web-based tools - TRF, RepeatMasker

VII Mutations in DNA sequences (2 Lectures)
- Types of Mutations
- Single Nucleotide Polymorphisms (SNPs) and Haplotypes
- SNP database - dbSNP, TSC
- Web-based tool - Polybase (based on Bayesian statistics)

Week 14

VIII Comparative Genomics (1 Lecture)
- Basic concepts and applications


**Projects (if any)**
*Mandatory Tutorials*

**Grading**: Mid-term-I: 15, Mid-term-II: 15, Assignment: 10, Programming Assignment: 10, Lab Exam: 10, Final Exam: 40

**Outcome**:  
**Remarks**:  

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**Title**: Introduction to Biology  
**Credits**: 3-1-0-4  
**Faculty Name**: Dr. A. Rameshwar  

**Preferred Text Books**: Voet,Voet & Pratt, Fundamentals of Biochemistry, Wiley pp931, MBV Roberts Biology: A Functional Approach., ELBS pp693

**Reference Books**:  

**Course Description**:  
Robotics is an inter-disciplinary subject concerning areas of mechanics, electronics, information theory, control and automation. This course provides an introduction to robotics and covers fundamental aspects of modeling and control of robot manipulators. Topics include history and application of robotics in industry, rigid body kinematics, manipulator forward and inverse kinematic solution methods, Jacobians, singularities, redundancies, serial link manipulator dynamics, trajectory generation, sensors and actuators, position control and interaction force control.
Syllabus & Timetable:

- Overview [w 1]
- Introduction to Robotics Manipulators [w 1]
- Rigid Motions: Spatial Descriptions and Transformations [w 1-3]
- Forward and Inverse Kinematics, Workspace, and Redundancies [w 3-4]
- Differential Kinematics and Statics [w 5-6]
- Dynamics [w 7-8]
- Position Control [w 8-11]
- Force Control [w 11]
- Trajectory Generation [w12]
- Actuators and Sensors [w 7-12] (Time Permitting)


Lab Experiments: Students will have the opportunity to build robot models with CAD softwares like Solidworks and MSC Visual Nastran and also integrate them using MATLAB and SIMULINK.

Grading Scheme:
- Assignments 15%
- Laboratories 10%
- Mid-Term 30%
- Final 45%

<table>
<thead>
<tr>
<th>TITLE</th>
<th>Intro to VLSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>CREDITS</td>
<td>3-1-0-4</td>
</tr>
<tr>
<td>TYPE-WHEN</td>
<td>Core Course – Spring Semester 2013</td>
</tr>
<tr>
<td>FACULTY NAME</td>
<td>Vijaya Sankara Rao</td>
</tr>
<tr>
<td>PRE-REQUISITE</td>
<td>Basic Electronics</td>
</tr>
</tbody>
</table>

COURSE TOPICS:
- Introduction to CMOS and BiCMOS Circuits
  - MOS Transistors, MOS transistor switches, CMOS Logic – Inverters, Combinational Logic, NAND gate, NOR Gate, Compound Gates, MUX, Memory, Circuit representation
- Properties of Transistors and Theory
  - nMOS, pMOS, threshold, body effect, design equations, MOS models, Complementary CMOS Inverter, Transmission Gate, Tristate Inverter, Bipolar Devices
- CMOS Processing Technology
  - Silicon Semiconductor technology, CMOS Technology, BiCMOS Technology, Interconnects, Circuit elements, layout design rules, stick diagrams
- VLSI Circuits Concepts and Characterization
  - Resistance estimation, capacitance estimation, Inductance, switching characteristics, Delays – Interconnects and Inverter chain, Power, Energy
- Performance evaluation of VLSI Circuits
  - CMOS gate transistor sizing, power dissipation, scaling of MOS transistors, Fan-in fan-out, NAND and NOR Delays, Transistor sizing
- VLSI Circuit and Logic Designs
  - Physical design of simple logic gates, Data operations - Adders – Ripple carry adder, Carry look-ahead adder, etc, Multiplier, ALU, Sequential Circuits, Control Logic - Finite State Machine, Memory elements - Flip Flops, Latches, Registers, SRAM, DRAM

PREFERRED TEXT BOOKS:

*REFERENCE BOOKS:

PROJECT: 7 lab assignments and 1 Final Project will be given

OUTCOME: Upon completion of the course, the students should be able to:
- Design combinational, sequential, and arithmetic circuits using CMOS transistors.
- Design both static and dynamic CMOS circuits.
- Understand the performance metrics of CMOS circuits. Be able to evaluate and optimize the designed circuits.
- Perform transistor-level simulation to verify and evaluate the designed circuits.
- Perform layout design for CMOS circuits. Understand modern IC Layout design techniques, including Design Rule Check (DRC), Layout Versus Schematic (LVS), and layout parasitic extraction.

REMARKS:
- Course consists of Lab Assignments and a final Project using VLSI Design Tool kit of Synopsis

**TITLE**: Introduction to Vedic Darshan
**CREDITS**: 3-1-0-4
**TYPE-WHEN**: Humanities, Spring 2013
**FACULTY NAME**: Shatrunjay Rawat
**PRE-REQUISITE**: Willingness to understand traditional literature, Hindi language

**OBJECTIVE**: To introduce Vedic Darshan (philosophies) as it is seen by traditional Indian scholars. This is a departure from majority of such courses where Western view of Indian philosophies are presented. While doing so, we will be open to seeing other interpretations and will attempt to analyse them.

The course will cover 6 ‘Vedic Darshans’ – Sankhya-Yoga, Nyaya-Vaisheshika, Vedanta and Poorva Mimansa. We will try to explore whether these texts are written in isolation and contradict each other or they are in synergy and present different aspects of the same coherent philosophy. The course would raise deep philosophical questions and would try to find answers as proposed in Vedic philosophy.

The subject-matter of the course is vast. We will only give an overview, but will cover all key thoughts made in these texts.

**COURSE TOPICS**
Following topics will be covered:
1. Overview of Vedic Darshan and its place in overall Vedic literature – history; systems of knowledge; various schools of philosophy.
2. Introduction to Nyaya darshan – traditional Indian logic as compiled by Maharshi Gautam; concept of pramana; system of decision making/reaching truth. This will provide the framework for studying other darshans as well.
3. Introduction to Vaisheshik darshan: Analysis of matter and its characteristics as seen my Maharshi Kanad; concept of time, space, mind and atma; dharma-adharma, etc
4. Introduction to Patanjal Yoga Darshan: eight-fold path of Yoga (ashtanga yoga); various stages of meditation; concept of moksha;
5. Introduction to Sankhya darshan: logical proof for existence of fundamental particles of matter and atma (consciousness); reason for creation of universe;
6. Introduction to Vedanta darshan (Brahma sutra): Purpose of Brahma sutra; concept of brahma (God) and its characteristics; outcome/result of understanding Brahma; Importance and limitations of symbols & rituals; movement of atma after death; concept of prana, etc

Deliberation on various questions/concepts: principle of Karma phal, rebirth, non-violence, trai-tadvait-advaita, dharma-adharma, moksha, causality, etc

*REFERENCE BOOKS:
1. Original Texts of Vedic Darshan – Hindi and English translations
2. Audio recordings of lectures of some Vedic scholars
3. Writings of some of modern Indian scholars like Swami Dayanand Saraswati, Maharshi Aurbindo, Swami Ramsukhdas ji, etc.

*PROJECT:* Course projects will be of the nature of term-papers.

**GRADING:**

(1) Class participation – 30%
(2) Assignments - 20%
(3) Term paper - 20%
(4) End Sem Viva – 20%

**OUTCOME:** Understanding and appreciation of the Vedic philosophical thoughts and its relevance to our life in modern times.

**REMARKS:**

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**Title:** Linear Algebra

**Credits:** 4 (three hours per week plus tutorial)

**When:** Spring

**Faculty Name:** Rajat Tandon

**Prerequisites:** Basic 12th class algebra including basic operations on matrices and the definition of a Group.

**Objective:** to give a theoretical justification for matrix theory.

**Course Topics:**


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**TITLE:** Linguistics Data II: Collection and Modeling

**CREDITS:** 4

**TYPE-WHEN:** Spring

**FACULTY NAME:** Radhika Mamidi and Soma Paul

**PRE-REQUISITE:** Linguistic Data I

**OBJECTIVE:** The objective of Linguistic Data II course is to introduce the students to the necessary concepts and the methods for analysing linguistic data at different levels of language organization. They will also be given practical training in analyzing data, storing and modeling it for NLP applications.

**COURSE TOPICS:**

1. Discourse structure theory
   - Informational structure
   - Attentional structure
   - Intentional structure
2. Collection and formatting of data from various web resources
3. Various discourse annotation schema
   - Penn Discourse Tree Bank (PDTB)
   - Hindi Discourse Relation Bank (HDRB)
   - Rhetorical Structure Theory (RST)
   - Indian grammatical tradition
4. Annotation of collected data
5. Discourse modelling

**GRADING:** HA10, Seminar 10, Project 30, MidSem 20, End Semester 30

**Reference:**

- PDTB Guidelines
- HDRB Guidelines
TITLE : Medical Image processing
CREDITS : 3-1-0-4
TYPE-WHEN :
FACULTY NAME : Dr. Jayanthi Sivaswamy
PRE-REQUISITE : Digital image processing (preferred)

OBJECTIVE : Medical images are a vital and widely used source of diagnostic information. From simple X-rays to SPECT and FMRI such images provide a window into the functioning of human bodies and other organisms. Processing of medical images is needed for various purposes ranging from providing high quality information for visual inspection and guidance for surgeries, to extracting higher order information about the condition of different tissues/organs/structures. This course will provide an hands-on introduction to the exciting area of medical image processing, an area of focus for several major international conferences.

COURSE TOPICS :
1. Physics of medical imaging Optical, X-ray, acoustic, magnetic and nuclear
2. Fundamentals Types of images, data formats, tools for medical image processing (ITK, VTK)
3. 3D and nD image processing
4. Problems in med IP Image conditioning illumination/geometric correction, denoising Segmentation Geometric and other methods Rigid and non-rigid image registration and Fusion Reconstruction
5. Validation of results Signal detection theoretic issues

PREFERRED TEXT BOOKS:

*PROJECT:

GRADING: 2 midsem exams (40%) + 1 final project (30%)+ assignments using ITK (National Library of Medicine Insight Toolkit) an open source software library (30%).

OUTCOME:
REMARKS:

TITLE : Modeling and Simulations
CREDITS : 3-0-1-4
TYPE-WHEN : Bouquet core & Open elective, Spring 2011-12
FACULTY NAME : Prabhakar. B + Harjinder Singh
PRE-REQUISITE : None

OBJECTIVE : To introduce the fundamental concepts of molecular modeling and simulation to students (mainly for computational natural sciences and bioinformatics students) and motivate/train them to apply these concepts/techniques to solve interesting research problems.

COURSE TOPICS :
(13) Basic Maths: coordinate systems, vector algebra, differential equations, matrices, Taylor expansion (1 lecture)
(14) Molecular Mechanics: Molecular force fields, energy minimization (2 lectures)
(15) Molecular Dynamics: Equations of motion, phase space distribution functions, sampling, integrators, boundary conditions, electrostatics, molecular constraints (5 lectures)
(16) Free energy calculations: Umbrella sampling, thermodynamic integration, replica exchange method (2 lectures)
(17) Monte Carlo methods: Pi-value computation, important sampling, Metropolis algorithm, applications (1 lecture)
(18) Non-equilibrium molecular dynamics: Jarzynski equality, steered molecular dynamics, shear flow (2 lectures)
(19) solvent models: Implicit models, explicit models (1 lectures)
(20) Quantum Chemistry: Operators, wavefunctions, postulates, probability density, time-dependent Schrodinger equation (2 lectures)
(21) Translational, rotational, vibrational dynamics of simple quantum systems, hydrogen atom (3 lectures)
(22) Molecular quantum mechanics: Born-Oppenheimer approximation, LCAO, Variation theorem, perturbation theory, Huckel theory, HF, semi-empirical methods, electron correlation, CI (4 lectures)
(23) DFT (1 lecture)
(24) Force field parameterization using quantum mechanical methods (1 lecture)
(25) Students presentations (3 lectures)

PREFERRED TEXT BOOKS:

*REFERENCE BOOKS:
2. Understanding Molecular Simulation: From Algorithms to Applications, by D. Frenkel and B. Smit
3. Molecular Quantum Mechanics by Atkins

*PROJECT:

GRADING: Will be decided later after discussing with students

OUTCOME:

REMARKS:

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TITLE : NLP Applications
CREDITS : 3-0-1-4
TYPE-WHEN :
FACULTY NAME : (TBD)
PRE-REQUISITE : Intro to NLP
OBJECTIVE : This is the advanced course in Natural Language Processing intended for honors, dual degree, BTP, MTech and PhD students.

COURSE TOPICS :
In this course, students get an overview of various areas in NLP and the current research trends in each of them. The topics covered include machine translation (rule based & statistical), discourse, statistical parsing, word sense disambiguation, natural language generation, coreference resolution, semantic role labeling etc.. The course also covers two of the most popular machine learning methods (Expectation-Maximization and Maximum Entropy Models) for NLP. Students would be introduced to tools such as NLTK, CoreNLP to aid them in their research.

PREFERRED TEXT BOOKS:

*REFERENCE BOOKS:

*PROJECT: There will be a mini project and research readings once every alternate week.

REMARKS:

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TITLE : Optical Communication and Networks
CREDITS : 3-1-0-4
TYPE-WHEN : Spring Semester
FACULTY NAME : Jayashree Ratnam
PRE-REQUISITE : Communication / Computer Networks
OBJECTIVE : Study architectural aspects of current and evolving fiber-based Optical Networks as well as the underlying lightwave communication technology
COURSE TOPICS:

Optical fiber-based communication:
Signal Propagation, Attenuation, Dispersion, Non-linear effects (SPM, XPM, FWM), Crosstalk;
Wavelength division multiplexing (WDM)
Amplification, Dispersion Compensation, Crosstalk Reduction, Wavelength Stabilization;
Modulation/Demodulation- Single/Multilevel, Signal Formats, Spectral Efficiency,
Capacity limits, Coherent modulation, Optical CDMA

WDM-based Devices and Subsystems: Optical Add Drop Multiplexers, Modulators, Wavelength Converters, Erbium Doped Fiber Amplifier, Optical Cross Connects; Device Impairments and Optical Link Design

WDM-Based Optical Networks:
Broadcast and Select networks: Single/ multi hop; Access Control, Scheduling methods;
Performance Analysis
Wavelength-routed Networks: Network Design: Routing and wavelength assignment;
Virtual Topology, Survivability, Dimensioning; Performance Analysis

Internetworking with Optical Layer: IP over WDM, Optical Transport Network, Gigabit & WDM-PONs, Multi Protocol Lambda Switching, Optical Burst Switching, Storage Area Networks

PREFERRED TEXT BOOKS/ PAPERS:
(1) Optical Networks: A Practical Perspective by Rajiv Ramaswami and Kumar Sivarajan, Morgan Kaufmann Publishers 2000
(2) Broadband Access Networks by L. G. Kazovsky, Ning Cheng, Wei-Tao Shaw, David Gutierrez, Shing-Wa Wong, Wiley Publishers

*REFERENCE BOOKS:
1. Some Tutorial/Survey Papers from IEEE Journals

*PROJECT:

GRADING:
• Periodic Assignments/Quiz: 20 marks
• Mid-term Examinations: 40 marks
• End Semester Examination: 40 marks

OUTCOME:

REMARKS:
1. This subject partly covers communication-intensive as well as protocol/algorithm-intensive topics. Hence might be suitable as an Elective Course for ECE/EC Dual or CSE/CS Dual students in their 4th years at L1/L2.
2. Tentative limit on number of students is 20. Pre-requisites are as mentioned above.
**COURSE TOPICS**: Linear Equations, Solutions based Matrix Factorization, Singular Value Decomposition, Linear Least squares, Numerical algorithms, Convergence, Applications.

Nonlinear equations, Unconstrained minimization, Gradient, Hessian, Conjugate gradient, Newton's method, Applications and Computational Issues.

Linear Programming, Geometric Interpretation, Simplex Method, Duality, primal dual method, Interior point methods, Ellipsoidal methods, Computational Issues.

Integer programming, LP relaxation, Examples from combinatorial optimization. Shortest paths, network flows and matchings

Additional topics (if time permits) related to (i) Specific Algorithms (eg. Cutting plane algorithms, Stochastic gradients)
(ii) Applications in Approximate Algorithms (iii) Computational issues in large scale optimization (iv) Heuristic methods for optimization

**PREFERRED TEXT BOOKS:**

*REFERENCE BOOKS:

1. M T Heath, "Scientific Computing", TMH (Most of First six chapters)
2. C H Papadimitriou and K Steiglitz, "Combinatorial Optimization: Algorithms and Complexity" (Most of First seven chapters), Dover
   (Online Copy available at: http://www.stanford.edu/~boyd/cvxbook/)
5. D Bertisimas and J N Tsitsiklis, "Introduction to Linear Optimization", Athena Scientific

**GRADING:** Evaluation will be more or less as follows:
Mid Semester Exams (2) - 30
Final Exam - 25
Quizzes - 10
Assignments - 25
TermPaper/Project - 10

**OUTCOME:** This course will help in sharpen the problem solving skills of students. Students will have experience in formally stating problems with the associated constraints, and solving them with computer friendly algorithms.

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**TITLE**: Philosophical Discussion on Human Desires

**Note**: Please use course code for previously existing course

**CREDITS**: 4 credits

**TYPE-WHEN**: January 2013

**FACULTY NAME**: A. Raghuramaraju

**PRE-REQUISITE**: none

**OBJECTIVE**: The objective of this course to highlight the complexity of desire against the back drop of desires in the contemporary society getting either eliminated in the ascetic schools or proliferated in consumerist frameworks. Drawing from both Indian and Western traditions this course elucidates the foundational role of desires. In this context it explicated various shades and facets of human desires.

**COURSE TOPICS:**

1. Desire as the cause for the beginning of the universe: Brihadaranyaka and Chandogya Upanisad. Plato’s *Symposium*.
2. Elimination of Desires in ascetic schools like in Advaita, Buddhism.
3. Proliferation of Desires by reducing them to interests in Utilitarianism of Bentham, Delueze’s critique of Mill and Marx.
TITLE: Philosophy of Mind
CREDITS: 3-1-0-4

OBJECTIVE: Objective of the course is to give neutral and unbiased overview of issues related with Mind. At the end of the course students are expected to be aware of recent discussions, debates and research in philosophy of mind. Later part of the course will focus on the present Cognitive Science and Brain research.

COURSE TOPICS: The course will be divided into two parts in a week.
1. Lectures: There will be a lecture class. Lectures will focus on various issues /opinions /views on a particular topic.
2. Presentations: Students will be given papers every week and they will present them, which will be followed by a discussion. These papers are chosen to cover important topics in philosophy of mind written by famous philosophers. No of papers and presentations will be decided on the basis of class strength. Maximum two papers can be presented by students in a class and can be extended up to three papers, if required. In general there will be lots of reading, writing, discussions and debates. Students are expected to participate in the class discussions.

PREFERRED TEXT BOOKS:

*REFERENCE BOOKS:

Part 1. Short Introduction to Philosophical thinking and Philosophy

Recommended Book

1. Way to Wisdom: An Introduction to Philosophy By Karl Jaspers
   Published by Yale University Press (xxxx)
   Duration: 1-2 Week(s)

Topics to be covered:
- What is Philosophy?
- Branches and scope
- Western and Indian Philosophy
- Prominent Philosophers

Part 2. Traditional topics in Philosophy of Mind

Recommended Books

1. Philosophy of Mind: A contemporary introduction By John Heil
   Published by Routledge (2004)
2. Mind: A brief introduction By John R Searle
Published by Oxford University press (2004)
Duration: 4 weeks

Topics to be covered:

Behaviorism
- The logical analysis of psychology - Carl Hempel
- Brains and behavior - Hilary Putnam
- Mind and body - R. J. Hirst

The identity theory
- Is consciousness a brain process? - U T Place
- The mental and the physical - Herbert Feigl
- Sensations and brain processes - J J C Smart

Functionalism
- What is functionalism - Ned Block
- The nature of mental states - Hilary Putnam
- Troubles with Funcationalism - Ned Block

Artificial Intelligence
- Computing machinery and intelligence - Alan M Turing
- Minds, brains and programs - John R Searle
- Escaping from the chinese room - Margaret A Boden

Interpretationsim
- Radical interpretation - Donald Davidson
- Three kinds of intentional psychology - Daniel dennett
- Thought and Talk - Donald Davidson

Eliminativism
- Autonomous psychology and the belief-desire thesis - Stephen P Stich
- Eliminative materialism and the propositional attitudes - Paul Churchland
- Cognitive Suicide - Lynne Rudder Baker

Externalism and mental content
- Brain in a vat - Hilary Putnam
- Are we brains in a vat? - John Heil
- Mental content - Jaegwon Kim

Subjectivity and self knowledge
- What is it like to be a bat - Thomas Nagel
- Could love be like a heatwave? Janet Levin
- Knowing one's own mind - Donald Davidson

Consciousness
- What is consciousness? D M Armstrong
- Facing unto the problem of consciousness - David J Chalmers
- The intrinsic quality of experience - Gilbert Harman
- Precis of ten problems of consciousness - Michael Tye
- Is experiencing just representing? Ned Block

Reduction
- Mental event - Donald Davidson
- The irreducibility of consciousness - John R Searle
- The metaphysics of irreducibility - Derk Pereboom and Hilary Kornblith

The knowledge argument
- Epiphenomenal qualia - Frank Jackson
- What Experience Teaches - David Lewis
- Phenomenal States - Brian Loar

Is the mind body problem insoluble?
- Materialism and qual: the explanatory gap - Joseph Levine
- Can we solve the mind-body problem? - Colin McGinn
- The why of consciousness: a non-issue for materialists - Valerie Gray Hardcastle

Challenges to contemporary materialism
- The succinct case for idealism - John Foster
- Difficulties with physicalism and a program for dualists - Peter Forrest
- Non-Cartesian dualism - E J Lowe


**Recommended Books**

1. Neurophilosophy: Towards a unified science of the mind-brain By Patricia Smith Churchland, Published by MIT Press (1986)
2. Brain-wise: studies in neurophilosophy By Patricia Smith Churchland Published by MIT press (2002)

Extended reading:

Duration: 6 Weeks

Topics to be covered

Elementry Neuroscience
- The science of Nervous system: A Historical sketch
- Modern theory of Neurons
- The cellular components of Nervous system
- How do neurons work
- Neurotransmitters and other neurochemicals

Functional Neuroanatomy
- Prinicipal Anatomical Divisions
- Pathways and tracts
- The laminar structure of the cortex
- Topographic Maps in Nervous systems
- Vertical columns
- Neural Development

Higher Functions
- Cerebral specialisation and Naturally occurring lesions
- Mapping the brain by electrical stimulation
- Hemispheric lateralisation of functions: split-brain studies
- Hemispheric lateralisation: Neuropsychological techniques
- Techniques for Intrahehmispheric localization of functions
- Imaging techniques
- Some examples from Neurological studies

Recent Developments in the philosophy of mind
- Early Epistemology
- Logical empiricism
- Implications for a theory of the mind
- Reduction and the mind-body problem
- Intertheoretic Reduction

Mental states and Folk Psychology
- Irreduciblity of Mental states to neurobiological states
- Substance dualism
- property dualism and subjective experience
- Intentionality

Functionalist psychology
Antidirectionism in Functionalist theories of mind
The co-evolutionary research ideology
Representations and Reduction
Information processing and the sentential paradigm

Neurophilosophical perspective
Theories of Brain Function
In search of a brain theory
Tensor Network Theory
What a tensor does in sensorimotor control
Tensor Network theory and the vestibulo-ocular reflex
What has motor control got to do with mental states
Parallel models of neuronal computation
The neurobiology of an attentional operation

Metaphysics
An introduction to Metaphysics
Self and self-knowledge
Consciousness

Epistemology
Introduction to epistemology
How do brains represent
How do brains learn

Religion and the brain

What are Emotions
The brain machinery of emotions
Triggering and executing emotions
The emotions of simple organisms

What are Feelings
Is there more to feelings than the perception of body state
Feelings are interactive perceptions
Mixing memory with desire
Feelings in the brain
The substrate of feelings
Body states versus Body maps
Actual body states and simulated body states
Natural Analgesia
Empathy

Mirror Neurons
Decision making
Neurobiology and Ethical behaviors
The foundation of virtue
Perception
Free will

*PROJECT:

GRADING: No exams for the course. Students will be assessed on the basis of their
1. Class participation
2. Presentation
3. Weekly reports, and
4. Term paper

OUTCOME:

REMARKS:

TITLE : PHOTONICS
CREDITS : 3-1-0-4
**TYPE-WHEN**: Elective Course  
**FACULTY NAME**: Syed Azeemuddin

**PRE-REQUISITE**: Mathematics, Basics of Electromagnetic Theory

**OBJECTIVE**: To understand the basic concepts of photonics and optics To understand and design integrated photonic devices and circuits To explore an ever-increasing area of research

**COURSE TOPICS:**  
**RAY OPTICS**  
Postulates of Ray optics, Propagation, reflection, and refraction of rays, Snell’s law, Optical components, Paraxial optics, Graded Index optics, Matrix optics  
**WAVE OPTICS**  
Postulates of Wave optics, Monochromatic and polychromatic waves, Plane, Spherical and Paraxial waves, Wave interaction with optical components, Interference  
**BEAM OPTICS**  
Gaussian beam, Hermite Gaussian beam, Laguerre Gaussian beam, and Bessel beam, Transmission through optical components  
**ELECTROMAGNETICS**  
Elementary electromagnetic waves and their Absorption and Dispersion  
**POLARIZATION**  
Reflection, Refraction, Optical activity, and Faraday-effect by considering light polarization  
**GUIDED WAVES AND RESONATOR**  
Planar, step-index and graded index waveguides, Resonance conditions and frequencies of planar-mirror resonators and spherical-mirror resonators  
**LASER**  
The Photon, Photon streams, and Quantum states of light, Modeling and characterization of diode lasers, Statistical properties of random light.  
**NUMERICAL METHODS**  
Solving wave equation by Beam Propagation Method (BPM) and Finite-Difference Time-Domain method (FDTD)


**REFERENCE BOOKS**: S. O. Kasap, “Optoelectronics and Photonics”, Pearson

**PROJECT**: Lab Assignments using MATLAB and an open source optics software

**GRADING**: Relative Grading  
1. Home Work - 10%  
2. Lab Assignments - 20%  
3. Mid-term 1 Exam - 20%  
4. Mid-term 2 Exam - 20%  
5. Final Exam – 30%

**OUTCOME**:

**REMARKS**: As there is no course on optics and Photonics in Institute, this course will aim for teaching the student from very basics of Photonics till the design of Integrated Photonics Circuits.

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**TITLE**: Principles of Information Security  
**CREDITS**: 3-1-04  
**TYPE-WHEN**: Spring  
**FACULTY NAME**: Ashok Kumar Das  
**PRE-REQUISITE**: Algorithms

**OBJECTIVE**: To discuss on the fundamentals of the state-of-the-art information security protocols

**COURSE TOPICS**:  
Classical cryptography and their cryptanalysis, perfect secrecy, Shannon’s theorem, pseudorandom generators, stream ciphers, CPA-secure encryption, pseudorandom permutations, practical block ciphers (3-DES, AES), modes of operation, MACs, Hash functions, CCA-secure encryption, Diffie-
Hellman key exchange, Public key cryptosystems (RSA, El Gamal, Paillier, Rabin, Goldwasser-Micali), PKCSv1.5, digital signatures, DSS, digital certificates and PKI, basic cryptographic protocols, oblivious transfer, secret sharing, Byzantine agreement, secure multiparty computation, interactive proof systems, cryptography in noisy channels and quantum cryptography.

TEXTBOOK:

REFERENCE BOOKS:

GRADING:
Mid-sem exams: [40\% GRADE]
End-sem exam: [40\% GRADE]
Term-paper/Assignments: [20\% GRADE]

OUTCOME:
The course will be useful for students who plan to do research/product development/analysis in areas related to secure computing in their career.

<table>
<thead>
<tr>
<th>Title</th>
<th>Product Entrepreneurship</th>
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</thead>
<tbody>
<tr>
<td>Course Number</td>
<td>To be assigned</td>
</tr>
<tr>
<td>Credits</td>
<td>4 (Open Elective)</td>
</tr>
</tbody>
</table>

Instructors: Prashanth Meka (lead) + Satish Madira + Kalyan Manyam +Dr. Baba Prasad

Objective and Target Audience

The objective of this course is to equip technically strong students with the business expertise and the entrepreneurial spirit that might lead them to pursue their own ideas. The course is designed to be a hands-on mechanism of immersing students into the entrepreneurial mindset.

The target audience is senior undergraduate and postgraduate students who have achieved a level of technical expertise and are recognized as potential entrepreneurs.

This course will not teach students how to build an e-commerce/portal/mobile app business. This course will enable students to dig through IIIT's research and find technologies worth commercializing. At the end of the course, the groundwork is meant to be thorough enough for the students to launch a venture rather than leave the project dangling.

Prerequisite
None

Number of lectures
30 hours (15 weeks) of lecture
28 hours of hands-on activities

Tentative list of topics

<table>
<thead>
<tr>
<th>Topic</th>
<th># of weeks (2hrs per week)</th>
</tr>
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<tbody>
<tr>
<td>Finding the right idea</td>
<td>2</td>
</tr>
<tr>
<td>Elevator pitching</td>
<td>2</td>
</tr>
<tr>
<td>Business Models</td>
<td>2</td>
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<tr>
<td>Building the right product</td>
<td>2</td>
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<tr>
<td>Marketing &amp; Sales</td>
<td>2</td>
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<tr>
<td>Operations</td>
<td>2</td>
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<tr>
<td>Entrepreneurial finance</td>
<td>2</td>
</tr>
<tr>
<td>Presentations</td>
<td>1</td>
</tr>
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</table>

Week-wise list of topics
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Innovation &amp; Creativity</td>
</tr>
<tr>
<td></td>
<td>a. What is Innovation</td>
</tr>
<tr>
<td></td>
<td>b. Assessing opportunities and finding the right idea</td>
</tr>
<tr>
<td>2</td>
<td>Innovation &amp; Creativity</td>
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<tr>
<td></td>
<td>a. From Idea to Execution</td>
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<td>b. Assignment: Identifying the right idea to take from Lab to Market</td>
</tr>
<tr>
<td>3</td>
<td>Elevator Pitches</td>
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<td>4</td>
<td>Elevator Pitches</td>
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<td>5</td>
<td>Business Models</td>
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<td></td>
<td>a. Value chain</td>
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<td></td>
<td>b. Different business models</td>
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<td></td>
<td>c. Pricing</td>
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<td>6</td>
<td>Business Models</td>
</tr>
<tr>
<td></td>
<td>a. Building a team</td>
</tr>
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<td></td>
<td>b. Legal</td>
</tr>
<tr>
<td>6a</td>
<td>Founder Dating (4hrs)</td>
</tr>
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<td>7</td>
<td>Building the right product</td>
</tr>
<tr>
<td></td>
<td>a. Product Definition &amp; Positioning</td>
</tr>
<tr>
<td>8</td>
<td>Building the right product</td>
</tr>
<tr>
<td></td>
<td>a. Product Design &amp; Development</td>
</tr>
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<td></td>
<td>b. Assignment: Develop your product</td>
</tr>
<tr>
<td>8a</td>
<td>Startup Marathon: Weekend Hackathon (16hrs)</td>
</tr>
<tr>
<td>9</td>
<td>Marketing</td>
</tr>
<tr>
<td></td>
<td>a. Go-To-Market strategy</td>
</tr>
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<td>b. Branding</td>
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<td></td>
<td>c. Marketing Communications</td>
</tr>
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<td>d. Assignment: Marketing Plan</td>
</tr>
<tr>
<td>10</td>
<td>Sales</td>
</tr>
<tr>
<td></td>
<td>a. Sales channels</td>
</tr>
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<td>b. Distribution strategies for B2B</td>
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<tr>
<td>11</td>
<td>Operations</td>
</tr>
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<td></td>
<td>a. Leadership</td>
</tr>
<tr>
<td></td>
<td>b. Startup Mantras – Being lean</td>
</tr>
<tr>
<td></td>
<td>c. Startup Mantras – Failing fast &amp; Pivoting</td>
</tr>
<tr>
<td>12</td>
<td>Operations</td>
</tr>
<tr>
<td></td>
<td>a. Startup Mantras – Innovation &amp; Creativity</td>
</tr>
<tr>
<td></td>
<td>b. Startup Mantras – Decision Making</td>
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<td></td>
<td>c. Negotiation</td>
</tr>
<tr>
<td>13</td>
<td>Entrepreneurial Finance</td>
</tr>
<tr>
<td></td>
<td>a. Managing capital</td>
</tr>
<tr>
<td></td>
<td>b. Accounting</td>
</tr>
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<td></td>
<td>c. Fundraising options</td>
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<tr>
<td>14</td>
<td>Entrepreneurial Finance</td>
</tr>
<tr>
<td></td>
<td>a. Shareholding structure</td>
</tr>
<tr>
<td></td>
<td>b. Exit options</td>
</tr>
<tr>
<td></td>
<td>c. Assignment: B-Plan</td>
</tr>
<tr>
<td>14a</td>
<td>Business Plan Workshop (8hrs)</td>
</tr>
<tr>
<td>15</td>
<td>Presentations</td>
</tr>
</tbody>
</table>

**Homeworks and Readings**
There will be written assignments, as well as presentations. Grades will be based on class participation as well as presentations.

**Reference Books and Textbooks**

1. Crossing the Chasm by G. Moore
2. The Tipping Point by Malcolm Gladwell
3. Venture Deals by Brad Feld & Jason Mendelson
4. Do More Faster by Brad Feld & David Cohen
5. The Lean Startup by Eric Ries
6. The Four Steps to the Epiphany by Steven Gary Blank
7. Founders at Work by Jessica Livingston
8. The 4-Hour Workweek by Timothy Ferriss

**Project**

The students will undertake several assignments and projects which will lead to the flagship project of delivering a business plan for their product.

**Grading**

Students will be graded on 2 things:

1. Their growth (in terms of business thinking) from day one to the last day (50%)
2. Their B-plan presentation, which includes their idea, their business model, their marketing plan and their financials (50%)

**Outcome**

The desired outcome of the course is for students to understand the process of thinking about and building a startup. The student should be acquainted well enough with the nuts and bolts of entrepreneurship to confidently build a business.

The secondary desired outcome is for the students to build a business plan that is robust enough for them to confidently launch it into a startup at an opportune time.

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**TITLE**: Quantum Mechanics II  
**CREDITS**: 4  
**TYPE-WHEN**: UG3 CND core course  
**FACULTY NAME**: Harjinder Singh  
**PRE-REQUISITE**:  
**OBJECTIVE**: Origins, domain of dominance and relevance of quantum phenomena with particular stress on quantum mechanics will be studied.

**COURSE TOPICS**: To be used as a guide.  
1. Introduction.  
4. Further applications: Periodic potential (solids), electronic structure of molecules, Hartree Fock theory, etc.  
5. Time dependent quantum mechanics, Evolution of a wave packet. Fermi-Golden rule, etc.  
7. Special topics: Spinors, Klein-Gordon and Dirac equations.  
4 may not be covered if time is not sufficient.

**PREFERRED TEXT BOOKS**:  
- W. Greiner and B. Muller, Quantum Mechanics.  
- B. H. Bransden and C. J. Joachain, Quantum Mechanics.  
- Enrico Fermi, Notes on Quantum Mechanics.

1. Schiff, Quantum Mechanics.  
A. Messiah, Quantum Mechanics (Two Vols.)  
L.D. Landau and I.M. Lifshitz, Quantum Mechanics.

**GRADING**:  
- Mid-sem exam I - 20% , Mid-sem exam II - 20%  
- End-sem exam - 40%  
- Assignments – 20%
OUTCOME: A deeper understanding of quantum theory and an ability to apply its methods to solving problems in diverse fields.

REMARKS:

TITLE : Remote Sensing
CREDITS : 3-1-0-4
TYPE-WHEN : Open Elective
FACULTY NAME : RC Prasad
PRE-REQUISITE : Open to PG, UG-4 & UG-3

OBJECTIVE : Remote sensing techniques are widely used as a primary source of information in a range of applications including natural resource management and mitigating disasters. The objective of the course is to impart knowledge on various techniques of remote sensing, data acquisition, processing, product generation and its utility for modeling and management purposes.

COURSE TOPICS :
Course Structure (each of approximately 1-2 week duration):
1. Introduction to Remote sensing
2. Physics of Electro Magnetic Radiation (EMR)
3. Earth Observation Satellites and Platforms
4. EMR interaction with Atmosphere and Earth materials
5. Sensors and its characteristics
6. Optical Remote sensing
7. Hyper-spectral Imaging
8. Microwave Remote sensing
9. Geo-registration and Map projections
10. Image processing techniques
11. Image Interpretation
12. Digital image classification
13. Major applications of Remote sensing in
   a. Vegetation / Terrestrial ecology
   b. Hydrology
   c. Land use / Land cover – Carbon Assessment
   d. Urban / Object detection
A few lectures, may be given by Invited Speakers in related areas during the course to provide the students a wider understanding of its relevance and application. In addition, there will be a hands-on (lab tutorials) introduction to one or two RS software and tools at relevant times during the course.

PREFERRED TEXT BOOKS:
1. Introduction to Remote Sensing by James B. Campbell
2. Remote Sensing and Image Interpretation by Thomas.M.Lillesand
3. Remote sensing Digital Image Analysis by J.A Richards and Xiuping Tia

*REFERENCE BOOKS:
1. Fundamental of Remote Sensing by CCRS (Online)
2. Principles of Remote sensing by ITC (online)

*PROJECT:

GRADING:
1. Assignments (max. of 4) 30%
2. Project 10%
3. Mid-term Exams (2) 30% [15% + 15%]
4. End-Semester Exam (1) 30%
Details of Assignments/Projects will be announced during the course.

OUTCOME: Students after finishing this course are expected to be well versed with the techniques and approaches that are used to understand and process Satellite imagery and extract meaningful earth/terrestrial surface or sub-surface parameters. Also, they are expected to get a feel of the
application gaps and limitations of the current satellite imageries & their processing or information extraction techniques with respect to the multiple application domains like urban mapping, agriculture, forestry, water resources, defense, natural resource management and disaster management.

**TITLE**: RF AND MICROWAVE CIRCUIT DESIGN  
**CREDITS**: 3-1-3-4  
**TYPE-WHEN**: Elective Course  
**FACULTY NAME**: Syed Azeemuddin  
**PRE-REQUISITE**: RF and microwave Engineering

**COURSE TOPICS:**  
**INTRODUCTION**  
Overview of Communication concepts – Analog and Digital modulations, RF Communications, Multiple access techniques and wireless standards, Receiver Architectures, Transmitter Architectures - Heterodyne, Homodyne (Direct Conversion), Image reject, Low-IF (Intermediate Frequency) Receivers

**LOW NOISE AMPLIFIER**  
LNA topologies – common gate, common source, cascode, Design using Schmitt chart, Design of amplifiers both at IC level and at board level, Non linearity calculations, narrowband and broadband designs

**MIXER**  
Mixer noise figure, single and double balanced Mixers, Passive and Active Downconversion mixers, Mixer topologies, Upconversion mixers, Design with specific performance parameters

**OSCILLATOR**  
Principle of working, Condition for stable oscillations, Types of oscillators – cross-coupled, 3-point, voltage controlled, phase noise mathematical model, quadrature, Design with specific performance parameters

**POWER AMPLIFIER**  
Classification – Class A, B up to class F, High efficiency power amplifiers, Large signal matching, Cascade, Modulation techniques, Design with specific performance parameters

**PHASE LOCKED LOOP**  
Basic concepts, Types of PLLs – Phase detectors, Frequency detectors, Charge pumps, Higher order loops, Non-idealities, Phase noise, Loop bandwidth, Settling time, Frequency Synthesizer

**FILTER**  
Active and Passive filters, Microwave filters, Types of Filters – Low Pass, high Pass, Band Pass, Band stop, Filter classification based on their performance - Butterworth, Chebyshev, Circuit design of Filters, Design of specific filters with given specifications

**PREFERRED TEXT BOOKS**  

**REFERENCE BOOKS**  
2. Robert Caverly, "CMOS RFIC, Design Principles", Artech House  

**PROJECT**  
Lab Assignments on each block of Transceiver and final project - Design of complete transceiver at various frequencies and architectures

**GOALS**  
- Acquire the background knowledge for RF integrated circuit design.  
- Gain exposure to CAD tools for analysis and design of RF integrated circuits.  
- To enable student to design the RF Transceiver completely

**TITLE**: Science Lab II  
**CREDITS**: 4
List of proposed experiments:
UV-Vis Absorption Spectroscopy
FT-IR Spectroscopy
Cyclic Voltametry
Determination of Wavelength of a Source – Diffraction Grating.
Newton’s Rings Radius of Curvature of Plano – Convex lens:
Laser – single and double slits
Melde’s Expt. - Transverse & Longitudinal Modes:
Magnetic Field Expt: Stewart & Gees method
Determination of Velocity of sound-volume resonator

Project:
1.1.1. Groups of two students
1.1.2. Start date Jan 21, 2011
1.1.3. Submission of working experiment April 10, 2011
1.1.4. Talk to instructors a few times before the start date; only approved experiments will be supported by lab infrastructure.

Grading: Tentative
60 % Lab work (Report + Performance)
20 % Viva voce/ quiz
20 % Project

PREFERRED TEXT BOOKS: No preferred textbooks. Hands-out will be provided.

OUTCOME: This laboratory course is designed to introduce students to the bachelor level science laboratory techniques. Students completing this course are expected to learn the following: (i) hands on experience of select science topics (ii) measure and report physical quantities with appropriate precision, (iii) convert raw data to a physically meaningful form, (iv) apply appropriate methods of analysis to raw data, (v) recognize the relevance of data, (vi) work safely in the lab, (vii) adhere to instructions on laboratory safety, (viii) recognize hazardous situations and act appropriately, and (ix) recognize the applicability of scientific principles to real world situations.
### 7.1 Week-wise list of topics

**Week Topics**

1. Review of basic set theory and Term Algebras
2. Propositional and Predicate logic
3. Denotational Semantics
4. Operational Semantics
5. Type systems
6. Concurrency

**Total # weeks**

14

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**Homeworks and Readings**

There will be written assignments, possibly weekly, and an occasional programming assignment. Grades will be based on class participation and performance in the homeworks, mid1, mid2 and final exams.

There is no text book for the course. Instead, sections and chapters will be assigned each week as reading assignments from the reference texts given below:

**Reference texts**

1. *Denotational Semantics*  
   Robert Tennent  
   Semantics of Programming Languages
TITLE: Society and Development  
COURSE CODE: HSD261  
CREDITS: 3-0-0-4  
TYPE-WHEN: Humanities, Spring semester  
FACULTY NAME: Nandakishor Acharya + Harsh Satya  
REGISTRANTS: DD students EHCS ug1  

OBJECTIVE:  
The course will introduce concerns, deeper issues and discourses related to societal development. Ideas of development will be object of reflection in context of desired society. The state of Indian society during pre-British times, the changes that took place under colonial situation, national movement and post independence, and even some proposals of alternatives to modern ideas of development will be introduced. Further, role of ICT in development of society will be analyzed.

COURSE TOPICS:  
Pre-British India: Production system and technology; market and society; state and society; education and intellectual tradition.  
Encounter with modernity: Concepts of development; idea of nation state; process of encounter; changes in economy; relation of state and society; impact of British educational system.  
Alternatives: Political economy:- market relations, ownership, production system; polity:- alternatives to present parliamentary system; ideas on education- nayi taleem, Tagore, Krishnamurthy.  
Case studies of alternative effort: Happiness Index; water conservation efforts by Rajendra Singh; Grameen Bank by Md. Yunus; and some more. Socionity Project: Role of ICT in development of society based on community and self-help.

REFERENCE BOOKS:  
1. UN development reports.  
2. Dharampal: The Beautiful Tree, Other India Store, ISBN 8185569509  
3. Dharampal: Indian Science and Technology in 18th Century, Other India Store ISBN 8185569509  
4. Dharampal: Angrezon se pehle ka Bharat (Hindi), Other India Store ISBN 8185569509  
5. Dharampal: Panchayat Raj and India’s Polity, Other India Store ISBN 8185569509  
16. Lohia: Marx, Gandhi and Socialism, Navahind, 1963  
19. Speeches and articles by Tagore, Aurobindo, Lohia

**GRADING:** Mid Term I: 15%, Mid Term II: 15%, End Sem: 30%, Assignments: 40%
(Students will be asked to write on issues and theories, possibly leading to a term paper).

**OUTCOME:**
After completing the course the student would be able to have an overview of the traditional Indian society. The student would also be able to develop a critique of modern society and have an perspective towards desired society.

**REMARKS:** Some documentary films would also be shown.

<table>
<thead>
<tr>
<th>TITLE</th>
<th>: Software Engineering</th>
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<tbody>
<tr>
<td>CREDITS</td>
<td>: 3-1-0-4</td>
</tr>
<tr>
<td>TYPE-WHEN</td>
<td>: Flexicore</td>
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<tr>
<td>FACULTY NAME</td>
<td>: Kirti Garg</td>
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<tr>
<td>PRE-REQUISITE</td>
<td>: Programming, some project work</td>
</tr>
<tr>
<td>OBJECTIVE</td>
<td>: To develop in-depth understanding of software engineering principles, practices and ability to apply them in developing large scale software systems.</td>
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</tbody>
</table>


**PREFERRED TEXT BOOKS:** references will be provided in class

*REFERENCE BOOKS:* Fundamentals of Software Engineering (2e) By Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli Prentice Hall.
Software Engineering, 4/e, by Pfleeger and Atlee, Pearson Education, web references will be provided

*PROJECT:* There will be case studies. Each case is like a mini project, with challenges embedded inside the case. Students learn theory, then apply this theory to challenges given in the case (hence practice).

**GRADING:** (Tentative) Solutions to Case studies: 50% * Mid Semester Exam: 20% * End Semester Exam: 20% * Class Participation and others: 10%

**OUTCOME:** After taking the course, the student will be able to relate to software development practices in the software industry. The student will be able to employ these practices in medium-to-large scale projects both in research/academic environment as well as in the commercial software development.

**REMARKS:** The course will involve student group presentations and discussions during the course.

<table>
<thead>
<tr>
<th>TITLE</th>
<th>: Speech Technology</th>
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<tbody>
<tr>
<td>CREDITS</td>
<td>: 3-1-0-4</td>
</tr>
<tr>
<td>TYPE-WHEN</td>
<td>: Spring Semester</td>
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<tr>
<td>FACULTY NAME</td>
<td>: SVG</td>
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<tr>
<td>PRE-REQUISITE</td>
<td>: Speech Signal Processing</td>
</tr>
</tbody>
</table>

**OBJECTIVE** : This is an advance course whose objective is to discuss and provide hands-on experaince on implementstion of algorithms, models used in feature extraction and in building speech systems.

**COURSE TOPICS**
1. Introduction to speech technology
2. Feature extraction from speech signal
3. Algorithms for speech recognition
4. Methods for speech synthesis
5. Approaches for speech enhancement
6. Approaches for speaker recognition
PREFERRED TEXT BOOKS:  Fundamentals of Speech Recognition (Prentics Hall Signal Processing Series) (Paperback) by Lawrence Rabiner and Biing-Hwang Juang

*REFERENCE BOOKS:  Spoken Language Processing: A Guide to Theory, Algorithm and System Development by Xeudong Huang, Alex Acero, and Hsiao-Wuen Hon

*PROJECT:  Mini projects on each topic

GRADING:  20% - Laboratory Assignments 20% - Review papers reading and presentation 20% - Midterm-1 20% - Midterm-2 20% - Final Examination

OUTCOME:  At the end of the course, the students are expected to attain the theoretical and practical knowledge of the different algorithms used in speech technology.

REMARKS:

TITLE:  Statistical Mechanics
CREDITS:  3-1-0-4
TYPE-WHEN:  Spring 2013
FACULTY NAME:  M. Krishnan
PRE-REQUISITE:  –

OBJECTIVE:  To teach the concepts of statistical physics; the concepts are learnt in a hands on fashion by using computer simulation/analysis of appropriately constructed models.

COURSE TOPICS:

1. Why statistics are required?
2. Why “statistics” in “Statistical Mechanics”?
3. Statistical Mechanics and Thermodynamics: differences, similarities of goals and approaches
4. A very short review of thermodynamics
5. Review of relevant probability theory
6. Postulates of statistical mechanics: Ergodic theorem
7. Phase space, Louville Theorem and Boltzmann's distribution law
9. Ising model for magnetic systems. Phase separation, critical point.
13. Equation of state
17. Universality and Scaling. Renormalization group theory, applied to simple models of percolation.

PREFERRED TEXT BOOKS:
We will be using extensively (and almost exclusively) ”Thermal and Statistical Physics” by Harvey Gould and Jan Tobochnick. A soft copy of the book is available at http://stp.clarku.edu/notes/. A soft copy of this book will be provided for each student, as also the programs that are used in lectures.

REFERENCE BOOKS:

*PROJECT:

GRADING:

25% for assignments (about 8 assignments)
15% for quizzes (3 quizzes)
25% for Midsem Exams (2 exams)
30% for Endsem
5% class and/or tutorial participation
OUTCOME: A thorough understanding of statistical physics using computing.

REMARKS:

TITLE : System and Network Security
CREDITS : 3-1-0 (4 credits)
TYPE-WHEN : Spring
FACULTY NAME : Ashok Kumar Das
PRE-REQUISITE : Discrete Mathematics, Basics of Cryptography, Computer Networks

Digital Signature Standards
Authentication Applications: Kerberos, X.509 authentication service.
Encrypting communication channels: LLE and EEE.
Security at the Network Layer: IPSec
Security at the Datalink Layer: Internal and External Error Controls.
Intruders: Intruders, Intrusion detection, Intrusion prevention.
Malicious Software: Virus and related threats, Virus countermeasures.
Firewalls: Firewall design principles, Trusted systems.
Software Vulnerabilities: Phishing, Buffer overflow (BOF), Format string attacks, Cross-site scripting (XSS), SQL Injection.
Malware Analysis
Botnet Detection
Other advanced topics in system security

PREFERRED TEXT BOOKS:
Research papers

GRADING:
Mid Sem 1 : 15 %
Mid Sem 2: 15 %
End Sem : 30 %
Lab assignments + Project: 40 %

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TITLE : System and Resource Virtualization
Course Code :
Note: Please use course code for previously existing course
CREDITS : 4
TYPE-WHEN : Fall 2013
FACULTY NAME : Dr. Prasad Saripalli
PRE-REQUISITE : Operating Systems
OBJECTIVE : This hands-on course with an equal number of Lab and Theory lectures will provide an in-depth introduction to Systems and Resources Virtualization of computer systems. Concepts addressed will include hypervisors, virtual machines, paravirtualization and virtual appliances.

COURSE TOPICS :
Course Outline and Lecture Schedule (Pl. also see Lab Exercises in detailed syllabus)

1. Introduction to Virtualization
2. Process Virtual Machines vs. System Virtual Machines
3. X86 Architecture and its Virtualization: Challenges
4. Emulation and Binary Translation
5. Virtual Machine Monitor (VMM)
6. Virtualization Application Overview
7. Hypervisors, VMs and Paravirtualization
8. Client vs. Server Virtualization
9. Desktop Virtualization
10. Application Virtualization
11. Presentation Virtualization & Graphics Remoting
12. Graphics Virtualization
13. Deployment & Management of VMs
14. Security Implications of Virtualization
15. Virtual networking and overlays
16. Virtualization of devices and peripherals
17. Virtual machine migration
18. Virtualization-based computing environments

PREFERRED TEXT BOOKS:

*REFERENCE BOOKS:

*PROJECT:
A group project will allow participants to gain firsthand experience of virtualization technology. Virtualization solutions like Xen, Hyper-V, VMWare, Citrix and TS.

GRADING:
Grades are assigned as below: 55% for theory, 32% for Lab (8x4), 10% for Project and 3% for class participation.

Each lesson will have a lecture and 1-2 reading assignments. We will have a 15 min Quiz every Saturday at beginning of class, with 2-3 questions.

<table>
<thead>
<tr>
<th>Assignment</th>
<th>% of Total Grade</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>2 Term Exams</td>
<td>12</td>
<td>Mid-sem</td>
</tr>
<tr>
<td>Best 4 out of 6 quizzes</td>
<td>10</td>
<td>A 15 min short quiz</td>
</tr>
<tr>
<td>Final Exam</td>
<td>15</td>
<td>Comprehensive final exam</td>
</tr>
<tr>
<td>6 Home Works</td>
<td>18</td>
<td>Theory and Analysis/Design</td>
</tr>
<tr>
<td>8 Lab Exercises</td>
<td>32</td>
<td>Groups of 2-3 students complete a Lab/week</td>
</tr>
<tr>
<td>1 Class Project</td>
<td>10</td>
<td>Groups of 2-3 students complete project</td>
</tr>
<tr>
<td>Class participation/Attendance</td>
<td>3</td>
<td>Attend &gt; 80% classes</td>
</tr>
</tbody>
</table>

Lesson Plan (reading and lecture material provided a week prior to each lecture).

<table>
<thead>
<tr>
<th>Lesson</th>
<th>[No. of Lectures] Reading Assignments (HW/Quiz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Virtualization</td>
<td>[2] (HW1)</td>
</tr>
<tr>
<td>Real Machines</td>
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<tr>
<td>Operating Systems Review</td>
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<tr>
<td>Computer Architecture Overview: X86 ISA</td>
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<tr>
<td>Process Virtual Machines vs. System Virtual Machines</td>
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<tr>
<td>X86 Architecture and its Virtualization: Challenges</td>
<td>[2] (HW2; Quiz 1)</td>
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<tr>
<td>Virtual Machine Monitors (VMM)</td>
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<tr>
<td>Emulation and Binary Translation</td>
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<tr>
<td>Hypervisor Types and Paravirtualization</td>
<td>[2] (HW3; Quiz 2)</td>
</tr>
<tr>
<td>Client vs. Server Virtualization</td>
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<tr>
<td>Survey of Virtualization Technologies</td>
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<tr>
<td>Xen Virtualization</td>
<td>[2]</td>
</tr>
<tr>
<td>Networking and Virtualization</td>
<td>[1] (HW 4; Quiz 3)</td>
</tr>
<tr>
<td>Inter-VM Communication</td>
<td>[1]</td>
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<tr>
<td>Virtualization of the Graphics Stack</td>
<td>[1] (Quiz 4)</td>
</tr>
<tr>
<td>Virtualization of Devices and peripherals</td>
<td>[1] (HW 5)</td>
</tr>
<tr>
<td>Deployment &amp; Management of VMs</td>
<td>[1] (Quiz 5)</td>
</tr>
</tbody>
</table>
Application Virtualization (App Streaming) [1]
Presentation Virtualization & Graphics Remoting [1] (HW 6; Quiz 6)

OUTCOME: Letter grade

REMARKS:

TITLE: Topics in Nanosciences
CREDITS: (L = 4, T=0, P = 0, C=4)
TYPE: Domain Elective for UG3 CND, post-BSc dual 2nd yr, M Tech/MS I, II Bioinfo, PhD CNS/Bioinfo, and General Elective for B. Tech. students with Science II background.
FACULTY NAME: Tapan Sau
NUMBER OF STUDENTS: -

COURSE TOPICS:
   General Elective) students
   OBJECTIVE: To introduce the students to the rapidly developing fields of science and technology at the nanometer scales.
   Adsorption. Melting behavior of Metal nanoparticles.
5. Catalysis by Metal Nanoparticles. Size and Shape effects. Effects of Alloying and Supports.
6. Tools for Nanosystems. AFM, SEM, TEM.
7. Making Nanostructures. Top-down and bottom-up methods.

PREFERRED TEXT BOOKS:
1. Introduction to Nanoscience, by S. M. Lindsay, Oxford University Press.

REFERENCE BOOKS:
2. nanotechnology by M. Kohler and W. Fritzsche, Wiley-VCH.

GRADING: Student assessment will be on the basis of:
1. Class Performance/Participation 10%
2. Mid-Term Exams (20% each) 40%
3. End-Semester Exam 30%
4. Research Paper Presentations & Discussion 20%
   (Four nanoscience-related research papers have to be presented: 1 before each Mid Term and 2 before End Sem)

OUTCOME: Students after finishing this course are expected to develop a better understanding of the principles and techniques of nanoscience, real world applications and scopes.

TITLE: Topics in NL Semantics
CREDITS: 4
TYPE-WHEN: Spring-2013
FACULTY NAME: Soma Paul
PRE-REQUISITE: CL1, CL2

OBJECTIVE:
Formal Analysis and logical representation of natural language enable computer-based analysis of natural languages for a wide range of applications such as Word Sense Disambiguation, Inferencing, machine translation and so on. This course aims at building a strong theoretical understanding of the
semantics of various linguistic constructions and then developing a computer tractable framework for representing the semantic analysis of natural language.

COURSE TOPICS:
1. Overview of Dependency Relations as described in Paninian Dependency Grammar
   a. Karaka relations
   b. Non-karaka relations

2. Need for Deeper Semantic Analysis from the perspective of MT and QA

3. Semantic analysis of various constructions with examples from Indian Languages
   a. Modifiers such as adjective, adverb, Relative clause, genitive
   b. Complex Predicate
   c. Quantifier

4. Formal Semantic Representation
   a. Integration of Logical and ontological concepts for formal semantic representation
   b. Semantic Lexicon in terms of feature structure
      i. Karaka frame and Lakshana Chart
      ii. Qualia Structure of Pustejovsky
      iii. Lexical Conceptual Structure of Jackendoff

5. Conversion of Dependency structure of Indian Language text to Formal semantic representation

*REFERENCE BOOKS:

Materials on Lakshana chart (To be provided as manuscripts)

PROJECT:
*Semantic Annotation on the corpus annotated with dependency relation.*

GRADING:
Assignment 10%
Mid-Sem Exam 30%
End Sem Exam 30%
Term Project 30%

OUTCOME:
Participants of the course will gain understanding of semantic analysis of natural language. They are expected to learn various semantic representation with an aim of developing deeper semantic annotated text for Indian languages.

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**TITLE**: Topics in Software Engineering (Software Re-engineering and Evolution)
**CREDITS**: 4
**TYPE-WHEN**: Spring 2013
**FACULTY NAME**: Dr. Y. Raghu Reddy
**PRE-REQUISITE**: None (but Software development experience is recommended)

**OBJECTIVE**: Change is an inherent property of all software systems and software development life-cycles. Systems that have long passed the life expectancy envisioned by their initial developers have accumulated many changes as a result of the maintenance of defects, advancements in technology and new business needs. The goal of this course is to introduce the challenges presented by legacy systems and examine strategies for evolving systems through assessment techniques and the application of reengineering methodologies.
COURSE DESCRIPTION:
This course explores the concepts of software reengineering and evolution and introduces approaches and support tools used to extract the information needed to assess existing software systems. Major maintenance issues are presented including managing change and predicting maintainability with software quality metrics. Organizational issues relative to product maintenance are discussed. The course introduces Aspect Oriented Software Development (AOSD), Component-Based Software Development (CBSD) as techniques to evolve software systems. Principles of software reuse and reverse engineering techniques are discussed through lectures and seminar sessions. Students are expected to write and present research papers of publishable quality by the end of the term.

COVERED TOPICS:
1. Motivation, Software Evolution and Reengineering
   i. Economic Impact
   ii. Organizational Impact
2. Introduction to Software Evolution
   i. Design Patterns
   ii. Legacy Systems
   iii. System Evolution
   iv. System Change & Maintenance
   v. Software Reengineering
3. Evolution Planning
   i. Legacy System Assessment
   ii. Evolution Strategies
   iii. Maintenance Metrics
4. Evolution techniques
   i. Aspect-Oriented Software Development
   ii. Component-Based Software Development
5. Reengineering
   i. Mining and Reusing Existing Assets.
   ii. System Restructuring
   iii. Program Re-factoring
   iv. Anti-Patterns
6. Software Maintenance
   i. Standards – IEEE, ISO/IEC
   ii. Planning for Maintenance
   iii. Change Control and Traceability
   iv. Developing a Software Maintenance Organization
7. Tools and Methodologies
   i. SEI Methodologies
   ii. Reverse and Re-engineering Engineering Tools

PREFERRED TEXT BOOKS: None

*REFERENCE RESOURCES:
1. Design patterns : Elements of Reusable Object-Oriented Software, Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides. Addison Wesley
**PROJECT:** None

**GRADING:** Assignments and Term paper.

**LEARNING OUTCOMES:**
1. Define the concepts of software reengineering, system evolution and maintenance.
2. Describe how software quality attributes are impacted by the evolution and maintenance of legacy systems.
3. Define common strategies for the evolution of legacy systems.
4. Use AOSD and CBSD as ways to evolve software systems.
5. Identify relevant software maintenance standards.
6. Describe guidelines for the development of a software maintenance organization.
7. Identify existing methodologies, tools and resources used for software reengineering.

**REMARKS:**

**TITLE**

**TOPICS IN SPEECH PROCESSING - AUDIO INFORMATION RETRIEVAL**

**Credits**

4-3-0-0 (= credits - hours per week - tutorials - lab sessions)

**Type-When**

Spring Semester 2013

**Faculty Name**

Kishore Prahallad & Suryakanth V. Gangashetty

**Pre-Requisite**

CS4731 Information retrieval and extraction / ECE 448 Speech signal processing / IEC239 Digital signal analysis and applications / ECE341 Digital signal processing

**Objective**

The objective is to provide fundamentals of handling time series data including speech, audio and music signals for the application of information retrieval and analysis, and to provide hands-on experience in building audio information retrieval system(s).

**Course:**

Topics Fundamentals (Units 1-2): Text retrieval Vs audio/speech/music retrieval, issues in audio/speech/music retrieval, feature extraction from time series, segmentation, signal to symbol transformations (classifying sounds, speech recognition), indexing mechanisms, statistical and template based matching and search algorithms.

Applications (Units 3-4): Audio and music search, speaker diarization, meetings data

**Preferred Text Book**

There is no single text book. Relevant chapters will be suggested from


**Reference Books**

A few relevant research articles and journals will be provided in due course.

**Project**

One major project involving the development of an audio information retrieval system.

**Grading**

[Assignments = 30%] + [Project = 30%] + [One Mid-semester Exam = 20%] + [Final Exams = 20%]

**Outcome**

The students are expected to become well-versed with fundamentals of handling time series data and with tools and techniques for implementation of audio information systems.

**Remarks**

**ELECTIVITY:** This is an elective course and can be taken by 3rd Year or 4th Year undergraduate students in Computer Science (CS) or by any postgraduate students in Computer Science (CS) or Electronics and Communication Engineering (ECE).
Objective: Keeping Indian languages as the focus, the course will discuss about basic units in writing, script, transliteration, text normalization, text-encoding and related issues. It will have exercises in phonemic inventory preparation from phonetic data, text normalization, morphophonemic processes, and their implementation(s) in text-to-speech systems for Indian languages.

Course Topics: Linguistic Aspects of Text and Sound:
Composition of Text: Letters, punctuation marks, digits, spaces, abbreviations etc.
Script and Encoding: Script, Letters, Glyphs, Graphemes, Allographs, Code-points
Letter to Phoneme conversion and Morphophonemic Processes.

Speech Systems: Components of a text-to-speech (TTS) system; Building limited domain and unrestricted TTS systems; Letter-to-phoneme conversion and prosody (duration and F0) generation using machine learning techniques; Building Indian language (IL) voices.


Project: One major project involving implementation of text processing for speech synthesis.

Grading: [Assignments = 30% ] + [Project = 30%] + [One Mid-semester Exam = 20%] + [Final Exams = 20%]

Outcome: The students are expected to become well-versed with text processing aspects of Indian languages and their implementation(s) in speech systems.

Remarks: ELECTIVITY: This is an elective course and can be taken by 3rd Year or 4th Year undergraduate students in Computer Science or by any postgraduate students in Computational Linguistics or in Computer Science.

TITLE: Topics in Theoretical Physics
CREDITS: 4 credits
TYPE-WHEN: Science/CNS elective, Spring 2013
FACULTY NAME: Dr. Marimuthu Krishnan

PRE-REQUISITE: The theoretical formalisms involved in this course demand some experience on elementary mathematics (single/multivariate calculus and ordinary/partial differential equations) and physics (Science I/II level). Students interested in taking this course are required to have a minimum of B grade in Science I and II.

OBJECTIVE: This course is an attempt to introduce certain fundamental and advanced concepts of theoretical physics to students and motivate them to apply these concepts to solve interesting research problems.

COURSE TOPICS:
(1) Stochastic Variables and Random Events (2 lectures)
(2) Markov Processes (2 lectures)
(3) The Master Equation (2 lectures)
(4) The Fokker-Planck Equation (2 lectures)
(5) Kramer’s Equation (2 lecture)
(6) The Langevin Approach (2 lectures)
(7) The Smoluchowski Equation (2 lectures)
(8) Stochastic Behavior of Quantum Systems (1 lecture)
(9) Scattering Theory (2 lectures)
(10) Mean-Field Theory (2 lectures)
(11) Theory of Elasticity (2 lectures)
(12) Dynamic Correlation and Response (3 lectures)
(13) Students presentations (3 lectures)
PREFERRED TEXT BOOKS:
*REFERENCE BOOKS:
(1) Stochastic Processes in Physics and Chemistry, by N.G. Van Kampen
(2) Principles of Condensed Matter Physics, by P.M. Chaikin and T.C. Lubensky

*PROJECT:
GRADING: Will be decided later after discussing with students

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**TITLE**: Understanding Work and Life
**CREDITS**: 4
**TYPE-WHEN**: Spring 2013
**FACULTY NAME**: Ramancharla Pradeep Kumar + Devansh
**PRE-REQUISITE**: Human Values I & II

**OBJECTIVE**:
To develop the critical ability in student to set the goal.
To develop commitment towards the fulfillment of the goal.

**COURSE TOPICS**:
Deep introspection of past 5 years
- Scope of living
- Choosing means of livelihood
  - (1) Review of relationships in family
  - (2) Review of relationships with teachers and friends
  - (3) Selecting life partner
  - (4) Concept of swa-nari/purush
  - (5) Building personal physical assets (swa-dhan)
  - (6) Effect of colleagues at work on lifestyle
  - (7) Stages of fear
  - (8) Sketch of long term plan
    - Gyan, vivek aur vigyan
  - (9) Self assessment on the essential factors for living
    - Prosperity
    - Happiness

**PREFERRED TEXT BOOKS**: Reading material and notes will be given

*REFERENCE BOOKS*: Human Values and Professional Ethics

*PROJECT*: Mini Project on some topics mentioned above

**GRADING**:
- 40 marks: Assignments (4)
- 20 marks: Mid-Semester Exams (1)
- 40 marks: Project and presentation (1)

**OUTCOME**: Clarity on the goal and commitment towards achieving the same.

**REMARKS**:

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Course Name : Usability Engineering
Credits : 4
Type-when : Spring, 2013
Faculty Name : Amitash Ojha

Pre-requisite:
None (Intro to cognitive science recommended but not compulsory)

Objective: The focus of this subject is on human-computer interaction and specifically on making interfaces with high usability. Usability is basically about making a product easy to use (user friendly) and is concerned with design, implementation, and evaluation of interfaces, and study of various issues affecting the user interaction — whether a website, software application, mobile device, robotic
system, or any other user-operated product. The goal is to ensure the safety, utility, effectiveness, efficiency, accessibility and usability of such products or systems. The underlying vision of usability engineering is to offer an approach for designing and developing computational environments that cater to the broadest possible range of human abilities (cognitive and physical), skills, requirement, and preferences.

This course is designed to give an overview of various methodologies of usability engineering, knowing user-centered design with focus on cognitive science, evaluation techniques (usability testing). The course will give students an overall understanding of the field and would help them know that usability is not a luxury but a fundamental requirement of any interactive software or any other interface.

The course would allow the students to develop design skills by reading some experimental papers, discussions, dealing with practical design problems and doing small projects as a part of the course work.

**Course Topics:**
- Introduction and Motivation
- Basics of Human Computer Interface Design
- User-Centered Design Process and methodologies
- Basic principles of Visual Design
- Usability testing
- Usability and accessibility

**Reference Books:**

**Project:** Yes

**Grading policy**
1. Mid term : 15%
2. Assignments: 15%
3. Presentations: 20%
4. Project: 40%
5. Class participation and attendance: 10%

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**TITLE** : VLSI Architectures  
**CREDITS** : 4  
**TYPE-WHEN** :  
**FACULTY NAME** : Dr. Shubhajit Roy Chowdhury  
**PRE-REQUISITE** : Basic Electronic Circuits, Digital Logic  
**OBJECTIVE** : After completing the course a student shall be able to:

1. Design, model and simulate the architecture of a VLSI system subject to specific constraints of performance, accuracy and area.
2. Analyze circuit architectures to check whether design goals have been met or not. The course shall cover the architectural design of VLSI systems with the notion of optimization for area, speed, power dissipation, cost and reliability. It will encompass within its folds traditional and state of the art analog and digital VLSI architectures optimized for specific purposes.

**COURSE TOPICS** :  
1. Introduction. Goals of VLSI Design: Optimization of Speed, Area, Power dissipation, cost and reliability. Review of VLSI design flow 2L  
2. Algorithmic modeling of system 4L  
3. Architectural design of VLSI circuits and systems: Resource utilization and time constraints 4L
4. Data-path subsystems: Adder and multiplier data-path architectures 6L
5. Array subsystems: Memory arrays and programmable gate arrays 4L
6. Logic level design and optimization 2L
7. Analog array architectures 4L
8. Low power and high speed analog and digital VLSI architectures 4L
9. Clock generators and clock routing for VLSI chips 2L
10. High speed interconnect design 2L
11. Digital Signal Processing using array architectures: Systolic array and Wave-front array 4L
12. Dynamically reconfigurable gate arrays 2L
13. Inexact computing: Probabilistic CMOS model based design architectures and probabilistic pruning 2L


*REFERENCE BOOKS:

PROJECT:

GRADING:

OUTCOME:

REMARKS:

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**TITLE**: Wireless Communication

**CREDITS**: 3-1-0-4

**TYPE-WHEN**:

**FACULTY NAME**: G. Rama Murthy

**PRE-REQUISITE**:

**OBJECTIVE**:

**COURSE TOPICS**:
- Models of Wireless channel s-Characterization of fading, channel correlation and scatter functions, Simulation using Jakes model
- Diversity techniques - Time, Frequency and space diversity
- Spread spectrum communication and RAKE receiver
- MIMO systems
- Cellular systems

**Text books**:
2. Wireless Communications Principles and Practice - Rappaport

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