COURSE DESCRIPTION – SPRING – 2018
ELECTIVES

Version 1(09/12/2017)

Advances in Database Systems	PK Reddy
Advanced Topics in Game Theory	Ganesh Iyer
Classical Text Reading II: Greek Thought	Navjyoti Singh
Classic Text Reading IV: Research Specific	CEH Faculty
Cognitive Neuroscience	Kavita Vemuri
Computational Linguistics 2	Soma Paul
Computer Vision	Anoop Namboodiri
Comprehension of Indian Music	Saroja TK
Concurrent Data Structures	R. Govindarajulu
Critical Thinking	Jolly Thomas
Database Systems	Vikram Pudi
Distributed Systems	R Govindarajulu
Distributing Trust and Blockchains	Sujit P Gujar
Digital Humanities Project	CEH Faculty
Disaster Management	Sunitha P
Earthquake Engineering	R Pradeep Kumar
Error Correcting Codes	Prasad Krishnan
Finite Element Methods	Venkateswarlu M
Foundation Engineering & Design	Sunitha P
Functional Analysis	Lakshmi Burra
General & Structural Chemistry	Abhijit Mitra
Gravity & Gravitational Waves	C Mukku
Human Rights	Nand Kishore Acharya
ICTs for Development	Nimmi Rangaswamy
Information Security Audit and Assurance	Shatrunjay Rawat
Intro to Robotics: Mechanics & Control	Abhishek Sarkar
Introduction to Nano biotechnology	Tapan Kumar Sau
Introduction to Systems Biology	Vinod PK
Introduction to parallel Scientific Computing	Pawan Kumar
Internals of Application Servers	Ramesh Loganathan
Linear Algebra	Indranil Chakrabarthy
Literature - American Classics	Aruna Chaluvadi
Material Science and Engineering	N V Suresh Kumar
Mathematical Methods	Subhadip Mitra
Modeling and Simulations	Deva Priyakumar
Music, Mind and Technology	Vinoo Alluri
NGS Data Analysis	Nita Parekh
NLP Applications	Manish Shrivastava
Optimization Methods	Sujit Gujar
Photonics	Syed Azeemuddin + K R Sarma
Principles of Information Security	Kannan Srinathan

Radar Systems	K R Sarma
Readings from Hindi Literature	Harjinder Singh
Remote Sensing	RC Prasad
Science Lab II	Tapan K Sau + Prabhakar B
Select topics in Physical Chemistry	Harjinder Singh
Signal Detection and Estimation Theory	Sachin Chaudhari
Software Engineering	Vasudeva Varma
Speech Systems	Suryakant VG
Statistical Methods in AI	Naresh Manwani
System and Network Security	Ashok Kumar Das
Time Frequency Analysis	Anil Kumar V
The State in Colonial India	Aniket Alam
Topics in Information Retrieval	Manish Srivastava
Topics in Discourse Analysis	Radhika M
VLSI Architectures	Govind Krishnan
Woman & Politics in India	Sinjini Bhattacharya

TITLE : Advances in Database Systems
Course Code : CSE541
CREDITS : 4
TYPE-WHEN : Advanced elective
FACULTY NAME : P.Krishna Reddy
PRE-REQUISITE : Database Management Systems, Operating Systems, Computer organization, programming language.

OBJECTIVE:

Database system technology manages (stores and retrieves) disk resident data in an efficient manner. Typical DBMSs have been designed to manage data for banking and retail applications. However, this narrow view of DBMSs has changed significantly, during the last two decades, to meet the data management requirements of emerging applications from various domains. In this course, we will cover several advanced techniques (NoSQL, MapReduce, Stream data management, data integration, query processing, indexing, new storage architectures, graph data management) for large-scale data management requirements of emerging applications in Internet era.

The objective of this course is to give sufficient background to think about possible solutions to current data management problems. For this we discuss key research papers related to the building of database systems to support traditional and emerging applications.

COURSE TOPICS:

About 25 key research papers will be discussed on the following topics: Research papers related to relational database engine, distributed database engine, data warehousing, stream processing, NOSQL, map-reduce, graph databases, database integration, and web services.

REFERENCE BOOKS.

1. Readings in Database Systems, Fifth Edition - edited by Peter Bailis, Joseph M. Hellerstein, Michael Stonebraker, (We will also discuss few papers from earlier editions)

2. Gray, J., and Reuter, A., Transaction Processing: Concepts and Techniques, Morgan Kaufmann, 1993.

3. Database System Implementation by Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom,

4. Database System Concepts, Abraham Silberschatz Henry F. Korth S. Sudarshan

5. Database Management Systems by Raghu Ramakrishnan and Johannes Gehrke

6. Papers from SIGMOD, VLDB, ICDE, IDAR, and database journals.

PROJECT:

Each student has to submit the summary of the research paper. As we are discussing the key papers, each student has to make the presentation of three related important papers written after the publication of the key research paper. It is expected that a student will form a new idea in a comprehensive manner which may lead to publication.

GRADING:

MIDTERM EXAM: 30% .
ENDSEM EXAM: 40 %
Research paper: 30 %

OUTCOME:

After taking the course, the student will have a comprehensive view about the database system technology. Also, he/she will be able to appreciate the research efforts that have been made to

manage emerging database related applications. Further, a student is expected to get a capability to think about new solutions for ongoing and future data management problems.

REMARKS: The course is aimed at research students. Under-graduate and post-graduate students who are interested in doing research can take this course. It is very intensive course. The students are going to get enough base to get new ideas for doing MS and PhD. Pls. talk to me if you want more clarity.

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List of research papers (A list of 23 papers is given. A few will be added/replaced.)

1. E. F. Codd: "A Relational Model of Data for Large Shared Data Banks." CACM 13(6): 377-387 (1970)

2. Morton M. Astrahan et al., System R: Relational Approach to Database Management. ACM Transactions on Database Systems, 1(2), 1976, 97-137.

3. Stonebraker, M., et al., (1976) The Design and Implementation of INGRES, *ACM TODS*, 1(3), 1976.

4. Patricia G. Selinger et al., Access path selection in a relational database management system. SIGMOD, 1979.

5. Jim Gray et al. Granularity of Locks and Degrees of Consistency in a Shared Data Base., IBM, September, 1975.

6. C. Mohan et al. ARIES: A Transaction Recovery Method Supporting Fine-Granularity Locking and Partial Rollbacks Using Write-Ahead Logging. ACM Transactions on Database Systems, 17(1), 1992, 94-162.

7. Rakesh Agrawal et al. Concurrency Control Performance Modeling: Alternatives and Implications. ACM Transactions on Database Systems, 12(4), 1987, 609-654.

8. C. Mohan et al. Transaction Management in the R* Distributed Database Management System. ACM Transactions on Database Systems, 11(4), 1986, 378-396.

9. David J. DeWitt et al, The Gamma Database Machine Project. IEEE Transactions on Knowledge and Data Engineering, 2(1), 1990, 44-62.

10 Jeff Dean and Sanjay Ghemawat. MapReduce: Simplified Data Processing on Large Clusters. OSDI, 2004.

11 Franklin, Michael J., et al. Design Considerations for High Fan-In Systems: The HiFi Approach. CIDR. 2005.

12 M Stonebraker, C-store: A Column-oriented DBMS. SIGMOD, 2005.

13 Suraji Chaudari et al. A Primitive Operator for Similarity Joins in Data Cleaning. ICDE 2006.

14 Giuseppe DeCandia et al., Dynamo: Amazon's Highly Available Key-Value Store. SOSP, 2007

15 Matthias Brantner et al. Building a Database on S3, SIGMOD 08.

16 Alagiannis, Ioannis, et al. NoDB: Efficient Query Execution on Raw Data Files, ACM SIGMOD 2012.

17 SharedDB: Killing one thousand queries with one stone, G. Giannikis, G. Alonso, D. Kossmann, VLDB 2012, Istanbul.

18 Stonebraker, Michael, et al. Data Curation at Scale: The Data Tamer System. CIDR. 2013

19 Henrico Dolfing et al., MONDRIAN: Annotating and querying databases through colors and blocks

20 Meehan, John, et al. S-Store: Streaming Meets Transaction Processing PVLDB 8(13), Sept 2015.

21 C. Wang et al. Scalable mining of large disk-based graph databases SIGKDD 2004.

22 Martínez-Bazan, N et al. DEX: high-performance exploration on large graphs for information retrieval CIKM 2007.

23 G Malewicz et al. Pregel: a system for large-scale graph processing, SIGMOD 2010,

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TITLE: Advanced Topics in Game Theory

Course Code: CSE593
CREDITS:3-1-0-4
TYPE-WHEN: Spring-2018
FACULTY NAME:Dr. Ganesh Iyer,
PRE-REQUISITE:
OBJECTIVE:
The aim of this course is to introduce students to the novel concepts of game theory with special emphasis on its applications in current day Computer Science domains including Cloud computing systems, social media analytics, security mechanisms and Internet marketing strategies.

COURSE TOPICS :
Game theory is the mathematical modelling of strategic interaction among rational (and irrational) agents. Beyond what we call 'games' in common language, such as chess, soccer, etc., it includes the modelling of conflict among nations, political campaigns competition among firms, and trading behaviour in stock markets. There has been a remarkable increase in the usage of game theory and mechanism designs for computer science applications in the past decade.

In computer science game theory and mechanism design are used as a way to solve optimization problems in systems where participants act independently and their decisions change the whole system. Application areas include, communication networks, artificial intelligence systems, distributed systems such as grid and Cloud computing paradigms, network security, online systems such as eBay, Google keyword auctions etc. This course aims to provide basic understanding of various game - theoretic concepts (non-cooperative games, cooperative games, mechanism design concepts) and its application in different solution architecture domains. After this course the students should be able to model several real situations using game-theory and design solutions (mechanisms, algorithms, protocols etc.) that are robust even in presence of "self-centred" entities.

Topics:
Basic concepts, definitions, utilities, classification of games, classic examples, typical application scenarios. Non-cooperative games: Extensive form games, dominant strategy equilibrium, Nash equilibrium and related concepts, Cloud market pricing and usage modeling through extensive form games. Repeated games: monitoring, discounting, Cloud provider’s reliability. Congestion games:Energy minimization in mobile cloud computing. Robustness: Non-cooperative games for Cyber physical systems (e.g. Cloud Computing systems) . Bargaining Theory: Resource allocation in Cloud computing, Multimedia resource management. Coalitional Game theory: Revenue maximization in Mobile Cloud networks, cooperation between multiple networks. Mechanism design: Incentive compatible mechanisms, profit maximization, cost sharing, pricing and investment decisions in Internet. Auction Theory: Social media marketing (Google, Facebook), Cloud brokers, online auctions (eBay), sponsored search. Crowdsourcing and Schelling’s Theory of Self -Command. Security Games: Defense–attack interactions, security and dependability measurement, assessing and managingsecurity risks. Network Games: Routing, flow control, congestion control, revenue sharing between Internet service providers.

Coordination games – Sustaining marketer - consumer cooperation. Miscellaneous topics: Future directions and remarks, Recap.

PREFERRED TEXT BOOKS:
Game Theory in Wireless and Communication Networks: Theory, Models, and Applications, Zhu Han, Dusit Niyato, Walid Saad, Tamer Baar, Are Hjørungnes, Cambridge Publications, 2011

*REFERENCE BOOKS:
1. Social Media Marketing: Game Theory and the Emergence of Collaboration, Eric Anderson, Springer, 2010.
2. Game Theoretic Problems in Network Economics and Mechanism Design Solutions, Y. Narahariet. al., Springer 2009.
3. Dynamic Pricing and Automated Resource Allocation for Complex Information Services, Michael Schwind, Springer 2007.
4. Games and Decision Making, Charalambos D. Aliprantis and Subir K. Chakrabarti, Oxford Press 2010.
5.Computational aspects of Cooperative game theory, Georgios Chalkiadakis, Morgan and Claypool Publishers, 2012.
6.Game Theory in Communication Networks, Josephina Antoniou, CRC Proess, 2012.
7. Algorithmic Game Theory, Noam Nissan et. al., Cambridge University Press, 2007.
8. Lectures in Game Theory in Computer Scientists, Krzysztof R. Apt, Erich Grädas, Cambridge University Press, 2012.

*PROJECT:

1. Students will be given a specific computer science problem and will be asked to come up with an approach/algorithm to solve the same. Later they will be required to implement/simulate to solve using the proposed algorithm

2. Students will be given some of the current day game theory applications (e.g. pricing strategies among Cloud products: Revenue models) and asked to analyze and understand different game theoretic approaches to solve the same problem to achieve different objectives
GRADING: 2 quizzes (5%+5%), Mid - term (25%), Assignment (25%), Final Exam (40%)

OUTCOME:
Knowledge on game theory, understanding of modern computer science problems and use cases from the game theoretic point of view, ability to model real - world situations such as social media marketing, social analytics and Cloud computing issues using game theory, design robust and efficient solutions (mechanisms, algorithms, protocols) that would work for agents that are rational and intelligent.

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TITLE: **Classical Text Reading I, II, III, IV**
CREDITS: 3-0-0-4 each semester for 4 semesters
TYPE-WHEN: Humanities Elective, EH Stream Elective
FACULTY NAME: CEH Faculty

PRE-REQUISITE: None

OBJECTIVE:

The purpose of the course is to study original source books dealing with specific strand of classical knowledge and further to relate them with contemporary concerns of humanities. The course will focus on the conceptual reading of classical texts in contemporary languages. Such reading will be done under supervision.

Choice of the text will be worked out by instructors in consultation with registrant from the list of texts, which will be made available in translation and original. Each registrant is expected to study one text in details and other related texts in summary. The text will be read in available translations (usually English, Hindi and other contemporary languages) along with constant reference to the original (in classical languages). The reading of text will culminate in an essay by registrant.

COURSE TOPICS:

Offering of texts for the course are related to following area-streams:

1. Philosophy and Ontology:
2. Arts and Aesthetics:
3. Society and Polity:

Registrants can choose any one of the three area-streams to pursue text readings. Scheduling of supervised reading sessions will be done after common introductory classes on exegesis. Classical language textual traditions in the three area-streams will be introduced in the common classes. Exemplary reading of the portion of one text in each area-stream will be done in common classes. Class will be divided into three area-stream groups for presentations and discussions.

The four courses in the stream would cover different regions of classics:
CTR-I: Sanskrit, Pali, Prakrit
CRT-II: Greek, Arabic, Persian, Chinese
CRT-III: Modern Classics
CRT-IV: Thematic Classics across regions

Methodologically, the course would focus on conceptual reading in between the lines of translation. However, literary reading and analytic reading would also be explored.

REFERENCE BOOKS:

Text with Translations will be made available in soft form and in printed form.

GRADING:

Weekly submission/blogging of Reports on reading 10% (~ Assignments)

Note on Discourse context of the text; Presentation	20% (~ 1st MidSem)
Note on Basic concepts enunciated in the text; Presentation	20% (~ 2nd MidSem)
Final Essay	50% (~ EndSem)

OUTCOME:

Students would have learnt to appreciate issues involved in conceptual reading of classical text. Further, familiarity with classical thought would enrich the mindscape.

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Title: **Cognitive Neuroscience**
Type When: Spring 2018
Faculty Name: Kavita Vemuri
Joint course: IIITH and University of Hyderabad.

The course will examine how modern cognitive neuroscientists explore the neural Underpinnings of sensory information – vision, sound, and touch leading to visual/auditory attention, language processing, memory, empathy/emotion and other higher-order cognitive processes. Investigates the different techniques applied to uncover observations of clinical populations & non-clinical human populations and also some specimens from the insect/ animal kingdom. Data collected from powerful methods like functional magnetic resonance imaging (fMRI) and electroencephalogram (EEG) will be analyzed to examine functional brain connectivity. Equal emphasis is on understanding analytical methods and the limitations of each. The third part of the course will cover a part of computational neurosciences, which involves building computer simulation on models of neurons and dynamic neural circuits

Lectures: 70%
Lab work: 30%

The lab work will cover analysis of fMRI, Difusion Tomography imaging, EEG data from research studies designed to investigate the neural responses to a visual, auditory or task stimuli.

Textbooks:1.Cognitive Neuroscience by Gazaniga (copy available in ITH library)
2. Fundamentals of Computational Neuroscience by Thomas Trapenberg.
3. Required research papers.
Evaluation:
Assignments(6):20%
Class presentation (1): 10%
Lab work: 30%
Mid-sem I: 20%
Final Sem: 20%

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Title: Comprehension of Indian Music

Course Code: **HSS337**
Faculty name: TK. Saroja
Type-When: Humanities Elective, Spring 2018
Credit: 3-0-0-4

Course Description:
This course offers an overview of Indian music and its classicism. The two major styles Hindustani and Karnataka with their rich traditions glorify Indian music. The creative aspect which is the foremost feature of Indian music is what takes the art form to its zenith. Its huge variety contributes to the cultural heritage of the civilization. The logic, science, philosophy, history, emotions, imagination in Indian music gives the art its completeness. The course will cover conceptual base of Indian music and emphasize on informed comprehension of music.

Objectives:
1. Study of basics of both the styles (Hindustani and Karnataka) to know the characteristics of them. Importance of *nāda* in music.
2. Emphasis on the conceptual system of *rāga*-s and *tāla*-s that gives Indian music its stature.
3. Introduction to different genres of India music like the semi classical, light, folk music studying their peculiar aspects. The aspects that differentiate them from each other would be analyzed.
4. The role of language and the interwoven relationship of literature and music in musical compositions. The association of melody and rhythm that go hand in hand in the compositions with focus on the vowel elongations. Role of music in bringing out the emotions and expressions in poetry and literature.
5. The contribution of different composers who enriched the classical form of art particularly in south Indian music. A special study of the compositional style of the South Indian musical trinity Tyagaraja, Mythuswamy Dixitar and Syama Sastry.
6. The existence and the prominence of *gharānā*-s in Hindustani music and the musicians who represent the particular *gharānā*-s.
7. The indispensable place of music in other art forms like dance, theatre and also spheres like cinema, commercials etc. (medium of communication).

Course outcomes:

- Understanding the theory of Indian music which gives it the status of a *śāstra* and appreciation of the practice of classical music.
- Understanding the rational, creative and social elements of the art which makes the art an integral part of the society.
- Ability to recognize different musical forms with a systematic approach.
- Understanding the universality of music with the knowledge of Indian music.
- Understanding the importance of music and related arts in one's life as those that foster individual growth.

Reference Materials:
1. *South Indian Music* – Volumes 1 to 6 by Professor P. Sambamurthy

2. *The quest for Music Divine* by Suresh Chandra Dey
3. *The Spiritual Heritage of Tyagaraja* by C. Ramanujacharya and Prof V. Raghavan
4. *Karnataka Sangita Sastra* by A.S. Panchapakesa Ayyar
5. *Appreciating Carnatic Music* by Chitraveena N.Ravikiran
6. *Nuances of Hindustani Classical Music* by Hema Hirlekar
7. *The Hindu Speaks on Music* - compilation of 232 selective music articles by The Hindu
8. *A Southern Music (The karnatic story)* by T.M. Krishna
9. *Hindustani Music: A tradition in transition* by Deepak Raja
10. *Raga Chikitsa* by Suvarna Nalapat
11. *Sangitha Ratnakara of Sarngadeva* by Shringy RK and Premlata Sharma
12. *Matanga and his work Brhaddesi*-edited by Prem Lata sharma
13. Videos and audios of music which practically demonstrate all the concepts of the course.

Tentative lesson Plan

Lecture 1, 2 - Introduction to Indian music along with technical terms.

Lecture 3 – Nāda, the basic of music. Sound, timbre and related topics

Lecture 4 - Laya, the introduction of rhythm in general, its role in any kind of music with examples from numerous varieties of songs.

Lecture 5, 6 - The concept of tāla in both North and South Indian music.

The similarity of the theory behind tāla system with difference in the execution of it.

Lecture 7, 8, 9 - Manodharma sangeet - The improvisational music. What is manodharm sangeet with respect to Classical music and how this plays a major role in composing different kinds of music compositions.

Lecture 10, 11, 12, 13 – Genres of Indian music like the semi classical or devotional music, light music, folk music, sufi music, popular music where different musical forms that hold different genres of music introduced.

Lecture 14, 15, 16 - Musical forms that are strictly categorized under traditional classical music. The peculiarity of these forms to be listed as classical compositions different from all other genres of music.

Lecture 17, 18, 19 - Language and its role in Indian music where the combination of musical notes, rhythm, letters of the language, vowels together contribute in the composing of songs. Grammatical aspects of language and music are exposed.

Lecture 20 - The importance of *gharānā*-s in North Indian music and the musicians who represent particular *gharānā*-s.

Lecture 21, 22, 23 - The different composers who contributed to Indian music in its development from different time periods.

Lecture 24, 25, 26 - The blend of music with different art forms like dance, theatre and role of music in different spheres of society like different communication medium.

Grading :

Mid Sem1 – 20%

Mid Sem 2- 20%

Assignments-20%

Individual Project and viva- 40%

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TITLE : Computer Vision
CREDITS : 3-1-0-4
TYPE-WHEN : Spring 2017
FACULTY NAME : Dr. Anoop
PRE-REQUISITE : Computer Graphics or Image processing
OBJECTIVE :
COURSE TOPICS : Relationship between computer vision, graphics and Image processing.
Camera model: Imaging process 3D to 2D projection and loss of information, calibrated and un calibrated 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, Pearsen Education Inc.

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TITLE : Concurrent Data Structures

CREDITS : 3-1-0-4

TYPE-WHEN : Spring 2018

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:

***REFERENCE BOOKS:**

Maurice Herlihy and Nir Shavit, "The Art of Multiprocessor Programming", Morgan Kaufmann Publication, 2008.

***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%

OUTCOME:

REMARKS:

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TITLE : Critical Thinking
Course Code :
CREDITS : 4
Semester : Spring-2017
FACULTY NAME : Jolly Thomas

PRE-REQUISITE : Willingness for critical thinking

OBJECTIVE **:** To critically engage with arguments

COURSE TOPICS :

Unit 1: Introduction: Critical thinking and Informal logic

1. What is critical thinking?
2. What is informal logic?
3. Disentangling and mapping arguments

Unit 2: Argument, constituents of the argument and the relations between the constituents of the argument

1. Argument and the standard form of an argument
    - Sentences and Truth-Values
    - Validity and Soundness
2. Basic Sentential Logic semantics
    - Truth-Functional Connectives and other English connectives
    - Truth functional equivalence, consistency, entailment and validity
3. Methods to prove validity or invalidity
    - Truth table and short truth table, Tree method and Derivation
4. Syllogisms and Venn Diagrams
    - Formal Nature of Syllogistic Argument
    - Venn Diagram Technique for Testing Syllogisms

Unit 3: Fallacies: The Principal Forms of Illogical Thinking

1. Informal fallacies
    - Fallacies of relevance, defective induction, presumption and ambiguity
2. Formal Fallacies
    - Existential fallacy and Formal syllogistic fallacies

Unit 4: Induction and Scientific Reasoning

1. Inductive Arguments and Arguments from Analogy
2. Hypothetical-deductive method, Causal Reasoning and Inference to the Best Explanation
3. Briefly on Ockham's Razor

PREFERRED TEXT BOOKS:

1. Bergmann, Merrie, Moor, James and Jack Nelson. 2008. The Logic Book. 5th edition, McGraw-Hill.

2. Copi, Irving M, Cohen, Carl, Jetli, Priyadarshi and Monica Prabhakar. 2014. Introduction to Logic. 14th edition.

3. Grennan, Wayne. 1997. Informal Logic: Issues and Techniques: A proposal for a new system of argument evaluation. Montreal: McGill-Queen's University Press.

4. Noel Moore, Brooke and Richard Parker. 2009. Critical Thinking. 9th edition, McGraw-Hill.

5. Sinnott-Armstrong, Walter, and Robert J. Fogelin. 2009. Understanding Arguments: An Introduction to Informal Logic. 8th edition, Wadsworth Publishing.

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	15
Mid Sem-2 Exam	15
End Sem Exam	30
Assignments	20
Term Paper	20
Other Evaluation _____	

REMARKS:

Critical thinking inevitably involves breaking arguments and claims to their underlying structure, and this helps one to determine whether the arguments are rational. The objective of this course is to look at the techniques that evaluate what we read, hear, and what we ourselves write and say. This course is not a mere reproduction of formal logic. We will look at the techniques used in formal logic and certain concepts of formal logic in order to examine the idea critical thinking and argumentation procedure.

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TITLE : CSC 441- Database Systems

CREDITS : 4

TYPE-WHEN : Second-level course in database systems

FACULTY NAME : Vikram Pudi

PRE-REQUISITE : Students should have knowledge of SQL, database design and operating systems, programming language, algorithms.

OBJECTIVE : Databases have become essential part of every business. A database system can be used to manage large amounts of data in a persistent manner. The objective of this course is to study the methods that have been evolved over several decades to build database systems or database management systems software in a focused manner which include storage management, index management, query processing, recovery management and transaction management.

COURSE TOPICS

Introduction (3 hours); Data storage (3 hours); Representing data elements (3 hours); Index structures (3 hours); Multidimensional indexes (6 hours); Query execution (6 hours); The query compiler (6 hours); Coping with system

failures (3 hours); Concurrency control (6 hours); More about transaction management (6 hours).
PREFERRED TEXT BOOKS:
1. Database System Implementation, Hector Garcia-Molina, Jeffrey D. Ullman and Jennifer Widon, Pearson Education, 2003
OTHER TEXT BOOKS:
2. Elmasri & Navathe, Fundamentals of Database Systems, Pearson Education, 5th Education.
3. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, Third edition, Mc Graw Hill, 2003.
4. Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database system concepts, fifth edition, Mc Graw Hill, 2006.
PROJECT:
A practical project on indexing, query optimization, and transaction management will be given. The project will be evaluated.
GRADING:
PROJECT and Assignments: 30%; MIDSEM: 30%; ENDSEM: 40%
OUTCOME:
The course will help the students in understanding the fundamental concepts of several database management systems like ORACLE, DB2, SYBASE and so on. Also, the students will understand the solutions/options to interesting problems which have been encountered by the designers of preceding DBMSs. Most important, the students will be exposed to internal design of DBMSs and able to tune the DBMSs to meet the performance demands of diverse applications.

TITLE : Distributing Trust and Blockchains
Course Code :

CREDITS : 3-0-0-4
TYPE-WHEN : Spring 2018
FACULTY NAME : Sujit P Gujar

PRE-REQUISITE : Nil

OBJECTIVE :

Bitcoin has made a big leap in alternative to centralized financial systems. It is one of the most impressive technological innovation of 21st century. There are people who believe it is a gold where as there is a section of population who believe this is just a bubble. What is that makes bitcoin so interesting? Answer is its underlying blockchain technology that not only enabled a first successful crypto currency but also many real-world applications through smart contracts. In this course, we will study about bitcoins, blockchains and smart contracts along with key basic crypto fundamentals.

COURSE TOPICS :

(i) Basic maths (probability theory) and cryptography concepts such as encryption, hashing and Merkel Trees. (Introduction to basic stuff so that course can be self-sufficient).
(ii) What is cryptocurrency? What is bitcoin? How does bitcoin work?
(iii) What is double spending? How it is avoided by proof of work in bitcoins?
(iv) Bitcoin mining: strategies and incentives, and mining pools.

(v) Distributed consensus. Block chain technology.
(vi) Use of block chains to design smart contracts (Ethereum/solidity) and their applications such as secure auction, distributed machine learning, secure crowd sensing etc.
(vii) Other Cryptocurrencies: Altcoins, ZeroCash etc.

PREFERRED TEXT BOOKS:

Bitcoin and Cryptocurrency Technologies, Narayanan, Bonneau, Felten, Miller, Goldfeder, Clark, Princeton University Press 2016

***PROJECT:**

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	**15**
Mid Sem-2 Exam	**15**
End Sem Exam	**-**
Assignments	**10**
Programming Assignments	**25**
Scribes	**5**
Course Participation	**5**
Reading Assignments (2)	**25**

OUTCOME:

In this course the participants will learn about bitcoin, security aspects of bitcoins, how alternate cryptocurrencies are proposed to improve certain aspects. Also, the participants will learn what are key concepts behind block chain technology, how to design smart contracts using block chains, program in solidity. The participants should be able to develop new applications using block chain technology.

REMARKS: The course has multiple aspects varying from implementation and hands on to reading recent research papers in this domain and present it to broader audience.

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TITLE : Distributed Systems
CREDITS : 4
FACULTY NAME : K. Kishore + Suresh Purini
Foundations: Characterizations of Distributed Systems
System Models
Networking and Internetworking
Inter-process Communication

Logical Time:
A framework for a system of logical clocks
Scalar time, vector time and efficient implementation of vector clocks
Synchronization of physical clocks. NTP
Global state and snapshot recording algorithms:
System model and definition
Snapshot algorithms for FIFO channels
Middleware:
Distributed objects and RMI
Termination Detection:
Termination detection using distributed snapshots
A spanning-tree-based termination detection algorithms
Distributed mutual exclusion algorithms:
Lamport‘s algorithm, Ricart-Agarwala Algoritm
Sughal‘s dynamic information – Structure Algorithm
Quorum-based mutual exclusion Alogorithm
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 (messagepassing)
synchronous system with failures. Agreement in asynchronous message passing systems with failures.
The syllabus includes the following topics:
- RPC, Google protobufs
- Logical clocks, vector clocks, generalized clocks
- Totally ordered multicase
- Mutual exclusion, leader election algorithms
- Deadlock detection/prevention algorithms
- Consensus algorithm, Paxos (possibly Raft)
- Consistency, eventual consistency, monotonic reads, read your writes, etc
- Failure modes, types of failures
- Distributed transactions, 2 phase commit, 3 phase commit
- CAP theorem
- Apache HDFS, MapReduce
- Google BigTable
- Amazon Dynamo DB
- Kafka

Grading:
Mid-1: 15%
Final: 40%
Assignment-1: 5% (Compare Google Protobuf with JSON for serialization)
Assignment-2: 10% (Gossip protocol)
Assignment-3: 30% (Lab project, groups of 2. Implement MapReduce)

Reference Books

1) Ajay D. Kshemkalyani and Mukesh Singhal, —Distributed Computing Principles, Algorithms and

System‖, Cambridge University Press 2008.
2) Sukumar Ghosh, ―Distributed Systems – An Algorithmic Approach‖, Chapman & Hall ICRC, 2007.
3) M. L. Liu, ―Distributed Computing Principles and Applications‖, Pearson, 2004.
4) George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, ―Distributed Systems Concepts and Design‖, Fifth Edition, Pearson 2011.
5) Mukesh Singhal and Niranjan G. Shivaratri, ―Advanced Concepts in Operating Systems‖, TMH, 1994, 2010.

TITLE: Disaster Management

Course Code:CES442

Credits: 3-1-0-4
Type-when: Spring-2018
Faculty Name: Sunitha P
Pre-Requisite: None
Max.Limit: 40

OBJECTIVE :

1. To teach students about types of natural and environmental disasters.
2. To help students to develop skills in various stages of disaster preparedness, mitigation and management.
3. To teach the students the methodologies for disaster risk assessment.

COURSE TOPICS:

- Natural Disasters Mitigation and Management – An Outline
- Natural Hazard Evaluation, Mitigation and Preparedness
- Earthquakes , Landslides and Tsunamis
- Tornadoes, Cyclones, Floods , Drought
- Disaster Awareness Education and Communication

UNIT I:

Introduction - Natural Disasters - Natural Disaster Risk Assessment - Earth and its characteristics – Environmental Change and Degradation–Disaster mitigation, preparedness, response and recovery - comprehensive emergency management - Emergency Services - Natural Disasters, Environment and Public Policy –Impact on Natural and Built Environments - Early warning systems and disaster Preparedness – Rehabilitation , Vulnerable Populations - Role Volunteers of National and International agencies

UNIT II:

Natural hazards – Mapping - Modeling, risk analysis and loss estimation – Natural disaster risk analysis - prevention and mitigation - Applications of Space Technology (Satellite Communications, GPS, GIS and Remote Sensing and Information / Communication Technologies (ICT) in Early warning Systems - Disaster Monitoring and Support Centre – Information Dissemination – Mobile Communications etc.,

UNIT III:

Introduction and Review-Core Issues in Natural Disasters–Disaster Risk Assessment Methods-Geological-Geomorphological aspects, Plate Tectonics & Earthquakes-Earthquake Geology, Seismology, Magnitude & Intensity – Tectonic Processes & Fault Systems -Landslides–Characteristics and dimensions – Geomorphological, Geotechnical aspects – liquefaction – Tsunami - Mitigation &Preparation–Response, Recovery and Rehabilitation

UNIT IV:
Oceanic, Atmospheric and Hydrologic cycles-Severe Weather & Tornadoes, Cyclones, Floods and Droughts-Global Patterns-Critical Climate System Aspects and Processes -Mitigation & Preparation–Drought–Drought Assessment and Monitoring.

UNIT V:
Organizational and Administrative strategies for managing large scale disasters—Administrative mechanisms , Community and Social organizations–Role of Regional and local administrative team-Vulnerability-catastrophic effects of natural hazards on human settlements-Education and Training–Establishment of capacity building among various stake holders–Government-Educational institutions - Awareness training and short -term programs for critical population -Use of multi-media and press for disaster communication

PREFERRED TEXT BOOKS:
*REFERENCE BOOKS:
1. Kovach, Robert L. Earth's Fury (1995), An Introduction to Natural Hazards and Disasters, Englewood Cliffs, N.J.: Prentice Hall.
2. Alexander, David A. (1995), Natural Disasters. New York: Chapman and Hall.
3. Bryant, Edward (1995), Natural Hazards,. New York: Cambridge University Press.
4. Robinson, Andrew (1996), Earthshock: Hurricanes, Volcanoes, Earthquakes, Tornadoes and Other Forces of Nature, New York: Thames and Hudson.

*PROJECT:

GRADING:
Assignment 20%
Minor project 15%
(different project for different groups with 3 students in each and it has to be presented)
Mid Exams 25% (written exam)
Final examination 40% (written exam)

OUTCOME:

1. Learn about the types of natural and environmental disasters and its causes.

2. Develop ways and means by which a natural disaster effect is minimized.

3. Learn about organizational and Administrative strategies for managing large scaledisasters.

4. Learn about the early warning systems, monitoring of disasters effect and necessity of

rehabilitation.

5. Learn about the engineering and non-engineering controls of mitigating various natural disasters.

6. Understand the key roles of capacity building to face disaster among government bodies, institutions, NGO's and other voluntary organizations at national and international level.

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TITLE : Earthquake Engineering
Course Code : CES641
CREDITS : 3-1-0-4
TYPE-WHEN : Spring 2018
FACULTY NAME : Ramancharla Pradeep Kumar
PRE-REQUISITE : Structural Dynamics
OBJECTIVE :

- Knowledge of Earthquake Engineering and its application to building design
- Understanding of behavior various structural elements

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:

- Seismic Design of Reinforced Concrete and Masonry Buildings by T. Paulay and M.J.N. Priestley.
- Earthquakes by Bruce A. Bolt.

- Earthquake Engineering, Application to Design by Charles K. Erdey.
- Earthquake Engineering: From Seismology to Performance Based Design by Yousef Bozorgnia and Vitelmo Bertero.

***PROJECT:** Mini Project on some topics mentioned above

GRADING:

30 marks: Assignments (4) + Mini project
30 marks: Mid-Semester Exams (2)
40 marks: End Sem exam

OUTCOME:

- Understanding of earthquake behavior of buildings
- Post-earthquake assessment of buildings
- Seismic safety assessment of buildings
- Earthquake resistant design of buildings

REMARKS: None

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TITLE : Error Correcting Codes
Course Code : ECE439
CREDITS : 4
TYPE-WHEN : Spring
FACULTY NAME : Prasad Krishnan

PRE-REQUISITE : Digital Communication, Probability theory basics, Basics of Linear Algebra and Combinatorics
OBJECTIVE :
COURSE TOPICS :

[Detailed Syllabus]

1. Channel-digital communication-information theory basics, difficulty with Shannons results.
2. Role of coding theory, coding gain depiction,
ML criterion - how it maps to hamming distance.
3. What is a code? Types of codes. Factors affecting design of a code.
4. Block codes - hamming code encoding and decoding - alphabets/algebraic motivation/linear algebra motivation.
5. Groups, rings, finite fields (structure), linear algebra - vector space, subspaces, dimension, basis, linear transformations, range+null space, rank-nullity theorem, codes as linear transformations
6. Cyclic codes, BCH codes, Reed Solomon codes (encoding and decoding)
7. Restrictions of block codes, motivation for convolutional codes.

8. Convolutional codes - algebraic structure codes and encoders difference
8. Decoding on trellis - viterbi algorithm, hard decision, soft decision.
9. Trellis coded modulation (capacity curve - bandwidth limited region TCM motivation), Ungerboeck partitioning, gray encoding, decoding of TCM, coding gain.
10. Turbo codes - encoding, decoding [depth as time permits]
11. LDPC - encoding, decoding [depth as time permits]
12. Reed Muller Codes [as time permits]
13. Codes for Distributed Storage and Broadcast Channels [as time permits]

PREFERRED TEXT BOOKS:

Todd K Moon, Error Correction Coding: Mathematical Methods and Algorithms, Wiley Interscience.

- S. Lin and D.J. Costello, *Error Control Coding*, Pearson, 2011
- R.E. Blahut, *Algebraic Codes for Data Transmission*, Cambridge University Press, 2003

***REFERENCE BOOKS:**

- F.J. MacWilliams and N.J.A. Sloane, *The Theory of Error-Correcting Codes*, North-Holland Publishing Company, 197
- R. Roth, *Introduction to Coding Theory*, Cambridge University Press, 2007
- W.C. Huffman and V. Pless, *Fundamentals of Error Correcting Codes*, Cambridge University Press, 2003
- J.G. Proakis and M. Salehi, *Digital Communications*, McGraw-Hill, 2008

- Research Articles as necessary

***PROJECT:**

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	**30 %**
Mid Sem-2 Exam	
End Sem Exam	**40 %**
Assignments	
Project	
Term Paper	
Quizes and Problem Solving Sessions	**30 %**

OUTCOME: Student will have a strong foundation in Coding Theory basics and would have learnt the basic code constructions widely used in theory and practice.

REMARKS:

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TITLE : Finite Element Method
CREDITS : 4
TYPE-WHEN : Spring Semester
FACULTY NAME : Venkateswarlu M
PRE-REQUISITE :
OBJECTIVE: To give wide exposure of Finite Element Method, its uses, implementation and limitations.
COURSE TOPICS: Introduction to the use of Finite Element Procedures, Broader aspects of finite elements: Variational Considerations Steady state heat conduction Method of weighted residuals Two dimensional potential flow of fluid - Finite elements for trusses - Finite elements for beams - Elements and interpolation functions - FE Nonlinear analysis in solid & Structural mechanics - Finite elements for Dynamics
PREFERRED TEXT BOOKS: Finite Element Method by Chandraputla and Balagundu Energy & Finite Element methods by Shames and Dym Finite Element method by JN Reddy
***REFERENCE BOOKS:** Finite Element Procedures by Klaus-Jurgen Bathe
***PROJECT:**
GRADING:
40 marks : Assignments (6)
30 marks : Mid-Semester Exams (2)
30 marks : End-Semester Exams (1)
OUTCOME: Student will be able to analyze trusses, beams, plates and other similar structures using Finite Element Method.
REMARKS:

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TITLE : Functional Analysis
Course Code : IMA301
CREDITS : 3-1-0-4
TYPE-WHEN : Maths Elective, Spring-2018
FACULTY NAME : Lakshmi Burra

PRE-REQUISITE : Maths II

OBJECTIVE : Functional analysis is the branch of mathematics concerned with the study of spaces of functions.
This course is intended to introduce the student to the basic concepts and theorems of functional analysis and its applications.

COURSE TOPICS :
(please list the order in which they will be covered)

- Linear spaces and linear operators; Normed linear spaces and inner product spaces

- Banach spaces

- Hilbert spaces
- Bessel's inequality, Existence of a complete orthonormal Basis of a Hilbert space
- Adjoint, Normal, Unitary Operators Normal and Unitary operators, Projections.
- Finite-dimensional spectral theory: Matrices, determinants and the spectrum of an operator.

PREFERRED TEXT BOOKS:

E. Kreyszig, *Introductory Functional Analysis with Applications*, John Wiley & Sons, New York, 2001
G.F. Simmons, *Introduction to Topology and Modern Analysis*, Â McGraw-Hill Kogakusha, Ltd., New Delhi, 1963

***REFERENCE BOOKS:B.V.Limaye**, *Functional Analysis*, New Age International Limited, Publishers, New Delhi, 1996.

***PROJECT:**

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	**20**
Mid Sem-2 Exam	**20**
End Sem Exam	**30**
Assignments	**20**
Project (or)	
Term Paper	**10**
Other Evaluation _____	

OUTCOME: To extend basic notions from calculus to metric spaces and normed vector spaces To prove that a given space is a Hilbert spaces or a Banach Space To apply orthonormality to expansions of functions

REMARKS:

TITLE **: Foundation Engineering & Design**

Course Code **: CEF631**

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

TYPE-WHEN **:** Electives for I year M.Tech CASE

FACULTY NAME **:** Sunitha P

PRE-REQUISITE **:** Basic Soil Mechanics

OBJECTIVE **:** To develop in students an understanding of the basic analysis and design of different types of foundations for civil engineering structures.

COURSE TOPICS **:**

- Subsurface Exploration and Geotechnical Investigation.
- Shallow Foundations–Terzaghi's, Meyerhoff, Hansens bearing capacity theories, based on SPT, layered soils, eccentric and inclined loads, Bearing capacity on slopes, Foundation settlements.
- Design of Combined and Raft Foundations.
- Design of Retaining Structures.
- Design of Deep Foundations: Pile Foundations–Load transfer mechanism, Pile capacity in various soil types, negative skin friction, group action, settlements, laterally loaded vertical piles.
- Case studies

PREFERRED TEXT BOOKS:

- Das, B. M. "Principle of Foundation Engineering", Cengage Learning India Private Limited.
- Bowles, J. "Foundation Analysis and Design", McGraw-Hill Book Company.

GRADING:

- Home Assignment: 10%
- Mid Sem Exams: 30%
- End Sem Exam: 45%
- One Term **Project**: 10%
- Quizzes: 5%

OUTCOME: At the end of the course, M.Tech I Year students will have a broad understanding of design and analysis of foundations for civil engineering structures.

REMARKS: The course "Foundation Engineering & Design**"** is an elective course for I year M.Tech CASE.

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TITLE : General and Structural Chemistry
Course Code : SCI341
CREDITS : 4
TYPE-WHEN : Core for CND /Open elective for others
Spring-2K18
FACULTY NAME : Abhijit Mitra

PRE-REQUISITE : None
OBJECTIVE : *Help students to understand basic principles of chemistry from a cross disciplinary point of view.*

COURSE TOPICS :
1. The structure of atoms – a basic QM treatment
2. From atoms to molecules – Chemical Bonding and Shapes of molecules - VSEPR theory, hybridization, dipole moment, ionic solids and lattice energy
3. QM approach to structure and bonding – introduction to Molecular Orbital theory
4. Periodic classification of elements - outer electronic configuration, periodicity in properties, classification into metals, non-metals and insulators
4a. 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.
4b. Rare gas: Structure and bonding in rare gas compounds
4c. Transition Metals (d block): Characteristics of 3d elements and coordination complexes, color and magnetic properties of metal complexes.
5. Types of chemical reactions and reaction stoichiometry
6. Basic Concepts in Organic Chemistry and Stereochemistry: Nomenclature and isomerism, Electronic (resonance and inductive) and steric effects, Optical isomerism in compounds containing one and two asymmetric centers, designation of absolute configuration, conformations of cyclohexanes, aromaticity and Huckel's rule.
7. 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.
8. Laws of thermodynamics: Enthalpy and thermochemistry, Entropy and free energy, criterion of spontaneity for equilibrium processes.
9. 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. Hard-Soft Acid Bases (HSAB theory).
10. Solutions and phase equilibria: Colligative properties, Electrolytes and non-electrolytes, Ideal

and non-ideal solutions, colloids; Chemical equilibrium in the gas phase – equilibrium constants and their relation to free energy – temperature dependence
11. Heterogeneous equilibria – adsorption
12. Equilibrium in the aqueous phase – pH, chemical and biological buffers and indicators – complex ions
13. Electrochemistry – voltage and free energy – standard potentials

PREFERRED TEXT BOOKS: *1. Ralph H. Petrucci, General Chemistry: Principles & Modern Applications, 8th Edition, Addison Wesley Longman (2003)*
2. Resource materials uploaded from time to time

***REFERENCE BOOKS:** *1. J. D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley-Blackwell*
2. J. E. Huheey, R. L. Keiter and E. A. Keiter and O. K. Medhi, Inorganic Chemistry: Principles of Structure and Reactivity, 4th Edition, Pearson Education (2008)
3. J. Clayden, N. Greeves, S. Warren, P. Wothers, Organic Chemistry, Oxford University Press
4. T. E. Brown, H. E. LeMay, B. E. Bursten, C. Murphy, Chemistry: The Central Science, 11th Edition, Prentice Hall
5. P W Atkins, Elements of Physical Chemistry, 5/E, Oxford University Press (2010)

***PROJECT:** TBD

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	**12.5**
Mid Sem-2 Exam	**12.5**
End Sem Exam	**25**
Assignments	**42.5**
Project	**TBD**
Term Paper	**TBD**
Other Evaluation - Quizzes_________	**7.5**

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.*
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TITLE : Gravity and Gravitational Waves.
Course Code :
CREDITS :
TYPE-WHEN : Elective, Spring 2018.

FACULTY NAME : Chandrasekher Mukku

PRE-REQUISITE : A preliminary test will be administered for knowledge of Coordinate transformations, grad, curl and div in different coordinate systems and Maxwell's equations and accordingly, participation in the course will be restricted. Willingness to work hard before and after is essential!

OBJECTIVE : Hopefully will lead to a better understanding of the importance of LIGO in the development of gravitational wave astronomy.

COURSE TOPICS :

Geometry of Euclidean space, distance measurements, metric as matrix, coordinate transformations and isometries, derivation of rotational and translation symmetries for Euclidean space as consequences of isometry.

Propagation of light and Minkowski space, isometry in Minkowski space and derivation of Lorentz transformations as rotational and translational transformations of 4 dimensional Minkowski spacetime.

Introduction to Tensors and their properties, covariant derivatives and connections, Riemann metrics, Christoffel symbols, Riemann curvature tensor, Ricci tensor, Ricci scalar.

Newtonian gravity, derivation of Poisson's equation.

Simple derivation of Einstein's equations.

Waves and Oscillations, Plane waves, group and phase velocities, E.M. waves, polarizations, multipoles.

Geodesic deviation equation and quadrupole nature of gravitational waves.

Properties of gravitational radiation, polarizations, sources and detectors.

PREFERRED TEXT BOOKS:

"Gravitation and Cosmology: Principles and Applications of the General Theory of Relativity", Steven Weinberg, Wiley, Asian Edition (2004).

"General Relativity and Cosmology" Sriranjan Banerji and Asit Banerjee,
Science and Technology Books, Elsevier, 2007.

Recommended reading: "The lighter side of Gravity", Jayant V. Narlikar, CUP (1996).

***REFERENCE BOOKS:**

"Gravitation", C.W. Misner, K.S. Thorne and J.A. Wheeler, W.H. Freeman & Co. (1974).

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	**30%**
Mid Sem-2 Exam	**30%**
End Sem Exam	**40%**

Assignments	**None**
Project	**None**
Term Paper	**None**
Other Evaluation _____	**None**

OUTCOME:
Knowledge of the basic mathematical tools used in Einstein's
theory of Gravity and its geometric nature. Steps towards understanding current developments in gravitational wave detectors and future of gravitational wave astronomy.

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TITLE: Human Rights
COUSE CODE: HSS361
CREDITS: 3-0-0-4
TYPE-WHEN: Humanities, Spring 2018
FACULTY NAME: Nand Kishore Acharya
PRE-REQUISITE: None
OBJECTIVE: The course deals with analysis of concept of Human Rights with its philosophical basis and programme described in various declarations and covenants and the relevance of Human Rights to socioeconomic, political and cultural structures.
COURSE TOPICS:
1. Definition and concept of Human Rights- its philosophical basis:- Religion, Natural Law theory, Utilitarian theory, Reconciliation theory, Theory of Justice, Cultural Relativism versus Universalism.
2. Historical evolution of Human Rights- Universal declaration of Human. Rights- Three generations of Human Rights.
3. Right to life, Civil and Political Rights, Economic Rights, Cultural Rights, Right to Development, Rights of Indigenous people, Rights of Minorities, Rights of Women, Rights of Children, Human Rights and present socio-economic system, Concept of Animal Rights.
REFERENCE BOOKS:
1. Human Rights- V.T Patil
2. Human Rights: Free and Equal- Giriraj Shah & K.N Gupta. ISBN 8126109742
3. Human Rights Encyclopedia- James R Lewis & Carl Skutch (ed.). ISBN 0765680033
4. Human Rights: Concepts and Standard- Janusg Symonides (ed.). ISBN-10: 0754620255
5. Rethinking Human Rights: Challenges for Theory and Action- Smitu Kothari & Harsh Sethi, ISBN-10: 0945257090
6. Rethinking Human Rights for New Millennium- A. Beldem Fields. ISBN-10: 1403960615
7. Human Rights: Theory and Practice- A. Shankar & Giriraj B. Nanda
8. Human Rights: Global Perspectives- Anuradha Kumar. ISBN : 81-7625-322-7
9. Manavadhikar ki Samskriti (Hindi)- Nandkishore Acharya
GRADING:
Mid-term: 40%,
Assignments: 30%,
Term Paper: 30%

OUTCOME:
After completing the course the student would be able to understand the structures which are violating the Human Rights. He/she is likely to appreciate the necessity of developing a society based on Human Rights and work for the same.
REMARKS: Films etc may also be used if possible, to understand the violation and need of Human rights.

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TITLE : ICTs for Development [ICT4D]
Course Code :
CREDITS : 4
TYPE-WHEN : Winter 2018 January to April
FACULTY NAME : Nimmi Rangaswamy
PRE-REQUISITE : UG 3, UG 4

OBJECTIVE :

To introduce the idea of channelling the potential of Information and Communication Technology for socio-economic development to students of Engineering and the Social Sciences
To debate the notion of development as a sociological concept, with a particular focus on India, and discuss and impacts of the development process on society as and a multi-faceted phenomenon
To formulate the idea of social media, as a component of ICTs, and the role they play in shaping the contours of a digital society

COURSE TOPICS/CONTENT/OUTLINE

Information and Communications Technology for Development is a growing area of research and community of scholars studying the role of technology in international development. Students in this course will study contemporary debates, issues and field projects that engage with information and communication technologies [ICTs] in the service of socio-economic progress and human development. This means a range of things: it could refer to the scope of technology in alleviating poverty, in impacting low-resource settings, in designing and engineering relevant technologies to close digital literacy gaps in specific populations.

Topics that will be covered as part of the course are the following. These are broad umbrella categories which contain sub-topics

<u>Introduction to the idea of Development:</u>
Studying development is essentially a multidisciplinary exercise rooted in a range of technical and social-science research. By combining a variety of subject areas, the course will engage deeply with some of the complex problems associated with developing economies especially

unstable infrastructures, scarce resources and social disadvantages. We will discuss A Sen, K Galbraith among others

Globalization and Development

The course will specifically look at globalization as a socio-economic disruptor having far-fetched implications for not only wealth generation for a country but also bringing cultural transformations. We will disuses several historical trajectories of globalization in specific country contexts. We will include works of J Sachs, W Easterly

Technology and Development

The course will introduce a variety of social environments across resource and economic constraints that are targets for socio-economic development either through a top down model of deploying ICTs or through a more market driven and organic social processes. These can range from building low-cost technologies to studying user-driven innovations of ICTs to fit contexts of use. We will cover certain domain areas, using relevant theoretical models and practical outcomes, within ICTs and Development, like, education, healthcare, livelihoods, entertainment and governance. Students will develop a critical lens to evaluate the processes and impacts and gain a well-rounded and practical perspective on issues of assessment and successes of development projects

A second focus of this course will be on digital and new media technologies as products of the digital revolution and as rapidly transforming the 'everyday' life of societies and individuals. As emerging economies globalize and urbanize rapidly, and users in the global south become 'prosumers' or more critical consumers and creative contributors of digital content, we require a shift in approaching new media users with a more open-ended and explorative perspective. Thereby, the motivating question for our course is what are the implications and impacts of new media as leisure (entertainment/pleasure/ play) artifacts and as professional tools for social mobility especially in the contexts of developing economies and emerging markets.

Introducing Information and communication technologies as harbingers of social change

Under this topic we will debate and discuss the nature and contours of new channels of information, social networking the rise of social media and online content generation. Questions posed by these digital artifacts evaluate the inherently democratizing, process of owning, using and networking with new media technologies. With the help of case studies, with a focus on India, we will articulate the implications of new and digital media in everyday life. We will focus on the sociology of new media technologies, with a specific aim to anchor them within select theoretical debates and in specific geographic contexts.

Social Media as a Developmental tool

Research had pointed to the rich field of utilization of new media tools for leisure and social networking as well as the unique affordances they spawn in the arena of self-expression and acquiring socio-digital identities. For example, the pre-pay mobile internet made web surfing an affordable and engaging activity even in the down markets and resource poor social ecologies of urban India. The course will critically evaluate the impacts of media technologies in the

development discourse of a nation. The topic will include case-studies from the global North and South centering on social segments in resource-poor and emerging market settings [for example, 'Twitter in Political campaigns, Facebook use in the urban slum…].

This class has no pre-requisite requirements and open to students from any background.
Students will be continuously evaluated with periodic quizzes/short tests and a course end assignment that will gauge student ability in engaging with and comprehending the course readings and class room discussions.

PREFERRED TEXT BOOKS:

1. J. Timmons Roberts and Amy Bellone Hite, Eds. The Globalization and Development Reader: Perspectives on Development and Global Change, Blackwell: London, 200

*REFERENCE BOOKS:

1. Amartya Sen, Development as Freedom, Anchor Books: New York, 1999
2. C K Prahalad, The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits, Revised and Updated 5th Anniversary Edition, Prentice Hall, New Jersey
3. Jeffrey Sachs, The End of Poverty: Economic Possibilities for Our Time, Penguin Books: New York, 2006
4. Friedman, Thomas L. 2006. The World Is Flat: A Brief History of the Twenty-first Century, Farrar, Straus and Giroux
5. Easterly, W. 2002. "The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics. MIT Press
6. Turkle, S. (1984) The second self. New York: Simon & Schuster.
7. Mizuko Ito, Daisuke Okabe, and Misa Matsuda, eds., 2005, Personal, Portable, Pedestrian: Mobile Phones in Japanese Life(Cambridge, MA: MIT Pres
8. Turkle, S. (1995). Life on the screen: Identity in the age of the Internet. New York: Simon & Schuster.
9. Castells, Manuel (2001): Internet Galaxy. Oxford University Press
10. Lessig, Lawrence. 2009. "RE, Revived" i Remix: Making Art and Commerce Thrive in the Hybrid Economy. The Penguin Press, New York
11. Lister et. al. (2008): New Media A Critical Introduction. London and New York, Routledge.

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	
Mid Sem-2 Exam	
End Sem Exam	**25%**
Assignments	**25%**
Project	
Term Paper (In Lieu of Mid Sem-1)	**25%**
Other Evaluation (Term Paper and Presentation)	**25%**

OUTCOME:

Students will be able to identify and apply a developmental lens in a variety of and diverse socio-economic contexts. The course will provide a strong grounding in developing a sociological perspective of digital media and their impact in the evolution of a digital society as a part of parcel of socio-economic development. One of the critical question the course will attempt to unpack is how technology seeks to address the needs and aspirations of people who are increasingly consuming technologies and services despite living in low resourced eco systems.

REMARKS:

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TITLE : MATHEMATICAL METHODS

Course Code : IMA307

CREDITS : 4

TYPE-WHEN : Spring 2018

FACULTY NAME : Subhadip Mitra

PRE-REQUISITES : Mathematics 2 & 3

OBJECTIVE : To cover some essential mathematical ideas and tools used in different branches of science and technology.

DESCRIPTION : The course will build on some basic ideas introduced in Mathematics 2 & 3 (linear algebra, group theory and complex analysis). The starting point will be the complex linear vector space. We will connect it to domains that, apparently, have very little in common (like physical vectors and functions). We will extend our ideas to vector fields, their calculus and tensors to investigate multidimensional problems. Some special applications like Fourier Transforms will also be covered. Finally, we shall consider some continuous group theory and discuss some Lie groups (like the Rotation groups SO(2) or SO(3) etc).

COURSE TOPICS :

Linear vector space: Dirac notation and n-dim spaces, from vectors to matrices, their basic properties,

- products, determinants, orthogonal/hermitian/unitary matrices, diagonalization etc. Calculus of vector
- & tensor fields: gradient/divergence/curl, line/surface/volume integrals, Gauss's theorem, Stokes theorem, Dirac delta function, curvilinear coordinates, definition of tensors, properties: symmetric/anti-symmetric tensors, Kronecker delta/Levi-civita, non-Cartetian tensors: metric, Christoffel Symbols, covariant derivatives, geodesics, parallel transport. Special topics: special functions like Legendre functions, Fourier transformations etc.
- Group theory/symmetries: representations, Lie algebra, rotational/Lorentz symmetries, Unitary
- group, Special Unitary group, angular momentum

PREFERRED TEXT BOOKS:

1. Mathematical Methods for Physicists - Arfken and Weber
2. Advanced Engineering Mathematics - Erwin, Kreyszig

***REFERENCE BOOKS:**

1. Will add later depending on the progress

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	20
Mid Sem-2 Exam	20
End Sem Exam	40
Assignments + Quizzes	20

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TITLE : Modeling and Simulations
CREDITS : 3-0-1-4
TYPE-WHEN : Bouquet core & Open elective, Spring 2018
FACULTY NAME : Deva PriyaKumar
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:
1 Basic Maths: coordinate systems, vector algebra, differential equations, matrices, Taylor expansion (1 lecture)
2 Molecular Mechanics: Molecular force fields, energy minimization (2 lectures)
(3) Molecular Dynamics: Equations of motion, phase space distribution functions, sampling, integrators, boundary conditions, electrostatics, molecular constraints (5 lectures)
(4) Free energy calculations: Umbrella sampling, thermodynamic integration, replica exchange method (2 lectures)
(5) Monte Carlo methods: Pi-value computation, important sampling, Metropolis algorithm, applications (1 lecture)
(6) Non-equilibrium molecular dynamics: Jarzynski equality, steered molecular dynamics, shear flow (2 lectures)
(7) solvent models: Implicit models, explicit models (1 lectures)
(8) Quantum Chemistry: Operators, wavefunctions, postulates, probability density, time-dependent Schrodinger equation (2 lectures)
(9) Translational, rotational, vibrational dynamics of simple quantum systems, hydrogen atom (3 lectures)
(10)Molecular quantum mechanics: Born-Oppenheimer approximation, LCAO, Variation theorem, perturbation theory, Huckel theory, HF, semi-empirical methods, electron correlation, CI (4 lectures)
(11)DFT (1 lecture)
(12) Force field parameterization using quantum mechanical methods (1 lecture)
(13) Students presentations (3 lectures)
PREFERRED TEXT BOOKS:
***REFERENCE BOOKS:**
1. Computer Simulation of Liquids, by M.P. Allen and D.J. Tildesley
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 : Music, Mind, & Technology
Course Code :

CREDITS : 4
TYPE-WHEN : Winter Semester (Jan-May)
FACULTY NAME : Dr. Vinoo Alluri

PRE-REQUISITES : None (Interest in Music, Open mind, Enthusiasm and Motivation! No dislike for DSP helps! Basic MATLAB programming)

DESCRIPTION:

The objective of the course is to give an appreciation of the main concepts of the field of Music Cognition and Technology. You will learn about topics in music psychology (from perception to cognition), familiarize yourselves with music signal analysis and music information retrieval (MIR), ending with the interdisciplinary field of cognitive neurosciences of music (with a focus on functional magnetic resonance imaging (fMRI) studies).

Apart from this, the course provides an overview of main areas of contemporary research of music perception and cognition such as musical preferences and personality, music and movement, music and emotion, music and mental well-being, and music processing in the brain.

As part of the course requirements, students are required to do two mini-projects (one major and and minor), one that requires conducting experiments on human subjects to study any one of the topics covered in the class, and another that encourages them to conceive and design solutions to problems using signal processing and pattern classification (focusing on the field of MIR). MIR-related work will be primarily carried out in MATLAB. Interest in Signal processing certainly helps!

The students can decide which mini-project they would like to focus more on (the cognitive aspect or technical aspect (MIR)) and that would be their main mini-project. Hence, the minor mini-project should encompass the other aspect (ex: MIR project as major, and Cognitive project as minor or vice-versa).

COURSE TOPICS:

Music Psychology: Introduction, Origins and functions of music, effect of music listening and training on cognitive skills, music in everyday life, Music and Movement, Music and Personality and Preferences.

Psychoacoustics of Music a.k.a Music Perception: Auditory system, pitch, timbre, rhythm, dissonance, segmentation

Music Information Retrieval: Audio/Musical Signal analysis (with a focus on the MIRToolbox), Digital Filters in Musical Signal Processing, Acoustic Feature Extraction, Similarity and Classification

Music Cognition and Neuroscience:

Musical moods and emotions, Music and mental well-being, Music processing in the brain.

REFERENCE BOOKS:

(PDF copies of material from the following will be made available for reading)

- Cook, P. (Ed.) (1999). Music, cognition, and computerized sound. MIT Press: Cambridge, MA. (Chs. 1, 2, 6, 7, 8, 10, 13, 14, 17)

- W. F. Thompson (2009). Music, thought, and feeling. Understanding the psychology of music. OUP: New York.
- P. N Juslin & J. A. Sloboda (Eds.) (2001), Music and Emotion: Theory and Research. New York: Oxford University Press
- S. Hallam, I. Cross, M. Thaut (2017), The Oxford Handbook of Music Psychology (2 ed.) 10.1093/oxfordhb/9780198722946.001.0001

***REFERENCE CONFERENCES AND JOURNALS:**
Relevant conference proceedings and journal articles will be suggested per lecture.

- Proceedings of following Conferences: **ICMPC, ESCOM, & ISMIR**
- Journals: Music Perception, Psychology of Music, Journal of New Music Research, Psychomusicology, Mind and Brain.

***MINI-PROJECTS:**
Mini-Project 1: Students will be assigned projects where small groups have to take up one topic from the course topics. The group will design and conduct experiments on human subjects and then process / analyze and interpret the data collected from the experiments. Performance assessment will be based on Group presentation, Viva and a Final report submission.
Mini-Project 2: Students will, in small groups, conceive and design solutions to problems in the field of MIR. Performance assessment will be based on Final Presentation / Report, along with meeting intermediate deadlines.

GRADING (indicative only):
Mid-term Exam (1): 20%
Final Exam: N/A
Mini-Project 1 (major): 40%
Mini-Project 2 (minor): 25%
Quizzes/ Assignments/ Class Attendance and Participation: 15%

OUTCOME:
At the end of the course, students will have an appreciation for the interdisciplinary field of Music Perception & Cognition and MIR. It is expected that students would acquire both the knowledge of the state-of-the-art in the same and also practical experience and appreciation of how empirical studies are conducted to investigate human behavior in relation to music. One of the purposes of the mini-projects is to provide means for the students to address a research question in the broader framework of music research with the hope of eventually leading to a conference submission or subsequent journal article. Furthermore, this course would enable the students to carve out a long-term interdisciplinary research / development project in fields such as Cognitive Science, Signal and Speech processing, Computer Vision and Music Information Retrieval.
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TITLE : NGS Data Analysis
Course Code : SCI653

CREDITS : 4
TYPE-WHEN : SPRING
FACULTY NAME : Dr. Nita Parekh (coordinator), Guest Lectures by Dr. Shrish Tiwari (CCMB), Dr. Shanta Pendkar (Senior Research Staff); Labs by NP (planning) and SP along with D. Prashanthi (Phd student)
PRE-REQUISITE :
OBJECTIVE :
The course will provide a comprehensive genome analysis using next generation sequencing data, both at the whole-genome level (WGS) and transcriptome-level (RNAseq). A major component of the course will be hands-on-sessions, wherein various available resources will be used to carry out the analysis on real genome data to address biological problems. The course structure will be one theory lecture followed by one lab session. The course also has a project component wherein the students will carry an end-to-end genome analysis using NGS for a biological problem.

COURSE TOPICS:
Theory lecture – TL, Hands-on-lecture (Lab) - HL

1. Introduction – 3 TL
   - Importance of genome analysis
   - Workflow of NGS data analysis
   - Types of reads - single-end, paired-end, mate-pairs
   - Applications of genomics - RNA-Seq, *De novo* sequencing, non-coding RNA sequencing, metagenomics by NGS, etc.
   - Sequencing technologies - read lengths, accuracy, biases introduced, etc.

2. Introduction to some basic Unix/Linux/R commands – 1 HL
   - NGS Data Formats - FASTA, FASTQ, SFF, VCF, SAM/BAM, etc.
   - Parsing NGS Files (Accessing, Querying, Comparing, etc.)

3. Algorithms in Short Read Alignments - 2 TL, 1 HL
   - Alignment of short reads
   - Alignment based assembly
   - *De novo* assembly

4. Tools for alignment based assembly - 2TL, 2HL
   - Bowtie (genome)
   - BWA (genome)
   - TopHat (transcriptome)

5. Downstream analysis of alignment based assembly - 3TL, 3HL
   - Methods for identification of variants (genome-level)

        - Data-preprocessing, Data pretreatment, Data analysis for Single nucleotide variations (SNVs), Structural variations (SVs) - CNVs, indels, inversions and translocations
    - Visualisation and Annotation of variants
    - Differential gene expression analysis (CuffDiff) – (transcriptome-level)

6. Tools for *de novo* assembly - 1TL, 2HL
    - Velvet (genome)
    - Soapdenovo (genome)
    - Cufflinks (transcriptome)

7. Downstream analysis of *de novo* assembly - 1TL, 1HL
    - Genome annotation
    - Enrichment analysis – resources

8. Small RNA analysis – 1TL, 1HL

9. Project presentations – 2 classes

PREFERRED TEXT BOOKS:
Research Papers (to be uploaded on course website)
https://en.wikibooks.org/wiki/Next_Generation_Sequencing_(NGS)

GRADING:
Mid semester exam 1 - NA
Mid semester exam 2 - 30%
Project/Assignments - 30%
End semester exam - 40%

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TITLE : NLP Applications
CREDITS : 3-0-1-4
TYPE-WHEN : Spring 2018
FACULTY NAME : Manish Shrivastava
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, co reference 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 : Optimization Methods
Course Code: CSE481
CREDITS : 3-1-0-4
TYPE-WHEN : Spring, 4XXX level
FACULTY NAME : Sujit Gujar
PRE-REQUISITE : Strict Prerequisites: NIL
Expected Background: To follow this course, some level of familiarity with linear algebra (specially, vectors and matrices) is expected. In addition, student is expected to know the fundamentals of algorithms and some of the popular problems (eg. shortest path.)
OBJECTIVE: 1.To enable students to formulate and solve problems in an optimization framework.
2. To expose a set of powerful tools and techniques to the students. To demonstrate how these tools (i.e., optimization methods) can be used in practice.
3. To visualize the optimization algorithms and know the numerical and practical issues in their implementation.
4. To relate the optimization methods to applications in diverse areas.
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
3. S. Boyd and L Vandenberghe, ``Convex Optimization'', Cambridge University Press (Online Copy available at: http://www.stanford.edu/~boyd/cvxbook/)
4. L Vandenberghe, Lecture Notes for Applied Numerical Computing, (Online available at: http://www.ee.ucla.edu/~vandenbe/103/reader.pdf)
5. D Bertisimas and J N Tsitsiklis, ``Introduction to Linear Optimization'', Athena Scientific
6. J Matousek and B. Gartner, ``Understanding and Using Linear Programming'', Springer, 2007
GRADING: Evaluation will be more or less as follows:
Mid Semester Exams (2) - 30
Final Exam - 25
Quizes - 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.

TITLE : Organic Chemistry
Course Code : SCI346
CREDITS : 4
TYPE-WHEN : Core for CND /Open elective for others

Spring-2K16

FACULTY NAME : Abhijit Mitra

PRE-REQUISITE : ABA or GSC
OBJECTIVE : Understand principles of organic chemistry

COURSE TOPICS :

Concepts on structures, stabilities and reactivities

1. Reactive intermediates: Formation, structure, stability and fate of various reactive intermediates (Carbanion, carbocation, carbenes, nitrenes, benzynes, free radicals) - Reactive intermediates in biology and environment
2. Concepts of aromaticity
3. Molecular symmetry and chirality, Stereoisomerism, Classification of stereoisomerism, configuration, chiral centre, Axial chirality, planar chirality, helicity, Racemization and methods of optical resolution, Determination of configuration, Conformation of acyclic and monocyclic molecules-conformation and reactivity, Prochirality and prostereoisomerism, Stereochemistry of alkene, Chirality in molecules devoid of chiral centers, Chirooptical properties.

Some reactions and their mechanisms

4. Methods for determining structures and reaction mechanisms
5. Types of reactions and their mechanisms
    - Radical substitution
    - Electrophilic addition to alkenes and alkynes – stereochemical considerations – Markonikov rule
    - Nucleophilic Substitution at saturated carbons (SN1, SN2 and SNi): Types, stereochemical considerations, Role of solvent
    - Nucleophilic addition to the Carbonyl group
    - Elimination reactions: Types (E1, E2 and E1cB) - stereochemical consideration, Role of solvent-Hofmann rules- Zaytsev Rules
    - Nucleophilic substitution at the carbonyl group
    - Electrophilic Aromatic Substitution: Benzene and its reaction with electrophiles- Effect of functional groups
    - Nucleophilic Aromatic substitution: Diazonium compounds-benzyne mechanism
    - Pericyclic reactions: Electrocyclic reactions, Cycloadditions, Sigmatropic rearrangements and Group transfer reactions
    - Important name reactions involving rearrangements

Functional group wise reactions

Conversions and Identifications

PREFERRED TEXT BOOKS:

1. Michael B Smith, MARCH'S ADVANCED ORGANIC CHEMISTRY REACTIONS, MECHANISMS, AND STRUCTURE (7th Edition) Wiley (2013)

OR

M. B. Smith, J. March, Advanced Organic Chemistry: Reactions, Mechanisms and Structures, 6th Edition, Wiley Interscience, (2007)

2. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Prentice Hall, (1992)

***REFERENCE BOOKS:**

1. J. Clayden, N. Greeves, S. Warren, P. Wothers, Organic Chemistry, Oxford University Press, (2000)
2. P. Sykes, A Guidebook to Mechanism in Organic Chemistry, Addison-Wesley, (1996)
3. F. A. Carey, R. J. Sundberg Advnaced Organic Chemistry, 5th editon, Springer (2007)
4. E. L. Elilel, S. H. Wilen, L. N. Mander, Stereochemistry of Organic compounds (Wiley)
***PROJECT: NA**

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	**15**
Mid Sem-2 Exam	**15**
End Sem Exam	**30**
Assignments	**20**
Project	**NA**
Term Paper	**10**
Other Evaluation __Quiz_____	**10**

OUTCOME:

REMARKS:

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TITLE : Principles of Information Security
CREDITS : 3-1-04
TYPE-WHEN : Spring
FACULTY NAME : Kannan Srinathan
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:
Y. Lindell and J. Katz. Introduction to Modern Cryptography. MIT press.
REFERENCE BOOKS:
(a) Oded Goldreich. Foundations of Modern cryptography: Parts I and II. Cambridge Press. 2001.
(b) A. Menezes, P.C. van Oorschot and S.A. Vanstone. Handbook of Applied Cryptography, CRC Press, 1996.
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.

TITLE : Statistical Methods in AI
CREDITS : 3-1-0-4
Course Code : CSE471
TYPE-WHEN : Spring 2018
FACULTY NAME : **Naresh Manwani**
COURSE TOPICS : Introduction, Linear Discriminant Functions, Perceptron Learning, Minimum Squared Error Procedures, Linear Classifiers: Class Test, Neural Networks: Nonlinearity, Neural Networks: Backpropagation, Improving NN Training, Random Variable, Probability Densities, Multivariate Densities, Bayesian Decision Theory, Maximum Likelihood Estimation (MLE), Principal Component Analysis (PCA), Eigen Faces, Linear Discriminant Analysis & Fischer Faces, Max-Margin Classification (SVM), SVM variants, Kernalization, Data Clustering, Kmeans (EM) and variants, Spectral Clustering, Decision Trees, Graphical Models, Combining Classifiers.
PREFERRED TEXT BOOKS: “Pattern Classification” by Duda, Hart & Stork
*REFERENCE BOOKS: “Machine Learning - A Probabilistic Perspective” by Kevin Murphy (free ebook available online),
Other Material: Online Courses/Tutorials and Research Papers
Pre-requisite : Basics of Linear Algebra, Probability Theory and Statistics.
Programming in Matlab and C/C++.
Course Website : http://courses.iiit.ac.in
GRADING: 27% Project + 18% Assignments + 30% Midsem + 25% Final Exam
OUTCOME: This course will enable students to understand pattern recognition techniques namely, classification and clustering in detail including both theoretical and practical aspects.

TITLE: SIGNAL DETECTION AND ESTIMATION THEORY
Course Code: ECE431
Credits: (3-0-0-4)
Prerequisites: ECE 230 AND ECE 335 OR INSTRUCTOR’S CONSENT
Faculty: Sachin Chaudhari
TOPIC OUTLINE (APPROX):
1. Introduction to Decision making under uncertainty, Minimax, Bayesian, Maximum likelihood approaches.
2. Clasical Binary Hypothesis testing, LRTs, suficient statistic, Detection Performance, Neyman- Pearson approach, Uniformly Most Powerful tests, Generalized LRT.
3. M-ary Hypothesis Testing, Performance
4. General Gausian Detection problems, Performance Bounds
5. Parameter estimation: MSE, MAP, MLE; Cramer-Rao Performance bounds
6. Karhunen-Loeve representation of Random signals
7. Detection of Known signals in additive white Gausian noise, Optimum receivers, Performance.
8. Detection of Known signals in additive colored Gausian noise, Optimum receivers, Performance, Signal design considerations.
9. Estimation of signals with unknown parameters in additive white gausian noise, estimation error performance
10. Detection of Signals with unwanted parameters, Performance
1. Estimation of continuous waveforms in modulation systems with/without memory
12. Linear estimation: Wiener Filtering, Prediction and smoothing
13. Kalman-Bucy Filtering, Prediction and smoothing
TEXTS AND REFERENCE BOOKS:
1. H.L.Vantrees : Detection, Estimation and Modulation Theory, Part I, Wiley, 1968
2. Srinath, M.D, Rajasekaran, P.K, Viswanathan, R : Introduction to Statistical Signal Processing with Applications, Prentice-Hal, 1999
3. Sage, A.P and Melsa, J.L : Estimation Theory with Applications to Communications and Control, McGraw-Hil, 1971
4. McGarty, T.P : Stochastic Systems and State Estimation, Wiley, 1971
5. Mood, A.N, Graybil, F.A, and Boes, D.C : Introduction to the Theory of Statistics, McGraw-Hil, 1974
Examination:
First Mid-Semester (20), Second Mid-Semester (20), Term-Paper (20), End-Semester (40)

* FORMER COURSE NUMBER: ET4105

TITLE : Speech Systems
Credits : 3-1-0-4
Faculty : Suryakant VG
Semester :Spring 2018
Type-When : Elective - offered anytime on need basis - for Year 3/4 and PG students
Pre-Requisite : Speech Signal Processing
OBJECTIVE: This is an advance (Level 2) course which deals with algorithms and models for processing, recognition, synthesizing, enhancement of speech signals. The objective is to provide rigorous theoretical background and hands on experience to the students in implementing basic and advanced algorithms in speech signal processing, speech recognition and speech synthesis.
COURSE TOPICS:
W1: Review of Speech Signal Processing
W2-W3: Representation of Speech (Feature extraction)
W4-W5: Modeling techniques for speech systems
W6-W8: Speech Recognition
- Limited domain (Word recognition, Dynamic time warping)
- Large vocabulary (Continuous speech recognition, Hidden Markov Models, Sphinx)
W09-W10: Models for Speech Synthesis
- Concatenative synthesis (data driven, Festival)
- Parametric synthesis (HTS)
W11-W12: Speaker Recognition
- Text dependent (DTW based, VQ based)
- Text independent (GMM based, Neural network based)
W13-W14: Speech Enhancement
- Spectral subtraction
- Harmonic noise decomposition
- Enhancement by processing high SNR regions
TEXTBOOK: (1) Spoken Language Processing: A Guide to Theory, Algorithm and System Development by Xuedong Huang, Alex Acero, Hsiao-Wuen Hon, Prentice-Hall.
(2) Fundamentals of Speech Recognition (Prentics Hall Signal processing Series) (Paperback) by Lawrence Rabiner and Biing-Hwang Juang)
(3) Documentation associated with Sphinx/HTK and Festival
(4) Relevant papers/materials will be provided
GRADING:
First Mid-Semester Examination:: 15%
Second Mid-Semester Examination:: 15%
End Mid-Semester Examination:: 30%
Assignments: 20%
FINAL PROJECT: 20%Assignments:
1. Feature extraction (W3)
2. Modeling techniques (W5)
3. Speech Recognition (W8)
4. Speech Synthesis (W10)
5. Speaker Recognition (W12)
6. Speech Enhancement (W13)
FINAL PROJECT: During the last four weeks of the course the students are required to take up a project related to one of the two topics (1) Models for Speech Recognition, (2) Models for Speech Synthesis,
OUTCOME: Upon the completion of this course, the student would gain not only theoretical knowledge about processing of speech but also understand the implementation issues in speech signal processing, speech recognition and speech synthesis.

TITLE : Internals of Application Servers
Course Code: CSE563
CREDITS : 3-1-0-4
TYPE-WHEN : Spring 2018
FACULTY NAME : Dr. Ramesh Loganathan
PRE-REQUISITE:
OBJECTIVE :
COURSE TOPICS: Understand essence of middlewares and distributed object technology. J2EE Technology and Architecture overview. J2EE App Server architecture. Lifecycle of a J2Eapplication-deployment thru running and unemployment. Web Container internals. EJB Container internals. Essentials of Clustering architecture, Project problems Discussions
PREFERRED TEXT BOOKS: *REFERENCE BOOKS: *PROJECT:
GRADING:
OUTCOME:
REMARKS:

TITLE : INTRODUCTION TO SYSTEMS BIOLOGY

Course Code :
CREDITS : 4
TYPE-WHEN : SPRING
FACULTY NAME : Dr. Vinod P.K.
PRE-REQUISITE : Advanced Biology
OBJECTIVE :

This course provides an overview of systems biology approaches and tools, and will enable students to integrate concepts from multiple disciplines and understand how advances in biochemistry, cell and molecular biology, genomics, proteomics, computation, and bioinformatics support novel insights into biological complexity.

COURSE TOPICS:

Introduction

o Systems-level thinking
o Bottom-Up and Top-Down Approaches for Complex Systems
o Overview of Cell and Systems physiology
o Types of networks

Mathematical modeling of biological systems

o Input/output relationships
o Enzyme Kinetics
o Design principles of biological systems
o Deterministic and stochastic modelling
o Parameter estimation and sensitivity analysis
o Spatial modeling
o Modeling signaling pathways
o Biological Switches and Clocks
o Metabolic networks and flux balance analysis
o Neuronal Dynamics- from single neurons to network (Dr. Dipanjan Roy)
o Advantages and limitations of various modelling techniques
o Simulations of Cell biological Systems

o Modelling standards and Tools

Network Biology

o Graph theoretic description of network(Dr. Dipanjan Roy)
o Motifs, modules and hierarchical networks
o Network Robustness
o Network inference and visualization
o Introduction to high throughput data analysis

Applications of Systems biology

o Systems Biotechnology
o Systems and Synthetic Biology
o Systems Analysis of Complex Diseases (Biomedicine)
o Systems Pharmacology: Understanding Drug Action from a Systems Perspective

PREFERRED TEXT BOOKS:

1. **Systems Biology: A Textbook answers to problems** By Edda Klipp, Wolfram Liebermeister, Christoph Wierling, Axel Kowald, Hans Lehrach, Ralf Herwig, Wiley-VCH
2. **Systems Biology: Properties of Reconstructed Networks** By Bernhard O.Palsson Cambridge University Press
3. **An Introduction to Systems Biology: Design Principles of Biological Circuits** by Uri Alon , Chapman & Hall

GRADING:

Mid semester exam 1 – 20%
Mid semester exam 2 – 20%
End semester exam – 40%
Project/Assignments – 20%

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TITLE : Introduction to Parallel Scientific Computing
Course Code :
CREDITS : 3-1-3-4
TYPE-WHEN : Spring
FACULTY NAME : P. Kumar

PRE-REQUISITE : Calculus, Linear Algebra, and Computer Programming.
OBJECTIVE : Learn Basic Ideas of Scientific Computing on Modern Day Architectures.

COURSE TOPICS :
(please list the order in which they will be covered)

1. Basic Matrix Computations: Floating Point Arithmetic, Sensitivity Analysis and Condition Numbers; Sparse Data Structures; LU Decomposition, CG, GMRES; Orthogonal Decompositions; Least Squares; Eigenvalue Problems.

2. Introduction to Parallel Computing: Distributed (MPI, GPI) and Shared Memory (Open MP, Cilk++, pthreads, Intel TBB).

3. Parallel Matrix Computations: Some Case Studies with Parallel LU, Parallel Least Squares, Parallel CG and GMRES, and Parallel Eigenvalue Problems.

4. Some Model Equations and their Significance: Laplace, Diffusion, Convection-Diffusion, Navier-Stokes, etc.

5. Discrete Representation of Continuous Models: Finite Difference and Finite Elements for Simple Models such as Poisson and Diffusion Models.

6. Graph/Mesh Partitioning: Basic Ideas of Parallel Mesh Partitioning. AMR.

7. Parallel Iterative Solution of PDE: Basic Ideas of Algebraic Domain Decomposition, and Parallel Algebraic Multi-grid Methods.

8. Full Parallel Simulation for Simple Model Problems.

PREFERRED TEXT BOOKS: Any book or other materials the student is comfortable studying from.

***REFERENCE BOOKS:**

- **Anthony Williams, C++: concurrency in action.**
- **M. Snir et. al., MPI Complete Reference, http://www.netlib.org/utk/papers/mpi-book/node1.html**
- **L. N. Trefethen and D. Bau, Numerical Linear Algebra, SIAM, 1997.**
- **D. Braess, Finite Elements: Theory, Fast Solvers, and Applications in Solid Mechanics.**
- **O. Widlund et. al., Domain Decomposition Methods.**

***PROJECT:**

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	**20**
Mid Sem-2 Exam	**20**
End Sem Exam	**40**
Assignments	**20**
Project	

Term Paper	
Other Evaluation _____	

OUTCOME:

REMARKS:

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TITLE : Computational Linguistics 2
CREDITS : 3-0-0-4
TYPE-WHEN : Spring 2018
FACULTY NAME : 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:
SEMANTICS
-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 implicative, conventional implicative 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:
Alan Cruse (2004). Meaning in Language.
John Lyons (1995). Linguistic Semantics.
Cruse Alan (2004). Meaning in Language: An Introduction to Semantics and Pragmatics. Part 2 and Part 4.
Levinson, Stephen C. (1983). Pragmatics.
Brown, G and Yule, G. (1983). Discourse Analysis.
Cutting Joan (2002). Pragmatics and Discourse: A resource book for students.
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.

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TITLE **: Introduction to Nanobiotechnology**
CREDITS **:** 4 credits
TYPE-WHEN **:** Spring 2018
Elective (for **CND**, other **B.Tech.** programsand **M. Tech.**Bioinfo.)
FACULTY NAME **:** Tapan K. Sau

PRE-REQUISITE **:** None

OBJECTIVE **:** To introduce the students to the topics of Nanobiotechnology.
..To understand the essential features of emerging converging areas of nanotechnology, biology and nanomedicine.

COURSE TOPICS :

1. Nanobiotechnology Overview: Nanotechnology and Nanobiotechnology

2. Natural Biological Assembly at the Nano-Scale:

The Process of Self-Assembly and Self-Organization in Biology, Organization of Bacterial S-Layers, Self-Organization of Viruses, Self-Organization of Phospholipids Membranes, Fibrillar Cytoskeleton Assemblies, Amyloid Fibrils as Self-Assembled Nano-Scale Bio-Assemblies, Silk: Natural Fibrillar Supramolecular Protein Assembly, Ribosome: The Protein Assembly Line Instrument, Protein Quality-Control Machinery: The Proteosome, Biological Nano-Motors: Kinesin and Dynein, Other Nano-Motors: Flagella and Cilia, Ion Channels: Nano-Pores of High Specificity.

3. Bio-Inspired Nano-Materials:

Nucleic Acids: Template for Nanotechnological Applications, Formation of DNA-Based Materials, Peptide-Based Nanomaterials, The First Peptide Nanotubes, Amphiphile and Surfactant-Like Peptide Building-Blocks, Charge Complementary as a Driven Force for Self-Assembly, Conjugation of Peptides for Self-Assembly, Aromatic Interactions for the Formation of Nanostructures, The Formation of Aromatic Dipeptide Nanotubes (ADNT) The Formation of Spherical Nanostructures by Short Peptides, Peptide Nucleic Acid (PNA).

4. Inorganic Nanosystems in Biological Applications:

Quantum dots, plasmonic particles, magnetic nanoparticles, carbon nanoparticles.

5. Nanoprobes:

Optical Tools, Nanoforce and Imaging, Surface Methods, Mass Spectrometry, Electrical Characterisation.

6. Nanomedicine, Nanopharmaceuticals and Nanosensing:

Nanomedicine, Nano-Sized Carriers for Drug Delivery, Gene and Drug Delivery System with Soluble Inorganic Carriers, Molecules, Cells, Materials, and Systems Design Based on NanoBiotechnology for Use in Bioanalytical Technology.

7. Bionanoelectronics and Nanocomputing:

DNA-Based Nanoelectronics, Photoinduced Electron Transport in DNA: Toward Electronic Devices Based on DNA Architecture, Optimizing Photoactive Proteins for Optoelectronic Environments, Electrical Manipulation of DNA on Metal Surfaces, Nanocomputing, DNA and Protein Microarrays, Lab on a Chip.

PREFERRED TEXT BOOKS:

1. BioNanotechnology, by Elisabeth S. Papazoglou and AravindParthasarathy, Morgan & Claypool Publishers, 2007.
2. Bionanotechnology, by David S. Goodsell, John Wiley & Sons, Inc., 2004.
3. Plenty of Room for Biology at the Bottom: An Introduction to Bionanotechnology, by Ehud Gazit, Imperial College Press, 2007.
4. Nanobiotechnology&Nanobiosciences, by Claudio Nicolini, Pan Stanford Publishing Pte. Ltd., 2009.

5. Nanoscience:Nanobiotechnology and Nanobiology, by P. Boisseau, P. Houdy, M. Lahmani (Eds.), Springer, 2007.

REFERENCE BOOKS:

1. Nanobiotechnology: Bioinspired Devicesand Materials of the Future,by OdedShoseyov and Ilan Levy (Eds.), Humana Press Inc., 2008
2.Biological Nanostructuresand Applications ofNanostructures in BiologyElectrical, Mechanical, andOptical Properties, by Michael A. Stroscio and Mitra Dutta (Eds.), Springer, 2004.
3. TheNanobiotechnologyHandbook, by YubingXie (Ed.), CRC Press, 2013.

GRADING: 20% Assignments/Quizzes+ 80% Term Exams
REMARKS: None

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TITLE : Introduction to Robotics: Mechanics & Control
Credits : 3-1-0-4
FACULTY NAME : Abhishek Sarkar
Requisite : A course in linear control systems and the like
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)
Text Book: "Introduction to Robotics: Mechanics and Control," by John J. Craig, 3rd edition, Pearson Prentice-Hall, 2005. (Several copies Available in the Library)
Additional References: —Robotics : Fundamental Concepts and Analysis,‖ by Ashitava Ghosal ,Oxford University Press.(Available in the Library)
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%

TITLE : **Information Security Audit and Assurance**
Course Code: CS5476
CREDITS : 3-0-0-4
TYPE-WHEN : Spring 2018

FACULTY NAME : Shatrunjay Rawat
PRE-REQUISITE : Basic understanding of Computer Networks and Operating Systems
OBJECTIVE : To learn how to evaluate and enhance information security of IT infrastructure and organizations
COURSE TOPICS :
(1) Introduction to Information Security
(2) Security weaknesses in various networking protocols – IP, TCP, UDP, SMTP, RIP, OSPF, etc.
(3) Network Security Products – Firewall, IDS/IPS, VPN Devices, Content Screening Gateways, etc.
(4) Physical Security – Access Control Systems, Video Surveillance, etc.
(5) Security Features of Operating Systems
(6) PKI
(7) Security Standards – ISO 27001, Indian IT Act, IPR Laws
(8) Security Audit procedures
(9) Developing Security Policies
(10)Disaster Recovery, Disaster Management
(11)Business Continuity Management
(12) Security considerations while developing software
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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TITLE : Science Lab II
CREDITS : 4
TYPE-WHEN : Spring 2017
FACULTY NAME : Tapan Kumar Sau + B. Prabhakar
PRE-REQUISITE:
OBJECTIVE : Main objective of this laboratory course is to understand the concepts of select science topics through lab sessions.
List of proposed experiments:
UV-Vis Absorption Spectroscopy
FT-IR Spectrscopy
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.

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TITLE : Remote Sensing
Course Code: CEG461
CREDITS : 3-1-0-4
TYPE-WHEN : Open Elective, Spring2018
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 subsurface
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.

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TITLE : PHOTONICS
CREDITS : 3-1-0-4
TYPE-WHEN : Elective Course , Spring 2018
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 andParaxial 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 planarmirror 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)
PREFERRED TEXT BOOKS: B. E. A. Saleh and M. C. Teich, ―Fundamentals of Photonics‖, 2nd Edition,Wiley; C. Pollock and M. Lipson, ―Integrated Photonics‖, Kluwer Academics Publishers; L. Coldren and S. W. Corzine, ―Diode Lasers and Photonic Integrated Circuits‖, Wiley
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 : Readings from Hindi Literature
Course Code: LAN318
CREDITS : 4
FACULTY NAME : Harjinder Singh
PRE-REQUISITE :

OBJECTIVE : This course will expose the students to selected works from modern Hindi literature along with elements of literary criticism and contemporary debates.

Course Topics:
Poetry: Ajnyeya, Muktibodh, Nagarjun, Shamsher Bahadur Singh, Raghuveer Sahay, Faiz Ahmed Faiz, Nand Kishore Acharya, Sarveshwar Dayal Saksena, Manglesh Dabral, Vinod Kr Shukla, Kumar Vikal, Gagan Gill, Katyayani, Anamika, etc.

Ghazals, Geets, will also be discussed.

Fiction: Saadat Hasan Manto, Nirmal Varma, Bhishm Sahani, Manto, Gyanranjan, Kamaleshwar, Uday Prakash, Ismat Chugtai, etc.

Play: Mohan Rakesh (Aadhe-adhoore)

Non-fiction and criticism: (i) Pleasure readings; (ii) aesthetics versus committed literature; (iii) Sociology of literature; (iv) elements of lit crit developed in the west – Derrida, Goldman; (v) Namvar Singh, Manager Pandey

For comparative exercise, works from other languages, will also be used occasionally. Films based on literature may be shown and discussed.

PREFERRED and reference BOOKS: Works of writers available in IIIT library. Additional handouts may be given. Material available from Kavitakosh.org and hindisamay.com and other sites may be used.

***PROJECT:** Every student will have to write a project report on a writer or text of his/her choice.

GRADING (tentative): Two Mid Sem and Final exams 75% (2X20+35)

assignments 10%

term paper & project: 15%

(other options for grading will be allowed and fixed before the end of Jan 2017)

OUTCOME: Greater interest and appreciation of literature in general and a reasonable amount of knowledge of contemporary writing in Hindi.

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TITLE : Linear Algebra
Course Code : IMA 304
CREDITS : 4
TYPE-WHEN : Spring 2018

FACULTY NAME : Dr. Indranil Chakrabarty
PRE-REQUISITE :

OBJECTIVE : To give an exhaustive overview of Linear Algebra

COURSE TOPICS : Sets and functions, groups and group homomorphisms, rings and fields, vector spaces and linear maps. direct products and internal direct sums, linear independence, bases and dimension, rank and nullity, Dual space, dual basis, transpose of a map. Matrices, linear systems, Gauss-Jordon elimination, row-echelon form, reduced row-echelon form, solution of linear systems using Gauss-Jordon elimination, matrix inversion by Gauss-Jordon elimination, similar and equivalent matrices. Matrices as representations of linear maps, matrix of the composition of two maps, change of basis, Determinant as the multilinear alternating normalized map, properties of determinants, nonrecursive formula, determinant of a product, determinant of the inverse. Characteristic polynomial, Eigen values, eigen vectors, eigen basis, Cayley-Hamilton theorem, triangular form, characteristic subspaces, nilpotent maps, Jordon canonical form, minimal polynomial.

PREFERRED TEXT BOOKS: Linear Algebra by Hoffman and Ray Kunze, PRENTICE-HALL, INC . , Englewood Cliffs, New Jersey

***REFERENCE BOOKS:**

1. Linear Algebra And its Applications by Gilbert Strang, Cengage Learning
2. Linear Algebra : A Geometric Approach by S. Kumaresan

GRADING:

Mid Sem 1: 25%
Mid Sem 2: 25%
End Sem : 30%
Assignment: 10%
Tutorial Quizz: 10%

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TITLE : **Literature –American Classics**
CREDIT : 4
TYPE-WHEN : Spring 2018
FACULTY NAME: Aruna Chaluvadi
PRE-REQUISITE : 3rd and 4th yr students
OBJECTIVE : This course aims to introduce literature with a focus on Classic American works.It examines the ethos in which themes and sensibilities took shape and expression.

COURSE TOPICS :

1. What constitutes Literature - Introduction, Historical Survey- Romanticism, Realism, Naturalism

2. Literary Theories - Historical Survey, Moral Criticism, Dramatic Construction (~360 BC-present),Formalism, New Criticism, Neo-Aristotelian Criticism (1930s-

present),Psychoanalytic Criticism, Jungian Criticism(1930s-present),Marxist Criticism (1930s-present)Reader-Response Criticism (1960s-present),Structuralism/Semiotics (1920s-present),Post-Structuralism/Deconstruction (1966-present),New Historicism/Cultural Studies (1980s-present),Post-Colonial Criticism (1990s-present),Feminist Criticism (1960s-present)Gender/Queer Studies (1970s-present),Critical Race Theory (1970s-present)

3. Thomas Jefferson- Declaration of Independence, R W Emerson-Nature, H D Thoreau- Civil Disobedience

4.James Fenimore Cooper - The Last of the Mohicans, Edgar Allen Poe- The Tell Tale Heart and The Raven, Herman Melville- Moby-Dick, Mark Twain-Tom Sawyer, Nathaniel Hawthorne-The Scarlet Letter

5.Harriet Beecher Stowe-Uncle Tom's Cabin, W.E.B. Du Bois- The Souls of Blackfolk

6.Walt Whitman -Leaves of Grass, Emily Dickinson, Stephen Crane, Robert Frost

7.Henry James, Jack London, Upton Sinclair

8.Edith Wharton, Gertrude Stein, Willa Cather

9.T.S. Eliot, John Steinbeck

10.F. Scott Fitzgerald, Ernest Hemingway,

11. William Faulkner, Langston Hughes, Zora Neale Hurston

13.Eugene O'Neill, Tennessee Williams, Arthur Miller

14.Ralph Ellison, JD Salinger

15. Harper Lee, Toni Morrison

Selections for Reading:

Upton Sinclair: The Jungle
Willa Cather: My Antonia
Jack London: On the Road
Emily Dickinson: Selected Poems
Stephen Crane: Selected Poems
Robert Frost: Selected Poems
John Steinbeck : East of Eden
F Scott Fitzgerald: Tender is the Night
Ernest Hemingway : Old Man and the Sea
William Faulkner: The Sound and the Fury
Eugene O'Neill: Desire Under the Elms, Arther Miller : Death of a Salesman
JD Salinger: Catcher in the Rye, Franny and Zooey
Toni Morrison: The Bluest Eye, The Beloved

PREFERRED TEXT BOOKS: https://owl.english.purdue.edu/owl/resource/722/01/
Online Material, Movies, Audio Texts (Extracts- Poetry, Short Stories, Novels, Essays)

REFERENCE BOOKS: The Norton Anthology of American Literature, Online Material, https://archive.org/details/outlinehistoryof00hudsuoft

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	15%
Mid Sem-2 Exam	15%
End Sem Exam	30%
Assignments	15%
Project	-
Term Paper	15%
Group Presentation of evaluation of a Text _____	10%

OUTCOME: Students would come to be familiar with American Classics and would learn to appreciate and evaluate literature critically.

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Title: **Material Science & Engineering**
Credits: 4
Type-When: Spring Semester 2018 (Jan-May of 2018)
Faculty Name: Dr. N.V. Suresh Kumar

Obective: To introduce the knowledge in theoretical concepts of structure and properties of different types of materials and their applications for design of materials.

Pre-Requisite: Science-I (and preferably Science-II). Or equivalent course work.

Description: Course aims to bring to the student the application aspect of physics and chemistry especially the material science aspects of structure and properties.

Course topics:

S. No.	Name of topic	Lectures
1	**Structure of crystalline solids:** Crystal structures, Crystal directions and planes, Reciprocal lattice, Determination of crystal structures by X-ray Diffraction, Crystalline and non-crystalline materials.	3
2	**Imperfections in crystals:** Point defects, Miscellaneous imperfections, Effects of imperfections on properties of crystals.	2
3	**Electrical properties:** Drude and Sommerfeld theory of metals, Electron levels in a periodic potential, Electrical properties of conductors, Mathiessen rule, Semiconductors, Factors effecting the carrier concentration, Conductivity and mobility of charge carriers in semiconductors. Insulators, Dielectrics, Electric polarization, Frequency dependence of polarization, Applications of Ferro, Piezo electric materials.	6
4	**Optical properties:** Light interaction with solids, Atomic and electronic interactions, Optical properties of metals and non-metals. Applications of optical phenomena: Luminescence, Photo conductivity, LASER, Optical fibers in	3

	communication.	
5	**Magnetic properties:** Origin of magnetic moment, Theories of dia magnetism, para magnetiesm and ferro, magentism, Antiferro and Ferri magnetic materials, Domain theory and Hysteresis effect of ferro and ferri magnetisms, Soft and hard magnetic materials, Magnetic storage.	6
6	**Thermal properties:** Crystal vibrations with mono atomic basis, Phonon momentum, Heat capacity, Thermal expansion and Thermal conductivity in metals, ceramics and polymers.	3
7	**Mechanical properties:** Elastic deformation, Plastic deformation, Hardness test methods- Vickers, Rockwell and Brinell, Property variability and design/safety factors. Heat treatment of materials: Hardening, Tempering, Quenching and Nitriding.	3
	Total	**26**

Preferred Text books:

1) William D. Callister,Jr. "Materials Science and Engineering: An Introduction" 6th edition, 2007, Wiley India Pvt.Ltd.
2) Charles Kittel, " Introduction to Solid State Physics" 8th edition, 2012, Wiley India Pvt.Ltd.
3) Adrianus J. Dekker, "Solid State Physics" 1st Edition *2002*, Macmillan India Ltd.
4) Neil W. Ashcroft, N. David Mermin, "Solid State Physics", Thomson Learning, Inc .

GRADING (indicative only):
Mid-term Exam (2): 20% each
Final Exam: 40%
Quizzes/ Assignments/ Class Attendance and Participation: 20%

Outcome: Understands theoretical knowledge of structure, property and performance interrelationship for design of materials having specific applications.

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TITLE : Select Topics in Physical Chemistry

CREDITS : 4 credits
TYPE-WHEN : Spring 2017
Core for CND Students + Elective for BTech Students
FACULTY NAME : Harjinder Singh
PRE-REQUISITE : Science I or Science I courses for BTech (CSE/ECE) students (Selection Based on CGP)
OBJECTIVE : To introduce students to a few selected topics of physical chemistry

Topics: There are four modules in the course, they will be covered in nearly 6 lectures each in the order shown:

1. Electrochemistry: 5-6L

2. Chemical Kinetics: 6L

3. Molecular Reaction Dynamics: 6-7L

4. The Solid State: 6 L

Material for the course will be mostly taken from the text 'Physical Chemistry' by P W Atkins. The details (all taken from the Atkins' text) are as follows:

1. Electrochemistry:

a) Activities: The solvent activity, The solute activity, The activities of regular solutions, The activities of ions in solution

b) Equilibrium electrochemistry: Half-reactions and electrodes, Varieties of cells, The electromotive force, Standard potentials, Applications of standard potentials, Impact on biochemistry: Energy conversion
in biological cells

c) The conductivities of electrolyte solutions; The mobilities of ions; Conductivities and ion-ion interactions; Impact on biochemistry: Ion channels and ion pumps

2. Chemical Kinetics

a) Empirical chemical kinetics: Experimental techniques; The rates of reactions; Integrated rate laws; Reactions approaching equilibrium; The temperature dependence of reaction rates; Accounting for the rate laws; Elementary reactions; Consecutive elementary reactions; Impact on biochemistry: The kinetics of the
helix-coil transition in polypeptides; Unimolecular reactions

b) Chain reactions; The rate laws of chain reactions; Explosions; Polymerization kinetics; Stepwise polymerization; Chain polymerization; Homogeneous catalysis; Features of homogeneous catalysis; Enzymes

c) Photochemistry, Kinetics of photophysical and photochemical processes; Impact on environmental science: The chemistry of stratospheric ozone; Impact on biochemistry: Harvesting oflight
during plant photosynthesis; Complex photochemical processes; Impact on medicine: Photodynamic therapy.

3. Molecular Reaction Dynamics: Reactive encounters; Collision theory; Diffusion-controlled reactions; The material balance equation; Transition state theory; The Eyring equation; Thermodynamic aspects; The dynamics of molecular collisions; Reactive collisions; Potential energy surfaces; Some results from experiments and calculations; The investigation of reaction dynamics with ultrafast laser techniques; Electron transfer in homogeneous systems; The rates of

electron transfer processes; Theory of electron transfer processes; Experimental results; Impact on biochemistry: Electron transfer in and between proteins

4. The Solid State:

a) Crystal lattices; Lattices and unit cells; The identification of lattice planes; The investigation of structure; Impact on biochemistry: X-ray crystallography of biological macromolecules; Neutron and electron diffraction

b) Crystal structure; Metallic solids; Ionic solids; Molecular solids and covalent networks

c) The properties of solids; Mechanical properties, Electrical properties, Impact on nanoscience: Nanowires, Optical properties, Magnetic properties, Superconductors

In addition to the main text 'PHYSICAL CHEMISTRY' BY P W ATKINS, OUP 2016, the following books may be consulted:

Physical Chemistry by Berry, Rice and Ross

Chemical Kinetics by Keith Laidler PREFERED TEXT BOOKS: (1) Physical Chemistry, by P. W. Atkins.
(2) Physical chemistry: a molecular aproach by Donald Alan
McQuarie and John Douglas Simon.
(3) Physical Chemistry, by Thomas Engel and Philp Reid
(4) Physical Chemistry, by G. W. Catelan
*REFERENCE BOOKS: (1) Chemical Kinetics, by K. J. Laidler
(2) Modern Electrochemistry v.2A Fundamentals of Electrodics, by J.O.
Bockris and A. Redy
(3) Modern Electrochemistry v. 1, Ionics, by J. O. Bockris and A. Redy

Grading:
(THERE IS AN ABSOLUTE CUTOFF FOR PASSING THE COURSE. THE MINIMUM MARKS NEED TO PASS THE COURSE ARE 36%.)

2 mid sem exams: 20% each

end sem exam: 45%

assignments: 15%

REMARKS: -

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TITLE: Software Engineering
CREDITS: 3-1-0-4

TYPE-WHEN : Flexicore
FACULTY NAME : Vasudeva Varma
PRE-REQUISITE : Programming, some project work
OBJECTIVE: To develop in-depth understanding of software engineering principles, practices and ability to apply them in developing large scale software systems.

COURSE TOPICS:

Case study - Need for Software Engineering

- Product Management
  - *Requirements Gathering (Functional and Nonfunctional)*
  - *Requirements Filtering & Setting User expectations*

- *Use case creation*

  - *Success Metrics*
- Program Management

- *Requirements Management and Requirements Tracking*

  - Estimation (Milestones)
  - Project Planning
  - Project Tracking
  - Stakeholder management
- Engineering Management
  - Software Design
    - HLD
    - LLD
    - Design Patterns
    - Configuration Driven Design
    - Prototyping
  - Software Construction
    - Software Development Models
      - Waterfall Model
      - Incremental Model
      - Agile Methodology
        - Scrum
        - Kanban

Coding Guidelines (use of IDEs)
Software Configuration Management
Software Testing
White Box/Black Box Testing
Unit Testing
Integration Testing
End-to-end Testing/User Testing
Usability Testing
Deployment and Release Management
Release Management
Continuous Deployment

User Documentation (Help)
Software Maintenance
Refactoring
Operations management

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:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	**5**
Mid Sem-2 Exam	**5**
End Sem Exam	**10**
Assignments	**10**
Project	**50**
Term Paper	**-**
Other Evaluation – In class activity	**20**

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.

TITLE : System and Network Security
Course Code : CSE538
CREDITS : 4
TYPE-WHEN :
FACULTY NAME : Ashok Kumar Das
PRE-REQUISITE: programming languages (C/C++, Python), operating systems + architecture (basis), POIS (CSE418) (have taken earlier or enrolled this semester).
OBJECTIVE : This course is intended to introduce students the exciting world of information security research. The main focus of this course would be on non-cryptographic security research (as cryptographic security is covered in detail in CSE418) i.e. topics related to software vulnerabilities, malware, intrusion detection/prevention systems. The course is divided into two major parts. The first part is about “offensive computing” which is based on the premise “Know your enemy first”. This part covers techniques that are used for attacking systems, including low-level vulnerabilities like buffer-overflow, cross-site scripting, format strings. These techniques are used by hackers and malwares to invade systems (thus know your enemy first). The second part is about “defensive computing”, which covers techniques/technologies to defend against above mentioned attacks, including cryptographic protocols, intrusion detection systems, firewalls. At the end of the course, the students should:
1. understand the various issues in software security;
2. understand the techniques that are applied in order to address security issues;

3. understand the majority of the attacks that hamper the security of the networks, e.g. bug exploitation (aka hacking);
4. learn basics of malware analysis and defensive techniques;
5. learn the use of cryptographic primitives for securing networks
6. Understand that security is a layered approach.

COURSE TOPICS :

PART I- Offensive Computing
A. Introduction to Software vulnerabilities:
- Non-web software vulnerabilities (low level bug, e.g., buffer overflow, use-after-free etc.)
- How to find such vulnerabilities and then attack/hack?
- Web specific vulnerabilities and their analysis (e.g. XSS, CSRF, SQLinjection etc.)

B. Malware Analysis:
- Introduction to Malwares
- Analysis techniques
- Android malwares

PART II – Defensive Computing
C. Operating system and application level defense
- Stack overflow prevention
- Address space layout randomization
- Input sanitization

D. Firewalls – first layer of defense
- Introduction to Firewalls and type of firewalls

E. Intrusion Detection System:
- Introduction to IDS/IPS
- Types of IDS

F. Network Security with Cryptography
- IPSec
- SSL

PREFERRED TEXT BOOKS:
Text book: to be announced

***REFERENCE BOOKS:**
- Assembly book for x86
- Practical malware analysis, by Sikorski and Honig

GRADING:
10%: Class attendance and discussion/participation
25%: Hands-on assignments (4-6)
25%: mid term (2)
40%: End exam

TITLE: Time Frequency Analysis

Course Code: ECE442
Credits: 3-1-0-4
Type-When: Spring - 2017
Faculty Name : Anil Kumar Vuppala
Pre-Requisite:

COURSE TOPICS:
I. Introduction to the course Vector Space, Basis Functions,
Basis, Frames, Signal Expansion.

II. Linear time frequency representation–Fourier and Gabor Review of Fourier Transform and Fourier Series Localisation problem Time - Frequency distributions, general concepts Short - Time Fourier Transform Gabor Transform Instantaneous Frequency.

III. Linear time frequency representation–Wavelets Nested subspaces Multiresolution formulation Continuous wavelet transform discrete wavelet transform.

IV. Quadratic time frequency representation Energy distributions Wigner distribution.

V. Applications in signal and image processing

*REFERENCE BOOKS:
Time - Frequency Analysis, L. Cohen, Prentice Hall.
A wavelet tour of signal processing, S. Mallat, Academic Press

GRADING:
Assignments 20%
2 mid sem exams 30%
1 project 15%
End sem exam 35%

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TITLE	**:**	**Topics in Information Retrieval**
Course Code	**:**	**CSE974**
CREDITS	**:**	**04**
TYPE-WHEN	**:**	**Elective – Spring 2018**
FACULTY NAME	**:**	**Manish Shrivastava**
PRE-REQUISITE	**:**	**IRE or NLP**

OBJECTIVE **:** This course is intended to be an advanced course for graduate and senior MS students planning to pursue research in the areas of NLP and IR. The course draws heavily from the latest research papers and tutorials covering the state-of-the-art techniques and problems in these areas.

COURSE TOPICS :

1. Deep Learning for NLP
    a. RNN based Language models
    b. LSTM for Language Modelling
    c. Deep NNs for POS tagging, Chunking and NER
2. Deep Structured Semantic Models
    a. Deep Learning for Semantic Matching
    b. Learning Deep structured models for Search
    c. CNNs for DSSMs
3. Multilingual IR
    a. Cross Lingual IR
    b. Multilingual PRF
    c. Multilingual Topic Modelling
4. Learning to Rank
    a. Point-wise, Pairwise and Listwise Ranking Paradigms
    b. Discriminative Models (SVMs, MeMM, RankSVM, IRSVM)

    c. Ranking Evaluation - Online & Offline Techniques
5. Statistical Translation Models for IR
    a. IR as SMT
    b. Word based Translation Models (TMs)
    c. Phrase-based TMs, Syntax-based TMs

PREFERRED TEXT BOOKS:

Research papers from Tier I conferences and journals

List of papers :

Ronan Collobert, Jason Weston, Léon Bottou, Michael Karlen, KorayKavukcuoglu, and PavelKuksa. 2011. Natural Language Processing (Almost) from Scratch. J. Mach. Learn. Res. 12 (November 2011), 2493-2537.

Sundermeyer, Martin, Ralf Schlüter, and Hermann Ney. "LSTM Neural Networks for Language Modeling." INTERSPEECH. 2012.

Mikolov, Tomas, et al. "Recurrent neural network based language model." INTERSPEECH 2010, 11th Annual Conference of the International Speech Communication Association, Makuhari, Chiba, Japan, September 26-30, 2010. 2010.

Gao, Jianfeng, et al. "Learning continuous phrase representations for translation modeling." *Proc. of ACL. Association for Computational Linguistics, June* (2014).

Yang, Bishan, et al. "Embedding Entities and Relations for Learning and Inference in Knowledge Bases." *arXiv preprint arXiv:1412.6575* (2014).

Yih, Wen-tau, Xiaodong He, and Christopher Meek. "Semantic parsing for single-relation question answering." *Proceedings of ACL*. 2014.

Shen, Yelong, et al. "Learning semantic representations using convolutional neural networks for web search." *Proceedings of the companion publication of the 23rd international conference on World wide web companion*. International World Wide Web Conferences Steering Committee, 2014.

Huang, Po-Sen, et al. "Learning deep structured semantic models for web search using clickthrough data." *Proceedings of the 22nd ACM international conference on Conference on information & knowledge management*. ACM, 2013

Manoj K. Chinnakotla, Karthik Raman, and Pushpak Bhattacharyya. 2010. “Multilingual PRF: english lends a helping hand.” In Proceedings of the 33rd international ACM SIGIR conference on Research and development in information retrieval (SIGIR '10). ACM, New York, NY, USA, 659-666.

Kim, Woosung, and SanjeevKhudanpur. "Cross-lingual latent semantic analysis for language modeling." Acoustics, Speech, and Signal Processing, 2004. Proceedings.(ICASSP'04). IEEE International Conference on. Vol. 1. IEEE, 2004.

Jordan Boyd-Graber and David M. Blei. 2009. "Multilingual topic models for unaligned text." In Proceedings of the Twenty-Fifth Conference on Uncertainty in Artificial Intelligence (UAI '09). AUAI Press, Arlington, Virginia, United States, 75-82.

Tie-Yan Liu. 2009. "Learning to Rank for Information Retrieval." Found. Trends Inf. Retr. 3, 3 (March 2009), 225-331.

JianfengGao, Xiaodong He, and Jian-Yun Nie. 2010. "Clickthrough-based translation models for web search: from word models to phrase models." In Proceedings of the 19th ACM international conference on Information and knowledge management (CIKM '10). ACM, New York, NY, USA, 1139-1148.

Adam Berger and John Lafferty. 1999. "Information retrieval as statistical translation." In Proceedings of the 22nd annual international ACM SIGIR conference on Research and development in information retrieval (SIGIR '99). ACM, New York, NY, USA, 222-229.

***REFERENCE BOOKS:**
Same as text books

***PROJECT:**
Various Projects on related topics

GRADING:
40%: Assignments
20%: Project
20%: Mid-Sems
20%: End Sem

OUTCOME:
Understanding of the state of the art in IR and NLP

REMARKS:
This is an advanced course intended for students in 4th year onwards.

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TITLE : The State in Colonial India

Course Code :
Note: Please use course code for previously existing course

CREDITS **:** Four

TYPE-WHEN **:** Elective, UG 3 and 4 year, and MS CHD students.

FACULTY NAME **:** Aniket Alam

PRE-REQUISITE **:**

OBJECTIVE **:** This course is an intensive study of the state in India during the colonial period. Rather than looking at the state from the perspective of theory or political science, it will historicise the state by looking at how it came to being, how it was a changing entity constantly responding to historically particular contexts and conditions. It will introduce the student to the history of the state in India, the elements which went into making the state under colonial conditions and explain the development of its various institutions. It will also discuss what goes towards making the state legitimate and what creates its ideological hegemony.

COURSE TOPICS **:** The course is divided into five parts; (i) the idea of the state, (ii) the geography of the colonial state, (iii) the economy of the colonial state, (iv) the technology of the colonial state, and (v) the ideology of the colonial state.

The first part of the course will look at ideas and definitions of the state among the Mughal, Rajput and Maratha kingships, at the development of the state in India over the past two millennia as well as the definitions and development of the state in Europe, in particular the ideas of Hobbes, the Enlightenment, Adam Smith and the Utilitarians. This will help set the context in which the British built up the colonial state.

The second part will study how the territory of British India was gained and how it defined the nature of the state. It will look at the land-locked nature of the sub-continent and the open sea-faces on three sides, the river valleys, mountains, deserts and forests, and the trade routes. It will study the trigonometrical survey and the cadastral surveys. It will look at how the frontiers, boundaries and borders, as well as the regions and provinces were formed.

The third part of the course will engage with the economy and resources of the colonial state. It will encompass the land, its agricultural and mineral products, the forests and water resources,

the manufactures and commerce. It will also study the financial foundation of the state and its accounts.

The fourth section of the course will look at the technology of this state. These include (a) technologies of government, (b) technologies of transport and communication and (c) technologies of measurement. This will include a study of the military, police, civil and judicial administration, the schools, colleges and universities, the medical institutions, the other institutions of state and legal systems. It will also include posts and telegraph, the railways, telephones and press. Finally it will also discuss the various methods of measuring land, forest, wealth, populations, etc.

The last part of the course will study the ideology of the colonial state, how it saw itself as a legatee of the Mughals and yet as scientific and modern with its mission to civilize; how it considered its main task to be the guarantor of stability and peace, while also claiming for itself the role of protector of the poor. Finally how, the colonial state became and was seen as the "jewel in the crown" of the empire where the sun does not set.

PREFERRED TEXT BOOKS: **(All students are expected to read *at least* two of these books)**

Lakshmi Subramanian: *History of India: 1707 to 1857*

Sekhar Bandyopadhyay: *From Plassey to Partition*.

Sumit Sarkar: *Modern Times: India 1880s to 1950s.*

Barbara and Thomas Metcalf: *A Concise History of India*.

R.C. Majumdar, H. C. Raychaudhuri, Kalikinkar Datta: *An Advanced History of India*.

Romila Thapar, *From Lineage to State*.

James Scott: *The Art of Not Being Governed – An Anarchist History of South East Asia*.

***REFERENCE BOOKS:** **(Selected readings from these books will be suggested. Each student will read only a selection of book chapters and articles)**

Manu Goswami: *Producing India – From Colonial Economy to National Space*.

Ashin Das Gupta and M.N. Pearson: *India and the Indian Ocean, 1500-1800*.

Thomas Metcalf: *Ideologies of the Raj*.

Stewart Gordon: *Marathas, Marauders, and State Formation in 18th Century India*.

Amiya Kumar Bagchi: *The Political Economy of Underdevelopment.*

Marc Galanter: *Law and Society in Modern India.*

S. Gopal: *British Policy in India, 1858-1905*.

Ranajit Guha, *A Rule of Property for Bengal*.

Eric Stokes: *The English Utilitarians and India*.

C A Bayly: *Empire and Information: Intelligence Gathering and Social Communication in India, 1780-1870*.

Mathew Edney: *Mapping an Empire: The Geographical Construction of British India, 1765-1843.*

Douglas M Peers and Nandini Gooptu: *India and the British Empire*.

B H Baden-Powell: *A Manual of the Land Revenue Systems and Land Tenures of British India*.

Tirthankar Roy: *The Economic History of India – 1857-1947*.

H. S. Bhatia: *Military History of British India, 1607-1947*.

Preeti Nijhar: *Law and Imperialism: Criminality and Constitution in Colonial India and Victorian England*.

Charles Edward Trevelyan: *On the Education of the People of India*.

Krishna Kumar: *Politics of Education in Colonial India*.

Bhavani Raman: *Document Raj: Writing and Scribes in Early Colonial India*.

Ian J. Kerr: *Engines of Change: The Railroads that Made India*.

Shriram Maheshwari: *The Census Administration under the Raj and After*.

Nicholas B Dirks: *Castes of Mind: Colonialism and the Making of Modern India*.

Sharad Singh Negi: *Indian Forestry Through the Ages*.

Bankey Bihari Misra: *The Bureaucracy in India: An Historical Analysis of Development up to 1947*.

Stephen Cohen: *The Indian Army: Its Contribution to the Development of a Nation*.

A. S. Gupta: *The Police in British India, 1861 – 1947*.

Francis G. Hutchins: *The Illusion of Permanence – British Imperialism in India*.

Articles.

M. Athar Ali: “Political Structures of the Islamic Orient in the Sixteenth and Seventeenth Centuries” in Irfan Habib ed. *Medieval India 1 – Researches in the History of India, 1200-1750*.

B.L. Bhadani: “The Ruler and the Nobility in Marwar During the Reign of Jaswant Singh”, in Irfan Habib ed. *Medieval India 1*.

Bipan Chandra: “Colonialism, Stages of Colonialism and the Colonial State” *Journal of Contemporary Asia*, Vol 10, No 3, 1980.

Sabyasachi Bhattacharya: “Colonial Power and Micro-Social Interactions: Nineteenth Century India”, *EPW*, 1-8 June 1991.

Ramachandra Guha, “Forestry in British and post-British India, an Historical Analysis”, *Economic and Political Weekly*, xvii, 1983, pp 1882-96

Mahesh Rangarajan, “Imperial Agendas and India’s Forests : The Early History of Indian Forestry, 1800-1878”, *Indian Economic and Social History Review*, 1994

R.Guha and M.Gadgil, “State Forestry and Social Conflict in British India”, *Past and Present*, cxxiii, 1989, 99141-77.

Sudipta Kaviraj: “On the Construction of Colonial Power: Structure, Discourse, Hegemony”, NMML Occasional Paper.

Sudipta Kaviraj: “On the Enchantment of the State: Indian Thought in the Role of the State in the Narrative of Modernity”, in *Trajectories of the Indian State*.

Bernard Cohn: “The Census, Social Structure and Objectification in South Asia”, in *An Anthropologist among the Historians and Other Essays*.

Bernard Cohn: “Representing Authority in Victorian India”.

Padmanabh Samarendra: “Census in Colonial India and the Birth of Caste”, *EPW*, 13 Aug, 2011.

K N Reddy: “India’s Defence Expenditure, 1872-1967”, *IESHR*, No 7, 1970.

Neeladri Bhattacharya: “Colonial State and Agrarian Society”, in S. Bhattacharya and R Thapar eds, *Situating Indian History*.

W. Murray Hogben: “An Imperial Dilemma – The Reluctant Indianisation of the Indian Political Service” *Modern Asian Studies*, Vol 15, No 4, (1981)

***PROJECT:** Each student need to write a 3,000 to 4,000 word essay on a topic which will be selected in consultation with the teacher. This will require working with primary source materials.

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	
Mid Sem-2 Exam	
End Sem Exam	**40%**
Assignments	
Project	**20%**
Term Papers (two)	**15% each**
Other Evaluation: Book Review	**10%**

OUTCOME: The student who takes this course will gain a comprehensive understanding of the state in colonial India, how it emerged and grew and what were its main features. She will be able to understand the complexity of the state, identify its ideological and institutional inheritances, its innovations and mark out its strengths and weaknesses. This course will help the student gain an understanding of the history of the independent Indian state, in as much as it is a continuation of the colonial state.

REMARKS: The course will be based on classroom lectures and will require intensive reading and writing. On an average, each student will be required to read between 1,500 to 2,000 pages of books and articles and submit written work between 6,000 to 8,000 words. Apart from the project (3,000 to 4,000 words), each student will be required to submit two 1,000-1,500 word term papers by the time of each mid-sem exam and a 1,000-1,500 word review of one book or of a set of articles/chapters. The final exams will also require long essay type answers.

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Title	**Topics in Discourse Analysis**
Credits	4-3-0-0 (credits - hours per week - tutorials - lab sessions)
Type-When	Spring Semester 2018
Faculty Names	Radhika Mamidi
Pre-Requisite	CL1, CL2 or NLP
Objective	To give a general introduction to the analysis of discourse and dialogue. Discourse is the text organization above sentence level and dialog is the interaction between two or more people. The course will provide an overview of the structure of discourse and dialogue, from linguistic and computational points of view. Students will read original (classical) and recent work in these areas. The seminar presentations and related project will reflect the outcome of these readings.
Course topics and related readings	**1. INTRODUCTION** • Brown, Gillian and George Yule. (1983). Discourse Analysis. Cambridge: Cambridge University Press. Chapter 1. Introduction: Linguistic forms and functions (pp. 1-26). • Brown, Penelope and Stephen C. Levinson. (1999 [1987]). Politeness: Some universals in language usage. In A. Jaworski and N. Coupland (eds.) The Discourse Reader. London: Routledge. (pp. 321-335). • Jurafsky, Daniel and James Martin. (2000). Speech and Language Processing. NJ: Prentice-Hall. Chapters 18 and 19. • Jurafsky, Daniel. (2004). Pragmatics and computational linguistics. In L. Horn and G. Ward (eds.) Handbook of Pragmatics. Malden, Mass: Blackwell. (pp. 578-604). **2. DISCOURSE DATA** • Discourse Tagging Reference Manual - Lynn Carlson and Daniel Marcu • An overview of PennTreebank - Ann Taylor, Mitchell Marcus and Beatrice Santorini • Coding Dialogs with the DAMSL Annotation Scheme - Mark G Core and James F Allen

	D 3. **GENRES AND REGISTERS; WRITTEN AND SPOKEN LANGUAGE** • Crystal, David. (1995). Speech and writing. The Cambridge Encyclopedia of the English Language. Cambridge: Cambridge University Press. (pp. 291-293). **4. ROLE OF CONTEXT IN INTERPRETATION OF DISCOURSE - SPEECH ACTS** • Mey, Jacob L. (2001). Pragmatics: An Introduction (2nd ed.). Malden, Mass: Blackwell. Chapter 3. Context, implicature and reference. (pp. 39-66). • Sadock, Jerrold. (2004). Speech acts. In L. R. Horn and G. Ward (Eds.), The Handbook of Pragmatics (pp. 53-73). Malden, MA: Blackwell. • Grice, H. P. (1975 [1996]) Logic and conversation. In P. Martinich (Ed.) The Philosophy of Language. Oxford: Oxford University Press. (pp. 156-167). 5. **CONVERSATIONAL ORGANIZATION** • Sacks, Harvey, Emmanuel Schegloff and Gail Jefferson. (1974). A simplest systematics for the organization of turn-taking in conversation. Language, 50, 696-735. • Tsui, Amy B. M. (1989). Beyond the "adjacency pair". Language in Society, 18(4), 545-564. **6. DISCOURSE TOPIC; SENTENCE TOPIC; INFORMATION STRUCTURE** • Brown, Gillian and George Yule. (1983). Discourse Analysis. Cambridge: Cambridge University Press. Chapter 3. Topic and the representation of discourse context (pp. 68-124). **7. COHERENCE, COHESION AND REFERENCE** • Grosz, Barbara J., Aravind K. Joshi and Scott Weinstein. (1995). Centering: A framework for modeling the local coherence of discourse. Computational Linguistics, 21(2), 203- 225. • Mann, William C. and Sandra A. Thompson. (1988). Rhetorical Structure Theory: Toward a functional theory of text organization. Text, 8(3), 243-281. • Mitkov, Ruslan. (1999), "Anaphora Resolution: The State of the Art", Working paper. (Based on the COLING'98/ACL'98 tutorial on anaphora resolution) **8. DISCOURSE STRUCTURE** • Grosz, Barbara J. and Candance L. Sidner. (1986). Attention, intentions, and the structure of discourse. Computational Linguistics, 12(3), 175-204. (Review from previous topic) • Bonnie Webber and Aravind Joshi. (2010). Discourse Structure and Computation: Past, Present, and Future, ACL 2010 **9. DISCOURSE MARKERS** • Fraser, Bruce. (1999) What are discourse markers? Journal of Pragmatics 31. 931-952. • Schiffrin, Deborah. (2001) Discourse markers: Language, meaning and context. In D. Schiffrin, D. Tannen and H. Hamilton (Eds.) The Handbook of Discourse Analysis. Malden, Mass: Blackwell. (pp. 54-75). • Rouchota, Villy. (1996)Discourse connectives: what do they link? UCL Working Papers in Linguistics 8.
Projects	1. Computing discourse connectives 2. Discourse relations and automatic summarization 3. Generating a coherent story 4. Sentiment detection in a text

	5. Sentiment similarity in parallel corpus 6. Speech act detection [Some more will be added to this list based on students' interest and background]
Grading	[Assignments = 20%] + [Seminar = 10%]+ [Project = 30%]+ [Midsem exams = 40%] [No final exam]

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TITLE : VLSI Architectures
Course Code: ECE465
CREDITS : 4
TYPE-WHEN : Spring 2017
FACULTY NAME : Govind Krishnan
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
PREFERRED TEXT BOOKS: 1. N. Weste and D. Harris, —CMOS VLSI Design: Circuit and Systems Perspective||, Pearson Education (2008)
2. J.M. Rabaey, A. Chandrakasan, B. Nikolic, —Digital Integrated Circuits||, Prentice Hall (2009)
***REFERENCE BOOKS:**
***PROJECT:**
GRADING:
OUTCOME:
REMARKS:

TITLE : Women and politics in India
Course Code :

CREDITS : Four
TYPE-WHEN : **Spring**
FACULTY NAME : **Sinjini Bhattacharya**

PRE-REQUISITE :
OBJECTIVE : This course will introduce students to the various aspects of women's participation in politics in India. The course will start with introducing students to Women's role in the nationalist movement in India. It will then introduce to the students the various stands of arguments surrounding Women's movement in contemporary India and the women's reservation bill. The right wings successful mobilization of women has led to a lot of theorizing about ideas of femininity, masculinization of religion and controlled emancipation of women. The final section will introduce students to these various strands of argument ultimately enabling students to have a more nuanced understanding of politics and the women's question.

COURSE TOPICS : 1. Women in the Nationalist Movement
2. Women's Movement in Independent India
3. 73rd and 74th Amendment Act and the Women's Question
4. Women's Reservation Bill
5. Women's Participation in Politics – A case study of the Successful Right-Wing mobilization of Women
6. Women and Political Violence

PREFERRED TEXT BOOKS:

1.History of Doing: Radha Kumar
2. Changing Terms of Political Discourse: Women's Movement in India: 1970s-1990s – Indu Agnihotri and Vina Mazumdar
3. Nivedita Menon. 1997 (Sept). Issue on the Women's Reservation Bill. Seminar 457.
4. Nandita Shah and Nandita Gandhi. 1991. The Quota Question: Women and Electoral Seats. Bombay: Akshara Publication.
5. (En)Gendering the Maoist Insurgency in India: Between Rhetoric and Reality: Swati Parashar and Janet Andrew Shah
6. Nivedita Menon. 2001. Gender and Politics in India. New Delhi: OUP
7. Sarkar, Tanika. "The gender predicament of the Hindu right." The Concerned Indian's Guide to Communalism.
8. Gender and nationalism: the masculinization of Hinduism and female political participation in India: Sikata Banerjee
9. Stree Shakti Sangathan. 1989. 'We were making history…' Life Stories of Women in the Telangana People's Struggle. New Delhi: Kali

***REFERENCES:**

1. Women in Modern India: Geraldine Forbes
2. Tanika Sarkar and Urvashi Butalia, eds. 1995. Women and the Hindu Right. New Delhi: Kali Gender,
3. Religion and Democratic Politics in India: Zoya Hasan
4. Women, Communal Violence, and Rights Rhetoric: D. Parthasarathy
5. Avenging Angels and Nurturing Mothers: Women in Hindu Nationalism: Manisha Sethi
6. Controlled Emancipation: Women and Hindu Nationalism
Reflecting on Resistance
7. Hindu Women 'Soldiers' and the Birth of Female Militancy: Atreyee Sen

***PROJECT:** None.

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	
Mid Sem-2 Exam	**15%**
End Sem Exam	**30%**
Assignments (Class work and Presentations)	**25%**
Term Paper (in lieu of Mid 1)	**15%**
Book Review	**15%**

OUTCOME: The student will have an overview about the issues and debates surrounding the women's question in India and a nuanced understanding of the Indian political process.

REMARKS: The course will be based on lectures and the students will be expected to engage with specific debates and issues within political science and the women's question in their term paper and assignments. They will have to read all the books given in the reading list.

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Sd/
Dean(Academics).