COURSE DESCRIPTION – SPRING – 2019
ELECTIVES

Version 2(19/12/2018)

Code	Course Name	Faculty
ECE441	Adaptive Signal Processing	Santosh Nannuru
CSE422	Advanced Computer Architecture	R. Govondarajulu
CSE541	Advances in Database Systems	PK Reddy
CES616	Advanced Mechanics of Structures	Venkateswarlu M
ECE551	Advances in Robotics and Control	Madhava Krishna+ Abhishek Sarkar
SCI477	Machine Learning for Natural Sciences	Deva Priyakumar+Girish Varma+Jawahar CV+Prabhakar B+Raghunathan Ramakrishnan (TIFR)+ Vindo PK
CSE583	Big Data and Policing	Ponnurangam K
HSS424	Classic Text Reading IV: Research Specific	CEH Faculty
CSE586	Cognitive Neuroscience	Kavita Vemuri
SCI760	Computer Aided Drug Design	Deva Priyakumar
CLG422	Computational Linguistics 2	Radhika M + Dipti M Sharma
CSE578	Computer Vision	Anoop Namboodiri
HSS337	Comprehension of Indian Music	Saroja TK
TS17001	Critical Thinking	Nishad Patnaik
CEW612	Design of Hydraulic Structures	Shaik Rehana
ECE463	Digital VLSI Design	Zia Abbas
CSE441	Database Systems	Vikram Pudi
CSE431	Distributed Systems	K.Kishore
HSS481/ HSS482	Digital Humanities Project	CEH Faculty
CES442	Disaster Management	Sunitha P
CES641	Earthquake Engineering	R Pradeep Kumar
SCI438	Electromagnetism & Optics	Prabhakar B
TS18006	Environment and Politics in India	Radhika Krishnan
ECE439	Error Correcting Codes	Prasad Krishnan
ECE562	Flexible Electronics	Aftab M Hussain
ECE538	Fiber Optic Communication Systems	Kavita Vemuri
CEF631	Foundation Engineering & Design	R Pradeep Kumar
SCI341	General & Structural Chemistry	Abhijit Mitra
TS19008	Gender and Society	Sushmita Banerji
CEB413	Heat, Ventilation and Air Condition(HVAC)	Vishal Garg
CEG462	Hydroinformatics	Shaik Rehana
CSE595	ICTs for Development	Nimmi Rangaswamy
CSE581	Information Security Audit and Assurance	Shatrunjay Rawat
ECE452	Intro to Robotics: Mechanics & Control	Abhishek Sarkar

TS19002	Indian Semantics & Ontology	Peter M Scharf
TS19007	Introduction to Philosophy of Technology	Nishad Patnaik
TS19009	Introduction to Sanskrit	Peter M Scharf
CSE504	Introduction to parallel Scientific Computing	Pawan Kumar
CSE563	Internals of Application Servers	Ramesh Loganathan
CLG452	Linguistics Data 2: Collection & Modeling	Radhika M + Aditi Mukherjee+ Dipti M Sharma
TS17003	Literature - American Classics	Aruna Chaluvadi
SCI455	Material Science and Engineering	N V Suresh Kumar
IMA307	Mathematical Methods	Subhadip Mitra
ECE575	Medical Image Analysis	Jayanthi Sivaswamy
SCI433/ SCI633	Modeling and Simulations	Prabhakar B + Suresh Kumar NV
CSE588	Music, Mind and Technology	Vinoo Alluri
IMA409	Multivariate Statistical Inference	Venkateswarlu M
CSE573	NLP Applications	Manish Shrivastava
SCI491	Nonlinear Dynamics	Vinod Palakkad
CSE481	Optimization Methods	CV Jawahar
CLG423	Phonetics and Phonology	Suryakanth VG + Aditi Mukherjee
CSE418	Principles of Information Security	Kannan Srinathan
CSE582	Quantum Information and Computation	Indranil Chakrabarty
LAN318	Readings from Hindi Literature	Harjinder Singh
CEG461	Remote Sensing	RC Prasad
SCI372	Science Lab II	Tapan K Sau + Prabhakar B
SCI347	Select topics in Physical Chemistry	Harjinder Singh
ECE431	Signal Detection and Estimation Theory	Sachin Chaudhari
CSE461	Software Engineering	Vasudeva Varma
ECE446	Speech Systems	Suryakant VG
CES617	Stability of Structures	Sunitha P
CSE471	Statistical Methods in AI	Santosh Ravi Kiran
CSE538	System and Network Security	Ashok Kumar Das
ECE442	Time Frequency Analysis	Anil Kumar V
SCI761	Topics in Nano Sciences	Tapan Kumar Sau
CSE881	Topics in Optimization on Manifolds	Pawan Kumar
CSE567	Usability Engineering	Priyanka Srivastava

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TITLE: Advanced Computer Architecture
Course Code: CSE422
CREDITS:3-1-0-4
TYPE-WHEN: Spring2019
FACULTYNAME: **R. Govindarajulu**
PRE-REQUISITE:
OBJECTIVE :

COURSE TOPICS :

1. Fundamentals of Quantitative Design and Analysis:

Introduction classes of computer, defining computer architecture, trends in technology, power and energy, costs Dependability, Performance, Principles of computer design.

2. Memory hierarchy design:

Introduction, optimization of cache performance, memory technology and optimization, protection, Virtual Memory and virtual machines.

3. Introduction level Parallelism(ILP) and its exploitation:

ILP concepts and challenges. Basic compiler techniques for exposing ILP. Reduced branch costs with advanced branch prediction. Overcoming data hazards with dynamic scheduling. Dynamic scheduling examples and algorithms. Hardware based speculation. Multiple issue. Static and dynamic scheduling Speculation. Multi threading. Exploiting thread-level parallelism to improve uniprocessor throughput. Core i7 & ARM Catex A8.

4. Data-Level Parallelism in Vector, SIMD and GPU Architecture:

Vector Architecture, SIMD instruction set extensions for Multi Media GPUs. Detecting and Enhancing Loop-Level Parallelism.

5. Thread Level parallelism:

Centralized shared-memory architectures, performance of shared-memory multiprocessors. Distributed shared memory and Directory based coherence Synchronization. Models of memory consistency.

6. Warehouse scale computers to exploit Request level and data level Parallelism:

Introduction to Domain specific Architectures.

PREFERRED TEXT BOOKS:

References:

1. John L Hennessy and David A Patterson “Computer Architecture A quantitative Approach” Morgankaufman, VI Edition 2019, V edition 20102, 3rd & 4th editions also referenced.
2. David E Culler, JasWinder pal Singh with Anoop Gupta, “Parallel Computer Architecture: A Hardware/Software Approach” Eslevire’99.
3. David A Patterson and John L Hennassy, “Computer Organization and Design” RISC-V Edition 2014. & Vth Edition

*PROJECT:

GRADING:

OUTCOME:

REMARKS

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TITLE : Advances in Database Systems

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 (new DBMS frameworks for efficient data management and query processing, NoSQL, MapReduce, Stream data management, data integration, query processing, 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 related to relational database engine, distributed database engine, Efficient/scalable retrieval, stream processing, NOSQL, map-reduce, graph databases, database integration, and web services.

REFERENCES.

1. Papers from SIGMOD, VLDB, ICDE, IDAR, and database journals.
2. 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

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

OUTCOME:

After taking the course, the student will have a comphrehensive 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 students who wants to pursue research as their career or wants to do jobs related to system building. Under-graduate, post-graduate and PhD 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, PhD and imagining/building next generation systems for different domains. Pls. talk to me if you want more clarity.

REFER RESPONSE FROM THE STUDENTS OF SPRING 2017 AT THE END.

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List of research papers covered during Spring 2016 (The list will be updated by including latest trends)

1. E. F. Codd: A Relational Model of Data for Large Shared Data Banks (Reprint).Commun. ACM 26(1): 64-69 (1983)
2. Jeffrey Dean, Sanjay Ghemawat: MapReduce: Simplified Data Processing on Large Clusters.OSDI 2004: 137-150
3. Michael Stonebraker, Daniel J. Abadi, Adam Batkin, Xuedong Chen, Mitch Cherniack, Miguel Ferreira, Edmond Lau, Amerson Lin, Samuel Madden, Elizabeth J. O'Neil, Patrick E. O'Neil, Alex Rasin, Nga Tran, Stanley B. Zdonik: C-Store: A Column-oriented DBMS.VLDB 2005: 553-564
4. David J. DeWitt, ShahramGhandeharizadeh, Donovan A. Schneider, Allan Bricker, Hui-I Hsiao, Rick Rasmussen: The Gamma Database Machine Project.IEEE Trans. Knowl. Data Eng. 2(1): 44-62 (1990)
5. IoannisAlagiannis, Renata Borovica, Miguel Branco, StratosIdreos, AnastasiaAilamaki: NoDB: efficient query execution on raw data files.SIGMOD Conference 2012: 241-252
6. PavanDeolasee, Amol Katkar, AnkurPanchbudhe, KrithiRamamritham, Prashant J. Shenoy: Adaptive push-pull: disseminating dynamic web data.WWW 2001: 265-274
7. Surajit Chaudhuri, VenkateshGanti, Raghav Kaushik: A Primitive Operator for Similarity Joins in Data Cleaning.ICDE 2006: 5
8. Mohamed F. Mokbel, Chi-Yin Chow, Walid G. Aref: The New Casper: Query Processing for Location Services without Compromising Privacy.VLDB 2006: 763-774
9. Stephan Börzsönyi, Donald Kossmann, Konrad Stocker: The Skyline Operator.ICDE 2001: 421-430
10. Ihab F. Ilyas, George Beskales, Mohamed A. Soliman: A survey of top-*k* query processing techniques in relational database systems.ACM Comput. Surv. 40(4): 11:1-11:58 (2008)
11. Ronald Fagin, AmnonLotem, Moni Naor: Optimal Aggregation Algorithms for Middleware.PODS 2001
12. Sarah Masud, FarhanaMurtaza Choudhury, Mohammed Eunus Ali, SaranaNutanong: Maximum visibility queries in spatial databases.ICDE 2013: 637-648
13. Lukasz Golab, Howard J. Karloff, Flip Korn, AvishekSaha, Divesh Srivastava: Sequential Dependencies.PVLDB 2(1): 574-585 (2009)
14. Abdullah Mueen, Eamonn J. Keogh, NimaBigdelyShamlo: Finding Time Series Motifs in Disk-Resident Data.ICDM 2009: 367-376

15. P. Krishna Reddy, Masaru Kitsuregawa:Speculative Locking Protocols to Improve Performance for Distributed Database System.IEEE Trans. Knowl. Data Eng. 16(2): 154-169 (2004)
16. Matthias Brantner, Daniela Florescu, David A. Graf, Donald Kossmann, TimKraska:Building a database on S3.SIGMOD Conference 2008: 251-264
17. GrzegorzMalewicz, Matthew H. Austern, Aart J. C. Bik, James C. Dehnert, Ilan Horn, NatyLeiser, GrzegorzCzajkowski: Pregel: a system for large-scale graph processing.SIGMOD Conference 2010: 135-146
18. Peter Buneman, Adriane Chapman, James Cheney: Provenance management in curated databases.SIGMOD Conference 2006: 539-550
19. AlampallyAnirudh, R. Uday Kiran, P. Krishna Reddy, Masaru Kitsuregawa:Memory efficient mining of periodic-frequent patterns in transactional databases.SSCI 2016: 1-8
20. Mohamed Y. Eltabakh, MouradOuzzani, Walid G. Aref: bdbms - A Database Management System for Biological Data.CIDR 2007: 196-206
21. NileshPadhariya, AnirbanMondal, Vikram Goyal, Roshan Shankar, Sanjay Kumar Madria:EcoTop: An Economic Model for Dynamic Processing of Top-*k* Queries in Mobile-P2P Networks.DASFAA (2) 2011: 251-265
22. The Beckman report on database research.Commun. ACM 59(2): 92-99 (2016)
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Advances in Databases: Response from the students of Spring 2017

(i)Vishal Gupta

I very much enjoyed the course, and I am grateful I got a chance to take it.I learned so many things in this course.

1. What was your thinking before taking this course.

I was under the assumption that we will be discussing only core database concepts which were pioneered a long back and not get to work on the latest things.

2. What is your thinking after completing this course.

I was blown away by the depth and breadth of the course, and would like to recommend this course to other students as well.

How this course is useful to you for doing research.

Serendipity. I wouldn't say the course explicitly impacted my research, but I would say there were a lot of implicit things that I learned from the course.

4. Suppose, if you are not a research student, do you think that the course is relevant. If YES, why? If NO, why?

Yes. The skills/implicit things learnt are very much required for anyone in Computer Science industry or research. It's a very much industry research kind of a course, in a manner.

5. Do you recommend this course to BTech/Mtech students?

Yes.

6. Do you propose any change in teaching methodology?

The current teaching pedagogy was really good. Additionally, I'd like to recommend a more practical and hands on approach for teaching the course, to enhance learning.

I personally would like the instructor to pose the problem, give everyone the time to ponder upon it, discuss their ideas and then go through the approach mentioned in the research paper.

That said, this is a very very time consuming process, so we could do it for some 3-4 selected research papers, covering a single paper over a week or marathon class session (3hrs).
I think the structure of the course is really good in its present form.
7. In your view, who should take this course?
8. How to minimize the load on the students and maximizing advantage?
9. Any other comments.
I think students who want to gain some research + industry exposure in database / distributed systems should take this course.

Additionally, this course could be much more interesting if it is combined with the distributed systems course in some way Some guest lectures by Prof Vellanki, co-instructors kind of a thing. If more people from the industry join this course, they could provide their practical experiences learnt along the way.

(ii)ChinmayBapna

1. What was your thinking before taking this course.
After reading the course description I thought that the course would comprise of reading research papers from different areas of Database Systems. We would get a more detailed insight into the whole notion of 'Research', which would help us with our MS.
2. What is your thinking after completing this course.
We did read quite a few research papers related to DBMS. A subset of the papers seemed interesting to me, but I wasn't able to develop a research aptitude which I had expected to inculcate in the process of completing the course.
3. How this course is useful to you for doing research.
Reading and reviewing research papers is a core part of being a researcher. We read papers and gave our reviews in the form of presentations. But, it could have helped if there were more people taking part in the course. Although, it was a good experience and I'd look forward to doing something like this again.
4. Suppose, if you are not a research student, do you think that the course is relevant. If YES, why? If NO, why?
If you are not a research student but you are interested in Database Systems and ongoing research related to it, then this course is pretty relevant for you.
But, for normal students who don't want to pursue research profiles, this course is as relevant as any other. Since, like any other course it has a learning objective attached to it, and if you pursue any course sincerely you can learn a lot from it.
5. Do you recommend this course to BTech/Mtech students?
Yes, belonging to a research institute courses like this give you a taste of what research really means. This will give them an apprehension of concepts from a researcher's perspective.
6. Do you propose any change in teaching methodology?
Since it was taught like a course, it had quite a few constraints attached from the outlook of grading students. I think it could be taught with a more open view towards things. A certain set of research papers were established which were discussed in the course. I think the students should be given a bit more encouragement in introducing new research topics - allowed to do survey and discuss research on those aspects. The course should have been more interactive

from both ends. With regular guidance and discipline from the instructor's end and motivation and curiosity from the student's end the course can become more interesting. We got the freedom when we took the course, but it was a lack of motivation from the student's end which was a problem.
7. In your view, who should take this course?
Students interested in research should take this course. Other students who don't have any particular interest in taking other courses can also pick it up as an elective.
8. How to minimize the load on the students and maximizing advantage?
As far as I know, there wasn't much load on us during this course. The course curriculum was well established and there weren't many assignments.
9. Any other comments.
None.

(iii) Rudra Banerjee

1. What was your thinking before taking this course.
<Rudra> I felt that i will get to learn the latest developments that is happening in the filed of Data Science. Build more knowledge of the domain that will help me in my research work.
2. What is your thinking after completing this course.
<Rudra> I would say the course was very well intended. It have covered a wide variety of Research paper catering to various domains. I really felt that this kind of courses will really stimulate ideas for taking up good research work.
3. How this course is useful to you for doing research.
<Rudra> This course cultivates the habit of going through and understanding research work done previously in various domains. It introduces the habit of reading research papers regularly. This will help in generating various ideas in Data Science Domain.
4. Suppose, if you are not a research student, do you think that the course is relevant. If YES, why? If NO, why?
<Rudra> Absolutely Yes. But the course work can be improved by introducing more recent research work and papers.
5. Do you recommend this course to BTech/Mtech students?
<Rudra> Absolutely Yes
6. Do you propose any change in teaching methodology?
<Rudra> No
7. In your view, who should take this course?
<Rudra>BTech, Mtech and PHD students working in Data Science Domain should take this course. The course is absolutely fundamental for Research students, but regular students can also take up the course. It is interesting.
8. How to minimize the load on the students and maximizing advantage?
<Rudra> I think, load of this course work is fine. To increase advantage, we can ask the students to come up with more research ideas around the same topic that are getting covered in class or being presented by other students.
9. Any other comments.
<Rudra> I would like to see more current and recent research works and developments being covered in the class. It will give ideas to the student about the current trend that are being followed, or the most pursued / sought after areas.

(iv) Gangumalla Nirmala Ganga Lakshmi

1. What was your thinking before taking this course.

Before taking the course, I couldn't think properly about posing a problem statement.

2. What is your thinking after completing this course.

After thinking, I understood several difficulties in finding a problem statement and solving it in very efficient way, understood how to do background work.

3.How this course is useful to you for doing research.

This course helped me alot in my research. Infact, I got my problem statement out of this course only.

4. Suppose, if you are not a research student, do you think that the course is relevant. If YES, why? If NO, why?

If not a research student and not interested in research, it might not help you so much. But even though not research student but interested in knowing latest works happenings, this course wil help you a lot in gaining insights.

5. Do you recommend this course to BTech/Mtech students?

I would recommend this course to B.Tech dual degree students.

6. Do you propose any change in teaching methodology?

Everything was good.

7. In your view, who should take this course?

B.Tech dual degree students

8. . How to minimize the load on the students and maximizing advantage?

By having active group discussions

9..Any other comments.

I would definitely suggest this kind of course to all the dual degree students in their respective domains.

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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 Mechanics of Structures
Course Code :
CREDITS : 4
TYPE-WHEN : Spring
FACULTY NAME : M. Venkateswarlu
PRE-REQUISITE : Structural Analysis

OBJECTIVE : The course aims at an in-depth coverage of fundamental concepts of structural behavior and this, in turn, will help to recognize when the output from a computer does not make sense.

COURSE TOPICS :

1.Kinematic Analysis: Classification, geometrically unchangeable structures, required constrains, Redundant constraints, Analytical criteria, Degrees of freedom.

2. General Theory of Influence Lines: Analytical method, Influence lines for reactions, Influence lines for internal forces, Application of influence lines for fixed and moving loads, Indirect load application, combining fixed and moving load approaches, Properties of influence lines.

3. Multi-Span Beams and Trusses: Multi-span statically determinate hinged beams, Interaction schemes and load path, Influence lines for multi-span hinged beams, Generation of statically determinate trusses, Influence lines for simple trusses, Three-hinged trusses.

4. Three-Hinged Arches: Geometric parameters, internal forces, Influence lines for reactions and internal forces, Application of influence lines, , askew arch, parabolic arch with complex tie.

5. Cables: Direct and inverse problems, fundamental relationships, cables with neglected self-weight, effect of arbitrary load on the thrust and sag, cable with self-weight, supports at the same level, supports located on different elevations, effect of axial stiffness.

6. Deflections of Elastic Structures: Initial parameters method, Maxwell-Mohr method, deflections due to fixed loads, deflections due to change of temperature, displacements due to settlement of supports and errors of fabrication, graph multiplication method, elastic loads method, reciprocal theorems.

7. Force Method: Fundamental idea of the force method, canonical equations of force method, analysis of statically indeterminate structures, beams, frames, trusses, arches, computation of deflections of redundant structures, settlement of supports, temperature changes.

8. Displacement method: Fundamental idea of the displacement method, Kinematical Indeterminacy, canonical equations of the displacement method, beams, frames, side-sway frames with absolutely rigid crossbars, special types of exposures, settlement of supports, errors of fabrication, analysis of symmetrical structures.

9. Mixed Method: Fundamental ideal of the mixed method, Mixed indeterminacy and primary unknowns, primary system, canonical equations of the mixed method, computation of internal forces.

10. Influence Lines Method: Construction of influence lines by the force method: Continuous beams, Hinge-less arches, Statically indeterminate trusses, Construction of Influence Lines by the displacement method: Continuous beams, Redundant frames, Kinematical method for construction of influence lines.

PREFERRED TEXT BOOKS: Structural Analysis by A.Ghali, A.M.Neville, and T.G.BrownSixth Edition.

***REFERENCE BOOKS:**

GRADING PLAN:

Type of Evaluation	Weightage (in %)

Mid Sem-1 Exam	20
Mid Sem-2 Exam	20
End Sem Exam	40
Assignments	20

OUTCOME: The knowledge that is gained from this course should help the engineer in the modeling of structural analysis problems on computers using the commercial software.

REMARKS:

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TITLE : Advances in Robotics and Control
Course Code : ECE551
CREDITS : 4
TYPE-WHEN : Level-2 Elective, Spring
FACULTY NAME : Madhav Krishna + Abhishek Sarkar

Contents

Kinematics of Common Robot [3]
Omnidirectional, Aerial / Quadrotor, Differential Drive
RRT [1]
Trajectory Parameterization (Bezier Curves, Frenet Frames) [2]
Optimization Basics [2] Least Square, Nonlinear
Controller [1+4=5]
Tracking Controller, Pure Pursuit Controller [1]
Nonlinear Model Predictive Controller[4] or, Optimal Controller
LQG
LQR
Reinforcement Learning[4]
Function approximation
Effective representations
Approximate models
Prior knowledge or information
Uncertainty [2]
Markov Decision Process (MDP) [1]
Partially Observable Markov Decision Process (POMDP) [2]

GRADING:

2 Mid Semester Exams,
6 Assignments, and End Semester Exam

OUTCOME:

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

REMARKS:

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TITLE : **Adaptive Signal Processing**

Course Code : ECE441

Credits : 3-1-0-4

Type-When : Spring 2019

Faculty Names : Santosh Nannuru

Pre-Requisite : Signals and Systems, Digital Signal Processing, Probability

Theory and Random Processes

PRE-REQUISITE : Signals and Systems, Digital Signal Processing, Probability Theory and

Random Processes

COURSE TOPICS :

1. Review of Random Signal Theory & Discrete Time Systems

2. System Models: All Pole, All Zero. Pole-Zero models

Lattice structures, Direct to lattice conversions of AP, AZ, PZ systems

The problem of Spectral Factorization

3. Signal Models :

AR, MA,&AARMA Processes

Generation of Random processes and whitening

The AR process and Yule Walker equations

4. Introduction to Adaptive Signal processing & applications:

5. Statistical approach to ASP:

Mean Square Error Criteria

MSE Estimation

Properties of the Quadratic Error Surface

Levinson Durbin Method, Steepest Descent Method

Least Mean Square(LMS)

6. Data Dependant Approach to ASP:

Least square techniques

Geometrical interpretation

LS, WLS & their statistical properties

Orthogonalization techniques QR decomposition, House Holder Transformation,

Givens' Rotation, Graham Schmidt Orthogonalization

Recursive Least Square techniques

7. Applications:

Echo cancellation

Channel identification/equalization

BOOKS:

Statistical & Adaptive signal Processing by Manolakis, Kogan & Ingle, and McGraw Hill Pub.

Adaptive Signal Processing by Alexander

Adaptive Signal Processing by Widrow, Pearson Education.

GRADING:

Assignment – 10%

Project – 10%

2-Mid terms examinations – 40%

End term examination – 40%

OUTCOME:

On successful completion of this course, students should be able to demonstrate a theoretical understanding and problem solving skills of statistical and data dependent approaches to the adaptive signal processing.

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TITLE : ML for Natural Sciences
Course Code :
CREDITS : 4 credits
TYPE-WHEN : Science/CNS elective - Spring 2019
FACULTY NAME :U. Deva Priyakumar, Girish Verma, C. V. Jawahar, Prabhakar. B, Raghunathan Ramakrishnan (TIFR Hyd) and Vinod PK

PREREQUISITE : Statistical methods in AI (additionally Science-I and Science-II for non-CND students)

OBJECTIVE : This course will attempt to enable students along with faculty mentors to review the emerging utility of machine learning in natural sciences, and to apply state-of-the-art machine learning methods to solve problems in natural sciences.

COURSE TOPICS :

Application of machine learning in the following broad areas:

- Materials discovery
- Molecular design in chemistry and biology
- Higher-dimensional molecular potential energy surfaces
- Molecular simulations
- Bioinformatics

Additionally, lectures by scientists from academia and industry working in these areas.

PREFERRED TEXT BOOKS:
Review papers in the broad areas listed above published during the last three years; recent research articles related to the chosen project. Material will be provided from time to time.

***REFERENCE BOOKS:**
1. Introduction to Computational Chemistry by Frank Jensen
2. Modern Quantum Chemistry by Attila Szabo and Neil Ostlund

***PROJECT:** Major component of this course is a project during the last two-thirds of the semester. Students will form teams of two or three (one from CNS + one from CSE + one from

TIFR Hyderabad) to do projects. Each faculty member involved in the course will guide one or two teams with weekly meetings for discussions and assessment of the progress of the projects.

GRADING PLAN:

Grading will be based on literature review and project.

Type of Evaluation	Weightage (%)
(A) Literature review (30%)	
Class participation	10%
Presentation & term paper	20%
(B) Project (70%) - after Midsem-I	
Weekly progress (as assessed by faculty mentor)	20%
Intermediate presentations (once in two weeks)	20%
Final presentation	20%
Final Scientific report	10%

OUTCOME: An understanding of how AI/ML is applied for solving problems in natural sciences, and hand-on experience in problem solving.

REMARKS: This course is being offered on an experimental basis and will be continued to be offered based on the experience after suitable modifications. It is proposed that a limited number of students (6 CSD/CSE Honors + 6 CND + up to 6 early-PhD students from TIFR) will be interviewed and selected for this course.

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TITLE **:Big Data and Policing**

Course Code **:**

CREDITS **:**4

TYPE-WHEN **:**Spring 2019

FACULTY NAME **:PonnurangamKumaraguru**

PRE-REQUISITE **:** Anybody from 5th semester and beyond in B.Tech. and anybody from M.S / M.Tech. / Ph.D.

OBJECTIVE **:**With increasing use of latest and lethal technologies by criminals, it demands that the police organizations also become very tech savvy and use the latest technologies available or build technologies that may be needed for their purpose. In particular, in India there are multiple government initiatives like Police Modernization Schemes which are

enabled to advise, build, and deploy technologies that will be useful for smart policing. There is a lack of detailed understanding of the policing problems in academia in India, where technologies can play a big role in helping the day-to-day policing activities. Aim of this course is to explore some of the pain points of policing,and develop strategies / technologies / methodologies for addressing the problems. Course will help enable the flow of information between the Police organizations and Academia in a modest way through this course. In particular, thefocus of the course will be on large data that is getting generated across platforms and infrastructure that could be used effectively for policing. Gaining these skills will enable students to build appropriate technologies in future which can be very useful and have a large impact on the society.

COURSE TOPICS :

1. Policing 101
    a. Different aspects of policing – Law & Order, Investigation / Forensics, Intelligence gathering
    b. Role of technologyin policing
    c. Crime and Criminology
2. Big Data 101
    a. Foundations of big data systems
    b. Data that gets generated which can be useful for policing
    c. Big data tools and its applications
3. Predictive Analysis
    a. Using big data for predicting crime
    b. Open source data
    c. Open source tools
    d. Geographic Information Systems (GIS) & Crime mapping
4. Cyber, Digital, & Mobile Forensics
    a. Digital evidence acquisition / seizure
    b. CDR analysis
5. Social Media
    a. Using social media for collective / citizen policing
    b. Drawing actionable information from social media
    c. Platforms and mechanisms to push information on social media
6. Ethical & Legal aspects of policing
    a. IT ACT 2000
    b. Legal aspects of cybercrime
    c. Privacy issues

PREFERRED TEXT BOOKS: None. All course material will be shared with students beforehand, there will be pointers / code, etc.

***REFERENCE BOOKS:**

***PROJECT:**Students will undertake projects that are directly relevant and motivated by policing needs; some officers have already shared the kind of projects that they would like the students to undertake in the course.

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	-
Mid Sem-2 Exam	5
End Sem Exam	5
Assignments	20
Project	48
Term Paper	10
Other Evaluation • Class participation • Poster presentation	 2 10

OUTCOME: Students will be able to:

1. List various aspects of policing and how technologies can help policing, especially using large amount of data that is getting generated on various platforms.
2. Describe different technologies that are currently being used for solving day-to-day problems in policing in India.
3. Describe pain-points for doing effective policing in India, inparticularusing technologies.
4. Design, implement and evaluate 2 technologies that will address the pain-points of policing.

REMARKS:

I have discussed this course with multiple law enforcement officers, they are excited about it, some of them will also participate in the course through guest lectures, sharing project ideas, discussing case studies, project evaluation, etc. Some officers have already committed to share their views in the class.

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Title: **Linguistic Data 2: Collection & Modeling**
Credits : 3-1-0-4
Course Code: **CLG452**
When : Spring 2019
Course Instructor : **Radhika M + Aditi Mukherjee + Dipti M Sharma**
Prerequisites : CL1 or NLP/SMAI

● Expected Background : To follow this course, some level of familiarity with linguistics, computational linguistics, especially syntax, and machine learning is expected.

● Limit : 15

● Objective : The exponentially growing popularity of social media and user generated web content is producing huge amounts of textual data. This social data produced by multilingual speakers tends to be codemixed

where a sentence, be it a comment or a
review, is written in more than one language. Analyzing and building tools for social media code mixed data is a new and significant research problem. This course will teach students how to deal with such supposedly noisy data. It will include building and gathering relevant data (e.g. social media HindiEnglish
Code Mixed data) and then
using the data to solve research problems (e.g., parsing social media code mixed data). It is a practical course and would equip the students to tackle their research problems better.

- Course topics :
  - Understanding Social Media Code Mixed Data (CMST)
  - Understanding CMST pipeline
  - Data creation, annotation and system implementation for:
    - Language Identification
    - Normalization
    - Transliteration
    - POS tagging
    - Shallow Parsing
    - Full Parsing (if time permits)
- Course website : To be created
- Project
  - Language Identification
  - Normalization (along with Transliteration)
  - POS tagging
  - Annotated data along with report
- Grading : The accuracies below will be multiplied with the weights mentioned next to it to compute the final score.
  - The accuracy of Language Identification 10%
  - The accuracy of Normalization (along with Transliteration) 20%
  - The accuracy of POS tagger 20%
  - The accuracy of annotated data and quality of report 50%

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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**

Course Code: CSE586

Type When: Spring 2019

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: **Computer Aided Drug Design (CADD)**
COURSE CODE: SCI760
CREDITS: 4
TYPE-WHEN:Elective
FACULTY NAME: **Deva Priyakumar**
PRE-REQUISITE:
Molecular architecture or advanced biomolecular architecture or equivalent. Those who are interested in taking the course and do not have one of these prerequisites; please talk to the course instructor.
OBJECTIVE:
This course aims to introduce principal concepts in drug design, and specifically the role of computational models. Various methods that are used in computer aided drug design would be discussed, and the basic principles to understand these methods will also be taught.
COURSE TOPICS:
Course overview and Introduction (What to expect for the next 15 weeks)
Introduction to few computational methods
-Potential energy surface
-Force Field parameters
-Conformational analysis
-Energy calculations using molecular mechanics

-Free energy of binding
-Basics of chemical bonding
Drug design
-Drug
-Traditional drug design
-Drug-receptor interactions
-Biological activity and various measures
-Importance of computational methods in drug design Databases
-biomolecules & small molecules
Ligand based drug design
-Structure activity relationship
-Quantitative structure activity relationship (2D & 3D methods)
-QSAR parameters
-QSAR validation
-Pharmacophore based models
Structure based drug design
-Docking
-Discussion of various common algorithms
-Protein flexibility in docking
-Scoring functions
-De novo drug design
Molecular similarity analysis
ADME-T prediction
Advanced topics in drug design (Student Seminars)
PREFERRED TEXT BOOKS:
Textbook of drug design & discovery (Ed. Krogsgaard-Larsen & Lilijefors and Madsen) 2001, CRC; Pharmacophore perception, development, and use in drug design (Ed. Gunter) 2000, IUL; Molecular modeling: principles and applications (Leach) 2001, Prentice Hall; Molecular modeling and simulations (Schlick) 2002, Springer.

***REFERENCE BOOKS:**

Material will be given from time to time

***PROJECT:**

GRADING:

Exams-40% (10 + 10 + 20);
Assignments-40%;
Lab Assignment-10%;
Seminars/Quiz-10%

OUTCOME:

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

Remarks:

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Title: **Comprehension of Indian Music**
Course Code: **HSS337**
Faculty name: TK. Saroja
Type-When: Humanities Elective, Spring 2019
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%

TITLE : Computer Vision

Course Code: CSE578

CREDITS : 3-1-0-4

TYPE-WHEN : Spring 2019

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, Pearson Education Inc.
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TITLE : Computational Linguistics 2
Course Code : CLG422
CREDITS : 3-0-0-4
TYPE-WHEN : Spring 2019
FACULTY NAME : Radhika M + Dipti M Sharma

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:

HA	10,
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 **: Critical Thinking**
Course Code **: TS17001**
CREDITS **:** 4
Semester **:** Spring-2019
FACULTY NAME **:** Nishad Patnaik

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 : Database Systems

COURSE CODE: CSE441

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.

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TITLE : Design of Hydraulic Structures
Course Code : CEW612
CREDITS : 3-1-0-4
TYPE-WHEN : Spring-2019
FACULTY NAME : Dr. Shaik Rehana

PRE-REQUISITE : Nil
OBJECTIVE : To develop a detailed understanding about the design aspects of the hydraulic structures those are constructed for the purpose of storage, diversion, conveyance and distribution of water.
COURSE TOPICS :

- Introduction of Hydraulics: Fluid Properties and Classification, Hydrostatics, Equation of Motion, Continuity Equation, Flow Measurements
- Introduction of types of hydraulic structures: Storage, Diversion, Conveyance and Distribution structures
- Gravity Dams: Site selection, Forces, Stability analysis, Modes of Failure
- Reservoirs: Storage Capacity of a Reservoir and Design aspects, Reservoir operation and irrigation water management, hydropower potential and storage capacity
- Design of Diversion Works: Weirs and Barrages, Spillways
- Canal irrigation System; hydraulics of alluvial channels; Sediment transport and design of irrigation canals

REFERENCE BOOKS:

- *Hydraulic Structures*, P. Novak, A. I. B. Moffat, C. Nalluri and R. Narayanan, Taylor and Francis, U. K
- Irrigation Engineering and Hydraulic Structures- Garg S.K- Khanna Publishers N.D.13th ed, 1998.
- Irrigation and Water Resources Engineering by G. L. Asawa, New Age International Publishers, 2008.

Grading Policy:

Assignments =10 %
Mid Sem I = 20 %
MID Sem II =20 %
Project = 20%
Final Exam =30 %

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TITLE : Differential Equations
Course Code : IMA303
CREDITS : 3-1-0-4
TYPE-WHEN : Elective, Spring-2019
FACULTY NAME : Dr. BS Lakshmi
PRE-REQUISITE : Calculus
Max.Limit :

OBJECTIVE : To understand the basic concepts of elementary differential equations, to learn to solve certain forms of first order and second order differential equations and applications.

To be able to use mathematical modeling of some physical phenomena using differential equations.

COURSE TOPICS :

1. First order ODEs
2. Second order ODEs
3. Higher order ODEs
4. Systems of equations
5. Phase-plane analysis
6. Laplace Transforms
7. Series Solutions
8. Mathematical modeling
9.

PREFERRED TEXT BOOKS:

Boyce di-Prima, Elementary Differential Equations and Boundary Value Problems (John Wiley and sons, Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley

***REFERENCE BOOKS:** Differential equations, dynamical systems and an Introduction to Chaos, Hirsch,M.W., Smale and Devaney (Elsevier), Differential Equations, S.L.Ross (John Wiley and sons)

George F. Simmons, Differential Equations With Applications and Historical Notes

***PROJECT:**

GRADING:

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

OUTCOME:

Upon successful completion of the course the student must be able to

1. Solve first order differential equations using the techniques of separation of variable, integrating factors, power series and Laplace transforms. Understand the existence and uniqueness
2. Use Euler's method to approximate solutions for first order ODEs
3. Find general and particular solutions of second order linear ODEs using the techniques of undetermined coefficients, variation of parameters, power series and Laplace transforms.
4. Solve homogeneous first order systems of linear ODEs
5. Use direction fields, phase lines and phase portraits to qualitatively analyze the solutions to differential equations.
6. Understand how to model simple physical phenomena using differential equations.

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TITLE : Distributed Systems
Course Code : CSE431
CREDITS : 4
FACULTY NAME : K. Kishore

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.

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TITLE : Disaster Management
Course Code : CES442
Credits : 3-1-0-4
Type-when : Spring-2019
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 : Digital VLSI Design
Course Code : **ECE463**
Credits : 04
Faculty Name : Dr. Zia Abbas
Pre-requisite : Basic Electronics
Course Topics :

Unit 1: Introduction to digital design, Digital design metrics (Performance, Power, Functionality, Robustness, etc.) and their discussion in general, why low power, why high performance, Power-delay optimal designs, why technology scaling, issues in state of the art digital designs i.e. making modern digital circuits, corner based nanoscale design, statistical circuit design.

Expected outcome:After completing Unit-1, the respective students (in general) will be able to understand the historical background that drive to the development of state of the art VLSI digital circuits, the importance of low power, high-performance and power-delay optimal designs, state of the art design issues in digital circuits, the difference between corner based and statistical variations aware designs.

Unit 2: CMOS Process Technology: Silicon Semiconductor technology, Manufacturing CMOS Technology (Silicon wafer, photolithography, processing steps), Packing and testing, Interconnects, layout design, Layout versus Schematic (LVS), Design Rule Check (DRC), Process parameters and their impact on device performance, stick diagrams.

Expected outcome:Students will be able to understand the main steps in the fabrication of CMOS technology. They will able to perform layout design for CMOS circuits. Understand modern IC Layout design techniques including Design Rule Check (DRC), Layout Versus Schematic (LVS), and layout parasitic extraction. Afterward, they will be able understand the important sources of process variations due to non-idealities of the manufacturing process.

Unit 3: MOSFET Circuits : MOS Capacitor, Electrical Characteristics of MOS Transistors, Threshold Voltage, Transconductance (g_m), Body Effect, Channel-Length Modulation, MOS Transistors as a Switch, MOS Inverter, Switching Characteristics, Delay-Time Estimation, Resistance Estimation, Area Capacitance, Driving Large Capacitive Loads, CMOS Realization,

Switching Characteristics, CMOS NAND, NOR and other basic combinational/sequential circuits, CMOS Complex circuits.
Complementary CMOS, Pass transistor logic, Dynamic CMOS design, Transmission gate, BiCMOS technology.

Expected outcome:Students will get familiar with the structure of various types of MOS transistors, characteristics of MOS transistors, operation of the MOS transistor, three different modes of operation (accumulation, depletion, and inversion), Electrical characteristics of MOS transistors. Basic characteristics of a CMOS inverter followed by its noise margin, Switching characteristics of MOS inverters, Various delay parameters, different circuit configurations, delays/power estimation of full-adder, mux, AO/AOI cells, flip-flip, latch, parity checker, priority encoder, multiplier, ALU, and other ISCAS benchmark circuits, etc.

Unit 4: Digital Design - From Power perspective: Introduction, Dynamic power dissipation (Short-Circuit and Switching), Dynamic Power in the Complex Gate, Switching Activity, Switching Activity of Static CMOS Gates, Transition Probability in Dynamic Gates, Power Dissipation due to Charge Sharing, Static i.e. Leakage Power Dissipation (leakage mechanism): p–n Junction Reverse-Biased Current, Band-to-Band Tunnelling Current, Tunnelling through and into gate oxide, Injection of hot carriers from substrate to gate oxide, GIDL, Punch-through, Subthreshold Leakage Current including DIBL. Impact of technology scaling on leakage currents/power, need for technology scaling, factors effecting the leakage current especially in scaled technology nodes (input pattern dependency, stacking effect, loading effect, etc.), Impact of process, temperature and supply voltage variations on leakage currents. Internal node voltage impact.

Expected outcome:Students will be able understand the various sources of power dissipation. Various mechanism affecting the different leakage components in CMOS circuits. They will be able to understand, how technology scaling is enormously increasing the leakage current, and also the impact of process and operating variations on dynamic/static power dissipation.

Unit 5: Digital Design - From Performance (i.e. delay) perspective: Computing the Capacitances, Propagation delays, Factors affecting the propagation delays, Mathematical formulation of the delays in CMOS circuits, Technology scaling impact on propagation delays, Mean and variance of the delays in a gate, Impact of process variations on delays in CMOS circuits, Impact of operating (temperature and supply voltage) variations on delays.

FinFET technology will also be discussed in parallel. Such delay/leakage estimation techniques will also be applied on FinFET circuits.

Expected outcome:Students will be able understand the delays mechanism in circuits, mathematical formulation of delays in CMOS circuits. They will also be able to understand the impact of process and operating variations on propagation delays.

Recommended books:

- Jan M. Rabaey, A. Chandrakasan, B. Nikolic “Digital Integrated Circuits- A Design Perspective, PHI.

- Douglas A. Pucknell, K. Eshraghian, “Basic VLSI Design”, 3rd Edition, Prentice Hall of India.
- Neil H. E. Weste, K. Eshraghian, “Principles of CMOS VLSI Design”, A Systems Perspective, 2nd Edition, Pearson Education Pvt. Ltd.

Journals:

- IEEE Transactions on Very Large Scale Integration (VLSI) Systems
- IEEE Transactions on Computer-Aided Design of Integrated Circuits
- Microelectronics Journal, Elsevier
- Integration, The VLSI Journal, Elsevier

Grading Scheme:

Assignments	: 10%
Quiz	: 10%
Mid-Semester	: 20%
End-Semester	: 30%
Project	: 30%

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TITLE : Earthquake Engineering
Course Code : CES641
CREDITS : 3-1-0-4
TYPE-WHEN : Spring 2019
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:**Electromagnetism and Optics**
Course Code: **SCI438**
CREDITS:4 (3-1-0-0)
TYPE-WHEN:Spring 2019
FACULTY NAME:**Prabhakar Bhimalapuram**
PRE-REQUISITE:None
OBJECTIVE:
Understand
Maxwell Equations as the central unifying ``principle'' of electromagnetic phenomena. And provide introduction to modern optics.
COURSE TOPICS:
One half of the course (~12 lectures and about 5 tutorials) will directly deal with Electromagnetism, starting with Maxwell Equations.
The second half (~12 lectures and 5 tutorials) will deal with optics; after a short overview of geometric optics.
Following are the topics in their rough chronological order:
A-1. Maxwell Laws of electromagnetism; Electrostatics and Magnetostatics; scalar and vector potentials
A-2. Poisson & Laplace equations; named laws in electromagnetism.
A-3. Dielectrics and their polarisation; use in capacitors.
A-4. Electromagnetic radiation: Light
A-5. Plane wave solutions to Maxwell Equations in vacuum;
A-6. Light polarization. Other effects on radiation propagating in medium.

B-1. Various physical properties of light
B-2. Phenomena of diffraction: models
B-3. Scalar theory of light: Helmholtz equation. Kirchoff formulation. Rayliegh -Somerfield formulation. Huygens-Fresnel Principle.
B-4. Holography.
B-5. Introduction to non-imaging optics, statistical optics.
B-6. Theory of lasers
B-6. Overview of working of a few optical instruments (telescope, microscope, camera, Atomic Force Microscopes,compound lenses etc)
PREFERRED TEXT BOOKS:
1) Feynman Lecture notes on Physics, Volume II. (for electromagnetism)
2) Feyman Lecture notes on Physics, Volume I (for optics)
3) Optics, by Ajoy Ghatak.(for Wave optics)
*REFERENCE BOOKS:
*PROJECT:
GRADING:
Every week will have one homework, but need not be submitted. Every week, the tutorial will start with a quiz (30min), so approximately 10 quizzes will be conducted; of these ~10 quizzes, marks from top 8 quizzes will be considered for grading purposes.
1) Quizzes: ~ 10 quizzes of which top 8 will be considered: 30%
2) In class work: small problems, participation: 10%
3) Exams: Midsem-1 and Midsem-2, 15% each: 30%
4) Endsem exam: 30%
OUTCOME: The student after taking this course will be able to appreciate and use Maxwell Equations as the central tool for estimating and computing various optical phenomena.
Remarks:

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TITLE **: Environment and Politics in India**
Course Code **: TS18006**
CREDITS **:** Four
TYPE-WHEN **:** Spring 2019
FACULTY NAME **:** Radhika Krishnan

PRE-REQUISITE **:**
UG 3, UG 4. Students who have attended the Introduction to Sociology/ Introduction to Politics courses will be preferred.

OBJECTIVE **:** This course aims to introduce students to concepts of environmental justice, environmental politics and environmental citizenship. It will touch upon environmental history and the emergence of 'environment' as a concern globally as well as in India. The course will deal with the dynamics around environmental legislation (including legislation related to forests, conservation and climate change), as well as environmental concerns in urban India. It will look at how environmentalism in the global North is substantially different from environmentalism in the

global South, by studying their respective demands, agendas, strategies and concerns. This course is essentially intended at understanding environment as a political agenda, the reasons for its emergence and the limitations the environmental movement faces in India and elsewhere.

COURSE TOPICS:

(1) Environmental History, Emergence of 'environment' as a discourse
(2) Principles of Environmental Justice and Environmental Citizenship
(3) Indigeneity and the Environmental Question
(4) Environmental Legislation – Land, Air, Water, Forests, Climate Change, Wildlife Conservation
(5) Environmental Politics in Urban India

PREFERRED TEXT BOOKS:

(1) Archana Prasad (ed.), *Environment, Development and Society in Contemporary India: An Introduction* (New Delhi: MacMillan India, 2008).

(2) Ramachandra Guha and Joan Martinez Alier, *Varieties of Environmentalism: Essays North and South* (London: Earthscan, 1997).

***REFERENCE BOOKS:**

Alpa Shah, *In the Shadows of the State: Indigenous Politics, Environmentalism and Insurgency in Jharkhand, India* (New Delhi: Oxford University Press, 2011).

Amit Prakash, *Jharkhand: Politics of Development and Identity* (New Delhi: Orient Longman, 2001).

Amita Baviskar, *In the Belly of the River: Tribal Conflicts over Development in the Narmada Valley* (New Delhi: Oxford University Press, 2004 [reprint, 1995]).

Andrew Dobson, *Environmental citizenship and pro- environmental behavior* (Rapid research and evidence review, The Sustainable Development Research Network, 2010).

Anil Agarwal et.al., *State of India's Environment: The First Citizens' Report* (New Delhi: Centre for Science and Environment, 1982).

Anil Agarwal, *The Anil Agarwal Reader Volume I* (New Delhi: Centre for Science and Environment, 2008).

Anil Agarwal, *The Anil Agarwal Reader Volume II* (New Delhi: Centre for Science and Environment, 2008).

Anil Agarwal, *The Anil Agarwal Reader Volume III* (New Delhi: Centre for Science and Environment, 2008).

Archana Prasad, *Environmentalism and the Left: Contemporary Debates and Future Agendas in Tribal Areas* (New Delhi: Left Word Books, 2004).

Darryl D'Monte, *Temples or Tombs? Industry Versus Environment Three Controversies* (New Delhi: Centre for Science and Environment, 1985).

Jairam Ramesh, *Indira Gandhi: A Life in Nature* (New Delhi: Simon and Schuster, 2017).

Joan Martinez-Alier, *The Environmentalism of the Poor: A Study of Ecological Conflicts and Valuation* (New Delhi: Oxford University Press, 2005).

John Bellamy Foster, *Marx's Ecology: Materialism and Nature* (Kharagpur: Cornerstone Publications, 2001).

Madhav Gadgil and Ramachandra Guha, *This Fissured Land: An Ecological History of India* (New Delhi: Oxford University Press, 1992).
Mahesh Rangarajan (ed.), *Environmental Issues in India: A Reader* (New Delhi: Pearson Longman, 2008).

Mahesh Rangarajan and K. Sivaramakrishnan (eds.), *India's Environmental History: A Reader Volumes 1 and 2* (New Delhi: Permanent Black, 2013).

Mukul Sharma, *Green and Saffron: Hindu Nationalism and Indian Environmental Politics* (New Delhi: Permanent Black, 2012).

Raka Ray and Mary Katzenstein (eds.), *Social Movements in India: Poverty, Power, and Politics* (Lanham, MD: Rowman and Littlefie, 2005).

Ram Dayal Munda and S. Bosu Mullick (eds.), *The Jharkhand Movement: Indigenous Peoples' Struggle for Autonomy in India* (Denmark: International Work Group for Indigenous Affairs, 2003).

Ramachandra Guha, *Environmentalism: A Global History* (New Delhi: Oxford University Press, 2008).

Ramachandra Guha (ed.), *Social Ecology* (New Delhi: Oxford University Press, 1994).

Rohan D'Souza, *Drowned and Dammed: Colonial Capitalism and Flood control in Eastern India (1803-1946)* (New Delhi: Oxford University Press, 2006).

Sanjay Sangvi, *The river and life – story of the Narmada Bachao Andolan* (Kolkata: Earthcare Books, 2002).

T.K. Oommen (ed.), *Social Movements Part II*: *Concerns of Equity and Security* (New Delhi: Oxford University, 2010).
Wolfgang Sachs, *Environment and Human Rights* (Wuppertal: Wuppertal Institute for Climate, Environment, Energy, 2003).

W.M. Adams, *Green Development: Environment and sustainability in the Third World* (London and New York: Routledge, 2001).

***REFERENCE ARTICLES/DOCUMENTS:**

ILO Convention 169 concerning Indigenous and Tribal Peoples in Independent Countries.

ILO, 'Indigenous & Tribal Peoples' Rights in Practice. A guide to ILO Convention No. 169' (2009).

J. Tarter, 'Some live more downstream than others', in J. Adamson et.al. (eds), *The Environmental Justice Reader* (Arizona: University of Arizona Press, 2002), 213-228.

P. Mohai et.al, 'Environmental Justice', *Annual Review of Environment and Resources* 34 (2009): 405-430.

'The Principles of Environmental Justice', *First National People of Color Environmental Leadership Summit* (1991).

United Nations Declaration on the Rights of Indigenous Peoples. 2008.

***PROJECT:** None.

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	
Mid Sem-2 Exam	**20%**
End Sem Exam	**40%**
Assignments	
Project	
Term Paper (In Lieu of Mid Sem-1)	**2 Assignments (20%)**
Other Evaluation (Term Paper and Presentation)	**20%**

OUTCOME: Students are expected to get an overview of the various debates around environment in India. Through an overview of global and Indian environmental history, an introduction to environmental legislation and environmental politics, they will be asked to think about the contexts in which the 'environmental discourse' operates. Students are expected to critically reflect upon the political construction of 'environment' in India, along with its limitations.

REMARKS: The course will be based on lectures and the students will be expected to read books and articles mentioned in the reading list. Students will be expected to write assignments/tutorials in class, on various questions discussed in class. The term paper is expected to be an original work, reflecting on the dynamics of environment in the Indian context.

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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 : Flexible Electronics

Course Code : ECE562

CREDITS : 3-1-0-4

TYPE-WHEN : Level 2 – Spring semester

FACULTY NAME : Dr. Aftab M. Hussain

PRE-REQUISITE : -

OBJECTIVE : To make students familiar with the different micro-machining techniques in use in semiconductor fabrication, along with knowledge of the state-of-the-art of flexible electronic systems.

COURSE TOPICS :

1. Unit one: a) Clean room environment, analysis of semiconductor fabrication techniques such as lithography, dry and wet etching, oxidation, thin film deposition and implantation.

b) Silicon electronics and non-silicon electronics

c) Need for non-silicon and flexible electronics – study of use cases and applications

2. Unit two: (Constraints on flexible electronics – material selection) a) Carbon based electronics such as graphene and CNTs

b) 2D atomic crystal structure materials

c) Commercial applications of novel electronic materials

3. Unit three: (Constraints on flexible electronics – process selection) a) Organic and polymer electronics

b) Various fabrication techniques for flexible electronics such as microfabrication, inkjet printing, 3D printing etc.

c) Large area flexible electronics (electronic fabric)

d) Stretchable electronics

REFERENCE BOOKS:

1. “Introduction to Microfabrication”, Sami Franssila, Wiley VCH, 2010

2. “Large Area and Flexible Electronics”, Mario Caironi , Yong-Young Noh, Wiley VCH, 2015

3. “Stretchable Electronics”, Takao Someya, Wiley VCH, 2013

PROJECT:

Students will be expected to fabricate flexible electronics circuits using flexible PCBs and surface mount components (groups of two). All necessary trainings for this will be provided during the course.

GRADING PLAN: Type of Evaluation	**Weightage (in %)**
Mid Sem-1 Exam	**15**
Mid Sem-2 Exam	**15**
End Sem Exam	**40**
Assignments	**-**
Project	**20**
Term Paper	**-**
Class quizzes	**10**

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TITLE **:** Fiber Optic Communication Systems

Course Code :
CREDITS : 4
TYPE-WHEN : Spring 2019
FACULTY NAME : Kavita Vemuri (plus one or two guest lectures)
PRE-REQUISITE : Electromagnetic Theory
OBJECTIVE : Introduction of lightwave propagation for communication.

COURSE TOPICS :

1. Introduction - will cover the why of FO communications, revise analog/digital signals, modulation formats, the lightwave system components (examples of long haul cable networks & FTTH).
2. Optical Fibers – geometry, wave propagation, dispersion in single-mode fibers, loss and intro to non-linear effects.
3. Transmitters/Receivers – LED's Semiconductor lasers, design, receiver noise, photodetector, sensitivity.
4. System design and performance – architecture, design, power penalty
5. Coherent lightwave systems – homo-heterodyne detection, modulation formats, BER.
6. Optical amplifiers – laser amplifiers, fiber Raman, system applications.
7. Dispersion compensation – introduction to fiber Bragg gratings, broadband compensation (time & wavelength division multiplexing)

PREFERRED TEXT BOOKS:
Fiber Optic Communication Systems by Govind P Agrawal, 4th edition

***REFERENCE BOOKS:**
Few reference papers.

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-2 Exam	30
End Sem Exam	40
Assignments	20
Other Evaluation ___quiz_____	10

OUTCOME: Understanding the difference between electrons & photons in communication systems. The advantages and advances in FO systems. Analysis of FO signals as compared to electronic signals.

REMARKS: If possible, can include a project but requires at least a 1550nm laser source & a receiver. Else, they can meet companies which have installed FO's and FTTH to understand the issues.

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TITLE **: Foundation Engineering & Design**
Course Code **: CEF631**
CREDITS **:** 3-1-0-4
TYPE-WHEN **:** Electives for I year M.Tech CASE
FACULTY NAME **:** Pradeep Kumar R

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-2K19
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 : **GENDER AND SOCIETY**
Course Code : **TS19008**
CREDITS : **4**
TYPE-WHEN : **Spring**
FACULTY NAME : Sushmita Banerji
PRE-REQUISITE : None
OBJECTIVE : To introduce students to basic concepts in gender theory and Feminist practice and help students locate themselves using these concepts. Literature and film shall be taught to demonstrate the various ways in which popular culture establishes, represents, perpetuates, and occasionally disrupts gender roles.

COURSE TOPICS :

Unit 1: Core concepts and terms

Differences between terms like Gender, Sex, Normative and Non-normative sexuality, Trans-bodies.

Unit 2: <u>Power, Ideology and Intersectionalities</u>

Concepts of Power, Ideology, Patriarchy, and Privilege. What are intersectionalities, and why is it important to study them when we study gender? Gender and Class – what do we mean by class; how class modifies/intensifies the experience in the workplace, science, education, home Gender and Caste – what do we mean by caste; how class modifies/intensifies the experience in the workplace, science, education, home.

Unit 3: <u>Representation of Gender</u>

A: Who writes women? Short Stories on, about, and by women.
B: Films - Three films. Popular representations of women. How does the popular visual circulation affect gender politics.

PREFERRED TEXT BOOKS:

Adichie, Chimamanda Ngozi (2014). We Should All Be Feminists. Fourth Estate.

Beauvoir, Simone (1997), ""Introduction" to The Second Sex", in Nicholson, Linda, The Second Wave: a Reader in Feminist Theory, New York: Routledge, pp. 11–18.

Menon, Nivedita (2012), *Seeing Like a Feminist.* New Delhi, Penguin.

***REFERENCE BOOKS:**

Bhasin, Kamla (1999), Understanding Gender. India, Kali for Women.

Butler, Judith (1990), Gender Trouble: Feminism and the Subversion of Identity, New York: Routeledge.

Freedman, Estelle B. (ed) The Essential Feminist Reader. New York: Modern Library, 2007.

McCann, Carole R. and Seung-Kyung Kim, eds. Feminist Theory Reader: Local and Global Perspectives. New York: Routledge, 2003.

Mazumdar, V. *Emergence of Women's Question and Role of Women's Studies.* New Delhi: Centre for Women's Development Studies, 1985.

Kumar, Radha (2002), *A History of Doing: Movements for Women's Rights and Feminism in India, 1800-1990.* India, Kali For Women.

Tharu, Susie and K. Lalita eds. *Women Writing in India: 600 B.C. to the Present. I and II. Delhi: Oxford University Press, New York: Feminist Press and London: Harper Collins, 1990-1993.*

Uberoi, Patricia (2006) Freedom And Destiny: Gender, Family, And Popular Culture In India. USA: Oxford University Press.

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-2 Exam	**20%**
End Sem Exam	**30%**
Assignments	**20%**
Term Paper	**30%**

OUTCOME: Students will have increased familiarity with contemporary issues in gender discourse. They will be able to question their prior opinions and think in more informed ways about the nature of gender relations, individual roles, and socio-cultural formations.

REMARKS: Students are expected to read up to 30 pages a week and attend film screenings when required.

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TITLE **:**Hydroinformatics
Course Code **: CEG462**
CREDITS **:**3-1-0-4
TYPE-WHEN **:**Engg Elective - Spring 2019
FACULTY NAME **:**Dr. Shaik Rehana
PRE-REQUISITE **:**Nil

OBJECTIVE: The goal of the course is to teach the principles and operation of Hydroinformatics in water management with the application of information technology

COURSE TOPICS:

Acquisition and Processing of Hydroinformatics Data: Automated data collection, data storage, file formats and standards, web-based data distribution, access and processing, geographic information system;digital image processing, digital elevation modeling.

Technologies in Hydroinformatics: Regression, Stochastic Models, Optimization, Data Driven Models

Application of Hydroinformatics: Operation, management and decision making, development of decision support systems for water, agriculture, energy, climateand environment

Grading Policy:

Assignments =40%
Mid Sem I = 10 %
MID Sem II =10 %
Project = 20%

Final Exam =20%

REFERENCE BOOKS:

- Introduction to Geographic Information Systems by Kang-Tsung Chang
- Geographical information systems and science by Paul A. Longley, Michael F. Goodchild, David J. Maguire, and David W. Rhind
- Haan, C.T., Statistical Methods in Hydrology, East West Publishers, 1998
- Remote Sensing and Image Interpretation by Lillesand, T., Kiefer, R. W., and Jonathan Chipman.
- Lo, C. P., and Albert K. W. Yeung., Concepts and techniques of geographic information systems by C P Lo and Albert K W Yeung

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TITLE : ICTs for Development [ICT4D]
Course Code : CSE595
CREDITS : 4
TYPE-WHEN : Spring 2019 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
Introduction to the idea of Development:
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 2019

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: Medical Image Analysis
Course Code: ECE575
CREDITS:3-1-0-4
TYPE-WHEN: Spring2019
FACULTYNAME: Jayanthi Sivaswamy
PRE-REQUISITE: Digital image processing (preferred)
OBJECTIVE : Medical images are a vital and widely used source of diagnostic information. From simple X-rays to SPECT and FMRI such images provide a window into the functioning of human bodies and other organisms. Processing of medical images is needed for various purposes ranging from providing high quality information for visual inspection and guidance for surgeries, to extracting higher order information about the condition of different issues/organs/structures. This course will provide an hands-on introduction to the exciting area of medical image processing, an area of focus for several major international conferences.
COURSE TOPICS :
1.Physics of medical imaging Optical,X-ray, acoustic, magnetic and nuclear
2.Fundamentals Types of images, data formats, tools for medical image processing (ITK, VTK)
3.3D and nD image processing
4.Problems in med IP Image conditioning illumination/geometric correction, denoisingSegmentation Geometric and other methods Rigid and non-rigid image registration and Fusion Reconstruction
5.Validation of results Signal detection theoretic issues
PREFERRED TEXT BOOKS:
*REFERENCE BOOKS:Fundamentals of medical imaging by Paul Seutens, Cambridge University Press. Handbook of Medical Imaging, Vol 2: Medical image processing and analysis, by Jacob Beutel and Milan Sonka. Geometric methods in medical image processing by Ravikanth Malladi. Medical image processing-reconstruction and restoration by Jiri Jan. Medical Imaging Systems, by Albert Macouski, Prentice Hall, New Jersey.
*PROJECT:
GRADING:
2 midsem exams (40%) + 1 final project (30%)+ assignments using ITK (National Library of Medicine Insight Toolkit) an open source software library (30%).
OUTCOME:
REMARKS

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TITLE **: Modeling and Simulations**
CREDITS **:** 3-0-1-4
TYPE-WHEN **:** Bouquet core & Open elective, Spring 2019
FACULTY NAME : Prabhakar B + Suresh Kumar NV

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 : CSE588
CREDITS : 4
TYPE-WHEN : Spring 2019
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 three projects:

1) requires conducting experiments on human subjects to study any one of the topics covered in the class (perceptual study)
2) design solutions to problems using signal processing and pattern classification (focusing on the field of MIR)
3) music and neuroscience based project (data will be provided by the instructor)

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/Music Perception: Auditory system, pitch, timbre, rhythm

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

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 when needed.

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

GRADING(indicative only):

Mid-term Exam (1): 10%
Final Exam: N/A
Project 1 : 20%
Project 2 : 20%
Project 3 : 30%
Quizzes/ Assignments: 15%
Class Attendance and Participation: 5%

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 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 : **Multivariate Statistical Inference**
Course Code :
CREDITS : 4
TYPE-WHEN : Spring
FACULTY NAME : M. Venkateswarlu
PRE-REQUISITE : Statistics

OBJECTIVE :The course aims at the coverage of statistical methods that infer information from the datasets that are obtained by measurements on several variables and to look at the underlying probability model.

COURSE TOPICS :

1. Preliminaries: Organization of data, Statistical distance, Geometry of the sample, Random samples, expected values of the sample mean and covariance matrix, Generalized variance, Matrix operations for sample mean, covariance, and correlation, Linear combination of variables.

2. Matrix Algebra and Random Vectors: Positive definite matrices, Quadratic forms, Spectral decomposition of a matrix, Square-root matrix, Random vectors and matrices, Mean vectors and covariant matrices, Matrix inequalities and maximization

3. Multivariate Normal Distribution: Multivariate normal density, Sampling from a multivariate normal distribution, Maximum likelihood estimation, Sampling distributions, Large-sample behavior, Assessing the assumption of normality.

4. Inferences About a Mean Vector: Testing a multivariate mean vector, Likelihood ratio tests, Confidence regions, Simultaneous comparison of component means, Large sample inferences about a population mean vector.

5. Comparison of Several Multivariable Means: Paired comparisons, Repeated measures design for comparing treatments, comparing mean vectors from two populations, A review of univariate analysis of variance (ANOVA), Comparing several multivariate population means (One-Way MANOVA), Simultaneous confidence intervals for treatment effects, Testing for equality of covariance matrices, A review of univariate two-way analysis of variance, Two-way multivariate analysis of variance, Profile analysis.

6. Inferences for Regression: Review of the classical linear regression model and Inferences about the regression model, Inferences from estimated regression function, Model checking, Multivariate Multiple Regression

PREFERRED TEXT BOOKS: Applied Multivariate Statistical Analysis, Richard A Johnson and Dean W Wichern.

***REFERENCE BOOKS:**

GRADING PLAN:

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

OUTCOME: Testing of specific statistical hypotheses, formulated in terms of the parameters of multivariate populations; Comparisons among mean vectors using multivariate analysis of variance; Data reduction and Interpretation.

REMARKS:

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TITLE : NLP Applications
CREDITS : 3-0-1-4
TYPE-WHEN : Spring 2019
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: Nonlinear Dynamics
Course Code: SCI491
CREDITS: 4
TYPE-WHEN: SPRING
FACULTY NAME: Dr. Vinod P.K.
COURSE DESCRIPTION:

This subject deals with mathematics of how systems evolve in time. It is used to analyse whether system in question settles down to equilibrium, keeps repeating in cycles or does something more complicated. The course focuses on nonlinear dynamics with applications in science and engineering. The emphasis will be on geometric thinking, computational and analytical methods.

COURSE TOPICS:

1. **Overview**
   Capsule history of Dynamics, A dynamical view of world
2. **One-Dimensional flows**
   Flows on the line, Bifurcations, Flows on the circle
3. **Two-Dimensional Flows**
   Linear System, Phase Plane, Limit Cycles, Bifurcations

4. **Chaos**
   Lorenz Equations, One-Dimensional Maps

PREFERRED TEXT BOOKS:

1. Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry and Engineering by Steven Strogatz
2. Understanding Nonlinear Dynamics by Daniel Kaplan and Leon Glass
3. Simulating, Analyzing and Animating Dynamical Systems: A Guide to XPPAUT for Researchers and Students by Bard Ermentrout

GRADING:

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

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TITLE : Optimization Methods
Course Code : CSE481
CREDITS : 3-1-0-4
TYPE-WHEN : Spring, 4XXX level
FACULTY NAME : CV Jawahar

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 informally stating problems with the associated constraints, and solving them with computer friendly algorithms.

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TITLE : Phonetics and Phonology
Course Code : CLG413
Credits : 3-1-0-4 (= credits - hours per week – tutorials - lab sessions)
Type-When : Spring 2019
Faculty Name : **TBD**
Pre-Requisite : None
OBJECTIVE: To teach the fundamentals of speech sounds of Indian languages, their patterning in higher level processing in phonology, morphophonology etc.
COURE TOPICS:
Speaking and Writing: Relationship between spoken sound, written letters of a script, and abstract units such as Phonemes.
Organs of Speech and Transcription: Sagittal section of human head showing the Organs of Transcription and transliteration.
Speech Production Mechanisms: The four processes – Airstreams, Phonation, Ori-nasal,
•Speech; Principles of transcription. Airstreams: Chamber and initiator; Pulmonic, Glottalic, and Velaric Airstreams; Egressive
•Articulation. Articulation: Various Places and Manners of articulation (stricture types). Median and Lateral

•and Ingressive types. airflow Phonation (States of Glottis): Voicelessness, Modal Voicing, Breathy voicing, Creaky More Details of Articulation: Aspiration; Median and Lateral Airflow; Simple and Complex

• Ori-Nasal Process: Oral, Nasal and Nasalized sounds.

•voicing. Vowels and vocoid articulations: Parameters for classifying various vowels; Concomitant

•Articulations – Double Articulation and Secondary Articulation. Suprasegmentals: Pitch, Loudness, and Duration. Their articulatory, perceptual and linguistic

•features of vowels: Nasalization, phonation types. Phonemics: Phonemes, and Allophones; Principles of Contrast, Context-Dependent

• Syllable: Vowels, Consonants, Semi-vowels and Syllabic Consonants; Stress and Tone.

•correlates. Distribution, and Free- variation; Neutralization of Contrast; Problem solving in Phonology and Preparation of Coherent Phonemic Inventory from a given Data Set along with Rules for deriving various Allophones in the data.

PREFERRED TEXT BOOKS: Ladefoged, P., & Johnson, K. (2011). A course in phonetics (6th ed.). Boston, MA: Wadsworth, Cengage Learning. Catford, J. C. (1988). A practical introduction to phonetics. Oxford: Oxford University Press. Abercrombie, D. (1967). Elements of general phonetics. Edinburgh: Edinburgh University Press. Pike, K. L. (1947). Phonemics: A Technique for reducing languages to writing. Ann Arbor: University of Michigan Press. Ladefoged, P.,• Laver, J. (1994). Principles of phonetics. Cambridge: Cambridge University Press. •

REFERENCE BOOKS: & Maddieson, I. (1996). The sounds of the world's languages. Oxford: Pike, K. L. (1972). Phonetics. A critical analysis of phonetic theory and a technic for the•Blackwell. Tatham, M.,•practical description of sounds. Ann Arbor: University of Michigan Press. & Morton, K. (2011). A guide to speech production and perception. Edinburgh: Clark, J.,•Edinburgh University Press. & Yallop, C. (1995). An introduction to phonetics and phonology (2nd ed.). Oxford: Basil Blackwell. Project: None

Grading: [Assignments = 50%]+ [1st Mid-semester Exams = 15%] + [2nd Mid-semester Exams = 15%] + [Final Exams = 20%]

Outcome: The successful pupils are expected to be equipped with the capacity to understand the details of production mechanisms of different speech sounds of Indian languages and the skill set for developing phonological rules for a given coherent phonetic data set.

Remarks:

ELECTIVITY: This is an Elective course and can be taken by 3rd Year or 4th Year undergraduate students or by any Postgraduate students.

ASSIGNMENTS: Consist of all or some of the following types: Descriptive assignments; Waveform and/or spectrogram labeling of sounds and sound segments; Problem solving in phonology.

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TITLE : Principles of Information Security

COURSE CODE: CSE418

CREDITS : 3-1-04

TYPE-WHEN : Spring 2019

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.

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TITLE : QUANTUM INFORMATION AND COMPUTATION

Course Code : CSE582

CREDITS : 3-1-0-4

TYPE-WHEN : Spring 2018

FACULTY NAME : Dr. I. Chakrabarty (IIIT) and Microsoft Faculty

PRE-REQUISITE : Knowledge of Advanced Linear Algebra, Quantum Mechanics, Classical information Theory .

OBJECTIVE : Quantum information and computation science is an emerging field at the crossroads of physics, mathematics, computer science, and technology. It promises to revolutionize our abilities to compute and communicate. The basic purpose of this course is to develop the basic foundations of the field of quantum information and computation among the graduate students so that they can pursue their research in this field and can put their contributions in the development of this future technology.

COURSE TOPICS :

1. Introduction and Overview: Transition from Classical to Quantum

2. Foundations of Quantum Theory I: States, Ensembles, Qubits, Pure and Mixed states, Multi-qubit states, Tensor Products, Unitary transformations, Spectral Decomposition theorem, Singular value Decomposition

3. Foundations of Quantum Theory II: Generalized Measurement, Projective Measurement, POVM, Evolution of a Quantum State. Krauss representation.
4. Quantum Entropy: Sub additivity of Quantum Entropy, Araki-Leib Inequality, Quantum Channel, Quantum Channel Capacity, Data Compression , Benjamin-Schumacher theorem
5. Quantum Entanglement: EPR Paradox, Schmidt Decomposition, Purification of Entanglement, Entanglement Separability Problem, Pure and Mixed State Entanglement, Measure of Entanglement
6. Basic Quantum Information Processing Protocols: Teleportation, Super Dense Coding, Entanglement Swapping
7. Impossible Operations in Quantum Information: No Cloning, No Deleting, No Partial Erasure
8. Quantum Computation : Introduction to quantum computing, Pauli Gates, Hadamard Gates, Universal Gates, Quantum algorithms (including Shor's factoring algorithm, Grover's search algorithm, Hamiltonian simulation, machine learning and optimization).
9. Quantum Programming: Programming quantum algorithms, Q# programming language, Quantum subroutines.

PREFERRED TEXT BOOKS:

1. Quantum Computation and Quantum Information –M. A. Nielsen, I. L. Chuang. Cambridge University Press.

***REFERENCE BOOKS:**

1. Quantum Computer Science: An Introduction --- N. D. Mermin, Cambridge University Press.
2. Quantum Computing: From Linear Algebra to Physical Realizations---M. Nakahara, T. Ohmi, Taylor and Franchis Group.
3. Lectures on Quantum Information (Physics Textbook)---D. Brub, G. Leuchs, WILEY-VCH.

***PROJECT:** Each student has to submit a project to be decided upon by the faculty concerned. They have to submit the project before the end of the semester 25% of the total grading will come from the project.

GRADING:

Mid 1- 15%
Mid 2- 15%
End Sem- 30%
Assignment- 15%
Projects- 25%

OUTCOME:

REMARKS:

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TITLE : Statistical Methods in AI
CREDITS : 3-1-0-4
Course Code : CSE471
TYPE-WHEN : Spring 2019
FACULTY NAME : **Santosh Ravi Kiran**

Pre-requisite : Basics of Linear Algebra, Probability Theory and Statistics.
Programming in Matlab and C/C++.

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
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)
Faculty : Sachin Chaudhari

Prerequisites: ECE 230 AND ECE 335 OR INSTRUCTOR'S CONSENT

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

Course Code: CES617
Course Title: Stability of Structures
Credits: 3-1-0-4
Type-when: Spring 2019
Course Faculty: Sunitha Palissery
Pre-requisite: Design of Steel Structures (Undergraduate Course)

Objective: To facilitate understanding of the concepts of structural stability, key factors influencing the stability of structures, buckling, and mathematically formulate structural stability applications.

Course Contents

1. **Basic Concepts of Stability**- Bifurcation Buckling- Methods of Stability Analysis-Post-buckling Behaviour-Large Deflection Analysis
2. **Buckling of Columns**- Differential Equations using Equilibrium, Large Deformation Theory, Effects of Imperfections, Inelastic Buckling – Tangent and Reduced Modulus Concepts, Shanley's theory of Inelastic Column Behaviour, Effects of Residual Stresses-Beam Columns
3. **Buckling of Frames-** Modes of Buckling- Frame Stability Analysis-Non-sway and Sway Frames-Critical Load Estimation using Slope Deflection Equations
4. **Torsional and Flexural-Torsional Buckling**- Thin-walled Open Cross-Sections-Columns-Beams-Beam Columns
5. **Buckling of Plates**- Governing Differential Equations for Plate Buckling, Plates Subjected to various Loading Actions, Post-buckling Behaviour

Grading

Homework: 10%

Assignments: 20%
Term Project: 10% (Using Finite Element Software)
Two Mid-Semester Exams: 30%
End-Semester Exam: 30%

References

1. Alexander, C., *Principles of Structural Stability Theory*, Prentice-Hall Inc, New Jersy
2. Chen, W.F., and Lui,E.M., (1987), *Structural Stability: Theory and Implementation*, Elsevier Science Publishing Co., New York
3. *Guide to Stability Design Criteria for Metal Structures*, Edited by Ziemian, R.D., (2010)
4. Timoshenko,S.P., and Gere,J.M., (1985), *Theory of Elastic Stability*, McGraw Hill International Book Company
5. Galambos,T.V., and Surovek,A.E., (2008), *Structural Stability of Steel: Concepts and Applications for Structural Engineers*, John Wiley & Sons, New Jersy
6. Bažant,Z.P., and Cedolin,L., (2010), *Stability of Structures- Elastic, Inelastic, Fracture and Damage Theories*, World Scientific Publishing Co. Pvt. Ltd., Singapore
7. Gambhir,M.L., (2004), *Stability Analysis and Design of Structures*, Springer, New York
8. Kumar,A., (1998), *Stability of Structures*, Allied Publishers Limited, Mumbai

Expected Course Outcome

Demonstrate and apply understanding of buckling and stability analysis methods, to address practical structural design problems.

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TITLE : **Speech Systems**
Course Code: ECE446
Credits : 3-1-0-4
Faculty : Dr. Suryakant V Gangashetty
Semester :Spring2019
Type-When : Elective - offered anytime on need basis - for Year 3/4 and PG students
Pre-Requisite : None

OBJECTIVE: This course deals with building the systems for speech processing tasks such as recognition, synthesis, enhancement of speech signals. The objective is to provide rigorous hands on experience to the students to build the systems for speech recognition, speech synthesis, and speech enhancement.

COURSE TOPICS:
W1: Basics of Speech Processing
W2-W3: Parametric representation of speech using source and system features
W4-W5: Statistical and neural network based models for speech systems
W6-W8: Building speech recognition systems for word and continuous speech recognition
W09-W10: Building speech synthesis and voice conversion systems
W11-W12: Building emotion recognition system
W13-W14: Building speech enhancement and audio source separation systems
TEXTBOOK:

(1) Fundamentals of Speech Recognition (Prentics Hall Signal processing Series) (Paperback) by Lawrence Rabiner and Biing-Hwang Juang)
(2) Text-to-Speech Synthesis by Paul Taylor, University of Cambridge
(3) Speech Enhancement: Theory and Practice by Phillipos C Loizou, Second Edition CRC Press
(4) Spoken Language Processing: A Guide to Theory, Algorithm and System Development by Xuedong Huang, Alex Acero, Hsiao-Wuen Hon, Prentice-Hall.
(5) Relevant papers/materials will be provided

GRADING:
First Mid-Semester Examination:: 15%
Second Mid-Semester Examination:: 15%
End Semester Examination:: 30%
Assignments: 10%

FINAL PROJECT: 30%
Assignments:
One assignment will be given after completion of a topic. It should be submitted within a week.

FINAL PROJECT: The students are required to develop a system for one of the following topics: (1) Speech Recognition, (2) Speech Synthesis (or Voice Conversion), (3) Speech Enhancement (4) Emotion Recognition

OUTCOME: Upon the completion of this course, the student would understand the issues involved in building a speech system.

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TITLE : Internals of Application Servers
Course Code : CSE563
CREDITS : 3-1-0-4
TYPE-WHEN : Spring 2019
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 J2Eeapplication-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:

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TITLE : **Introduction to Parallel Scientific Computing**
Course Code : **CSE504**
CREDITS : **3-1-3-4**
TYPE-WHEN : Spring
FACULTY NAME : **Pawan Kumar**

PRE-REQUISITE : **Calculus, Linear Algebra, and Computer Programming.**

OBJECTIVE:
Learn Basic Ideas of Scientific Computing on Modern Day Architectures.
COURSE TOPICS :
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 : Introduction to Game Theory

Course Code: CSE498

CREDITS : 3-0-0-4
TYPE-WHEN : Spring-2019
FACULTY NAME: Sujit Gujar

PRE-REQUISITE: Basic Knowledge in Linear Algebra, Probability Theory and comfortable in basic maths

OBJECTIVE:

Game theory is a mathematical model to analyze and predict behavior of strategic agents. In the modern world, where every individual has access to the Internet and immense computing power, game theory has become an important, useful and relevant tool in day to day life to design protocols in various contexts, analyze negotiations or induce cooperation. The objective in this course is to introduce students to game theory and different types of games such as non-cooperative games, cooperative games, games with incomplete information. Additionally the students will be exposed to various tools and solution concepts in game theory.

COURSE TOPICS:

(a) What is game? Extensive form games vs strategic form games, two player zero sum games, mini-max theorem, dominant strategy equilibrium, Nash equilibrium and its existence. Co-operative game theory, core, imputations, Shapley value, Nash bargaining solution.
(b) Mini-max Theorem, Nash Theorem, Shapley's Theorem for core and algorithmic aspects of these theorems.
(c) Game with incomplete information, introduction to mechanism design, revelation principle, voting schemes.
(d) Application of the above concepts will be illustrated with use cases in wireless communication, e-Commerce, social networking, crowdsourcing and, cloud management. (If

time permits, advance topics such as) Arrows impossibility theorem, price of anarchy in routing games.

PREFERRED TEXT BOOKS:
"Game Theory and Mechanism Design" by Y Narahari.

***REFERENCE BOOKS:**
"Game Theory: Analysis of Conflict", by Roger B. Myerson.
***PROJECT:**
Students are expected to work in groups and develop a small software in Java to compute various solution concepts taught in the class.

GRADING PLAN:

Mid Sem-1 Exam	15
Mid Sem-2 Exam	15
End Sem Exam	20
Quizes	2.5
Homeworks	10
Scribes	5
Course Participation	2.5
Programming	10
Reading Project	10
Project	10

OUTCOME:
At the end of the course a student should be able to
(i) Model and generate strategies for two person games.
(ii) Take a strategy decision problem and model it as appropriate game theoretic problem
(iii) Understand of different kinds of games and what kind of solutions are possible and their meaning
(iv) Apply mechanism design to design games for specific outcomes.
REMARKS: The course is designed for senior undergraduate students. Postgraduate students are also welcomed.

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TITLE : Computational Linguistics 2
Course Code : CLG422
CREDITS : 3-0-0-4
TYPE-WHEN : Spring 2019
FACULTY NAME : Radhika M + Dipti M Sharma

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:

HA	10,
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 :Indian Semantics and Ontology
COURSE CODE : **TS19002**
CREDITS : 4
TYPE-WHEN : Winter-Spring 2019
FACULTY NAME : Peter M. Scharf
PRE-REQUISITE : none

OBJECTIVE :To introduce students to semantic and ontological theories in ancient Indian in relation to modern linguistics and to investigate their application in computational implementation.

COURSE TOPICS :

Cognition of a speech units (*sphoṭa*): phonemes, morphemes, words, and sentences
Theories of the denotation of a sentenceand its parts
The structure of verbal cognition in Nyāya, Mīmāṁsā, and Vyākaraṇa
Nyāyalogic and modern propositional logic
Vaiśeṣika ontology and the Amarakośa
Semantic conditions in Pāṇini's*Aṣṭādhyāyī*

PREFERRED TEXT BOOKS:

Gillon, Brendan S. 2019. *Grammatical structure and its interpretation: an introduction to natural language semantics*. Cambridge, Mass.: MIT Press.

GaurinathSastri 1959. *The philosophy of word and meaning: some Indian approaches with special reference to the philosophy of Bhartṛhari*. CSCRS 5. Reprint: Calcutta: Century Press, 1983.

Subha Rao, Veluri. 1969. *The Philosophy of a Sentence and its Parts.* New Delhi: Munshi Ram Manohar Lal.

***REFERENCE BOOKS:**

Brough, John 1951. "Theories of general linguistics in the Sanskrit grammarians." *TPS* 1951:27-46. Reprint: Staal 1972:402-14.

---. 1953. "Some Indian Theories of Meaning." *TPS* 1953:161-76. Reprint: Staal 1972:414-23.

Chakravarti, Prabhat Chandra. 1930. The Philosophy of Sanskrit Grammar. University of Calcutta.

Deshpande, Madhav 1972. "Kauṇḍabhaṭṭa on the philosophy of nominal meanings: The text of Kauṇḍabhaṭṭa'sNāmārthanirṇaya, with an English translation, explanation and an introductory essay." Ph.D. diss., University of Pennsylvania.

Gerow, Edwin. 1984. "Language and symbol in Indian semiotics." *PEW* 34, no. 3 (July): 245-60.

Kunjunni Raja, K. 1955. "Indian Theories of Homophones and homonyms." *ALB* 19:193-222.

---. 1963. Indian Theories of Meaning. *ALS* 91. Madras: The Adyar Library and Research Center. Second edition: 1969.

Matilal, Bimal Krishna. 1966. "Indian theorists on the nature of the sentence (*vākya*)." *FL* 2: 377-93.

---. 1988. "Śābdabodha and the Problem of Knowledge-Representation in Sanskrit." *JIP* 16, no. 2 (June): 107-22.
---. 1990. *The Word and the World: India's Contribution to the Study of Language*. Delhi: Oxford University Press.
Matilal, Bimal Krishna, and Jaysankar Lal Shaw, eds. 1985. *Analytic Philosophy in Comparative Perspective: Exploratory Essays in Current Theories and classical Indian Theories of Meaning and Reference*. Dordrecht and Boston: D. Reidel.
Narayana Murti, M. S. 1973. "Philosophy of Grammar." In *SVUOJ* 16, *Proceedings of the Seminar on Andhra's contribution to Indian culture*, 37-54.
Pandeya, R. C. 1963. *The Problem of Meaning in Indian Philosophy*. Delhi: Motilal Banarsidass.
Ramasvami Shastri, V. A. 1952. "Bhāvanā: the leading concept of Verbal Cognition." *BhāratīyāVidyā* 13:169-76.
Siderits, Mark. 1982. 1985. "Word Meaning, Sentence Meaning, and Apoha." *JIP* 13:133-51.
SreekrishnaSarma. 1954. 1959. "Syntactical Meaning - Two Theories." *ALB* 23:41-62.
Staal, J. F. 1962. "Philosophy and language." *T.M.P. Mahadevan Volume*, 10-25. Madras
---. 1966. "Indian Semantics, I." *JAOS* 86:304-11.
---. 1976. "Sanskrit philosophy of language." *History of Linguistic Thought and Contemporary Linguistics*, ed. by H. Parret. Berlin and New York: Walter de Gruyter.
Suryanarayana Sastri, S. S. 1942. "Word and sense" *ABORI* 23, *Silver Jubilee Volume*, 424-30.
Taber, John A. 1989. "The Theory of the Sentence in PūrvaMīmāṁsā and Western Philosophy," *JIP* 17, no. 4 (December): 407-30.
Van Nooten, Barend A. 1969. "Pāṇini's theory of verbal meaning." *FL* 5:242-55.
Varma, Siddhesvara. 1925. "Analysis of Meaning in the Indian Philosophy of language." *JRAS* 1925:21-35.
---. 1926. "Analysis of Meaning in Indian Semantics." *Journal of the Department of Letters* 13:1-38. University of Calcutta.

***PROJECT:**Design an ontology for a subset of the semantic conditions in Pāṇini's*Aṣṭādhyāyī* subsuming them under the Vaiśeṣika ontology as far as possible.

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	15%
Mid Sem-2 Exam	15%
End Sem Exam	30%
Assignments	10%
Project	30%

OUTCOME: Students should come away with an understanding of semantic and ontological theories in ancient Indian and the experience of having applied them computationally. They should thereby have the ability to apply them to other sets of semantic conditions and in other languages.

REMARKS: The mentioned textbook by Gillon has a publication date of 26 February 2019 so may have to be replaced by another comparable book.

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TITLE **:** Introduction to Philosophy of Technology
Course Code : TS19007
CREDITS : 4 (Four)
TYPE-WHEN : Spring 2019
FACULTY NAME : Nishad Patnaik
PRE-REQUISITE :

OBJECTIVES:

This course aims to introduce students to basic themes and debates in the field ofphilosophy of technology. These include:
1) What is Technology? How does it relate to human beings?
2) How do we conceive the relation between technology and science?
3) How do we understand the relationship between technology and nature?
4) Is the distinction between the 'real' and the 'virtual' still tenable?
5) Do visions of technologically dystopian or utopian futures overestimate the possibilities of technology?

COURSE TOPICS:

Topic 1: Traditional Philosophical Thinking on Technology
Marx's conception of the division of labour and alienation under Capitalism.
Heidegger's articulation of the essence of technology as 'enframing'
Topic 2: The Relation between Science and Technology
The phenomenological critique of Positivism
The notion of 'technoscience'
Topic 3 Social Networking and its Effects on Human Sociality
Cyber alienation
The 'virtual' and the 'real'
Topic 4 Environmental Crisis in the age of the 'Anthropocene'
Disenchantment, the manipulation of nature and anthropocentric ecological arguments
'Deep Ecology' and the project of 're-enchantment'
Topic 5
Technological 'progress', determinism and contingency
Dystopian and utopian views of technological society
The possibilities and limits of technology

Recommended Readings:

1. Walter Benjamin, *The Work of Art in the Age of Mechanical Reproduction*, 1935
2. David Chalmers, *The Virtual and the Real* (Forthcoming, Available as a pdf)
3. Andrew Feenberg, *Between Reason and Experience: Essays in Technology and Modernity* 2010
4. G. W. Hegel, *Phenomenology of the Spirit* (Master-Slave dialectic), 1977
5. Martin Heidegger, *The Question Concerning Technology* 1977

6. ---------- *Being and Time* (Chapter One) 1962
7. Edmund Husserl, *The Crisis of the European Sciences* (Intro and first Chapter) 1954
8. Don Ihde, *Philosophy of Technology*: *An Introduction* 1993
9. ---------- *Heidegger's Technologies*: *Postphenomenological Perspectives* 2010
10. ---------- Ironic Technics 2008
11. Bruno Latour, *Facing Gaia. Eight Lectures on the New Climatic Regime* 2017
12. Karl Marx, *Economic and Philosophical Manuscripts* 2007
13. Sherry Turkle, *Alone Together*: *Why We Expect More from Technology and Less from Each Other*
14. Peter Paul Verbeek, *What Things Do: Philosophical Reflections on Technology Agency and Design*, 2005

PROJECT: A final term paper of 3000 words or less.

GRADING PLAN:

Type of Evaluation	**Weightage (in %)**
Three Assignments	60
Final Term Paper	40

OUTCOME: Students would be able to comprehend and critically analyze key debates in the philosophical thinking on technology. As part of their analytic comprehension they would be able to identify the historical context and its underlying presuppositions in relation to which these issues emerge.

REMARKS: This course provides a selection of issues/debates/arguments and not a comprehensive survey, nor a detailed analysis, of any specific issue concerning technology. However, the course is designed to encourage students to explore these specific issues in greater detail through their assignments and final term papers.

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TITLE : A Linguistic Introduction to Sanskrit
COURSE CODE : TS19009
CREDITS :4
TYPE-WHEN :2019 Winter-spring
FACULTY NAME : Peter M. Scharf
PRE-REQUISITE : None

DESCRIPTION :``The Sanskrit language, whatever be its antiquity, is of a wonderful structure; more perfect than the Greek, more copious than the Latin, and more exquisitely refined than either," Sir William Jones said in his third anniversary address to the Asiatic Society of Bengal on 15 January 1787, and Arthur Schopenhauer wrote in 1819, ``Sanskrit literature will be no less influential for our time than Greek literature was in the fifteenth century for the Renaissance." With a continuous production of literature in all disciplines from mathematics and medicine to philosophy and poetry for more than three millennia and more than seven million extant manuscripts, Sanskrit contains the largest body of literature in the world prior to the

invention of the printing press. The language itself transparently reveals a rich morphological structure that lent itself to analysis by a linguistic tradition unmatched in its sophistication until its discovery inspired modern linguists to broaden and extent the application of its principles.

OBJECTIVE : To develop the ability to read simple Sanskrit with the help of a dictionary.

COURSE TOPICS : The course surveys basic Sanskrit grammar in a linguistically explicit manner accompanied by traditional oral practice and exercises consisting of readings adapted from ancient Indian narratives.

Week	**Topic**
Week 1	Ch. 1, Introduction to Sanskrit language and literature; Ch. 2, The Sounds of Sanskrit, and Ch. 3, Devanagari script
Week 2	Ch. 4, Sandhi
Week 3	Ch. 5, Verbs: present and past indicative active and middle of verbs of classes 1, 4, 6, and 10
Week 4	Ch. 6, Nouns: masculine and neuter a-stem
Week 5	Ch. 7, Nouns: feminine long a-stem; a-stem adjectives
Week 6	Ch. 8, Imperative and optative moods a-stem verbs
Week 7	Ch. 9, Mono and polysyllabic fem. long i/u-stem nominals
Week 8	Ch. 10, Present stem of verbs of classes 5, 8, and 9
Week 9	Ch. 11, i/u-stem nominals
Week 10	Ch. 12, Vocalic-r-stem nominals
Week 11	Ch. 12, Present stem of verbs of classes 2, 3, and 7
Week 12	Ch. 12, continued
Week 13	Ch. 13, Consonant stem nominals
Week 14	Ch. 14, Passive voice of the present system
Week 15	Review

PREFERRED TEXT BOOKS:

Scharf, Peter M. 2010. *Šabdabrahma: a first-year Sanskrit text*. Providence: The Sanskrit Library.

***REFERENCE BOOKS:**

***PROJECT:**

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	12%
Mid Sem-2 Exam	12%
End Sem Exam	25
Assignments (Weekly homework)	25%

Quizzes (Weekly)	25%

OUTCOME: At the end of the course students will be expected to have the ability to read simple Sanskrit containing the common grammatical forms covered, with the help of a dictionary. An additional semester course will complete the survey of basic Sanskrit grammar.

REMARKS:Format and assignments
Generally, I will introduce new material during the first class each week and assign daily home practice, which we will quiz regularly, and weekly exercises which we will and go over together in the second class each week. Mid-terms and the final exam will follow the format of weekly exercises. Because learning a language involves the cumulative acquisition of knowledge and skills, regular attendance and keeping up with assignments will be essential.

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TITLE : Introduction to Robotics: Mechanics & Control
Course Code : ECE452
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 : CSE581
CREDITS : 3-0-0-4
TYPE-WHEN : Spring 2019
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 2019
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, Spring2019
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 : 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 2018)

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 : **Literature –American Classics**
COURSE CODE : TS17003
CREDIT : 4
TYPE-WHEN : Spring 2019
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

COURSE CODE: SCI455

Credits: 4

Type-When: Spring Semester 2019 (Jan-May of 2019)

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 communication.	3
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 2019
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 : Raghu Reddy

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 - 2019
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 Nano sciences
COURSE CODE : SCI761
CREDITS :(L=4,T=0,P=0,C=4)
TYPE :Elective
FACULTY NAME : TapanK.Sau
NUMBER OF STUDENTS : Max. 40 students (preference to CND/M.Tech. Bioinfo)

OBJECTIVE : To introduce the students to the rapidly developing fields of science and technology at the nanometer scales.

COURSE TOPICS:

1. Introduction to Nanoscience.
• **Nanomaterials:** Definitions.Size Scales.Surface and Interface. Magic Numbers and Coordination Numbers.

• **Classification of nanomaterials**: Clusters, Nanoparticles and Colloids.
• **Scope of nanomaterials**
2. Making Nanostructures. Top-down and bottom-up methods.
3. Tools for Nanosystems. Microstructure/Chemistry/Defects and Structure.AFM, SEM, TEM,XRD, SAXS**,N**anoindentation.
4. Properties of Nanomaterials
Electrons in Nanostructures. Discrete states vs. band structure: Effects of dimensionality and symmetry in nanostructures. Metal-to-nonmetal transition.
Thermodynamics and Kinetics of Small Sized Systems. Capillarity, Liquid droplets, Lotus effect. Classical nucleation theory. Size and shape control in nanoparticle formation. Self-assembly principles. Adsorption. Melting behaviour of metal nanoparticles.
Mechanical,Magnetic, Electrical, Optical, and Thermal properties.
5. **Applications of Nanomaterials.**Catalysis,Nano-electronic devices and sensors, medical, food and agriculture industries, automobile, textile, water treatment and civil applications, strategic use in energy, space and defense
6. **Concerns and Challengesof Nanotechnology.**Environmental, ecological and health hazards of nanoparticles. Nanotoxicology and its effect

PREFERRED TEXT BOOKS:

1. Introduction to Nanoscience, by S. M. Lindsay, Oxford University Press.
2. Nanoscopic Materials: Size-dependent Phenomena, by E. Roduner, RSC Publishing.
3. Textbook ofandNanoscienceNanotechnology:B. S.Murty, P. Shankar, B. Raj, B. B.Rathand J.Murday,Universities Press (India) Private Limited.

REFERENCE BOOKS:

1. Nanochemistry by G.A. Ozin and A. C. Arsenault, RSC Publishing.
2. Nanotechnology by M. Kohler and W. Fritzsche, Wiley-VCH.

GRADING

Student assessment will be on the basis of:

1. Class Performance/Quiz/Assignment/Research Paper Study	20%
2. Mid-Term Exams(2 x 20%)	40%
3. End-Semester Exam	40%

OUTCOME

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

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TITLE : Usability Engineering
Course Code : CSE567

Note: Please use course code for previously existing course
CREDITS : 4
TYPE-WHEN : Spring 2019
FACULTY NAME : Priyanka Srivastava
PRE-REQUISITE : None
OBJECTIVE : The focus of this course is on role of cognitive and non-cognitive perspectives in ergonomic and user-friendly designs. Ergonomics deals with design factors required for equipment designs for the workplace to maximize the productivity and minimize the fatigue error and discomfort. User-friendly or Usability, deals with the ease, efficiency and effectiveness of any system/ design interface. Since, any human activity entails physiological and mental/ cognitive processing, which understanding would play an important role in ergonomics and user-friendly design. The course will highlight the competencies and limitations of the human being in general (such as perception, memory, attention and time-sharing, mental-workload, stress, decision making and problem solving), to make better technologies for society and science.
Upon completion of course students will be able to identify/ recognize the cognitive and non-cognitive perspective in designing more effective and better machines such as automated machines and assistive technologies.
COURSE TOPICS :
1. Introduction to Ergonomics, Neuroergonomics, and Usability
2. History of Human Factors
3. Psychology of Everyday Actions
4. To Err is Human: Design challenges and User-centered design
5. Differently abled people, easy and complex designs
6. Identifying Mental Model and its relations with design
7. Generation of User Interface
8. Human factors in augmented and virtual reality
9. Design and Evaluation Methods

PREFERRED TEXT BOOKS:
1. Norman, D. (2013). The Design of Everyday Things: Revised and Expanded Edition
2. Proctor, R.W., & Zandt, T.V. (2008). Human Factors in Simple and Complex Systems, Second Edition. 24

***REFERENCE BOOKS:**
1. Hale, K.S., & Stanney, K.M. (2014). Handbook of virtual environments: design, implementation, and Applications, Second Edition (Human Factors and Ergonomics)

***PROJECT:**
Each team of 2 will conceptualize, design, the study and highlight the implications.
GRADING:
Exams – 60
Quizzes – 10
Assignments – 10
Exams – Mid semester II and Final Term – 40
Project – 40
OUTCOME:
The course aims to introduce various emerging issues in ergonomics and usability research. The student will realize the issues related to cognitive and non-cognitive processing and its implication through conducting psychophysical experiments.
REMARKS:
The course requires reading, field and lab work and further designing a small study, highlighting the various issues of ergonomics and usability in design interface and submitting at the end. Students will be encouraged to use various tools available in Cognitive Science lab to address their research problems. The students will be allowed to work at any time for experiments and studies during the ideas development and conducting studies.

TITLE : Topics in Optimization on Manifolds
Course Code :
CREDITS : 3-1-0-4
TYPE-WHEN : Spring
FACULTY NAME : Pawan Kumar
PRE-REQUISITE :Linear Algebra (inner products, spaces related to matrices, linear transforms, etc), Calculus (Single and multivariable), Vector Calculus (Equations of lines,

planes, etc in vector form), Statistics (Expectance, Variance of Multivariate distributions), Optimization methods (first and second order methods, equality and inequality constrained problems, duality), and any one of the programming languages: Python/Matlab/Octave to write codes for assignment problems.

OBJECTIVE : To learn selected optimization techniques on manifolds, and to apply them to solve selected problems stemming from data sciences and scientific computing.

COURSE TOPICS :
0. Review of Linear Algebra, Calculus, Optimization, Probability, and Statistics.
1. Motivation for learning on Manifolds.
2. Matrix Manifolds: First-Order Geometry.
3. Gradient Descent Algorithms, and Line-Search Algorithms on Manifolds.
4. Matrix Manifolds: Second-Order Geometry.
5. Newton's Algorithm on Manifold.
6. Trust-Region Algorithms on R^n and Manifolds.
7. Various Applications to Scientific Computing / Machine Learning / Data Sciences.

PREFERRED TEXT BOOKS:
1. P. A. Absil, R. Mahony, R. Sepulchre, *Optimization algorithms on Matrix Manifolds*, Princeton University Press. Link: https://press.princeton.edu/absil

***REFERENCE BOOKS/ARTICLES:**
2. Lawrence Cayton, *Algorithms for manifold learning,* http://www.lcayton.com/resexam.pdf
3. Lawrence K. Saul, Sam T. Roweis, *Think Globally, Fit Locally: Unsupervised Learning of Low Dimensional Manifolds.*
4. Christopher J. C. Burges, *Dimension Reduction: A Guided Tour.*

***PROJECT:** There are no projects.

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	10
Mid Sem-2 Exam	10
End Sem Exam	35
Assignments	35
Other Evaluation: Quizzes	10

OUTCOME: After taking this course, student should be able to identify some constrained problems as an optimization problem on manifold, and select appropriate algorithm, and implement it efficiently. When solving assignments, students will learn/use the existing libraries (such as manopt) for solving optimization problem on Manifolds.

REMARKS:

1. Due to lack of TAs for this new course, the **maximum number of students allowed for this course is 10.** Students are encouraged to meet me before taking this course. This course is primarily designed for research students who are working, or are interested in working in these selected topics, or their applications.

2. This is a relatively advance course! Please check the prerequisites above. Differential geometry that is needed will be taught from scratch.

3. Attendance rules of the institute will apply strictly.

4. There will be several guest lectures by people from industry towards the end of this course.

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Sd/
Dean(Academics).