COURSE DESCRIPTION – SPRING – 2020
ELECTIVES

Version 1(10/12/2019)

Code	Course Name	Faculty
CSE422	Advanced Computer Architecture	R. Govondarajulu
ECE551	Advances in Robotics and Control	Madhava Krishna+ Abhishek Sarkar
	Alternate Religious Traditions in India History	Nilam Kakati(HCU) + Aniket Alam
	An Introduction to William Blake	Aruna Chaluvadi
CSE586	Cognitive Neuroscience	Kavita Vemuri
CSE578	Computer Vision	Avinash Sharma
HSS337	Comprehension of Indian Music	Saroja TK
CEW612	Design of Hydraulic Structures	Shaik Rehana
ECE463	Digital VLSI Design	Anshu Sarje
CSE441	Database Systems	P. Krishna Reddy
	Deep Learning: Theory and Practices	Naresh Manwani
CSE431	Distributed Systems	Lini Thomas
HSS481/ HSS482	Digital Humanities Project	CEH Faculty
IMA303	Differential Equations	Lakshmi Burra
CES442	Disaster Management	Sunitha P
CES641	Earthquake Engineering	R Pradeep Kumar
	Elasticity: Theory and Finite Elements	Venkateswarlu M
HSS466	Environment and Politics in India	Radhika Krishnan
	Ethics	Don Wallace Freeman Dcruz
ECE538	Fiber Optic Communication Systems	Kavita Vemuri
ECE562	Flexible Electronics	Aftab M Hussain
ECE538	Fiber Optic Communication Systems	Kavita Vemuri
SCI341	General & Structural Chemistry	Tapan Kumar Sau
HSS447	Gender and Society	Sushmita Banerji
CEG422	Green Buildings	Vishal Garg
CEG462	Hydroinformatics	Shaik Rehana
CSE595	ICTs for Development	Nimmi Rangaswamy
	Introduction to Coding Theory	Prasad Krishnan
CSE486	Introduction to Neural and Cognitive Modeling	Bapi Raju S
CSE498	Introduction to Game Theory	Sujit Gujar
CSE581	Information Security Audit and Assurance	Shatrunjay Rawat
ECE452	Intro to Robotics: Mechanics & Control	Abhishek Sarkar
CSE504	Introduction to parallel Scientific Computing	Pawan Kumar
SCI765	Introduction to Systems Biology	Vinod PK
CSE563	Internals of Application Servers	Ramesh Loganathan
CLG452	Linguistics Data 2: Collection & Modeling	Radhika M + Aditi Mukherjee+ Dipti M Sharma

TS17002	Language, Mind and Society	Aditi Mukherjee
SCI433/ SCI633	Modeling and Simulations	Prabhakar B + Deva PriyaKumar
CSE588	Music, Mind and Technology	Vinoo Alluri
IMA409	Multivariate Analysis	Venkateswarlu M
SCI653	NGS Data Analysis	Nita Parekh
CSE573	NLP Applications	Manish Shrivastava
CSE481	Optimization Methods	CV Jawahar
ECE566	Photonics	Syed Azeemuddin
	Probabilistic Graphical Models	Girish Varma
CSE418	Principles of Information Security	Kannan Srinathan
CEG461	Remote Sensing	RC Prasad
HSS365	Science Technology and Society	Harjinder Singh
ECE431	Signal Detection and Estimation Theory	Santosh nannuru
	Social Computing	Vasudeva Varma
CSE461	Software Engineering	Vasudeva Varma + Prakash Yalla
CSE569	Software Foundations	Venkatesh Choppella
CES617	Stability of Structures	Sunitha P
CSE471	Statistical Methods in AI	Santosh Ravi Kiran + Vineet Gandhi
CSE538	System and Network Security	Ashok Kumar Das
ECE442	Time Frequency Analysis	Anil Kumar V
HSS446	The State in Colonial India	Aniket Alam
ECE537	Topics in Coding Theory	Lalitha V
SCI761	Topics in Nano Sciences	Tapan Kumar Sau
CSE567	Usability Engineering	Priyanka Srivastava

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TITLE: Advanced Computer Architecture
Course Code: CSE422
CREDITS:3-1-0-4
TYPE-WHEN: Spring2020
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 Robotics and Control
Course Code : ECE551
CREDITS : 4
TYPE-WHEN : Level-2 Elective, Spring
FACULTY NAME : Madhav Krishna + Abhishek Sarkar

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B. Nonlinear Model Predictive Controller [4] or, Optimal Controller 4

6. Reinforcement Learning [4].....4
   A. Function approximation.....4
   B. Effective representations.....4
   C. Approximate models.....4
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7. Uncertainty [2] 4
   A. Markov Decision Process (MDP) [1].....4
   B. Partially Observable Markov Decision Process (POMDP) [2].....4

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 : **Alternate Religious Traditions in Indian History**
Course Code :
CREDITS : **4**
TYPE-WHEN : **Spring**
FACULTY NAME : **Nilam Kakati and Dr. Aniket Alam**

PRE-REQUISITE :
OBJECTIVE : The course "Alternate Religious Traditions in Indian History" intends to familiarize the students with the knowledge minor religious traditions during the pre-colonial period and the colonial period. The course deliberately excludes the themes of major religious traditions like Hinduism and Islam. The course will however also discuss slightly the two important religious movements of the former period i.e. Buddhism and Jainism. The objective is to give the student a broad overview of how different religious traditions developed in India and in what form they reached us in modern times. The course hopes to broaden the student's understanding of Indian religions and also enable him/her to appreciate the place of religion in history.

COURSE TOPICS :

1. Introduction to Religious studies: This module will help familiarize the student with the study of religion in history, as also theology and theophany. (4 lectures)
2. Buddhism and Jainism: This module will teach the foundational ideas and practices of these two religions and how they evolved over history in the Indian sub-continent. (8 lectures)
3. Bhakti Movement: This module will cover the main Bhakti preachers, their spread, their social and cultural impact, the important commonalities, and their distinctions. (5 lectures)
4. Sufi Movement: This module will cover the emergence of Sufi ideas and practices, their spread over the sub-continent, their relation to other religious traditions and state power. (4 lectures)
5. Tantra and Tantric Practices: In this module we will unbundle the idea of Tantra from modern stereotypes by tracing its ideational and practice lineage over the past two millennia. We will also look at Tantric influences on mainstream religious thought and practice. In Tantric practices we will study forms of religion which are often clubbed under witchcraft and magic. (5 lectures)

PREFERRED TEXT BOOKS:

1. *The Sacred and the Profane: The Nature of Religion* by Mircea Eliade (1957)
2. *Indian Buddhism* by A. K. Warder (1980)

3. *History of Medieval India: 800-1700* by Satish Chandra (2007)

***REFERENCE BOOKS:**

1. *Buddhism: A Very Short Introduction* by Keown Damien (2013)
2. *Indian Buddhism: A Survey with Bibliographical Notes* by H. Nakamura (1989)
3. *Origin and Nature of Ancient Indian Buddhism*by K.T.S. Sarao (2004)
4. *Buddhist Thought in India* by E. Conze (1996)
5. *A Genealogy of Devotion: Bhakti, Tantra, Yoga, and Sufism in North India by* Patton E. Burchett (2019)
6. *History of the Tantric Religion* by N. N. Bhattacharyya (2005)
7. *The Power of Tantra: Religion, Sexuality and the Politics of South Asian Studies* by Hugh B. Urban (2010)
8. *A companion to Tantra* by S.C. Banerji (2007)
9. *The Tantric Tradition* by Agehananda Bharati (1965)
10. *Jainism: An Indian Religion of Salvation*by Helmuth von Glasenapp (1999)
11. *Jainism and Indian Civilization*by Raj Pruthi (Ed.) (2004)
12. *Faith & Philosophy of Jainism*by Arun Kumar Jain (2009)
13. *Medieval bhakti movement its history and philosophy*by SusmitaPande (1993)
14. *Bhakti Movement in Medieval India: Social and Political Perspectives*by Shahabuddin Iraqi (2009)
15. *For the Love of God: Women Poet Saints of the Bhakti Movement* by Sandhya Mulchandani (2019)
16. *The Sufi saints of the Indian subcontinent*by Zahurul Hassan Sharib (2006)
17. *Sufism and Society in Medieval India*by RaziuddinAquil (2010)
18. *Indian Witchcraft*by Rajaram Narayan Saletore
19. *Ancient Indian Magic and Folklore: An Introduction*by Margaret Stutley (1980)
20. *Empire of Enchantment: The Story of Indian Magic* by John Zubrzycki (2018)

***Articles**

1. *Buddhism in Indian philosophy* by Raghuramaraju (India International Centre Quarterly, Vol. 40, No. ¾ , 2013)
2. *Social background of Buddhism in Gandhara (2nd C B.C. to the middle of the 4th C C.E.)* by Sarita Khettry (Source: Proceedings of the Indian History Congress, Vol. 75, Platinum Jubilee 2014)
3. *Jainism and Society* by Peter Flügel (Bulletin of the School of Oriental and African Studies, University of London, Vol. 69, No. 1 2006)
4. *Dharma in Jainism- A preliminary survey* by OlleQvarnstrom (Journal of Indian Philosophy, Vol. 32, No. 5/6 December 2004)
5. *Bhakti as an Ideology : Perspectives in deconstructing the early medieval Indian Tradition* by Vijay Kumar Thakur (Proceedings of the Indian History Congress, Vol. 55 1994)
6. *Bhakti and the British Empire* by Vijay Pinch (Past & Present, No. 179 (May, 2003)
7. *Sufism in History and its Relationship with Power* by Tanvir Anjum (Islamic Studies, Vol. 45, No. 2 Summer 2006)
8. *The Eclectic Spirit of Sufism in India: An Appraisal* by Babli Parveen (Social Scientist, Vol. 42, No. 11/12 November–December 2014)
9. *Matrix of Power: Tantra, Kingship, and Sacrifice in the Worship of Mother Goddess Kāmākhyā* by Hugh B. Urban (South Asia: Journal of South Asian Studies 2010)

10. *Medieval Jaina Goddess* Traditions by John Cort (Numen, Vol. 34, Fasc. 2 Dec.1987)
11. *What Tantrism means to modern western Civilization* by J. Evola (East and West, Vol. 1, No. 1 APRIL 1950)
12. *Witchcraft in Ancient India* by M. Winternitz (The Indian Antiquary, A Journal of Oriental Research Vol. XXVIII, 1988)

***PROJECT:**

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Mid SemExam	**15%**
End Sem Exam	**30%**
Short Assignments (Four)	**20%**
Term Paper	**20%**
Book Reviews (two)	**15%**

OUTCOME: The course aims to develop knowledge and understanding of the histories, social conditions, practices and cultural expressions of religious traditions which have historical roots in India but are under-studied and lesser known in public life. The students will gain foundational knowledge in the subject of religion, which will help in understanding the contemporary religious setting in the country.

REMARKS: The course will involve reading about 700 printed pages and writing about 8000 words in assignments of various sorts over the entire semester. Class participation and readings will influence the grading.

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TITLE **:** An Introduction to William Blake
(Selections from Songs of Innocence and Songs of Experience)
Course Code **:**
CREDITS **: 3-1-0-4**
TYPE-WHEN : Spring 2020
FACULTY NAME **:**ArunaChaluvadi
PRE-REQUISITE : 4th Yr Students
OBJECTIVE : To introduce William Blake
COURSE TOPICS : Introduction

List of Poems:

SONGS OF INNOCENCE

Introductory Poem; The Shepherd; The Echoing Green; The Lamb; The Little Black Boy; The Blossom; The Chimney Sweeper; The Little BoyLost; The Little Boy Found; Laughing Song; A Song; Divine Image; Holy Thursday; Night; Spring; Nurse's Song; Infant Joy; A Dream; On Another's Sorrow.

SONGS OF EXPERIENCE

Introductory Poem; Earth's Answer; The Clod and the Pebble; Holy Thursday; The Little Girl Lost; The Little Girl Found; The Chimney Sweeper; Nurse's Song; The Sick Rose; The Fly; The Angel; The Tiger; My Pretty Pretty Rose Tree; Ah Sunflower; The Lily; The Garden of Love; The Vagabond; London; The Human Abstract; Infant Sorrow; A Poison Tree; A Little Boy Lost; A Little Girl Lost; The Schoolboy; To Terzah; The Voice of the Ancient Bard

PREFERRED TEXT BOOKS:

http://triggs.djvu.org/djvu-editions.com/BLAKE/SONGS/Download.pdf

***REFERENCE BOOKS:**
***PROJECT:**

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Quiz-1	15
Mid Sem Exam	25
Quiz-2	15
End Sem Exam	40
Other Evaluation	

OUTCOME: Students learn to appreciate how language intersects with beauty and truth and the search for meaning of life in William Blake's Poetry

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TITLE : Linguistics Data II: Collection and Modeling

COURSE CODE: CLG452

CREDITS : 4

TYPE-WHEN : Spring 2020

FACULTY NAME : Radhika Mamidi, Dipti Misra Sharma, Aditi Mukherjee

PRE-REQUISITE : Preferred Introduction to Linguistics, CL1

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

COURSE TOPICS:

1.Discourse and Dialogue coherence theories

a. Discourse relations and connectives

b. Dialogue acts

c. Anaphora processing

d. Politeness theory

e. Bias in news data

2. Collection and formatting of data from various web resources

3. Developing an annotation schema

4. Annotation of collected data

GRADING: Seminar 10, Term paper 20, MidSem 30, Project 40

Reference:

Penn Discourse Tree Bank (PDTB) guidelines

Rhetorical Structure Theory (RST) manual

Greene, Judith. 1986. Language Understanding: A Cognitive Approach. Open University Press.

Leech, Geoffrey N. 1983. Principles of Pragmatics. London: Longman.

Levinson, Stephen C. 1983. Pragmatics. Cambridge University Press.
Sacks, Harvey, Emmanuel Schegloff and Gail Jefferson. 1974. A simplest systematics for the organization of turn-taking in conversation. Language, 50, 696-735.

Brown, Gillian and George Yule. 1983. Discourse Analysis. Cambridge: Cambridge University Press.

Andrew Mullen and Jeffery Klaehn. 2010. The Herman–Chomsky Propaganda Model: A Critical Approach to Analysing Mass Media Behaviour.

http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.458.4091&rep=rep1&type=pdf

Steven J. Allen. 2015. Article on Deception and Misdirection: 8 types of media bias.

https://capitalresearch.org/article/media-bias-8-types-a-classic-kinda/

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TITLE : Language, Mind and Society

COURSE CODE : TS17002
CREDITS : 3-0-0-4
When : Spring 2020

FACULTY : Aditi Mukherjee
PRE-REQUISITE : None

OBJECTIVE : To introduce the students to the basics of language as situated in mind and society.
The course will also attempt at demystifying certain language related stereotypes.

COURSE CONTENT : Nature and structure of language.

1. Structure dependence at different levels – sounds and sound patterns (phonetics and phonology), words and how they are formed (morphology), sentence (morpho-syntax, syntax).
Language Universals at all levels.
2. Language and Brain/Mind : Modularity of the brain, Aphasia, Innateness – principles and parameters, Universal Grammar. Language acquisition – nature/nurture, behaviorist and mentalists hypotheses.

3. Language and Society : Structure of variation – Attitudes, identity. Sociolinguistic variables.
Language Planning – corpus (Standaridization) and status. Language contact - Multilingualism.
Pidgin, Creole. Code mixing, code switching. Convergence.

PREFERRED TEXT BOOKS:
1. Jean Aitchison – The Articulate Mammal (10th edition),
2. Fromkin, V, Robert Rodman, Nina Hyams (9th edition) An Introduction to Language, Thomson Wadsworth
3. Rajend Mesthrie et al : Introducing Sociolinguistics (2nd edition), Edinburgh University Press
(Supplementray readings will also be suggested in the class)
PROJECT : The course will have a project content where students will study and solve a problem using real language data.

GRADING : HA 15%, Class presentations 10%, Mid term 20%, Project/Term paper 25%, End term 30%

OUTCOME : At the end of the course, the students will begin to understand the logical moorings of language and will also be able to critically examine some of the prevalant beliefs about language.

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Title: **Cognitive Neuroscience**
Course Code: CSE586
Type When: Spring 2020
Faculty Name: Kavita Vemuri
Joint course: IIITH and University of Hyderabad.

The course will examine how modern cognitive neuroscientists explore the neural Underpinnings of sensory information – vision, sound, and touch leading to visual/auditory attention, language processing, memory, empathy/emotion and other higher-order cognitive processes. Investigates the different techniques applied to uncover observations of clinical populations & non-clinical human populations and also some specimens from the insect/ animal kingdom. Data collected from powerful methods like functional magnetic resonance imaging (fMRI) and electroencephalogram (EEG) will be analyzed to examine functional brain connectivity. Equal emphasis is on understanding analytical methods and the limitations of each. The third part of the course will cover a part of computational neurosciences, which involves building computer simulation on models of neurons and dynamic neural circuits
Lectures: 70%
Lab work: 30%
The lab work will cover analysis of fMRI, Difusion Tomography imaging, EEG data from research studies designed to investigate the neural responses to a visual, auditory or task stimuli.
Textbooks:
1.Cognitive Neuroscience by Gazaniga (copy available in ITH library)
2. Fundamentals of Computational Neuroscience by Thomas Trapenberg.
3. Required research papers.
Evaluation:
Assignments(6):20%
Class presentation (1): 10%
Lab work: 30%
Mid-sem I: 20%
Final Sem: 20%
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Title: Comprehension of Indian Music

Course Code: HSS337
Faculty name: TK. Saroja
Type-When: Humanities Elective, Spring 2020
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 2020
FACULTY NAME : Avinash Sharma

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 : Database Systems
COURSE CODE: CSE441
CREDITS : 4
TYPE-WHEN : Second-level course in database systems
FACULTY NAME : P. Krishna Reddy

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 : Deep Learning: Theory and Practices
Course Code : TBD
CREDITS : 3-1-0-4
TYPE-WHEN : Spring 2020
FACULTY NAME : Dr. Naresh Manwani
PRE-REQUISITE : Good background in Linear Algebra and Probability theory, Statistical Methods in AI (Compulsory), Optimization Methods (Optional).
OBJECTIVE : The course is designed to cover the fundamentals of Deep Learning in depth. The objective of this course is to familiarize the audience with the theoretical as well as practical aspects of deep learning.
COURSE TOPICS :

1. Introduction to neural network, Perceptron and its convergence proof. Feed-forward neural network, back propagation, convergence in neural networks, rates of convergence, loss surfaces, learning rates. [3 Lectures]
2. Representation power of feedforward neural network, limitations of shallow networks, why and when can deep networks avoid curse of dimensionality. [3 Lectures]
3. Optimization for deep networks: gradient descent (GD), momentum based GD, Nesterov accelerated GD, stochastic GD, AdaGrad, RMSProp, Adam [5 Lec-tures]
4. Bias variance tradeoff, L2 regularization, early stopping, dataset augmentation, parameter sharing and tying, injecting noise at input, ensemble methods, dropout. [2 Lectures]
5. Greedy layerwise pre-training, better activation functions, better weight initial-ization methods, batch normalization [2 Lecture]

6. Auto-encoders and relation to PCA, regularization in auto-encoders, denoising auto-encoders, sparse auto-encoders, contractive auto-encoders, variational auto-encoders (VAEs), mutual information and the information bottleneck [4 Lectures]
7. Convolutional neural networks (CNNs), backpropagation in CNNs, variations in the basic model, Alexnet, Inception, VGG [2 Lectures]
8. Recurrent neural networks, backpropagation through time (BPTT), vanishing and exploding gradients, truncated BPTT, stability, bidirectional RNNs, gated recurrent units (GRUs), long short term memory (LSTM), solving the vanish-ing gradient problem with LSTMs, Resnets [5 Lectures]

PREFERRED TEXT BOOKS: 1. Simon Haykin. 1998. Neural Networks: A Comprehensive Foundation (2nd ed.). Prentice Hall PTR, Upper Saddle River, NJ, USA. 2. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016. 3. R. Rojas: Neural Networks, Springer-Verlag, Berlin, 1996

***REFERENCE BOOKS: Recent research papers in deep learning (papers pub-lished in ICLR, ICML and NIPS)**

***PROJECT:**

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Quiz-1	7.5
Mid Sem Exam	20
Quiz-2	7.5
End Sem Exam	20
Assignments	25
Project	15
Scribing	5

OUTCOME: By the end of the course, it is expected that students will have very good familiarity with the subject in Deep Learning, and they should be able to apply Deep Learning to a variety of problems. They will also be in a position to understand much of the current literature in Deep Learning and extend their knowledge through further study (research). **Type of Evaluation**

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TITLE : **Design of Hydraulic Structures**
Course Code : **CEW612**
CREDITS : **3-1-0-4**
TYPE-WHEN : **Spring-2020**
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-2020
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 : Lini Thomas
Pre-requisite: Operating Systems, Networks desirable

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-2020
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
Faculty Name: **Anshu Sarje**
Pre-requisite: **Basic Electronics&(Digital VLSI) ECE 361**
Course Topics

Unit 1: Introduction to digital design: Analog vs Digital, Process Technology and Design/process parameters: technology scaling, power, speed, leakage, performance. CMOS process, transistor, registers. Idea of design+fabrication process. Recap: Inverter, transmission & logic gates

Unit2: MOS transistor: operation, threshold voltage, body effect, channel length modulation, C-V characteristics, Switching and DC characteristics (noise margin), First order & Second order effects, Short channel transistors vs Long Channel, FinFET, metal gate

Unit 3: CMOS Process Technology: Silicon Semiconductor technology, Manufacturing CMOS Technology (Silicon wafer, photolithography, processing steps, well formation, self aligned process), Packaging/Assembly and Testing, Layout (Hierarchy & special layout techniques) and process steps, I/O, ESD, Pad-frame, Layout versus Schematic (LVS), Design Rule Check (DRC),Process parameters and their impact on device performance.

Unit 4: Design topics: Memory: SRAM, DRAM, Counters, Combinational and Sequential circuit. Project ideas: counters, array scanner, pulse width

Unit 5: Design & process issues:Delay, Power and Robustness. Issues: leakage (types of leakages) mechanism,, Band-to-Band Tunnelling Current, Tunnelling throughand into gate oxide, Injection of hot carriers from substrate to gate oxide, GIDL, Punch-through, Sub-threshold Leakage Current including DIBL. Latch up. Process Variation and its affect.

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.

Grading Scheme:
Assignments 10%

Quiz (class quizzes, Mid-term); 5% & 10%
Mid-Semester Project (Layout):25%
End-Semester Project 30 %
Final Exam: 20%

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TITLE : Earthquake Engineering
Course Code : CES641
CREDITS : 3-1-0-4
TYPE-WHEN : Spring 2020
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: Elasticity Theory and Finite Elements

Course Code:

Credits: 4

When: **Spring Semester**

Name: **M. Venkateswarlu**

Prerequisite: None

Objective: Understand the theory behind the formulation and numerical solution of boundary value problems in solid mechanics.

Course topics:

Part A: Elasticity Theory

1. Mathematical Preliminaries: Scalar and vector fields, index notation, coordinate transformations, Cartesian tensors, tensor operations, Integral theorems.
2. Formulation of elasticity problems: Theories of stress and strain, stress-strain relations, equilibrium, compatibility, displacement formulation, force formulation.
3. Extension, Bending and Torsion: Prismatic bar under axial loading, cantilever beam under end loading, torsion of bars, membrane analogy, computation examples.
4. Two-dimensional elasticity: Plane stress, plane strain, cylindrical coordinates, axisymmetric stress and displacements, thick walled cylinders, disks, sheet with a circular hole, curved beam, narrow beams, semi-infinite plate with a concentrated load.

Part B: Finite Elements

1. Basic concepts: Truss and frame elements, isoparametric elements, gauss quadrature, integration by parts, derivatives of shape functions, evaluation of boundary integrals, integral relations, Galerkin formulation, assembly process.

2. Analysis of elastic solids: Governing equations, weak form, finite element equations, tetrahedral element, hexahedral solid element, evaluation of derivatives, surface integrals, and line integrals, stress calculation, static condensation, sub structuring, patch test for incompatible elements.
3. Solids of revolution: Equations of elasticity in cylindrical coordinates, axisymmetric analysis, potential energy, finite element equations, symmetric loading, antisymmetric loading, Fourier series representation of loading.
4. Multi-field formulation-Beams: Euler Bernoulli beam theory, mixed beam element based on EBT, Timoshenko beam theory, displacement based beam element on TBT, shear locking, mixed beam element based on TBT
5. Multi-field formulation-Elastic solids: Governing equations, displacement formulation, stress formulation, mixed formulation, stress field for mixed formulation.

Grading Plan:

Type of Evaluation	Weightage (in %)
Quiz-1	**15**
Mid SemExam	**20**
Quiz-2	**15**
End Sem Exam	**40**
Assignments	**10**

Outcome: will be able to handle stress analysis problems using computers with confidence.

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TITLE **: Environment and Politics in India**
Course Code **: HSS466**
CREDITS **:** Four
TYPE-WHEN **:** Spring 2020
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 **: Ethics**
Course Code **:**
CREDITS **:** 3-1-0-4
TYPE-WHEN **:** Spring-2020
FACULTY NAME **:** Don Wallace Freeman Dcruz
PRE-REQUISITE **:**
OBJECTIVE **:**

1. Examine major theories in ethics by dividing the various approaches in ethics to normative ethics, meta-ethics and applied ethics.

2. To look into some of the possible scenarios or cases in which one would face moral dilemma in deciding what would be the (morally) right thing to do. Response to such question or moral dilemma will lead to normative approach in ethics. Thus, the objective is to see various approaches in normative ethics.

3. Examine some of the major approaches in meta-ethics to understand the nature of morality. For example, to enquire whether there is only one absolute morality or is morality relative.

4. Examine some of the actual moral issues such as abortion, animal rights, environmental issues etc.

COURSE TOPICS:
Topic 1: Normative Ethics
Consequentialism
Deontology
Virtue Ethics
Social contract theory
Topic 2: Meta-Ethics
Non-naturalism
Non-cognitivism
Moral Realism and Moral relativism
Moral Skepticism and Intuitionism
Topic 3: Applied Ethics
Abortion
Duties to animals
Environmental Ethics

Engineering ethics
Situated Ethics

PREFERRED TEXT BOOKS:

Russ Shafer-Landau (ed.) 2013. *Ethical Theory: an Anthology*. Wiley-Blackwell.
George Sher (ed.) 2012. *Ethics: Essential Readings in Moral Theory*. Routledge.
Hugh LaFollette (ed.) 2000. *The Blackwell Guide to Ethical Theory*. Blackwell.
Peter Singer (ed.) 1991. *A Companion to Ethics*. Wiley-Blackwell.

***PROJECT:** None.
GRADING PLAN:

Type of Evaluation	**Weightage (in %)**
Participation in class room discussions and interactions	20
End Sem Exam	30
Assignments	20
Term Paper and Presentation	30

OUTCOME: Students will be able to distinguish between meta-ethical, normative ethical and applied ethical concerns from each other. Students will be able to critically think and examine actual problems mentioned in the applied ethics based on the theories in normative and meta ethics.
REMARKS: This course will give more emphasis on normative and applied ethics, though the topics from meta-ethics are discussed.

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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 **: ECE538**
CREDITS **:** 4
TYPE-WHEN **:** Spring 2020
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 : General and Structural Chemistry
Course Code : SCI341
CREDITS : 4
TYPE-WHEN : Core for CND /Open elective for others Spring-2K20
FACULTY NAME : Tapan Kumar Sau

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 : HSS447

CREDITS : 4

TYPE-WHEN :

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: <u>Core concepts and terms</u>

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 %)
Quiz 1	**10%**

Mid Sem- Exam	**20%**
End Sem Exam	**20%**
Term paper 1	**25%**
Term Paper 2	**25%**

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: Green Buildings
CourseCode:CEG422
Credits:4
Type/ When:Spring-2020
Faculty name:Vishal Garg

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

Course Topics:
•Conventional building impacts•Introduction to Green Buildings
•Impacts of building construction, operation and disposal
•The green building process and assessment
•Ecological design
•Sustainable sites and landscaping
•Energy efficiency in buildings
•Renewable energy
•Water conservation
•Sustainable and alternative materials
•Indoor environmental quality

- Construction Operations and Building Commissioning
- Certification Systems
- Sustainable Operations
- Economic issues andfuture directions in green building

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

Site Visits:
Site visit(s) to building(s)/campus(es) in Hyderabad which aredesignedor operated in sustainablemanner.Students will have to submit their individual site visit reports.

Preferred Text Books:
1.Sustainable Construction: Green Building Design and Delivery, Second Edition, Charles Kibert,John Wiley and Sons
2.The Integrative Design Guide to Green Building: Redefining the Practice of Sustainability, BillReed, John Wiley and Sons
3.ASHRAE Standard 189.1–Standard for the Design of High Performance Green Buildings
4.LEED Reference Guide forGreen Building Design and Construction
5.LEED Reference Guide for Green Building Operations and Maintenance

Reference Books:
1.The Green Studio Handbook: Environmental Strategies for Schematic Design, Alison Kwok ,Walter Grondzik, Elsevier
2.Carbon-Neutral Architectural Design, Pablo M. La Roche, CRC Press
3.Green Building: A Professional's Guide to Concepts, Codes and Innovation, Anthony C. Floyd,International Code Council
4.Green Building Fundamentals (2nd Edition), Mike Montoya, Pearson Education
5.Fundamentals of Integrated Design for Sustainable Building, Marian Keeler, Bill Burke, JohnWiley and Sons

Grading:
Mid-term exams = 10%+10%
Report on Site Visit(s) =5%
Attendance in the Invited lectures/seminars = 5%
Project work and presentation=20%
End semesterExam=50%

Outcome:
Students will get an overview of green building design and operations. They will also understandvarious rating systems and will apply these to evaluate sustainability of the campus.

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

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TITLE **:Hydroinformatics**
Course Code **: CEG462**
CREDITS **:**3-1-0-4
TYPE-WHEN **:**Engg Elective - Spring 2020

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 2020 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 : Introduction to Coding Theory
Course Code :

CREDITS : 4
TYPE-WHEN : Spring 2020
FACULTY NAME : Prasad Krishnan

PRE-REQUISITE : Necessary - Basics of Linear Algebra, Probability theory basics,
Recommended -Basics of Introduction to Information Systems (also called "Information and Communication")

OBJECTIVE : This course aims to introduce students to the idea that coding theory is a fundamental block of communications systems, whether in the form of real-time communication or in the form of storage. The course will be taught top-down – various current communication systems and storage systems will be shown and the error correcting codes used in those systems will be enunciated upon starting from the basics. The theory required in each will be concurrently covered to a limited extent.

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

1. *The General Purpose of Coding Theory – Channel Coding (Error Correcting Codes) and Source Coding (for Data Compression)*
    1.1. Error Models – Probabilistic and Worst Case
    1.2. Shannon theory review – Source and Channel Coding limits

2. *Channel Codes used in Storage Media*
    2.1. Codes on Magnetic and SSD media - Hard Disks and Flash Drives **(Repetition Codes, Hamming Codes and Related Codes)**

    2.2. Theory of Linear Block Codes – Finite Fields and Linear Algebra Review, Minimum distance and bounds.

    2.3. Codes for Storage Media – ECC Memory (DDR RAM), (Optical) Blu Rays and DVDs, Magnetic tapes**(Reed Solomon Codes)**

3. *Channel Codes in Communication Systems*
    3.1. Codes over the Internet (TCP-IP) **(Cyclic Codes - CRC)**
    3.2. Codes used in Long-Distance Space Communication **(Convolutional Codes and LDPC Codes)**
    3.3. Codes in the Wireless Medium – **Turbo Codes, Polar Codes**
    3.4. How good are these codes in light of Shannon Theory ?

4. *State of the Art and the Future :***DNA Data Storage, Codes for Data Storage Applications, Codes for Distributed Computation**

5. *Source Coding – ZIP, Images, Video***(Huffman and other source coding techniques).**

6. *Source Coding for Distributed Communication Systems* – **Codes for Content Distribution in the presence of Caches**

PREFERRED TEXT BOOKS:
Parts of each of these will be required:

1. "Essential Coding Theory", VenkatesanGuruswami, AtriRudra, Madhu Sudan (Available online)

2. "Error Correction Coding: Mathematical Methods and Algorithms" Todd K Moon,

3. "Channel Codes : Classical and Modern" , William Ryan and Shu Lin.
4. Papers, Technical Reports.

***REFERENCE BOOKS:**

1. "Error Control Coding", Shu Lin and D. Costello.

2. Blahut, R. E. *Theory and Practice of Error-Control Codes*. Reading, MA: Addison-Wesley, 1983. ISBN: 0201101025.

3. "Information Theory, Inference, and Learning Algorithms", David J.C. MacKay.

***PROJECT:**There will be a paper implementation/presentation as part of this course, based on each student's capabilities and interests in theory/application. A list of plausible papers will be released after Quiz 1 or Mid exam from which the students can select.

GRADING PLAN:

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

OUTCOME: At the end of the course, the student is expected to appreciate how coding theory has been and will be instrumental in engineering efficient engineering systems. The student should also be ready to read introductory papers on research topics related to coding theory.

REMARKS:

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TITLE : NGS Data Analysis
Course Code : SCI653
CREDITS : 4
TYPE-WHEN : SPRING
FACULTY NAME : Dr. Nita Parekh
PRE-REQUISITE :
OBJECTIVE :

The course will provide a comprehensive genome analysis using next generation sequencing data, both at the whole-genome level (WGS) and transcriptome-level (RNAseq). A major component of the course will be hands-on-sessions, wherein various available resources will be used to carry out the analysis on real genome data to address biological problems. The course structure will be one theory lecture followed by one lab session. The course also has a project component wherein the students will carry an end-to-end genome analysis using NGS for a biological problem.

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

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

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

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

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

5. Downstream analysis of alignment based assembly - 3TL, 3HL
   - Methods for identification of variants (genome-level)
     - Data-preprocessing, Data pretreatment, Data analysis for Single nucleotide variations (SNVs), Structural variations (SVs) - CNVs, indels, inversions and translocations
   - Visualisation and Annotation of variants
   - Differential gene expression analysis (CuffDiff) – (transcriptome-level)

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

- Soapdenovo (genome)
- Cufflinks (transcriptome)

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

8. Small RNA analysis – 1TL, 1HL

9. Project presentations – 2 classes

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

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

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TITLE **: Modeling and Simulations**
CREDITS **:** 3-0-1-4
TYPE-WHEN **:** Bouquet core & Open elective, Spring 2020
FACULTY NAME : Prabhakar B + Deva PriyaKumar

PRE-REQUISITE: None

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

COURSE TOPICS:
1 Basic Maths: coordinate systems, vector algebra, differential equations, matrices, Taylor expansion (1 lecture)
2 Molecular Mechanics: Molecular force fields, energy minimization (2 lectures)
(3) Molecular Dynamics: Equations of motion, phase space distribution functions, sampling, integrators, boundary conditions, electrostatics, molecular constraints (5 lectures)
(4) Free energy calculations: Umbrella sampling, thermodynamic integration, replica exchange method (2 lectures)

(5) Monte Carlo methods: Pi-value computation, important sampling, Metropolis algorithm, applications (1 lecture)
(6) Non-equilibrium molecular dynamics: Jarzynski equality, steered molecular dynamics, shear flow (2 lectures)
(7) solvent models: Implicit models, explicit models (1 lectures)
(8) Quantum Chemistry: Operators, wavefunctions, postulates, probability density, time-dependent Schrodinger equation (2 lectures)
(9) Translational, rotational, vibrational dynamics of simple quantum systems, hydrogen atom (3 lectures)
(10)Molecular quantum mechanics: Born-Oppenheimer approximation, LCAO, Variation theorem, perturbation theory, Huckel theory, HF, semi-empirical methods, electron correlation, CI (4 lectures)
(11)DFT (1 lecture)
(12) Force field parameterization using quantum mechanical methods (1 lecture)
(13) Students presentations (3 lectures)
PREFERRED TEXT BOOKS:
***REFERENCE BOOKS:**
1. Computer Simulation of Liquids, by M.P. Allen and D.J. Tildesley
2. Understanding Molecular Simulation: From Algorithms to Applications, by D. Frenkel and B. Smit
3. Molecular Quantum Mechanics by Atkins
***PROJECT:**
GRADING: Will be decided later after discussing with students
OUTCOME:
REMARKS:
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TITLE : Music, Mind, & Technology
Course Code : CSE588
CREDITS : 4
TYPE-WHEN : Spring 2020
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.
****

TITLE **: Multivariate Analysis**
Course Code **: IMA409**
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
Course Code : CSE573
TYPE-WHEN : Spring 2020
FACULTY NAME : Manish Shrivastava

PRE-REQUISITE : Intro to NLP

OBJECTIVE :

This is the advanced course in Natural Language Processing intended for honors, dual degree, BTP, MTech and PhD students.

COURSE TOPICS :

In this course, students get an overview of various areas in NLP and the current research trends in each of them.

The topics covered include machine translation (rule based & statistical), discourse, statistical parsing, word sense disambiguation, natural language generation, co reference resolution, semantic role labeling etc.. The course also covers two of the most popular machine learning methods (Expectation-Maximization and Maximum Entropy Models) for NLP. Students would be introduced to tools such as NLTK, CoreNLP to aid them in their research.

PREFERRED TEXT BOOKS:

***REFERENCE BOOKS:**

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

REMARKS:

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TITLE : Optimization Methods
Course Code : CSE481
CREDITS : 3-1-0-4
TYPE-WHEN : Spring, 4XXX level
FACULTY NAME : 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 : Principles of Information Security
COURSE CODE: CSE418
CREDITS : 3-1-04
TYPE-WHEN : Spring 2020
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 : Statistical Methods in AI
CREDITS : 3-1-0-4
Course Code : CSE471
TYPE-WHEN : Spring 2020
FACULTY NAME : **Santosh Ravi Kiran + Vineet Gandhi**

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 : Santosh Nannuru

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 2020
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 : Internals of Application Servers
Course Code : CSE563
CREDITS : 3-1-0-4
TYPE-WHEN : Spring 2020
FACULTY NAME : 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 Neural and Cognitive Modeling
Course Code : CSE 486
CREDITS : 4
TYPE-WHEN : Spring semester
FACULTY NAME: Dr. S. Bapi Raju

PRE-REQUISITE:
Interest in Neuroscience and Cognitive Science, Basic background in Calculus, Probability and Statistics, Linear Algebra, Ordinary Differential Equations and aptitude for programming.

OBJECTIVE:
This is an introductory course on computational models used in Neuroscience and Cognitive Science. The emphasis is on multiple scales (three levels) of modeling – Single Neuron-level, Network-level and Abstract (Connectionist) models. The course emphasizes the need for and role of theory and computation in Neuroscience and Cognitive Science.

COURSE TOPICS:

Part I: Introduction to Neuroscience; Compartmental models of neuron; Spiking Neuron models.
Part II: Neural population codes; information representation; neural encoding and decoding; hierarchy and organization of sensory systems; Spiking Network models of sensory systems; Neuroplasticity and learning.
Part III: Introduction to Hebbian, Competitive and Error-driven learning rules; Neural Network models of Perception, Attention, Memory, Language and Executive Function.

PREFERRED TEXT BOOKS:

REFERENCE BOOKS:

1) R. O'Reilly & Y. Munakata (2000). Computational Explorations in Cognitive Neuroscience: Understanding the Mind by Simulating the Brain. MIT Press.
2) J. M. Bower and D. Beeman (2003). The Book of GENESIS: Exploring Realistic Neural Models with the GEneral NEural SImulation System, Internet Edition.
3) Peter Dayan and L. F. Abbott (2005). Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems. MIT press.
4) Thomas Trappenberg (2009). Fundamentals of Computational Neuroscience. 2nd edition, OUP Oxford.
5) Daniel S. Levine (2018). Introduction to Neural and Cognitive Modeling: 3rd Edition, Routledge, USA.
6) V. Srinivasa Chakravarthy (2019). Demystifying the Brain: A Computational Approach. 1st Edition, Springer, Singapore.

PROJECT: (see below)

GRADING:

Mid-term Exam(s) (1):	30%
Final Exam:	35%
Quiz / Assignment / Project:	30%
Other:	5%

OUTCOME:

At the end of the course, students will have an appreciation of models used in Neuroscience at multiple levels of resolution and would acquire familiarity with programming environments that implement them. Although the course stands independently by itself, it adds computational perspective to courses such as Introduction to Cognitive Science and Introduction to Cognitive Neuroscience.

REMARKS:

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TITLE : Introduction to Parallel Scientific Computing
Course Code : CSE504
CREDITS : 4
TYPE-WHEN : Spring
FACULTY NAME : Pawan Kumar
PRE-REQUISITE : C/C++/Python, Linear Algebra, Basic Machine Learning (desirable). Strong Interest in algorithms and data structures.

OBJECTIVE : To learn basic concepts of parallel algorithm design and implementation.

COURSE TOPICS :

1. **Basic Matrix/Tensor Algorithms:** Vector-Vector operations, Matrix Vector Operations, Vectorizations of codes, Matrix-Matrix Operations. Special Structured Matrices, Matrix Factorizations: LU, QR, SVD, PCA. Introduction to Tensors, Tensor Factorizations. (7L)

2. **Shared Memory Programming:** Basic computer Architecture: Memory hierarchy, Caches, Shared memory architectures, NUMA architectures, Multithreading with pthreads and OpenMP. Introduction to CUDA. (7L)

3. **Distributed Memory Programming:** Distributed memory architectures, Process Topology. Introduction to message passing interface. Global address space programming. Communication hiding and communication avoiding algorithm designs. Complexity of parallel algorithms. (3L)

4. **Selected Case Studies of Recent Papers:** Parallel stochastic gradient descent methods (Sign SGD, ADAM, Hogwild, Coordinate Descent, etc), Parallel 2nd Order Gradient Methods, Parallel Least Squares for Regression, Parallel SVM for classification, Parallel Feed forward and Training of Basic Neural Networks (ANN,CNN,RNN,RL some possibly as projects). Brief Remarks on Classical versus quantum parallelism. (9L)

PREFERRED TEXT BOOKS:

1. Matrix Computations, Golub, John-Hopkins
2. MPI complete reference
3. Matrix Methods in Data Mining
4 High performance computing for scientists and engineers

REFERENCE BOOKS:

***PROJECT:**

Grading Plan:Type of Evaluation	**Weightage (in %)**
Quiz-1	
Quiz-2	
Mid Sem Exam	25
End Sem Exam	30
Assignments	**20**
Project	**25**

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Course Code : SCI765
CREDITS : 4
TYPE-WHEN : SPRING
FACULTY NAME : Dr. Vinod P.K.
PRE-REQUISITE : Advanced Biology

OBJECTIVE :

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

COURSE TOPICS:

Introduction

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

Mathematical modeling of biological systems
o Input/output relationships
o Enzyme Kinetics
o Design principles of biological systems
o Deterministic and stochastic modelling
o Parameter estimation and sensitivity analysis
o Spatial modeling
o Modeling signaling pathways
o Biological Switches and Clocks
o Metabolic networks and flux balance analysis
o Neuronal Dynamics- from single neurons to network (Dr. Dipanjan Roy)
o Advantages and limitations of various modelling techniques
o Simulations of Cell biological Systems
o Modelling standards and Tools
Network Biology
o Graph theoretic description of network(Dr. Dipanjan Roy)
o Motifs, modules and hierarchical networks
o Network Robustness
o Network inference and visualization
o Introduction to high throughput data analysis
Applications of Systems biology
o Systems Biotechnology
o Systems and Synthetic Biology
o Systems Analysis of Complex Diseases (Biomedicine)
o Systems Pharmacology: Understanding Drug Action from a Systems Perspective
PREFERRED TEXT BOOKS:
1. **Systems Biology: A Textbook answers to problems** By Edda Klipp, Wolfram Liebermeister, Christoph Wierling, Axel Kowald, Hans Lehrach, Ralf Herwig, Wiley-VCH
2. **Systems Biology: Properties of Reconstructed Networks** By Bernhard O.Palsson Cambridge University Press
3. **An Introduction to Systems Biology: Design Principles of Biological Circuits**
by Uri Alon , Chapman & Hall
GRADING:
Mid semester exam 1 – 20%
Mid semester exam 2 – 20%
End semester exam – 40%
Project/Assignments – 20%
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TITLE : Introduction to Game Theory
Course Code: CSE498
CREDITS : 3-0-0-4
TYPE-WHEN : Spring-2020
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 : 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 2020
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 **: PHOTONICS**
Course Code **: ECE566**
CREDITS **:** 3-1-0-4
TYPE-WHEN **:** Elective Course, Spring 2020
FACULTY NAME **:** Syed Azeemuddin

PRE-REQUISITE: Mathematics, Basics of Electromagnetic Theory

OBJECTIVE: To understand the basic concepts of photonics and optics To understand and design integrated photonic devices and circuits To explore an ever-increasing area of research
COURSE TOPICS:
RAY OPTICS Postulates of Ray optics, Propagation, reflection, and refraction of rays, Snell's law, Optical components, Paraxial optics, Graded Index optics, Matrix optics
WAVE OPTICS Postulates of Wave optics, Monochromatic and polychromatic waves, Plane, Spherical andParaxial waves, Wave interaction with optical components, Interference
BEAM OPTICS Gaussian beam, Hermite Gaussian beam, Laguerre Gaussian beam, and Bessel beam, Transmission through optical components
ELECTROMAGNETICS Elementary electromagnetic waves and their Absorption and Dispersion
POLARIZATION Reflection, Refraction, Optical activity, and Faraday-effect by considering light polarization
GUIDED WAVES AND RESONATOR Planar, step-index and graded index waveguides, Resonance conditions and frequencies of planarmirror resonators and spherical-mirror resonators
LASER The Photon, Photon streams, and Quantum states of light, Modeling and characterization of diode lasers, Statistical properties of random light.
NUMERICAL METHODS Solving wave equation by Beam Propagation Method (BPM) and Finite-Difference Time-Domain method (FDTD)
PREFERRED TEXT BOOKS:
B. E. A. Saleh and M. C. Teich, —Fundamentals of Photonics‖, 2nd Edition,Wiley; C. Pollock and M. Lipson, —Integrated Photonics‖, Kluwer Academics Publishers; L. Coldren and S. W. Corzine, —Diode Lasers and Photonic Integrated Circuits‖, Wiley
REFERENCE BOOKS:

S. O. Kasap, —Optoelectronics and Photonics‖, Pearson PROJECT: Lab Assignments using MATLAB and an open source optics software

GRADING:

Relative Grading

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

OUTCOME:

REMARKS:

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

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TITLE **:** CEG461 - Remote Sensing

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

TYPE-WHEN **:** Open / Engineering Elective

FACULTY NAME **:** Rama Chandra Prasad Pillutla

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 **:**

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
   (Data acquisition Geo-registration and Map projections, Image processing techniques, Image Interpretation (visual), Digital image classification
7. Object based classification
8. Image arithmetic, Change detection
9. DEM –Creation and Application
10. Thermal Remote sensing
11. Hyper-spectral Imaging
12. Microwave Remote sensing
13. Lidar Remote sensing

14. Major applications of Remote sensing in
    a. Vegetation / Terrestrial ecology/wildlife
    b. Hydrology/Land use / Land cover /Agriculture
    c. Disaster management

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)

GRADING:

1. Assignments (max. of 4)	15%
2. Project	25%
3. Quiz (2)	20%
4. End-Semester Exam (1)	30%

Details of Assignments/Projects will be announced during the course.

OUTCOME:

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

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Title : Science, Technology and Society

Course Code: HSS365

Credits: 3-1-0-4

Objectives: Objectives for each section are itemized:

Sec. I: Preparing the platform on which scientific epistemology may be discussed.

Sec. II: Understanding how science is done – the nature and characteristics of science; distinguishing science from what is not science.

Sec. III and Sec. IV: Understanding the linkages between science and technology; Illustrative learning of the impact of science and technology on society and how these can become tools serving larger political structures.

Sec. V: A comparative understanding on distinct features of the human sciences.

Syllabus:

I. Review of theory of knowledge: 3-4 Hrs.

1. The problem of knowledge

2. Common sense – uncertain versus certain knowledge

3. Language, perception, reason and emotion; illustrations with limitations of each; the power and limitations of science emanating from the lack of emotion in scientific epistemology.

4. Generalisations and fallacies.

5. Beliefs versus Truth continuum – Justified True beliefs**.**

Required readings (Relevant chapters from):

1. Richard van de Lagemaat, *Theory of Knowledge*, Cambridge Univ Press

2. First chapter (Introduction) of Robert Audi's *Epistemology: A Contemporary Introduction to the Theory of Knowledge*

3. First chapter of Dunkan Pritchard *What is this thing called knowledge*

4. A chapter from *Epistemology: the theory of knowledge*, by Daniel Cardinal, Jeremy Hayward, and Jerald Jones, published by John Murray, London, 2004

II. Scientific epistemology: 10-11 hrs.

6. (a) The (internal) world of science: Scales in Nature, Forms in Nature

(b) Methods of Science – Deduction/Induction.

(c) Methods of science – from hypothesis to law.

(d) Methods of science –Modeling in sciences; (i) Geometry and linear algebra; (ii) change and calculus; (iii) Chance and statistics

(e) Measurement and the uncertainties – deterministic chaos, classical stochasticity and the quantum uncertainty

7. Characteristics of Science – controllability, reproducibility, verifiability and falsifiability

8. Scientific revolutions – the Copernican revolution; the atomic theory, the atomic structure, the 'quantum', The theory of evolution

9. Scientific theory versus pseudoscience

Required readings:

Notes provided by the instructor and relevant chapters from:

Samir Okasha, Philosophy of Science, OUP Monograph

Sundar Sarukkai, What is Science, NBT

Richard van de Lagemaat, Theory of Knowledge, Cambridge Univ Press

J D Bernal, Science in History, vols. 1-4, MIT press

III. Science, Technology and Society-I: theoretical issues: 7-8 hrs.

10. What is technology

11. Science- Technology interactions and linkages; Examples of how S & T mutually benefit each other; Variation of these linkages in time.

12. Social construction of technology; technology as a force that diffuses/enhances social contradictions

13. S & T and culture and politics

Required readings (Relevant chapters from):

David Bell, Science, Technology and Culture, Open University Press, McGraw-Hill Education

Rudi Volti, Society and Technological Change, Worth Publishers

Samir Okasha, Philosophy of Science, OUP Monograph

Sundar Sarukkai, What is Science, NBT

Richard van de Lagemaat, Theory of Knowledge, Cambridge Univ Press

J D Bernal, Science in History, vols. 1-4, MIT press

IV. Science, Technology and Society-II: A few burning issues of our times: 10-11 hrs.

14. Energy – the crisis and strategies

15. Nuclear energy – pros and cons

16. Renewable energy sources

17. Conflicts and the war industry - War as a Social Institution, technology and war, the technology of war, resource based conflicts, the development debate and the internal conflicts.

18. Technology and genocide**.**

Required readings

Note provided by instructor and relevant chapters from:

Edward O. Wilson, On Human Nature, Harvard University Press, 1994,

F.T. Marinetti, Critical Writings, trans. D. Thompson, Farrar, Straus & Giroux.

Achin Vanaik and Praful Bidwai, New Nukes: India, Pakistan and Global Nuclear Disarmament, Interlink.

Ethics and Weapons of Mass Destruction: Religious and Secular Perspectives, ed. Sohail H. Hashmi and Steven P. Lee, Cambridge University Press.

Margaret Mead, "Warfare Is Only an Invention, Not a Biological Necessity," Asia 40 (1940).

V. The Human sciences and Arts: 1-2 hrs.

19. Brief discussion on distinct features of the human sciences
Durkheim's naturalist and Weber's interpretivist approaches
– the self-consciousness of the living being; the creative imagination in literature and arts as distinct from the scientific creativity.

Required reading (Relevant chapters from):

Richard van de Lagemaat, Theory of Knowledge, Cambridge Univ Press

VI. Conclusion: 1-2 hrs.

Review of Sections I-V; Questions for future and Discussions on the way forward**.**

Films:

Powers of Ten, Charles and Ray Eames

The day after, American made for TV documentary on post nuclear-war scenario

BBC documentaries on science and technology: The ghost in your genes, etc.

Assessment:

assignments: 15%

2 mid sem exams: 25% (12½% each)

end sem exam: 30%

project (30%): focussed work on a select topic related to the course content; research work in teams (max of four students in a team) and independent individual write ups will be required. Presentations are encouraged but will not be mandatory.

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TITLE : Probabilistic Graphical Models
Course Code :
CREDITS : 3-1-0-4
TYPE-WHEN : Spring, 2020
FACULTY NAME : Girish Varma
PRE-REQUISITE : Probability, Discrete Maths, Linear Algebra.

OBJECTIVE: To understand how probability, statistics and graph theory can be used to model machine learning problems. We will further see efficient algorithms for these problems with provable guarantees on runtime and accuracy. An Introduction to Learning Theory (statistical and computational) will also be covered. The focus will be to understand the theoretical underpinnings.

COURSE TOPICS :
(please list the order in which they will be covered)
Introduction: Reminder of Probability Theory, Overview of Graphs, Graphical Models Examples, Introduction to Spectral Graph Theory.
Models: Bayesian Networks, Undirected Graphical Models, Template Based Representations, Gaussian Network Models Exponential Family of Models.
Inference: Variable Elimination, Belief Propagation, MAP Inference, Sampling Based Inference, Variational Inference.

Learning: Directed Models, Undirected Models, Latent Variable Models, Bayesian Learning, Structure Learning. Variational Autoencoder.
Learning Theory: PAC Learning, VC Dimension, Computational Learning Theory. Learning Boolean functions using Fourier Analysis.

PREFERRED TEXT BOOKS:
Probabilistic Graphical Models: Principles and Techniques
by Daphne Koller, Nir Friedman

Understanding Machine Learning: From Theory to Algorithms
by Shai Shalev-Shwartz and Shai Ben-David
https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine-learning-theory-algorithms.pdf

***REFERENCE BOOKS:**

- ("GEV") *Graphical models, exponential families, and variational inference* by Martin J. Wainwright and Michael I. Jordan. Available online.
- *Modeling and Reasoning with Bayesian Networks* by Adnan Darwiche.
- *Pattern Recognition and Machine Learning* by Chris Bishop. Available online.
- *Machine Learning: A Probabilistic Perspective* by Kevin P. Murphy.
- *Information Theory, Inference, and Learning Algorithms* by David J. C. Mackay. Available online.
- *Bayesian Reasoning and Machine Learning* by David Barber. Available online.

***PROJECT:**
Yes
GRADING PLAN:

Type of Evaluation	Weightage (in %)
Quiz 1	**10**
Mid Sem Exam	**15**
Quiz 2	**10**
End Sem Exam	**25**
Assignments	**20**
Project	**20**
Term Paper	**NA**
Other Evaluation _____	**NA**

OUTCOME: To understand the theoretical underpinnings of Machine Learning Problems.

REMARKS:
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TITLE : Social Computing
Course Code :
CREDITS : 4 credits
TYPE-WHEN : CS/CLD/CHD elective - Spring 2020
FACULTY NAME : Vasudeva Varma (Guest lectures by Manish Gupta and Nimmi Rangaswamy)
LTP Structure: 3-0-3-4
PREREQUISITE (Recommended but not mandatory): Statistical methods in AI, Information Retrieval and Extraction

Maximum Students: 30

OBJECTIVE : Exposure to the trans-disciplinary area of Social Computing with hands-on exploration to computing on online social networks, leveraging user generated data.

COURSE TOPICS :
Social Computing
- • Motivation - why should we study Online Social Networks (OSN)?
- • Characteristics, Complexity and challenges of OSN
- • Taxonomy, Ontology and Knowledge Graph (KG)
- • Wiki Data and other KGs
- • Building and Using KGs

Human computation
- • Crowdsourcing and Incentive mechanisms
- • Wikipedia cases study
- • Gamification

Social monitoring - OSN Network analysis
- • Basic structures
- • Measures
- • Propagation models
- • Crawling the OSN
- • Link prediction, recommendation systems, Link farming

Social Listening - Content analysis
- • Characteristics of OSN content
- • NLP for OSN content - language identification, text normalization, POS tagging
- • Sentiment analysis
- • Opinion mining
- • Entity identification, and linking
- • Relation Identification

Social Intelligence - Applications
- • Community detection
- • Social media analytics in Healthcare domain

- • Social commerce

TEXT BOOKS: None
Several research papers will be given and discussed
REFERENCE BOOK: Analyzing the Structure of Social Web by Jennifer Golbeck

Grading Plan:

Class participation	**10%**
Project Several Subcomponents of the project:	**90%**
Phase 1: Literature survey	**20%**
Phase 2: Problem outline, defining expected outcome	**20%**
Phase 3: Solution outline - mid term	**20%**
Phase 4: Solution outline – final	**20%**
Phase 5: Final report and presentation	**10%**

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TITLE: Software Engineering
Course Code: CSE461
CREDITS: 3-1-0-4
TYPE-WHEN : Flexicore
FACULTY NAME : Vasudeva Verma + Prakash Yalla

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.

Course Title : Software Foundations: A verification based approach
Course Code: CSE569
Credits : 4 (2 lectures per week)
Type-When: Spring-2020
Faculty Name : Venkatesh Choppella

Objective :
The purpose of this course is to study the mathematical foundations of programs and software systems so as to be able to prove properties about their behaviour. The approach we take is to understand programs in terms of their static structure (types) and their dynamic structure (state). The former involves building type systems and proving properties about the type system (safety and progress) etc. The latter involves building state machines and then verifying properties (safety and liveness) on them through model checking. The course will use modern verification tools like the Coq theorem prover and model checkers like Spin.

Audience :
The course is intended for anyone interested in modern engineering methods for the design of robust and high integrity software systems.
Prerequisites : CS415 (Principles of Programming Languages) or prior permission from the instructor(s).

Course Topics :
Preliminaries Natural deduction [2 lec] Operational Semantics Dynamic (small step) and static semantics.
Type soundness: preservation and progress. [4 lec]. Type systems Simply typed lambda calculus. Type Checking and
Inference. Polymorphism. Sub typing. [5 classes] Co-inductive types Simulation and Bisimulation, Conductive
semantics of type safety. [4 lec] Model Checking [11 lec] Automata and Timed Automata. Temporal Logics. Model

Checking. Specification of safety and liveness properties. Tools: Spin and Uppaal The syllabus may be suitably
modified to include some extra or advanced topics.

Text Books: Software Foundations (Pierce et al.) http:// www. cis.upenn.edu/~bcpierce /sf/current/index.html
Systems and Software Verification (Berard et al.) Springer, 1998.

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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 - 2020
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 Coding Theory
Credits : 3-1-0-4
Course Code : ECE537
TYPE-WHEN : Spring2020
FACULTY NAME : Lalitha Vadlamani

PRE-REQUISITE : Error Correcting Codes, especially finite fields and block codes. It is not necessary to have done the formal course. Knowledge of the abovementioned topics is sufficient. There will be an evaluation exam in the beginning to refresh these coding theory basics. You would be allowed to continue only if you pass this exam. If you still want to do the course without having these basics please contact me.
Added Advantage - Information theory (basics).

OBJECTIVE : The course participants will be exposed to recent important research topics in Coding Theory (Error Correcting Codes). Another important goal of the course is to bring the participant up to speed in a particular area of choice in which they can work on a research problem of interest to the international community.

COURSE TOPICS :
(ordering is not assured)

- Review of Reed Solomon Codes + Locally Repairable Codes.
- Index Coding + Coded Caching
- LDPC Codes + Codes for Compressive Sensing.
- Reed Muller Codes + Polar Codes.
- Codes for DNA Storage.

PREFERRED TEXT BOOKS:
Mainly Research Papers.

***REFERENCE BOOKS:**
***PROJECT:**
GRADING PLAN:

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

Assignments	
Project (Implementation or Presentation of a theoretical paper)	**30 %**
Term Paper (Open problems discussion, ideas to approach solutions, writing research paper)	**20 %**
Other Evaluation ___Quizes_____	**20 %**

OUTCOME: (See Objective)
REMARKS: Needless to say, only those serious about learning this stuff may take this course. It won't be easy, the course or the grade.

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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 **: The State in Colonial India**

Course Code **: HSS446**

CREDITS **:** Four

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

FACULTY NAME **:** Aniket Alam

PRE-REQUISITE **:**

OBJECTIVE **:** This course is an intensive study of the state in India during the colonial period. Rather than looking at the state from the perspective of theory or political science, it will historicise the state by looking at how it came to being, how it was a changing entity constantly responding to historically particular contexts and conditions. It will introduce the student to the history of the state in

India, the elements which went into making the state under colonial conditions and explain the development of its various institutions. It will also discuss what goes towards making the state legitimate and what creates its ideological hegemony.

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

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

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

The third part of the course will engage with the economy and resources of the colonial state. It will encompass the land, its agricultural and mineral products, the forests and water resources, the manufactures and commerce. It will also study the financial foundation of the state and its accounts.

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

The last part of the course will study the ideology of the colonial state, how it saw itself as a legatee of the Mughals and yet as scientific and modern with its mission to civilize; how it considered

its main task to be the guarantor of stability and peace, while also claiming for itself the role of protector of the poor. Finally how, the colonial state became and was seen as the "jewel in the crown" of the empire where the sun does not set.

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

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

Sekhar Bandyopadhyay: *From Plassey to Partition*.

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

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

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

Romila Thapar, *From Lineage to State*.

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

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

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

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

Thomas Metcalf: *Ideologies of the Raj*.

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

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

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

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

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

Eric Stokes: *The English Utilitarians and India*.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Articles.

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

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

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

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

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

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

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

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

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

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

Bernard Cohn: “Representing Authority in Victorian India”.

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

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

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

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

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

GRADING PLAN:

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

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

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

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TITLE : Usability Engineering
Course Code : CSE567
CREDITS : 4
TYPE-WHEN : Spring 2020
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 theworkplace 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.

Sd/
Dean(Academics).