



Syllabus for Courses of Spring 2023

Dt: 06.01.2023 Ver.4

S.No.	Code No	Course Name	Credits	Faculty Name(s)
1	CS1.406	Advanced Algorithms	3-1-0-4	Suryajith Ch
2	SC3.303	Advanced Bioinformatics	3-1-0-4	Nita Parekh
3	CS1.501	Advanced Optimization: Theory and Applications	3-1-0-4	Pawan Kumar
4	CE1.603	Advanced Structural Analysis	3-1-0-4	Pravin Kumar Venkat Rao
5	EC4.501	Advances in Robotics & Control	3-1-0-4	Spandan Roy
6	CS9.422	Behavioral Research: Statistical Methods	3-0-1-4	Vishnu Sreekumar + Vinoo Alluri
7	SC2.203	Biomolecular Structures (H2)	3-1-0-2	Prabhakar B
8	PD2.422	Business Finance (H1)	3-1-0-2	TBD
9	CS9.430	Cognitive Neuroscience	3-1-0-4	Bhaktee Dongaonkar
10	CS9.432	Cognitive Science and AI	3-1-0-4	Bapi Raju S
11	EC5.203	Communication Theory	3-1-0-4	Praful Mankar
12	EC5.204	Communication and Controls in IoT (H1)	3-1-0-2	Sachin Chaudhari + Aftab Hussain
13	CS1.403	Compilers	3-1-0-4	Venkatesh Choppella
14	HS1.206	Comprehension of Indian Music	3-1-0-4	TK Saroja
15	CS9.435	Computational Social Science	3-1-0-4	Ponnurangam K
16	CS7.302	Computer Graphics (H1)	3-1-0-2	Avinash Sharma
17	CS2.201 a	Computer Systems Organization	3-1-0-4	Praveen Paruchuri
18	CS7.505	Computer Vision	3-1-0-4	Avinash Sharma
19	CS0.302	Computing Tools	3-1-3-4	Sriranjani + Charu Sharma
20	CL2.402	Convergence & Divergence in Indian Languages	3-1-0-4	Parameswari Krishnamurthy
21	CS4.409	Data Foundation Systems	3-1-0-4	Vikram Pudi + G.Venugopal, iHub-Data
22	CS4.401	Data Systems	3-1-0-4	Krishna Reddy P
23	CS4.302	Data Visualisation (H2) -	2-0-1-2	Kamal Karlapalem

24	CS6.301	Design and Analysis of Software Systems	3-1-0-4	Ramesh Loganthan + Raghu Reddy
25	CE5.501	Design of Hydraulic Structures	3-1-0-4	Shaik Rehana
26	PD1.502	Design of Wearable Systems (H2)	3-1-0-2	Raghu Reddy
27	CS7.303	Digital Signal Analysis (H2)	3-1-0-2	Anil Kumar V
28	EC2.408	Digital VLSI Design	3-1-0-4	Zia Abbas
29	CE8.401	Disaster Management	3-1-0-4	Sunitha P + Pravin Kumar
30	CS3.401	Distributed Systems Prerequisite: Operating Systems. Networks desirable	3-1-0-4	Lini Thomas
31	SC1.440	Dynamical Processes in Complex Networks	3-1-0-4	Chittaranjan Hens
32	CE1.601	Earthquake Engineering	3-1-0-4	Srinagesh D (Retd. Prof. NGRI)
33	EC2.202	Electronics Workshop II	0-1-3-4	Arti Yardi + Anshu Sarje
34	EC2.202a	Electronics Workshop II	3-1-3-4	Spandan Roy + Prasad Krishnan
35	HS0.209	Exploring Masculinities (H2)	3-0-0-2	Vindhya Undurti, TISS, Hyd
36	EC2.502	Flexible Electronics	3-1-0-4	Aftab Hussain
37	HS2.302	Gender, Kinship, and State Law (H2)	3-1-0-2	Rama Srinivasan
38	HS5.201	Growth and Development	3-1-0-4	Anirban Dasgupta
39	PD1.501	Human Computer Interaction (HCI)	3-1-0-2	Raman Saxena
40	CS9.433	Hydro Informatics	3-1-0-4	Shaik Rehana
41	CS8.402	Information Security Audit and Assurance	3-1-0-4	Shatrunjay Rawat
42	CS1.502	Information-Theoretic Methods in Computer Science	3-1-0-4	Prasad Krishnan + Gowtham
43	CS3.404	Internals of Application Servers	3-1-0-4	Ramesh Loganathan
44	HS4.302	Internet and Democracy	3-1-0-4	Aakansha Natani
45	EC1.201	Intro to Bio Electronics (H2)	3-1-0-2	Prabhakar B
46	HS8.102	Intro to Human Sciences	3-1-0-4	Aniket Alam + Nazia Akhtar + Priyanka Srivastava + Aakansha Natani
47	EC2.204	Intro to Processor Architecture (H1)	3-1-0-2	Deepak Gangadharan
48	EC4.402	Intro to UAV Design	3-1-0-4	Harikumar Kandath
49	CS1.305	Introduction to Algorithms Engineering (H2)	3-1-0-2	Kishore Kothapalli
50	CS9.311	Introduction to Brain and Cognition (H2)	3-1-0-2	Kavita Vemuri

51	EC5.205	Introduction to Coding Theory (H2)	3-1-0-2	Lalitha V
52	HSo.213	Introduction to Existential Philosophy	3-1-0-4	Shipra Dikshit
53	HS1.208	Introduction to Film	3-1-0-4	Sushmita Banerjee
54	CS1.408	Introduction to Game Theory	3-1-0-4	Sujit Gujar
55	CS8.301	Introduction to Information Security (H1)	3-1-0-2	Ashok Kumar Das
56	CS7.401	Introduction to NLP	3-1-0-4	Manish Srivastava
57	SC1.420	Introduction to Particle Physics	3-1-0-4	Subhadip Mitra
58	HSo.204	Introduction to Philosophy of Technology	3-1-0-4	Ashwin Jayanti
59	CS9.312	Introduction to Quantum Information and Computation (H1)	3-1-0-2	Siddhartha Das + Shantanav Charkravarthy
60	MA4.303	Linear Partial Differential Equations and Variational Calculus	3-1-0-4	Samyadeb Bhattacharya
61	CL3.406	Linguistic Data 3: Data Modelling in ILs (H2)	3-1-0-2	Parameswari Krishnamurthy
62	HSo.210	Literature and the Ethics of telling a Story (H1)	3-0-0-2	Sushmita Banerjee
63	SC4.411	Machine Learning for Natural Sciences	3-1-0-4	Prabhakar B + Vinod PK
64	CS7.301	Machine, Data and Learning	3-1-0-4	Vikram Pudi + Praveen P
65	CS7.508	Mathematics of Generative Models	3-1-0-4	Pawan Kumar
66	EC4.404	Mechatronics System Design	3-1-0-4	Nagamanikandan + Harikumar K
67	EC5.405	Medical Image Analysis	3-1-0-4	Jayanthi Sivaswamy
68	HS3.305	Migrants and Migrations in Modern South Asia	3-1-0-4	Isha Dubey
69	SC2.316	Molecular Modeling and Simulations	3-1-0-4	Deva Priyakumar + Marimuthu Krishnan
70	CS9.434	Music, Mind, and Technology (Open Elective)	3-1-0-4	Vinoo Alluri
71	CL3.407	Neural Natural Language Generation (H1)	3-1-0-2	Manish Srivastava + Vasudeva Varma
72	SC1.315	Nonlinear Dynamics	3-1-0-4	Abhishek Deshpande
73	SC2.450	Non-equilibrium Statistical Mechanics	3-1-0-4	Bhaswar Ghosh
74	CS9.436	Optical Remote Sensing	3-1-0-4	RC Prasad
75	CS1.404	Optimization Methods	3-1-0-4	Naresh Manwani
76	SC2.202	Organic Chemistry (H1)	3-1-0-2	Prabhakar B
77	PD2.423	Organizational Operations	3-1-0-2	TBD

78	CS3.307	Performance Modeling of Computer Systems (H1)	3-1-0-2	Tejas Bodas
79	HSo.212	Philosophical Foundations of Knowledge	3-1-0-4	Saurabh Todariya
80	SC2.301	Physics of Soft Condensed Matter	3-1-0-4	Marimuthu Krishnan
81	SC1.415	Physics of The Early Universe	3-1-0-4	Diganta Das
82	CS8.401	Principles of Information Security	3-1-0-4	Kannan Srinathan
83	PD1.411	Product Design Workshop (H1)	3-1-0-2	Prakash Yalla + Deepak Guna
84	PD2.501	Product Marketing	3-1-0-4	Ravi Warrier
85	HSo.208	Questions of Crime and Punishment in Literature (H1)	3-0-0-2	Nazia Akhtar
86	HS1.302	Readings in Russian Literature: The Nineteenth Century	3-1-0-4	Nazia Akhtar
87	HSo.302	Research Methods in Human Sciences	3-1-0-4	Aniket Alam
88	EC4.403	Robotics: Planning and Navigation	3-1-0-4	Madhava Krishna K
89	HSo.207	Science and Technology: Critical Perspectives (H2)	3-0-0-2	Saurabh Todariya
90	SC1.111	Science II	3-1-0-4	Nita Parekh + Chittaranjan Hens
91	SC4.111	Science Lab II (H)	0-0-3-2	Tapan Kumar Sau + Prabhakar B
92	HS7.301	Science, Technology and Society	3-1-0-4	Radhika Krishnan
93	CS6.401	Software Engineering	3-1-0-4	Karthik Vaidhyanathan
94	CS4.410	Spatial Data Sciences	3-1-0-4	KS Rajan
95	CE1.602	Stability Design of Steel Structures	3-1-0-4	Sunitha P
96	SC1.205	Statistical Mechanics (H2)	3-1-0-2	Bhaswar Ghosh
97	CS7.403	Statistical Methods in AI	3-1-0-4	Vineet Gandhi
98	CS8.403	System and Network Security	3-1-0-4	Ankit Gangwal
99	CS9.424	Technology Product Entrepreneurship	3-1-0-4	Ramesh Loganathan + Prakash Yalla
100	HS3.304	The Gutenberg Parenthesis	3-1-0-4	Aniket Alam
101	SC1.204	Thermodynamics (H1)	3-1-0-2	Subhadip Mitra
102	HSo.206	Thinking through moral problems (H2)	3-0-0-2	Ashwin Jyanti
103	EC5.402	Time Frequency Analysis	3-1-0-4	Anil Kumar V + Chiranjeevi Yerra
104	CS7.602	Topics in Deep Learning	3-1-0-4	Charu Sharma + Makarand Tapaswi
105	CS7.603	Topics in Reinforcement Learning	3-1-0-4	Tejas Bodas + Harikumar K
106	EC5.401	Topics in Signal Processing	3-1-0-4	Santosh Nannuru

107	CS6.502	Topics in Software Foundations	3-1-0-4	Venkatesh Choppella
108	CL5.401	Topics in SSMT	3-1-0-4	Anil Kumar V + Chiranjeevi Yerra
109	CS5.402	Usability of Software and Digital Products	3-1-0-2	Raman Saxena + Nimmi Rangaswamy
110	CS5.401	User Interaction and Usability of Digital Products (Open Elective)	3-1-0-4	Raman Saxena + Nimmi Rangaswamy
111	OC3.102	Value Education II	0-2-0-2	Radhika M + Anil Kumar V (Coordiantors)
112	HS0.211	Values, Ethics and AI (H1)	3-0-0-2	Shatrunjay Rawat + Rajeev Sangal

Title of the Course : Advanced Algorithms

Faculty Name : Suryajith Ch
 Course Code : CS1.406
 L-T-P : 3-1-0
 Credits : 4
 Name of the Academic Program : B. Tech. in CSE

Prerequisite Course / Knowledge:

Should have taken Introduction to Algorithms, and Formal Languages, or equivalent courses

Course Outcomes (COs):

After completion of this course successfully, the students will be able to..

CO-1 : Demonstrate familiarity with using randomness in computing

CO-2: Apply principles of randomized algorithm design and analyze them for correctness and efficiency

CO-3: Synthesize randomized algorithms with either zero-error or one sided error for a variety of problems

CO-4: Explain the significance of parallelism to modern day computing and problem-solving needs

CO-5: Apply principles and paradigms of parallel algorithm design and analyze parallel algorithms for correctness and efficiency

CO-6: Create efficient parallel algorithms for a variety of semi-numerical problems and problems on graphs

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	2	1	1	1	2	1	1	1	2	3	1	1	3
CO2	2	3	2	2	1	1	1	2	2	2	1	3	3	1	1	3
CO3	2	2	2	2	1	1	1	2	1	1	1	2	3	1	1	3
CO4	1	3	2	2	1	1	1	2	2	2	1	3	3	1	1	3
CO5	2	2	2	2	1	1	1	2	2	2	1	3	3	1	1	3
CO6	2	2	2	2	1	2	1	2	1	1	1	2	3	1	1	3

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping Mapping with PSOs, where applicable.

Detailed Syllabus:

Unit 1: Randomness in computing: Tail inequalities and applications, fingerprinting, proofs of existence, expander graphs

Unit 2: randomized rounding, approximate counting

Unit 3: Parallelism in computing: Models of PRAM, Basic algorithms for prefix, search, sort, merge,

Unit 4: Parallel algorithms for lists, graphs, and symmetry breaking

Reference Books:

1. R. Motwani and P. Raghavan (1995), Randomized Algorithms, Cambridge University Press.USA.
2. J. JaJa (1992), Introduction to Parallel Algorithms, Addison-Wesley, USA.
3. G. Tel (2000). Distributed Algorithms, 2nd Edition, Cambridge University Press. USA.

Teaching-Learning Strategies in brief (4 to 5 sentences):

The course lectures will include activities that promote the understanding of the lecture content by using small examples that students work out during the class itself and promote active and participatory learning. A good part of the lecture will involve problem solving and finding solutions to problems rather than expositing known material. In class tests that are held periodically are useful as summative assessments. Homework assignments are designed to reiterate the material covered in class lectures and also solve problems that are based on simple extensions of concepts described in the lectures.

Assessment methods and weightages in brief (4 to 5 sentences):

- Homeworks: 20%
- In-class Objective Tests: 20%
- Quiz1: 15%
- Quiz 2: 15%
- End Exam: 30%

Title of the Course : Advance Bioinformatics

Faculty Name : Nita Parekh

Course Code : SC3.303

L-T-P : 3-1-0

(L= Lecture hours, T=Tutorial hours,
P=Practical hours)

Credits : 4

Name of the Academic Program : CND

1. Prerequisite Course / Knowledge: Bioinformatics Course, Basic Statistics and computing skills

2. Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to

CO-1: Learn, extract and utilize information related to structure-function analysis of proteins

CO-2: Develop methods for various biological data analysis, viz., secondary structure prediction, Hidden Markov model for pattern search, e.g., CpG islands, gene prediction, etc. and sequence comparison (pairwise and multiple sequence alignments), and phylogenetic reconstruction, gene prediction

CO-3: Learn to perform genome analysis to understand evolutionary relatedness between species at various levels, viz., genes, proteins, noncoding conserved regions, horizontally transferred regions, etc.

CO-4: Perform high-throughput data analysis, such as microarray data analysis, computational proteomics, protein interaction networks.

CO-5: Familiarize with various sequence and structural variations in human genome and their functional impact

CO-6: The course provides breadth and depth of various types of bioinformatics data analysis and prepares a student to embark on a research project.

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3												2	2		
CO2		3		3	3										3	3
CO3		3		3	3										3	3
CO4		3		3	3										3	3
CO5		3		3	3										3	3
CO6			3													3
CO7																

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

Unit 1: Statistical approaches for pattern search. Markov Chains and Hidden Markov models and their applications in identifying CpG islands and gene prediction. Viterbi algorithm, Forward and Backward algorithms, Baum-Welsch algorithm

Unit 2: Genome Variation Analysis. Types of Genomic Variations – Tandem & Interspersed Repeats, Segmental Duplications, SNPs & Haplotypes, Copy Number Variations (CNVs). Polybayes approach to SNP identification, SNP-Haplotypes

Unit 3: Clustering techniques – Distance measures, Linkage rules, Hierarchical clustering. Application to Bioinformatics - In Phylogeny Construction, Clustering of EST Sequences, Clustering of Gene Expression Data, Clustering Mass Spectral Data

Unit 4: Structural classification of Proteins. Statistical, Physico-chemical and machine learning methods, e.g., Chou-Fasman method, GOR method, Nearest Neighbour methods, Neural networks, Patterns of hydrophobic amino acids, Hydrophobic moment, SSP accuracy – Mathews correlation coefficient, Jackknife test, NR-dataset

Unit 5: Protein Structure Prediction. Homology determination based on full-length sequence information – PSI-BLAST, PIRSF, COGs & KOGs, MSA, SSP, Identifying domains, Homology Modeling - Finding a structural template for protein sequence, Homology determination based on 3D-structural information – comparative homology, fold recognition methods, Alignment of sequence to tertiary structure, ab initio methods, Based on sequence and structural motifs, Genetic Algorithm

Unit 6: Comparative Genomics and Proteomics. Genome Analysis, Comparative and Functional Genomics, Role of Conserved Noncoding sequences, Gene Clustering, Horizontal Gene Transfer, Applications of Comparative Genomics. Overview of Proteomics – experimental techniques and computational methods for identifying protein-protein interactions, Protein identification by MS

Reference Books:

1. Bioinformatics Sequence and Genome Analysis, David W. Mount, Cold Spring Harbor Laboratory Press, 2001.
2. Biological Sequence Analysis, Probabilistic Models of Proteins and Nucleic Acids, Richard Durbin, Sean R. Eddy, Anders Krogh and G. Mitchison, Cambridge University Press 1998.
3. Computational Genome Analysis – An Introduction, Richard C. Deonier, Simon Tavae and Michael S. Waterman, Springer 2005.

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

The objective of the course is to familiarize the students with mathematical, algorithmic, and computational foundations of common tools used in genomics and proteomics. Hands-on sessions on using various bioinformatics resources and implementation of algorithms would give them necessary skills to build similar tools for their research. At the end of the course the students would have a good idea about the computational approaches in biological data analysis and also learn to how to use them intelligently. This would prepare them for their research work.

6.Assessment methods and weightages in brief (4 to 5 sentences):

1. Assignments – written, implementation of algorithms and tutorial session (25%), Class Quizzes + Two Mid-term evaluation (35%), Final exam (40%)

Title of the Course : Advanced Optimization: Theory and Applications

Name of the Faculty : Pawan Kumar

Course Code : CS1.501

L-T-P : 3-1-0.

Credits : 4

(L= Lecture hours, T=Tutorial hours,

P=Practical hours)

Name of the Academic Program: B.Tech. in Computer Science and Engineering

1. Prerequisite Course / Knowledge:

Linear Algebra, Calculus

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able to –

CO-1. Learn basic mathematics tools of convex sets, functions, optimization methods.

CO-2. Learn advanced theory on nonlinear optimization, non smooth, and min-max optimization.

CO-3: Learn to prove convergence estimates and complexity of the algorithms rigorously.

CO-4. Learn to code advanced optimization solvers efficiently using Python.

CO-5. Demonstrate expertise in applying optimization methods in computer science such as data science and machine learning.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1	1	1	-	-	2	2	1	3	3	3	1	3
CO2	3	3	3	3	3	1	-	-	2	2	1	3	3	3	2	3
CO3	1	3	1	3	1	-	-	-	2	2	1	3	3	3	2	3
CO4	1	2	3	2	3	-	-	-	2	2	3	3	3	3	2	3
CO5	3	3	3	3	3	-	-	-	2	2	3	3	3	3	2	3

‘3’ in the box denotes ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level mapping

4. Detailed Syllabus:

Unit 1: Review of convexity, duality, and classical theory and algorithms for convex optimization(6 hours)

Unit 2: Nonlinear and non-smooth optimization, projected gradient methods, accelerated gradient methods, sub-gradient projection methods, adaptive methods, second order methods, dual

methods,solvers for min-max, alternating minimization, EM algorithm, convergence estimates (12 hours)

Unit 3: Applications of advanced optimization: sparse recovery, low rank matrix recovery, recommender systems, extreme classification, generative adversarial methods(6 hours)

- A project related to the above syllabus will be done by students.

References :

- Stephen Boyd and Lieven Vandenberghe, Convex Optimization, Cambridge University Press, 2004.
- Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.
- Prateek Jain and Purushottam Kar, Non-convex Optimization for Machine Learning, 2017, arXiv.
<https://arxiv.org/pdf/1712.07897.pdf>
- W. Hu, Nonlinear Optimization in Machine Learning,
https://web.mst.edu/~huwen/lectures_Nonlinear_Optimization_in_Machine_Learning.pdf

5.Teaching-Learning Strategies in brief:

Lectures by integrating ICT into classroom teaching, weekly tutorials involving problem solving and active learning by students and Project-based Learning by doing one mini-project.

6. Assessment methods and weightages in brief :

Assignments in theory: 15 marks, Mid Semester Examination: 25 marks , End Semester Examination: 30 marks, Assessment of four projects: 30 marks

Title of the Course

: Advanced Structural Analysis

Faculty Name

: P. Pravin Kumar Venkat Rao

Course Code

: CE1.603

L-T-P

: 3-1-0

Credits

: 4

Name of the Academic Program

: M.Tech in CASE

1.Prerequisite Course / Knowledge:Basic Structural Analysis

2.Course Outcomes (COs):

After completion of this course successfully, the students will be able to:

- CO 1: Develop the stiffness matrix for prismatic members and have a sound knowledge of matrix computations.
- CO 2: Analyze determinate and indeterminate plane and space truss/frame system.
- CO3: Derivethe collapse load factors for a given structure
- CO4: Understand how standard software packages (routinely used for frame analysis in design offices) operate.

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	3	3	3	3	3	3	3	1	3	3
CO2	3	3	2	1	3	2	2	3	3	3	2	2	3	3
CO3	3	3	2	2	3	3	3	3	2	3	3	1	3	2
CO4	3	3	2	2	3	3	3	3	3	3	3	2	3	3

4.Detailed Syllabus:

Unit 1: Linear and non-linear analysis, Types of structures, Idealized structure, type of elements, type of connections, Degree of freedom, Degree of static and kinematic indeterminacy. Introduction to stiffness and flexibility approach.

Unit 2: Stiffness matrix for spring, Bar, torsion, Beam (including 3D), Frame, and Grid elements, Displacement vectors, Local and Global co-ordinate system, Transformation matrices, Global stiffness matrix and load vectors, Assembly of structure stiffness matrix with structural load vector, Effect of sinking and rotation of a support.

Unit 3: Analysis of spring and bar assembly, Analysis of plane truss, space truss, plane frame, plane grid and space frames subjected to joint loads, Analysis of structures for axial load, Frames with inclined members, Analysis for member loading (Self, Temperature & Imposed), Inclined supports, Lack of fit, Initial joint displacements, Effect of shear deformation, Inclined roller supports.

Unit 4: Elastic and plastic behaviour of steel, Plastic hinge, Fundamental conditions for plastic analysis, Combination of mechanisms, Theorems of plasticity, Mechanism method, Statical method, Uniformly distributed loads, Continuous beams and frames, Collapse load analysis for prismatic and non-prismatic sections.

Reference Books:

1. Cheng, F.Y. "Matrix Analysis of Structural Dynamics", M. Dekke, NY, 2000.
2. Menon, D. "Structural Analysis", Narosa Publishing House, 2008.
3. Kanchi, M.B. "Matrix Analysis of Structural Analysis", John Wiley & Sons, 2nd Edition 1999.
4. Kasmali A. "Matrix Analysis of Structures", Brooks/Cole Publishing Co., 1999.
5. Gere, W. and Weaver, J.M. "Matrix Analysis of Structural Analysis", 3rd Edition, Van Nostrand Reinhold, NY, 1990.
6. Martin, H.C. "Introduction to Matrix Method of Structural Analysis", McGraw Hill Book Co., 1996.
7. Menon, D. "Advanced Structural Analysis", Narosa Publishing House, 2009.
8. Ghali, A., Neville, A.M. and Brown, T.G. "Structural Analysis: A Unified Classical and Matrix Approach" 6th Edition, Chapman & Hall, 2007.

9. McGuire, W, Gallagher R.H., Ziemian, R.D. "Matrix Structural Analysis", 2nd Edition, John Wiley & Sons, Inc., 2000.
10. Wong, M.B. "Plastic Analysis and Design of Steel Structures", Elsevier Publications, 2009.

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

In this course, the main objective is to enable the student to have a good grasp of all the fundamental issues in these advanced topics in structural analysis, besides enjoying the learning process, developing analytical, and intuitive skills.

6.Assessment methods and weightages in brief (4 to 5 sentences):

Assignments and Quizzes - 40%

Mid Semester Exam - 25%

End Semester Exam - 35%

Title of the Course : Advances in Robotics and Control

Faculty Name : Spandan Roy

Course Code : EC4.501

Name of the Academic Program : B. Tech. in ECE

L-T-P : 3-1-0

Credits : 4

Prerequisite Course / Knowledge:

Should have taken courses Systems Thinking / Introduction to Robotics & Control/ Robotics: Dynamics and Control

Course Outcomes (COs):

After completion of this course successfully, the students will be able to..

CO-1: Demonstrate familiarity with Euler-Lagrange dynamics

CO-2: Apply principles of computed torque method for controller development of a robotic system

CO-3: Understanding the concepts of Lyapunov theory for stability analysis

CO-4: Apply principles of Lyapunov theory for controller design

CO-5: Design inverse dynamics based robust controller to address uncertainty in robot dynamics

CO-6: Design adaptive-robust controller for robotic systems to address unmodelled dynamics

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO11	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	3	2	2	1	1	1	2	1	1	1	3	1	1	1	3
CO2	2	3	2	2	1	1	1	2	2	2	1	3	1	1	1	3
CO3	2	3	2	3	1	1	1	2	1	1	1	3	1	1	1	3
CO4	2	3	2	2	1	1	1	2	2	2	1	3	1	1	1	3

CO5	3	3	1	3	1	1	1	2	2	2	1	3	1	1	1	3
CO6	3	3	1	3	1	1	1	2	2	1	1	3	1	1	1	3

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

Mapping with PSOs, where applicable.

Detailed Syllabus:

Unit 1: Introduction to robotic systems and control

Unit 2: Stability analysis and design

Unit 3: Robust control design via inverse dynamics and switching gain

Unit 4: Model reference adaptive control and robust adaptation against uncertainties

Reference Books:

1) Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, Robot Modeling and Control, John Wiley & Sons.

2) Nonlinear Systems by Hassan Khalil, Prentice Hall.

3) Applied Nonlinear Control by Slotine and Lee, Prentice Hall.

Teaching-Learning Strategies in brief (4 to 5 sentences):

The course lectures will include activities that promote the understanding of the lecture content by using small examples that students work out during the class itself and promote active and participatory learning. A good part of the lecture will involve problem solving and finding solutions to problems rather than expositing known material. Homework assignments are designed to reiterate the material covered in class lectures and apply them in robotic systems via simulation. The course project will help to read, understand and implement relevant scientific publications.

Assessment methods and weightages in brief (4 to 5 sentences):

- Assignments: 20%
- Project: 20%
- Quiz1: 15%
- Quiz 2: 15%
- End Exam: 30%

Title of the Course

: Behavioral Research: Statistical Methods

Course Code

: CS9.422

Faculty Name

: Vishnu Sreekumar + Vinoo Alluri

L-T-P

: 3-1-0

Credits

: 4

(L= Lecture hours, T=Tutorial hours,

P=Practical hours)

1.Prerequisite Course / Knowledge:

None

2.Course Outcomes (COs):

After completion of this course successfully, the students will be able to

CO-1: develop an understanding of various experimental designs

CO-2: recognize and employ appropriate statistical packages to analyze data

CO-3: apply appropriate parametric and non-parametric analyses techniques

CO-4: perform exploratory data analysis and examine intrinsic relationships between variables

CO-5: reflect and draw appropriate inferences post analyses

CO-6: create custom code by adapting exploratory and confirmatory analyses techniques

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1	1	2	1	1	1	1	-	-	-	-	-	-
CO2	2	2	2	3	3	2	1	1	3	1	-	-	-	-	-	-
CO3	2	3	2	3	3	3	1	1	3	1	-	-	-	-	-	-
CO4	2	3	2	3	3	3	1	1	3	1	-	-	-	-	-	-
CO5	1	1	1	1	1	3	1	1	2	1	-	-	-	-	-	-
CO6	2	2	3	3	3	1	1	1	2	2	-	2	1	1	2	3

4. Detailed Syllabus:

Module 1: Introduction to Experimental Design; Foundations of Inferential Statistics

Experimental Design: Literature review, Hypothesis Testing, Type I and II errors, Hypothesis-based vs Exploratory Research, Types of variables and levels of Measurements, Different types of experimental designs: Between-subject and within-subject factors in an experiment; Factorial designs, Simple repeated measures design, Randomized blocks design, Latin square type designs, Foundations of Inferential Statistics, Standardized Distributions, Probability.

Module 2: Parametric tests of difference and association

Parametric tests of difference: Multivariate Analysis, Linear Models (GLM) and Mixed models; Multivariate Regression Techniques, Multi-level tests (ANOVA), MANOVA, ANCOVA, MANCOVA. Main effects and interaction.

Module 3: Non-parametric tests of difference and association

Nonparametric tests of association – chi-square test, Mann Whitney U test, Binomial Sign test, Wilcoxon's T test,

Related and Unrelated t tests; correlation, regression; Power Analysis

Module 4: Multivariate Methods

Multidimensional Scaling, Data Reliability, Tests of Normality and Data Transformation, Outliers, Collinearity in

Data, Data Summarization vs Data Reduction Techniques: Exploratory Factor Analysis, Principal Component Analysis, Multiple Comparison problems

Module 5: Special Topics

Behavioral time-series analysis, Structural Equation Modelling.

Reference Material:

Lecture slides and supplementary reading materials (journal articles, books/book chapters, online resources) will be uploaded on the course page on Moodle.

5. Teaching-Learning Strategies in brief:

Students will be introduced to the different statistical methods employed in the analysis of behavioral data. The material will be delivered as a combination of lectures and practical sessions. In the practical sessions, students will be provided with data and code snippets to help them practice the concepts taught in the lectures. They will also receive regular problem sets/assignments which will comprise the majority of the course evaluation. We will primarily rely on R for statistical analysis but may also use other tools as deemed appropriate for the material being covered.

6. Assessment methods and weightages in brief:

In-class problem sets = 30%

Take-home assignments and problem sets = 50%

Final Project = 20%

Title of the Course	: Biomolecular Structures
Faculty Name	: Prabhakar Bhimalapuram
Course Code	: SC2.203
Name of the Academic Program	: CND
L-T-P	: 3-1-0
Credits	: 2

1.Prerequisite Course / Knowledge:

Basic thermodynamics, mathematics, and computing skills

2. Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to

CO-1 Describe how different building blocks of biomolecules assemble to form diverse biomolecular architectures that drive many biological processes

CO-2 Familiarize with different types of biomolecular interactions and analyze how they contribute to the structural and thermodynamic stability of biomolecules and biomolecular complexes.

CO-3 Outline different experimental techniques commonly used to characterize the structure and dynamics of biomolecules

CO-4 Interpret experimental binding affinity data using molecular thermodynamic and statistical principles

CO-5 Familiarize with the theory of enzymatic reactions

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

4.Detailed Syllabus:

Unit 1: Hierarchy of length and time scales in biological systems and processes

Unit 2: Biological macromolecules: proteins, nucleic acids, lipids, carbohydrates (The building blocks of these biomolecules and their chemical bonding and interactions will be discussed. The following topics will be covered in this module: different amino acids, their classification, dipeptides, conformations, different nucleotides, nucleobases)

Unit 3: Structure and properties of biomolecules: (Levels of protein structure: primary, secondary, tertiary and quaternary structures, Ramachandran plot, double helical structure of DNA, RNA structures, experimental techniques commonly used for analyzing structures and interactions including NMR, ESR, X-Ray, CD, Fluorescence)

Unit 4: Interactions between biomolecules (covalent and noncovalent interactions, base pairing, hydrogen bonding, salt bridges, hydrophobic interactions, solvation, protein-ligand, protein-protein, protein-nucleic acid interactions)

Unit 5: Thermodynamics of protein folding (entropic vs enthalpic factors), energy landscape, structural stability and mutations

Unit 6: Introduction to enzymes, enzyme catalysis, enzyme kinetics, Michaelis-Menten equation

Unit 7: Biomolecular assemblies: biomembranes, chromatin, molecular motors, cellulose, riboswitches

Unit 8: Molecular modeling and docking: concepts and techniques

Unit 9: Biomolecular databases and tools: protein data bank, nucleic acid databases

Unit 10: Dry lab: Models, visualization, calculation of structural properties

Reference Books:

1. Lehninger Principles of Biochemistry - D. L. Nelson and M. M. Cox

2. Biochemistry - L. Stryer et al

3. Fundamentals of Biochemistry: Life at the Molecular Level - J. G. Voet, D. Voet, and C. W. Pratt

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

6.Assessment methods and weightages in brief (4 to 5 sentences):

Quizzes (20%), Assignments (25%), Reading Projects (25%), Final Exam (30%)

Title of the Course

: Business Finance

Faculty Name

: TBD

Course Code

: PD2.422

Credits

: 2 Credits

L - T - P

: 1.5 -0- 3

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year

: 2nd Sem – Year 1 (Monsoon, 2022)

Name of the Program

: M. Tech in Product Design and Management program

(Ex: Spring, 2022)

Pre-Requisites

: None

Course Objective

:

As a part of the Business Finance course, we go over the fundamentals of business finance in the contemporary world. We discuss some basic definitions and concepts of business finance regarding organizations required to understand their financial health concerning the markets. The

managers need to know, understand and analyze the three main arms of the organization's financial health. The course will cover the financial statements in detail. The course also covers aspects of assets, liabilities, debits, credits, profit, loss, earning, lending, and a detailed dive into financial ratios. The other main modules we cover are as follows:

- Working capital decision-making,
- forecasting,
- Startup Valuation, and
- Time Value of Money (TVM)

CO-1 Demonstrate a good understanding of an organization's financial health and position through the study of financial statements.

CO-2 Demonstrate a good understanding of various Financial Ratios and parameters derived out of the monetary positions of an organization.

CO-3 Demonstrate the ability to understand and analyze the working capital decision-making based on the above parameters and hands-on skills in applying allocation of the working capital.

CO-4 Demonstrate the ability to understand and analyze the valuation exercise as an entrepreneur of one's startup organization and make decisions on the decision making again related to the Use Case Scenarios.

CO-5 Demonstrate the ability to determine, analyze and make decisions as per the Time Value of Money (TVM) of the assets owned in running own businesses.

Course Topics :

- Basics of Business Finance/ Corporate Finance, two sessions
- Financial statements and Ratios, three sessions
- Working capital decision-making, three sessions
- Startup Valuation and entrepreneur's view, three sessions
- Forecasting, two sessions
- Time Value of Money (TVM), three sessions
- Case Scenarios and Case studies, five sessions

Preferred Text Books :

Fundamentals of Financial Management,
Author(s): Eugene F. Brigham | Joel F. Houston

Reference Books :

- Finance: The Basics by Erik Banks. Author: Erik Banks Publisher: Routledge.
- Finance Sense: Corporate Finance For Non-Finance Executives by Chandra Author: Prasanna Chandra

Grading Plan :

(The table is only indicative)

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

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a '-' dash mark if not relevant).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	1	3			
CO2	3	3	3	2	3			1
CO3	3	3	3	2	3			3
CO4	3	2	3	2	3			3
CO5				1	1			

Teaching-Learning Strategies in brief (4-5 sentences) :

I believe in inclusive teaching with involvement from the class as much as possible. I tend to keep the teaching and learning hand in hand and ensure we teach, learn and evaluate as we go. This helps students to pace the subject well and also makes them accustomed to the subject in a better way. I keep quizzes and assignments to include them in the classes as much as possible. We keep the Case studies and hands-on culture intact.

Title of the Course

: Cognitive Neuroscience

Faculty Name

: Bhaktee Dongaonkar

Course Code

: CS9.430

L-T-P

: 3-0 -1.

Credits

: 4

1. Prerequisite Course / Knowledge:

1. Intro to psychology
2. Cognitive Science

2. Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

A student introduced to the concepts in the course will be able to:

CO-1: Neuroanatomy

CO-2: Brain & Behavior – perceptual

systems CO-3: Techniques for brain imaging

CO-4: Brain signal analysis

CO-5: Clinical case studies

CO-6: Cognitive process – memory, decision making, empathy,

learning CO-7: Ethics of Neuroscience findings

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO1	PSO2	PSO3	PSO4
CO1	3	3	0	2	0	0	0	3	0	0	0	3	0	0	0	4
CO2	3	3	3	3	3	3	1	3	3	3	0	3	2	1	2	4

CO3	3	3	2	4	2	1	2	1	0	1	1	3	3	3	1	4
CO4	3	3	3	3	1	3	1	3	1	1	1	2	2	2	1	4
CO5	3	3	3	3	3	1	1	1	3	2	3	3	2	2	2	4
CO6	2	2	3	3	2	1	1	1	3	1	1	1	2	1	1	4
CO7	1	1	1	1	2	1	4	4	2	1	1	1	2	1	1	4

4.Detailed Syllabus:

OBJECTIVE : Understand the mechanisms of the brain in sensory & higher order cognitive processing.

The course will examine how modern cognitive neuroscientists explore the neural underpinnings of sensory information – vision, sound, touch,taste & smell, the neural processing supporting visual/auditory attention, areas of the brain attributed to motion & depth perception and action; higher order cognitive processes like language processing, memory, empathy/emotion, the theory of intelligence, and decision making. The topics will be introduced after a brief review of neuroanatomy & evolution. The latest research from clinical & non-clinical studies will be presented to the class. Brain imaging techniques like functional magnetic resonance imaging (fMRI) and electroencephalogram (EEG) will be introduced along with the limitations of each in making inferences about the brain functionality. Equal emphasis is on understanding analytical methods and the limitations of each.

The focus will not be on memorizing biological vocabulary details but on understanding principles on the sensory perceptual & cognitive process of human brain which are necessary to design and build any technological interventions.

COURSE TOPICS :

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

1. Neuroanatomy & evolution
2. Sensory inputs (vision,auditory, taste,touch, smell)
3. Motion & depth perception and action
4. Language
5. Memory
6. Decision making
7. Emotion/empathy

Wide topics covering human intelligence and models for AI. Also clinical conditions for each topic will be covered.

Reference Books:

1. Cognitive Neuroscience by Gazzaniga
2. Required research papers.

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

The inclass lectures will cover basics – developmental brain, areas, neurons, followed by discussions based on research findings. As each topic is introduced as case studies supported by videos, the learning is reenforced. Quizzes are conducted periodically to evaluate transfer of knowledge and critical thinking of the implication of each study finding.

6. Assessment methods and weightages in brief (4 to 5 sentences):

Type of Evaluation	Weightage (in %)
Mid Sem-1 Exam	15
Mid Sem-2 Exam	15
End Sem Exam	20
Quiz (2)/viva	20
Project/term paper	30
Other Evaluation	

Title of the Course : COGNITIVE SCIENCE AND AI
Faculty Name : S. BAPI RAJU
Name of the Program : Computer Science & Engineering (Graduate Elective)
Course Code : CS9.432
L - T - P : 3-1-0
Credits : 4
(L - Lecture hours, T-Tutorial hours, P - Practical hours)

Semester, Year : Spring 2022
(Ex: Spring, 2022)

Pre-Requisites :

It is preferable that students have taken Introduction to Cognitive Science / Cognitive Neuroscience; a course with emphasis on ML, AI, Neural Networks (such as SMAI); have an aptitude for programming; and familiarity with ML and Deep Learning tools such as Scikit-learn / PyTorch / Keras / TensorFlow. Efforts will be made to run tutorials or assigned practice for course participants who do not have familiarity with the ML/DL programming tools.

Course Outcomes :

(list about 5 to 6 outcomes for a full 4 credit course)

After completion of this course successfully, the students will be able to...

CO-1: Learn and demonstrate understanding of how basic concepts in machine learning (ML) and deep learning (DL) are applied for problems in neuroscience and cognitive science

CO-2: Demonstrate use of ML/DL algorithms on simple problems in neuroscience and cognitive science.

CO-3: Analyze and evaluate ML/DL algorithms about their ability to unravel the functional architecture of cognition

CO-4: For a selected problem, design computational solutions and evaluate their goodness of fit to the actual empirical data from cognitive neuroscience

CO-5: Create and develop novel solutions in either direction: Cognitive Science-to-AI or AI-to- Cognitive Science and compare their strengths and limitations vis-à-vis existing solutions

Course Topics :

(please list the order in which they will be covered, and preferably arrange these as five to six modules.)

Module 1: Introduction to cognitive science and neuroscience. A brief tour of the principles of cognitive science, cognitive architecture, principles of information processing in the brain/mind, brain anatomy and functional parcellation of the brain.

Introduction to AI, Machine Learning (ML) and Deep Learning (DL). Basic introduction to supervised, unsupervised and reinforcement learning paradigms, recent advances in ML and DL with a focus on their applications in neuroscience. Debates on the strengths and limitations of deep neural networks as models of information processing in the brain as well as models for artificial general intelligence (AGI).

Module 2: Vision. Brief tour of recent developments of application of deep neural networks (DNN) in computer vision. Introduction to human perceptual processing (with emphasis on vision) and the neural correlates of the perceptual function. The relation between the representation of information across layers (of DNN) and their match with visual cortical areas in the brain. Current knowledge of the perceptual and neural phenomena in human visual system and the ability and lack thereof of deep neural networks in mimicking these phenomena.

Module 3: Language. Introduction to higher-level cognitive phenomena, including human language processing. Current understanding of the neural correlates of language processing, or the extraction of meaning from spoken or written phrases, sentences, and stories. Recent developments in applying word embedding models and transformer models for brain encoding decoding. Debates about the kind of representations learned in deep learning models and their relation to how brain represents and processes language.

Module 4: Motor function and Skill Learning. Principles of hierarchical motor control in the mammalian brain, in AI systems and their relationship. Application of the concepts of reinforcement learning (RL) and deep RL for motor control, relationship to neurotransmitter activity of dopamine and the cortical and subcortical systems participating in motor learning, planning and control. Skill acquisition in humans and machines. Debates about the adequacy of RL-framework for understanding various aspects of skill acquisition such as compositionality, abstraction, curiosity, mental simulation, etc.

Module 5: Predictive (Bayesian) Brain. Predictive coding and the related ideas of Bayesian Brain and Free Energy Principle -- theoretical frameworks of brain function. Generate-compare-update process of a mental model of the environment. Debates about the Predictive Brain and Free Energy Principle.

Tutorials: Special tutorials will be conducted to familiarize with fMRI experiments, Neuroimaging data and preprocessing, ML/DL tools and how to set up these to complete assignments and project.

Preferred Text Books : No text book is available on this topic. Apart from the general reference books, list of readings will be assigned for various topics (sample references given below).

Reference Books :

Grace Lindsey (2021). Models of the Mind: How Physics, Engineering and Mathematics Have Shaped Our Understanding of the Brain. Bloomsbury Publisher (General Reading)

Pearl, J. & Mackenzie, D. (2018). The Book of Why: The New Science of Cause and Effect. Basic Books. (General Reading)

V. Srinivasa Chakravarthy (2019). Demystifying the Brain: A Computational Approach (1st Edition), Springer, Singapore. (General Reading)

Shimon Edelman (2008). Computing the Mind: How the Mind Really Works. New York: Oxford University Press, 2008

Kenji Doya, Shin Ishii, Alexandre Pouget, Rajesh PN Rao (2007). Bayesian brain: Probabilistic approaches to neural coding. MIT press

Rumelhart, D.E., J.L. McClelland and the PDP Research Group (1986). Parallel Distributed Processing: Explorations in the Microstructure of Cognition. Volume 1: Foundations, & Volume 2: Psychological and Biological Models, Cambridge, Massachusetts: MIT Press (Still a classic, highlights various issues in Cognitive Science & Computational Models)

C. M. Bishop (2006). Pattern Recognition and Machine Learning. Springer.

I. Goodfellow, Y. Benjio, A. Courville (2016). Deep Learning. MIT Press

Example Readings/Viewings:

Jacob, RT Pramod, Harish Katti, SP Arun (2021), Qualitative similarities and differences in visual object representations between brains and deep networks, Nature Communications, 12, 1872. <https://doi.org/10.1038/s41467-021-22078-3>

Martin Schrimpf, Idan Asher Blank, Greta Tuckute, Carina Kauf, Eghbal A. Hosseini, Nancy Kanwisher, Joshua B. Tenenbaum, Evelina Fedorenko (2021). The neural architecture of language: Integrative modeling converges on predictive processing. Proceedings of the National Academy of Sciences Nov 2021, 118 (45) e2105646118; DOI: 10.1073/pnas.2105646118

Marcus, G. (2020). The Next Decade in AI: Four Steps Towards Robust Artificial Intelligence. <https://arxiv.org/abs/2002.06177>.

Manfred Eppe, Christian Gumbsch, Matthias Kerzel, Phuong Nguyen, Martin V. Butz, and Stefan Wermter (2020). Hierarchical principles of embodied reinforcement learning: A review. arXiv:2012.10147v1

Matt Botvinick (Jul 3, 2020): Neuroscience, Psychology, and AI at DeepMind | Lex Fridman Podcast #106 https://www.youtube.com/watch?v=3to6ajvBtlo&ab_channel=LexFridman

Yoshua Bengio and Gary Marcus on the best way forward for AI (Moderated by Vincent Boucher, Dec 2019). https://www.youtube.com/watch?v=EeqwFjqFvJA&ab_channel=Montreal.AI

Merel, J., Botvinick, M. & Wayne, G. Hierarchical motor control in mammals and machines. Nat Commun 10, 5489 (2019). <https://doi.org/10.1038/s41467-019-13239-6>

Blake A. Richards, Timothy P. Lillicrap, Philippe Beaudoin, Yoshua Bengio, et al. (2019). A deep learning framework for neuroscience. Nature Neuroscience, 22: 1761–1770. <https://doi.org/10.1038/s41593-019-0520-2>

- Doya K, Taniguchi T (2019). Toward evolutionary and developmental intelligence. *Current Opinion in Behavioral Sciences*, 29, 91-96. <http://doi.org/10.1016/j.cobeha.2019.04.006>.
- Schrimpf M, Kubilius J, Hong H, et al. (2018). Brain-Score: Which Artificial Neural Network for Object Recognition is most Brain-Like?. *bioRxiv*. 2018. doi:<https://doi.org/10.1101/407007>
- Pereira, F., Lou, B., Pritchett, B. et al. (2018). Toward a universal decoder of linguistic meaning from brain activation. *Nat Commun* 9, 963 (2018). <https://doi.org/10.1038/s41467-018-03068-4>
- Pearl, J. (2018). Theoretical impediments to machine learning with seven sparks from the causal revolution. *arXiv:1801.04016*.
- Lake, B., Ullman, T., Tenenbaum, J., & Gershman, S. (2017). Building machines that learn and think like people. *Behavioral and Brain Sciences*, 40, E253. doi:[10.1017/S0140525X16001837](https://doi.org/10.1017/S0140525X16001837)
- Kumaran, Dharshan, Demis Hassabis, and James L. McClelland (2016). "What learning systems do intelligent agents need? Complementary learning systems theory updated." *Trends in cognitive sciences* 20.7 (2016): 512-534.
- Friston, K. J. The free-energy principle: a unified brain theory? *Nature Neuroscience*, 11:127– 138, 2010.

E-book Links :

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz-1	10%
Mid Sem Exam	15%
Quiz-2	10%
End Sem Exam	--
Assignments / Term Paper / In-class Presentation / Peer Review	25%
Project	40%
Term Paper	-- See Above --
Other Evaluation	

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	2	1	1	1	1	1	1	1	1	1	1	2	2	1	2	1
CO 2	3	3	1	2	1	1	1	1	1	1	1	2	2	2	3	2
CO 3	2	2	2	3	2	1	1	1	1	1	1	2	2	2	3	2
CO 4	2	3	2	3	3	1	1	1	3	3	1	2	3	2	2	3
CO 5	2	2	3	2	1	1	2	2	2	1	1	3	3	1	3	3

Teaching-Learning Strategies in brief (4-5 sentences):

Lectures will initially introduce the motivations and concepts, illustrated with simpler examples. This will be followed by assignments and in-class presentation of relevant papers that will ensure that the students are engaged with the methods and the debates. Deeper lectures and final project are expected to lead the students to a broader but more concrete understanding of the issues in Cogsci & AI. The practical (programming) assignments and the final project (with significant programming component) give hands-on experience of application of ML and DL algorithms for problems in cognitive neuroscience.

Title of the Course	: Communication Theory
Faculty Name	: Praful Kumar
Course Code	: EC5.203
L-T-P	: 3-1-1.
Credits	: 4
(L= Lecture hours, T=Tutorial hours, P=Practical hours)	
Name of the Academic Program	: B.Tech. in Electronics and Communication Engineering

1.Prerequisite Course / Knowledge:

A prior knowledge of signals and systems, probability theory, random variables, and random process is required.

2.Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1. Explain the basic elements of a communication system.

CO-2. Interpret the complex baseband representation of passband signals and systems and its critical role in modeling, design, and implementation.

CO-3. Explain the basic concepts and implementations of analog modulation and demodulation techniques.

CO4: Explain different linear digital modulation techniques using constellations such as PAM, QAM, PSK, orthogonal modulation and its variants.

CO-5: Apply the concepts of power spectral density, energy spectral density and bandwidth occupancy, Nyquist pulse shaping criterion for avoidance of intersymbol interference.

CO-6. Derive the optimal demodulation schemes for the digital schemes in the presence of AWGN

CO-7: Evaluate the performance of different digital communications schemes in the presence of AWGN.

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PO1 3	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	1	1	1	1	-	-	-	-	1	-	3	1	3	2	1	
CO2	3	3	-	3	3	-	-	-	-	1	-	3	1	3	-	-	

CO3	3	3	-	3	3	-	-	-	-	1	-	3	1	3	2	1
CO4	3	3	-	3	3	-	-	-	-	1	-	3	1	3	2	1
CO5	3	3	-	3	3	-	-	-	-	1	-	3	-	3	-	-
CO6	3	3	-	3	3	-	-	-	-	1	-	3	-	3	-	-
CO7	3	3	-	3	3		-			1	-	3	-	3	-	-

'3' in the box denotes 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

4.Detailed Syllabus:

Unit 1: Representation of bandpass signals and systems; linear bandpass systems, response of bandpass systems to bandpass signals, representation of bandpass stationary stochastic processes

Unit 2: Analog Communication Methods: AM-DSB and SSB, PM, FM-narrowband and wideband, demodulation of AM and PM/FM, Phased locked loop (PLL); Brief view of Line Coding and PWM

Unit 3: Digital Modulation: Representation of Digitally Modulated Signals; Memoryless modulation methods: PAM, PSK, QAM, Orthogonal Multi-Dimensional Signals

Unit 4: Random Processes: Review of Correlation, Energy Spectral Density and Power Spectral Desity; Noise Modelling, Thermal Noise, AWGN.

Unit 5: Optimum digital demodulation: Hypothesis testing, Signal Space Concepts, Performance analysis of ML reception, Bit error probability, Link budget analysis

References:

- U. Madhow, "Introduction to Communication Systems," Cambridge University Press, 2014.
- J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", Pearson Education 2006.
- B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, 2007.

5.Teaching-Learning Strategies in brief:

Lectures will be integrating ICT into classroom teaching, active learning by students, followed by weekly tutorials involving problem solving, and project-based learning by doing theoretical and simulation assignments.

6.Assessment methods and weightages in brief :

Quizzes: 20

MidSem: 20

Assignments: 20

Final Quiz: 40

Title of the Course

: **Communications and Controls in IoT**

Faculty Name

: Sachin Chaudhari + Aftab Hussain

Course Code

: EC5.204

L-T-P

: 1.5-0.5-0

Credits

: 2

(L= Lecture hours, T=Tutorial hours,

P=Practical hours)

Name of the Academic Program : **B.Tech. in Electronics and CommunicationsEngineering**

1. Prerequisite Course / Knowledge:

Basic computer programming (C, C++), 10+2 level physics.

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able

to CO-1. Explain the basic elements of a communication system.

CO-2. Describe the working principle of commonly available sensors and actuators.

CO-3: Design an embedded system using advanced concepts such as timers and interrupts.

CO-4. Explain the basics concepts of communication networks on physical and MAC layer.

CO-5. Assess different communication technologies from IoT application point of view.

CO-6. Develop and implement an IoT-based solution for a real-life problem.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	2	2	3	1	2	-	1	2	-	3	1	1	3	1
CO2	3	3	3	1	3	1	2	-	1	2	-	2	3	-	3	1
CO3	3	2	2	1	3	1	2	-	1	2	-	2	3	-	3	1
CO4	3	2	2	1	3	1	2	-	1	2	-	2	-	3	3	1
CO5	3	2	2	1	3	1	2	-	1	2	-	2	-	3	3	1
CO6	3	3	3	3	3	1	2	-	3	2	3	3	3	3	3	1

'3' in the box denotes 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

4. Detailed Syllabus:

Unit 1: Introduction to IoT (1 lecture)

Unit 2: Sensor physics, sensor characteristics and properties, sensor read-out circuitry, actuator physics, actuator drive circuits (3 lectures)

Unit 3: Interfacing of sensors and actuators, wired communication protocols – SPI, I2C, UART, timers and interrupts, analog-to-digital and digital-to-analog convertors. (3 lectures)

Unit 4. Basics of Networking (2 lectures)

Unit 5. Communication Protocols: WiFi/Bluetooth/Zigbee/LoRaWAN/NB-IoT; Data Protocols: MQTT/CoAP (4 lectures)

Reference:

1. Raj Kamal, Internet of Things, McGraw Hill, 2018
2. P. Lea, Internet of Things for Architects, 2018
3. O. Hersistent, D. Boswarthick, O. Elloumi, The Internet of Things, Wiley, 2016
4. D. Norris, The Internet of Things, McGraw Hill, 2015
5. A. Bahga and V. Madisetti, Internet of Things, University Press, 2016

5. Teaching-Learning Strategies in brief:

Lectures will be integrating ICT into classroom teaching, active learning by students, and project-based learning by doing an IoT-based project.

6. Assessment methods and weightages in brief :

Quizzes: 20

MidSem: 20

Final Exam: 20

Project: 20

Title of the Course	: Compilers
Faculty Name	: Venkatesh Choppella
Course Code	: CS1.403
L-T-P	: 3-1-0.
Credits	: 4
(L = Lecture Hours, T = Tutorial Hours, P = Practical Hours)	

1. Prerequisite Course / Knowledge:

Computer Programming. Data structures and algorithms. Computer Systems Organization. Operating Systems. Automata Theory.

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able to:

CO-1: Explain the principles and practices underlying production quality compilers such as GCC and LLVM (Cognitive Level: **Understand**)

CO-2: Modify open source compilers such as GCC and LLVM to support new languages and processor architectures; and write custom analysis and transformation passes. (Cognitive Level: **Apply**)

CO-3: Identify problems or sub-problems in real world projects which can be solved by building custom compilers and interpreters of varying scale and complexity. (Cognitive Levels: **Analyze, Evaluate and Create**)

CO-4: Employ software engineering principles and practices to design, develop and manage complex software engineering tasks. Examples include object oriented design and programming, choosing appropriate design patterns, good support for debugging the system with ease and, develop comprehensive test suite with good coverage. (Cognitive Levels: **Analyze, Evaluate and Create**)

CO-5: Use software management tools such as GIT, build systems such as Make/Ant etc. Write proper software design documents and end-user manuals (Cognitive Levels: **Apply**)

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	2	-	-	-	-	2	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	2	3	3	3	3
CO4	2	3	3	3	3	-	-	-	3	3	-	2	3	3	3	3
CO5	2	2	3	3	3	-	-	3	3	3	3	2	3	3	3	3

4. Detailed Syllabus

- Unit 1: Syntax Analysis**

- Micro and macro syntax specification using regular expressions and context free grammars
- Lexical Analysis
- Top-down (LL(1)) and bottom-up (LR(1), LALR(1)) parsing

- **Unit 2: Semantic Analysis and IR Generation**
 - Abstract Syntax Tree (AST) construction
 - Static and Dynamically typed language
 - Type Checking
- **Unit 3: Intermediate Representations and their Generation**
 - Intermediate representations such as three address tuples, stack code
 - AST to linear intermediate representation generation
 - Basic blocks and control flow graphs
 - Static Single Assignment Form (SSA)
 - LLVM IR case study
- **Unit 4: Machine Independent Optimizations**
 - Local and regional optimizations using value numbering optimization as a case study
 - Global optimizations like constant propagation and dead code elimination
 - Data flow analysis theory and practice. Examples include Available expressions analysis and live variable analysis.
 - Compiler phase sequencing problem
- **Unit 5: Code Generation and Register Allocation**
 - Runtime environment for C-like programming languages
 - Scope and lifetime of variables. Parameter passing mechanisms.
 - Generating machine code with virtual registers from machine independent linear intermediate representation.
 - Local and global register allocation. Mapping virtual registers to physical registers.
 - Basics of instruction scheduling

Reference Books:

1. Keith Cooper and Linda Torczon. 2011. Engineering a Compiler, Second Edition. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA.
- Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman. 2006. Compilers: Principles, Techniques, and Tools (2nd Edition). Pearson.

5. Teaching-Learning Strategies in brief

The most important component of this course is the project in which students design a C like imperative programming language. Write a manual for their programming language specifying syntactic and semantic rules along with example programs written in their own language. Over the course, as students are introduced to principles and practices involved in designing various compiler modules, they build the corresponding modules for their programming language. At the end of the course, students will be able to run the example programs they have written by compiling them with the compiler built by them. The target language for the compiler is usually LLVM IR.

Through the mini homeworks, theoretical ideas introduced in the class are reinforced. Students get continuous support through tutorial sessions, office hours conducted by teaching assistants and the concerned faculty.

6. Assessment methods and weightages in brief

1. Mini Homeworks (7 to 8) : 15 percent
2. Course Project
 - a. Syntax Analysis: 10 percent
 - b. AST Construction: 10 percent

- c. Semantic Analysis: 10 percent
 - d. LLVM IR Generation: 10 percent
 - 3. Mid Term Quiz: 15 percent
 - 4. Final Theory Exam: 30 percent
-

Title of the Course : Comprehension of Indian Music

Faculty Name : T K Saroja
 Course Code : HS1.206
 L-T-P : 3-0-1
 Credits : 4
 (L= Lecture hours, T=Tutorial hours,
 P=Practical hours)

1.Prerequisite Course / Knowledge:

Faculty Consent

2.Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to..

CO-1Understanding the theory of Indian music which gives it the status of a *sāstra* and appreciation of the practice of classical music.

CO-2Understanding the rational, creative and social elements of the art which makes the art an integral part of the society.

CO-3Ability to recognize different musical forms with a systematic approach

CO-4Understanding the universality of music with the knowledge of Indian music.

CO-5Understanding the importance of music and related arts in one's life as those that foster individual growth.

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO 1		PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	1		1	1	1	0	2	1	2	3	1	0	3	0	0	0	0
CO 2	1		1	1	1	0	2	1	2	3	1	0	3	0	0	0	0
CO 3	1		1	1	1	0	2	1	2	3	1	0	3	0	0	0	0
CO 4	1		1	1	1	0	2	1	2	3	1	0	3	0	0	0	0
CO 5																	
.....	1		1	1	1	0	2	1	2	3	1	0	3	0	0	0	0
.....																	

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

4.Detailed Syllabus:

Unit 1: Study of basics of both the styles (Hindustani and Karnataka) to know the characteristics of them. Importance of nāda in music.

.....
Unit 2: Conceptual study of rāga-s and tāla-s that gives Indian music its stature.

This includes 72 melakartha system, 10 Thaats, Talas of both South and North Indian music system.

.....
Unit 3: Introduction to different genres of India music like the semi classical, light, folk music studying their peculiar aspects. (Kalpithasangita)Musical forms of both the systems.

.....
Unit 4: 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, MythuswamyDixitar and SyamaSastry. Life and Contribution of Bhatkande, Vishnu DigambarPaluskar. The existence and the prominence of gharānā-s in Hindustani music and the musicians who represent the particular gharānā-s.

.....
Unit 5: Manodharma Sangit- Improvisational music

Reference Books:

1. *South Indian Music – Volumes 1 to 6* by Professor P. Sambamurthy, Published by The Indian music publishing house, 1994

2. *Karnataka Sangita Sastra* by A.S. PanchapakesaAyyar, Published by GanamruthaPrachuram, 2008.

3. *Appreciating Carnatic Music* by ChitraveenaN.Ravikiran, Published by Ganesh &Co.

4. *Nuances of Hindustani Classical Music* by HemaHirlekar, Published by Unicorn books Pvt Ltd, 2010

5. *The Hindu Speaks on Music - compilation of 232 selective music articles* by The Hindu, Kasturi and Sons Ltd, December 1999.

6. *A Southern Music (The karnatic story)* by T.M. Krishna, Published by Harper Collins, 2010.

7. *Hindustani Music: A tradition in transition* by Deepak Raja, Published by D.K.Print world ltd, 2015.

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

... Demonstrations by the faculty of all the concepts to make the students understand the core concepts.

Video and audio demonstrations is the crucial part, along with the faculty demonstrating the concepts.

Attempt to arrange one guest lecture to demonstrate any important concept from the course on a practical basis.

6.Assessment methods and weightages in brief (4 to 5 sentences):

Quizzes – 20%

Assignments-20%

Mid term exams- 20%

Individual Project and viva- 40%

Title of the Course : Computational Social Science

Faculty Name : Ponnurangam Kumaraguru

Course Code : CS9.435

Credits

L - T - P : 3-0-1
Name of the Program : Applicable to all Programs on campus including, CSE, CLD, CHD, CND, both at UG & Masters level.
(L - Lecture hours, T-Tutorial hours, P - Practical hours)
Semester, Year : Spring, 2022
(Ex: Spring, 2022)
Pre-Requisites : Any UG3, UG4, M.Tech., MS, and Ph.D. student should be able to take it

Course Outcomes :

- ② Co-1: Students will describe the opportunities and challenges that the digital age creates for social sciences research.
- ② Co-2: Students will evaluate modern social research from the perspectives of both social science and data science.
- ② Co-3: Students will create research proposals that blend ideas from social science and data science.
- ② Co-4: Students will be able to summarize and critique research papers in Computational Social Science
- ② Co-5: Students will conduct, develop, and practice the techniques needed to conduct their proposed research, through course project.

Course Topics :
(please list the order in which they will be covered, and preferably arrange these as five to six modules.)

Module 1: Social Research

- ② Computational Social Science 101
 - o What is Computational Social Science?
 - o Is Computational Social Science = or ② Computer Science + Social Science?
 - o Why study Computational Social Science?
 - o Challenges with only Computer Science or Social Science
 - o Does Social Media data == Computational Social Science? Class debate.
- ② Social Science vs. Data Science
- ② Prediction vs.

Causality Read / Listen /

Watch:

- ② Hanna Wallach. 2018. Computational social science ≠ computer science + social data. Commun. ACM 61, 3 (March 2018), 42–44.
DOI:<https://doi.org/10.1145/3132698>
<https://cacm.acm.org/magazines/2018/3/225484-computational-social-science-computer-science-social-data/fulltext>
- ② Lazer D, Pentland A, Adamic L, Aral S, Barabasi AL, Brewer D, Christakis N, Contractor N, Fowler J, Gutmann M, Jebara T, King G, Macy M, Roy D, Van Alstyne M. Social science. Computational social science. Science. 2009 Feb 6;323(5915):721-3. doi: 10.1126/science.1167742. PMID: 19197046; PMCID: PMC2745217. <https://pubmed.ncbi.nlm.nih.gov/19197046/>
- ② Coded Bias
 - o Trailer <https://youtu.be/jZl55PsfZJQ>
 - o Full documentary <https://www.netflix.com/title/81328723>

Module 2: Modeling & Causal Inference

- ② Linear Regression, Model building, Hypothesis testing
- ② Causal Inference
- ② Running Experiments – Lab, Real-world
- ② Read / Listen / Watch:
 - Blumenstock et al. 2015. Predicting Poverty and Wealth from Mobile Phone Metadata. Science.
<https://www.unhcr.org/innovation/wp-content/uploads/2016/11/blumenstock-science-2015.pdf>
 - Lazer, David and Kennedy, Ryan and King, Gary and Vespiagnani, Alessandro, Google Flu Trends Still Appears Sick: An Evaluation of the 2013-2014 Flu Season (March 13, 2014). Available at SSRN:
<https://ssrn.com/abstract=2408560> or
<http://dx.doi.org/10.2139/ssrn.2408560>
 - M. R. Khan, J. Manoj, A. Singh and J. Blumenstock, "Behavioral Modeling for Churn Prediction: Early Indicators and Accurate Predictors of Customer Defection and Loyalty," 2015 IEEE International Congress on Big Data, 2015, pp. 677-680, doi: 10.1109/BigDataCongress.2015.107.
 - Chapter 3 of Mostly Harmless Econometrics: An Empiricist Companion

Module 3: Mass Collaborations

- ② Human Computation
 - Galaxy Zoo
 - ② Lintott, Chris J, Kevin Schawinski, Anže Slosar, Kate Land, Steven Bamford, Daniel Thomas, M. Jordan Raddick, et al. 2008. "Galaxy Zoo: Morphologies Derived from Visual Inspection of Galaxies from the Sloan Digital Sky Survey." *Monthly Notices of the Royal Astronomical Society* 389 (3):1179–89. <https://doi.org/10.1111/j.1365-2966.2008.13689.x>
<https://watermark.silverchair.com/mnras0389-1179.pdf>
 - ② Kuminski, Evan, Joe George, John Wallin, and Lior Shamir. 2014. "Combining Human and Machine Learning for Morphological Analysis of Galaxy Images." *Publications of the Astronomical Society of the Pacific* 126 (944):959–67. <https://doi.org/10.1086/678977>.
 - Crowd-coding of political manifestos
 - ② Benoit, Kenneth, Drew Conway, Benjamin E. Lauderdale, Michael Laver, and Slava Mikhaylov. 2016. "Crowd-Sourced Text Analysis: Reproducible and Agile Production of Political Data." *American Political Science Review* 110 (2):278–95.
<https://doi.org/10.1017/S0003055416000058>
https://kenbenoit.net/pdfs/Crowd_sourced_data_coding_APSP.pdf
- ② Open Calls
 - Netflix Prize
 - ② Netflix. 2009. "Netflix Prize: View

- Leaderboard.” <http://www.netflixprize.com/leaderboard>.
- ② **Bell, Robert M., Yehuda Koren, and Chris Volinsky.** 2010. “All Together Now: A Perspective on the Netflix Prize.” *Chance* 23 (1):24–24. <https://doi.org/10.1007/s00144-010-0005-2>.
 - o **Foldit: Protein-folding game**
 - ② Hand, Eric. 2010. “Citizen Science: People Power.” *Nature News* 466(7307):685–87. <https://doi.org/10.1038/466685a>.
 - ② Distributed Data collection
 - o eBird: Bird data from birders
 - ② **Kelling, Steve, Daniel Fink, Frank A. La Sorte, Alison Johnston, Nicholas E. Bruns, and Wesley M. Hochachka.** 2015. “Taking a Big Data Approach to Data Quality in a Citizen Science Project.” *Ambio* 44 (Suppl 4):601–11. <https://doi.org/10.1007/s13280-015-0710-4>.
 - o Photocity
 - ② **Tuite, Kathleen, Noah Snavely, Dun-yu Hsiao, Nadine Tabing, and Zoran Popovic.** 2011. “PhotoCity: Training Experts at Large-Scale Image Acquisition Through a Competitive Game.” In *Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems*, 1383–92. CHI ’11. New York: ACM.
<https://doi.org/10.1145/1978942.1979146>
<https://dl.acm.org/doi/pdf/10.1145/1978942.1979146>
 - ② **Agarwal, Sameer, Yasutaka Furukawa, Noah Snavely, Ian Simon, Brian Curless, Steven M. Seitz, and Richard Szeliski.** 2011. “Building Rome in a Day.” *Communication of the ACM* 54 (10):105–12. <https://doi.org/10.1145/2001269.2001293>.
 - ② How to develop our own (including around course project) Mass Collaborations?
 - o Opportunities
 - o Methods
 - o Challenges

Module 4: Ethics

- ② Studies of concern
 - o **Experiment on 700,000 Facebook users**
 - ② Kramer, Adam D. I., Jamie E. Guillory, and Jeffrey T. Hancock. 2014. “Experimental Evidence of Massive-Scale Emotional Contagion Through Social Networks.” *Proceedings of the National Academy of Sciences of the USA* 111 (24):8788–90.
<https://doi.org/10.1073/pnas.1320040111>
 - o Tastes, Ties, and Time study on Facebook users
 - ② **Wimmer, Andreas, and Kevin Lewis.** 2010. “Beyond and Below Racial Homophily: ERG Models of a Friendship Network Documented on Facebook.” *American Journal of Sociology* 116 (2):583–642. <http://www.jstor.org/stable/10.1086/653658>.
 - ② **Lewis, Kevin, Marco Gonzalez, and Jason Kaufman.** 2012. “Social

Selection and Peer Influence in an Online Social Network.” Proceedings of the National Academy of Sciences of the USA 109 (1):68–72. <https://doi.org/10.1073/pnas.1109739109>.

- o Web Censorship
 - ② Burnett, Sam, and Nick Feamster. 2015. “Encore: Lightweight Measurement of Web Censorship with Cross-Origin Requests.” In Proceedings of the 2015 ACM Conference on Special Interest Group on Data Communication, 653–67. SIGCOMM ’15. London: ACM. <https://doi.org/10.1145/2785956.2787485>
<https://dl.acm.org/doi/pdf/10.1145/2785956.2787485>
 - ② Narayanan, Arvind, and Bendert Zevenbergen. 2015. “No Encore for Encore? Ethical Questions for Web-Based Censorship Measurement.” Technology Science, December. <http://techscience.org/a/2015121501/>.
 - ② Jones, Ben, and Nick Feamster. 2015. “Can Censorship Measurements BeSafe(R)?” In Proceedings of the 14th ACM Workshop on Hot Topics in Networks, 1:1–1:7. HotNets-XIV. New York: ACM. <https://doi.org/10.1145/2834050.2834066>.
- ② Crime prediction using Social data, Tracking immigrants through their phone apps
- ② Institutional Review Board / Ethics Committee – Expectations, Why is it necessary?
- ② Informed consent, Privacy, Risk

Module 5: Biases in CSS Research

- ② Biases & inaccuracies at the source of the data
- ② Biases & inaccuracies during processing
- ② Biases in social data
- ② Inferences from biased data
- ② Read / Listen / Watch:
 - o danah boyd & Kate Crawford (2012) CRITICAL QUESTIONS FOR BIG DATA, Information, Communication & Society, 15:5, 662-679, DOI: 10.1080/1369118X.2012.678878
 - o Daniel Gayo-Avello. 2011. Don't turn social media into another 'Literary Digest' poll. Commun. ACM 54, 10 (October 2011), 121–128. DOI:<https://doi.org/10.1145/2001269.2001297>
 - o McFarland DA, McFarland HR. Big Data and the danger of being precisely inaccurate. Big Data & Society. December 2015. doi:10.1177/2053951715602495
 - o https://en.wikipedia.org/wiki/Weapons_of_Math_Destruction
 - o Ricardo Baeza-Yates. 2018. Bias on the web. Commun. ACM 61, 6 (June 2018), 54–61. DOI:<https://doi.org/10.1145/3209581>
 - o Hargittai E. Potential Biases in Big Data: Omitted Voices on Social Media. SocialScience Computer Review. 2020;38(1):10-24. doi:10.1177/0894439318788322
 - o Olteanu Alexandra, Castillo Carlos, Diaz Fernando, Kiciman Emre. Social Data: Biases, Methodological Pitfalls, and Ethical Boundaries. Frontiers in Big Data. VOLUME 2, 2019 DOI=10.3389/fdata.2019.00013

<https://www.frontiersin.org/article/10.3389/fdata.2019.00013>

Preferred Text Books :

1. Salganik, Matthew J., Bit by Bit: Social Research in the Digital Age, Princeton University Press, 2018. Free Online Version:
<https://www.bitbybitbook.com/en/1st-ed/preface/>

Reference Books :

E-book Links :

- <https://www.bitbybitbook.com/en/1st-ed/preface/>
- <https://www.nature.com/collections/cadaddgige/>
- https://www.researchgate.net/profile/Joshua-Angrist/publication/51992844_Mostly_Harmless_Econometrics_An_Empiricist%27s_Copanion/links/oob4953344a9aocb13000000/Mostly-Harmless-Econometrics-An-Empiricists-Companion.pdf

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quizzes	20.0
Assignments + Activities	30.0
Project report + Blog + Video	20.0 [15 + 2.5 + 2.5]
Project	30.0
Other Evaluation	

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	1	-	-	-	3	-	-	-	3	-	1	3	-	-	3
CO 2	3	1	-	-	3	3	-	-	3	3	-	1	3	-	-	3
CO 3	3	3	-	-	-	3	1	3	3	3	-	1	3	3	-	3
CO 4	3	1	-	-	-	-	-	-	3	3	-	1	3	1	-	3
CO 5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Teaching-Learning Strategies in brief (4-5 sentences) :

Learning

- ② Lectures
- ② Reading research papers
- ② Class participation: questions, discussions
- ② Online discussion: Teams

Learning by doing

- ② Course project

- ❑ Real world issues
- ❑ Interdisciplinary approach
- ❑ Real world implementation

POTENTIAL GUEST LECTURES:

1. Prof. Mathew Salganik, Princeton University
 2. (Soon to be Dr.) Ashwin Rajadesingan, University of Michigan
 3. Dr. Hemank Lamba, Dataminr
-

Title of the Course : **Computer Graphics**

Faculty Name : **Avinash Sharma**

Course Code : **CS7.302**

Credits : **02**

L - T - P : **19.5 hrs (L) – 13 hrs (T)**

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year : **Spring 2023**

(Ex: Spring, 2022)

Name of the Program : **Introduction to Computer Graphics**

Pre-Requisites : **C Programming**

Course Outcomes :

After completion of this course successfully, the students will be able to.

- CO-1 Understand & implement basic graphics pipeline for game design.
- CO-2 Understand various geometric transformations and projections for graphics.
- CO-3 Implement rasterization pipeline features using OpenGL library.
- CO-4 Design virtual environments using popular libraries like Unity and Unreal Engine.

Course Topics :

1. Geometry Module:Graphics Primitives, Geometric Transformations.
2. Pipeline Module: Hierarchical Modeling and Viewing Transforms.
3. Projection Module: Perspective and Orthographic Projection.
4. Rasterization Module:Clipping Points and Lines, Polygon Filling, Visibility.
5. Intro to Unity& Unreal Engine based virtual world design.

Preferred Text Books : Computer Graphics with OpenGL by Hearn and Baker

Reference Books :

- Fundamentals of Computer Graphics by Peter Shirley.
- Computer Graphics: Principles & Practice by Foley, van Dam, Feiner, Hughes. Indian Edition available.
- Interactive Computer Graphics: A Top-Down Approach Using OpenGL, Fifth edition by Edward Angel.
- OpenGL Programming Guide by Neider,et.al.

E-book Links :

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz	10%
Final Exam	35%
Assignments	55%

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2	2	1	1	1	1	1	1	2	3	2	1	2
CO2	2	1	2	1	3	1	1	1	3	1	1	2	3	2	2	3
CO3	2	3	3	3	3	1	1	1	3	1	1	3	3	3	2	3
CO4	2	3	3	3	3	2	2	1	3	1	1	3	3	3	3	3

Teaching-Learning Strategies in brief (4-5 sentences) : The course is designed to introduce the fundamentals of Computer Graphics. The objective of this course is to familiarize the audience with the theoretical as well as practical aspects of computer graphics and imaging process. The expected outcome is to give good familiarity of computer graphics pipeline to students so that they can design virtual world using OpenGL or Unity/Unreal kind of public libraries for gaming and AR/VR type of applications.

Title of the Course : Computer Systems Organization

Faculty Name : Praveen Paruchuri

Course Code : CS2.201 a (UG1 students only)

L-T-P : 3-1-0.

Credits : 4

(L = Lecture Hours, T = Tutorial Hours, P = Practical Hours)

Name of the Academic Program : **B.Tech in Computer Science and Engineering**

1. Prerequisite Course / Knowledge:

Digital logic circuits and design. Combinational and Sequential Circuits. Fundamentals of Programming.

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able to:

CO-1: Explain the Von Neumann Model of Computing. Describe all the steps involved in the execution of a program: composition, compilation, assembly, linking, loading and hardware interpretation of the program instructions. (Cognitive Level: **Understand**)

CO-2: Describe the instruction set architecture design principles. Show how programming language constructs can be mapped to sequences of assembly language instructions. Analyze and assess any given ISA. (Cognitive Levels: **Analyze and Evaluate**)

CO-3: Describe processor design architectural approaches. Compare and contrast sequential designs with pipelined designs. Propose new architectural approaches to optimize on performance and hardware costs (Cognitive Levels: **Apply, Analyze and Create**)

CO-4: Describe the basic functionality of an operating system. Clearly explain the system call interface, its design and implementation. Build systems akin to a bash shell, file server etc. using system calls. (Cognitive Levels: **Understand and Apply**)

CO-5: Describe the basics of process control and management. (Cognitive Levels: **Understand and Apply**)

CO-6: Describe the principles of virtual memory management. Analyze various memory management schemes for process isolation and physical memory utilization across multiple processes (Cognitive Levels: **Understand, Apply and Analyze**)

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2	-	-	-	2	2	1	1	3	2	3	3
CO2	3	3	2	2	2	-	-	-	2	2	1	1	3	2	3	3
CO3	3	3	2	2	2	-	-	-	2	2	1	1	3	2	3	3
CO4	3	3	2	2	2	-	-	-	2	2	1	1	3	2	3	3
CO5	3	3	2	2	2	-	-	-	2	2	1	1	3	2	3	3
CO6	3	3	2	2	2	-	-	-	2	2	1	1	3	2	3	3

4. Detailed Syllabus

- **Unit 1:**
 - Basic computer organization, Von Neumann architecture and stored program concept
 - High level programming languages, assemble code, binary instructions, compilers and assemblers
 - Programming editing, compilation and execution cycle
- **Unit 2:**
 - Instruction Set Architecture Design Principles
 - CISC vs RISC ISAs
 - Binary encoding of the instructions
 - Mapping language constructs such as expressions, if-then-else statements, loops, functions to assembly code
 - Machine representation of numbers
- **Unit 3:**
 - Processor design fundamentals
 - ALU Design
 - Single Cycle and Multi Cycle Processor Design
 - Pipelined Architectures
 - Hazards in Pipelined Architectures and approaches to resolve them.

- **Unit 4:**
 - Introduction to Operating Systems. Bootstrapping Process
 - System Calls, their design, implementation and application.
 -
- **Unit 5:**
 - Process Control and Management
 - Scheduling multiple processes on multiple cores.
 - Basics of scheduling mechanisms and policies.
- **Unit 6:**
 - Physical vs Virtual Memory
 - Process and memory isolation/protection mechanisms
 - Virtual memory management
 - Page replacement algorithms

Reference Books:

1. Computer Systems: A Programmer's Perspective. Randal Bryant and David O'Hallaron
2. Computer Organization and Design. The Hardware/Software Interface. David A. Patterson and John L. Hennessy.
3. Operating Systems: Three Easy Pieces by Remzi H. Arpaci-Dusseau and Andrea C. Remzi H. Arpaci-Dusseau

5.Teaching-Learning Strategies in brief

Lectures are conducted in a highly interactive fashion. Use of various system tools such as compilers, assemblers, loaders, linkers, simulators etc. are demonstrated live in the class. Assignments include assembly language programming, digital system design exercises such as Arithmetic and Logic Unit Design, programming using system calls. Most of the ideas introduced in the class are emphasized through these assignments. Teaching Assistants and Faculty conduct office hours every day. Thus students have continuous access to resources to get their doubts clarified and seek any extra help that is required. Some times students are encouraged to come to the board and explain the novel design ideas they came up with while solving assignments or mini-projects.

6.Assessment methods and weightages in brief

1. Programming Assignments (5 to 6) :25 percent
2. Two Quizes: 2 x 10 percent
3. Mid Term: 20 percent
4. Final Exam: 35 percent

Title of the Course : Computer Vision

Faculty Name : Avinash Sharma

Course Code : CS7.505

Credits : 4

L - T - P : 40.5 (L) – 13 (T)

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Name of the Program : Introduction to Computer Vision

Semester, Year : Spring 2023

(Ex: Spring, 2022)

Pre-Requisites :Computer Graphics and/or Digital Image processing

Course Outcomes :

After completion of this course successfully, the students will be able to.

CO-1 Introduce the image formation process and camera modelling.

CO-2 Introduce multi-view geometry methods in computer vision.

CO-3 Introduce classical computer vision techniques for semantic segmentation, retrieval, 3d reconstruction.

CO-4 Explain modern computer vision techniques with focus on deep learning architectures.

CO-5 Introduce 3D computer vision research problems and latest deep learning solutions.

Course Topics :

Module 1: Introduction

Image Formation ,Traditional Feature Detection & Description, Pinhole Camera Model & Projective Geometry, Camera Calibration.

Module 2: Multi-view Geometry

2-View Geometry, Homography, Multi-camera Geometry (Image Rectification), Stereo Correspondence, Depth from Stereo.

Module 3: Classical Computer Vision Methods

Motion Estimation and Optical Flow, Segmentation as Labelling: Introduction to Ncut, Image Segmentation by MRF, SfM / Bundle Adjustment, Bag-of-Words Representation.

Module 4: Modern Computer Vision

Intro to Conv-Neura-Nets (CNN), CNNs for Detections, CNN for Recognition, Recurrent NN for Video Analysis, Generative Models for CV (GAN,VAE, DM) , Vision Transformers (VT) for CV Applications.

Module 5: 3D Computer Vision Applications

Intro do 3D Vision (Representation and Learning), 6Dof Pose Estimation, Human Body Modelling, Neural Radiance Field (NeRF).

Preferred Text Books :Forsytn and Ponce' Computer Vision: a modern approach, Pearson Education Inc.

Reference Books :Multi-view Geometry by Hartley & Zisserman, Computer Vision by Rick Szeliski

E-book Links :<https://szeliski.org/Book/>

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz	5
Mid SemExam	15
End Sem Exam	20
Assignments	30
Project	30

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2	2	1	1	1	1	1	1	2	3	2	1	2
CO2	2	1	2	1	3	1	1	1	3	1	1	2	3	2	2	3
CO3	2	3	3	3	3	1	1	1	3	1	1	3	3	3	2	3
CO4	2	3	3	3	3	1	1	1	2	1	1	3	3	3	2	3
CO5	2	3	3	3	3	2	2	1	3	1	1	3	3	3	3	3

Teaching-Learning Strategies in brief (4-5 sentences) :

The course lectures will include technical content on algorithm with appropriate visualization for effectively conveying the basic concepts as well as small activities to promote the understanding of the lecture content. Significant focus will be on problem solving aspect and concepts will be introduced in the context of relevant research challenges. Tutorials will further try to bridge the gap between theoretical understanding and practical aspects of problem solving. Assignments are designed to solve problems that are based on simple extensions of concepts described in the lectures. Course project will encourage learning collaborative skills with goal to induce system building capability among students to complement lecture-based learning.

Title of the Course

: Computing Tools

Name of the Faculty

: Sriranjani + Charu Sharma

Course Code

: CSo.302

L-T-P

: 3-1-3

Credits

: 4

Name of the Academic Program: M.Tech. in CASE, Bioinformatics (1st year, 2nd semester)

Prerequisite Course / Knowledge:

1. First course on programming and problem-solving
2. Basics of Python language, to be able to use relevant libraries and toolkits

Course Outcomes (COs):

After completion of this course successfully, the students will be able to:

CO-1. Model and create datasets.

CO-2. Visualize and present data.

CO-3. Collect data from across networks and internet to store in databases

CO-4. Prepare and preprocess datasets to make them ready for application of various data analytics algorithms.

CO-5. Employ known algorithms to solve common analytics tasks in practical applications, setting their parameter values, and using relevant libraries and toolkits.

CO-6. Evaluate and determine the best algorithm among known algorithms for specific datasets and applications.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	1	2	1	1	3	1	1	1	3	1	2	3
CO2	3	2	1	2	3	1	1	1	3	2	1	2	3	1	2	3
CO3	3	1	3	1	3	1	1	1	3	1	1	2	3	1	2	2
CO4	3	2	3	3	3	3	2	2	3	2	2	3	2	2	2	3
CO5	3	1	3	1	3	2	1	1	3	3	2	3	2	1	2	3
CO6	2	3	3	1	1	1	2	1	3	3	2	3	2	2	2	3

‘3’ in the box denotes ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level mapping.

Detailed Syllabus:

Unit 1: Databases (Design, SQL)

Unit 2: Visualization (e.g. Bokeh, V Tk)

Unit 3: Networking and data collection (e.g. requests and json modules)

Unit 4: Scientific Python Modules: NumPy, Matplotlib, Tkinter, SciPy

Unit 5: Data analytics: Preprocessing, Clustering, Classification (e.g. pandas, scikitlearn)

Reference Books:

1. Official documentation and online tutorials on Python, V Tk, etc.
2. Python – <https://docs.python.org/3/tutorial/>

Teaching-Learning Strategies in brief (4 to 5 sentences):

This is a highly practicals-oriented course. Lectures showcase handson usage of various computing tools and modules for interdisciplinary students. Theoretical concepts in database design and data analytics are also covered with a practical focus, with examples and assignments. A mini-project is given in each module. Mini projects may be done in groups of 3. Lab exams may be done as a single large problem with intermediate milestones and choice of 1 out of 3 problems to solve. Python modules specified are suggestive and may be replaced with better ones.

Assessment methods and weightages in brief (4 to 5 sentences):

- Mini Projects: 5x10=50%

- Lab reports: 10%
 - Mid semester exams: $10+15=25\%$
 - Lab exams: 15%
-

Title of the Course : **Convergence & Divergence in Indian Languages**

Name of the faculty : **Parameswari Krishnamurthy**

Course Code : **CL2.402**

Credits : **4 (FOUR)**

L - T - P : **3-1-0 (L - Lecture hours, T-Tutorial hours, P - Practical hours)**

Semester, Year : **Spring, 2023**

1. Prerequisite Course / Knowledge: Introduction to Linguistics-1

Course Introduction:

Natural languages are complex systems due to various linguistic and non-linguistic factors. Complexity in languages affects building efficient NLP tools and applications. Similarly, research on multilingual NLP does face various challenges compromising with multiple languages and its complexity. In this course, we learn to measure language complexity individually and cross-linguistically through convergence and divergence indices, thereby understanding the linguistic level at which languages show similarities and differences. This kind of study helps us in designing robust NLP applications by understanding the linguistic complexity involved. To study the convergence and divergence, we will be working with Dravidian and Indo-Aryan languages of India along with English.

2. Course Outcome:

At the end of the course, students will be able to

CO1: Understand the language complexity measures which are useful for NLP

CO2: Analyze and compare languages to build convergence and divergence indices

CO3: Apply the linguistic knowledge required for NLP applications

CO4: Evaluate NLP applications using the indices

CO5: Design NLP applications for Indian languages with a deeper understanding of its linguistic nuisances

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	3	2	3		3	3	1	2	3		3	3	2	2	3
CO2	2	3	2	2		3	3	1	2	3		2	3		2	3
CO3	2	3	2	2	2	2	3	1	2	3			3		3	3
CO4	2	3	2	2	3	2	3	1	2	1			3	2		3
CO5	2	2	2	2	3	2	3	1	3	3		3	3	2	2	3

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

- Unit-1:**Languages of India- Linguistic features ofDravidian (Dr) and Indo-Aryan Languages (IA)- Principles and Parametric variations. Language Contact: Convergence and Divergence.
- Unit-2:**Computational complexity in natural languages- Linguistic Complexity Measures-Text Analysis- Lexical richness- Type-Token Ratio
- Unit-3:**Understanding Morphological Complexity and Syntactic Variations-Classification of Divergence. Convergence and Divergence indices
- Unit-4:** Complexity measures andNLP application-Machine Translation. Data selection for training and testing.

References:

- Bikel, D. and Zitouni, I., 2012. *Multilingual natural language processing applications: from theory to practice*. IBM Press.
- Chomsky, Noam. 1959. "On certain formal properties of grammars" (PDF). *Information and Control*. 2 (2): 137–167.
- Clark, A., Fox, C. and Lappin, S. eds., 2012. *The handbook of computational linguistics and natural language processing* (Vol. 118). John Wiley & Sons.
- Comrie, Bernard. 1988. "Genetic classification, contact, and variation." *Synchronic and diachronic approaches to linguistic variation and language change*. Georgetown University Round Table on Languages and Linguistics 1988 (1989): 81-93.
- Krishnamurti, Bhadriraju. 2003. *The Dravidian languages*. Cambridge University Press,
- Masica, C.P., 1993. *The Indo-Aryan languages*. Cambridge University Press.
- Miestamo, Matti, Kaius Sinnemäki, and Fred Karlsson, eds. 2008. *Language complexity: Typology, contact, change*. Vol. 94. John Benjamins Publishing
- Steever, Sanford B., ed. , 2019. *The Dravidian Languages*. Routledge

5. Teaching-Learning Strategies in brief (4 to 5 sentences):

The main objective of this course is to prepare students to apply linguistic knowledge in current NLP applications. It helps them to work with Indian languages in general and with their mother-tongue. They are taught traditional and current linguistic theories in analysing languages in connection with computational requirements. At the end of the course, students will be able to understand how to improve current NLP methods with Indian languages and will be prepared for research.

6. Assessment methods and weightages in brief (4 to 5 sentences):

Type of Evaluation	Weightage (in %)
Assignments	15%,
Seminar	10%
Project	25%,
Midsem Exam	15%,
Endsem Exam	35%

Title of Course	: Data Foundation Systems – A Project-Based Elective
Faculty Name	: Vikram Pudi + G. Venugopal, iHub Data
Course Code	: CS4.409
Credits	: 1-1-3-4
L - T - P	: (L - Lecture hours, T-Tutorial hours, P - Practical hours)

Semester, Year : Spring, 2022

(Ex: Spring, 2022)

Name of the Program : Elective for B.Tech/M.Tech/MS/PhD students CSE

Pre-Requisites : SSAD, SSDD, or background knowledge/experience in python webprogramming

Course Outcomes :

After completion of this course successfully, the students will be able to:

1. Participate in building large, deployable software systems
2. Automate data ingestion
3. Fluently use Javascript, NodeJS and related frameworks to build interactive web-components
4. Fluently use one or more modern Python backend web frameworks
5. Rapidly build responsive websites with complex layouts

Course Topics :

1. Code and design review of large software systems
2. NodeJS
3. Asynchronous Javascript web components
4. One or more modern python web framework (e.g. django, py4web, etc.)
5. Responsive webpages and complex layouts
6. Data scraping and ingestion

Preferred Text Books :

Online material:

1. Python documentation
2. NodeJS documentation
3. HTML5/CSS and bootstrap (or similar) layouts tutorial
4. Django/py4web documentation

Reference Books :

E-book Links :

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz-1	15%
Mid SemExam	
Quiz-2	15%
End Sem Exam	
Assignments	10%
Project	60%
Term Paper	
Other Evaluation	Project evaluation will be based on deliverables at intermediate deadlines, including for requirements, screenshots, database design, prototype building, etc. A: If deliverable is deployable, well-designed and efficient A: If deliverable is deployable B: If deliverable is deployable with some more effort B- to C: If deliverable is deployable with considerably more effort. F: If deliverable is not deployable.

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	3	3	3	3	1	1	1	3	2	2	3	2	1	2	1
CO 2	3	3	3	2	3	1	1	1	3	2	2	3	2	1	2	1
CO 3	3	3	3	2	3	1	1	1	3	2	2	3	2	1	2	1
CO 4	3	3	3	2	3	1	1	1	3	2	2	3	2	1	2	1
CO 5	3	3	3	3	3	1	1	1	3	2	2	3	2	1	2	1

Teaching-Learning Strategies in brief (4-5 sentences) :

This is a practicals oriented course, where the students will participate in projects to collaboratively build a large-scale application, which is the data-foundation – a technology-platform to collect, create, curate, annotate, secure and deploy a library of datasets for developing solutions driven by AI and analytics in socially-relevant domains such as Healthcare, Mobility, Buildings and Systems.

Necessary background skills, languages and tools for backend and frontend programming will be taught during lectures, along with code and design reviews of large software systems.

Students will work in teams to build a deployable system. This exposure will enable students to become industry-ready with skills to innovate and build large software systems and/or startups.

According to Massimo Di Pierro, the creator of py4web: “The ability to easily build high quality web applications is of critical importance for the growth of a free and open society. This prevents the biggest players from monopolizing the flow of information.” This course is geared towards that goal.

Sample projects to choose from:

1. Dataset library
2. Data ingestion from various sources
3. Data annotation plugins
4. Dataset approval workflow
5. Javascript components to handle medical images (CT/MRI/X-Ray)

Title of the Course : Data Systems

Faculty Name : Krishna Reddy P

Course Code : CS4.401

L-T-P : 3-1-1.

Credits : 4

(L= Lecture hours, T=Tutorial hours,
P=Practical hours)

1. Prerequisite Course / Knowledge:

Basic principles of Operating systems, Structured Query Language, Relational Data Model, Data structures, Programming language, Algorithms,

2.Course Outcomes (COs)

After completion of this course successfully, the students will be able to..

CO-1. Develop the tree-based and hash-based indexing algorithms to improve efficiency of the retrieval

CO-2. Tune the optimizer moduleof DBMS to meet the performance demands of diverse applications,including distributed applications.

CO-3: Design the recovery sub-system of any given information system

CO-4. Design archival strategy for any given information system

CO-5. Develop a concurrency control algorithm for any given database system

CO-6. Develop a framework for building a large scale big data system.

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	2	2	2	3	-	1	-	3	1	3	2	3	3	2	3
CO2	3	3	3	1	3	-	1	-	2	2	2	3	3	2	1	1
CO3	3	2	2	1	2	2	1	-	2	2	2	1	3	3	3	2
CO4	3	2	2	1	2	2	1	-	2	2	2	1	3	3	3	2
CO5	3	2	2	1	2	2	1	-	2	2	2	1	3	3	3	2
CO 6	3	3	3	3	2	2	1	-	2	2	3	2	3	3	3	3

‘3’ in the box denotes ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level mapping

4.Detailed Syllabus:

Unit 1: Introduction, Data storage, Representing data elements (9 hours)

Unit 2: Index structures, Multidimensional indexes (7.5 hours);

Unit 3: Query execution, The query compiler (9 hours)

Unit 4: Coping with system failures, Concurrency control (7.5 hours);

Unit 5: Transaction management, NoSQL and big data systems (9 hours)

- Five mini projects related to the above syllabus will be done by students in the laboratory

References :

- Hector Garcia-Molina, Jeffrey D. Ullman and Jennifer Widom , Database System Implementation, Pearson Education, 2003
- Elmasri & Navathe, Fundamentals of Database Systems, 6th Edition, Pearson Education, 2013
- Raghu Ramakrishnan and Johannes Gehrke ,Database Management Systems, Third edition, Mc Graw Hill, 2017
- Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database system concepts, fifth edition, Mc Graw Hill, 2006
- Research papers

5.Teaching-Learning Strategies in brief:

Lectures by integrating ICT into classroom teaching, weekly tutorials involving problem solving and active learning by students and Project-based Learning by doing 5 mini-projects in laboratory by the students

6.Assessment methods and weightages in brief :

Assignments in theory: 10 marks, Quizzes in theory: 10 marks, Mid Semester Examination in theory: 20 marks, End Semester Examination in Theory: 30 marks, Assessment of 5 mini projects in Laboratory: 30 marks

Title of the Course : Data Visualisation

Faculty Name : Kamal Karlapalem

Course Code : CS4.302

Credits : (2)2-0-1-2

L - T - P : (2)2-0-1-2

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year : Spring 2023

(Ex: Spring, 2022)

Pre-Requisites : Statistics

Course Outcomes :

(list about 5 to 6 outcomes for a full 4 credit course)

1. Comprehend purpose of visualization
2. Learn visualization design
3. Perform exploratory data analysis
4. Utilize perception and interaction in data visualization
5. Learn using space in 2d and about colors in visualization

https://iiitaphyd-my.sharepoint.com/:b/r/personal/dyacad_iiit_ac_in/Documents/NBA-2020-21/Reference%20Documents/Curriculum%20Design%20in%20NBA%20Framework%20and%20Course%20design%20for%20all%20offaculty%20IIIT%20Hyderabad%207th%20july%202021.pdf?csf=1&web=1&e=387W1k

Course Topics :

(please list the order in which they will be covered, and preferably arrange these as five to six modules.)

The Purpose of Visualization. Visualization

Design.

Exploratory Data Analysis. Perception

.

Interaction.

Using Space Efficiently: 2D Color.

A project to show case data visualization of complex dataset.

Preferred Text Books :

Visualization Analysis and Design Tamara Munzner 2014 CRC.

Reference Books :

[The Visual Display of Quantitative Information \(2nd Edition\)](#). E. Tufte. Graphics Press.

E-book Links :

Grading Plan :
 (The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz-1	Nil
Mid SemExam	Nil
Quiz-2	Nil
End Sem Exam	Nil
Assignments	40%
Project	60%
Term Paper	Nil
Other Evaluation	100%

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

https://iiitaphyd-my.sharepoint.com/:w/r/personal/dyacad_iit_ac_in/Documents/NBA-2020-21/Course%20Content/IIIT-CSE-ECE.docx?d=w111foeffcae41b3a4d1e8a3fb6332d&csf=1&web=1&e=z1Khby

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	3	3	2	3	4	3	3	3	4	3	3	2
CO2	3	3	2	2	3		1	2	3	1	2	3	3	2	2	3
CO3	3	3	2	1	1			2	3	3	2	3	2	2	2	3
CO4	3	3	3	1	1	1	3	2	2	2	3	2	2	3	3	3
CO5	3	3	3	1	2	1	3	1	3	3	1	3	1	4	2	2

Teaching-Learning Strategies in brief (4-5 sentences) :

Significant in class lab exercises with relevant reasoning for visualization. Practice by doing, and learning with doing, Detailed assignments and projects to comprehend the materials

Title of the Course	: Design & Analysis of Software Systems
Faculty Name	: Ramesh Loganathan + Raghu Reddy
Course Code	: CS6.301
L-T-P:	
Credits	: 4

(L= Lecture hours, T=Tutorial hours,
P=Practical hours)

Name of the Academic Program: Bachelor of Technology in Computer Science and Engineering

1.Prerequisite Course / Knowledge: Intro to Software Systems

2.Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to...

CO-1: Understand the process of building software, through a live project

CO-2: Inculcate software engineering knowledge, skills, and technologies needed to build software

CO-3: Understand the structured approach and disciplined process (iterative) to develop software

CO-4: Learn the steps in building a reasonably complex piece of usable that is maintainable

CO-5: Enhance written and oral communication skills, needed for software engineering

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2			2	1				2		1	1		1		
CO2	3			1		2					1		1	3		
CO3	2		1	1							1		1	2		1
CO4	2		2	2						3				2		1
CO5										3						

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

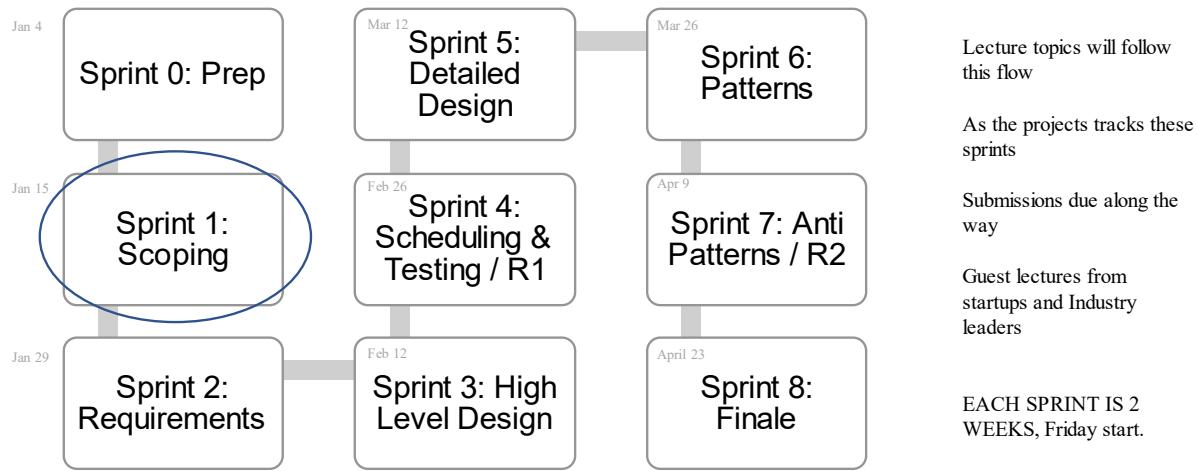
The course will be run as units, following typical agile development sprints

1. Introduction
 - a. Introduction to Software Engineering
 - b. Development Lifecycle, Process Model - Traditional Vs Agile processes.
 - c. Project and Team Management - Project organization concepts (roles, tasks, work products),
2. Requirements
 - a. Analysis and Specification),
 - b. Estimation, Release Planning, Organizational activities (communication, status meetings).
3. Design
 - a. Modelling (UML), Architecture and Design,
 - b. System Decomposition, Software Architectural styles, Documenting Architectures,
4. Testing
 - a. Quality Assurance - Unit, Integration, System and Acceptance Testing, Introduction

to various testing techniques (e.g. Stress testing),

5. Design Patterns

- a. Design patterns, UI design
- b. Software Development for startups



Reference Books:

Software Engineering – A Practitioner's Approach, 10th Edition, Roger Pressman.

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

The proposed course provides an introduction to software engineering concepts and techniques to undergraduate students using project based methodology. Students work in a small teams to deliver a software system that are proposed by real industrial clients. The course content and project introduces various software technologies, process and project management skills that are needed for the delivery of software in a team setting.

6.Assessment methods and weightages in brief (4 to 5 sentences):

Component	Percentage (%)
Project	40
Client Feedback (R1 1% + R2 3%)	4
Coding Assignments (4)	20
Quizzes (Q1 + Q2, no midterm)	12
Class submissions (3 Questions)	4
Class Assignments	8
End Exam/Research Paper	12
TOTAL	100

Title of the Course

: Design of Hydraulic Structures

Faculty Name

: Shaik Rehana

Name of the Program

: M.Tech in CASE

Course Code

: CE5-501

Credits

: 4

L - T - P

: 3-1-0

(L - Lecture hours, T-Tutorial hours, P - Practical hours)

Semester, Year : Spring, 2022
(Ex: Spring, 2022)

Pre-Requisites : Basics of fluid mechanics and hydraulics

Course Outcomes :

After completion of this course successfully, the students will be able 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.
- Design various major hydraulic structures such as dams, reservoirs, aqueducts, weirs, canals, etc.
- Understand how basic principles of hydraulics can be used in the design of structures in terms of safety measures, etc.

Course Topics :

(please list the order in which they will be covered, and preferably arrange these as five to six modules.)

Introduction of Hydraulics: Fluid Properties and Classification, Hydrostatics,
Equation of Motion, Continuity Equation, Flow Measurements

Introduction: 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

Design of Diversion Works: Weirs and Barrages, Spillways

Preferred Text 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 Plan :

(The table is only indicative)

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

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4	
CO1	3	1	2	2	3	1	1	3	1	1	1	1	2	2	3	2	3
CO2	1	3	2	3	2	1	1	1	1	3	1	2	2	2	2	2	
CO3	2	2	2	2	3	1	2	1	1	1	1	1	2	2	2	2	
CO4	2	2	3	2	3	1	2	1	1	1	1	1	2	2	2	2	
CO5	2	3	2	2	3	2	3	2	1	1	1	1	2	2	2	2	
CO 6	2	2	3	2	2	2	2	2	1	3	1	2	2	1	2	2	

Teaching-Learning Strategies in brief (4-5 sentences) :

Lectures and tutorials to solve various hydraulic structures, practice problems, assignments with real-time case studies and data. Starting from basic hydraulics to design of large structures such as Weirs, dams, canals, aqueducts, spillways, the lectures try to cover diverse topics related to safety and design aspects for the better water resources management.

Title of the Course : Design of Wearable Systems

Faculty Name : Raghu Reddy

Course Code : PD1.502

L-T-P : 3-0-0

Credits : 2 (Half Course)

(L= Lecture hours, T=Tutorial hours,

P=Practical hours)

Name of the Academic Program: Master of Technology in Product Design and Management

1. Prerequisite Course / Knowledge:

Students must have knowledge of basic electronics or seek permission from instructor.

2. Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to...

CO1: Understand the design and construction of a bare-minimum wearable system

CO2: Demonstrate the ability to explore and identify feature requirements for building a wearable system

CO3: Apply engineering principles and practices from existing use-cases of wearable systems

CO4: Demonstrate use of tools required to design and prototype a wearable system

CO5: Practice social ethics and human values while building wearable system for the targeted audience

CO6: Exhibit aptitude for working in teams and deliver task outcomes effectively

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1		PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	2		3	2	2	2	1	1	2	1	2	3	3	3	2
CO2	3		3	2	2	2	2	1	2	2	2	2	3	3	2
CO3	2		3	1	1	3	1	1	1	2	2	3	3	3	2
CO4	2		2	1	3	2	2	1	1	2	2	2	3	2	2
CO5	2		2	2	2	3	2	2	1	3	2	2	3	2	2
CO6	2		2	2	2	3	2	2	3	2	3	2	3	2	2

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

UNIT 1:

- Wearable systems Fundamentals – Attributes, challenges and opportunities.
- Applications of wearable device technology such as Healthcare, Sports, Fitness, Entertainment, Connected cars, etc.
- Wearable systems design and architecture

UNIT 2:

- User Experience of Wearable Technology
- Social Aspects of Wearable Technology

UNIT 3

- Wearable Technologies - Energy Expenditure and Energy Harvesting.
- Technology of Connected Devices – Energy Considerations
- Recommend appropriate process steps for a device based on size, cost, operating conditions, and capabilities.

UNIT 4

- Analyze performance; including sensitivity, noise, bandwidth, and dynamic range for common wearable and implantable systems a variety of applications.
- Evaluate the methods, results, and conclusions from case studies and extract relevant details for a performance comparison.
- Describe design tradeoffs in selecting, developing or redesigning wearable and implantable solutions.

Reference Books:

1. Edward Sazonov (Eds), Wearable Sensors: Fundamentals, Implementations and Applications, 2014, Academic Press, ISBN 978-0124186620
2. Scott Sullivan, Designing for Wearables: Effective UX for current and future devices, 2017, O'Reilly Media, Inc, ISBN 978-14911944158
3. Claire Rowland, Elizabeth Goodman, Martin Chalier, Ann Light, Alfred Lui, Designing Connected Products: UX for the Consumer Internet of Things, 2015, O'Reilly Media, Inc, ISBN 978-1449372569

4. Kate Hartman, Wearable Electronics – Design, prototype, and wear your own interactive garments, Shroff/Maker Media, 2015, ISBN 978-9352131983

5. Yangsheng Xu, Intelligent wearable interfaces, Wiley-Interscience, 2008, ISBN 978-0470179277

5. Teaching-Learning Strategies in brief (4 to 5 sentences):

The course is delivered using a combination of project based and case based learning methodology. Design and architecture of wearable systems from different domain is reinforced through various case studies. The lectures emphasize on the fundamentals as well as applications of wearable systems. Focus is on understanding and analyzing various attributes like performance, bandwidth, noise, energy consumption, latency, etc. to build a wearable system by the end of the class.

6. Assessment methods and weightages in brief (4 to 5 sentences):

Course Project	40%
Case study presentation	10 %
Case study report	15 %
Assignments	25 %
Other In-class Activities	10 %

Title of the Course: Digital Signal Analysis

Faculty Name : Anil Kumar Vuppala

Course Code : CS7.303

L-T-P : 2-1-0

Credits : 2

Name of the Academic Program B. Tech. in CSE

Prerequisite Course / Knowledge:

No prerequisite as it is a core course for CLD program.

Course Outcomes (COs):

After completion of this course successfully, the students will be able to..

CO-1: Introduce the fundamentals of digital signal representation and processing to undergraduate students of CLD/CS/CSD.

CO-2: Introduce the advantage of a transformed domain representation.

CO-3: Application of basic signal processing to speech signals.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO 1	PO 2	P O3	PO 4	PO 5	PO 6	PO 7	P O8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	1	1	1	1	1	1	2	1	1	2	-	3	-	-
CO 2	3	2	1	1	1	1	1	1	2	1	1	2	-	3	-	-

CO 3	3	2	2	1	1	1	1	2	1	1	2	-	3	-	-
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Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping Mapping with PSOs, where applicable.

Detailed Syllabus:

Unit 1: Basics of Fourier series and transform, sampling and quantisation, different types of signals and systems.

Unit 2: Z-transform, FIR and IIR systems. Introduction to digital filter design.

Unit 3: Application of concepts using speech signals.

Reference Books:

1. Digital signal processing by John G. Proakis and Dimitris K Manolakis.
2. Digital signal processing by Alan V. Oppenheim and Ronald W. Schafer.
3. Introduction to Digital Speech Processing by Lawrence R. Rabiner and Ronald W. Schafer, now Publishers Inc. Hanover, USA, 2007

Teaching-Learning Strategies in brief (4 to 5 sentences):

It is a mathematical oriented signal processing course, so regular problem solving assignments are given to understand the concepts. Surprise class tests are conducted based on assignments to test the seriousness in assignment solving. As a part of teaching practical examples like speech signal is used for demonstration of mathematical concepts learned.

Assessment methods and weightages in brief (4 to 5 sentences):

Assignments -- 20%
 Quiz -- 30% End
 exam -- 50%

Title of the Course	: Digital VLSI Design
Faculty Name	: Zia Abbas
Course Code	: EC2.408
L-T-P	: 3-1-0
Credits	: 4

Prerequisite Course / Knowledge:

Basic knowledge of digital design.

Course Outcomes (COs):

After completion of this course successfully, the students will be able to.

CO-1: Understand the background that drive to the development of state-of-the-art VLSI digital circuits, the importance of low power, high-performance and power-delay optimal designs, state of the art design issues in digital circuits, understand the CMOS digital IC design process.

CO-2: Design and Synthesis of Verilog/VHDL codes, test benches to meet specifications, to synthesise Verilog/VHDL onto hardware using required EDA tools.

CO-3: design and analyze CMOS circuits using both analytically and SPICE tools, derive analytical circuit equations to estimate performances (e.g., power) of a VLSI design. Able to identify the impact of Process, Voltage and Temperature on circuit's performance.

CO-4: Analyze the design flow to design complex CMOS digital circuit using required CAD tools. Create a cell library to be used in other designs.

CO-5: Create a low-power digital design, estimate static and dynamic power dissipation in CMOS circuits. Impact of CMOS technology scaling. Low power design methodologies.

CO-6: Design of high-performance circuits, and power-delay optimal designs.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1	1	1	2	2	2	1	1	2	3	2	2	2
CO2	3	3	2	2	2	1	1	2	1	1	1	1	3	1	1	1
CO3	3	3	2	2	2	1	1	2	2	2	1	2	3	1	1	1
CO4	3	2	3	3	3	1	1	2	2	2	1	3	3	1	1	1
CO5	2	3	3	3	3	1	1	2	3	3	3	3	3	1	2	1
CO6	2	3	3	3	3	1	1	2	3	3	3	3	3	2	1	1

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping. Mapping with PSOs, where applicable.

Detailed Syllabus:

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

Unit 2: Combinational IC design, Sequential IC design, Role of CAD tools, RTL design, Logic Synthesis, Logic Simulations, Static Timing Analysis.

MOS Capacitor, Electrical Characteristics of MOS Transistors, Threshold Voltage, Transconductance (gm), Body Effect, Channel-Length Modulation, MOS Transistors as a Switch, MOS Inverter, Switching Characteristics, Driving Large Capacitive Loads, CMOS Realization, Switching Characteristics, CMOS NAND, NOR and other basic combinational/sequential circuits, CMOS Complex circuits, CMOS technology scaling, CMOS Gate sizing-logical effort, Complementary CMOS, Pass transistor logic, Dynamic CMOS design, Transmission gate, Layout basics, Floor Planning, Introduction to FinFET technology.

Unit 3: Digital Design - From Power perspective: Introduction, Dynamic power dissipation (Short-Circuit and Switching), Dynamic Power in the Complex Gate, Switching Activity, Switching Activity of Static CMOS Gates, Transition Probability in Dynamic Gates, Power Dissipation due to Charge Sharing, Static i.e. Leakage Power Dissipation (leakage mechanism): p-n Junction Reverse-Biased Current, Band-to-Band Tunnelling Current, Tunnelling through and into gate oxide, Injection of hot carriers from substrate to gate oxide, GIDL, Punch-through, Subthreshold Leakage Current including DIBL. Impact of technology scaling on leakage currents/power, need for technology

scaling, factors effecting the leakage current especially in scaled technology nodes (input pattern dependency, stacking effect, loading effect, etc.), Impact of process, temperature and supply voltage variations on leakage currents. Internal node voltage impact.

Unit 4: Digital Design - From Performance (i.e., delay) perspective: Computing the Capacitances, Propagation delays, Factors affecting the propagation delays, Mathematical formulation of the delays in CMOS circuits, Technology scaling impact on propagation delays, Mean and variance of the delays in a gate, Impact of process variations on delays in CMOS circuits, Impact of operating (temperature and supply voltage) variations on delays.

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

Reference Books:

1. Jan M. Rabaey, A. Chandrakasan, B. Nikolic "Digital Integrated Circuits - A Design Perspective, PHI.
2. Douglas A. Pucknell, K. Eshraghian, "Basic VLSI Design", 3rd Edition, Prentice Hall of India.
3. Neil H. E. Weste, K. Eshraghian, "Principles of CMOS VLSI Design", A Systems Perspective, 2nd Edition, Pearson Education Pvt. Ltd.

Teaching-Learning Strategies in brief (4 to 5 sentences):

The course will start with the background that drive us to the development of state-of-the-art digital VLSI designs, then fundamental and core topics of the course will be discussed in detail broadly at logic and transistor level with hands-on with related CAD tools. Circuit simulations, layout, RTL coding, synthesis, etc. will be highly encouraged throughout the course. The broad approach of the course is to discuss the digital VLSI design from three perspectives; power, performance, and power-delay optimal designs to understand the different design approaches. Students will be exposed to state-of-the-art scaled technology node to better understand the issues related to scaled nodes. Regular assignments will be given to reinforce the concepts.

Weekly tutorials will involve students in active learning by applying the lecture discussion. Quizzes will be designed to test student's understandings on the discussed concepts. Projects will be carried out in groups, thereby developing the students' abilities to work in teams.

Assessment methods and weightages in brief (4 to 5 sentences):

- Home Assignments: 20%
- Quiz: 10%
- Mid Semester Exam: 15%
- End Semester Exam: 30%
- Project: 25%

Title of the Course : Disaster Management

Faculty Name : Sunitha P + Pravin Kumar

Course Code : CE8.401

L-T-P : 3-1-1.

Credits : 4

(L= Lecture hours, T=Tutorial hours, P=Practical hours)

1. Prerequisite Course / Knowledge:

General awareness about disasters, computer programming skills, and electronic hardware knowledge to develop tools and aids to assist effective disaster management.

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able to:

- CO-1. Develop awareness about natural and man-made disasters and help contribute holistically towards a disaster resilient community
- CO-2. Employ the core area skills in developing disaster management tools and sensors
- CO-3. Illustrate problem solving skills for various disaster scenarios and work towards a research-based disaster management for the country.
- CO-4: Develop critical thinking to help policy making in disaster management activities
- CO-5. Analyze ethical and effective disaster management practices and related e-governance
- CO-6. Reorganise inter-personal skills required to manage inter-disciplinary, inter-departmental collaborations in disaster management

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	2	1	3	3	3	2	2	3	3	1	1	1	1
CO2	3	3	3	2	3	1	1	1	2	2	2	1	2	2	2	3
CO3	3	3	3	3	2	1	1	1	1	1	1	1	3	3	2	3
CO4	1	1	1	1	1	2	2	3	3	3	3	3	1	1	1	2
CO5	1	1	2	2	2	3	3	3	1	1	2	2	1	1	2	1
CO6	1	1	2	2	2	2	2	2	3	3	3	3	1	2	3	1

‘3’ in the box denotes ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level mapping

4. Detailed Syllabus:

- Unit 1: Disaster Management Cycle- Mitigation, Preparedness, Response, Rehabilitation, Reconstruction, Recovery, Resilience, Capacity Building (9 hours);
- Unit 2: Institutional Arrangements-NDMA, SDMA, DDMA, FEMA (7 hours);
- Unit 3: Management of Natural and Man-made- Case Studies- Flood, Drought, Earthquakes, Cyclones, Tsunami, Landslides, Avalanche, Forest Fire, Air Pollution, Terrorist attacks, Nuclear Disaster, Chemical Disaster (12 hours);
- Unit 4: Role of Information and Communications Technologies in Disaster Management Mitigation, Preparedness, Response, Recovery-Early Warning Systems, Mobile Communications, Information Dissemination (7 hours);
- Unit 5: Disaster Risk Analysis-Mapping, Modelling, Risk Analysis, Introduction to Risk Modelling & Analysis using softwares, hands-on training (QGIS) (7 hours)

References :

1. Alexander, D., (1999), *Natural Disasters*, Kluwer Academic, London
2. Bhandani, R.K., An Overview on Natural & Man-made Disasters and their Reduction,

CSIR, New Delhi

3. Bryant,E., (1995), *Natural Hazards*, Cambridge University Press, New York
4. Coppola, D.P., (2007), *Introduction to International Disaster Management*, Elsevier Science (B/H), London
5. Federal Emergency Management Agency (FEMA), *Guidelines*, FEMA, USA
6. Kanda, M., (2017), *Disaster Management in India Evolution of Institutional Arrangements and Operational Strategies*, Centre for Good Governance, Hyderabad, India
7. Malhotra, S., (2005), *Natural Disaster Management*, Avishkar Publishers, Distributors, Jaipur, India
8. National Disaster Management Authority (NDMA), *Guidelines*, NDMA, India (<https://ndma.gov.in/en/ndma-guidelines.html>)
9. Robinson, A., (1996), *Earth Shock: Hurricanes, Volcanoes, Earthquakes, Tornadoes and other Forces of Nature*, Thames and Hudson, New York
10. Sinha, P.C., (2006), *Disaster Vulnerabilities and Risks: Trends, Concepts, Classification & Approaches*, SBS Publishers & Distributors, New Delhi, India

5. Teaching-Learning Strategies in brief:

Lectures by integrating ICT into classroom teaching, tutorials involving simulation modelling, analysing GIS data for predicting disasters, critical and active learning, and project-based learning by doing term-projects which involves hands-on use of computer programming skills and software/hardware tools applications.

6. Assessment methods and weightages in brief:

Assignments in theory: 20 marks, Quizzes in theory: 10 marks, Mid Semester Examination in theory: 20 marks, End Semester Examination in Theory: 30 marks, Term-project: 20 marks

Title of the Course: Distributed Systems

Faculty Name : Lini Thomas

Course Code : CS3.401

L-T-P :3-1-0

Credits :4

(L= Lecture hours, T=Tutorial hours, P=Practical hours)

Name of the Academic Program B. Tech. in Computer Science and Engineering

1.Prerequisite Course / Knowledge:

An understanding of operating systems, networks, and algorithms

2.Course Outcomes (COs):

After completion of this course successfully, the students will be able to..

CO-1 : Explain the challenges faced by distributed systems in terms of lack of global time, synchrony, faults, programming support, etc.

CO-2 :Employ standard distributed programming frameworks to write distributed programs for problem solving

CO-3 : Explain the properties and design principles of various real-world and practical distributed systems

CO-4 :Interpret the impact of faults in distributed systems in the context of important problems such as distributed agreement, distributed consensus, and distributed transaction processing

CO-5 :Analyze distributed algorithms for graphs with respect to correctness, round complexity, and message complexity.

CO-6 : Analyze the limitations of distributed systems and assess the operational scope of large scale distributed systems

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO 1		PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	1		1	1	1	1	1	1	1	1	2	1	2	3	3	3	3
CO2	1		2	2	2	3	2	1	1	2	1	2	2	3	3	3	3
CO3	1		1	2	2	1	2	1	1	1	2	1	2	3	3	3	3
CO4	1		2	2	2	1	2	1	1	2	2	1	2	3	3	3	3
CO5	2		2	2	2	1	1	1	1	2	1	2	2	3	3	3	3
CO6	2	2	2	2	2	1	2	1	1	2	2	2	2	3	3	3	3

Note: '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

- Unit 1
 - Introduction
 - Communication models
 - Time and Synchronization
 - Practice: MPI/Map-Reduce
- Unit 2
 - Distributed file systems
 - Consensus, Agreement, Locking
 - Practice: GFS, Chubby
- Unit 3
 - Distributed Database systems
 - Practice: NoSQL, MongoDB
- Unit 4
 - Limitations of distributed computing
 - Self-Stabilization
 - CAP Theorem
- Unit 5
 - Distributed algorithms for graphs
 - Advanced Topics such as Blockchain, Distributed Storage, and Distributed Program Verification

Reference Books:

1. A.D. Kshemkalyani, M. Singhal, (2011) Distributed Computing: Principles, Algorithms, and Systems, ISBN: 9780521189842, paperback edition, Cambridge University Press, USA.
2. N. Lynch, 1996. Distributed Algorithms, Morgan Kauffman, USA, Chapter 5.
3. Other significant papers from conferences such as OSDI, USENIX, NSDI, for material that is not part of textbooks

5.Teaching-Learning Strategies in brief:

Lectures of the class use the active learning methodology and allow students to learn concepts thoroughly in class along with practising small examples. Homeworks assigned as part of the course are useful to impart knowledge of using practical distributed programming tools and libraries. To promote team work, some of the homeworks are done in a team of two students. The overall learning from the course is enhanced by doing a substantial practice-based project – usually in a team of two students. The course will also have a summative assessment in the form of a final/end-semester exam.

6.Assessment methods and weightages in brief :

- In-class Quiz Exams (Cumulative over several): 15%
- Homeworks: 20%
- Project: 25%
- End Semester Examination: 40%

Title of the course : **Dynamical processes in complex networks**

Faculty Name : Chittaranjan hens, CCNSB

Name of the Program :

Course Code : **SC1.440**

Credits : **4**

L - T - P : **L=2, T+P=1**

(L - Lecture hours, T-Tutorial hours, P - Practical hours)

Semester, Year : Spring 2023(Ex:Spring,2023)

Pre-Requisites: Linear Algebra, Differential Equations, Basic of Statistical Physics

Course Outcomes

After completion of the course, the students will be able to..

1. Interpret and quantify the connectivity patterns of real-world systems.
2. Model how the infection spreads in a well-mixed population setup and how chaos develops in the double pendulum.
3. Identify how structure influences synchronization and the spread of disease in metapopulation networks.
4. Implement the use of various appropriate pharmaceutical or non-pharmaceutical intervention strategies for reducing the severity of infectious diseases in actual circumstances.
5. Design cutting-edge problems regarding the diverse dynamical process in complex networks.

Course Topics :

- A. **Networks:** A general introduction. Dynamical processes in networks (1 Lecture)
- B. **Fundamentals of Network theory:** Mathematics of networks, Measures and metrics(3 Lectures)
- C. **Network Models:** Erdos-Renyi, Scale-free networks, and small-world model. Statistical properties and degree distribution. Random graphs with general

degree distributions. Percolation Process in complex networks. (4 Lectures)

- D. **Nonlinear Dynamics:** From fixed points to chaos theory. Application: Epidemics(SIR/SIS dynamics) and double pendulum (4 Lectures).
- E. **Dynamical Processes in Networks:** Epidemics in complex networks, Role heterogeneity in disease spreading. Pharmaceutical and nonpharmaceutical intervention strategy. Epidemics in metapopulation networks, epidemics in time- varying networks, and epidemics in multiplex networks, Activity-driven networks (4 Lectures).
Synchronization in coupled nonlinear oscillators (2 lectures).
- F. **Recent literature survey, and problem design** (4 lectures).

Preferred Text Books :

1. Barrat, Alain, Marc Barthelemy, and Alessandro Vespignani. *Dynamical processes on complex networks*. Cambridge university press, 2008.
2. Networks: An Introduction, Mark Newman

Reference Books :

- E-book/ review paper Links:
1. Boccaletti, Stefano, et al. "Complex networks: Structure and dynamics." *Physics reports*, 424.4-5 (2006): 175-308.
 2. Arenas, Alex, et al. "Synchronization in complex networks." *Physics reports* 469.3(2008): 93-153.
 3. Pastor-Satorras, Romualdo, et al. "Epidemic processes in complex networks." *Reviews of modern physics* 87.3 (2015): 925.
 4. Perra, Nicola. "Non-pharmaceutical interventions during the COVID-19 pandemic: A review." *Physics Reports* 913 (2021): 1-52.

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz-1	10
Mid SemExam	20
Quiz-2	10
End Sem Exam	0
Assignments	
Project	30
Term Paper	20
Other Evaluation	10

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 –

Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	3	2	2	1	2	-	-	3	2	2	3	1
CO2	2	2	2	2	3	2	2	1	2	-	-	3	2	1	3	1
CO3	3	3	2	2	3	3	3	1	2	-	-	3	3	2	2	3
CO4	3	2	3	2	2	3	2	3	1	-	-	3	3	3	2	1
CO5	2	3	3	2	2	3	2	3	1	-	--	3	3	2	3	3

Teaching-Learning Strategies in brief (4-5 sentences) :

This course is specially tailored for students who are eager to learn and gain access to cutting-edge information on complex networks and disease propagation. This curriculum requires active participation from the students, who must come up with fresh ideas, present them by forming small groups, and examine related research. Comprehensive computer simulation is a requirement.

Title of the Course

: Earthquake Engineering

NAME OF FACULTY

: Srinagesh D (Retd. Prof. NGRI)

Course Code

: CE1.601

L-T-P

: 3-1-0

Credits

: 4

Name of the Academic Program: M.Tech in Computer Aided Structural Engineering

1.Prerequisite Course / Knowledge:

B.Tech in Civil Engineering subjects i.e., Engineering Mechanics, Reinforced Concrete Design, Structural Analysis, Structural dynamics

2.Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to..

CO-1 Use the understanding of the earthquake engineering for structural design;

CO-2 Write computer programs, to understand earthquake behaviour;

CO-3 Analyse and design the structure using commercially available software

CO-4 Apply the knowledge of code provisions for design of buildings and structures

CO-5 Appreciate the challenges in construction industry and get equipped to address some of the challenges

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1	2	3	3	-	-	-	-	-	3	3	2	3
CO2	2	1	2	2	2	1	1	-	-	-	-	-	2	2	3	3
CO3	1	2	3	2	2	3	2	-	-	-	-	-	2	3	3	3
CO4	3	3	2	3	3	3	2	-	-	-	-	-	3	2	2	3
CO5	2	2	2	3	3	3	3	-	-	-	-	-	3	3	2	2

Note: '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

Unit 1: Earthquake Hazard on Buildings: Plate tectonics, Origin of earthquakes, types of faults and seismic waves, measurement of earthquakes, magnitude and intensity, characteristics of earthquake ground motion

Unit 2: Earthquake Behavior and Analysis of Buildings: Behavior of MRFs, behavior of SWs, Earthquake Analysis of Buildings, methods of Analysis

Unit 3:Earthquake Resistant Design and Detailing of Buildings: IS 1893-2016, concept of earthquake resistant design, seismic code Provisions for design of buildings, earthquake Resistant Detailing of Buildings, IS 13920-2016

Unit 4:Earthquake Safety Assessment of Building: Pre-earthquake safety assessment, post-earthquake evaluation of structures & Retrofitting

Unit 5: Earthquake Strengthening of Buildings and Special Topics: Methods of Retrofitting, Methods of Strengthening, Special topics, non-engineered constructions

Reference Books:

1. Seismic Design of Reinforced Concrete and Masonry Buildings by T. Paulay and M.J.N. Priestley.
2. Earthquakes by Bruce A. Bolt.
3. Earthquake Engineering, Application to Design by Charles K. Erdey.
4. Earthquake Engineering: From Seismology to Performance Based Design by Yousef Bozorgnia and Vitelmo Bertero.

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

A lecture on a theory concept will be preceded by its practical relevance, appreciation of field level challenges and immediately followed by on-hands-practice using manual approach as well as using appropriate scientific software. Student will be encouraged to come up with issues and how the theory and hands-on experience is helping them. Student is also encouraged to do homework and assignments individually and mini-projects as a group task.

6.Assessment methods and weightages in brief (4 to 5 sentences):

The course will rely heavily on looking at problem solving capability of student and hence the assessment is divided as follows i.e..

- a) 20% weightage is given to individual assignments for checking the concepts taught in the class,
- b) 20% weightage is for group projects for checking software application
- c) 30% is quizzes & Mid exam for checking the application of concept and,
- d) 30% for end-sem exam is for overall assessment.

Title of the Course : Electronics Workshop-II

Name of the faculty : Arti Yardi+ Anshu Sarje

Course Code : EC2.202

L-T-P : 0-0-6

Credits : 4

Name of the Academic Program: B. Tech. in ECE

Prerequisite Course / Knowledge:

Basic knowledge of Electronics design (digital, analog, etc.).

Course Outcomes (COs):

After completion of this course successfully, the students will be able to. CO-1: EW-II will enable students to have conceptual understanding and practical implementations of theoretical knowledge e.g., p-n junction diode, need of rectifiers, understanding of filters, understanding the working of transistors in various configuration; understanding of MOSFET,

amplification, conversion, processing, etc.

Practical implementations will reinforce various concepts.

CO-2: Able to use various tools used in electronic, such as Soldering Iron, soldering wire, flux, Multimeter (analog and digital), male and female connectors (audio, video), Use of various devices (MOS, transistors, Diodes, SCR, etc.), Op-amp, Use of electronic instruments (multimeter, signal generator, power supply, oscilloscope), etc.

CO-3: At the end of the course students are expected to be able to design and analyse electronic circuits, which involve many discrete active and passive components.

CO-4: Able to articulate the functionality of such circuits as well as be proficient in implementing the same in various domains.

CO-5: Posed with a non-obvious design problem the student should feel adequately confident to come up with the design, implement, debug and get it to work.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	1	1	2	2	2	1	1	3	3	2	2	2
CO2	3	3	2	2	2	1	1	2	1	1	1	3	3	2	2	2
CO3	3	3	3	2	2	1	1	2	2	2	1	2	3	3	3	3
CO4	3	3	3	3	2	1	1	2	2	2	1	3	3	3	3	3
CO5	2	3	3	3	2	1	1	2	3	3	3	3	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'- level mapping.

Mapping with PSOs, where applicable.

Detailed Syllabus:

EW-II is a project intensive course focused on Electronics (analog, digital, mixed) design and application while elements of microcontroller programming that aids this design is an option. The course is broadly divided in two projects;

Project-1 (e.g., Design of an Audio Amplifier) is common to all students (in a group of 2 students with the following specifications (for illustration only)

- Supply: 5V
- Input: 10-20 mV peak to peak
- Gain: $G_1 \times G_2 \geq 500$ (Pre amp and Gain stage)
- Frequency: Audible range (20 Hz - 20KHz)
- Power: $P \geq 1.5$ W
- Filter should not attenuate the gain; Power amp shouldn't be used for gain.
- Load: 10Ω

Project-2 is an individual project (in a group of 2 students), which are very applied test the students' mettle in the following areas broadly-

- Filter Design
- Amplifier and Rectifier Design
- Regulator Design
- ADC

- Sensor Integration to Controllers and Calibration
- Signal Processing
- Robotics
- IoT, etc.

Reference Books:

No preferred text book as this is a project course. Indicative textbook include Microelectronic Circuits by Sedra and Smith.

Teaching-Learning Strategies in brief (4 to 5 sentences):

Projects are the best way to open student minds to learning electronics practically. Making projects that do an exciting real-world task will make students curious to understand electronics better. The aim of this subject is to provide the knowledge of the fundamental concepts related to Electronics. The learning will involve handling wide variety of instruments while testing, trouble shooting, calibration etc. The study of EW-II will help students to gain the knowledge of working principles and operation of different instruments. During EW-II practical sessions, they will acquire the requisite skills.

Assessment methods and weightages in brief (4 to 5 sentences):

- Project 1: 40%
- Project 2: 60%

Title of the Course : Electronics Workshop-II

Name of the faculty : Spandan Roy + Prasad Krishnan

Course Code : EC2.202 a

L-T-P : 0-0-6

Credits : 4

Name of the Academic Program: B. Tech. in ECE

Prerequisite Course / Knowledge:

Basic knowledge of Electronics design (digital, analog, etc.).

Course Outcomes (COs):

After completion of this course successfully, the students will be able to. CO-1: EW-II will enable students to have conceptual understanding and practical implementations of theoretical knowledge e.g., p-n junction diode, need of rectifiers, understanding of filters, understanding the working of transistors in various configuration; understanding of MOSFET, amplification, conversion, processing, etc. Practical implementations will reinforce various concepts.

CO-2: Able to use various tools used in electronic, such as Soldering Iron, soldering wire, flux, Multimeter (analog and digital), male and female connectors (audio, video), Use of various devices (MOS, transistors, Diodes, SCR, etc.), Op-amp, Use of electronic instruments (multimeter, signal generator, power supply, oscilloscope), etc.

CO-3: At the end of the course students are expected to be able to design and analyse electronic circuits, which involve many discrete active and passive components.

CO-4: Able to articulate the functionality of such circuits as well as be proficient in implementing the same in various domains.

CO-5: Posed with a non-obvious design problem the student should feel adequately confident to come up with the design, implement, debug and get it to work.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3	PSO 4
CO1	3	3	2	1	1	1	2	2	2	1	1	3	3	2	2	2
CO2	3	3	2	2	2	1	1	2	1	1	1	3	3	2	2	2
CO3	3	3	3	2	2	1	1	2	2	2	1	2	3	3	3	3
CO4	3	3	3	3	2	1	1	2	2	2	1	3	3	3	3	3
CO5	2	3	3	3	2	1	1	2	3	3	3	3	3	3	3	3

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'- level mapping.

Mapping with PSOs, where applicable.

Detailed Syllabus:

EW-II is a project intensive course focused on Electronics (analog, digital, mixed) design and application while elements of microcontroller programming that aids this design is an option. The course is broadly divided in two projects;

Project-1 (e.g., Design of an Audio Amplifier) is common to all students (in a group of 2 students with the following specifications (for illustration only)

- Supply: 5V
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- Frequency: Audible range (20 Hz - 20KHz)
- Power: $P \geq 1.5$ W
- Filter should not attenuate the gain; Power amp shouldn't be used for gain.
- Load: 10Ω

Project-2 is an individual project (in a group of 2 students), which are very applied test the students' mettle in the following areas broadly-

- Filter Design
- Amplifier and Rectifier Design
- Regulator Design
- ADC
- Sensor Integration to Controllers and Calibration
- Signal Processing
- Robotics
- IoT, etc.

Reference Books:

No preferred text book as this is a project course. Indicative textbook include Microelectronic Circuits by Sedra and Smith.

Teaching-Learning Strategies in brief (4 to 5 sentences):

Projects are the best way to open student minds to learning electronics practically. Making projects that do an exciting real-world task will make students curious to understand electronics better. The aim of this subject is to provide the knowledge of the fundamental concepts related to Electronics. The learning will involve handling wide variety of instruments while testing, trouble shooting, calibration etc. The study of EW-II will help students to gain the knowledge of

working principles and operation of different instruments. During EW-II practical sessions, they will acquire the requisite skills.

Assessment methods and weightages in brief (4 to 5 sentences):

- Project 1: 40%
 - Project 2: 60%
-

Title of the Course

: Exploring Masculinities

Faculty Name

: Vindhya Undurti, TISS, Hyd

Name of the Program

: Humanities Elective

Course Code

: HSo.209

Credits

: 2 credits

L - T - P

: 18Lecture hours (12 classes)

Semester, Year

: Spring 2022

Pre-Requisites

: Introduction to Human Sciences, Ethics 1 (Basics)

Course Description :

This course explores the construction and meaning of masculinities and examines in particular the linkages between the social construction of masculinities and power and violence. The course will provide an overview of the key discussions and perspectives from different disciplines such as psychology, sociology, and gender studies, on the connections between the construction of masculinities, their intersections with markers such as class, ethnicity, caste, sexual orientation, and the many forms of power and violence. While the theoretical understanding of masculinities and their connections with power and violence will form the bedrock of the course, a distinctive feature will be the experiential component – the opportunity the course aims to provide for students to reflect and imagine the possibility of ethical masculinities that is transformative, based on ideals of mutuality, care and respect, and awareness of gendered vulnerabilities. This course will thus enable students to be familiar with the key concepts in relation to the social construction of masculinities in different disciplines, unravel the links between masculinities and violence, and to facilitate engagement, through self-reflection of behaviors, norms and values, with the transformative potential of ethical masculinities.

Course Outcomes :

On successful completion of this course, students will be able to

1. Explain how masculinities are socially constructed
2. Understand the connections between harmful masculinities and perpetration of violence
3. Critically reflect on their own individual behavior, socialization patterns and identity development in order to contextualize the understanding of masculinities in the 'personal'.

Course Topics :

Module I:

- Introduction: Origins of scholarly interest and research in masculinities
- How are power, violence and the social construction of masculinities connected?

Module II:

- Gender stereotypes, construction of male identity: An intersectional approach
- Social psychology of sexism: hostile and benevolent sexism and links with violence perpetration

Module III:

- Ethical masculinities

Readings:

Bowker, L. (1998/2013). *Masculinities and violence*. Newbury Park, CA: Sage

<https://sk.sagepub.com/books/masculinities-and-violence/n11.xml>

Connell, R.W. (2005). *Masculinities*. University of California Press.

Sharma, A., & Das, A. (2016). Men, Masculinities and Violence. *Graduate Journal of Social Science*.

Grading Plan :

Type of Evaluation	Weightage (in %)
Quiz-1 (3-5 questions; answers of 200-300 words)	20%
Assignment 1/Reflective piece (1000-word essay)	30%
Quiz-2 (3-5 questions; answers of 200-300 words)	20%
Assignment 2 (1000-word essay)	30%

Mapping of Course Outcomes to Program Objectives:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO ₁₂	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	
CO1						3		2										3
CO2						2				3								3
CO3						3		3		3								3

Teaching-Learning Strategies in brief (4-5 sentences) :

The teaching-learning strategy will consist of a combination of powerpoint-based lectures, and discussions on the selected readings. In addition, there will be classroom activities designed to encourage students to take an experiential stance and critically reflect on their own socialization patterns and construction of identities for a critical appraisal of the concepts learnt in class. The participatory methodology of pedagogy will be supplemented with assessments aimed to test comprehension of students' knowledge, as well as their abilities of critical reflection, interpretative reading and structured writing.

Title of the Course

: Flexible Electronics

Faculty Name

: Aftab Hussain

Course Code

: EC2.502

L-T-P

: 3-1-0

Credits

: 4

(L= Lecture hours, T=Tutorial hours, P=Practical hours)

1. Prerequisite Course / Knowledge:

Understanding of basic concepts of Physics and Chemistry taught up to the 10+2 level

2. Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to..

CO-1: Describe the physical reason for flexibility in various material systems.

CO-2: Explain the various processes, such as lithography, etching, deposition etc., that are involved in silicon semiconductor fabrication.

CO-3: Compare the fabrication and functioning of flexible electronic systems with their rigid counterparts.

CO-4: Employ various microfabrication techniques to obtain flexible electronic systems.

CO-5: Choose the correct approach for designing and fabricating a fully flexible system including, flexible memory, processor, display, power source and so on.

CO-6: Create a report of the various advances in the state-of-the-art of a specific topic in flexible electronic systems.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1	1	1	1	1	1	1	1	2	2	1	1	2
CO2	3	2	1	1	1	1	1	1	1	1	1	2	3	1	1	1
CO3	2	3	3	1	1	2	2	1	1	1	1	1	2	1	2	2
CO4	1	3	3	2	1	1	1	1	1	2	1	1	2	1	2	1
CO5	1	1	3	2	1	2	2	2	1	2	2	1	1	2	2	1
CO6	1	3	1	3	2	1	2	2	3	3	2	2	1	1	1	1

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs.

Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4. Detailed Syllabus:

Unit 1: Physics of silicon electronics, silicon band structure, flexible materials

Unit 2: VLSI fabrication: silicon wafer, deposition, lithography, etching

Unit 3: Flexible electronic systems, flexible PCBs, interconnects, flexible silicon

processes Unit 4: Flexible displays, flexible TFTs, OLEDs, flexible memory

Unit 5: Flexible energy harvesters, photovoltaics, flexible interconnects

Reference Books:

1. Sami Franssila, *Introduction to Microfabrication*, Wiley VCH, 2010

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

3. Takao Someya, *Stretchable Electronics*, Wiley VCH, 2013

5. Teaching-Learning Strategies in brief (4 to 5 sentences):

The course instruction is delivered through lectures slides explained by the instructor. The slides include theoretical concepts with examples of real-world applications of flexible electronic systems to foster student understanding and interest. Assignments are designed to encourage students to critically think about the concepts discussed in the class and to learn to independently solve problems. The students are asked to create a literature survey report detailing the advances in the state-of-the-art of one of the topics in flexible electronic systems.

6. Assessment methods and weightages in brief (4 to 5 sentences):

Continuous evaluations:

Assignments – 20% MCQ

Quizzes – 20%

Comprehensive exams:

End semester exam – 35%

Term-paper report – 25%

Title of the Course	: Gender, Kinship, and State Law
Faculty Name	: Rama Srinivasan
Course Code	: HS2-302
Credits	: Two

Objective: Drawing inspirations from generations of feminist scholarship, this course will survey rules and laws governing gender and sexuality which help keep the social and political order intact. It will highlight how ordering and re-ordering of gender-based hierarchies are central to any political project though studies on nation-states do not always delve on this aspect (or devote a separate section to take up the question). Anthropological studies on gender, kinship, and sexuality, hence, are not just critical to understand the patterns in social organization and cultural representations but also offer key insights into how modern states persevere and when/how they collapse. Additionally, the texts will also highlight how gendered subjects are created, how subjects evolve and, in turn, transform law and legal practice. Students will learn to view the relationship between public institutions and private subjects as intimate, dynamic, and dialectic by the end of the semester.

Course Topics:

- To understand how sex, gender, and sexuality are encoded in social, political, and legal and state frameworks.
- To think beyond the dichotomy of traditional societies and modern nation-states when discussing gender/sexuality.
- Impact of national and transnational movements on family, kin groups and intimate relationships

Course Schedule:

1. Introduction (March 7): Gender, Sexuality, Caste and Law

Read these two news articles: <https://www.theatlantic.com/culture/archive/2020/08/netflix-indian-matchmaking-and-the-shadow-of-caste/614863/>

<https://www.indiatoday.in/magazine/cover-story/story/20131230-vikram-seth-on-gay-rights-homosexuality-769369-2013-12-20>

2. Gender in Anthropological Perspective (March 10)

Reading assignment: Sherry Ortner (1974) "Is female to male as nature is to culture?" pp. 67–87 in *Woman, Culture, and Society*, edited by M. Z. Rosaldo and L. Lamphere. Stanford, CA: Stanford University Press. [Special focus on pg 67-83](#)

Gayle Rubin (1984): The Traffic in Women: Notes on the 'Political Economy' of Sex.

3. Family, Kinship, Incest Taboos (March 14)

Reading assignment: MN Srinivas. *Marriage and Family in Mysore*. 1942. Chapters: [Introduction \(I\)](#) and [Kinship Terminology with Reference to Marriage Restrictions \(IV\)](#)

Lewis Henry Morgan (1871) *Systems of Consanguinity and Affinity of the Human Family*. Trawick, Magaret. 1992. *Notes on Love in a Tamil Family*. University of California Press.

4. State Formation and Early Legislations (March 21)

Reading assignment: Chapter 2 from Das, Veena (2007) Life and Words: Violence and the Descent into the Ordinary. Berkeley: University of California Press. [Special Focus pg 18-29](#)

Ramamurthy, Priti. "The Modern Girl in India in the Interwar Years: Interracial Intimacies, International Competition, and Historical Eclipsing." *Women's Studies Quarterly* 34, no. 1/2 (2006):197–226. <http://www.jstor.org/stable/40004749>.

5. Sexuality and Governance (March 24)

Puri, Jyoti. 2017. Sexual States: Governance and the Struggle over the Antisodomy Law in India
Vanita, Ruth. 2011. 'Democratizing Marriage: Custom, Consent and the Law' in Law like Love: Queer Perspectives on Law ed. Arvind Narrain. New Delhi: Yoda Press 338-354.

Guest lecture by Dr Jayaprakash Mishra, IIT-Hyderabad

Reading assignment: Mishra J. Understanding Re-partnership in Non-normative Conjugality:Narratives of Gay Men in Odisha, India. *Journal of Family Issues*. 2020;41(7):957-977.

6. Personal laws (March 31)

Reading Assignment: Introduction from Chitra Sinha, Debating Patriarchy: Hindu Code BillControversy In India (1941-1956).

Sylvia Vatuk. 2008. Islamic Feminism in India: Indian Muslim Women Activists and the Reform of Muslim Personal Law.

Mid-term due by April 2

7. Legal Pluralism (April 4)

Merry, Sally E. 1988 "Legal Pluralism". *Law & Society Review*. 22 (5): 869-896
Recognition. *Radical History Review* Fall 2005 (93): 122-141.

Livia Holden (2004) Official Policies for (Un)Official Customs: The Hegemonic Treatment of Hindu Divorce Customs by Dominant Legal Discourses, *The Journal of Legal Pluralism and Unofficial Law*, 36:49, 47-74. [Special focus on pg 53-68](#).

8. Sexual Consent, Crime, Litigation (April 7)

Reading Assignment: Introduction of Public Secrets of Law: Rape Trials in India. By Pratiksha Baxi. New Delhi: Oxford University Press, 2014.

Halley, Janet. 2016. "The Move to Affirmative Consent". *Signs*. 42 (1): 257-280.

9. Love, Deviations, Social Change (April 11)

Reading Assignment: Osella, Caroline, and Filippo Osella. 1998. "Friendship and Flirting: Micro-Politics in Kerala, South India." *The Journal of the Royal Anthropological Institute*.

Ahearn, Laura. 2001. Invitations to Love: Literacy, Love Letters, and Social Change in Nepal. University of Michigan Press.

Listen to: <https://www.youtube.com/watch?v=QBYgbckwmTk>

10. Negotiations for a happily ever-after (April 14)

Rama Srinivasan (2018) Courting marriage: juridification of intimate relationships in North India, The Journal of Legal Pluralism and Unofficial Law, 50:2, 213-234. [Special focus on 216-230.](#)

11. Global Circulations (April 18)

Sidharthan Maunaguru, Marrying for a Future: Transnational Sri Lankan Tamil Marriages in the Shadow of War (University of Washington Press) 2019.

Reading assignment: Samuel, Lina. 2010. "Mating, Dating and Marriage: Intergenerational Cultural Retention and the Construction of Diasporic Identities among South Asian Immigrants in Canada." Journal of Intercultural Studies. 31(1): 95-110.

Short lecture: Being an Engineer in Global Companies: Gender, Caste, Class, and Race

Presentation by Dr Nora Engelbert on the challenges faced by IT professionals working outside India. Please come prepared with questions!

12. Presentation (April 22)

Grading Plan:

Type of Evaluation	Weightage (in %)
Mid-Term Exam	30%
End Sem Exam (2000 words)	50%
Presentation + class participation	20%

Title of the Course : Growth and Development

Faculty Name : Anirban Dasgupta

Course Code : HS5.201

Credits : 4

L - T - P : 3 - 1 - 0

(L - Lecture hours, T - Tutorial hours,

P - Practical hours)

Semester, Year : Spring 2023

Pre-Requisites : BTech Students: Intro to Human Sciences, CHD Students: 3rd and 4th years

Course Outcomes : After completion of this course successfully students will be able to:

CO1: Apply the concept of development and economic growth from different perspectives

CO2: Examine the interrelationship between economic growth and development

CO3: Identify the role of technology in the development process

CO4: Compare cross-country data, including through computational tools

CO5: Analyze the alternative models of sustainable development in the face of looming climate crisis

Course Topics:

1. **'Growth' in History of Economic Thought:** The importance of economic growth from classical political economy to development economics.

2. **Growth vs. Development:** The ideas differentiating growth and development in early development economics. Growth as necessary but not sufficient for development.
3. **Theories of Economic growth:** Overview of main growth theories: classical, structuralist and neo-classical (including endogenous growth). Different conceptions of convergence. Fundamental causes of growth: history, geography and institutions.
4. **Development beyond growth:** Early critiques of growth centrisim – social development, Basic Needs and employment generation. Capability theory and Human Development. Limits to growth and sustainable development.
5. **Development without growth:** The ecological critique and economics of steady state. Climate change and the debate between green growth and degrowth.

Please Note: Relevant statistical and computational tools will be used throughout the course wherever applicable.

Textbooks :

- Ujiro Hayami and Yoshihisa Godo: *Development Economics: From the Poverty to Wealth of Nations* 3rd Edition. Oxford University Press.
- Michael Todaro and Stephen Smith: *Economic Development* 12th edition. Pearson.
- Gilbert Rist: *The History of Development: from Western Origins to Global Faith* 5th Edition. Zed Books
- Shahrukh Rafi Khan: *Development Economics: A Critical Introduction*. Routledge

Reference Books & Articles (indicative list, more will be added in the course of teaching):

- Herman E. Daly: *The Economics of Steady State*. American Economic Review
- Gerald Meier: *Development Economics: Biography of a Subject*. Oxford University Press
- Gerald Meier(ed.): *From Classical Economics to Development Economics*. Macmillan.
- Giorgos Kallis: *Degrowth*. Agenda Publishing
- Pulapre Balakrishnan: *Economic Growth in India: History and Prospect*. Oxford University Press.
- Amartya Sen: *Development as Freedom*. Oxford University Press.
- Bhaskar Vira: *Taking Natural Limits Seriously: Implications for Development Studies and the Environment*. *Development and Change*.
- Servaas Storm: *Structural Change*. *Development and Change*

Grading Plan :

(The table is Indicative)

Type of Evaluation	Weightage (in %)
Mid SemExam	25%
Class Presentation	15%
End Sem Exam	40%
Assignment	20%

Mapping of Course Outcomes to Program Objectives:

(1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant).

Computer Science and Engineering

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	2	3	-	3	3	3	2	2	-	2	-	1	-	2
CO2	1	-	1	2	-	2	2	2	2	2	-	2	-	1	-	3
CO3	1	1	2	2	-	3	3	2	2	2	-	2	1	2	1	3
CO4	1	-	2	1	2	2	2	3	2	2	1	2	-	1	-	2
CO5	1	1	1	2	1	2	3	3	2	2	1	2	1	2	1	2

Teaching-Learning Strategies in brief (4-5 sentences):

In this course, teaching will be primarily based on lectures and will be supplemented with group discussions, class presentations and film screenings related to the class material. This will be a reading intensive course with multiple readings recommended for each lecture. A substantial writing assignment (3000- 4000 words) with the objective of constructing a cogent analytical argument based on academic literature will be a requirement for this class. The teaching tools including class discussion and presentation will be designed to train students in formulating their independent views on critical social and economic issues of the day.

Title of the Course : Human-Computer Interaction

Faculty Name : Raman Saxena

Course Code : PD1.501

L-T-P : 1.5 -0- 3

Credits : 2

(L= Lecture hours, T=Tutorial hours,
P=Practical hours)

Semester, Year : 2nd Semester – Year 1 (Monsoon, 2022)

1. Prerequisite Course / Knowledge:

No prerequisites are required

2. Course Objectives & Outcomes (COs)

This course provides knowledge about the interaction between human(user), computer(machine) and environment. The course will examine the HCI from the science, technology and human-centered design perspective.

Lecture topics are aimed at guiding the students through analysing and discussing the interaction between products and people based on cognitive, physical and emotional factors. It will introduce fundamentals of interaction design such as mental models, human action cycles and difference between User Experience, User Interface and Interaction Design. It will look at the various types of human-computer interaction and how it affects the people intended goals and objectives. How a good HCI design delivers higher perceived usefulness, usability or ease of use leading to positive and delightful user experience. It will build understanding the factors that influence the interaction between people and products in a desired direction. The course will explain the process of User-centered software design and development and the deliverables within the same such as user cases, user stories, work flow, task analysis, information

architecture, wireframes, storyboards and low fidelity and high fidelity prototypes. The course will also introduce the concept and practice of usability testing and evaluation. The course will also look into the technology trends such as AI, Chatbots, etc. and their influence on the interactions between human and computers. The course will also cover User Experience. The Course will divide into lectures including classroom exercises, quizzes, a short project and home assignments.

The students of this course will be able to apply the knowledge/learning's from this course to their own professional work as HCI Designer, Interaction designer, UX Designer and design interaction layer of the software/IT products including Mobility, Healthcare, Learning, E-commerce and Utility etc. The course will include a short project to offer opportunity to the students to experience the full HCI cycle.

After completion of this course successfully, the students will be able to...

CO-1 Demonstrate good understanding of Human-Computer Interaction and How it influences the User Experience of digital products, systems, solutions and services.

CO-2 Demonstrate good understanding of methods and tools used to understand the HCI from the perspectives of technology, human-centered design and human/social sciences such as cognitive, and digital anthropology perspective.

CO-3 Demonstrate good understanding of incorporating human-centered approach in HCI to deliver useful and easy to use software and IT products including Mobility, Healthcare, Learning, E-commerce and Utility etc.

CO-4 Demonstrate the ability to create, document and present the various deliverables and communications related to HCI, UX and UI Design including Human-Action Cycle, Personas, Use Cases, Task Flow and Analysis, Information Architecture diagram, Wireframes, UI Design, and Usability Testing etc.

CO-5 Demonstrate the ability to plan and execute usability testing including creating test cases, usability matrix, performs testing, record test data and analyse the same to identify usability issues and report the same for updating the design.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Allocation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	1	3			
CO2	3	3	3	2	3			1
CO3	3	3	3	2	3			3
CO4	3	2	3	3	3			3
CO5	3	3	3	3	3			3

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

3. Detailed Syllabus:

UNIT 1. Introduction to Human-Computer Interaction (Week 1 - Lecture 1)

- Introduction to HCI?

- History of HCI
- How Human interact with outside world?
- Human Conceptual/Mental models
- Conflict between Mental Models and Design Models.

UNIT 2. UNDERSTANDING Human-Machine System (Week 1 - Lecture 2)

- Understanding Human-Machine System
- Human-Action Cycle (HAC)
- 7 stages of Human-action cycle.
- Classroom exercise on HAC
- User Experience

UNIT 3. Art and Science of User Experience and UI Design (Week 2 - Lecture 3 & 4)

- Attention and Memory
- Gestalt theory and principles
- UI Elements including colour and interaction model
- Information and Interaction Design principles

UNIT 4. User-Centered approach to the Software Design (Week 3 - Lecture 5 & 6)

- Perceived Usefulness and Perceived Ease of Use
- Understanding User Persona
- Why user person is important
- Use cases, User stories
- Task Flows & Task Analysis
- Human-centered software Design Workflow.

UNIT 5. User Experience and UI Design (Week 4 - Lecture 7 & 8)

- Information Architecture
- Wireframes and Storyboards
- Low and High Fidelity prototypes

UNIT 6. Usability Engineering and Testing (Week 5 - Lecture 9 & 10)

- What is Usability, usability requirements and how to measure it?
- Heuristics evaluation
- Usability Test planning and conducting usability test.
- Usability matrix and test reporting

UNIT 7. Usability Engineering and Testing (Week 6 - Lecture 11 & 12)

- Short term project
- Project completion, documentation and submission

Reference Books & Case Studies:

1. Book: Human-Computer Interaction in the New Millennium, by Carroll, John
2. Book: Learn Human-Computer interaction: Solve human problems and focus on rapid prototyping and validating solutions through user testing., by Christopher Reid Becker
3. Book: Lean UX: Designing Great Products with Agile Teams, by Jeff Gothelf & Josh Seiden
4. Book: Designing with Mind in Mind: Simple guide to understanding User Interface Guidelines, by Jeff Johnson
5. Book: Sketching User Experiences: Getting the Design Right and the Right Design, by Bill

- Buxton
6. Book: Human-Computer Interaction: Solve human problems and focus on rapid prototyping and validating solutions through user testing, by Christopher Reid Becker
 7. Book: Interaction Design: Beyond Human-Computer Interaction, By Helen Sharp, Jennifer Preece & Yvonne Roger
 8. Book: Designing User Interfaces: Exploring User Interfaces, UI Elements, Design Prototypes and the Figma UI Design Tool , Dario Calonaki
 9. Book: Designing Interfaces: Patterns for Effective Interaction Design , By Jennifer Tidwell, Charles Brewer and Aynee Valencia
 10. Book: UX for XR: User Experience Design and Strategies for Immersive Technologies (Design Thinking), by Cornel Hillmann
 11. Book: AI and UX: Why Artificial Intelligence Needs User Experience , by Gavin Lew , Robert M. Schumacher Jr.
 12. Book: Information Visualization: Design for Interaction, by Prof. Robert Spence
 13. Book: Moderating Usability Test: Principles and Practices for Interacting, by Dumas, Joseph
 14. Case study : Design of a complex software system- CMS of a media organization
 15. Case study : Defining a Mainframe System
 16. Case Example: Conversational UI's

4. Teaching-Learning Strategies in brief (4 to 5 sentences):

- The Course will divide into lectures (around 12 nos.) and hands-on work including assignments, classroom exercises and home work.
- The course will also include fieldwork, hand on activities, learning by doing, to practice the learning from the lectures.
- Introduce and discuss couple of case studies including cases related to HCI, User Experience and UI Design of software products.
- A short term project to practice HCI, UX, UI and Usability learnings.
- Other than attending the lectures and doing classroom exercises & assignments, students need to spend 4 hours per week on home/field assignments.

5.

6. Assessment methods and weightages in brief (4 to 5 sentences):

1.	Class/Home activities		40%
2.	Short-term project		50%
3.	Viva		10%
TOTAL			100%

Title of the Course

: Hydroinformatics

Faculty Name : Shaik Rehana

Course Code : CS9.433

Credits : 4

L - T - P : 3-1-0

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year : Spring, 2023

(Ex: Spring, 2022)

Pre-Requisites : NIL

Course Outcomes :

After completion of this course successfully, the students will be able to

CO-1: Handle various types of hydrological, climate data sources obtained from models, experimental, remote sensing and geographic information system based.

CO-2: Process various dimensions of data from open sources and acquiring data driven information using statistical methods

CO-3: Employ computer science skills in processing the hydroclimatic information

CO-4: Employ statistical and machine learning algorithms for predicting hydroclimatic processes

CO-5: Develop critical thinking to help in processing data from various sources to solve water related issues using computational algorithms and technologies

CO-6: To improve the problem-solving skills for solving water and climate related problems

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, climate and environment.

Preferred Text 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

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz-1	10%
Mid SemExam	15%
Quiz-2	10%
End Sem Exam	10%
Assignments	25%
Project	30%
Term Paper	Nil
Other Evaluation	Nil

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	1	2	2	3	1	1	3	1	1	1	2	2	3	2	3
CO2	1	3	2	3	2	1	1	1	1	3	1	2	2	2	2	2
CO3	2	2	2	2	3	1	2	1	1	1	1	2	2	2	2	2
CO4	2	2	3	2	3	1	2	1	1	1	1	2	2	2	2	2
CO5	2	3	2	2	3	2	3	2	1	1	1	2	2	2	2	2
CO6	2	2	3	2	2	2	2	2	1	3	1	2	2	1	2	2

Teaching-Learning Strategies in brief (4-5 sentences) :

Lectures and tutorials to analyze, process, visualize and map various water and climate related information. Hands on sessions and assignments with real-time case studies and data to process and understand hydroinformatics with the use of computer programming skills.

Title of the Course : Information Security Audit and Assurance

Faculty Name : Shatrunjay Rawat

Name of the Program : M.Tech CSIS and other programmes

Course Code : CS8.402

Credits : 4

L - T - P : 3-0-0

(L - Lecture hours, T-Tutorial hours, P - Practical hours)

Semester, Year : Spring, 2023

Pre-Requisites : Computer Networks and Operating Systems

Course Outcomes:

CO-1 Demonstrate understanding of security needs and issues of IT infrastructure

CO-2 Have basic skills on security audit of IT systems, do risk assessment and work out risk mitigation strategies

CO-3 Understand information security and privacy related laws, and their implication on IT systems

CO-4 Understand standards related to information security and develop security policies and procedures for an organisation.

CO-5 Understand functioning of security products, and design a reliable and secure IT infrastructure

CO-6 Respond to IT and other disasters in appropriate manner

Course Topics:

Unit 1: Introduction to information security, various aspects of information security; Review of TCP/IP, basic components of computer networks; Security products such as Firewall, IDS/IPS, VPN Concentrator, Content Screening Gateways, PKI, etc

Unit 2: Audit of various networking protocols/infrastructure from information security perspective– IP*, TCP/UDP, HTTP*, SMTP, OSPF/BGP/PIM, Ethernet/WiFi, switches/routers, etc.; Security audit of various Operating Systems

Unit 3: Information security standards – ISMS (ISO 27000 family), HIPAA, GDPR, etc; Security audit practices; Preparing security policies and procedures for organisations

Unit 4: Business Continuity Management, Disaster Recovery/Management; Designing security ready IT infrastructure

Unit 5: Information security related laws – Indian IT Act, IPR and privacy laws, various court judgements; Security Guidelines of various regulators (RBI, TRAI, IRDAI, etc); CERT and other information security organisations/bodies/industry associations.

Preferred Text Books:

No single text books. Required study material will be shared/identified as course progresses.

Reference Books:

Some references are listed below

1. RFCs of networking protocols
2. Various acts/laws - India IT Act, IPR and Privacy Laws, Court Judgements
3. Information security standards - ISO 27000 family, HIPPA, GDPR
4. Research papers
5. Security guideline documents/whitepapers published by Operating Systems and IT Systems manufacturers/developers.

E-book Links:

Grading Plan:

Based on class participation, presentations, assignments, security audits, Mid/End Sem exams, Simulation exercise, etc. Tentative marks distribution for grading is as follows:

Type of Evaluation	Weightage (in %)
Participation in class discussions, presentations	25
Assignments	25
Mid Semester Examination	20
End Semester Examination	30

Mapping of Course Outcomes to Program Objectives:

(1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	3	2	-	3	-	1	1	2	-	2	3	2	-	2
CO2	-	1	2	3	1	3	-	2	1	2	3	3	2	3	-	2
CO3	2	1	3	2	-	3	-	3	2	2	1	3	2	1	-	2
CO4	-	-	2	2	-	3	-	3	3	3	3	3	2	2	-	2
CO5	3	3	3	3	1	2	2	1	2	2	1	3	3	3	-	2
CO6	-	2	3	3	-	2	2	2	3	3	3	2	2	1	-	2

Teaching-Learning Strategies in brief:

Course will be primarily driven by classroom discussions, readings, surveys, exploratory practical assignments. It will involve a lot of critical thinking and active learning by the students to solve practical problems. Students will be asked to make presentations on topics assigned to them for exploration/experiment.

Title of the Course : **Information-Theoretic Methods in Computer Science**

Faculty Name : Prasad Krishnan and Gowtham

Name of the Program : Elective for B.Tech. in CSE/ECE

Course Code : **CS1.502**

L-T-P : 3-1-0

(L=Lecture Hours, T=Tutorial Hours,

P=Practical Hours)

Semester, Year : Spring, 2023

Prerequisites : Mathematical Maturity and Basics of Probability Theory - Random variable (RV), Joint and Conditional Probability Distributions, Expected Value of a RV, Linearity of Expectation, No Background on Entropy or Information Theory is assumed for the course.

Course Outcomes : After the completion of this course successfully, the students will be able to

1. Apply various Information Theoretic tools in the problems of Discrete Mathematics.
2. Demonstrate a familiarity with non-trivial proofs of combinatorial results like Shearer's lemma and Bregman's theorem using Entropy.
3. Articulate the underlying interconnections between the concepts of Information Theory and Computer Science.
4. Illustrate the applications of various statistical distances in theoretical computer science.
5. Explain the role of Information-Theoretic quantities in Machine Learning models like GANs.

Course Topics : A tentative list of topics to be covered in this course is below.

Module 0 : Review of Basics of Probability Theory.

Module 1 : Entropy and Its Properties: Entropy, Joint Entropy, Conditional Entropy, Sub-Additivity, Relative Entropy, Mutual Information, Chain Rules, Han's Inequality, Fano's Inequality, Source Coding

Module 2 : Applications of Entropy in Combinatorics, Graph Theory, Coding Theory, Shearer's lemma, and Bregman's theorem.

Module 3 : Pinsker's Inequality and Its Application to Distinguishing Coins.

Module 4 : Special Topics.

(i) Information-Theoretic Privacy - An Operational Approach to Information Leakage, Min-Entropy Leakage, Maximal Leakage.

(ii) Entropy and Guessing - Boltzmann Distribution, Guesswork, and Bounds via Entropy.

(iii) Generative Adversarial Networks (GANs) - Jensen-Shannon Divergence and Its Application in GANs.

Preferred Textbooks/Reference Material: There is no dedicated textbook for the course. The course broadly covers topics and material from various textbooks, research papers, and other similar courses. Some of them are listed below.

1. Cover and Thomas. *Elements of Information Theory*. John Wiley and Sons.
2. Jaikumar Radhakrishnan, “Entropy and Counting,” Computational Mathematics Modelling and Algorithms, 2003.
3. ‘Information and Coding Theory’ by Madhur Tulsiani @ TTIC, 2021.
4. Issa, Wagner, and Kamath, “An Operational Approach to Information Leakage,” IEEE Transactions on Information Theory, 2020.
5. I. J. Goodfellow et al., “Generative Adversarial Networks,” NIPS, 2014.

Grading Plan :
(This table is only indicative)

Type of Evaluation	Weightage (in %)
Assignments	15%
Quizzes	10%
Mid-Sem Exam	20%
End-Sem Exam	40%
Term Paper	15%

Mapping of Course Outcomes to Program Objectives (1 – Lowest, 2 – Medium, 3 – Highest, or a ‘–’ dash mark if not at all relevant):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	3	2	1	1	2	2	3	2	3	2	3	3
CO2	2	3	2	3	3	3	3	2	3	3	2	3	3	3	3	2
CO3	3	3	3	3	3	3	3	1	2	3	2	2	3	3	3	2
CO4	3	3	2	3	2	2	3	2	3	3	2	2	3	2	3	3

CO5	2	2	3	2	2	3	3	1	2	3	2	3	2	2	3	3
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Teaching-Learning Strategies in brief: Even though basic probability theory is a prerequisite, there will be a refresher lecture reviewing all the related concepts from it so as to ensure all the students are on the same page. All the concepts and the theoretical results in the course are illustrated through examples and/or applications wherever possible so that the students can comprehend them easily. Office hours are conducted with prior appointment via email where the students can interact with Teaching Assistant and/or Faculty to get their doubts on in-class discussion clarified and seek any extra help if required. Each assignment is associated with a short quiz primarily building upon the assignment so as to encourage the students to attempt and solve all the problems in the assignments on their own.

Title of the Course : **Internals of Application Servers**
Faculty Name : Ramesh Loganathan
Course Code : **CS3. 404**
Credits : 4
L - T - P : (3-1-0)
 (L - Lecture hours, T-Tutorial hours,
 P - Practical hours)
Semester, Year : Open
 (Ex: Spring, 2022)

Pre-Requisites : **None**

Course Outcomes :

A systems level understanding of distributed application platforms through building a contemporary platform. Key objectives of the course:

CO1: Understand Middleware systems concepts:

CO2: Understand Distributed Application Platforms through a project-based system building course structure.

CO3: Understand Key aspects of distributed applications, and the requirements from an underlying applications' platform

CO4: Understand the design of key subsystems of a contemporary application platform, and the same to be built as part of the course project

Course Topics :

Following topics will be covered in the context of the course project. Specific to the course project.

Lectures – 4 or 5 3-hour classes per Module

- M1- Understand essence of middlewares and distributed object technology
- M2- App Server architecture
- M3- Lifecycle of a Web Service request
- M4- Things “in” the Internet

- M5- Project problems Discussions
- M6- Project problems Discussions
- M7- Project problems Discussions
- M7- Project problems Discussions

Labs – L1 to L8 (16 hrs)

Seminars – 6 hrs (6 groups, 1 hr each)

Mini Project review – 3-4 hrs

Various topics that will be covered in the lectures:

- **Middleware/ App Server concepts**
 - Understanding concepts related to CMS, Application server, web server, message oriented middleware etc.
- **Distributed App Platforms components**
 - Understanding distributed applications tools, architecture and workings
 - RPC, servlets, stubs, Messaging services.
- **Project Overview and Understanding**
 - Project Idea discussion and idea finalization.
 - Blackbox overview of project from view points of various actors.
 - Idea Hackathon
- **Project Platform Deep dive (concepts)**
 - Discussion on major platform components.
 - Functionality finalization and designing major components
 - Project Documentation.
- **System Building Experience**
 - A full distributed app platform will be built.
 - Endpoint for each microservice.
 - Hackathon.
- **Integration of Platform Components.**
 - Designing endpoints for each component & integration with other components.
 - Testing use case for each component.

Preferred Text Books :None. Reading references will be provided in class.

Reference Books :-

E-book Links :-

Grading Plan :

Type of Evaluation	Weightage (in %)
Class quizzes	5
Lab submissions	15
Hackathons	10
Projects	40
- Reqts& Design docs	15
- Pre Demos	10
- Final Demos	15
End Sem Exam	30

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

https://iiitaphyd-my.sharepoint.com/:w/r/personal/dyacad_iit_ac_in/Documents/NBA-2020-21/Course%20Content/IIIT-CSE-ECE.docx?d=w111foeffcae41b3a4d1e8a3fbc6332d&csf=1&web=1&e=z1Khby

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P2O9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	1	1	1	1	1	2	2	1	2	3	1	2	2
CO2	1	2	2	1	2	1	1	1	2	2	2	2	2	3	2	1
CO3	3	2	2	3	2	1	1	1	3	3	2	2	2	2	2	1
CO4	3	1	2	3	2	1	1	1	3	3	3	2	2	2	3	1

Teaching-Learning Strategies in brief (4-5 sentences) :

Project problems Discussions; Project architecture & design reviews; Guest lectures from Industry (Projects built in previous years- JMS Server. Distributed web services platform (SOA). MiroServices Platforms. Ai on the Edge. Fog computing (IOT) platform)

There will be labs to understand basic concepts and then hackathons to help build subsystems. And through the course projects understand the various elemensot and subsystems of a distributed applications erver platforms.

Title of the Course

: Internet and Democracy

Faculty Name

: Aakansha Natani

Name of the Program

: B.Tech in Computer Science and Engineering

Course Code

: HS4.302

Credits

: 4

L - T - P

: 3-1-0

(L - Lecture hours, T-Tutorial hours, P - Practical hours)

Semester, Year

: Spring 2023

Pre-Requisites

: Completed one of the following courses: Intro to Politics, Intro to Sociology, Intro to History; CHD 3rd and 4th year students

Course Outcomes :

After completion of this course successfully students will be able to

CO1: Understand and describe the impact of scientific developments on society and political systems.

CO2: Explain theoretical concepts and substantive issues in digital democracy.

CO3: Analyse and elaborate on emerging debates and concerns on privacy and data ownership.

CO4: Explain what factors lead to efficient digital transformation of governance.

CO5: Assess the impact of tech-policy initiatives in advanced and developing societies.

CO6: Develop one's own understanding of emerging challenges in information society and the need for new digital rights paradigm from both citizen and institution centric perspectives.

Course Topics:

The course is divided into five modules

- (i) **Internet and Democracy:** Role of science and technology in evolution of Political systems; Impact of ICT on Democracy
- (ii) **Theory and Substantive issues in Digital Democracy:** Defining Digital Democracy, Debates on Right to Privacy, Data Ownership, New Digital Rights Paradigm
- (iii) **Tech-Policy Initiatives in Advanced Democracies:** Case Study of Right to High-Speed Internet Access in Finland, French Digital Republic Act, M5S (Italy) and Pirate Party (Germany), E-Voting in Estonia, Digital Inclusion Policy of Germany
- (iv) **Digital Democracy in Developing Societies:** Major issues and challenges; Digital India and National E-Governance Program; Judicial Interventions and Legislative Proposals on Privacy and Data Protection
- (v) **Towards Information Society in India:** Contemporary concerns and Need for New Public Policy Frameworks; Digital Divide and Inclusion

Course Modules:

Module 1: Role of Scientific and Technological Inventions in Evolution of Political Systems; New Information and Communication Technologies and its impact on Social Structures and Functioning of Democracy; Democratic Potential of Internet: Early Projection and Realities; Can the internet strengthen Democracy?

Module 2: Digital Democracy: Theory and Substantive issues, Global Concerns on Right to Privacy and Major Policy Initiatives, Key Debates on Data Ownership, Accessibility and Protection; New Digital Rights Paradigm: General Data Protection Regulation, Digital Service Act and Digital Market Act of the European Union.

Module 3: Tech-Policy Initiatives in Advanced Democracies, Case Study of Right to High-Speed Internet Access in Finland; Public Policy Frameworks for Digital Transformation of Governance, Case Study of French Digital Republic Act; Transitions in Political Culture and Civic Engagement, Emergence of New Public Sphere and e-Identities, Case Study of M5S (Italy) and Pirate Party (Germany); Democratic Credentials of e-Voting and e-Deliberation systems, Contradictions between Anonymity and Transparency on Digital Media Platforms, Case Study of Estonia; Digital Divide and Public Policy for Digital Inclusion, Case Study of Digital Inclusion Policy of Germany.

Module 4: Digital Democracy in Developing Societies: major concerns and challenges, Digital Governance Models in India, Policy Framework and Objectives of Digital India Program, National E-Governance plan of India; Important Judgments of Supreme Court and Legislative Proposals on Privacy and Data Protection in India.

Module 5: Towards Information Society: Challenges and Prospects in India; Concerns on uneven distribution of technology; Democratisation of Digital Spaces: Need for New Comprehensive Policies in India.

Preferred Text Books:

Selected Chapters from-

1. Andrew Chadwick and Philip N Howard (2009): *Routledge Handbook of Internet Politics*, Routledge Publications
2. Coleman, Stephen (2017), *Can the Internet Strengthen Democracy*, Cambridge: Polity Press
3. Andrew Chadwick (2006): *Internet Politics: States, Citizens, and New Communication Technologies*, Oxford University Press

4. Hacker, Kenneth L. & Dijk, Jan van (2000), *Digital Democracy: Issues of Theory and Practice*, London: SAGE.
5. Banerjee, Indrajit (2003), *Rhetoric and Reality: The Internet Challenge for Democracy in Asia*, Singapore: Eastern Universities Press

Reference Books and Policy Papers:

- Cynthia Alexander and Leslie A Pal (1998): *Digital Democracy: Politics and Policy in the Wired World*, Oxford University Press
- Dahl, R. A. (1989), *On Democracy*, London: Yale University Press.
- European Commission (2016), *General Data Protection Regulation*, Eur-lex: Brussels
- Feather, John (2013), *The Information Society: A Study of Continuity and Change*, UK: Cambridge University Press
- Goldstein, Keith et al (2018), *The Right to Privacy in Digital Age*, Online: OHCHR
- Greenberg, Sherri and Newell, Angela (2012), *Transparency Issues in E-Governance and Civic Engagement*, USA: IGI Global.
- Hindman, Matthew (2008), *The Myth of Digital Democracy*, Princeton NJ: Princeton University Press.
- Hippel, Eric Von (2005), *Democratising Innovation*, Cambridge, MA: MIT Press.
- Huang, Wayne et al. (2005), *Electronic Government Strategies and Implementation*, PA: Idea Group Pub.
- Huntington, Samuel P. (1991), *The Third Wave: Democratization in the Late Twentieth Century*, Norman: University of Oklahoma Press.
- Isakhan B. and Stockwell S. (eds) (2012), *The Edinburg Companion to the History of Democracy*, Edinburg: Edinburg University Press.
- Kersting, Norbert and Baldersheim, Harald (2005), *Electronic Voting and Democracy: A Comparative Analysis*, New York: Palgrave Macmillan.
- Kies, Raphaël (2010), *Promises and Limits of Web-deliberation*, New York: Palgrave Macmillan.
- Levitsky, Steven and Ziblatt, Daniel (2018), *How Democracies Die: What History Reveals about Our Future*, Audiobook: Penguin Books Ltd.
- Lutz, Barend and Toit, Pierre du (2014), *Defining Democracy in a Digital Age: Political Support on Social Media*, Basingstoke: Palgrave Macmillan.
- Madise, Ulle&Maaten, Epp(2010), “Internet Voting in Estonia” in David Rios Insua& Simon French (eds.) *e- Democracy: A Group Decision and Negotiation Perspective*, New York: Springer.
- Mattelart, Armand (2003), *The Information Society: An Introduction*, UK: Sage
- Norris P (2001), *Digital Divide, Civic Engagement, Information Poverty and the Internet worldwide*, Cambridge UK: Cambridge University Press.
- O’Neil Cathy (2016), *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*, New York: Crown Publications.
- OECD (2003), *Promise and Problems of E-democracy: Challenges of Online Citizen Engagement*, Paris: OECD.
- Reinsalu, Kristina (2010), *Handbook on E-democracy*, Finland: EPACE Theme Publication.
- Rice, Ronald E et al (2020), *The Oxford Handbook of Digital Information and Society*, UK:OUP
- Rifkin, Jeremy (2014), *The Zero Marginal Cost Society: The internet of things, the collaborative commons and the eclipse of capitalism*, New York: Palgrave Macmillan.

- Simon et al. (2017), *Digital Democracy: The tools transforming political engagement*, UK: Nesta.
- Toffler, Alvin (1980), *The Third Wave: The Classic Study of Tomorrow*, US: William Morrow.
- Van der Ploeg, I. (2012), “The body as data in the age of information”, Kirstie Ball, Kevin Haggerty and David Lyon (eds.), *Routledge Handbook of Surveillance Studies*, New York: Routledge.
- Van Dijk J. A. G. M., (2005), *The Deepening Divide: Inequality in the Information Society*, UK: Sage.

Journal and Web Articles

- Albrakht, K. (2014), “The Information Revolutions’ Broken Promises’, *The Futurist*, 48(2).
- Bailey, R. & Parsheera, S. (2018), *Data Localisation in India: Questioning the Means and Ends*. New Delhi, National Institute of Public Finance and Policy, Working Paper No. 242.
- Becker, M (2019) “Privacy in the Digital Age: Comparing and Contrasting Individual vs Social Approaches towards Privac’y, *Ethics Inf Technol* 21, pp 307-317
- Bolleyer, N, Little, C, Von Nostitz, FC (2015), “Implementing democratic equality in political parties: Organisational consequences in the Swedish and the German pirate parties”, *Scandinavian Political Studies*, 38(2): 158–178.
- Devanesan , V. Vijay and Chandrasekaran, P. Kingsley Alfred (2011), “E-Democracy In India-Implications and Imperative”,*The Indian Journal of Political Science*, 72 (2):395-401
- Dhont, Jan et al. (2016), “The French Digital Republic Act gives new Powers to the French DPA”, [Online: web]
- G.L.A. van der Meer, Toni et al. (2015) “E-Democracy: Exploring the Current Stage of E-Government”,*Journal of Information Policy*, 5: 589-506.
- Kovacs, Anja and Ranganathan, Nayantara (2019), *Data sovereignty of whom? Limits and suitability of sovereignty frameworks for data in India*, Delhi: Internet Democracy Project. [Online: web]
- Loucaides, Darren (2019), “What happens when techno-utopians actually run a country”, [Online: web]
- M. Castells (2008), “The New Public Sphere: Global Civil Society, Communication Networks and Global Governance”, *The Annals of the American Academy of Political and Social Science*, 616, 78-94.
- Nyst, Carl & Falchetta, Tomaso (2017),“The Right to Privacy in the Digital Age”, *Journal of Human Rights Practice*, 9(1): 104–118.

Grading Plan:

Type of Evaluation	Weightage (in %)
Quiz-1	10%
Mid SemExam	20%
End Sem Exam	30%
Assignments	20% x 2 = 40%

Mapping of Course Outcomes to Program Objectives:

(1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant).

Matrix for CSE

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	1	-	1	2	2	3	-	2	1	3	1	-	1	2
CO2	-	1	-	1	-	2	2	2	-	2	-	3	-	1	-	3
CO3	1	-	1	-	1	2	1	2	-	-	1	2	1	-	1	2
CO4	-	1	-	1	-	2	1	2	-	2	-	2	-	1	1	2
CO5	1	-	2	2	3	2	2	1	2	2	2	2	1	2	-	3
CO6	-	1	2	-	2	2	-	3	2	2	-	2	1	2	-	3

Matrix for ECE

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	1	-	1	2	2	3	-	2	1	3	1	-	1	2
CO2	-	1	-	1	-	2	2	2	-	2	-	3	-	1	-	3
CO3	1	-	1	-	1	2	1	2	-	-	1	2	1	-	1	2
CO4	-	1	-	1	-	2	1	2	-	2	-	2	-	1	1	2
CO5	1	-	2	2	3	2	2	1	2	2	2	2	1	2	-	3
CO6	-	1	2	-	2	2	-	3	2	2	-	2	1	2	-	3

Teaching-Learning Strategies in brief :

The course will be based on classroom lectures and in class discussion of assigned reading material. On an average, each student will be required to read between 500 to 700 pages of books and articles and submit written work between 3000-4000 words, cumulatively. The students will be expected to follow the latest news and developments on the topics to be discussed in this course. The assignments and project will focus on training students to develop their own ideas and research skills in social sciences. Audio-visual and interactive materials may be used.

Title of the Course

: Intro to Bio Electronics (H2)

Faculty Name

: Prabhakar Bhimalapuram

Course Code

: EC1.201

Credits

: 3-1-0-2

TYPE WHEN

: Elective-Spring 2021,

PRE-REQUIS: Interest in relevant chemistry, biology, and electronics

OBJECTIVE :

To appreciate the biochemical interactions relevant for bio sensing Understand the principles of commonlyavailable biosensors

COURSE TOPICS :

Biology – Basic Chemical and Biochemical Concepts, Cells and their Basic Building Blocks, Basic Biophysical Concepts and Methods, Luminescence, Chemiluminescence, Fluorescence and Phosphorescence, Types of Spectroscopy, The Beer - Lambert Law, Impedance Spectroscopy, Electrochemical Principles and Electrode Reactions, Electrochemical Impedance Spectroscopy (EIS) Biosensors-Physical and Chemical Methods, Biosensor Parameters, Amperometric Biosensors, Potentiometric Biosensors, Ion Selective Electrodes, Conductometric and Impedimetric Biosensors, Photometric Biosensors, Glucose Sensors, Bio compatibility of Implantable Sensors, Basic Sensor Instrumentation–Transducers, Sensors and Actuators, Conductometric Biosensors, FET Based Biosensors.

PREFERRED TEXTBOOK:

1. INTRODUCTORY BIO ELECTRONICS FOR ENGINEERS AND PHYSICAL SCIENTISTS Ronald Pethig and Stewart Smith,Wiley.

***REFERENCE BOOKS:**

Principles and Applications of RF/Microwave in Healthcare and Biosensing, Changzhi Li, Mohammad-RezaTofighi, Dominique Schreurs, Tzyy-Sheng Horng, Academic Press
Essential Cell Biology by B. Alberts

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Quiz-1	25
Mid SemExam	N/A
Quiz-2	N/A
End Sem Exam	40
Assignments	20
Project	15 (Reading & Presentation)
Term Paper	N/A
OtherEvaluation	N/A

OUTCOME: Student can expect to develop understanding of biology, biomaterial and biosensing.

REMARKS:

Title of the Course : Introduction to Human Sciences

Name of the faculty : Aniket Alam and Nazia Akhtar

Course code : HS8.102

L-T-P : 3-1-0

Credits : 4

Name of the Academic Programs: **B.Tech. inCSE, B.Tech in ECE**

Course: UG2 Humanities core for CSE, ECE

1.Prerequisite Course / Knowledge:Nil**2.Course Outcomes (COs)**

After completion of this course successfully students will be able to:

CO1: Discuss the origin and development of key disciplines in the human sciences

CO2: Identify some of the fundamental questions that shape and drive inquiry in human sciences

CO3: Demonstrate knowledge of concepts related to theorizing about reflection, society, and culture

CO4: Analyze crucial normative elements and descriptive frameworks in human sciences inquiry

CO5: Develop skills to formulate nuances involved in problems concerning humans and societies

CO6: Write clear and well thought out short essays on topics in humanities and social sciences

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	1	1	3	2	3	1	1	-	3	1	1	2	3
CO2	2	2	3	3	2	3	2	3	1	3	1	3	1	1	2	3
CO3	2	2	2	3	1	3	2	3	1	2	1	1	1	1	2	3
CO4	1	2	2	3	1	2	2	3	2	2	-	2	1	2	1	3
CO5	2	2	3	3	1	2	3	3	1	1	1	3	1	2	2	2
CO6	2	2	3	3	1	3	3	3	2	2	1	2	1	1	3	2

'3' in the box denotes 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

4.Syllabus:

The course will be divided into four modules, each of which will introduce students to a particular discipline in the human sciences. The various disciplines that constitute human sciences are:

1. Philosophy
2. Psychology
3. Literature
4. History
5. Sociology
6. Anthropology

Each module will offer a systematic worldview, tools of enquiry to study and analytical frameworks to make sense of topics taken up for discussion. Detailed list of topics under a module will be provided by the faculty teaching that module when the lectures begin. The overarching theme for the topics are the fundamentals of human sciences so that students grasp what human sciences are all about.

Reference books:

Readings for each of the modules will be given with the commencement of the lectures. There is no single textbook as such for all four modules.

5.Teaching-Learning Strategies in brief:

Each module will have one faculty giving six lectures of 90 mins each. Through discipline specific modes of understanding and everyday examples, class lectures will enable students to connect and ponder about themselves, the society and cultures that surrounds them. The teaching-learning strategy emphasises the merits of avoiding simplistic solutions to complex problems and instead ask meaningful questions that enrich debates about how we produce, distribute, consume, reflect, represent, and govern ourselves. Lectures impress upon students the need to critically reflect on issues that are impacted by technology, the historical and social context of the world they live in, the literary and philosophical ideas that permeate human thought and psychological principles of human behaviour.

6.Assessment methods and weightages in brief:

This is mainly a writing-driven course, and the evaluation questions are carefully designed to make students think independently. Students are assessed for abilities like critically assessing issues, questioning assumptions, clarifying distinctions, and bringing out nuances. In assignments and exams, students are expected to demonstrate these abilities by presenting their views clearly and systematically. Students will be evaluated for each of the four modules and the pattern of evaluation will be decided by the respective faculty.

Evaluation pattern can include weekly assignments, quizzes and term papers. Each module will carry 25 % of total marks. The End Semester exam carries 25% of marks.

Title of the course	: Intro to Processor Architecture
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Faculty Name : Deepak Gangadharan

Course Code : EC2.204

L-T-P : 3-1-0

Credits : 2 (Half semester course)

(L=Lecture hours, T=Tutorial hours,

P=Practical hours)

Name of the Academic Program: B-Tech in Computer Science and Engineering

1. Prerequisite Course/Knowledge

Digital Systems and Microcontrollers

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1. Explain Instruction Set Architecture (ISA) and the different paradigms RISC and CISC.

CO-2. Employ the different instructions and addressing modes to write assembly programs.

CO-3. Describe the instruction encoding in an ISA.

CO-4. Design and Develop Sequential and Pipelined Implementation of a Processor.

CO-5. Explain the different types of cache memories in memory hierarchy and its impact.

CO-6. Explain the importance of virtual memory and associated concepts such as page table, page faults and address translation.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	-	1	-	-	-	-	2	-	3	-	-	1	1	
CO2	2	1	-	2	3	-	-	-	2	2	-	3	1	1	-	
CO3	1	1	-	1	-	-	-	-	2	-	3	-	-	1	1	
CO4	3	2	-	2	3	-	-	2	3	2	-	3	3	2	1	3
CO5	1	1	-	1	-	-	-	-	2	-	3	-	-	1	1	
CO6	1	1	-	1	-	-	-	-	2	-	3	-	-	1	1	

Note: '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4. Detailed Syllabus

Unit 1: Introduction to Processor Architecture – Definition of Computer System, Models of Computer Architecture, Programming Abstractions, Definition of Instruction Set Architecture, ISA Design Paradigms: RISC vs CISC

Unit 2: Machine Level Representation of Programs – Accessing Information: Operand Specifiers, Addressing Modes, Data Movement Instructions, Push and Pop Instructions, Arithmetic and Logic Operations, Condition Codes, Accessing Condition Codes, Jump Instructions and Encoding, Conditional Branches, Loops, Switch Statements

Unit 3: Processor Architecture – Instruction Set Architecture, Sequential Implementation, Principles of Pipelining, Pipelined Implementation

Unit 4: Memory Hierarchy – Storage Technologies, Locality, Types of Cache Memories, Impact of Cache on Program Performance

Unit 5: Virtual Memory – Physical and Virtual Addressing, Page Tables, Page Hits, Page Faults, Address Translation

Reference Books:

1. Randal E. Bryant and David R. O'Hallaron. *Computer Systems : A Programmer's Perspective* – 3rd Global Edition.

2. David A. Patterson and John L. Hennessy. *Computer Organization and Design: The Hardware/Software Interface* – 5th Edition.

6. Teaching-Learning Strategies in brief

Weekly lectures cover the topics in the syllabus. Tutorials introduce the students to Verilog programming and general instructions on how to write Verilog program for various building blocks of a processor architecture – such as instruction decode, ALU, etc. There is one major project where each student designs and develops a HDL program for a pipelined processor architecture based on the theory covered in the lectures.

7. Assessment methods and weightages in brief

Type of Evaluation	Weightage (in %)
Quiz 1	10
End Sem Exam	30
Project	60

Title of the Course : **Introduction to UAV Design**

Faculty Name : Harikumar Kandath

Course Code : EC4.402

L-T-P : 3-1-0,

Credits : 4

(L= Lecture hours, T=Tutorial hours, P=Practical hours)

1.Prerequisite Course / Knowledge:

Basics of Linear Algebra, Laplace transform and Vector calculus.

2.Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to..

CO-1 Determine the design specifications of the Unmanned Aerial Vehicle (UAV) used for a particular application.

CO-2 Explain the various design phases involved in the UAV design.

CO-3 Perform the conceptual design and preliminary design for multi-rotor, fixed-wing and hybrid UAVs.

CO-4 Perform the stability and flight performance analysis for the designed UAV.

CO-5 Able to manufacture a prototype UAV.

CO-6 Perform the flight simulation and flight testing of the prototype UAV and verify its stability and performance characteristics.

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes

(POs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	3
CO2	2	2	3	1	1	1	1	1	1	1	1	1	1	1	1	3
CO3	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	3
CO4	3	3	2	1	1	1	1	1	1	1	1	1	1	1	1	3
CO5	2	2	3	1	2	1	1	1	3	1	1	1	1	1	1	3
CO6	2	2	2	1	1	1	1	1	3	1	1	1	1	1	1	3

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs.

Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

Unit 1: Types of UAVs--- Multi-rotors, fixed wing (FWUAV), Hybrid VTOLs

Unit 2: Multi-rotor design--- Concept of operation (CONOPS), design specifications, different reference frames, axis conventions, forces and moments, sizing and assembly, sensors and control.

Unit 3: FWUAV Flight mechanics and control--- wing, fuselage, stabilizer and control surfaces, propulsion system, forces (lift, drag, thrust, side force), moments (roll, pitch, yaw), trim conditions, longitudinal static stability, lateral and directional stability, PID control through successive loop closure.

Unit 4: FWUAV design-- Concept of operation (CONOPS), design specifications, preliminary sizing, airfoil selection, wing planform selection, control surface sizing, stabilizer sizing, selection of propulsion system (battery, motor/engine, propeller), stability and performance analysis, design trade-offs.

Unit 5: Different configurations (tilt-rotor, tail sitter), transition dynamics, design specifications, sizing, stability and control.

Reference Books:

Daniel P Raymer, Aircraft Design: A Conceptual Approach, second edition, AIAA USA, 1992.

1. John D. Anderson, Introduction to flight, third edition, McGraw Hill USA, 1989.

2. R. W. Beard and T. M. McClain, Small Unmanned Aircraft: Theory and Practice, first edition, Princeton University Press USA, 2012

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

Weekly lectures based on the course syllabus and based on the latest design technologies available in the literature and other industrial resources. Tutorials covering the use of software for UAV design and performance analysis. Detailed student assignment for practicing the different elements of conceptual design phase. Open book exam followed by detailed project submission including simulation studies, prototype development and flight testing.

6. Assessment methods and weightages in brief (4 to 5 sentences):

Type of Evaluation	Weightage (in %)
Quizzes	10
Assignments	40
Project	50

Title of the Course : **Introduction to Algorithm Engineering**

Faculty Name : Kishore Kothapalli

Course Code : CS1.305

Credits : 2

L - T - P :

(L - Lecture hours, T-Tutorial hours, P - Practical hours)

Semester, Year : Spring 2023

(Ex: Spring, 2022)

Pre-Requisites : first course on algorithms, programming, computer architecture/ organization

Course Outcomes :

(list about 5 to 6 outcomes for a full 4 credit course)

The action verbs to be used for writing the course outcomes can be found on slide 22 in the following presentation. You may remove this line and the following link after the course outcomes are formulated.

https://iiitaphyd-my.sharepoint.com/:b/r/personal/dyacad_iit_ac_in/Documents/NBA-2020-21/Reference%20Documents/Curriculum%20Design%20in%20NBA%20Framework%20and%20Course%20design%20for%20all%20faculty%20IIT%20Hyderabad%207th%20July%202021.pdf?csf=1&web=1&e=387W1k

At the end of the course, a student will be able to:

CO – 1: Demonstrate familiarity and scope of algorithm engineering

CO – 2: Explain the significance of algorithm engineering and analyze the practical performance of algorithms in connection to the nature of input

CO – 3: Apply algorithm engineering principles to implement a variety of graph and semi-numerical algorithms

Course Topics :

(please list the order in which they will be covered, and preferably arrange these as five to sixmodules.)

1. Introduction to algorithm engineering, its scope, and its importance – 1
2. Cache-Aware Design: Algorithms and Techniques – 1
3. Cache-Oblivious Design: Algorithms and Techniques -1
4. A Primer on Parallel Algorithms – 3
5. Graph connectivity – 2
6. Eccentricity and Diameter – 2
7. Centrality Measures on Graphs – 2

Preferred Text Books :

Reference Books : Reference papers that are used for some of the course topics will be posted as they are discussed in class.

E-book Links : Book being developed by the instructor available at <http://cstar.iiit.ac.in/~kkishore/pgae.pdf>

Grading Plan : Since the course is a half-course, we will have one quiz evaluation and one final evaluation.

Type of Evaluation	Weightage (in)
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	%)
Quiz-1	20%
Mid Sem Exam	
Quiz-2	
End Sem Exam	30%
Assignments	25%
Project	25%
Term Paper	
Other Evaluation	

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at
https://iiitaphyd-my.sharepoint.com/:w/r/personal/dyacad_iit_ac_in/Documents/NBA-2020-21/Course%20Content/IIIT-CSE-ECE.docx?d=w111foeffcae41b3a4d1e8a3fbc6332d&csf=1&web=1&e=z1Khby

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P O9	PO 10	PO 11	PO 12	PO 1	PSO 2	PSO 3	PSO 4
CO 1	1	2	2	2	1	1	1	1	1	2	1	1	2	1	1	2
CO 2	1	2	2	2	1	1	1	1	2	2	1	1	2	1	1	2
CO 3	1	2	3	3	1	1	1	1	2	2	1	1	2	1	1	2

Teaching-Learning Strategies in brief (4-5 sentences) :

The course will have hands-on exercises that help students understand the mechanisms available for algorithm engineering. The course project also equips them to explore an existing algorithm and a problem in depth and gain useful practical knowledge. The material used in the course is not part of standard textbook as yet, so lecture slides and reference papers will be made available for reading.

Title of the Course	: INTRODUCTION TO BRAIN AND COGNITION
Faculty Name	: Kavita Vemuri
Course Code	: CS9.311
Credits	: 2

L - T - P : 2-0-0

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year : Spring 2022 (H2)

(Ex: Spring, 2022)

Name of the Program : BTech CSE

Pre-Requisites : **NONE**

Course Outcomes :

(list about 5 to 6 outcomes for a full 4 credit course)

After completion of this course successfully, the students will be able to:

CO-1: develop understanding and familiarity with seminal research findings in brain and cognition.

CO-2: read, interpret, critique, and evaluate research explaining brain/mind/behavior.

CO-3: critically think about the relationship between diverse fields such neuroscience, cognitive psychology, and cognitive science

CO-4: critical understanding and evaluation of the experiments, methods and practices for empirical and computational investigation of cognition utilizing various instruments by different teams in Cognitive Science Lab in order to make informed decision about the Lab to work for further research in the Dual Degree Program

Course Topics :

(please list the order in which they will be covered, and preferably arrange these as five to six modules.)

Module 1: Introduction

Brain Anatomy basics; Spatial and temporal aspects of the Brain and Cognition; Methods of Investigation of the Brain and Cognition

Module 2: Vision

Visual Perception; Recognizing Objects; Attention

Module 3: Memory

Acquisition; Relation between Acquisition and Retrieval; Memory of Complex Events

Module 4: Knowledge

Concepts; Language

Module 5: Thinking

Problem Solving and Intelligence; Conscious and Unconscious Thought

Preferred Text Books :

- Daniel Reisberg (2019). *Cognition: exploring the science of the mind*. 7th Edition. W. W. Norton & Company, NY, USA
- V. Srinivasa Chakravarthy (2019). *Demystifying the Brain: A Computational Approach*. Springer, Singapore (1st Edition).

Reference Books :

- Eric Kandel, James H. Schwartz, and Thomas Jessell (2012). *Principles of Neural Science*. McGraw Hill Education (5th Edition).
- John R. Anderson (2009). *Cognitive Psychology and its Implications*. Worth Publishers (7th Edition).

E-book Links :

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quizzes (3 out of 4: each 20%)	60%
End Sem Exam	30%
Term Paper	10%

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	1	1	2	1	1	1	1	1	2	1	1	1	1
CO2	3	1	2	3	1	3	3	1	1	1	1	2	2	2	3	2
CO3	2	1	2	2	1	3	2	2	1	1	1	2	1	2	3	1
CO4	1	1	1	1	1	1	1	1	2	3	1	2	1	1	1	1

Teaching-Learning Strategies in brief (4-5 sentences) :

The IBC course is primarily lecture and discussion-based learning course. Students will be introduced to undergraduate-level introductory topics and issues in brain and cognition. Reading material will be assigned. Students will be required to engage in discussions, and to write a term paper on related topics. Students will be encouraged to relate the theory topics to everyday experiences and will be asked to evaluate the event/phenomenon/ processes critically and scientifically. They will be encouraged to interact with various research teams in Cognitive Science Lab to familiarize themselves with the research projects so that they can start thinking about a future lab to conduct their research work.

Title of the Course

: Introduction to Coding Theory

Faculty Name

: Lalitha V

Course Code

: EC5.205

L-T-P

: 1.5-0.5-0

Credits

: 2

(L= Lecture hours, T=Tutorial hours, P=Practical hours)

Name of the Academic Program: B. Tech in ECE, B. Tech in CSE

1. Prerequisite Course / Knowledge:

Linear Algebra

2. Course Outcomes (COs) :

After completion of this course successfully, the students will be able to:

CO-1: Explain the importance of redundancy and block codes as well as their parameters

CO-2: Discuss the characteristics of linear codes including generator matrix, parity-check matrix and dual code

CO-3: Apply encoding and decoding algorithms to linear codes

CO-4: Analyze the dependence between various parameters of the codes

CO-5: Deduce the additive, multiplicative and vector space structure of finite fields

CO-6: Construct BCH and Reed Solomon codes, given the specifications of the problem.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	-	-	-	-	-	-	-	2	1	3	1	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	1	3	1	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	1	3	1	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO6	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-

4. Detailed Syllabus:

Unit 1: Noisy channels, block codes, encoding and decoding, maximum-likelihood decoding, minimum-distance decoding, error detection and correction.

Unit 2: Minimum distance, generator and parity-check matrices, dual codes, standard array decoding, syndrome decoding. Repetition codes, Hamming codes.

Unit 3: Hamming bound, Singleton bound, Gilbert-Varshamov bound, Plotkin bound.

Unit 4: Definitions, prime fields, construction of prime power fields via irreducible polynomials, existence of primitive elements, minimal polynomials.

Unit 5: Bose-Choudhury-Hocquenghem (BCH) codes, Reed-Solomon codes. Applications of Reed-Solomon codes in digital communications and storage.

Reference Books:

1. R. Roth, Introduction to Coding Theory, Cambridge University Press, 2007.
2. W.C. Huffman and V. Pless, Fundamentals of Error Correcting Codes, Cambridge University Press, 2003.
3. S. Lin and D.J. Costello, Error Control Coding, Pearson, 2011
4. R.E. Blahut, Algebraic Codes for Data Transmission, Cambridge University Press, 2003

5. Teaching-Learning Strategies in brief (4 to 5 sentences):

The course has lectures supported by tutorials. In tutorials, problems related to the concepts presented in the class are solved by teaching assistants. Exams are conducted periodically so that students can actively engage with the course material. Viva is conducted at the end of the course to assess how students are able to apply concepts learnt in the class to new problems. A project is given towards the end of the course, which requires the students to present a research paper in the area of coding theory in detail.

6. Assessment methods and weightages in brief (4 to 5 sentences):

Type of Evaluation	Weightage (in %)
2 Mid Semester Exams	$2 \times 10 = 20\%$
Assignments	30%
Viva	10%
Project	20%
End Semester Exam	20%

Title of the course : Introduction to the Existential Philosophy

Faculty Name : Shipra Dikshit
 Course Code : HS0.213
 Credits : 4
 L - T - P : 3-0-0
 (L - Lecture hours, T-Tutorial hours,
 P - Practical hours)
 Semester, Year : Spring 2023
 (Ex: Spring, 2022)
 Name of the Program : B.Tech in Computer Science and Engineering

Pre-Requisites : Passed Intro to Human Sciences, CHD students 3rd and 4th years.

Course Outcomes :

At the end of the course the student will be able to:

- CO1: Understand and evaluate basic Existential questions like: What is the meaning of life? What is authenticity? And other concepts of Existentialism.
- CO2: Demonstrate understanding of the concept of absolute freedom.
- CO3: Apply the understanding of the relationship between finitude and human existence and the relationship of existentialism to technology.
- CO4: Analyze the concepts of authenticity, subjectivity and ambiguity of human existence.
- CO5: Evaluate the concept of absurdity and the human condition and reflect on the quest for meaning in a world of absurdity.
- CO6: Create, inculcate and practice various concepts of Existentialism and take position in reference to these larger philosophical concepts.

Course Topics :

Module I: Emergence of Existence as a philosophical problem

- (i) What is Existentialism? A Brief History from Fyodor Dostoevsky to Simone de Beauvoir.
- (ii) Edmund Husserl and the notion of the lifeworld
- (iii) Martin Heidegger, Jean-Paul Sartre, and the understanding of 'being'

Module II: Freedom and Subjectivity.

- (i) Soren Kierkegaard and the importance of the individual
- (ii) Freedom and subjectivity according to Jean-Paul Sartre.

(ii) Jean-Paul Sartre and Simone de Beauvoir on Anxiety, Nothingness and Ambiguity.

Module III: Cartesian legacy and its critique from embodiment

- (i) Rene Descartes, the mind-body problem, and the emergence of bodily existence
- (ii) Jean-Paul Sartre on ‘Existence precedes essence’
- (iii) Maurice Merleau-Ponty and the phenomenology of embodiment
- (iv) Simone de Beauvoir and the gendered body

(4) Module IV: Absurdity and the Human Condition.

- (i) Friedrich Nietzsche on nihilism and the concept of ‘Superman’
- (ii) Nietzsche and the ‘death of God’
- (iii) Existentialism and the question of technology

Preferred Text Books :

- Aho, K, 2014. *Existentialism, An Introduction*: Cambridge, Polity Press.
- Cooper, D, 1999. *Existentialism*, Oxford: Blackwell.
- Blackham, H.J. 1961. *Six Existential Thinkers*. London: Routledge and kegan Paul.
- Hubben, W.(1997), *Dostoevsky, Kierkegaard, Nietzsche and Kafka*, New York: Simon and Schuster
- Reynolds, J. 2006, *Understanding Existentialism*. Chesham: Acumen Press.

Reference Books:

- Kohn: Existentialism Here and Now.
- David Cogswell: Existentialism for Beginners
- Steven Crowell: The Cambridge Companion to Existentialism
- Cottingham, John. (ed). The Cambridge Companion to Descartes. (United States of America: Cambridge University Press, (1993).
- Felicity Joseph, Jack Reynolds and Ashley Woodward (ed). The Continuum Companion to Existentialism. London and New York: Continuum International Publishing Group, 2011
- Sartre: Existentialism is Humanism.
- Sartre: The Transcendence of the ego
- Sartre: Being and Nothingness.
- Merleau-Ponty, Maurice. Phenomenology of Perception. Translated by Colin Smith. New York: Routledge Publications, 2005.
- Beauvoir: The Ethics of Ambiguity
- Beauvoir: The Second Sex
- Albert Camus: The Stranger

Articles:

- Whitford, Margaret. An interpretative Account: Merleau-Ponty’s Critique of Sartre. *French Studies*. Volume.33, 1979: pp. 305-318.
- Carman, Taylor. The Body in Husserl and Merleau-Ponty. Barnad College Columbia University Press, 2008.
- Cassam, Quassim. “Embodied Self.” *Oxford Handbook of the Self*. 2001, 1-30.
- Dufrenne, Mikel and John Stewart. “Sartre and Merleau-Ponty.” The Debate between Sartre and Merleau-Ponty. Vol. 33, 1979: 279-289.
- Ruitenberg, Claudia W. “Philosophy and Lived Experience: A Phenomenological Revival?” *Philosophy of Education*, 2012: 11-14.
- Beauvoir, Simone-de. “Merleau-Ponty and Pseudo- Satreanism.” *International studies in Philosophy*. Vol.21, no.3. 1989:3-48.

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz-1	8%
Mid SemExam	20%
Quiz-2	7%
End Sem Exam	35%
Assignments	(15x2) 30%

Mapping of Course Outcomes to Program Objectives:

(1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	2	1	-	2	1	3	1	1	1	2	-	1	1	2
CO2	-	-	2	1	-	2	1	2	1	2	1	3	-	1	1	3
CO3	-	-	2	1	1	3	2	2	2	1	1	3	-	1	1	1
CO4	-	-	2	1	-	1	1	3	3	1	1	2	-	1	1	2
CO5	1	1	2	2	2	2	2	3	2	2	1	3	1	2	2	3
CO6	-	-	2	1	-	3	1	3	3	2	1	3	-	2	1	3

Teaching-Learning Strategies in brief (4-5 sentences) :

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 500 to 800 pages of books and articles, and submit written work between 3,000 to 4,000 words, cumulatively.

In each class some select students will be given a small topic from the next class to read up on, and they will be expected to initiate discussions around these.

The assignments and exams will focus on training students to develop their own ideas, and apply these to understanding the role of technology on our everyday modes of being. The course will encourage students to develop the ability to think beyond the given norms and also, apply them to their very understanding of being.

Title of the course

: **Introduction to Film**

Faculty Name

: Sushmita Banerji

Name of the Program

: Open Elective

Course Code

: HS1.208

Credits

: 4

L - T - P

: 3 – 1- 0

Semester, Year : Spring, 2023

Pre-Requisites : **Introduction to Human Sciences**

Course Outcomes

1. Introduce students to basic terms of film analysis and interpretation.
2. Introduction to Fundamental theories of cinema studies

3. Understand cinema as a medium, a phenomenon, art, and industrial practice.
 4. Introduction to Global Cinema Movements
 5. Introduction to Cinema in Art and Politics

Course Topics

Unit 1: Basic terms of analysis and interpretation. Misè-en-Scène, Cinematography, Editing, Sound, Narrative, Genre.

Unit 2: Fundamental conversations on medium specificity, Realism in Cinema, Phenomenology of film, the Soviet School, Digital Cinema.

Unit 3: Introduction to cinema movements. May include – German Expressionism, New Wave/s, Noir, Indian art film movement.

Preferred Text Books

Leo Braudy and Marshall Cohen, eds. *Film Theory and Criticism*, 6th Edition, (Oxford: 2004)

J. Dudley Andrew. *The Major Film Theories: An Introduction* (Oxford University Press, 1976)

Jill Nelmes (ed.) *An Introduction to Film Studies* (5th ed) (Routledge, 2012)

Reference Books

David Bordwell and Kristin Thompson. *Film Art: An Introduction* (10th ed) (Mc Graw-Hill Education, 2013)

David Bordwell and Kristin Thompson. *Film History: An Introduction*. McGraw-Hill Education; 9th ed. (2010)

J. Dudley Andrew. *Concepts in Film Theory* (Oxford University Press, 1984)

Sergei Eisenstein, Jay Leyda (ed.) *Film Form: Essays In Film Theory* (Mariner Books, 1969)

André Bazin *What Is Cinema* (vol 1 and 2) (University of California Press, 2004)

Grading Plan

Type of Evaluation	Weightage (in %)
Quiz 1	10%
Mid Semester Exam	20%
Quiz 2	10%
Assignment 1	25%
Assignment 2	25%

Mapping of Course Outcomes to Program Objectives

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1			2													3
CO2													2			
CO3						2							3			
CO4						2							3			
CO5			2			2							3			

Teaching-Learning Strategies in brief (4-5 sentences):

Students will learn to engage and interpret cinema critically; will be familiar with basic theoretical tools, and with the ways in which cinema has changed over time.

Students are expected to read up to 30 pages a week, watch recommended films, and attend film screenings when required.

Title of the Course

: Introduction to Game Theory

Faculty Name

: Sujit Gujar

Course Code

: CS1.408

L-T-P

: 3-1-4

Credits

: 4

(L= Lecture hours, T=Tutorial hours, P=Practical hours)

1.Prerequisite Course / Knowledge:

Basic Knowledge in Linear Algebra, Probability Theory and comfortable in basic maths

2.Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to

CO-1 understand how to define a game and strategies in a game

CO-2 demonstrate familiarity with different solution concepts in game theory

CO-3 write algorithms to solve many game theoretic problems

CO-4 understand the concept of mechanism design (incentive engineering)

CO-5 analyze given autonomous system for any strategic behavior of the agents

CO-6 design mechanism for autonomous agent systems to make them game theoretically sound

CO-7 design agents to participate in auction-based competition

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific

Outcomes (PSOs) – Course Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	1	3	1	1	1	1	1	1	1	1	3	3	1	1	3
CO2	1	1	3	1	1	1	1	1	1	1	1	3	3	1	1	3
CO 3	1	3	3	1	3	1	1	1	1	2	1	3	3	1	1	3
CO 4	1	2	3	1	2	2	1	1	1	1	1	3	3	1	1	3
CO 5	2	3	3	3	2	2	1	1	1	1	1	3	3	2	2	3
CO 6	3	3	3	2	2	2	1	1	1	1	1	3	3	3	2	3
CO7	3	2	3	2	3	3	1	1	3	3	1	3	3	3	2	3

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

- (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.

Reference Books:

1. "Game Theory and Mechanism Design" by Y Narahari.
2. "Game Theory: Analysis of Conflict", by Roger B. Myerson.

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

The course is designed mix of theory and practice. The theory part is planned to be taught with posing questions to the students to make them think how intelligent agents should behave in the give situation. The students are evaluated regularly with quizzes. To expose students to deep research aspects there are reading assignments. To enable learning practical aspects, there are programming assignment and tournament where they write their strategic agents. The assignments are done in teams to enable peer learning. To further enhance the knowledge further, the reading assignments are peer-evaluated.

6.Assessment methods and weightages in brief (4 to 5 sentences):

Type of Evaluation	Weightage (in %)
Mid Sem Exam	-
End Sem Exam	25
Quizzes/Reading Assignment	15
Programming/Reading Assignments	15
Scribes	5
Course Participation	5
Project (Competition)	10

Title of the Course : Introduction to Information Security

- Faculty Name : Ashok Kumar Das
 Course Code : CS8.301
 L-T-P : 3-1-0
 Credits : 2 (Half semester course)
 (L= Lecture hours, T=Tutorial hours, P=Practical hours)
 Name of the Academic Program B.Tech. In CSE / M.Tech. in CSE/CSIS

1.Prerequisite Course / Knowledge:

Discrete Structures, Programming Languages

2.Course Outcomes (COs) :

After completion of this course successfully, the students will be able to

CO-1: Demonstrate problem solving skills related to security

CO-2: Demonstrate critical thinking skills

CO-3: Demonstrate security protocols practically

CO-4: Demonstrate knowledge of Blockchain technology and its security aspects

CO-5: Demonstrate knowledge of Design and analysis of Internet of Things (IoT)-related security protocols

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	2	3	2	2	2	2	2	2	2	2	2	2	3
CO2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	3	3
CO3	1	1	2	2	3	2	2	2	1	2	2	2	2	2	3	3
CO4	1	1	2	2	3	2	2	2	1	1	2	2	2	2	3	3
CO5	1	1	2	2	3	2	3	2	1	1	2	2	2	2	2	3

Note '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

4. Detailed Syllabus:

- **Unit 1:** Basics of Cryptography: Cryptographic goals and objectives; Types of attacks, passive and active attacks; Introduction to Number Theory; Complexity Theoretic Connections; Overview of symmetric and public key cryptography
- **Unit 2:** Basics of System Security: Overview of intrusion detection: Types of intruders, intrusion detection and prevention mechanisms; Overview of software vulnerabilities: Overview of phishing, Buffer Overflow (BOF), heap overflow, and SQL injection attacks
- **Unit 3:** Basics of Network Security: Overview of encrypting communication channels
- **Unit 4:** Introduction to Internet of Things (IoT) security: IoT architecture; various IoT applications; security requirements, security attacks, threat model for the IoT ecosystem; taxonomy of security protocols
- **Unit 5:** Introduction to Blockchain technology: Various applications of Blockchain of Things (BCoT); centralized versus decentralized models; types of blockchain; brief overview of various consensus algorithms; block formation and addition in a blockchain

Reference Books:

1. William Stallings, "Cryptography and Network Security: Principles and Practices," Pearson Education, 6th Edition, 2014.

2. Bernard Menezes, "Network Security and Cryptography," Cengage Learning, 2010.

3. Behrouz A. Forouzan, "Cryptography and Network Security," Special Indian Edition, 2010.

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

- * Design of efficient and secure symmetric/public key cryptosystems
- * Design of efficient intrusion detection systems
- * Understanding various system related attacks and their remedies
- * Understanding security aspects of IoT-related applications
- * Understanding Blockchain technology and its usage in various real-life applications

6. Assessment methods and weightages in brief (4 to 5 sentences):

- In-Class Tests: 20%
 - Assignments: 20%
 - Mid Semester Examination: 20%
 - End Semester Examination: 40%
-

Title of the Course	: Introduction to NLP
Faculty Name	: Manish Srivastava
Course Code	: CS7.401
Credits	: 4
L - T - P	: 3-1-0
(L - Lecture hours, T-Tutorial hours, P - Practical hours)	
Semester, Year (Ex: Spring, 2022)	: Spring, 2023
Name of the Program	: B.Tech. in Computer Science and Engineering

Pre-Requisites : **None**

Course Outcomes :

After completion of this course successfully, the students will be able to –

- CO-1. Demonstrate the knowledge of stages and fundamental building blocks of NLP
- CO-2. Apply NLP machine learning algorithms for classification, representation, and parsing
- CO-3. Demonstrate the knowledge of Dense vector representation for NLP
- CO-4. Explain the concepts behind distributed semantics
- CO-5. Discuss the approaches to global and contextual semantic representation
- CO-6. Apply the above concepts for fundamental NLP tasks.

Course Topics :

Unit 1: Stages of NLP: from lexical to semantic. Fundamental Language processing: Tokenization, Language modeling, Text classification,

Unit 2: Morphology, POS Tagging, Chunking, Discriminative vs generative modes, HMM and CRF

Unit 3: Syntax parsing: Constituency and Dependency, PCFG, projectivity Arc-eager

Unit 4: Distributed semantics: SVD, Word2Vec, RNN, LSTM,

Unit 5: Contextual Distributed semantics: Elmo, BERT

Preferred Text Books : Christopher D. Manning and Hinrich Schütze. 1999. Foundations of Statistical Natural Language Processing. MITPress.

Reference Books :

Jurafsky, Dan, and James H. Martin. *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*. Upper Saddle River, N.J.: Prentice Hall, 2000.

E-book Links :

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz	10
Mid SemExam	10

End Sem Exam	20
Assignments	20
Project	40

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

https://iiitaphyd-my.sharepoint.com/:w/r/personal/dyacad_iit_ac_in/Documents/NBA-2020-21/Course%20Content/IIIT-CSE-ECE.docx?d=w111foeffcae41b3a4d1e8a3fbc6332d&csf=1&web=1&e=z1Khby

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	3	2	2	2	1	-	1	1	1	3	3	3	3	2
CO2	3	3	3	3	3	1	1	1	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	-	-	-	2	2	2	3	3	3	2	3
CO4	3	3	3	3	3	-	-	-	2	2	2	3	3	3	2	3
CO5	3	3	3	3	3	-	-	-	2	2	2	3	3	3	2	3
CO6	3	3	3	3	3	1	1	1	3	3	3	3	3	3	3	3

Teaching-Learning Strategies in brief (4-5 sentences) :

Lectures by integrating ICT into classroom teaching, weekly tutorials involving problem solving and active learning by students and Project-based Learning by doing four assignments and a project. Evaluation based on personal viva to judge deeper understanding.

Title of the Course

: Introduction to Particle Physics

NAME OF FACULTY : Subhadip Mitra

Name of the Academic Program : CND

Course Code : SC1.420

L-T-P : 3-1-0.

Credits : 4

(L=Lecture hours, T=Tutorial hours,

P=Practical hours)

1.Prerequisite Course / Knowledge:

Some exposure to Quantum Mechanics & basic Mathematics (i.e., some linear algebra & complex analysis, basic group theory etc.) and most importantly, interest about the subject.

2.Course Outcomes (COs):

After completing this course successfully, the students will be able to

CO-1 **Describe** the particle content of the Standard Model.

CO-2 **Discover** the various types of interactions among the elementary particles/antiparticles and the role of various symmetries and **classify** the particles according to their quantum numbers.

CO-3 **Discover** the representation of elementary processes with Feynman diagrams.

CO-4 **Recognize** the relativistic generalization of Quantum Mechanics through the Klein-Gordon and Dirac equations and **outline** the basic workings of Quantum Electrodynamics.

CO-5 **Apply** their knowledge and **calculate** simple processes (like two-body decay or two-going-to-two scattering, etc.).

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1										2		1		3	
CO2	2	2									2		2		3	
CO3	3	2									2		2		3	
CO4	3	3	1										1	1	3	
CO5	3	3	2										1	2	3	

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

Unit 1: Introduction: developments throughout the 19th century as the backdrop. From abstract atoms to the Large Hadron Collider, Elementary particles and forces, the Standard Model.

Unit 2: Relativistic kinematics and Symmetries of nature: the SU(2) & SU(3) groups and their connections with the elementary particles, discrete symmetries, antiparticles.

Unit 3: The Klein Gordon equation & the basics of the perturbation theory.

Unit 4: Core Concepts: Electrodynamics of spin-less particles, Feynman diagrams and rules, Dirac equation, Quantum Electrodynamics

Unit 5: Advanced Topics: Parton model and a little QCD, collider physics – a (very) quick tour, introduction to HEP computing – Monte Carlo tools, some basic simulations, challenges in modern particle physics, role of modern computing

Reference Books:

1. D J Griffiths, Introduction to Elementary Particles, John Wiley & Sons.
2. F Halzen and A D Martin, Quarks and Leptons, John Wiley & Sons.
3. D H Perkins, Introduction to High Energy Physics, Cambridge U.
- 4.

5.Teaching-Learning Strategies in brief:

This is an introductory (elective) course on Particle Physics designed to give the students who have no prior exposure to Quantum Field Theory a broad overview and some taste of the exciting world of Particle Physics. The approach would be somewhat intuitive. The design is for students with diverse backgrounds. The focus would be on concepts, simple explanations, and intuition building.

6.Assessment methods and weights in brief:

Assignments + Quizzes – (30%), Mid-term evaluation (30%), Final exam (40%)

Title of the Course**: Introduction to Philosophy of Technology**

Faculty Name

: Ashwin Jayanti

Name of the Academic Programs

: B.Tech. in CSE, B.Tech in ECE

Course Code

: HS0.204

L-T-P

: 3-0-0

CREDITS

: 4

(L = Lecture hours, T = Tutorial hours,

P = Practical hours)

1. Prerequisite Course /Knowledge:**None****2. Course Outcomes (COs):****After completion of this course successfully, the students will be able to:****CO-1:** Identify and recognize various conceptions of technology implicit in arguments for/against technology**CO-2:** Classify and describe various theories and interpretations of technological change through history**CO-3:** Compare analytical and continental approaches to technology and its relation to science and examine the limitations and advantages of both **the approaches****CO-4:** Assess the moral significance of technical artefacts within particular social contexts**CO-5:** Develop philosophical frameworks **in order** to understand and assess the impact of contemporary technologies to society at large**3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix**

PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10

PO11 PO12 PS PS PS PS

O1 O2 O3 O4

CO1	-	-	2	-	-	3	2	3	2	3	1	3	-	-	-	-
CO2	-	-	1	-	-	3	2	2	-	-	-	3	-	-	-	-
CO3	-	-	1	-	-	3	2	2	-	1	-	3	-	-	-	-
CO4	-	-	2	1	-	3	3	3	1	2	-	3	-	-	1	-
CO5	1	1	3	3	-	3	3	3	1	2	-	3	-	-	-	-

3 in the table denotes high level mapping, 2 denotes moderate level and 1 denotes low level

Detailed Syllabus:**Unit I** –Introduction: What is Philosophy of Technology? Engineering and Humanities Philosophies of Technology; Classical and Contemporary Philosophy of Technology**Unit II: Encountering Technological Artefacts** –Conceptual history of ‘technology’; What is ‘technology’? Continental and Analytic Perspectives

Unit III: Epistemological Aspects to Technologies –Science, Technology, and Engineering; Philosophy of science and philosophy of technology; Knowing-how and knowing-that

Unit IV: Moral Status of Technologies –Norms, Values, and Technologies; Debates Concerning Moral Significance of Artefacts; Role of Design in Moral Status

Unit V: Philosophical Debates in Artificial Intelligence –Philosophical background to Artificial Intelligence; Philosophical and ethical issues within Artificial Intelligence

REFERENCE BOOKS:

- Hans Achterhuis (ed.),*American Philosophy of Technology: The Empirical Turn*, translated by Robert Crease, Indiana University Press:2001.
- Carl Mitcham,*Thinking Through Technology: The Path Between Engineeringand Philosophy*, The University of Chicago Press:1994
- Robert C. Scharff and Val Dusek (eds.),*The Technological Condition: AnAnthology (Second Edition)*, John Wiley& Sons:2014
- Peter-Paul Verbeek,*What Things Do: Philosophical Reflections on Technology, Agency, and Design*, translated by Robert Crease, The Pennsylvania State University Press, 2005
- Peter Kroes and Peter-Paul Verbeek (eds.),*The Moral Status of TechnicalArtefacts*, Dordrecht: Springer,2014.
- Stuart J. Russell and Peter Norvig,*Artificial Intelligence:A Modern Approach*
(Second Edition), Pearson, 2003
- John Searle,*Mind: A Brief Introduction*, Oxford University Press:2004

4. Teaching-Learning Strategies inBrief

This course aims at reading, critically evaluating, and thinking through contemporary debates in philosophy of technology. For this purposes, the main strategy is to share the readings and resource material beforehand for the students to acquaint themselves with the topics and use the class time to discuss and evaluate the implications of the various positions respective to each topic. Continuous assessment methods will be employed to make sure the students have acquired the requisite conceptual understanding to explicate and argue for their position with greater nuance and logical rigor.

5. Assessment Methods and Weightages inBrief

Continuous assessment in the form of written assignments will carry the major weightage of the evaluation, with the rest of the weightage assigned to class participation in the ensuing discussions.

The assigned weightage is as follows: Assignments: 40 marks, class participation: 10 marks, Mid semester exam: 20 marks, End semester exam: 30marks.

Title of the Course : Introduction to Quantum Information and Computation

Faculty Name : Siddhartha Das+Shantanav Chakravarthy

Course Code : CS9.312

LTP : 2-1-0.

Credits : 2

(L= Lecture hours, T=Tutorial hours,

P=Practical hours)

Name of the Academic Program: **B.Tech. in Computer Science and Engineering**

Prerequisite Course / Knowledge:

Knowledge of Advanced Linear Algebra, Quantum Mechanics, Classical information Theory

Course Outcomes (COs):

After completion of this course successfully, the students will be able to..

CO-1. Explain the basic idea of Qubits (Quantum States), Pure and Mixed States, Quantum Measurements, Entanglement, Quantum Gates and the idea of extension of Entropy from Classical to Quantum. Learning Dirac Algebra to solve problems of Quantum Computing and Information

CO-2. Demonstrate familiarity with process like Quantum Measurement, Information processing tasks like Teleportation, Superdense Coding, Entanglement Swapping, s Quantum Circuits.

CO-3: Synthesize proofs of theorems related to Quantum Entropy using the mathematical and logical arguments.

CO-4. Design Quantum Circuits with Universal Gates,

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	2	1	-	-	-	-	-	3	3	3	3	3	3
CO2	2	2	1	3	1	-	-	-	-	-	3	3	2	3	3	3
CO3	1	2	-	3	-	-	-	-	-	-	2	3	2	2	3	3
CO4	1	2	-	3	2	-	-	-	-	-	2	2	3	3	3	3

'3' in the box denotes 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

Detailed Syllabus:

Unit 1. Introduction and Overview: Transition from Classical to Quantum (2L)

Unit 2. Foundations of Quantum Theory I: States, Ensembles, Qubits, Pure and Mixed states, Multi-qubit states, Tensor Products, Unitary transformations, Spectral Decomposition theorem, Singular value Decomposition, Generalized Measurement, Projective Measurement, POVM (4L)

Unit 3. Quantum Entropy and Entanglement: Quantum Entropy, EPR Paradox, Schmidt Decomposition. (2L)

Unit 4. Basic Quantum Information Processing Protocols: Teleportation, Super Dense Coding, Entanglement Swapping. (2L)

Unit 5 Quantum Computation :Introduction to quantum computing, Pauli Gates, Hadamard Gates, Universal Gates, Quantum algorithms . (2L)

Reference Books:

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

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

Teaching-Learning Strategies in brief (4 to 5 sentences):

First of all there will be lectures which will introduce the motivations, concepts, definitions along with simpler examples. After that there are going to be assignments and quizzes that will make sure that the students have understood the concepts. These will be followed by deeper lectures and assignments as the area is interdisciplinary and new. These will also be supplemented with innovative problems so that they can apply the concepts learned by them.

Assessment methods and weightages in brief (4 to 5 sentences):

Mid semester exam- 20%

End SemExam- 30%

Assignment- 15%

Quizz- 15%

Project -20%

Title of the Course : Linear partial differential equations and variational calculus

Faculty Name : Samyadeb Bhattacharya

Course Code : MA4.303

Credits : 4

L - T - P :

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year : Spring 2022

(Ex: Spring, 2022)

Pre-Requisites : Basic knowledge of ordinary differential equations

Course Outcomes :

- a) Getting students equipped with skills to solve practical physical problems.
- b) Basic ideas on partial differentiation, state functions, path functions etc.
- c) Introductory ideas on thermodynamics, wave propagation and heat conduction in connection to partial differential equations.
- d) Solid idea on the basics of partial differential equations and their uses.
- e) Basic idea about constructing boundary value problems.

Course Topics :

1. Basic concepts and definitions.
2. Mathematical problems.
3. Linear operators.
4. Superposition principle.
5. First order quasi-linear equations and method of characteristics.
6. Mathematical models: a) Vibrating strings and membranes, b) Heat conduction, c) Schroedinger equation
7. Classification of second order linear equations.
8. Method of separation of variables.
9. Introduction to eigenvalue problems.
10. Introduction to boundary value problems.
11. Variational calculus. a. Application: Least action principle, brachistochrone and related problems. b. Application:Euler-Lagrange's equation and related problems. c. Hamilton's principle and related problems.

Preferred Text Books :K.T. Tang, Mathematical methods Engineers and scientists 3.

Reference Books :TynMyint-U and Lokenath Debnath, Linear partial differential equations for scientists and engineers. (other references will be given during the course)

E-book Links : Will be shared during the course

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz-1	10%
Mid SemExam	10%
Quiz-2	10%
End Sem Exam	20%
Assignments	25%
Project	25%
Term Paper	
Other Evaluation	

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

https://iiitaphyd-my.sharepoint.com/:w/r/personal/dyacad_iit_ac_in/Documents/NBA-2020-21/Course%20Content/IIIT-CSE-ECE.docx?d=w111foeffcae41b3a4d1e8a3fbc6332d&csf=1&web=1&e=z1Khby

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	3	2	3	2	3	2	2	3	2	3	3	3
CO2	3	2	2	3	3	2	2	3	3	3	3	2	2	3	2	2
CO3	2	2	3	3	3	2	2	3	3	3	2	2	3	3	2	3
CO4	3	3	3	2	3	3	3	3	2	3	2	3	2	3	2	3
CO5	3	3	3	3	2	3	2	3	3	3	3	2	3	3	2	3

Teaching-Learning Strategies in brief (4-5 sentences) :

In this course, the main objective is to help the student understand the fundamental aspects of partial differential equations and their usage in practical problems. The course is of two aspects. First is the technical and mathematical aspect, which will be taught meticulously. Second is that of physical and practical, where student will be taught to construct a physical problem.

Title of the Course

Name of the faculty

: Linguistic Data III-Data modelling in ILs

: Parameswari Krishnamurthy

Course Code : CL3.406
 Credits : 2
 L - T - P : 3-1-0 (L - Lecture hours, T-Tutorial hours, P - Practical hours)
 Semester, Year : Spring, 2023 [H2]

Pre-requisite: Introduction to Linguistics 1

COURSE OUTCOME:

CO-1: Provide understanding of to the necessary concepts and methods for analyzing linguistic data at different levels of language organization.

CO-2: Acquire practical training in analyzing data, storing and modelling it for NLP applications

CO-3: Get training in general analytical thinking, practice and accountability with respect to linguistic data.

CO-4: They will explore data from different Indian Languages (ILs).

CO-5: The students will be exposed to different schemas necessary for future research. We focus simultaneously on language data and on the techniques used.

COURSE TOPICS:

Unit 1: Introduction to Linguistic analysis and Analytical techniques in Linguistics.

Unit 2: Basics of Data and Data Collection and Extraction; Crowd Sourcing; Structured Data acquisition and Pre-processing

Unit 3: Morphological Data Analysis and Compilation. Modelling morphological analysis and generation

REFERENCES BOOKS

Handel, Zev (Compiled and revised). 2009. Asian Linguistics Workbook. Seattle: University of Washington. Based on Hal Schiffman's Asian Linguistics Workbook, a Draft version.

Heine, Bernd and Heiko Narrog (Eds.). 2009. The Oxford Handbook of Linguistic Analysis. New York: OUP.

Langacker, Ronald Wayne. 1972. Fundamentals of Linguistic Analysis. New York: Harcourt Brace Jovanovich.

Nida, E. Nida. 1949. Morphology: The Descriptive Analysis of Words (2nd edition). Ann Arbor, MI: University of Michigan Press.

Sylak-Glassman, J., 2016. The composition and use of the universal morphological feature schema (unimorph schema). Johns Hopkins University.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2		1	1			2	2	1	1	2	3	1	2	3
CO2	2	3		3	3			2	2	1	1	2	3	1	2	3
CO3	2	2		3	3			2	2	3	1	1	3	1	3	3
CO4	2	2		1	1			2	2	1	1	2	3	1	2	3
CO5	2	3		3	3			2	2	1	1	2	3	1	2	3

Grading Scheme:

Assignment: 40 points

Quiz: 20

End Semester Exam: 40 points

Title of the Course : Literature and the Ethics of telling a Story

Faculty Name	: Sushmita Banerji
Course Code	: HSo.210
Credits	: 2 credits
L - T - P:	
Semester, Year	: Spring 2023
Name of the Program	: Humanities Elective

Pre-Requisites:

Introduction to Human Sciences, Ethics 2 (Basics)

Course Description:

Theodore Adorno famously said, “to write poetry after Auschwitz is barbaric.” He was clearly not talking about the act of writing poetry but rather the tension between ethics and aesthetics inherent in an act of artistic production that reproduces the cultural values of the society that generated the mass murder of Jews during WWII. How then does a writer presume to represent/re-present collective acts of extreme brutality while also not validating the culture that produces these violences?

This course shall look at key pieces of literature emerging from periods of extreme violence and orchestrated genocide in the 20th and 21st century to examine and interrogate models of remembering, testimony and representation. Readings shall include writings on the Holocaust, the Partition of India and Pakistan, and regional Indian Literatures.

Course Outcomes:

On successful completion of this course, students will be able to

1. Examine key ethical concepts and explain how they work or fail in the historical of war and genocide.
2. Examine **how** prominent writers have dealt with fundamental ethical questions, moral dilemmas and personal failures and successes in key pieces of writing.
3. Synthesize their knowledge of theories and concepts in ethics to critically examine the world they live in and the cultural production they encounter and produce.

Course Topics:

Unit I: Introduction

Ethics in the World

Literature and its dimensions, What is the value of representation?

Unit II:

Ethical Questions and World War II Literature

Ethics of Suffering

Unit III:

Indian Literatures of Strife

Preferred Text Books:

Adorno, Theodor W., 1997. *Can One Live After Auschwitz?: A Philosophical Reader*, ed. by Rolf Tiedemann, trans. by Rodney Livingstone et al, *Cultural Memory in the Present*. Stanford: Stanford University Press (2003)

Ali,Agha Shahid. *A Country Without a Post Office*. Delhi: Penguin, 2013.

Ao, Temsula, *These Hills Called Home: Stories from a War Zone*. Zubaan/Penguin, 2005.

Bhalla, Alok. ed. *Stories About the Partition of India*. Vol.1,2,3. New Delhi: Indus, 1994.

Levi, Primo, *The Truce*, 1963 trans. by Stuart Woolf. London: Abacus Books (1987).

Reference Books:

Caruth, Cathy. *Unclaimed Experience: Trauma and the Possibility of History*. Baltimore: Johns Hopkins University Press, 1996.

Das, Veena, "Language and Body: Transactions and the Construction of Pain." *Life and Words: Violence and the Descent into the Ordinary*. Berkeley: University of California Press, 2007.

Derrida, Jacques, *Demeure: Fiction and Testimony*, with Maurice Blanchot, *The Instant of My Death*, translated by Elizabeth Rottenberg. Stanford: Stanford University Press, 2000.

Lang, Berel, *Holocaust Representation: Art within the Limits of History and Ethics*. Baltimore: The Johns Hopkins University Press, 2000.

Talbot, Ian. "Literature and the Human Drama of the 1947 Partition." *Partition and Post-Colonial South Asia: A Reader*, Vol. II. Eds. Tai Young Tan and GyaneshKudaisya. London: Routledge, 2008.

Assessments:

Quiz 1	10%
Quiz 2	10%
Quiz 3	10%
End semester exam	20%
Term Paper 1	20%
Term Paper 2	20%

Teaching-Learning Strategies:

Students are expected to read prescribed texts in the course of the semester, watch any video lectures made available, and view films when required. This class is based on close reading of the texts prescribed and relies heavily on student participation and discussion.

This class shall deal with material students might disagree with. All informed disagreements, opinions, and discussions are encouraged. It shall however be the instructor's right to shut down any disrespectful behaviour.

Mapping of Course Outcomes to Program Objectives:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1						3		2								3
CO2						2										3
CO3						3		3								3

Name of the Academic Program : MS in Computer Science
 Course Code : SC4.411
 L-T-P : 4-0-0.
 Credits : 4
 (L= Lecture hours, T=Tutorial hours,
 P=Practical hours)

Prerequisite Course / Knowledge:

Probability & Statistics, Linear Algebra, Statistical Models in AI

Course Outcomes (COs):

After completion of this course successfully, the students will be able to....

CO-1: Learn and demonstrate understanding the basic concepts in machine learning

CO-2: Demonstrate use of machine learning algorithms on simple problems

CO-3: For a selected problem, apply the understanding of the principles, to formulate a problem statement

CO-4: Build Models based on requirements of the problem statement

CO-5: Analyze the constructed models for their usefulness, find deficiencies and identify possible improvements.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	3	1	1	1	1	2	2	1	3	1	1	1	2
CO2	1	2	2	2	1	1	1	1	2	2	1	1	3	1	1	2
CO3	2	3	1	3	1	1	1	1	2	2	1	3	2	1	1	2
CO4	1	3	2	2	1	1	1	1	2	2	1	1	3	1	2	2
CO5	1	3	2	3	1	1	1	1	2	2	1	1	3	1	1	3
CO6	1	2	1	2	2	1	1	1	2	2	1	2	3	2	2	2
CO7																

‘3’ for ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level’ mapping.

Detailed Syllabus:

Unit 1: Overview: Types of problems: regression, classification. Types of machine learning: (a) supervised, (b) unsupervised, (c) semi-supervised and (d) reinforcement learning

Unit 2: Problem specific issues:

- (a) representation: how to decide on a model that can solve the problem at hand?
- (b) evaluation: Construction of a loss function to evaluate the
- (c) Optimization: methods to use to iteratively improve the model from a starting guess?

Unit 3: Review of prominent current literature in ML as applied to natural sciences

Unit 4: Project discussion and implementation: Selection of a problem in natural sciences and developing a solution using ML techniques

Reference Books:

1. “Probabilistic Machine Learning”, Kevin Murphy, MIT Press 2022
2. Other material (websites, technical articles) will be given to the students, based on need.

Teaching-Learning Strategies in brief (4 to 5 sentences):

Lectures will initially introduce the motivations, concepts, definitions along with simpler examples. This will be followed by assignments and quizzes that will make sure that the

students have understood the concepts. These will be followed by deeper lectures and assignments which lead the students to the bigger questions in the area. These will also be supplemented with real world engineering problems so that they can apply the concepts learned by them.

Assessment methods and weightages in brief (4 to 5 sentences):

- Light In-class Quizzes: 15%
- Assignments: 15%
- Mini Project: 20%
- Major Project: 50%

Title of the Course : **Machine, Data and Learning**

Faculty Name : **Vikram Pudi + Praveen P**

Course Code : CS7.301

L-T-P : **3-1-0**

Credits : **4**

(L= Lecture hours, T=Tutorial hours, P=Practical hours)

Name of the Academic Program: **B.Tech. in Computer Science and Engineering**

1. Prerequisite Course / Knowledge:

Data Structures, Computer Programming

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able to:

CO-1. Understand basic ML concepts such as Underfitting, Overfitting and Bias-Variance tradeoff

CO-2. Gain hands-on experience of applying these concepts to example problems

CO-3. Understand local search techniques with focus on Genetic

algorithms

CO-4. Understand the basics of Probability and Utility theory
CO-5. Usage of these concepts in the context of formal models such as Decision theoretic models and Bayesian networks

CO-6. Understand Decision tree learning and notion of Information Gain

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2	3	-	-	3	2	2	2	1	2	2	1
CO2	2	2	3	1	1	3	-	-	3	2	1	2	1	2	2	1
CO3	2	1	3	1	1	3	-	-	3	2	1	2	1	2	2	1
CO4	2	2	3	2	2	3	-	-	3	2	2	2	1	2	2	1
CO5	3	3	3	2	1	3	-	-	3	2	1	2	1	2	2	1
CO6	3	2	3	2	1	3	-	-	3	2	1	2	1	2	2	1

'3' in the box denotes 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4. Detailed Syllabus:

Unit 1: Overview of AI and ML

Unit 2: Basic ML concepts including Data and generalization, Overfitting, Underfitting, Bias-variance tradeoff

Unit 3: Local Search Techniques, Genetic

Algorithms

Unit 5: Basics of Probability and Utility Theory

Unit 6: Decision Theory, Markov Decision Process, Modeling observation errors

Unit 7: Decision Tree Learning, Construct decision trees from examples, Notion of information gain

Unit 8: Bayesian networks

References :

- Python ML by Example by Yuxi (Hayden) Liu, Packt Publishing, 2017
- Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach, Pearson Education Inc., 2009

5. Teaching-Learning Strategies in brief:

The course lectures will cover the core concepts while assignments will provide ample scope to implement and understand many of the concepts in more detail. Learning of theoretical

concepts and problem solving will be enabled via quizzes, mid and final exams.

6. Assessment methods and weightages in brief :

Assignments: 35 marks, Quizzes: 15 marks, Mid Exam: 20 marks , End Exam: 30 marks

Title of the Course : Mathematics of Generative Models

Faculty Name : Pawan Kumar

Name of the Program : CSE Elective

Course Code : CS7.508

Credits : 3-1-0-4

L - T - P:

(L - Lecture hours, T-Tutorial hours, P - Practical hours)

Semester, Year : Spring, 2023

Pre-Requisites : Multivariable Calculus, Linear Algebra, Probability and Statistics, Optimization Methods, SMAI

Course Outcomes:

1. Learn extensive mathematical foundations required for generative models.
2. Learn to build mathematical models for a generative task.
3. Analyze and solve complex optimization models and solvers.
4. Analyze the obtained results with various benchmarks and scores.
5. Learn to program basic generative model applications.

Course Topics:

1. Brief review of Probability and Random processes, Ordinary differential equations, and optimization methods. (5 lectures)
2. Variational Autoencoders: The Gaussian VAE, ConvNets and ResNets, Posterior collapse, Discrete VAEs. (4 lectures)

3. Generative Adversarial Networks: f-GANs, Wasserstein GANs, Solvers for min-max, Generative Sinkhorn Modeling: KR-duality, Optimal Transport, Sinkhorn algorithm. (4 lectures)
4. Generative Flow: Autoregressive flows, Invertible networks, Neural Ordinary Differential Equations. (3 lectures)
5. Energy based Models: Stein's method and score matching, Langevin dynamics. (3 lectures)
6. Diffusion Models: Stochastic calculus, Diffusion Process, Stochastic differential equations, Simulated Annealing, Denoising diffusion models. (6 lectures)

Preferred Textbooks:

1. Class Lecture Slides and Notes (created from papers, see below!)
2. Machine Learning: A Probabilistic Perspective by Kevin P. Murphy.
3. Computational Optimal Transport, arXiv:1803.00567
4. Tutorial on Deep Generative Models. Aditya Grover and Stefano Ermon. International Joint Conference on Artificial Intelligence, July 2018.
5. Tutorial on Generative Adversarial Networks. Ian Goodfellow. Neural Information Processing Systems, December 2016.

Reference Books:

1. Score-Based Generative Modeling through Stochastic Differential Equations, arXiv:2011.13456
2. Sliced Score Matching: A Scalable Approach to Density and Score Estimation, arXiv:1905.07088
3. Backprop through Sinkhorn's algorithm for generative modeling, AISTATS 2018
4. Entropy, convexity, and matrix scaling, Lecture notes
5. Denoising Diffusion Probabilistic Models, arXiv:2006.11239
6. Wasserstein GAN, arXiv:1701.07875
7. Improved Training of Wasserstein GANs, arXiv:1704.00028
8. The Usual Suspects? Reassessing Blame for VAE Posterior Collapse, arXiv:1912.10702
9. NVAE: A Deep Hierarchical Variational Autoencoder, arXiv:2007.03898

E-book Links:

1. <https://optimaltransport.github.io/slides/>
2. <https://openai.com/blog/jukebox/>
3. <https://optimaltransport.github.io/book/>
4. <https://people.math.wisc.edu/~kurtz/m735.htm>
5. <https://ethz.ch/content/dam/ethz/special-interest/mavt/dynamic-systems-n-control/idsc-dam/Lectures/Stochastic-Systems/SDE.pdf>
6. <https://www.probabilitycourse.com/>

Grading Plan:

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz-1	10%
Mid SemExam	20%
Quiz-2	10%
End Sem Exam	30%

Assignments	20%
Project	None
Term Paper	10%
Other Evaluation	None

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	1	1	1	1	1	2	1	1	1	3	2	1	3
CO2	3	2	1	3	1	1	1	1	1	1	1	2	3	1	1	3
CO3	3	2	1	3	1	1	1	1	1	1	1	1	2	1	1	3
CO4	2	2	1	3	2	1	1	1	1	1	1	3	2	1	1	2
CO5	2	2	1	2	1	1	1	1	1	1	1	2	2	2	1	2

Teaching-Learning Strategies in brief (4-5 sentences) :

Title of the Course

: Mechatronics System Design

Faculty Name

: Nagamanikandan +Harikumar K

Course code

: EC4.404

L-T-P

: 3-1-0

Credits

: 4

(L=Lecture hours, T=Tutorial hours,

P=Practical hours)

1. Prerequisite Course / Knowledge:

Basic programming (Python, C++), Linear Algebra, Numerical methods, Basic microcontroller knowledge.

2. Course Outcomes (COs):

After completion of this course successfully, the students will be able to
CO-1 Describe important elements of mechatronics system

CO-2 Apply the previous knowledge of microcontroller programming for controlling multidisciplinary mechatronic systems.

CO-3 Describe and design basic mechanical elements and their feedback control.
CO-4 Synthesize and analyze a range of mechanisms.

CO-5 Design and execute a multidisciplinary project based on the given specifications as part of a team.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	1	1	1	2	2	1	2	1	3	3	2	2	2
CO2	3	3	2	1	3	1	1	1	3	1	2	3	3	2	2	3
CO3	3	2	2	1	2	1	1	1	1	2	1	2	1	1	1	3
CO4	3	3	3	1	2	1	1	1	1	2	1	3	1	1	1	3
CO5	3	3	3	2	3	2	2	1	3	3	2	3	1	2	3	3

4. Detailed Syllabus:

Unit 1: Sensors and Actuators:

Sensors for robotics application - position, speed, acceleration, orientation, range. Actuators - general characteristics, motors, control valves.

Unit 2: Computer based feedback control:

Sampled data control, sampling and hold, PID control implementation, stability, bilinear transformation.

Unit 3: Introduction to mechanical elements and transformations, basic concepts of kinematics and dynamics.

Unit 4: Design and analysis of mechanisms.

Unit 5: Programming and hardware experiments.

Reference Books:

1. Bentley, John P. "Principles of measurement systems," Pearson education, 2005.
2. D.R. Coughanowr, "Process system analysis and control," McGraw Hill, 1991
3. G.F. Franklin, J.D. Powell and M.L. Workman, "Digital control of dynamic systems", AddisonWesley, 3rd edition, 1998.
4. Hartenberg, R., & Danavit, J, "Kinematic synthesis of linkages," McGraw Hill, 1964.
5. <http://wiki.ros.org/>
6. User manual of microcontroller and data sheets of sensors and actuators

5. Teaching-Learning Strategies in brief:

This course aims to teach the students about designing and developing a mechatronics system by providing them with essential hardware and software. Part of the class is devoted to a learn-by-doing lesson where the students will learn theory and get hands-on experience with various aspects of the mechatronics system.

The goal for the students is to design, build, and debug the electromechanical system for a given task as part of the course project.

6. Assessment methods and weightages in brief:

Mid semester exam 20%

Assignments 40%

The class work assignments will be based on the application of a step-by-step engineering design process to a problem assigned in the course.

Project 40%

Proposal (5%)
Project demonstration (25%)
Final report (10%)

Title of the Course : Medical Image Analysis
Faculty Name : Jayanthi Sivaswamy
Name of the Program : ECE and CSE
Course Code : EC5.405
Credits : 4
L - T - P :
(L - Lecture hours, T-Tutorial hours,
P - Practical hours)
Semester, Year : Spring 2023
(Ex: Spring, 2022)

Pre-Requisites : signal processing or image processing preferred

Course Outcomes :

1. List and explain the physics and computing aspects behind different medical imaging modalities
2. Compare and assess imaging modalities and their ability to capture different types of information about living organisms
3. Identify the dimensionality, calculate the storage requirement and assess the limitations of images acquired by different imaging modalities
4. Develop algorithms to enhance, classify, segment and spatially align medical images
5. Design methods to fuse information from images from multiple imaging modalities
6. Apply deep learning based techniques for medical image computing

Course Topics :

1. Principles of imaging in different modalities
2. Image reconstruction – Radon transform, Fourier slice theorem, filtered backprojection
3. Image denoising and enhancement – N3 and N4 filtering techniques; Leveling operation
4. Image segmentation – classical approaches and voxel-level classification (deep learning)
5. Image registration – frameworks for rigid and non-rigid cases, deep learning-based approaches; Segmentation via registration
6. Quantitative assessment of segmentation and registration algorithms – Receiver operating characteristics, Decision threshold selection, Statistical significance testing

Preferred Text Books :

Reference Books : *Fundamentals of medical imaging* by P. Seutens;
Medical image processing- reconstruction and restoration by J.Jan;

E-book Links :

Grading Plan :
 (The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz-1	10
Mid SemExam	20
Quiz-2	0
End Sem Exam	0
Assignments	35
Project +viva	20+20
Term Paper	
Other Evaluation	

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3														
CO2	2	3														
CO3		3	3													
CO4			3	3												
CO5			3	3												
.....																

Teaching-Learning Strategies in brief (4-5 sentences) :

This course have a good mix of theoretical foundations and practical exposure to medical image computing. Training in computing will be achieved via weekly assignments. Exposure to emerging approaches to problem solving will be given by using research papers as source material for teaching and via a project. A field visit to a hospital will be part of the course to give students an appreciation of real-life use of medical imaging and to interact with radiologists.

Title of the Course	: Migrants and Migrations in Modern South Asia
Faculty Name	: Isha Dubey

Name of the Program : B. Tech in Computer Science and Engineering
Course Code : HS3.305
Credits : 4
L - T - P : 3-0-0
(L - Lecture hours, T-Tutorial hours,
P - Practical hours)
Semester, Year : Spring 2023
(Ex: Spring, 2022)

Pre-Requisites : Intro to Human Sciences, CHD 3rd and 4th year students

Course Outcomes:

After completion of the course successfully students should be able to:

CO1: Define various terms and concepts related to the topic, such as –migrant, immigrant, refugee, stateless, IDP, diaspora, etc.

CO2: Explain the academic theories and conceptual frameworks relating to human migrations in the modern world.

CO3: Analyse the nature and impact of some of the most important internal, cross-border and transnational migrations which have shaped modern and contemporary South Asia

CO4: Evaluate the different methods used for understanding how, why, and when people move from one place to another.

CO5: Examine what tools can be used to narrate, document and curate the lived experience of migrating under diverse circumstances in historical and present-day South Asia.

CO6: Develop a small-scale case-study aimed at understanding a specific kind of migration and its impact using any of the methodological tools covered in the course.

Course Topics:

- 1) **Migration, mobility, and motivation:** This module will introduce the basic concepts in migration studies, the different categories of people on the move, the possibilities for overlaps among them, and the various theoretical frameworks developed across disciplines for studying different kinds of migrations that have shaped the modern world. Students will be encouraged to develop critical understanding of these theories and their relevance for South Asia.
- 2) **Empire, colonialism, global histories of migration from South Asia:** This module will focus on bringing out the complex entanglements between the workings of colonialism and the transnational movement of people for meeting the needs of empire from South Asia. This module has two objectives: First, familiarise students with the nature and history of migrations spawned by 19th century indentured labour, the inter-generational trauma and the creolization of cultures it resulted in. Second, discuss the various migrations from this period with their linkages to colonialism, race, and the compulsory global passport regime which decides who gets to travel where and with what conditions.
- 3) **Borders boundaries and frontiers in South Asia:** Students will study the processes and politics of defining borders, borderlands, and frontiers in South Asia historically in this module. What are the physical limits of the nation? Have they always remained the same or do they change over time? Who draws these boundaries of belonging? Is the border only confined to the actual line on a map or is it constituted by a larger fluid space at the margins? Who are the people who populate these margins and how do they navigate these

geographies of flux? These are some of the questions that the module will pose and address.

- 4) **Nation-making, citizenship, and displacement:** Carrying forward the discussion from the previous one, this module is structured around the idea of the nation state and its centrality to questions of belonging and exclusion. How are these mitigated through the choice (of lack thereof) of ‘migration’ within and without it? This module will study certain colossal moments of rupture resulting in the breakup, creation, reorganization or reorientation of nations and national belonging in postcolonial South Asia. What impact have these had on mobility and movement across and within borders?
- 5) **South Asian diasporas:** This module will introduce students to the study of various kinds and contexts of diasporic migration extending outwards from the Indian subcontinent. What are the ways in which they widen the ambit of migration research? Using literature, film and memoir, the module will discuss the meanings attached to home and homeland, and the notions of return, nostalgia and assimilation, as well as their inter-generational transmission.
- 6) **Tools and methods of research in migration history:** This module will familiarise students with the major trends in qualitative migration research; more specifically historical research on varied experiences of migration. The objective is to prompt the class to engage with different methods for collecting and analysing data – archival, ethnographic, oral history etc. – for capturing narratives of people on the move and the possibilities offered by computational social science in broadening the scope of these methodological tools. Finally, the module shall also take up the questions related to the storing, documenting, curating, and disseminating of migration histories from South Asia and the role that technology plays/can play in these processes.

Preferred Textbooks:

- Ranabir Samaddar: *The Postcolonial Age of Migration*
- Lucy Mayblin and Joe Turner: *Migration Studies and Colonialism*
- Ian Goldin, Geoffrey Cameron, and Meera Balaraman: *Exceptional People: How migration shaped our world and will define our future*
- Neilesh Bose: *South Asian Migrations in Global History: Labour, Law and Wayward Lives*
- Ainslie T. Embree and Mark Juergensmeyer (ed.): *Frontiers into Borders: Defining South Asian States, 1757-1857*
- Vizira Fazila-Yacoobali Zamindar: *The Long Partition and the Making of Modern South Asia: Refugees, Boundaries, Histories*

Reference Books

- Sunil S. Amrith: *Crossing the Bay of Bengal: The Furies of Nature and the Fortunes of Migrants*
- Urvashi Butalia: *The Other Side of Silence: Voices from the Partition of India*
- Willem van Schendel: *The Bengal Borderland: Beyond State and nation in South Asia*
- Steven Vertovec: *The Hindu Diaspora: Comparative Patterns*
- Papiya Ghosh: *Partition and the South Asian Diaspora: Extending the Subcontinent*
- Amitav Ghosh: *Sea of Poppies*
- Arjun Appadurai: *Modernity at Large: Cultural Dimensions of Globalisation*
- Vivek Bald: *Bengali Harlem and the Lost Histories of South Asian America*
- Gaitura Bahadur: *Coolie Woman: The Odyssey of Indenture*
- Ranabir Samaddar (Ed.): *Borders of an Epidemic: COVID 19 and Migrant Workers*

Articles

- Md. Mahbubar Rahman and Willem van Schendel: “ ‘I Am Not a Refugee’ : Rethinking Partition Migration.”
- David Ludden: “Presidential Address: Maps in the Mind and the Mobility of Asia.”
- Radhika Singha: “ The Great War and a ‘Proper’ Passport for the Colony: Border Crossing in British India, c. 1882-1922.”
- Willem van Schendel: “Working Through Partition: Making a Living in the Bengal Borderlands.”
- Joya Chatterjee: “Dispositions and Destinations: Refugee Agency and ‘Mobility Capital’ in the Bengal Diaspora.”
- Alison Blunt: “Cultural Geographies of Migration: Mobility, Transnationality and Diaspora,”
- Lucas G. Drouhot, Emanuel Deutschmann, Carolina V. Zuccotti & Emilio Zagheni: “Computational Approaches to Migration and Integration Research: Promises and challenges.”
- Thompson: “Moving Stories: Oral History and Migration Studies.”
- Sucheta Mazumdar: "Localities of the Global: Asian migrations between Slavery and Citizenship."
- Leslie Page Moch: " From Regional to Global Repertoires of Migration."
- Lynn Hollen Lees: "Studying Migration on a Global Scale."
- Ravi Ahuja: “Mobility and Containment: The voyages of South Asian Seamen, 1900-1960.”

E-book Links :

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz-1	8%
Mid SemExam	20%
Quiz-2	7%
End Sem Exam	35%
Assignments	(15x2) 30%

Mapping of Course Outcomes to Program Objectives:

(1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	1	2	1	-	1	1	1	1	2	-	3	1	1	2	1
CO2	-	-	2	1	-	1	1	1	1	2	-	2	1	1	2	1
CO3	-	-	2	1	-	3	1	1	1	2	-	2	1	1	1	-

CO4	-	-	2	1	-	2	1	3	1	-	-	3	1	2	3	2
CO5	1	1	2	1	1	2	1	3	2	-	1	3	-	1	3	2
CO6	1	1	2	2	2	2	1	3	3	-	1	3	-	1	2	3

Teaching-Learning Strategies in brief (4-5 sentences):

The course will be based on classroom lectures and will require intensive reading, writing and active participation during the class. On an average, each student will be required to read between 500 to 800 pages of books and articles, and submit written work between 3,000 to 4,000 words, cumulatively.

Classroom discussions will be structured around certain pre-circulated question based on the larger thematic focus of that lecture and broad ideas emanating from prescribed readings for it. Students are expected to not only be able to grasp and articulate the arguments presented in the course literature but also to engage critically with how they speak to the more free-flowing discussion taking shape in the classroom based on these readings and the lecture.

Pictures, Extracts from primary sources, audio and video resources will be used to illustrate the points being taught.

The assignments and exams will focus on training students to develop their own ideas, and apply computer science tools, to the topics on hand.

Title of the Course

: Molecular Modeling and Simulations

Name of the Faculty

: U Deva Priyakumar + Marimuthu Krishnan

Course Code

: SC2.316

L-T-P

: 3-1-0

Credits

: 4

(L= Lecture hours, T=Tutorial hours,

P=Practical hours)

Name of the Academic Program : BTech &BTech+MS dual degree programs

1.Prerequisite Course / Knowledge:

None

2.Course Outcomes (COs):

After completion of this course successfully, the students will be able to

CO-1: Describe the different aspects of molecular modeling techniques

CO-2: Describe the fundamental methods of quantum chemistry, molecular mechanics, molecular dynamics in the context of modelling molecular systems

CO-3: Examine properties of molecules using quantum chemical methods

CO-4: Evaluate the dynamic characteristics of biomolecules such as protein, DNA and RNA using molecular dynamics simulations.

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	2	1	1	1	1	1	1	1	3	1	2	1	2

CO2	2	2	1	2	1	1	1	1	1	1	2	1	2	1	2
CO3	2	3	2	1	2	2	1	1	1	2	1	2	2	2	1
CO4	2	3	2	2	3	2	1	1	2	1	1	2	2	2	3

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

Unit 1: Potential energy surface: Concepts of minima, transition states and higher order saddle points. Optimization methods: gradient descent, conjugate gradient and Newton-Raphson methods

Unit 2: Basics of Quantum mechanics: Particle in a box, Hydrogen atom problem, two-body problem, molecular orbital theory

Unit 3: Practicals of quantum chemistry: Optimization of molecules, Understanding of the different components of the outputs, calculation of properties like the IR spectrum

Unit 4: Molecular mechanics: Force field equations, Additive forcefields, polarizable and machine learning forcefields

Unit 5: Molecular dynamics simulations: Integrating Newton's laws of motion with force derived from force fields, replica exchange simulations, umbrella sampling simulations

Unit 6: Practicals of molecular dynamics: Set up necessary requirements for MD simulations, perform short simulations, calculation of thermodynamic properties.

Reference Books:

1. Molecular Modeling by Andrew Leach
2. Molecular Modeling and Simulations by Tamar Schlick

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

The course aims to enable students to model a given chemical or biological molecular process. Lectures followed by practicals on the same aspects will be done in tandem. A bird's eye view will be followed where the emphasis is more on the philosophical understanding of the methods than elaborate derivations of all concepts. The evaluations will be continuous and will test the students' understanding of concepts and their implementations in performing a given task.

6.Assessment methods and weightages in brief (4 to 5 sentences):

- Assignments - 20%
- Quiz - 30%
- Exams - 50%

Title of the Course : Music, Mind, and Technology

Course Code : CS9.434
 Faculty : Vinoo Alluri
 Technology L-T-P : 3-1-0
 Credits : 4
 (L= Lecture hours, T=Tutorial hours,
 P=Practical hours)

Name of the Academic Program: **Open Elective**

1.Prerequisite Course / Knowledge: None

2.Course Outcomes (COs):

After completion of this course successfully, the students will be able to

CO-1 appreciate the fundamental concepts of the field of Music Cognition and Technology CO-2 understand the role of the individual in musical experiences in relation to music experience including music consumption, music industry, mental well-being, and critically think about the relationship between diverse fields that comprise music cognition such as psychology, music information retrieval, and neuroscience.

CO-3 understand the relation between physical aspects of sound and perceptual processes including sensation and perception

CO-4 understand sound synthesis and analysis in addition to application of machine learning to various music information retrieval tasks (eg: music genre classification, mood detection, recommendation)

CO-5 understand music processing in the brain, and effect of individual differences thereof (eg: musical expertise, empathy, gender). Analyze brain responses to music which includes an interdisciplinary approach combining sound- and brain-signal processing, statistical methods, and perceptual experimentation to analyze experimental data from human neurological experiments

CO-6 combine knowledge gained from CO-1-4 to formulate own research idea and go about solving it.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) –Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	3	1	1	1	1	1	2	-	1	2	1	1	1
CO2	1	1	1	1	2	2	2	1	1	1	-	1	1	1	2	2
CO3	3	1	1	1	1	1	1	2	1	1	-	1	1	1	1	1
CO4	3	2	1	2	3	2	1	1	3	1	-	2	2	2	1	2
CO5	2	1	2	2	3	1	1	1	2	1	-	1	2	1	1	2
CO6	3	3	3	3	2	1	1	1	3	2	-	1	2	2	2	2

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write ‘3’ in the box for ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level’ mapping

4. Detailed Syllabus:

Unit 1: Introduction to Music cognition, Evolutionary and Biological significance of music, Embodied music cognition, evolution of the field of psychology of music

Unit 2: Music experience and Individual differences, Music Emotion

Unit 3: Auditory Processing, Sensation, Perception, Auditory stream segregation Unit 4: Sound synthesis and analysis

Unit 5: Music information

retrieval Unit 6: Neuromusicology

Reference Material:

Lecture slides and supplementary reading materials (journal articles, review articles) will be uploaded on the course page on Moodle.

5. Teaching-Learning Strategies in brief:

Students will be introduced to the broad field of music cognition. The objective of the course is to give an appreciation of the main concepts of the field of Music Cognition and Technology. Students will learn about topics in music psychology (from perception to cognition), familiarize themselves 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.

By attending lectures, in addition to a few guest lectures by leading music researchers from around the world, students will be exposed to this interdisciplinary field and open questions. Students learn by working in groups to solve existing open problems in addition to creating their own research problem and addressing it to the best of their abilities.

Lectures are highly interactive as the course requires a student to actively participate and think and be creative. Students learn by doing assignments designed to achieve course outcomes and collaboratively working on a final project. The final project wherein students learn by working in teams, especially to devise a research question, identify hypotheses, operationalize it, deploy it, collect (if necessary) and analyze data and present the results thereby promoting collaboration, which is very much needed in interdisciplinary research.

6. Assessment methods and weightages in brief:

Quiz 1 = 10%

Quiz 2 = 10%

Assignments = 30%

Final Project = 40%

Class participation = 10%

Title of the Course

: Neural Natural Language Generation

Faculty Name

: Manish Shrivastava + Vasudeva Varma

Name of the Program

: CLD/Open Elective

Course Code

: CL3.407

Credits

: 2

L - T - P

:2-1-2

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year

: Spring 2023

(Ex: Spring, 2022)

Pre-Requisites

: CL1 or NLP1

Course Outcomes

CO-1: Understand Natural Language Generation (NLG) from Linguistic and Machine/Deep Learning perspectives (

CO-2: Analyze classical and Deep Learning based Natural Language Generation model design principles for Monolingual, Multilingual and Multi-Modal uses cases

CO-3: Understand and evaluate state-of-the-art Prompt and query-based NLG methods

CO-4: Develop specialized NLG systems

Course Topics

(please list the order in which they will be covered, and preferably arrange these as five to six modules.)

1. Background (4 Lectures): Introduction to NLG, Traditional Models for NLG
 - a. Information Extraction perspective on Natural Language Generation (NLG)
 - b. Linguistic perspective on Natural Language Generation
 - c. Template-based NL generation,
 - d. Statistical NLG
 - e. Language Modeling (LM) and sequence to sequence models for NLG
 - f. Merits and failures of traditional methods
2. Basic models for Neural NLG (2 lectures):
 - a. Large Language Models (LLMs)
 - i. Exploring major LLMs including BERT, GPT etc,
 - b. Transfer models
 - i. T5, BART etc
3. Controlled Generation(2 Lectures):
 - a. Controlled generation paradigm
 - b. Prompt based NLG
 - c. Prompt finetuning using foundational models
 - d. Evaluation of language generation models
4. Multilingual NLG(2 Lectures):
 - a. Multilinguality and Multilingual models
 - i. mT5, mBART
 - b. Cross Lingual Generation
 - i. Cross Lingual summarization
 - ii. ML Question Answering
5. Multimodal NLG (2 Lectures):
 - a. Modeling Image and Text modalities
 - b. Image Captioning
 - c. Scene Graph based description generation

Preferred Text Books : No text books

Reference Books :

1. [*Speech and Language Processing*, Daniel Jurafsky and James Martin, Prentice-Hall \(second edition\).](#)
2. Christopher D. Manning and Hinrich Schutze. *Foundations of Statistical Natural Language Processing*. MIT Press.
3. Ian Goodfellow and Yoshua Bengio and Aaron Courville. [*Deep Learning*](#). MIT Press.

E-book Links (indicative papers):

1. [The GEM Benchmark: Natural Language Generation, its Evaluation and Metrics](#)
2. Wenhao Yu, Chenguang Zhu, Zaitang Li, Zhiting Hu, Qingyun Wang, Heng Ji and Meng Jiang. 2022. [A Survey of Knowledge-Enhanced Text Generation](#). ACM Computing Survey.
3. [BLEURT: Learning Robust Metrics for Text Generation](#)
4. [Leiter et al., Towards Explainable Evaluation Metrics for Natural Language Generation](#)
5. [Li and Liang, Prefix-Tuning: Optimizing Continuous Prompts for Generation](#)
6. [Krause et al., GeDi: Generative Discriminator Guided Sequence Generation](#)
7. Ramesh, Aditya et al. “[Zero-Shot Text-to-Image Generation](#).” ICML2019
8. others

Grading Plan :

Type of Evaluation	Weightage (in %)
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End Sem Exam	20
Assignments	40
Project	40

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	1	1	3	3	2	2
CO2	3	3	3	2	1	1	1	3	3	3	2
CO3	1	3	3	3	2	1	1	3	3	3	3
CO4	1	1	1	1	1	2	3	3	2	2	2

‘3’ in the box denotes ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low’-level’ mapping

Teaching-Learning Strategies in brief :

This course is an advanced and research level course where each topic is being discussed in a flipped classroom model after necessary background is given. Students are expected to come to the class after reading/understanding given material for each session and share their understanding, analyze and synthesize the knowledge. This approach not only enhances the students’ understanding of the state of the art but also encourages them to push the knowledge boundaries by applying them to a given problem setting such as Indian languages.

Title of the Course : Nonlinear dynamics

Faculty Name : Abhishek Deshpande

Course Code : SC1.315

L-T-P : 3-1-0

Credits : 4

(L= Lecture hours, T=Tutorial hours,

P=Practical hours)

1.Prerequisite Course / Knowledge:

2.Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to

- CO-1:** Apply geometrical, analytical, and numerical methods for analyzing non-linear dynamics
- CO-2:** Calculate fixed points and determine their stability
- CO-3:** Analyze various types of bifurcations in one and two dimensions
- CO-4:** Analyze limit cycles and their stability
- CO-5:** Analyze chaotic dynamics
- CO-6:** Analyze discrete maps and period doubling
- CO-7:** Apply theoretical methods for analyzing nonlinear dynamics to problems in sciences and engineering.

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	3								1	3	3	3
CO2	3	3	1	1	3								1	3	1	3
CO3	3	3	1	3	3								1	3	3	3
CO4	3	3	1	3	3								1	3	3	3
CO5	3	3	1	3	3								1	3	3	3
CO6	3	3	1	3	3								1	3	3	3
CO7	3	3	3	3	3								1	3	3	3

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write ‘3’ in the box for ‘High-level’ mapping, 2 for ‘Medium-level’ mapping, 1 for ‘Low-level’ mapping

4.Detailed Syllabus:

Unit 1: Overview: Capsule history of Dynamics, A dynamical view of world

Unit 2: One-Dimensional flows: Flows on the line, Bifurcations, Flows on the circle

Unit 3: Two-Dimensional Flows: Linear System, Phase Plane, Limit Cycles, Bifurcations

Unit 4: Chaos: Lorenz Equations, One-Dimensional Maps, Fractals

Reference Books:

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

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

The course lectures will involve problem solving and simulations to analyse whether system in question settles down to equilibrium, keeps repeating in cycles or does something more complicated. The emphasis will be on geometric thinking, computational and analytical methods. Interactive tools are used to enhance the understanding. Project ideas from various disciplines (both engineering and sciences) are considered for the assessment.

6.Assessment methods and weightages in brief (4 to 5 sentences):

- Quiz - 20%
 - End semester exam – 30%
 - Assignments – 30%
 - Project – 20%
-

Title of the Course : Non-equilibrium Statistical Mechanics

Faculty Name : Bhaswar Ghosh

Name of the Program : B.Tech Dual Degree

Course Code : SC2.450 - CNS elective

Credits : 4

L - T - P : 3-1-0

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year : Spring 2023

Pre-Requisites : Classical and Statistical Mechanics

Course Outcomes :

The action verbs to be used for writing the course outcomes can be found on slide 22 in the following presentation. You may remove this line and the following link after the course outcomes are formulated.

On completion of the course, the students will be able to

CO:1 acquire the basic concepts of non-equilibrium process in natural sciences

CO:2 discuss fluctuation and its implications in the working of the system

CO:3 apply the concepts in analyzing signal to noise ratio in physical/chemical systems

CO:4 acquire concepts of information transmission in physical/biological systems

CO:5 understand aspects of entropy generation and energy consumption in systems out of equilibrium

Course Topics :

- Recapitulation of equilibrium thermodynamics.
- Equilibrium statistical mechanics.
- Entropy and entropy production for irreversible process.
- Work, free energy and entropy for non-equilibrium systems.
- Statistical mechanics for the classical Hamiltonian system.
- Deriving Langevin equation in a heat bath
- Noise and fluctuation.
- Fluctuation dissipation theorem.
- Noise and noise power spectrum.

- Velocity auto-correlation.
 - Work and free energy for Langevin equation
 - Derivation of Fokker-Planck equation.
 - Ornstein-Uhlenbeck process
 - Fokker-Plank equation for double well potential.
 - Statistical mechanics for jump processes
 1. Master equation approach
 2. generating function approach to solve master equation.
 3. Poisson process.
 4. Chemical reaction.
 5. Continuous limit in jump processes
 6. Entropy production rate in jump processes
 - Thermodynamics of information
 - 1 . Elements of information theory.
 2. Maxwell's demon
 3. Szilard's Engine and Landauer's erasure principle
 4. Entropy production and information transmission in non-equilibrium process.
 5. Elements of linear response theory

Preferred Text Books:

Non-equilibrium Statistical Mechanics by Robert Zwanzig (Oxford University press)
Elements of Non-equilibrium Statistical Mechanics by V. Balakrishnan (Springer)

Elements of Information Theory by Thomas M. Cover, Joy A. Thomas (Wiley)

Grading Plan :

Type of Evaluation	Weightage (in %)
Quiz-1	10
Mid SemExam	20
Quiz-2	10
End Sem Exam	30
Assignments	30

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------	------

CO1	3	3	1	1	2	2							3	2	1	1
CO2	2	3	1	1	1	1							2	3	1	1
CO3	2	3	2	1	1	1							2	3	2	1
CO4	1	2	3	2	1	1							1	2	3	1
CO5	1	2	2	3	1	1							1	3	2	1

Teaching-Learning Strategies in brief (4-5 sentences):

The course will be taught with a special emphasis on fundamental concepts of thermodynamics and statistical mechanics. The students will be able to understand the concepts through analytical problem solving and numerical analysis. Applications of the techniques will be demonstrated by taking specific examples from physics, chemistry and biology. Although, the course will be specifically focused on problems from natural sciences, the techniques can be used in different engineering problems which involve communication and power consumption.

Title of the Course : Optical Remote Sensing

Faculty Name : Ramachandra Prasad

Course Code : CS9.436

L-T-P : 3-0-1.

Credits : 4

(L=Lecture hours, T=Tutorial hours, P=Practical hours)

Open Elective (Spring) (UG and PG)

1. Prerequisite Course / Knowledge:

Basic Physics and computational knowledge.

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able to

CO-1: Comprehend processes of optical remote sensing

CO-2: Describe various sensors and their image characteristics

CO-3: Extract information from satellite imagery using conventional methods

CO-4: Apply advanced computational techniques for feature extraction

CO-5: Discuss satellite imagery applications (ex. Forest, Urban, Agriculture)

CO-6: Get basics of advanced remote sensing technologies

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	1	2	1	1	1	1	1	1	1	2	2	2	2
CO2	2	1	2	2	2	2	2	2	2	1	2	2	3	2	2	2

CO3	2	2	2	2	3	2	1	1	1	1	2	2	2	2	2	2
CO4	2	2	2	2	2	1	1	1	1	1	2	2	2	2	2	2
CO5	2	2	2	2	3	2	2	2	2	1	2	3	3	2	2	2
CO6	1	2	2	1	2	1	1	1	1	1	2	2	2	2	1	

4. Detailed Syllabus:

Unit-1: Introduction to Remote sensing: What is remote sensing? Earth Observation Satellites and Platforms(Evolution of platforms, sensors, satellites, national and international sensors)

Unit-2: Sensor and its characteristics – Classification; Remote sensing instruments, passive-active, imaging-non imaging, OIR-Microwave, framing-scanning, mechanical-pushbroom; Aerial photographs-satellite image; types of resolutions and their tradeoff

Unit-3: Physics of Electro Magnetic Radiation (EMR) EMR properties/characteristics-wave model- particle model; Radiation laws applicable to remote sensing: EMR interaction with Atmosphere and Earth materials: EMR interactions with atmosphere, atmosphere structure, Atmosphere blinds – windows; Absorption-scattering mechanism- types; EMR interactions with earth surface material-Specular - Diffuse; Albedo.

Unit-4: Data acquisition and image characteristics: Data creation at sensor level – telemetry-ground station acquisition: Old data formats (BIL, BIP, BSQ) and current ; Data products: Special Products –Processing software, Image characteristics, and FCC creation-types. Additional ways of Acquiring data in Non-optical or near Optical Image processing

Unit-5: Image pre-processing: Image restoration- Atmosphere errors, correction-methods; Correcting geometric distortions – Types of errors, Spatial and pixel interpolation (types), map projections and types: Image Enhancement - Contrast and Spatial enhancement, Hue, Intensity, and Saturation transformations, Density slicing

Unit-6: Information extraction- Multispectral classification – Visual interpretation-Digital classification –Unsupervised, supervised; other classifiers –Deep learning methods, Fuzzy logic, Decision tree (basic level); post classification smoothing, Ground truth, accuracy assessment. Object based image classification, difference between per pixel and object based classification. PCA; Image arithmetic, Change detection methods, State of the Art – Geo-AI.

Unit-7: Stereo Imagery - DEM Creation methods, examples, comparison and Application

Unit-8: Major applications of remote sensing in Vegetation / Terrestrial ecology/wildlife; Hydrology/Land use / Land cover /Agriculture; Disaster management

Unit-9: Overview of Advanced topics: Drone imagery – Ultra high resolutions (cm level data); Hyperspectral and thermal (near optical); Microwave/Radar

References:

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
4. Fundamental of Remote Sensing by CCRS (Online)

5. Principles of Remote sensing by ITC (online)

5.Teaching-Learning Strategies in brief:

Teaching, discussing current approaches of information extraction, challenges and limitations with satellite data; Current research papers presentations by students on chosen topic, writing assignments, periodical evaluation of course project implemented with open data and tools; applying remote sensing satellite imagery in different domains, develop an open source tool as part of project or revise algorithms for feature extraction or for any image processing method.

6.Assessment methods and weightages in brief :

- | | |
|--|----------|
| 1. Assignments [written, lab and presentations] | - (20%), |
| 2. Theory [Mid exams-2 (30%) and End exam (30%) | - (60%) |
| 3. Project [Literature survey, Preliminary and final presentation along with report] | - (20%) |

***PROJECT:** Development of open source tools, replication of case studies or working on new problem using open data and algorithms or any application or improvement - of existing algorithms in processing and feature extraction from satellite data

Title of the Course : Optimization Methods

FACULTY NAME	: Naresh Manwani
Course Code	: CS1.404
CREDITS	: 4 Credits
L-T-P	: 3-1-0
TYPE-WHEN	: Spring 2022

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 :

1. CO-1: Linear Programming, Geometric Interpretation, SimplexMethod, Duality, primal dual method, Interior point methods, Ellipsoidal methods, Computational Issues.
2. CO-2: Integer programming, LP relaxation, Examples from combinatorial optimization. Shortest paths, network flows and matchings.
3. CO-3: Convex sets and functions. Need for constrained methods in solving constrained problems.
4. CO-4: Unconstrained optimization, Optimality conditions, Gradient Descent, Newton Method, Quasi-Newton Methods, Trust Region Methods. Conjugate Gradient Methods. Least Squares Problems.

5. CO-5: Constrained Optimization, Optimality Conditions and Duality. Convex Programming Problem. Quadratic Programming. Dual Methods, Penalty and Barrier Methods, Interior Point Methods.
6. CO-6: Linear Equations, Solutions based Matrix Factorization, Singular Value Decomposition,
7. CO-7: **Additional topics** (if time permits) related to
 1. Specific Algorithms (eg. Cutting plane algorithms, Stochastic gradients)
 2. Applications in Approximate Algorithms
 3. Computational issues in large scale optimization
 4. Heuristic methods for optimization

PREFERRED TEXT BOOKS:

1. S. Boyd and L Vandenberghe, "Convex Optimization", Cambridge University Press (Online Copy available at: <http://www.stanford.edu/~boyd/cvxbook/>).
2. L Vandenberghe, Lecture Notes for Applied Numerical Computing, (Online available at: <http://www.ee.ucla.edu/~vandenbe/103/reader.pdf>).
3. Edwin K. P. Chong, Stanislaw H. Żak, Introduction to Optimization, Fourth Edition, Wiley-Interscience Series in Discrete Mathematics and Optimization, John Wiley & Sons.

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. D Bertsimas and J N Tsitsiklis, "Introduction to Linear Optimization", Athena Scientific.
4. J Matousek and B. Gartner, "Understanding and Using Linear Programming", Springer, 2007.

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.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3	3
CO2	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3	3
CO3	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3	3
CO4	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3	3
CO5	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3	3
CO6	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3	3
CO7	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3	3

GRADING PLAN:

Type of Evaluation	Weightage (in %)
Small Quizzes (10 quizzes)	10%
Mid-Sem Exams (2)	30%
End Sem Exam	20%
Assignments	25%
Term Paper/Project	10%
Scribe	5%

Title of the Course

: Organic Chemistry

Name of the Faculty : Prabhakar Bhimalapuram

Name of the Academic Program : CND

Course Code : SC2.202

L-T-P : 3-1-0

(L=Lecture hours, T=Tutorial hours,

P=Practical hours)

Credits : 2

1. Prerequisite Course / Knowledge: NA

2. Course Outcomes (COs) (2 credit course):

CO1: Explain various mechanisms of structural stability of organic compounds and their reactivities

CO2: Apply the mechanisms to describe types of reactions using stability of reaction intermediates

CO3: Analyze the outcomes of different organic reactions using the principles of structure and stability of reactants and intermediate compounds

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1									1	1	2	3
CO2	3	3	2	1									1	1	2	3
CO3	3	3	2	1									1	1	2	3
CO4																

4. Detailed syllabus

Concepts on structures, stabilities and reactivities

Unit 1: Reactive intermediates: Formation, structure, stability and fate of various reactive intermediates (Carbanion, carbocation, carbenes, nitrenes, benzenes, free radicals) – Reactive intermediates in biology and environment

Unit 2: Concepts of aromaticity

Unit 3: Molecular symmetry and chirality, Stereoisomerism, Classification of stereoisomerism, configuration, chiral centre, Axial chirality, planar chirality, helicity, Racemization and methods of optical resolution, Determination of configuration, Conformation of acyclic and monocyclic molecules-conformation and reactivity, Prochirality and prostereoisomerism, Stereochemistry of alkene, Chirality in molecules devoid of chiral centers, Chirooptical properties. Some reactions and their mechanisms

Unit 4: Methods for determining structures and reaction mechanisms

Unit 5: Types of reactions and their mechanisms Radical substitution Electrophilic addition to alkenes and alkynes – stereochemical considerations – Markonikov rule Nucleophilic Substitution at saturated carbons (SN₁, SN₂ and SNi): Types, stereochemical considerations, Role of solvent Nucleophilic addition to the Carbonyl group Elimination reactions: Types (E₁, E₂ and E_{1cB}) - stereochemical consideration, Role of solvent Hofmann rules- Zaytsev Rules Nucleophilic substitution at the carbonyl group Electrophilic Aromatic Substitution: Benzene and its reaction with electrophiles- Effect of functional groups Nucleophilic Aromatic substitution: Diazonium compounds-benzyne mechanism Pericyclic reactions: Electrocyclic reactions, Cycloadditions, Sigmatropic rearrangements and Group transfer reactions Important name reactions involving rearrangements Functional group wise reactions Conversions and Identifications.

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

The objective of the course is to familiarize the CND students with basic concepts of organic reaction mechanisms. Since organic reactions are wide spread in natural biological systems as well as their applications in various industries, understanding the mechanisms is crucial. The course would provide the students with tools to analyze outcomes of organic reactions. It will further help them to learn the numerical analysis of molecular reactions later.

6.Assessment methods and weightages in brief(4 to 5 sentences):

Assignments – (20%), Class Quizzes + Mid-term evaluation (40%), Final exam (40%)

Reference book

A Guidebook to Mechanism in Organic Chemistry by Peter Sykes

Title of the Course

: Organizational Operations

Faculty Name

: TBD

Name of the Program

: M. Tech in Product Design and Management program

Course Code

: PD2.423

Credits

: 2 Credits

L - T - P

: 1.5 -0- 3

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year

: 2nd Sem – Year 1

(Ex: Spring, 2022)

Pre-Requisites : **None**

Course Objective :

Operations are the work of managing the inner workings of your business so it runs as efficiently as possible. Whether you make products, sell products, or provide services, every small business owner has to oversee the design and management of behind-the-scenes work. Organizational operations management involves converting input into efficient outputs to achieve desired results for an entrepreneur. The course contains various operations models, tools, and techniques for supply chain management, quality control systems, and streamlining workflows. You will learn how to innovate business operations to improve productivity and capacity with the resources. You will develop skills that will empower you to configure business processes to channel operations and reduce bottlenecks.

Course Outcomes :

CO-1 Understand key functional areas of operations with the type of decisions they are typically involved in to run a business efficiently.

CO-2 Identify key differences between service and manufacturing organizations and the business operations in the two sectors of the businesses.

CO-3 Understand and map each process phase to formulate an organizational strategy with actions typically performed at that phase.

CO-4 Identify and categorize different transformation characteristics of manufacturing and service operations strategies.

CO-5 Understand the concept of organizational strategy, the four-phase process for formulating this strategy, and how the strategy should be aligned with operations strategy in the manufacturing and services context.

Course Topics :

Operations Management: Basics of production systems, Planning, Scheduling, Sequencing, Workplace Layouts, Locational problems of warehouses. **Four sessions**

Basics of Lean Operations: Classification of wastes, 5S, Kaizen, Jidoka, Kanban, Kaizen, Value Stream Mapping, Total Productive Maintenance. **Three sessions**

Service Operations - Service strategy, service enterprise design, service operations, service blueprint, Capacity planning, queueing models, forecasting demand, and managing service inventory. **Three sessions**

Supply Chain Management - Measuring supply chain performance, drivers and metrics, planning and managing inventories in the supply chain, managing economies of scale, uncertainty, optimal product availability, sourcing decisions, **Three sessions**

Basics of Information Systems and Impact on Operations - Basics of Business Analytics and Business Intelligence, Enterprise Management Systems, necessity, functions of ERP systems **Four sessions**

Modern Technology interventions - Impact of technology interventions like IoT, Blockchain, Artificial Intelligence, and Robotics on Manufacturing and service applications of the future**Four sessions**

Preferred Text Books :

Operations Management (McGraw-Hill Series in Operations and Decision Sciences) 12th Edition, by William J Stevenson

Reference Books :

- Operations Management: Processes and Supply Chains 11th Edition, by Lee Krajewski (Author), Manoj Malhotra (Author), Larry Ritzman (Author)
- Operations Management (11th Edition) by Heizer, Jay, Render, Barry

Grading Plan :

(The table is only indicative)

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

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a '-' dash mark if not relevant).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	2	3			
CO2	3	3	2	2	3	1		1
CO3	3	2	3	3	3	2		3
CO4	3	2	3	2	3			3
CO5		2		1	1			

Teaching-Learning Strategies in brief (4-5 sentences) :

I believe in inclusive teaching with involvement from the class as much as possible. I tend to keep the teaching and learning hand in hand and ensure we teach, learn and evaluate as we go. This helps students to pace the subject well and also makes them accustomed to the subject in a better way. I keep quizzes and assignments to include them in the classes as much as possible. We keep the Case studies and hands-on culture intact.

Title of the Course : Performance modeling of computer systems

Faculty Name : Tejas Bodas

Course Code : CS3.307

Credits : 2

L - T - P:

(L - Lecture hours, T-Tutorial hours,

P - Practical hours) 2-0-0

Semester, Year : Spring 2022

(Ex: Spring, 2022)

Name of the Program : CSE and or ECE
Pre-Requisites : MA6.101 Probability and Statistics

Course Outcomes :

Course outcomes (CO's): After completion of the course, the students will be able to

1. Explain and identify the role of performance modeling in different computer systems such as data networks, server farms and cloud computing platforms.
2. Apply Markov chains to model and analyze a variety of computer systems and analyze their performance metrics like response time, waiting time or job loss probability.
3. Derive expressions for the average delay or average number of jobs waiting for service in a variety of queueing systems.
4. Design and analyze the performance of multi-server queueing systems that have applications to cloud computing.
5. Analyze and understand the impact of scheduling policies like FIFO, LIFO, processor sharing and random routing on the performance of queues.
6. Identify causes for performance degradation (large latency problem) in queueing systems and offer easy scalable solutions.

Course Topics : Following is the tentative list of topics to be covered in this course in about 12 lectures. (Each lecture is of 90 mins.)

Module 1: (2 lectures)

- Motivation to Performance modeling (Modeling = Design + analysis)
- Probability refresher
- Basics of Stochastic processes

Module 2: (2 lectures)

- Discrete time Markov chains
- Continuous time Markov chains

Module 3: Elementary Queues (2 lectures)

- M/M/1 queue
- Loss queues
- Little's law and PASTA property

Module 4: Server-farms and networks (3 lectures)

- Multi-server queues
- Network of queues
- Load balancing systems
- Applications to data centers, cloud computing and distributed systems

Module 5: Scheduling and resource allocation in computer systems (3 lectures)

- M/G/1 queues
- Performance analysis of FIFO, round-robin, processor sharing, LCFS
- SMART scheduling policies

Preferred Text Books : Performance modeling and design of computer systems
(Cambridge press) by Mor Harchol-Balter (Professor, CMU)

Reference Books : 1) Probabilistic modeling by Iisi Mitrani

2) Queueing Systems (vol 1 and 2) by Klienrock

E-book Links : NA

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz-1	15
Mid SemExam	30
Quiz-2	15
End Sem Exam	40
Assignments	0 0
Project	0
Term Paper	0
Other Evaluation	0

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

https://iiitaphyd-my.sharepoint.com/:w/r/personal/dyacad_iit_ac_in/Documents/NBA-2020-21/Course%20Content/IIIT-CSE-ECE.docx?d=w111foeffcae41b3a4d1e8a3fbc6332d&csf=1&web=1&e=z1Khby

	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PO 1	PO 2	PO 3	PO 4
C O1	3	3	3	2	1	1	2	1	1	1	1	2	3	2	3	3
C O2	3	3	3	2	2	1	2	1	1	1	1	2	3	2	3	3
C O3	3	3	3	2	2	1	2	1	1	1	1	2	3	2	3	3
C O4	3	3	3	2	1	1	2	1	1	1	1	2	3	2	3	3
C O5	3	3	3	2	1	1	2	1	1	1	1	2	3	2	3	3
Co6	3	3	3	2	2	1	2	1	1	1	1	2	3	2	3	3

Teaching-Learning Strategies in brief (4-5 sentences) :

- The course is planned to be a fine balance between theory and practice.
- Traditionally, this course has been a theory intensive course with little emphasis on practical applications. We will however flip this around.

- We will introduce theoretical mathematical concepts on a need to know basis or as and when required.
 - The emphasis will be to look at plenty of practical examples of queueing systems that we encounter not just in our daily lives but also see in advanced computing systems.
 - The goal is not only to design queueing systems that offer better performance guarantees but also to be able to analyze such systems so as to fine tune or control them.
 - The 12 lectures are meant to be very interactive, there would be lot of discussion and exchange of ideas on the design aspect of queueing systems.
 - As for the analysis, ample practice problems and practice assignments would be provided to gain analytical expertise.
-

Title of the Course : Philosophical Foundations of Knowledge

Faculty Name : Saurabh Todariya

Name of the Program : B.Tech in CSE, ECE

Course Code : HS0.212

Credits : 4

L - T - P : 3-0-0

(L - Lecture hours, T - Tutorial hours, P - Practical hours)

Semester, Year : Spring, 2022

(Ex: Spring, 2022)

Pre-Requisites : Intro to Human Sciences.

Course Outcomes:

After completion of this course successfully students will be able to:

CO1: define the formation of knowledge and the role of cognitive framework in structuring our experience

CO2: explain the source of knowledge and its correspondence with reality

CO3: Analyze the fundamental process and structures which shapes our knowledge and experience

CO4: Examine the various process which leading to the belief-formation

CO5: Evaluate the various debates in the philosophical tradition with respect to the knowledge, validity and realism

Course Topics:

This course aims at introducing the fundamental issues and problems in the domain of knowledge as developed and debated in the history of western philosophy. The course will mainly introduce the modern concerns of epistemology traversing through the philosophy of Empiricism, Rationalism and Kant. The course will also introduce the two major streams of contemporary western philosophy i.e Phenomenology and Analytical Philosophy and their methodological departure with respect to epistemology.

Unit 1: Empiricism- This module will discuss the role of sensations in the construction of knowledge. The module will highlight the role of sensations as the building blocks of our knowledge.

John Locke: Sensations and Reflection, Primary and Secondary Ideas

David Hume: Impressions and Ideas, Simple and Complex Ideas, Problem of Induction in Scientific Knowledge

Unit 2: Rationalism- In this module students will be exposed to the various theories of Rationalism and will analyse the role of reason in the organizing our experiences. It will explore the rationalist thesis that the reality is logically structured which can be grasped through the exercise of our faculty of Reason.

Descartes: Cogito Ergo Sum, Innate Ideas

Leibnitz: Principle of Contradiction, Principle of Sufficient Reason, Identity of Indiscernibles

Unit 3: Transcendental Philosophy: This module will discuss the role and importance of the notion of transcendental in knowledge as developed by Kant. It will basically discuss the significance of transcendental method in accounting for the necessity in our judgments.

Kant: Sensations and Categories, Analytic and Synthetic Judgment, Transcendental Unity of Apperception

Unit 4: Phenomenology and Hermeneutics: This module will discuss the role of intentionality and the background structures in the experience of the world. The module will explore the efficacy of phenomenological method in explicating out the background which structure our experience of the world.

Husserl: Intentionality, Horizon, Life-World

Heidegger: Present-at-hand, Ready-to-hand, Hermeneutical Circle

Unit 5: Language and Reality: This module will discuss the relationship between the language and reality. It will basically explore the role of language in structuring our experience. And how does the logical language provide us the rational account of reality around us.

Bertrand Russell: Knowledge by acquaintance and Knowledge by description; Logical Atomism

Wittgenstein: Facts and Propositions, Logical Picture, Sense and Non-sense

Preferred Text Books:

1. Bertrand Russell. *History of Western Philosophy*.
2. Frank Thilly. *A History of Philosophy*
3. Peter Strawson. *The Bounds of Senses*
4. Dermot Moran. *Introduction to Phenomenology*
5. Stephen P. Schwartz. *A Brief History of Analytical Philosophy: from Russell to Rawls*

Reference Books :

1. Gaarder, Jostien (1997). *Sophie's World: A Novel about the History of Philosophy*. New York: Berkeley
2. Lavine, T.Z (1989). *From Socrates to Sartre*. New York: Bantam Books.
3. Nagel, Thomas (1986). *The View from Nowhere*. Oxford: Oxford University Press
4. Nagel, Thomas (1987). *What does it all Mean?A Very Short Introduction to Philosophy*. Oxford: Oxford University Press
5. Pirsig, Robert (2008). *Zen and the Art of Motorcycle Maintenance: An Inquiry into Values*. London: Vintage.
6. Russell, Bertrand (1912). *The Problems of Philosophy*. New Delhi: Prabhat Publications
7. Ruseell, Bertand (2010). *The Philosophy of Logical Atomism*. London: Routledge
8. Zahavi, D. (2003). *Husserl's Phenomenology*. California: Stanford University Press.
9. Heidegger, M. (1962). *Being and Time* (trans: Macquarie and Robinson). New York: Harper and Row.
10. Wittgenstein, L (1960). *Tractatus: Logico-Philosophicus*. London: Routledge

Grading Plan:

(The table is only indicative)

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

Mapping of Course Outcomes to Program Objectives:

(1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	1	2	2	-	3	1	3	-	-	-	3	-	-	-	2
CO2	-	1	2	3	-	3	1	3	1	1	-	3	-	-	-	2
CO3	1	1	3	2	1	3	1	3	-	1	-	3	-	1	-	2
CO4	-	1	2	3	1	3	2	3	1	1	-	3	-	-	-	3
CO5	-	1	2	3	-	3	3	3	1	1	-	3	-	1	-	3

Teaching-Learning Strategies in brief (4-5 sentences) :

The course aims at introducing the students the fundamental debates in knowledge through the classroom lectures and discussion. There would be emphasis on the perspective building of the students through intense reading, debates and continuous assessment. The students are expected to develop the logical reasoning for the conceptual development which will be assessed through the assignments and classroom presentations.

Title of the Course : Physics of Soft Condensed Matter

Faculty Name : Marimuthu Krishnan

Course Code : SC2.301

L-T-P : 3-1-0

Credits : 4

1.Prerequisite Course / Knowledge:

Science-I and Science-II (for non-CND students); thermodynamics and basic statistical mechanics (for CND students)

2.Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to

CO-1 Apply theoretical and numerical methods to analyze the structure and dynamics of soft condensed matter

CO-2 Analyze the time evolution of phase space probability density functions for many-body systems

CO-3 Calculate radial distribution functions and structure factors for condensed systems

CO-4 Explain density fluctuations and fluctuation dissipation theorem

CO-5 Calculate time correlation functions and mean-square displacement for condensed systems

CO-6 Explain fluctuation theorems for non-equilibrium systems

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2											1	1	1	2
CO2	3	3											2	2	2	2
CO3	3	2											1	1	1	2
CO4	3	2											1	1	2	2
CO5	3	3											1	1	1	2
CO6	3	2											1	1	2	1

4.Detailed Syllabus:

Unit 1: Introduction to soft condensed matter

Unit 2: Phase space probability density functions (PDFs) and their time evolution, Liouville equation and Liouville theorem

Unit 3: Particle densities and distribution functions, Radial distribution function and pair correlation functions

Unit 4: Statistical properties of liquids: thermodynamics and structure, static and dynamic structure factors

Unit 5: Density fluctuations and fluctuation-dissipation theorem

Unit 6: Fluctuation theorems

Unit 7: Mechanics of biomembranes, molecular transport through nanopores, single-molecule kinetics

Reference Books:

1. Theory of Simple Liquids: With Applications to Soft Matter by I. R. McDonald and J. P. Hansen

2. Principles of Condensed Matter Physics by P. M. Chaikin and T. C. Lubensky

3. Relevant research articles will be provided as additional reading material

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

Lectures will introduce the basic concepts and recent advances in soft condensed matter physics, with particular emphasis on the equilibrium and non-equilibrium properties of simple liquids, biopolymers, and macromolecular assemblies. This will be followed by lectures on theoretical tools needed to understand many-body systems and some discussion on experimental techniques commonly used to probe soft condensed matter. The course will also have hands-on sessions on computational analyses of condensed matter systems. As part of reading assignments, students will be asked to read and present some research articles on some interesting soft condensed matter systems. Class assignments and mid-term exams will be used evaluate students' understanding of concepts covered in the course. Computational projects will be given at the end of the course, which will enable students to apply the concepts to some real-world problems.

6.Assessment methods and weightages in brief (4 to 5 sentences):

Mid-term exams (20%), Assignments (20%), Final Exam (30%), Projects (30%)

Title of the Course : Physics of Early Universe

Name of the Faculty : Diganta Das

Name of the Academic Program : CNS, HSME

Course Code : SC1.415

L-T-P : 3-1-0.

Credits : 4

(L= Lecture hours, T=Tutorial hours, P=Practical hours)

1.Prerequisite Course / Knowledge:

Differentiation and integration, classical mechanics, electricity and magnetism

2.Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completing this course successfully, the students will be able to

- CO-1 Explain** the large-scale structure of the universe and its observational components
- CO-2 Demonstrate** understanding of how mass, radiation distribution shapes the dynamics of the universe
- CO-3 Apply** their knowledge and **calculate** dynamical properties of few model universe
- CO-4 Discover** the thermal history of the early universe
- CO-5 Familiarize** themselves with several unsolved problems in the research of cosmology

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1										2		3	1	2
CO2	2	1										2		3	1	2
CO3	1	1												2	3	1
CO4	2	2										1		2		3
CO5	3	1										2		3		3

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

Unit-1:Universe Observed: Expansion. Isotropy and homogeneity. Age. Cosmic microwave background

Unit-2: Geometry and Dynamics: Universe in the eyes of Newton. Geometry. Mass and curvature. Freedman equations. Model universes: empty universe, matter or radiation dominated universe, multi-component universe

Unit-3: Black-body radiation and the early history: Observation of CMB. Recombination and decoupling. Last scattering. Temperature fluctuations

Unit-4: Very early history of the Universe: Thermal history. Nucleosynthesis. Cold dark matter

Unit-5: Inflation: Flatness, horizon, and monopole problem. Physics of inflation

Reference Books:

1. **Barbara Ryden: Introduction to Cosmology**
2. **Matts Roos: Introduction to Cosmology**

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

This is an introductory course to cosmology. The course is for students who do not have any knowledge of cosmology. It is also designed to be taught to students from diverse background of science. In each lecture session, the focus will be on building concepts and intuition about the physics. It will be followed by hands-on session where application of the concepts to simple problems will be practiced.

6.Assessment methods and weightages in brief (4 to 5 sentences):

Assignments: 30%,

Quizzes : 30%,

End Semester: 35%,

Attendance: 5%

Title of the Course : Principles of Information Security

Faculty Name : Kannan Srinathan

Course Code : CS8.401

Credits : 4

L-T-P : 3-1-0

(L=Lecture hours, T=Tutorial hours,

P=Practical hours)

Name of the Academic Program : B.Tech. in Computer Science and Engineering

1. Prerequisite Course / Knowledge:

Basic principles of algorithms.

2. Course Outcomes (COs) :

After completion of this course successfully, the students will be able to..

CO-1 Discuss mathematical concepts of cryptographic primitives

CO-2 Describe fundamental concepts and algorithms of cryptography, including encryption/decryption and hash functions

CO-3 Summarize different authentication techniques and describe programs like PGP & S/MIME

CO-4 Discuss network security principles, applications, and practices

CO-5 Analyse protocols for various system security objectives using cryptographic tools

CO-6 Evaluate the role of different security mechanisms like passwords, access control mechanisms, firewalls, etc.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1									2	1		2
CO2	3	2	2	2									3	2	2	3
CO3	1	1	2	1									2	1	1	2
CO4	2	2	2	2									2	1	2	2
CO5	2	3	2	3									3	2	2	2
CO6	1	1	2	1									1	1	2	1

Note: '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

4. Detailed Syllabus:

Unit 1: Introduction: Security Trends, Security attacks, Security services, Security Mechanisms, A Model for Network Security Model, Classical Encryption Techniques, Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography.

Unit 2: Block Ciphers and Data Encryption Standard: Block Cipher Principles, Data Encryption Standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles, Advanced Encryption Standard, Evaluation Criteria of AES, AES Cipher, Multiple encryption and Triple DES, Block Cipher Modes of Operation, RC4.

Unit 3: Public-key Encryption and Hash Functions: Principles of Public Key Cryptosystems, RSA Algorithm, Key Management, Message Authentication and Hash Functions, Authentication Requirements, Authentication Functions, Message Authentication, Hash Functions, Security of Hash Functions and MACs, Digital Signatures, Authentication Protocols, Digital Signature Standard.

Unit 4: Network Security Applications: Kerberos, X.509 Authentication Service, Public Key Infrastructure, Pretty Good Privacy, S/MIME, IP Security Overview, IP Security architecture, Authentication Header, Encapsulating Security Payload, Combining Security associations, Key Management.

Unit 5: System Security: Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction, Intruders, Intrusion Detection, Password Management, Malicious Software, Firewalls, Trusted Systems

Reference Books:

1. W. Stallings, Cryptography and Network Security Principles & Practices, 4th edition, Prentice Hall, 2005
2. J. Katz and Y. Lindell, Introduction to Modern Cryptography, CRC Press, 2007
3. B. Schneier, Applied Cryptography, 2nd edition, John Wiley & Sons, Inc, 2001
4. Research papers

5. Teaching-Learning Strategies in brief (4 to 5 sentences):

Lectures by integrating ICT into classroom teaching; tutorials involving problem solving; being a fundamental course, it requires critical thinking and active learning by the students to solve problems.

5. Assessment methods and weightages in brief (4 to 5 sentences):

Assignments	30 marks
Mid Semester Examination	30 marks
End Semester Examination	40 marks

Title of the Course

: Product Design Workshop

Faculty Name

: Prakash Yalla + Deepak Guna

Course Code

: PD1.411

Credits

: 2 Credits

L - T - P

: 1.5 -0- 3

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year

: 2nd Sem – Year 1 (Monsoon, 2022)

(Ex: Spring, 2022)

Name of the Program

: M. Tech in Product Design and Management program

Pre-Requisites :

Basic principles of, Software programming, Design thinking and Product design. Basics of workshop tools and equipment operations (lathe, cnc, 3d printing, laser cutter & pcb maker). Else tutorials need to be taken. Basics of rapid prototyping CAD software for mechanical and electronics design (else tutorial to be taken)

Course Objective & Overview:

This course module intends to equip students with tools and techniques to rapid prototype a physical product that solve real life problems. Some of the most impactful systems interact with physical world. All of these have software driven intelligence. The objective of this learning module is to empower students with tools and techniques and to design real world physical systems.

Mode: Hands on workshop and project-based delivery. The course will involve a series of micro level projects that add up-to a larger project leading to a physical system (s).

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able to:

CO-1. Apply Product design & rapid prototyping tools in development of physical systems/products.

CO-2: Re-engineer/Design products based on end user needs

CO-3. Integrate and create an end to end physical system (SW, Mechanicals and Electronics).

CO-4. Deploy in live setting and capture usable information from physical world.

3. Detailed Syllabus:

#	Topics
1	Rapid Prototyping Techniques & Tools
2	Shapes, Cuts and Joints : Usage and realise using RPT tools
3	Materials and selection depend upon their applications.
4	Product aesthetics : Materials Texture, Feel, and colour.
5	Embedded Intelligence
6	System Integration & Live deployment

The course has four parts to it with each part naturally dove tailing into the other

Part 1: Understanding Physical Objects & Rapid Prototyping:

In this module students get introduced to basics of rapid prototyping and usage of equipment like 3d printers, laser cutters, CNC machines etc. The students replicate everyday objects as is using these tools (builds an understanding on the right tool for right job).

Part 2: Problem Solving – understanding user need, usage scenario and re-imagining:

In this module students are given design problems that makes one re-imagine known systems based on user needs e.g. How could the everyday object manifest in the context of say a Parkinson's patient.

Part 3: Embedding Intelligence:

In this module students are taught how to capture physical world information and how to embed smarts in a seamless manner into the physical system. This module brings into focus the behavior of software systems while engaging with real world parameters.

Part4: Putting it all Together: Final project

This part of the course assembles all the learning in the form of an end to end system/object that students showcase. The end semester exam for this is an end use feedback: the usability, the aesthetics , the functionality, the smarts etc.

4.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
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CO1	3	3	2	3	3	2	2	2	2	3	3	3	3	3
CO2	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO3	3	3	2	2	3	3	2	2	3	3	3	3	3	3
CO4	3	3	2	2	3	3	3	3	2	3	3	3	3	3

'3' in the box denotes 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

5. Teaching-Learning Strategies in brief:

The course is experiential in nature. It is workshops and discussions-based methodology to discover solutions to problems and projects that enables students to see their designs work in real world.

Lectures by integrating ICT into classroom teaching, weekly tutorials involving problem solving and active learning by students and Project-based Learning by doing 4 mini-projects & one major project in laboratory by the students

6. Assessment methods and weightages in brief :

In-class activities and Quizzes	20%
Weekly Lab assignments	30 %
Main Project	40 %
End Semester Exam	10 %

Title of the Course : Product Marketing

Faculty Name : Ravi Warrier

Course Code : PD2.501

Credits : 4

L - T - P : 3-1-0

(L - Lecture hours, T-Tutorial hours, P - Practical hours)

Semester, Year : I Sem 2nd Year 2023

(Ex: Spring, 2022)

Pre-Requisites : No pre-requisites

Course Outcomes :

The outcome of the Product Marketing course is to ensure that participants acquire skills and understand the processes involved in defining a complete and functional strategy to take their product or service to the market.

CO1- Learn methods, models and frameworks that can be employed to developing strategy artifacts relevant to product marketing.

CO2- Apply the concepts and tools in the development of go-to-market strategy and sales playbooks

CO3- Learn the principles of effective marketing, specifically those of pricing, positioning, narratives with respect to targeted segments and types of customers in each segment.

CO4- Understand the synthesis between product management and product marketing as to design and build better products from the beginning

Course Topics:

Unit 1 – Product Marketing and Product Management

Sub-topics covered: Recap of 1) how marketing is an integral part of Product Management, 2) Product Management fundamentals, 3) Product Market Fit – problem and solution validation

Unit 2 – Marketing Mix

Sub-topics covered: 1) Value Model (4Cs), 2) Marketing Mix (4Ps) and how to use them in tandem to strategize product launch

Unit 3 – Value Proposition and Promotion

Sub-topics Covered – 1) Segmentation and User Personas, 2) Customer Journey Mapping, 3) Pricing Mix, 4) Positioning, and 5) Product Branding

Unit 4 – Customer Engagement

Sub-topics – 1) Introduction to Marketing Communication, 2) Building a comprehensive narrative for marketing, and 3) Customer Engagement at all stages of acquisition

Unit 5 – Sales Playbooks

Sub-topics covered: 1) What are playbooks?, and 2) how to develop an actionable playbook for sales

Unit 6 – Go-to-Market Strategizing

Sub-topics covered: 1) Customer Acquisition Strategies, 2) Defining the GTM Strategy, and 3) Executing the GTM Strategy successfully

Preferred Text Books:

None

Reference Books:

There are a few books I will recommend during the course. Will make a list and add them here shortly.

E-book Links: TBD

Grading Plan:

Type of Evaluation		Frequency	Weightage (in %)
Assignments		10	50
Final Submissions		1	25
Final Exam		1	25

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	3	2	2	2	2	3	3	2	2	2	2
CO2	3	3	3	2	3	2	2	2	2	3	3	2	2	2	2

CO3	3	3	3	2	3	3	2	2	2	2	3	3	2	2	2
CO4	3	3	3	2	3	2	2	3	3	2	3	3	2	2	2

Teaching-Learning Strategies in brief (4-5 sentences) :

1. Each class will have prerequisite reading material that will be announced or provided at the end of the previous seminar. Discussions will cover subjects of interest or concern from the pre-reads with respect to that topic of the class.
2. Seminars will always cover the fundamentals and cover detailed concepts only when the participants need additional assistance grasping those concepts.
3. Assignments will be given in each seminar session and will be followed by a discussion session to review and discuss the assignment
4. The course leans more on practice and completion of assignments which will form a larger chunk of their efforts and grading.

Title of the Course : Ethics 2: Questions of Crime and Punishment in Literature

Faculty Name :Nazia Akhtar

Name of the Program : Ethics 2 Sub-Elective

Course Code : HSo.208

Credits : 2 credits

L - T - P : 18Lecture hours (12 classes)

Semester, Year : Spring 2023

Pre-Requisites : Introduction to Human Sciences, Ethics 1 (Basics)

Course Outcomes :

On successful completion of this course, students will be able to

1. examine key ethical concepts and explain how they work in a given context. These skills are portable and will stand students in good stead in the study and application of ethics in broader contexts.
2. assess how one of the most prominent creative writers and thinkers in history approached fundamental ethical questions, and analyse the development of ethics in his work.
3. synthesize their knowledge of theories and concepts in ethics with the ability to think and communicate carefully about ethical questions beyond casual statements or impressions, strengthening fundamental skills in critical thinking.

Course Topics :

Module I:

- Introduction: Ethics in the World
- Historical and Socio-Cultural Context

Module II:

- Ethical Questions in *Crime and Punishment*: ethical relativism, egoism, consequentialism, deontology, virtue ethics, feminist ethics

Module III:

- Ethics in Dialogue and Debate: “The Grand Inquisitor,” Dostoevsky vs. Tolstoy

Preferred Text Books :

- Dostoevsky, F.M. *Crime and Punishment*. Translated by Richard Pevear and Larissa Volokhonsky. Vintage, 1993.

- Shafer-Landau, R. 2019. *Living Ethics: An Introduction with Readings*. Oxford University Press.

Reference Books :

- Cahn, S. M. ed. *Exploring Ethics: An Introductory Anthology* 5th Edition. Oxford University Press, 2020.
- Leatherbarrow, W.J, ed. *The Cambridge Companion to Dostoevskii*. Cambridge University Press, 2002 (Reprint 2004).
- Shafer-Landau, R. *Ethical Theory: An Anthology* 2nd Edition. Wiley-Blackwell, 2013.
- Stich, S. and Donaldson, T. *Philosophy: Asking Questions, Seeking Answers*. Oxford University Press. 2019.
- Vaughn, L. *Doing Ethics: Moral Reasoning, Theory and Contemporary Issues* 5th Edition. W. W. Norton and Co, 2019.

E-book Links :-

Grading Plan :

Type of Evaluation	Weightage (in %)
Quiz-1 (3-5 questions; answers of 200-300 words)	20%
Assignment 1 (1000-word essay)	30%
Quiz-2 (3-5 questions; answers of 200-300 words)	20%
Assignment 2 (1000-word essay)	30%

Mapping of Course Outcomes to Program Objectives:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	2	-	3	3	3	2	3	-	3	-	-	2	3
CO2	-	-	-	2	-	3	3	3	3	2	-	3	-	-	1	3
CO3	-	-	3	2	1	3	3	3	2	3	-	3	-	-	3	3

Teaching-Learning Strategies in brief (4-5 sentences) :

The teaching-learning strategy in this course will consist of lectures based on set readings, which students are expected to complete in advance of the class. These lectures will incorporate prompts for classroom discussion and activities based on the readings to enable active learning and critical thinking. This learning will be further consolidated through assessments that will be designed to test and develop the student's knowledge and skills, especially interpretative reading and writing.

Title of the Course	: Readings in Russian Literature: The Nineteenth Century
Faculty Name	: Nazia Akhtar
Name of the Program	: BTech in Computer Science Engineering
Course Code	: HS1.302
Credits	: 4 credits
L - T - P	: 3 – 0 – 0
Semester, Year	: Spring 2023

Pre-Requisites : **BTech Students: Passed Intro to Human Sciences and one other HSS elective; CHD 3rd and 4th Year students**

Course Outcomes :

On successful completion of this course, students will be able to

CO1: Critically interpret, analyze, and appreciate Russian literature (and by extension, other kinds of texts and narratives as well) and its contributions to art and thought of the modern world.

CO2: Examine and discuss the literary merit of creative texts beyond casual impressions or value judgements, acquiring, in the process, fundamental skills in oral and written communication.

CO3: Connect human, creative expression to the issues that make up and are made by the world in which we live.

CO4: Apply this basic foundation in the study of creative writing to conduct further research on literature, including computational research on topics associated with literature.

CO5: Understand the socio-historical background and material foundation of modern Russia, whose geopolitics plays a crucial international role in our times.

Course Topics:

The nineteenth century in Russia saw the production of some of the greatest prose in the history of world literature. This was the century when Lev Tolstoy debated the question of non-violence through the prisms of philosophy and religion; when Fyodor Dostoevsky pondered over the psyche of human beings, pushing them to their extremes in his writings, and wrote one of the first creative texts of existentialism; and when Anton Chekhov wrote stories and plays that totally shifted paradigms and principles of representation on page and stage. Across the span of the century, writers of novels, novellas, and short stories grappled with fundamental questions about humanity: the eternal struggle between good and evil, the place of the individual in society and state, the conditions and rights of women, alienation and other discontents brought about by industrialization and urbanization, the uncanny in nature and folk, patriotism and the Russian soul and so on. Writers such as Marko Vovchok and Maxim Gorky envisaged and pushed for a transformation of the entire social order, fighting more particularly for the rights of serfs and the working classes. Others such as Elena Gan, Maria Zhukova, Nadezhda Khvoshchinskaya, Karolina Pavlova, and Olga Shapir not only engaged with and represented the concerns their male colleagues were preoccupied with, but also challenged existing discourses about women and their place in the world, ushering in change in social thought through their deliberations on the “new woman” and her aspirations and world view.

The impact of nineteenth-century Russian literature far exceeds its specific time and milieu; this body of writing raises and addresses questions that remain relevant to our world today. It has inspired figures as diverse as Sigmund Freud, Friedrich Nietzsche, Mahatma Gandhi, Virginia Woolf, Martin Luther King Jr, and Anita Desai. This course will introduce students to the terrain

and trajectory of the nineteenth-century Russian short story and provide them the opportunity to examine, interpret, and discuss the work of several writers from this period. It will equip them with a foundational understanding of major conceptual, theoretical, and methodological developments in Russian literature. Over the duration of this course, we will reflect on three key questions through our reading of nineteenth-century Russian short stories: what were the major moments and concerns of Russian literature during this period, and how are these still relevant today? How did the form of the Russian short story change over the course of the century, and what was the socio-cultural context for these developments? What was the long-term impact of these events for literature in general? The course will discuss issues fundamental to the study of literature, psychology, sociology, and philosophy through the lens of these texts and seek to understand their status as an indispensable and enduring body of writing in world literature.

To do so, it will cover the following topics:

1. **Defining the Literary, Socio-Historical, and Global Context of Nineteenth-Century Russian Literature:** the Russian Empire; the defeat of Napoleonic France in 1812; the Decembrist revolt of 1825; the court and country; the Crimean War of 1854-5; the annexation of the Caucasus; relations with the Ottomans, Persians, and the Chinese; urbanization and industrialization; 1861 Emancipation of the serfs; Nihilism and other political and intellectual developments.
2. **Mapping and Examining the Forms and Concerns of the Russian Short Story across the Nineteenth-Century through Close-Reading:** Romanticism (the Gothic and the uncanny, folklore, nature and human beings, patriotism and nationalism); Realism (psychological realism, social manners, structural inequalities, critique of the state); Existentialism (nature of existence, sovereign vs. relational self); Socialist Realism (socialism; the advent of revolutionary writing).
3. **Tracing the Literary History and Method of the Russian Short Story across the Nineteenth-Century:** poetics of sensibility vs. poetics of rationality and pragmatism; political, didactic, and ideological writing; temporal, stylistic, and narrative structure; thematic shifts.
4. **Synthesizing an Understanding of Nineteenth-Century Russian Literature with Its Enduring Place in World Literature:** universal philosophical, political, and aesthetic questions; major issues such as class, gender, empire, totalitarianism, and power; accessing world literature in translation; possibilities of research on nineteenth-century Russian literature using computing.

Preferred Text Books :

1. **Aleksandr Pushkin:** "The Queen of Spades" (1834), selections from *The Tales of the Late Ivan Petrovich Belkin* (1831).
2. **Zinaida Volkonskaya:** "The Dream: A Letter" (1829).
3. **Mikhail Lermontov:** "Ashik-Kerib" (1837).
4. **Nikolai Gogol:** "The Nose" (1835-6), Selections from *Evenings on a Farm Near Dikanka* (1829-32).
5. **Ivan Turgenev:** Selections from *A Hunter's Sketches* (1852).
6. **Karolina Pavlova:** "At the Tea-Table" (1859).
7. **Marko Vovchok:** "After Finishing School" (1859).
8. **Lev Tolstoy:** "Quench the Spark" (1885), selections from *Sevastopol Sketches* (1855).
9. **Sofya Soboleva:** "Pros and Cons" (1863).
10. **Fyodor Dostoevsky:** "The Crocodile" (1865), "Notes from Underground" (1846).
11. **Anton Chekhov:** "Death of a Clerk" (1883), "Lady with the Dog" (1899).
12. **Olga Shapir:** "The Settlement" (1892).

13. Maxim Gorky: “Old Izergill” (1895).

Reference Books:

1. Martin Puchner, ed. *The Norton Anthology of World Literature*, vol. 2, fourth ed. (2019).
2. Catriona Kelly, ed. *An Anthology of Russian Women’s Writing, 1777-1992* (1994).
3. Nicholas Rzhevsky, ed. *An Anthology of Russian Literature from Earliest Writings to Modern Fiction: Introduction to a Culture* (1996).
4. Dominic Lieven, ed. *The Cambridge History of Russia*, vol. 2 (Imperial Russia, 1689-1917; 2008).

Grading Plan :

Type of Evaluation	Weightage (in %)
Quizzes	15% (2 x 7.5%)
Writing Assignments	15% (2 x 7.5%)
Mid-Semester Exam	30%
Project	40%

Mapping of Course Outcomes to Program Objectives:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	1	3	-	3	2	3	3	1	-	3	-	1	1	3
CO2	-	-	1	3	-	3	2	3	3	1	-	3	-	1	1	3
CO3	-	-	1	3	-	3	2	3	3	3	-	3	-	1	1	3
CO4	-	1	1	2	-	3	2	3	3	2	-	3	-	1	1	3
CO5	-	-	1	3	-	3	2	3	3	1	-	3	-	1	1	3

Teaching-Learning Strategies in brief (4-5 sentences) :

The teaching-learning strategy in this course will consist of lectures based on set readings, which students are expected to complete in advance of the class. These lectures will incorporate prompts for classroom discussion and activities based on the readings to enable active learning and critical thinking. This learning will be further consolidated through assessments that will be designed to test and develop the student's knowledge and skills, especially interpretative reading and writing.

Faculty Name	: Aniket Alam
Course Code	: HSo.302
Credits	: 4 (four)
L - T - P	: 3-1-0
(L - Lecture hours, T-Tutorial hours, P - Practical hours)	
Semester, Year	: Spring 2022
(Ex: Spring, 2022)	
Name of the Program	: B.Tech in Computer Science and M.S. in Computing and Human Sciences by Research
Pre-Requisites	: Thinking and Knowing in the Human Sciences One and Two
Course Outcomes :	
CO1: Identify the main concepts of research method, and of methodology, in the human sciences	
CO2: Explain the different qualitative and quantitative tools used in human sciences research	
CO3: Apply one or many tools of research to specific given problems	
CO4: Differentiate the different sources of evidence and data: textual, material, human; and Analyse the common errors which occur during research	
CO5: Critically Evaluate existing research papers and books along different research methods	
CO6: Develop their own research method and methodology; Design their own research problem	

Course Topics :

1) What all does Research Methods encompass?

Explain the importance of research methods in making of a good research project. List and describe the different components of it. Introduction to Zotero (open-source reference management).

2) Textual Sources of Research: Literary, Historical.

The different categories of textual sources; how to read them in context; the distinction and similarity between literary and historical textual sources. The function of the archive and library.

3) Material Sources of Research: Artefacts, Built Environments, Nature; Pictures, Photographs, Audio sources of these.

How to “read” material objects for information and evidence. Audio and Visual evidence as artefacts.

4) Human Sources of Research: Relationships, Social Processes, Emotions, Ideas, Visual, Oral.

How to conduct ethnographic research; special emphasis on surveys and questionnaires, participant observation, focus group, ethics of conducting research. Placing audio-visual material in context.

5) Data Sources of Research: Numbers; Turning textual, material and human sources into computational data.

Importance of numbers and data; their limitations. The fraught relation between correlations and causation. The possibilities of using NLP tools and data analytic tools.

6) Placing Research in Space (and Time)

Importance of space and time in building context of information/evidence. Introduction to GIS and SNA

7) Common Errors in Research

Cherry-Picking data; strong determinism; generalizing/theorizing on insufficient evidence;

conceptual stretching; methodological nationalism; lack of originality, and/or following fashion; Straw-man.

8) Research Design and Presentation

How to design a research project: identifying the research gap/debate, identifying methods/approach/theories, collecting evidence, analysis. Writing out the research: how to write abstract, literature review, citation and references, plagiarism, other components of writing.

Preferred Text Books :

1. AnolBhattacherjee (2012), *Social Science Research: Principles, Methods, Practices*, Textbook Collection 3. http://scholarcommons.usf.edu/oa_textbooks/3
2. Paul S. Gray, et al (2007), *The Research Imagination*, Cambridge University Press.
3. Shawn Graham, et al (2015), *Exploring Big Historical Data: The Historian's Macroscopic*, Imperial College Press, <http://www.themacroscopic.org/2.0/>

Reference Books :

1. Peter J Carrington et al (ed) (2005), *Models and Methods in Social Network Analysis*, Cambridge University Press.
2. Mathew W Wilson, (2017), *New Lines: Critical GIS and the Trouble of the Map*, University of Minnesota Press.
3. Gabe Ignatow, Rada Mihalcea (2016), *Text Mining: A Guidebook for the Social Sciences*. Sage.
4. Andrew Piper (2020), *Can We Be Wrong? The Problem of Textual Evidence in a Time of Data*, Cambridge Elements – Digital Literary Studies, Cambridge University Press, <https://www.cambridge.org/core/elements/can-we-be-wrong-the-problem-of-textual-evidence-in-a-time-of-data/86A68A9A055DE5815F29AAE66F2AFF9A>
5. Johny Saldana (2016), *The Coding Manual for Qualitative Researchers*, Sage.
6. Bonita Aleaz, ParthaPratimBasu (eds) (2019), *Revisiting Qualitative Methods in Social Science Research*, Orient Blackswan.
7. Clifford Geertz (1973), “Deep Play – notes on the Balinese Cockfight”, *Interpretation of Cultures: Selected Essays*, Basic Books.
8. Clifford Geertz (1973), “Thick Description – towards an interpretive theory of culture”, *Interpretation of Cultures: Selected Essays*, Basic Books.
9. Akhil Gupta, and James Ferguson (1997), “Discipline and Practice: ‘The Field’ as Site”, Method, and Location in Anthropology”, In *Anthropological Locations: Boundaries and Grounds of a Field Science*. A. Gupta, J. Ferguson, eds. Berkeley: University of California Press. Pp 1-46.
10. George Orwell (1984), *The Road to Wigan Pier*, HarperCollins.
11. Aman Sethi (2012), *A Free Man*, Random House India.
12. Rukmini S. (2021), *Whole Numbers and Half Truths: What Data Can and Cannot Tell Us About Modern India*, Context Publishers.
13. Carl E. Pletsch (1981) “The Three Worlds, or the Division of Social Scientific Labor, Circa 1950-1975”, *Comparative Studies in Society and History*, 23(4), pp. 565-590.
14. D. D. Kosambi (1956), *Introduction to the Study of Indian History*, “Chapter 1: Scope and Methods”, Popular Prakashan.

15. Carlo Ginzberg (2002), *Wooden Eyes: Nine Reflections on Distance*, Verso. (Chapter I: Making it Strange – Prehistory of a Literary Device; Chapter II: Myth – Distance and Deceit; Chapter III: Representation – The World, The Idea, The Thing)
16. Jean-Claude Carriere, Umberto Eco (2012), *This is not the end of the book*; Vintage Books
17. James Hoopes (1979), *Oral History: An Introduction for Students*, University of North Carolina Press.
18. David L. Ransel (2010), “The Ability to Recognise a Good Source”, *Perspectives on History*. <https://www.historians.org/publications-and-directories/perspectives-on-history/october-2010/the-ability-to-recognize-a-good-source>
19. Lynn Hunt (2010), “How Writing Leads to Thinking”, *Perspectives on History*. <https://www.historians.org/publications-and-directories/perspectives-on-history/february-2010/how-writing-leads-to-thinking>
20. Giovanni Sartori (1970), “Concept Misinformation in Comparative Politics”, *American Political Science Review*.
21. Andreas Wimmer, Nina Glick Schiller (2003), “Methodological Nationalism, the Social Sciences, and the Study of Migration: An Essay in Historical Epistemology”, *International Migration Review*.
22. Stephen Kern (2004), *Cultural History of Causality : science, murder novels, and systems of thought*, Princeton University Press
23. Arthur Conon Doyle (1892), *Sherlock Holmes – Silver Blaze*.
24. Arthur Conon Doyle (1887), *Sherlock Holmes – A Study in Scarlet*.

E-book Links :

Grading Plan :

Type of Evaluation		Weightage (in %)	
Assignments		(3x15) 45%	
Project		35%	
Other Evaluation: Class Participation		20%	

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	3	2	2	3	1	1	1	3	1	3	3	3
CO2	2	3	1	3	3	2	2	3	1	2	1	3	1	3	3	3
CO3	2	3	3	3	3	2	3	3	2	2	1	3	1	3	3	3
CO4	2	3	3	3	3	3	2	3	3	2	1	3	1	3	3	3
CO5	2	3	3	3	3	2	2	3	2	3	1	3	1	3	3	3
CO6	2	3	3	3	3	2	2	3	2	3	1	3	1	3	3	3

Teaching-Learning Strategies in brief (4-5 sentences) :

The course will be held in the workshop mode with student engagement in the topics discussed in each class. Readings will be given out before the class and students will be expected to read and come, and then engage with the topic under discussion.

Each of the different modules will be taught through two or more examples and illustrations from existing research papers and books from different disciplines of the Human Sciences.

Students will be asked to make presentations for their assignments, and will be made to work in teams of three or four for their project.

Students will be expected to read about 1,500 pages of academic texts, as well as write about 8000 to 10000 words.

Title of the Course : Robotics: Planning and Navigation

Faculty Name : Madhava Krishna K

Course Code : EC4.403

L-T-P : 3-1-0

Credits : 4

Name of the Academic Program:B. Tech. in ECE, BTech in CSE

Prerequisite Course / Knowledge:

Computer Programming, Data Structures and Algorithms. Knowledge of Functional Optimization is a plus.

Course Outcomes (COs):

After completion of this course successfully, the students will be able to..

CO-1: Demonstrate familiarity with different paradigms in robotic motion planning

CO-2: Analyze robotic planning algorithms in the context of navigating in an environment to accomplish a goal

CO-3: Explain the significance of mathematical frameworks of functional optimization as well as robot kinematics in robotic planning and navigation tasks.

CO-4: Apply principles of functional optimization and robot kinematics to propose analytical frameworks, algorithms for solving real world problems in robotic motion planning, navigation.

CO-5: Create and Simulate the algorithms using state of the art software and libraries and evaluate its performance on specified tasks

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO 4	PO5	PO 6	PO7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PS O1	PS O2	PS O3	PS O4
CO1	3	2	1	1	1	1	1	2	2	1	1	2	1	1	1	2
CO2	3	3	1	2	1	1	1	2	2	1	1	1	1	1	1	2
CO3	2	3	1	2	1	1	1	2	2	2	1	2	1	1	1	3
CO 4	3	2	3	2	2	1	1	2	2	2	1	3	1	1	1	3

CO5	2	2	3	2	3	1	1	2	3	3	3	3	3	1	1	1	3
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Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping Mapping with PSOs, where applicable.

Detailed Syllabus:

Unit 1: Classical AI Based Planning and its Limitations

Unit 2: Sampling Based Kinematic Planners, Trajectory Optimization

Unit 3: Model Predictive Control and Velocity Obstacles for Dynamic Scenes

Unit 4: Uncertainty Modelling, Planning under Uncertainty

Reference Books:

1. Trajectory Planning for Automatic Machines and Robots by Luigi Biagiotti · Claudio Melchiorri
2. Introduction to Robotics: Mechanics and Control by John J Craig

Teaching-Learning Strategies in brief (4 to 5 sentences):

Classes invoke rich graphical content in the form of images, representations, videos to elucidate difficult concepts in robotic motion planning. Code walkthroughs, simulation of algorithms used to enhance understanding. Learning by doing, coding and simulation is highly promoted and encouraged. Students understand difficult mathematical concepts and abstraction by coding it using state of the art software, simulation frameworks, libraries and solvers.

Assessment methods and weightages in brief (4 to 5 sentences):

- Programming Assignments: 50%
- Mid Sem : 20%
- End Exam: 30%

Title of the Course : Science &Technology : Critical perspectives

Name of the Faculty : Saurabh Todariya

Course Code : HS0.207

L-T-P : 3-1-0.

Credits : 2

(L= Lecture hours, T=Tutorial hours, P= Practical hours)

Name of the Academic Program: CHD

1.Prerequisite Course / Knowledge:

None

2.Course Outcomes (COs) :

After completing this course successfully, the students will be able to

CO-1 Explain diverse perspectives on **Science & Technology with an ethical scrutiny.**

CO-2 Demonstrate understanding of how science and technology have differential effects on different sections of society.

CO-3 Apply their knowledge to critically and ethically evaluate applications of science and technology to social problems.

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2																
CO3																
CO4																
CO5																

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

4.Detailed Syllabus:

Unit-1: The problem of knowledge and science as an episteme; the nature of technology

Unit-2: Deterministic nature versus social construction of science and technology; differential effects on different sections of society

Unit-3: General critique of science - feminist critique, post-modern critique, etc.

Unit-4: Specific instances of ethical violations - abuse of science and technology, illustrations from biotechnology, technology of war, etc.

Reference Books:

1. Maurizio Iaccarino, Science and ethics, EMBO Rep. 2001 Sep 15; 2(9): 747–750
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1084045/> (and references therein)

2. R. Volti, Society and Technological Change, Worth Publishers, NY, USA, 2009

5.Teaching-Learning Strategies in brief :

Interactive class room teaching, multiple quizzes; encouragement for brief student presentations.

6.Assessment methods and weightages in brief :

Assignments: 30%,

Class Quizzes : 20%,

End Semester: 40%

Term Paper : 10%

A jump in grade will be awarded for an exceptional term paper. Plagiarism of any degree will invite a 'F' grade with no discussion.

Title of the Course : Science II
Faculty Name : Nita Parekh + Chittaranjan Hens
Course Code : SC1.111
L-T-P : 3-1-0
 (L= Lecture hours, T=Tutorial hours,
 P=Practical hours)
Credits : 4
Name of the Academic Program:B. Tech. (CSE)

1.Prerequisite Course / Knowledge:NA

2.Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

The course is divided into two halves:

First Half: Computing in Sciences

Second Half: Introduction to Biology

Outcomes of the First Half (Computing in Sciences):

After completion of the first half of this course successfully, the students will be able to

CO-1: Outline the uses of Monte Carlo to evaluate multidimensional integrals that appear in theoretical natural sciences

CO-2: Describe numerical algorithms and pseudocodes to solve ordinary and partial differential equations that appear in theoretical natural sciences

CO-3: Apply computational methods to find numerical solutions to scientific problems

Outcomes of the Second Half (Introduction to Biology):

After completion of this course successfully, the students will be able to

CO-1: Familiarize themselves with basic terms and terminology in biology, various biological entities and their function, DNA, RNA, proteins, and enzymes, cell and its functionality,

CO-2: appreciate that biology is very quantitative and how sequence analysis using algorithms can help in understanding the evolution, function of genes and proteins

CO-3: carry out a mini-project to learn how to go from sequence to structure, function and disease association

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

For the First Half (Computing in Sciences):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PO1 3	PO1 4	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	1	2	3	2	2	2	2	2	2	2	3	3	3	3	3	
CO2	3	3	1	2	3	2	2	2	2	2	2	2	3	3	3	3	3	
CO3	3	3	1	2	3	2	2	2	2	2	2	2	3	3	3	3	3	

.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix
For the Second Half (Introduction to Biology):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1														
CO2	1	1		1									1		1	1
CO3	1	1	1	1				1	1	1					1	1

4.Detailed Syllabus:

Syllabus of the First Half (Computing in Sciences):

Unit 1: Monte Carlo method: Its application in solving large dimensional integrals seen in statistical mechanics and quantum mechanics

Unit 2: Solving linear systems: Huckel molecular orbital approximation for band structure in metallic bonding

Unit 3: Algebra of matrices: Singular-Value Decomposition (SVD), Hessian matrix in normal mode analysis, and spectral decomposition

Unit 4: Differential equations in sciences: Prey predator model, dynamics from Newton Laws, molecular dynamics simulation

Unit 5: Stochastic differential equations: Diffusion, bistability of cellular processes

Unit 6: Partial Differential equations in sciences: Heat equation and wave equation

Syllabus of the Second Half (Introduction to Biology):

Unit 1: Introduction: Classification of Living Organisms, Origin of Life and Evolution, Biomolecules – Nucleotides, Amino Acids, Proteins, Enzymes

Unit 2: Cell Biology: Structure and Function - Prokaryotic and Eukaryotic Cells, Cell Cycle – Cell division – Mitosis, Meiosis, DNA Replication, Transition, Translation – Central dogma, DNA amplification, sequencing, cloning, restriction enzymes

Unit 3: Genetics: Mendelian Genetics – Genetic Disorders, Mendelian Inheritance Principles, Non-Mendelian Inheritance, Clinical Perspective

Unit 4: Macromolecules: DNA, Proteins – Structure, Function, Analysis, Carbohydrates – Features, Structure, Metabolism, Krebs cycle

Unit 5: Biological data analysis: Biological Data – sequence, structure, expression, etc., Sequence Data Analysis – alignment, database search, phylogeny, Applications

Reference Books:

1. Molecular Biology of the Cell by Alberts, Johnson, Lewis, Morgan, Raff, Roberts, Walter
2. Lehninger Principles of Biochemistry by David L. Nelson and Michael M. Cox
3. Reading the Story in DNA: A Beginner's Guide to Molecular Evolution by Lindell Bromham
4. An Introduction to Computational Physics by Tao Pang
5. Molecular Modelling – Principles and Applications by A. R. Leach

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

The objective of the course is to give the CSE students a flavour of biological sciences and scientific computing. To familiarize the students with available web-based resources (databases

and tools) for biological sequence analysis and extract meaningful information. Whenever possible, after a theory lecture to follow up with analysis of real sequence data. Give the student small programming tasks in biological data analysis to be able to appreciate the role of computing in biological data analysis. Applications of computational and mathematical models in natural sciences are also discussed.

6. Assessment methods and weightages in brief (4 to 5 sentences):

Assignments – (10%), Class Quizzes + Mid-term evaluation (20%), Final exam (20%)

Title of the Course : Science, Technology and Society

Faculty Name : Radhika Krishnan

Course Code : HS7.301

L-T-P : 3-0-0

(L= Lecture hours, T=Tutorial hours,

P=Practical hours)

Credits : 4

Name of the Program : B.Tech in Computer Science and M.S. in Computing and Human Sciences by Research

1. Prerequisite Course / Knowledge: Thinking and Knowing in the Human Sciences I and II (For students in the CHD program); or Intro to Sociology, Intro to Politics, Intro to Philosophy.

2. Course Outcomes (COs)

After completion of this course successfully, the students will be able to:

CO-1:

Students will have a working knowledge of the key methodological and theoretical frameworks, key debates and contributions of scholars within STS.

CO-2:

Students will understand the various approaches within the broad domain of the social construction of science.

CO-3:

Students will learn about how technology shapes and in turn is shaped by social, economic, political and cultural factors. They will understand various theories and methods under the broad rubric of the social construction of technology, and will be exposed to the debates between technological determinism and social construction of technology.

CO-4:

Students will be encouraged to identify values embedded in technical systems, and the potential as well as limitations of human and non-human agency. Students will have the conceptual ability to analyse various aspects of the society-technology interface.

CO-5:

CHD students will be able to think more deeply about confluence between the social sciences and the digital world of computing. This will help them think about possible research approaches and questions which they can later pursue.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	3	3	3	1	3	3	3	1	1	1	3	1	1	3	3
CO2	1	3	3	3	1	3	3	3	1	1	1	3	1	1	3	3
CO3	1	3	3	3	1	3	3	3	1	1	1	3	1	1	3	3

CO 4	1		3	3	3	1	3	3	3	1	1	1	3	1	1	3	3
CO5	1		3	3	3	1	3	3	3	1	1	1	3	1	1	3	3

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

Unit 1:

Structure and functioning of the scientific community (rules, norms, values). Social construction of scientific knowledge (controversies and the problem of replication, science as a negotiated process, role of interests). Strong Programme, Sociology of Scientific Knowledge, Empirical Programme of Relativism

Unit 2:

Introduction to Technology Studies: Understanding the technological visions of Jacques Ellul and Lewis Mumford.

Unit 3:

Social construction of Technology (SCOT): Introduction to the ideas of Michael Callon, Trevor Pinch, Wiebe Bijker, Bruno Latour, Thomas Hughes.

Unit 4:

Technological determinism and its debates with Social Construction of Technology: Introduction to the ideas of David Noble, Langdon Winner, Robert Heilbroner, David Harvey, Nathan Rosenberg.

Unit 5:

Digital Technologies in society: Discussion of recent research and case studies related to digital technologies.

Reference Books:

Harry M Collins and Trevor Pinch, *The Golem: What You Should Know About Science* (Cambridge: Cambridge University Press, 1998 [2nd edition]).

Jacques Ellul, *The Technological Society* (London: Vintage Books, 1954).

Langdon Winner, *Autonomous Technology: Technics-out-of-control as a Theme in Political Thought* (Cambridge, Massachusetts and London: MIT Press, 1978).

Lewis Mumford, *Myth of the Machine: Technics and Human Development* (London: Harcourt Brace Jovanovich, 1967).

Lewis Mumford, *Technics and Civilization* (London: Routledge, 1934).

Manuel Castells, *The Rise of Network Society* (London: Wiley, 2009).

Merritt Roe Smith and Leo Marx (eds.), *Does Technology Drive History: The Dilemma of Technological Determinism* (Cambridge, Massachusetts and London: MIT Press, 1994).

Robert Merton, *The Sociology of Science* (London: The University of Chicago Press, 1973).

Sergio Sismondi, *An Introduction to Science and Technology Studies* (Sussex: Wiley –Blackwell, 2009).

Wiebe Bijker and Trevor Pinch, *The Social Construction of Technological Systems* (Cambridge, Massachusetts and London: MIT Press, 2012).

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

Students are introduced to theories and concepts through lectures. Discussions and interventions in the classroom are highly encouraged. Case studies will be used extensively to explain theoretical concepts. This course involves 1 project (which will involve studying digital technologies using theories and methods in STS). The idea behind this project is to bring together

theory and practice. In addition, students are given 4 reading-based assignments through the course, which will help them to understand the concepts in some depth.

6.Assessment methods and weightages in brief (4 to 5 sentences):

Type of Evaluation	Weightage (in %)
Project	25%. Related to analysis of the society-technology interface using STS concepts and theories
Assignment 1	15%. Related to Unit I, II, III
Assignment 2	15%. Related to Unit IV, V
Mid Sem	15% Questions designed to evaluate understanding of basic concepts.
End Sem	30%. Questions designed to evaluate understanding of basic concepts.

Title of the Course : Software Engineering

Faculty Name : Karthik Vaidhyanathan

CourseCode :CS6.401

L-T-P : 3-0-1

Credits : 4

(L=Lecture hours, T=Tutorial hours,

P=Practical hours)

1.Prerequisite Course / Knowledge:

Students must have taken Intro to Software Systems, Design and Analysis of Software Systems or Equivalent courses

2.Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to...

CO-1: Demonstrate familiarity with various process models, design patterns, architecture patterns and the characteristics of good software architectures

CO-2 Apply principles of user interface design, sub-system design and analyze the designs for good Software Engineering principles

CO-3: Demonstrate the use of tools to quantitatively measure and refactor existing software systems

CO-4: Compare design trade-offs between different patterns and/or different implementations of the same pattern

CO-5: Design the major components and user interface for a small-scale software system using modeling approaches such as UML class diagrams, and sequence diagrams

CO-6: Critique the quality of a software design and use product quality metrics to assess the quality of delivered software

3.MappingofCourseOutcomes(COs)withProgramOutcomes(POs)andProgramSpecific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	1	1	1	1	1	2	2	1	1	1	1	1	1

CO2	1	2	2	2	2	2	1	3	3	2	2	1	1	2	1
CO3	2	1	2	3	3	1	1	1	2	2	2	2	2	1	2
CO4	2	1	2	2	2	1	1	1	3	3	2	2	1	1	2
CO5	1	1	2	2	2	1	1	1	3	3	1	1	2	1	2
CO6	1	2	3	3	3	1	1	2	3	3	1	2	2	2	2

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs.

Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4. Detailed Syllabus:

Unit 1: Software Development Lifecycle and importance of architecture and design in the lifecycle, Process models; Modeling using UML.

Unit 2: Anti-patterns; Metrics and Measurement; Reverse Engineering and Refactoring.

Unit 3: Design Principles and Classification of Patterns

- Structural patterns: Adapter, Composite, Façade, Proxy, Decorator
- Behavioral patterns: Iterator, Observer, Mediator, Command, Memento, State, Strategy, Chain of Responsibility
- Creational patterns: Abstract Factory, Builder, Singleton, Factory Method

Unit 4: Software architecture and Architectural business cycle; Quality attributes and Tactics for achieving attributes; Architectural styles and Techniques; Designing Architectures, Case studies.

Reference Books:

1. Design Patterns: Elements of Reusable Object- Oriented Software. E. Gamma, R. Helm, R. Johnson, and J. Vlissides. Pearson, 2015, ISBN-13 : 978-9332555402
2. Refactoring: Improving the Design of Existing Code. Martin Fowler. Addison-Wesley, 2018. ISBN-13 : 978-0134757599
3. Software Architecture in Practice, 3rd edition by Len Bass, Paul Clements and Rick Kazman, Addison- Wesley, 2012. ISBN-13 : 978-9332502307

5. Teaching-Learning Strategies in brief (4 to 5 sentences):

The course is delivered using project based learning methodology. Topics like software subsystems modeling, design analysis, design trade-offs, language agnostic designs and component-based software development are taught and reinforced via unit level projects. The lectures emphasize the study and development of software sub-systems, comprehension and analysis of design quality attributes. The focus is on application of these concepts to concrete design problems through in-class design exercises and analysis of existing designs of currently implemented software systems. Entire class is run in a studio mode to facilitate discussion between student teams and discuss design trade-offs among students within student teams. Students present their designs and implementations to other students who are expected critique the designs.

6. Assessment methods and weightages in brief (4 to 5 sentences):

Final Exam	22 %
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Mid-term Quiz	12 %
Unit Questions	12 %
3 Unit Projects ($2 * 17$) + ($1 * 10$)	44 %
Other In-class Activities	10 %

Title of the Course : **Spatial Data Science**

Faculty Name : K S Rajan

Course Code : CS4.410

Credits : 4

L - T - P : 3-1-0

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year : Spring 2022

(Ex: Spring, 2022)

Name of the Program : Open to All Programs on Campus at UG, PG/PhD Level

Pre-Requisites : Basic understanding of Locational Data and Computing –

Any UG3, UG4, M.Tech., MS, and Ph.D. student should be able to take it.

Prior course work in Spatial Informatics may help.

Course Outcomes :

CO-1: Describe how Spatial Data Science helps uncover patterns

CO-2: Apply Geospatial techniques to Prepare the data for analysis

CO-3: Analyze the spatial and temporal data and interpret its outcomes

CO-4: Assessment of application of Spatial data science in key domain areas

CO-5: Design research projects that helps synthesize the learning into an application

Course Topics :

Module 1: Introduction to Spatial Data Science

- What is special about Spatial Data and Geo-AI?
- How Spatial and Spatio-temporal Big Data helps uncover patterns?
- Spatial Data Handling including spatial data models, data formats
- Challenges to computing approaches when applied to Spatial Data
 - Effectsof Topology

Module 2: Geospatial Data Analysis and Modelling

- Vector Data Spatial Analysis
- Raster Data Spatial Analysis
- How to use temporal data in conjunction with Spatial data
- GeoSpatial Data

ModellingModule 3: Spatial Sciences

- Spatial Statistics including Spatial auto-correlation, Spatial tessellation
 - o Data Mining applications on Spatial data including Spatio-temporalData Mining
- Network Analysis and Graph theory

- Few relevant topics from Computational Geometry
- Geovisualization – Maps to

WebGISModule 4: Spatial Classification and Prediction

- Spatial decision trees
- Machine learning as applied to Spatial Data including Spatial-aware Neural Networks
- Hotspot Analysis
- Spatial Outliers detection

Module 5: Applications of Spatial Data Science

- Public Health – monitoring and mapping diseases, risk analysis and disease spread modelling
- Agriculture – crop growth monitoring, crop yield patterns and resource constraints
- Location based services – routing applications, ride-sharing algorithms, optimal location

Preferred Text Books :

1. Spatial Computing, By Shashi Shekar and Pamela Vold. The MIT Press. 2020
2. GIS – A computing perspective. By Micheal Worboys and Matt Duckham. CRC Press; 2nd edition 2004
3. Spatial Databases: A Tour. By S. Shekhar and S. Chawla, Prentice Hall, 2003, ISBN 013017480-7 .
4. Selected Research Papers and Articles (will be shared with the topics taught on the course portal)

Reference Books :

1. Geographical Data Science and Spatial Data Analysis - An Introduction in R. By LexComber and Chris Brunsdon. SAGE Publications Ltd. 2020

E-book Links : Will be provided in Class as appropriate

Grading Plan :

Type of Evaluation	Weightage (in %)
Class Quizzes	15.0
Mid Sem Exams – 2	20.0
End Sem Exam	30.0
Paper reviews and Presentations by each Student in Class	10.0
Project/Term paper demonstrating the Practical applications	25.0

Mapping of Course Outcomes to Program Objectives:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	3	-	-	-	1	2	-	-	3	2	-	-	-
CO2	2	-	-	-	3	-	-	-	2	-	-	-	2	-	2	2
CO3	3	2	-	-	3	-	-	-	2	-	-	-	2	2	3	2
CO4	3	2	3	3	2	2	-	3	2	3	-	3	3	2	2	3
CO5	3	3	3	3	2	3	1	3	3	3	2	3	2	3	2	3

Teaching-Learning Strategies in brief (4-5 sentences) :

Teaching - Learning

Lectures Guest

Lectures

Reading research papers

Class participation in Q&A, discussions

Online discussions over MS Teams

Learning by doing

Short Presentation and Discussion led by Student

Course project on conceptualization and

implementationReal world applications

Multi-disciplinary approach

Title of the Course : Stability Design of Steel Structures

Faculty Name : Sunitha Palissery

Course Code : CE1.602

Credits : 4

L-T-P : 3-1-0

Name of the Academic Program: M. Tech in CASE

1. Prerequisite Course / Knowledge: Design of RC and Steel Structures (Undergraduate course content)

2. Course Outcomes (COs):

After completion of this course successfully, the students will be able to:

CO-1. Develop knowledge and skills to mathematically formulate structural stability criteria of steel members

CO-2. Employ the computer application skills in developing structural models to perform buckling analysis and predict stability of frames

CO-3. Demonstrate problem solving skills for various instability modes and work towards a research-based approach to the stability design of steel frames

CO-4: Apply buckling and stability analysis methods, to address practical stability design problems

CO-5. Analyze ethical and effective structural design practices to preclude stability failure of steel structures and towards reasonably good behavior under extreme loading conditions

CO-6. Reorganize inter-personal skills required to manage possible negotiations with structural engineering design practitioners towards a stable steel structure

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	3	2	2	3	1	2	3	3	3	2
CO2	3	3	3	2	2	2	2	3	2	2	3	3	3	2
CO3	3	3	3	2	2	2	2	3	2	2	3	3	3	2
CO4	3	3	3	2	2	2	2	3	2	2	3	3	3	2
CO5	2	2	2	2	3	2	3	3	3	1	1	1	2	2
CO6	2	2	2	2	3	2	3	2	3	1	1	1	2	2

Note: '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

4.Detailed Syllabus:

Unit 1: Basic Concepts of Stability

Bifurcation Buckling- Methods of Stability Analysis-Post-buckling Behaviour-Large Deflection Analysis

Unit 2: Buckling of Columnsand Frames

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; Modes of Buckling- Frame Stability Analysis-Non-sway and Sway Frames-Critical Load Estimation using Slope Deflection Equations

Unit 3: Torsional and Flexural-Torsional Buckling and Buckling of Plates

Thin-walled Open Cross-Sections-Columns-Beams-Beam Columns; Governing Differential Equations for Plate Buckling, Plates Subjected Loading Actions, Post-buckling Behaviour of plates

Unit 4: Introduction to behavior of Steel Beams and Beam Columns

Limit State Design; Classification of sections; Buckling classifications; Laterally Restrained and unrestrained beams, Effective Length of Columns- AISc Alignment Charts; stability index, Design Strength

Unit 5: Design of Beam Columns

Interaction equations, Design for combined axial and bending effects; computer analysis of rigid steel frames

Reference Books:

1. Alexander, C., *Principles of Structural Stability Theory*, Prentice-Hall Inc, New Jersey
2. Bažant,Z.P., and Cedolin,L., (2010), *Stability of Structures- Elastic, Inelastic, Fracture and Damage Theories*, World Scientific Publishing Co. Pvt. Ltd., Singapore
3. Bureau of Indian Standards (BIS), (2007), Indian Standard Code of Practice for General Construction in Steel, IS800;2007, New Delhi, India
4. Chen, W.F., and Lui,E.M., (1987), *Structural Stability: Theory and Implementation*, Elsevier Science Publishing Co., New York
5. Galambos,T.V., and Surovek,A.E., (2008), *Structural Stability of Steel: Concepts and Applications for Structural Engineers*, John Wiley & Sons, New Jersey
6. Gambhir,M.L., (2004), *Stability Analysis and Design of Structures*, Springer, New York
7. Guide to Stability Design Criteria for Metal Structures, Edited by Ziemian, R.D., (2010)
8. Kumar,A., (1998), *Stability of Structures*, Allied Publishers Limited, Mumbai

9. Timoshenko,S.P., and Gere,J.M., (1985), *Theory of Elastic Stability*, McGraw Hill International Book Company
 10. Salmon, C.G., and Johnson,J.E., (1996), *Steel Structures Design and Behaviour*, Prentice Hall, NJ

5. Teaching-Learning Strategies in brief (4 to 5 sentences):

1. Lectures by integrating ICT into classroom teaching
 2. Tutorials involving mathematical formulation and graphical analysis of stability problems
 3. Assignments involving analysing structural data to understand buckling behaviour of steel members and frames
 4. Critical and active learning through projects, and project-based learning by doing term-projects which involves computer programming and hands-on use of software tools to investigate & predict stability behaviour of members and frames.

6. Assessment methods and weightages in brief (4 to 5 sentences):

Assignments in theory: 20 marks, Quizzes in theory: 10 marks, Mid Semester Examination in theory: 20 marks, Term-project: 20 marks, End Semester Examination in Theory: 30 marks

Title of the Course	: Statistical Mechanics
Name of the Faculty	: Bhaswar Ghosh
Course Code	: SCI 205
L-T-P	: 2(90mins)-1-0
Credits	: 2

(L= Lecture hours, T=Tutorial hours,
P=Practical hours)

Name of the Academic Program: B Tech (CND)

1. Prerequisite Course / Knowledge: Thermodynamics, elementary classical and quantum mechanics

2. Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to

CO-1 State principles of ensemble theory applied to statistical physics

CO-2 Apply statistical mechanics to investigate natural systems

CO-3 Apply scientific methodology to problems in allied disciplines.

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

CO5

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

4.Detailed Syllabus:

Unit 1: 1. The purpose of statistics: Bridging the micro and the macro, random walk, binomial distribution and the Gaussian limit: 1L

2. Ensemble, micro-canonical, canonical and grand canonical; Partition function, Lagrange multiplier technique to obtain the Boltzmann distribution: 2L

Unit 2: 3. Statistical expressions for thermodynamic functions for monatomic, diatomic and polyatomic perfect gases, equilibrium constant using partition function: 2L

4. Classical statistical mechanics, Liouville equation, Equipartition of energy: 1L

Unit 3: 5. Identical particles, Quantum statistics - Fermi-Dirac and Bose-Einstein statistics: 2L

6. Special topics (Real gases, Liquids, Lattice dynamics, Ising spins, etc.): 3L

Reference Books:

1. D. A. McQuarrie (2000), Statistical Mechanics, University Science Books, Paris

2. P W Atkins (2018), 11th Ed. Physical Chemistry, Oxford University Press, London

3. F Reif (2017), Fundamentals of Statistical and thermal Physics,(Berkeley Physics, vol. 5), McGraw Hill Education, NY

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

Teaching currently is on line. Along with prepared slides, tools are used to write material extempore and draw pictures to explain the material.

Assignments are open for discussion before submission, though submission must be original. Class exercises are used for effective learning.

Instructor is available 24X7 for discussions over the net either by a meeting or over email. This interactive process has helped the students to develop clarity on the learning material.

6.Assessment methods and weightages in brief (4 to 5 sentences):

Quiz	25%
Final Exam	55%
Assignments (4)	20%

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Title of the Course : Statistical Methods in Artificial Intelligence

Faculty Name : Vineet Gandhi

Course Code : CS7.403

L-T-P : 3:1:0

Credits: 4

(L= Lecture hours, T=Tutorial hours, P=Practical hours)

Name of the Academic Program: Btech in CSE and Btech in ECE

1.Prerequisite Course / Knowledge:

Basic probability theory

Basic Linear Algebra

Good programming skills in Python

2.Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to..

CO-1: Data processing: process raw data and convert it into machine exploitable format

CO-2: Problem formulation: formulate a practical problem as a machine learning problem (classification, clustering etc.)

CO-3: Classical algorithms: In depth investigation of theory and practice of classical algorithms in supervised and unsupervised learning (e.g. SVM, Kmeans, decision trees).

CO-4 Deep Learning: Introduction to theory and practice of deep learning and recent advances

CO-5 System building: design practical systems incorporating basic machine learning

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	3	2	2	3	2	2	2	2	2	2	1	2
CO2	3	3	3	3	1	3	2	3	1	2	2	3	1	3	2	2
CO3	1	2	2	2	2	1	2	1	1	1	2	3	3	2	2	3
CO4	2	2	2	3	3	1	1	1	1	1	2	3	3	2	2	3
CO5	3	1	1	2	3	3	3	2	3	2	2	2	2	3	3	3

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

Unit 1: Review of basic statistics, linear algebra, probability

Unit 2: Problem formulation in ML, Decision Trees, Nearest Neighbours

Unit 3: Supervised Machine Learning (SVM, Random Forest, Boosting etc.)

Unit 4: Unsupervised Machine Learning (kmeans, recommendation, anomaly detection, PCA, LDF etc.)

Unit 5: Deep Learning

Reference Books:

1. Richard O. Duda, Peter E. Hart, David G. Stork, *Pattern Classification*, 2nd Edition, John Wiley and Sons, October 2000

2. Christopher M. Bishop, *Pattern Recognition and Machine Learning*, 2nd Edition, Springer, 2011

3. Ian Goodfellow and Yoshua Bengio and Aaron Courville, *Deep Learning*, 1st Edition, MIT Press, 2016

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

The course involves heavy theory and programming components. The strategy is to first discuss a problem statement, introduce an algorithm and work out the details of the algorithm, and then use the algorithm to solve the problem. A lot of teaching on black board to discuss theory, large assignments are given for covering practical aspects and a large project is given mid-way of the course to cover the system building aspect.

6.Assessment methods and weightages in brief (4 to 5 sentences):

Programming Assignments: 25%

Quiz1: 10%

Quizz : 15%

Final exam: 25%

Course Project: 25%

Title of the Course

: System and Network Security

Faculty Name

: Ankit Gangwal

Course Code

: CS8.403

Credits

: 4

L - T - P

: 3-1-0

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Name of the Program : MTech. in CSIS and Open Elective for B.Tech. in CSE

Semester, Year : Spring, 2022

Pre-Requisites : Data Structures and Algorithms and Principles of Information Security

Course Outcomes :

After completion of this course successfully, the students will be able to..

CO-1 Demonstrate a familiarity with concepts of computer attacks and core defense techniques

CO-2 Discuss various vulnerability testing schemes

CO-3 Apply the knowledge of cryptography to build secure and efficient communication channels

CO-4 Analyze and compare mobile platform security architecture of iOS and Android

CO-5 Design security modules against web and network attacks

CO-6 Develop a framework to test web applications' security

Course Topics :

Unit 1: Attacks and Vulnerabilities: Exploits and defenses in control hijacking attacks; principle of least privilege, access control, and operating systems security; isolation and sandboxing; vulnerability testing using fuzzing, static, and dynamic analysis; brief overview of cryptography.

Unit 2: Web Security: Basic web security mode; web application security; web session management; goals and pitfalls for HTTPS.

Unit 3: Network Security: Internet Protocol security; DoS and DDoS attacks; network defenses.

Unit 4: Security of Mobile Platforms: Mobile platform security architecture; Android and iOS security models; topics in Android security.

Unit 5: Low-level Architectural Security and Misc. Topics: Processor and microarchitecture security; Intel SGX and the Specter attack; privacy, anonymity, and censorship.

Preferred Text Books :

1. J. R. Vacca. "Network and System Security."
2. B. Menezes. "Network Security and Cryptography."

Reference Books :

1. W. Stallings. "Cryptography and Network Security: Principles and Practice." Research papers.

E-book Links :**Grading Plan :**

Type of Evaluation	Weightage (in %)
Mid-term exams, quizzes	20
End-term exam	30
Assignments and projects	50

Mapping of Course Outcomes to Program Objectives:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	1	1	1	1	3	2	1	2	3	3	2	2
CO2	3	3	3	2	2	1	1	1	2	2	1	3	3	3	2	2
CO3	3	2	3	3	2	1	1	2	2	3	1	2	3	3	2	2
CO4	2	2	2	3	1	3	1	2	3	2	1	1	3	3	2	2
CO5	3	2	3	3	2	1	1	3	2	2	1	2	3	3	2	2
CO6	2	3	3	3	3	3	1	3	2	3	1	2	3	3	2	2

Teaching-Learning Strategies in brief (4-5 sentences):

The main objective of this course is to enable students to have a good understanding of the fundamental principles of computer systems and network security. It is designed to help the students understand various attack and defense techniques. The course is especially useful for students who plan to do research and/or product development in the area of system building.

Title of the Course

: Technology Product Entrepreneurship

Faculty Name

: Ramesh Loganathan, Prakash Yalla

Course Code

: CS9.424

Credits

: 4

L - T - P

: 3-1-0

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year (Ex: Spring, 2022)	: Spring 2020 & S21
Name of the Program	: Technology product entrepreneurship-
Pre-Requisites	: No prerequisites
Course Outcomes :	

This course introduces the fundamentals of technology product entrepreneurship. You will learn the process of building a technology enterprise in a workshop format. Starting from a technology idea, mapping the idea to a high-potential commercial opportunity, defining/designing/validating the product, figuring out the market avenues & how to sell the product, and planning/managing rapid growth.

The class will apply the learning to their tech product ideas and create a venture able product & plan; in a workshop mode thru extensive hands-on assignments concurrent with course modules.

CO1-Understand how to evaluate product ideas and assess the market opportunity in real-time, along with learning from current scenarios.

CO2-Connect products with markets and identify market & customer segments with the help of frameworks and business models.

CO3-Assess competition and evolve Value proposition for the product in cognisance of the current market trends and ever-evolving customer needs.

CO4-Be able to put a complete business plan for a technology product, after analysing the markets and building a GTM strategy.

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

https://iitaphyd-my.sharepoint.com/:w/r/personal/dyacad_iit_ac_in/Documents/NBA-2020-21/Course%20Content/IIIT-CSE-ECE.docx?d=w111foeffcae41b3a4d1e8a3fbc6332d&csf=1&web=1&e=z1Khby

Preferred Text Books:

High Tech Start Up, Revised and Updated: The Complete Handbook For Creating Successful New High Tech Companies by John L. Nesheim

The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries

Reference Books:

Technology Entrepreneurship: Overview, Definition, and Distinctive Aspects

1. http://timreview.ca/sites/default/files/article_PDF/Bailetti_TIMReview_February2012.pdf
2. Toward a General Modular Systems Theory and Its Application to Interfirm Product Modularity
3. <http://amr.aom.org/content/25/2/312.abstract>

4. Harvard: Why Lean Startup Changes everything
5. http://host.uniroma3.it/facolta/economia/db/materiali/insegnamenti/611_8959.pdf
6. The Power of Integrality: Linkages between Product Architecture, Innovation, and Industry Structure
7. <http://www.sciencedirect.com/science/article/pii/S004873308001091>

E-book Links:

The Art of the Start by Guy Kawasaki

1. Demand: Creating What People Love Before They Know They Want It by Adrian J. Slywotzky with Karl Weber
2. The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business by Clayton M. Christensen
3. Running Lean: Iterate From Plan A to a Plan That Works by Ash Maurya
4. Positioning: The Battle for Your Mind by Al Ries and Jack Trout
5. Venture Deals by Brad Feld and Jason Mendelson
6. Lean Analytics by Alistair Croll and Benjamin Yoskovitz
7. Crossing the Chasm by Geoffrey A. Moore

Grading Plan:

Type of Evaluation	Weightage (in %)
Quiz-1	20%
Labs	20%
Tech Product Quiz-2	20%
Demo and Presentation	10%
Final submission	30%

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	3	3	3	2	3	3	3	2	3	2
CO2	2	3	3	2	2	3	3	3	2	3	2	2	2	3
CO3	2	3	2	2	3	3	3	2	2	3	3	2	2	2
CO4	3	3	3	2	2	3	3	2	2	3	3	3	3	2

Teaching-Learning Strategies in brief (4-5 sentences) :

- Introduction: Assignment: Create startup website; Vision; Basic Positioning statement;
- Creativity & Innovation: Assignment: Based on team's tech idea considered, list 3 product possibilities, applying Idea hexagon framework.
- Frameworks & Models: Assignment: Assess opportunity for the ideas. And pick the “venturable business.”
- Customer Discovery/Opportunity mapping: Assignment: Apply Lean Startup Methodology, and Validate customer interest, need &... ; Assignment: First cut of Musiness Model Canvass filled in
- Design Thinking: Assignment: Rapidly create and refine the product functionality for the teams product using design thinking process
- Customer Development: Assignment: Competitive Positioning; Assignment: Update Product functionality capturing the competitive proposition
- Sales & Market Strategy: Assignment: Evolve the GTM plans
- Business Plans: Assignment: Completed, defensible, business model canvass; Assignment: Product roadmap- market & technical, GTM plans, revenue projections
- Technical Architecture considerations: Assignment: Study 2 similar solutions in market and compare/contrast tech architecture used by your product
- Corporate Technology Innovation : TBD
- Tech Product Pitch/Plan presentations

Title of the Course

: The Gutenberg Parenthesis

Faculty Name

: Aniket Alam

Course Code

: HS3.304

Credits

: 4

L - T - P

: 3 – 1 – 0

Semester, Year

: Spring 2023

Name of the Program

: B.Tech in Computer Science and Engineering

Pre-Requisites

: BTech Students: Passed Intro to Human Sciences, and One other HSS elective; CHD 3rd and 4th Year students.

Course Outcomes:

After completion of this course successfully students will be able to:

CO1: Define the concept of Orality, Literacy, and Textuality.

CO2: Describe the features of Oral Societies and Literate Societies.

CO3: Explain the importance of Print Technology in historical transformation and the concept of the Gutenberg Parenthesis.

CO4: Analyze the various aspects of the emergence of Capitalism, Enlightenment, Modernity in relation to Print Cultures.

CO5: Evaluate the range of academic theories relating to global historical transformations.

CO6: Develop their own understanding about the role of technology, historical change, and emerging futures.

Course Topics:

The Gutenberg Parenthesis refers to the 500 year long period of modernity, coterminous with print cultures, within a longer stretch of oral civilisations. This parenthesis started with the print revolution in medieval Europe which turned the world textual over the next few centuries. The parenthesis is perhaps closing now with the emergence of the new, post-textual, orality of the digital age. The idea of the Gutenberg Parenthesis suggests that despite its dominance and prestige, print-literacy is an exception in the much longer trajectory of human thought, whose primacy may be in the process of being restored through digital modes of speech and instantaneous ephemeral communication, rather than that based on space and time delay.

This course will study Print Cultures as an interregnum within the larger history of oral cultures. It will be organized into the following modules.

- (1) **Orality and Oral Cultures:** The structures and features of oral communications. How this in turn structures mental categories and thought and thus social organization. The specificities of societies based on orality and how scholars define these terms. The idea of primary orality.
- (2) **Literacy and Textual Cultures:** The historical rise of script, literacy and text based civilisations. What are the features and consequences of this technology and how it restructures society.
- (3) **Technology of Print and Print Cultures:** The emergence of print technology in Asia and Europe and its main product: books. The definition of print culture and its historical spread.
- (4) **Historical Transformations:** The changes in society, economy and politics consequent to the spread of print technology and print cultures. The emergence of capitalism, colonialism, Enlightenment Rationality and the scientific revolution. The linkages between printing and new ways of thinking and communicating. The economic, political and cultural effects of mass literacy and education. How the world has become textual.
- (5) **The New Orality:** The emergence of digital technologies and re-emergence of orality and instantaneous communications. The new orality as secondary orality based on textual foundations. How is this secondary orality changing our ways of thinking, of communicating and our social/political structures.

Preferred Text Books:

1. Walter J. Ong: *Orality and Literacy*
2. Elizabeth Eisenstein: *The Printing Revolution in Early Modern Europe*
3. Alfred W. Crosby: *The Measure of Reality*
4. Umberto Eco: *This Is Not The End Of The Book;*

5. V. Gordon Childe: *Man Makes Himself*

Reference Books:

1. Lucien Febvre, Henri-Jean Martin: *The Coming of the Book*
2. Fernand Braudel: *Capitalism and Material Life, 1400-1800*
3. Eric Hobsbawm: *Industry and Empire.*
- 4.
5. Marshal McLuhan: *The Gutenberg Galaxy: The Making of Typographical Man*
6. Neil MacGregor: *The History of the World in 100 Objects*
7. Ruth Finnegan: *Literacy and Orality: Studies in the Technology of communication.*
8. Ruth Finnegan: *Oral Poetry – Its Nature, Significance and Social Context.*
9. Elizabeth Eisenstein: *Divine Art, Infernal Machine: the Reception of Printing in the West from First Impressions to the Sense of Ending.*
10. Umberto Eco: *Travels in Hyperreality.*
11. Roger Chartier: *The Order of Books: Readers, Authors, and Libraries in Europe Between the Fourteenth and Eighteenth Centuries.*
12. David Diringer: *The Book Before Printing.*
13. David Diringer: *The Alphabet – The Key to the History of Mankind.*
14. Jack Goody: *Literacy in Traditional Societies.*
15. Andre Gunder Frank: *ReOrient – Global Economy in the Asian Age*
16. Bhavani Raman: *Document Raj: Writing and Scribes in Early Colonial India*
17. A R Venkatachalapathy: *The Province of the Book*
18. Krishna Kumar: *Politics of Education in Colonial India*
19. Eric Havelock: *Communication Arts in the Ancient World.*
20. C. K. Ogden, I. A. Richards: *The Meaning of Meaning – A Study of the Influence of Language upon Thought and of the Science of Symbolism.*
21. Pierre Maranda, Elli Kongas Maranda: *Structural Analysis of Oral Tradition.*
22. Vladimir Propp: *Morphology of the Folktale.*
23. Benjamin Stoltz, Richard Shannon: *Oral Literature and the Formula.*
24. Douglas Boyd, Mary Larson: *Oral History and Digital Humanities – Voice, Access, and Engagement.*
25. Jan Vansina: *Oral Tradition as History.*
26. Max Tegmark: *Life 3.0: Being Human in the Age of Artificial Intelligence*

Reference Articles:

1. Jack Goody and I. Watt: “The Consequences of Literacy” *Comparative Studies in Society and History.*
2. Thomas Pettitt: “Opening the Gutenberg Parenthesis”
3. Thomas Pettitt: “Bracketing the Gutenberg Parenthesis”
4. The Edge: “What is the Most Important Invention in the Past Two Thousand Years?”
5. Franz H. Bauml: “Varieties and Consequences of Medieval Literacy and Illiteracy”
6. John Miles Foley: “The Traditional Oral Audience”.
7. John Miles Foley: “Oral Literature – Premises and Problems”
8. Eric Havelock: “The alphabetization of Homer”
9. Bronislaw Malinowski: “The problem of meaning in primitive languages”
- 10.

Grading Plan :

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

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	1	2	1	3	2	3	2	1	-	3	-	2	1	3
CO2	-	-	1	1	1	2	2	2	2	1	-	3	-	1	1	2
CO3	1	-	1	2	1	3	3	3	1	1	-	3	-	2	1	3
CO4	-	-	1	2	1	3	3	3	2	1	1	3	-	1	2	2
CO5	-	-	1	1	1	3	2	2	1	1	1	3	-	1	2	3
CO6	1	1	3	2	2	3	3	3	2	2	1	3	-	2	3	3

Teaching-Learning Strategies in brief (4-5 sentences) :

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 1,000 to 1,500 pages of books and articles and submit written work between 6,000 to 8,000 words, cumulatively.

In each class some select students will be given a small topic from the next class to read up on, and they will be expected to initiate discussions around these.

Pictures, Extracts from primary sources, audio and video resources will be used to illustrate the points being taught.

The project will focus on training students to develop their own ideas, and apply computer science tools, to the topic given.

Title of the Course

: Thermodynamics

Name of the Faculty

: Subhadip Mitra

Course Code

: SC1. 204

L-T-P

: 2(90mins)-1-0

Credits: 2 (L= Lecture hours, T=Tutorial hours, P=Practical hours)

Name of the Academic Program : B Tech (CND)

1. Prerequisite Course / Knowledge: Basic (High school) physics/chemistry

2.Course Outcomes (COs) (5 to 8 for a 3 or 4 credit course):

After completion of this course successfully, the students will be able to..

CO-1 State principles and laws of Thermodynamics

CO-2 Apply thermodynamics to investigate natural phenomena

CO-3 Apply thermodynamic principles to allied disciplines like information processing.

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3		3							1	3			3	1	3
CO2	3		3							1	3			3	1	3
CO3	3		3							1	3			3	1	3
CO4																
CO5																

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs. Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

4.Detailed Syllabus:

Unit 1: 1. Thermodynamic space, system and surroundings, variable, function, Thermodynamic process and energy transaction: Work, Heat; Walls: Diathermal, Adiabatic, (im)permeable :1L
2. Properties of Gases: Perfect and real: 1L

3. Zeroth law and temperature, first law and internal energy, enthalpy, thermochemistry, Hess's law :1L

4. Expansion Work, Isothermal and Adiabatic Changes, Heat capacity :1L

Unit 2: 5. Second law and equivalence of different ways of stating it, Clausius inequality The Joule-Thomson Effect, Entropy, Heat Engine, Refrigerator, Carnot Cycle: 2L

6. Helmholtz and Gibbs Free Energies, thermodynamic equation of state, criteria for spontaneity, chemical potential, variation with temperature and pressure, Maxwell relations :2L
7. Fugacity and activity :1L

Unit 3: 8. Thermodynamics of mixing, Phase Diagrams and Phase Transitions: 2L

9. Chemical equilibrium, Equilibrium constant and standard free energy :1L

10: Equilibrium electrochemistry

Reference Books:

1. M W Zemansky and R H Dittman (1997), Heat and Thermodynamics, 7th Ed., McGraw-Hill Education, NY

2. P W Atkins (2018), 11th Ed. Physical Chemistry, Oxford University Press, London

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

Teaching currently is online. Along with prepared slides, tools are used to write material extempore and draw pictures to explain the material.

Class exercises are used to ensure effective learning.

Assignments are open for discussion before submission, though submission must be original. Instructor is available 24X7 for discussions over the net either by a meeting or over email. This interactive process has helped the students to develop clarity on the learning material.

6.Assessment methods and weightages in brief (4 to 5 sentences):

Quiz	25%
Final Exam	55%
Assignments (4)	20%

Title of the Course : Ethics-2: Thinking through moral problems

Faculty Name : Ashwin Jayanti

Course Code : HSo.206

L-T-P : 3-0-0

CREDITS : 2

(L = Lecture hours, T = Tutorial hours, P = Practical hours)

Name of the Academic Programs:

1. Prerequisite Course / Knowledge: Basics of Ethics-1

2. Course Outcomes (COs):

After completion of this course successfully, the students will be able to:

CO-1: Identify and recognize normative standpoints in ethical arguments concerning pressing debates

CO-2: Analyze and evaluate the validity of arguments for and against each of these ethical debates

CO-3: Understand the significance of normative ethics as it applies to pressing ethical dilemmas and debates

CO-4: Evaluate the arguments from both sides of the debate and assess the limitations and implications of each of the positions

CO-5: Develop and synthesize arguments in the light of current evidence and considering multiple aspects of a particular course of action

3. Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	2	-	-	3	2	3	2	3	1	3	-	-	1	1
CO2	-	-	1	-	-	3	2	2	-	-	-	3	-	-	1	1
CO3	-	-	1	-	-	3	2	2	-	1	-	3	-	-	1	1
CO4	-	-	2	1	-	3	3	3	1	2	-	3	-	-	1	1
CO5	-	1	3	3	-	3	3	3	1	2	-	3	-	-	1	1

4. Detailed Syllabus:

Unit I – Introduction to applied ethics; animal rights; animal rights and equality; Argument from marginal cases, unequal value thesis

Unit II: Environmental ethics; biocentric ethics; distributive and corrective justice, individual moral obligations

Unit III: Economic Justice and inequality; Rawls-Nozick debate

Unit IV: Genetic engineering; genetic engineering and perfection; genetic engineering and enhancement; GMOs

PREFERRED TEXTBOOK

Shafer-Landau, R. 2019. *Living Ethics: An Introduction with Readings. Part 2: Moral Problems.* Oxford University Press.

REFERENCE BOOKS

Cohen, Andrew I. And Wellman, Christopher Heath. 2005. *Contemporary Debates in Applied Ethics.* Blackwell Publishing

Vaughn, L. 2019. *Doing Ethics: Moral Reasoning, Theory and Contemporary Issues* 5th Edition. W W Norton and Co.

Singer, Peter. 1986. *Applied Ethics.* Oxford University Press

5. Teaching-Learning Strategies in Brief

This course aims at reading, critically evaluating, and thinking through contemporary debates in applied ethics. For this purposes, the main strategy is to share the readings and resource material beforehand for the students to acquaint themselves with the topics and use the class time to discuss and evaluate the implications of the various positions respective to each topic. Continuous assessment methods will be employed to make sure the students have acquired the requisite conceptual understanding to explicate and argue for their position with greater nuance and logical rigor.

6. Assessment Methods and Weightages in Brief

Continuous assessment in the form of written assignments will carry the major weightage of the evaluation, with the rest of the weightage assigned to class participation in the ensuing discussions. The assigned weightage is as follows: Assignments: 90 marks, class participation: 10 marks.

Type of Evaluation	Weightage (in %)
Class Participation	10
Assignments (1000 words)	60 (3 x 20)
Review Essay (1500 words)	30

Title of the Course : Time Frequency Analysis

Faculty Name : Anil Kumar Vuppala +Chiranjeevi Yerra

Course Code : EC5.402

L-T-P : 3-1-0

Credits : 4

Name of the Academic Program B. Tech. in ECE

Prerequisite Course / Knowledge:

Should have taken Signal Processing course.

Course Outcomes (COs):

After completion of this course successfully, the students will be able to..

CO-1: Demonstrate usability of joint time-frequency transforms and distributions in signal processing.

CO-2: Apply principles of time & frequency fundamentals to understand uncertainties in joint time-frequency representation.

CO-3: Developing mathematical foundation for joint time-frequency representation.

CO-4: Analyzing signals with Wavelet theory of signal processing.

CO-5: Explaining the application of advanced transforms for signal analysis.

CO-6: Designing the algorithms for modeling non-stationary signals.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program

Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1	1	1	1	1	2	1	1	2	-	3	-	-
CO2	3	2	1	1	1	1	1	1	2	1	1	2	-	3	-	-
CO3	3	2	2	1	1	1	1	1	2	1	1	2	-	3	-	-
CO4	3	2	2	1	1	2	1	1	2	1	1	2	-	3	-	-
CO5	2	3	2	2	1	2	2	1	2	1	1	3	-	3	-	-
CO6	2	3	3	3	2	2	2	1	3	2	2	3	-	3	-	-

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping Mapping with PSOs, where applicable.

Detailed Syllabus:

Unit 1: Introduction to Vector Space, Basis Functions, Basis, Frames. Review of Fourier series and transform.

Unit 2: Fundamentals of time and frequency. Time-bandwidth product. Uncertainty principle.

Unit 3: STFT, Wavelet theory of signal processing, multi-resolution analysis.

Unit 4: Wigner Ville distribution, HHT and S-transform.

Unit 5: Applications in signal and image processing.

Reference Books:

1. Time - Frequency Analysis, L. Cohen, Prentice Hall, 1997.
2. A wavelet tour of signal processing, S. Mallat, Third edition, Academic Press, 2009.
3. Fourier and wavelet signal processing, Kovacevic, J., Goyal, V.K. and Vetterli, M., 2013.

Teaching-Learning Strategies in brief (4 to 5 sentences):

It is a mathematical oriented signal processing course, so regular problem solving assignments are given to understand the concepts. Surprise class tests are conducted based on assignments to test the seriousness in assignment solving. As apart of teaching, practical examples like speech and images are used for demonstration of mathematical concepts learned. Advanced concepts applications are studied by doing course projects.

Assessment methods and weightages in brief (4 to 5 sentences):

Assignments -- 20% Mid
exams -- 30% End Project --
15% End exam -- 35%

Title of the Course	: Topics in Deep Learning
Faculty Name	: Charu Sharma and Makarand Tapaswi
Course Code	: CS7.602
Credits	: 4
L - T - P	: 3-1-0 (L - Lecture hours, T-Tutorial hours, P - Practical hours)
Semester, Year	: Spring, 2022
Name of the Program	: Honors, DD, MTech, PhD

Max. no. of students: 50

Pre-Requisites :

Mandatory: SMAI course and linear algebra.

Nice to have basics of graph theory, computer vision, and natural language processing.

Course Outcomes:

Recently, graph representation learning has gained prominence in the area of Deep Learning in a wide variety of tasks as there is a lot of graph data available in different forms from several domains such as social network, biological network, chemical compounds, citation network, retail network, transaction network, drug network, etc. Machine learning for graphs aims to solve various problems such as graph classification, node classification, link prediction, relation prediction, graph/node clustering, etc. This is a research-driven course that intends to describe variety of tasks, representation learning methods and its applications in the emerging field of machine learning for graphs. The aim of the course is to make students understand the theoretical and research aspects of the topics

(CO1) so that they can analyze and evaluate the research ideas behind the existing methods

(CO2). The students will also be able to look at the problem from different perspectives

(CO3) and extend or design a method/ algorithm for a real-world problem

(CO4). Students can relate to the real-world problem and apply the existing methods as well

(CO5).

Course Topics : Following topics are subject to minor changes.

1. Introduction, Fundamentals and Significance
 - A. Introduction to ML for Graphs, Applications, Problem Definition

- B. Basics of Networks and Graphs
- C. Node and Graph Embeddings
- 2. Problems in Graph ML
 - A. Node and Graph Classification
 - B. Link Prediction and Relation Prediction
 - C. Clustering and Community Detection
 - D. Graph/Subgraph Matching
 - E. Applications
- 3. Embedding Methods
 - A. Heuristic Methods, Graph Kernel-based Methods
 - B. Random Walk-based Methods: DeepWalk, Node2vec
 - C. Graph Laplacian and Spectral Methods
 - D. Applications
- 4. Graph Neural Networks
 - A. Popular GNNs and its Variants: GCN, GraphSAGE, GIN, DGCNN, etc.
 - B. Applications of GNNs
- 5. Knowledge Graphs
 - A. KG Embeddings
 - B. Applications of KG Embedding Methods
- 6. Other GNNs
 - A. Attention Model: GAT
 - B. Graph Transformers
 - C. Graph Generation: Deep Generative Models

Preferred Text Books for machine learning and deep learning basics:

Christopher Bishop. Pattern Recognition and Machine Learning.

Ian Goodfellow and Yoshua Bengio and Aaron Courville. Deep Learning.

Reference Books : There is an e-book (Graph Representation Learning) that came recently by William Hamilton (link mentioned under e-book links). Useful links, class notes and/or references will be provided for classes.

E-book Links:

https://www.cs.mcgill.ca/~wlh/grl_book/files/GRL_Book.pdf

Grading Plan : The evaluation below is subject to minor changes

Type of Evaluation	Weightage (in %)
Quiz-1	10
Assignment - 1	10
Assignment - 2	10
Project (proposal + presentation + report + work)	60 (10 + 10 + 10 + 30)
Others (class activity, surprise quiz, scribing, etc.)	10

Project evaluation:

- Teams of 3 members.
- 10 points: Proposal: 1 page + refs; Write about what you want to do,

- something achievable in 3months.
- 10 points: Final report: 2 pages + analysis figures + proofs + refs; Describe the main contribution. Reference previous work for everything else.
 - 10 points: Final presentation (5 slides) / video (4 minutes) / poster (1 A0 size)
 - Core research work, upto 30 points obtainable. If you do more, this may offset scoring in otherparts of the project evaluation.
 - (15 points max) Re-implementation of code + main experiment, or re-creation of several experiments using existing code
 - (5 points max) Additional interesting ablations, experiments, analysis
 - (10 points max) New ideas that unfortunately did not work
 - (15 points max) New working idea, publishable in a conference like ICVGIP, required for highest grade.

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

https://iiitaphyd-my.sharepoint.com/:w/r/personal/dyacad_iit_ac_in/Documents/NBA-2020-21/Course%20Content/IIIT-CSE-ECE.docx?d=w111foeffcae41b3a4d1e8a3fbc6332d&csf=1&web=1&e=z1Khby

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3	3
CO2	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3	3
CO3	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3	3
CO4	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3	3
CO5	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3	3

Teaching-Learning Strategies in brief (4-5 sentences):

The plan is to use the slides in general to explain the problem and methods. This would includethe handwritten notes or using white-board whenever required to describe the topics mathematically. The outline has quite a few topics from research papers and would be presented like a paper in detail. Coding sessions (using graph data) would be conducted to make the topics/papers easier to understand.

Title of the Course	: Topics in Reinforcement learning
Faculty Name	: Tejas Bodas & Harikumar Kandath
Course Code	: CS7.603
Credits	: 4
L - T - P	:
(L - Lecture hours, T-Tutorial hours, P - Practical hours)	2-2-0
Semester, Year (Ex: Spring, 2022)	: Spring 2023
Name of the Program	: CSE /ECE

Pre-Requisites : MA6.101 Probability and Statistics or Equivalent (Compulsory), MDL, Stochastic processes, or equivalent (desirable)

Course Outcomes :

Course outcomes

(CO's): After completion of the course, the students will be able to

1. ~ Analyze, understand and apply the theory of Markov Decision processes
2. ~ Analyze, understand and apply the theory of Reinforcement learning
3. ~ Implement reinforcement learning algorithms using Python
4. ~ Implement RL projects in group demonstrating use cases for topics learnt.

Course Topics : Following is the tentative list of topics to be covered in this course in about 12 lectures. (Each lecture is of 90 mins.)

Module 1: (3 lectures)

- Review of Probability and Stochastic Processes
- Markov Chains
- Introduction to Optimization
- Introduction to Dynamic programming and Markov Decision Processes

Module 2: (5 lectures)

- Infinite horizon discounted MDP
- Bellman Optimality Criteria
- Value Iteration & Policy Iteration
- Average cost criteria

Module 3; (6 lectures)

- Introduction to RL
- Monte Carlo methods
- TD Learning, Q-learning and Bootstrapping

Module 4: (5 lectures)

- Systems with continuous state-action space, Controllability and stability
- Linear Quadratic Regulator (LQR)
- Policy Iteration (PI) and Value Iteration (VI) methods

Module 5: (5 lectures)

- Function approximation techniques – DQN
- Actor-Critic methods
- Integral reinforcement learning
- Policy gradient methods

Preferred Text Book : Reinforcement learning: An Introduction by Sutton and Barto

Reference Books :

- 1) Applied probability models with Optimization Applications by Sheldon Ross
- 2) Approximate Dynamic programming by Warren Powell
- 3) Simulation based optimization: Parametric optimization techniques and Reinforcement learning. Abhijit Gosavi, 2015
- 4) Optimal Adaptive Control and Differential Games by Reinforcement Learning Principles. D. Vrabie, Kyriakos G. Vamvoudakis, Frank L. Lewis, 2013.

E-book Links : NA

Grading Plan :

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Quiz-1	10
Mid SemExam	20
Quiz-2	10
End Sem Exam	20
Assignments	20
Project	20
Term Paper	0
Other Evaluation	0

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant). Program outcomes are posted at

https://iiitaphyd-my.sharepoint.com/:w/r/personal/dyacad_iit_ac_in/Documents/NBA-2020-21/Course%20Content/IIIT-CSE-ECE.docx?d=w111foeffcae41b3a4d1e8a3fbc6332d&csf=1&web=1&e=z1Khby

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	2	2	-	-	2	1	1	2	3	2	2	3
CO2	3	3	3	2	2	2	-	-	2	1	1	2	3	2	2	3
CO3	3	3	3	2	2	2	-	-	2	1	1	2	3	2	3	3
CO4	3	3	3	2	1	1	2	1	1	1	1	2	3	2	3	3
CO5																

Teaching-Learning Strategies in brief (4-5 sentences) :

- The course is planned to be a balance between theory and practice.

- Traditionally, this course has been a theory intensive course with little emphasis on implementation and applications. We will however flip this around.
 - We will introduce theoretical mathematical concepts on a need to know basis or as and when required.
 - The emphasis will be to look at a lot of examples of MDP's and RL algorithms and possibly be able to use them in real world examples.
-

Title of the Course	:Topics in Software Foundations
Faculty Name	: Venkatesh Choppella
Course Code	: CS6.502
Credits	: 4 (Two 1.5 hour lectures per week)

Prerequisites

Database systems, Distributed Systems (recommended, or can be taken concurrently in the same semester)

2 Objective

The objective of this course is to explore the modeling, architecture, and design of advanced software systems from the perspective of Systems Theory. The theory equips the student with a conceptual vocabulary for describing systems. The practical perspective provides an opportunity to analyze a software system and model its structure and behavior using the vocabulary of transition systems.

The course is in three parts. The first part (Unit 1) is an introduction to the notion of transition systems and applying a systems approach when designing or analyzing iterative, interactive, parallel or distributed systems. . The second part of the course (Unit 2) dives into the architecture and design of large systems, including a brief on Infrastructure as a Service. The third part (Unit 3) applies the principles learned in Unit 1. We will analyze an existing open-source system and use transition systems modeling and specific system comprehension techniques to understand the dynamics of the system.

The course will involve lectures from industry experts: Mrityunjay Kumar (Zenoti) and Dr. Sudhir G Rao (ex-IBM Raleigh USA).

3 Course specific outcomes

After completing the course, the student should be able to accomplish the following:

1. CO1: Model simple to moderate interactive applications

Using the formalism of interactive systems, model simple systems like an Automatic Teller Machine, Boom Barrier Controller, etc.

2. CO2: Specify properties of systems

Formally state correctness conditions of sequential, concurrent and distributed systems.

3. CO3: Express Patterns of design formally

Write down formal descriptions of some basic and advanced design patterns, like Observer, State and Model-View-Controller.

4. Co4: Understand the architectural principles behind large systems

Analyze a given system in terms of its architecture and be able to judge how well it uses the architectural principles and patterns

5. Co5: Analyze the design of real-world systems

Take a real world system and model its dynamics in terms of patterns and express the patterns using a formal notation.

4 Detailed Syllabus

Unit 1: Principles of interactive systems

Sequential Systems. Algorithmic Problem Solving. Transition Systems. Interactive problem solving. Composition of systems. Feedback composition. Actor models of distributed systems.

Unit 2: Building large systems

Software System Architecture & Design Methodologies, A Software Systems Algebra for Architecture & Design, Client-Server Systems, Distributed Systems, Distributed Communication Protocols, Virtualized Infrastructure & Infrastructure Clouds, [time permitting] Server System Design & Protocol Subsystem Design.

Unit 3: Analyzing Systems

A comprehension strategy for software systems, using models to capture system behavior, iteratively gather information about an existing system and refine mental and formal models.

5 References

There is no text book for the course. Material will be used from a variety of books, research papers and online websites. Some reference books and sites are listed below.

- An introduction to Mathematical Computer Science. Kasturi Viswanath.
- Verification and Control of Hybrid Systems. Pablo Tabuada. Springer 2009.
- Patterns of Enterprise Application Architecture. Martin Fowler. Addison Wesley 2002.
- ISO/IEC 25010:2011 System and software quality models
<https://www.iso.org/standard/35733.html>
- Software Architecture in Practice, 4th Edition, 2021, Bass, Clements, Kazman

6 Teaching-Learning Strategies

The course will be lecture-driven. Students will need to complete assignments (including programming assignments) to demonstrate understanding of the material covered in class. In addition, there will be project presentations of case studies done by students. The project presentation will include a term paper and a talk.

7 Assessment Methods (Tentative)

Assignments	40				
Midsem	20				
Project	40				

8 Mapping of Course Outcomes to Programme and Programme Specific Outcomes

Programme Outcome (PO/PSO)	CO1	CO2	CO3	CO4	CO5	CO6
PO1 Engg. Knowledge	3	3	3	3	3	3
PO2 Problem Analysis	3	3	1	1	2	3
PO3 Design/Develop	3	3	3	3	2	1
PO4 Complex Problems	1	2	3	3	3	3
PO5 Modern tool usage	1	1	1	1	1	1
PO6 Engr. & Society	1	2	2	3	1	1
PO7	1	1	1	1	1	1

Environment & Sustainability						
PO8	1	2	2	2	2	2
Ethics						
PO9	1	1	1	2	1	3
Team work						
P10	3	3	3	3	3	3
Communication						
P11	1	1	1	1	1	1
Project Mgmt & Finance						
P12	2	2	2	2	1	2
Life learning						
PS01	3	3	3	3	3	2
Specialised knowledge						
PS02	2	2	2	2	2	2
Roadmap for technologies						
PS03	3	3	3	3	3	3
Research &						
Development Skills						
PS04	3	3	3	3	3	3
Potential for PG study						

Appendix: Programme and Programme Specific Outcomes

Programme Outcomes (POs)

PO1 :: Engineering knowledge

Use concepts from varied disciplines including Computer Science, Electronics, Mathematics, and the Sciences, to engineer and develop systems of varying scale.

PO2 Problem analysis

Identify, formulate and analyze complex engineering problems reaching substantial conclusions using first principles of Mathematics, Natural Sciences and Engineering Sciences.

PO3 Design/Development of solutions

Identify and bring to fore the necessary concepts from Computer Science and arrive at creative ways to solve problems that take into account the societal, cultural, and ethical considerations.

PO4 Conduct investigations of complex problems

Interpolate and extrapolate based on existing knowledge base and self-learning skills to investigate the dynamics of complex problems and find solutions.

PO5 Modern tool usage

Demonstrate requisite hands-on skills to work with a variety of software packages, libraries, programming languages, and software development environment tools useful in engineering large scale systems

PO6 The engineer and society

Make judicious use of resources and understand the impact of technology across the societal, ethical, environmental, and economic aspects.

PO7 Environment and sustainability

Find technological solutions by considering the environmental impact for sustainable development

PO8 Ethics

Practice principles of professional ethics and make informed decisions after a due impact analysis.

PO9 Individual and team work

Work efficiently in individual and team-oriented projects of varying size, cultural milieu, professional accomplishments, and technological backgrounds.

PO10 Communication

Effectively communicate and exchange ideas and solutions to any individual including peers, end-users, and other stakeholders.

PO11 Project management and Finance

Apply the principles of project management in general and software project management in particular with focus on issues such as the life cycle, scoping, costing, and development.

PO12 Life-long learning

Exhibit the aptitude for independent, continuous, and life-long learning required to meet their professional and career goals.

Programme Specific Outcomes (PSOs)

PSO1

Exhibit specialized knowledge in some sub-areas of Computer Science and Engineering such as Theoretical Computer Science, Computer Systems, Artificial Intelligence, Cyber-physical Systems, Cyber-security and use this specialized knowledge base to solve advanced problems

PSO2

Perform gap analysis in terms of systems and technologies and prepare roadmaps for incorporating state-of-the-art technology into system analysis, design, implementation, and performance.

PSO3

Demonstrate research and development skills needed to define, scope, develop, and market futuristic software systems and products.

PSO4

Demonstrate knowledge and skills at the required depth and breadth to excel in post-graduateand research programs.

Title of the Course : Topics in Signal Processing

Faculty Name : Santosh Mannuru

Course Code : EC5.401

Credits : 4

L - T - P : 3 - 1 - 0

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Semester, Year : Spring 2022

(Ex: Spring, 2022)

Name of the Program : Electronics and Communication Engineering

Pre-Requisites : Signal Processing, Linear Algebra

Course Outcomes :

1. Apply concepts from traditional signal processing for the study of graph signals and their processing
2. Apply Laplacian and Adjacency matrices from spectral graph theory to transform and interpret vertex-domain graph signals in frequency-domain
3. Analyze graph signals to perform the signal processing operations of

- filtering, denoising, sampling, and reconstruction
4. Analyze the connections between traditional signal processing and graph signal processing to develop abstract mathematical intuition for modeling and problem solving
 5. Design and execute a project which applies graph signal processing to solve a problem using the tools learned in the course

Course Topics :

This offering of Topics in Signal Processing will focus on Graph Signal Processing (GSP). In contrast to traditional signals which defined over regular domains such as time (e.g., speech), space (e.g., images) and space-time (e.g., video), graph signals are signals defined over an irregular domain of graph. Relation between various components of traditional time and space domain signals are captured by the temporal (past, present, future) and spatial (left, right, etc.) relations respectively. For graph signals, this relation is specified by the accompanying graph i.e., the vertices (nodes) and connections between the vertices (edges).

Review – brief review of relevant signal processing and linear algebra concepts
 Graph and graph signals – definition and descriptors of a graph (Laplacian and Adjacency matrices), spectral graph theory in brief, examples of graphs, signals over the graph domain
 Signal processing over graphs – shift operation, notion of frequency and smoothness, graph Fourier transform (GFT), vertex-domain and frequency-domain representation of graph signals, graph filters and convolution

Signal processing over graphs – band-limited graph signals, sampling and reconstruction of graph signals, uncertainty principles, denoising, compression, learning graph structure from signals, joint time-vertex signal processing

Applications – image processing, sensor networks, brain signals, etc.

Preferred Text Books : Online resources and reference papers will be

shared Reference Books :-

E-book Links :-

Grading Plan :-

(The table is only indicative)

Type of Evaluation	Weightage (in %)
Mid SemExam	25
Assignments	20
Project	40
Term Paper	15

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a ‘-’ dash mark if not at all relevant).

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	3	3	3	3	3	1	1	1	1	1	1	2	-	3	2	2
CO 2	3	3	3	3	3	1	1	1	1	1	1	2	-	3	2	2
CO 3	3	3	3	3	3	1	1	1	1	1	1	2	-	3	2	2
CO 4	3	3	3	3	3	1	1	1	1	1	1	2	-	3	2	2
CO 5	3	3	3	3	3	3	1	1	2	3	2	2	-	3	2	2

Teaching-Learning Strategies in brief (4-5 sentences):

Lectures are used to explain the core concepts in graph signal processing. Notes and slides will be shared along with online resources. Tutorials will be used for doubt clarifications and problem solving. Assignments are given to promote application of concepts to difficult problems. The course project exposes students to real-world applications and the role of graph signal processing.

Title of the Course	: Topics in Speech to Speech Translation (SSMT)
Faculty Name	: Anil Kumar Vuppala + Chiranjeevi Yerra
Course Code	: CL5.401
L-T-P	: 3-1-0
Credits	: 4
Name of the Academic Program B. Tech. in CSE and ECE	

Prerequisite Course / Knowledge:

Suggested to have a Speech Signal Processing course or NLP course.

Course Outcomes (COs):

After completion of this course successfully, the students will be able to..

CO-1 :Explaining the need for speech to speech translation

CO-2: Explaining ASR, MT and TTS systems.

CO-3: Applying AI models for ASR, MT and TTS.

CO-4: Analyzing the discourse role in SSMT.

CO-5: Explaining the issues in speech to speech translation.

CO-6: Designing speech to speech translation systems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
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CO1	2	2	1	1	1	1	1	1	2	1	1	2	-	3	-	-
CO2	3	2	1	1	1	1	1	1	2	1	1	2	-	3	-	-
CO3	3	2	2	1	1	1	1	1	2	1	1	2	-	3	-	-
CO4	3	2	2	1	1	2	1	1	2	1	1	2	-	3	-	-
CO5	2	3	2	2	1	2	2	1	2	1	1	3	-	3	-	-
CO6	2	3	3	3	2	2	2	1	3	2	2	3	-	3	-	-

Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs). Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping Mapping with PSOs, where applicable.

Detailed Syllabus:

Unit 1: Introduction to SSMT with demos. Automatic speech recognition introduction and state of the art approaches.

Unit 2: Machine translation introduction and state of the art approaches.

Unit 3: TTS introduction and state of the art approaches.

Unit 4: Role of discourse and prosody in SSMT.

Unit-5: Corpus standards. Need for human in the loop of SSMT and research issues in SSMT.

Reference Books:

1. **Speech and Language Processing (3rd ed. draft)** by [Dan Jurafsky and James H. Martin](#)
2. Machine Translation by Bonnie Jean Dorr, MIT press.

Teaching-Learning Strategies in brief (4 to 5 sentences):

It is topics course in speech to speech translation. Indian government has taken Speech to speech translation in Indian languages as mission project. There is a need to generate manpower in this new area which is combination of NLP and Speech domains. This is mainly project oriented course. After demonstration of necessary topics like Machine translation, ASR and TTS projects will be given.

Assessment methods and weightages in brief (4 to 5 sentences):

Quiz 20%
Assignments 30%
Project 50%

Title of the Course : Usability of Software and Digital Products

Faculty : Raman Saxena and Nimmi Rangaswamy

Course Code : CS5.402

No. of Credits : 2

Format: Lecture; Tutorial; Labs/Studio: 1.5 -0- 3

Target Students : Open Elective for UG and PG

Pre-requisite: HCI Course for PDM Students and other UG and PG students

Course Objectives & Outcomes

Usability is critical for the successful acceptance and adoption of any software and digital products by their targeted users. This course introduces the usability of software and digital products & systems. Students will learn about the Software Usability, Prototyping, including Low Fidelity and High-Fidelity Prototypes, Usability Evaluation Methods (including Usability Goals, Usability Test planning, Usability Matrix, Heuristic Review and Usability Testing, The course will also provide the understanding and skills conducting the evaluation, data collection, documenting the test results and interpreting the test data to access the usability of any software and digital product. Product usability and its assessment is a critical milestone of any product launch and understanding it will be an important skill/attribute for any excellent product manager.

The students of this course will be able to apply the knowledge/learning's from this course to their own professional work as product designer and product managers of the software/IT products/industry including Mobility, Healthcare, Learning, E-commerce and Utility etc. The course will include a short project to offer opportunity to the students to experience the full HCI cycle. This course will also help them better prepare to design and develop human-centered, easy to use & usable software and digital products and system leading to higher acceptance and adoption of those products and to work with the product managers and designers more collaboratively and effectively.

After completion of this course successfully, the students will be able to...

CO-1 Demonstrate good understanding of the full development life-cycle Human-Computer Interaction and How it influences the Usability of the digital products, systems, solutions, and services.

CO-2 Demonstrate good understanding about Software Usability in software development lifecycles and usability evaluation methods including heuristic review, expert review, usability testing etc.

CO-3 Demonstrate the understanding about the need for prototyping, types of prototypes including low fidelity & high fidelity and ability and skills for rapid prototyping.

CO-4 Demonstrate good understanding of usability evaluation process, protocols, usability matrix, and tools, and demonstrate the ability to conduct usability evaluation sessions, collect, and analyze test results, interpret test data to identify design changes, document and present the same.

CO-5 Demonstrate the ability to collaborate with end users (test users) and other stakeholders.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	3	2	1	2	3	2	3	2	2	2
CO2	3	3	3	3	3	2	1	3	3	2	3	2	2	2
CO3	3	3	3	3	3	2	1	3	3	2	3	2	2	2
CO4	3	2	3	3	3	2	1	3	3	3	3	2	2	2
CO5	2	2	2	2	2	2	1	2	3	3	3	2	2	2

Note: Each Course Outcome (CO) may be mapped with one or more Program Outcomes (POs) and PSOs.

Write '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level' mapping

Teaching-Learning Strategies

To enhance the learning and making it interesting and motivating, other than lecture sessions this course will include lots of interactive and hands-on activities, quizzes, classroom, fieldwork, and studio assignments and experiments both individual and group. Accordingly in the beginning, this course will run like a lecture and tutorial format but later it will transform into a studio format with students working on a project exploring Human-centered Software Design and Usability evaluation to experience the full HCI /UX/Usability cycle. The course will introduce and discuss a few case studies to HCI, Software Usability, Other than attending lectures and doing classroom exercises & assignments, students need to spend 4 hours per week on home/field assignments.

Lesson Plans

- The Course will be divided into lectures (around 12) and hands-on work including assignments, classroom exercises and homework.
- The course will also include fieldwork, hand on activities, learning by doing, to practice the learning from the lectures.
- Introduce and discuss a couple of case studies including cases related to the new product development and ICT/ digital domain.
- It will introduce and discuss a couple of case studies including cases related to HCI, User Experience and UI Design of software products.
- Design Project covering Interaction Design, User Experience Design and project to practice Usability learnings.
- Other than attending lectures and doing classroom exercises & assignments students need to spend around four to five hours per week on home/field assignments.

This course will consist of the following units.

UNIT 1: Software/Digital Product Usability	UNIT 2: Prototyping
<ul style="list-style-type: none">• Introduction to Software Usability?• Why should we evaluate usability?• Usability Goals	<ul style="list-style-type: none">• Why prototype• Low Fidelity prototypes• High Fidelity Prototypes• Rapid Prototyping tools
UNIT 3: Usability Evaluation	UNIT 4: Planning for Usability Evaluation
<ul style="list-style-type: none">• Types of Usability Evaluation• Usability Reviews,• Heuristic Evaluation• Usability Testing	<ul style="list-style-type: none">• Usability Testing Process• Usability Matrix• Defining Test Cases and usability goals and matrix• Test user screener and recruiting test users
UNIT 5: Conducting Usability Evaluation	UNIT 6: Project document and submission

<ul style="list-style-type: none"> • Usability evaluation protocol including test questioner and data sheets. • Briefing and debriefing questioner • How to run the usability test? • Test data collection and analysis • Identifying usability problems 	<ul style="list-style-type: none"> • Redesign recommendation based on usability evaluation • Usability Testing Documentation including test findings • Project Document/Project Report • Submission and Evaluation
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Reference Books & Case Studies

1. Human-Computer Interaction in the New Millennium, by Carroll, John
2. Learn Human-Computer interaction: Solve human problems and focus on rapid prototyping and validating solutions through user testing., by Christopher Reid Becker
3. Lean UX: Designing Great Products with Agile Teams, by Jeff Gothelf & Josh Seiden
4. Sketching User Experiences: Getting the Design Right and the Right Design, by Bill Buxton
5. Interaction Design: Beyond Human-Computer Interaction, By Helen Sharp, Jennifer Preece & Yvonne Roger
6. Designing User Interfaces: Exploring User Interfaces, UI Elements, Design Prototypes and the Figma UI Design Tool, Dario Calonaki
7. Moderating Usability Test: Principles and Practices for Interacting, by Dumas, Joseph
8. Ethnography and Virtual Worlds: A Handbook of Method [Tom Boellstorff](#), [Bonnie Nardi](#), [Celia Pearce](#), and [T. L. Taylor](#)
9. Rethinking Users: The Design Guide to User Ecosystem Thinking, Mike Youngblood & Benjamin Chesluk
10. [Designing with Data: Improving the User Experience with A/B Testing](#), Rochelle King, Elizabeth Churchill & Caitlin Tan
11. [Design + Anthropology](#), Christine Miller
12. [Quantified: Biosensing Technologies in Everyday Life](#), edited by Dawn Nafus
13. Case study: Design of a complex software system- CMS of a media organization
14. Case study: Defining a Mainframe System
15. Case Example: Conversational UI's.
16. Case Study: Designing Everyday Mobility

Assessment methods and weightage

	Assessment Methods	Weightage
1	Classroom /Home activities & assignments	30%
2	Project Individual/Group	50%
3	Final Exam	20%
	Total	100%

Title of the Course : User Interaction and Usability of Digital Products

Faculty : Raman Saxena and Nimmi Rangaswamy

Course Code : CS5.401

No. of Credits : 4

Format: Lecture; Tutorial; Labs/Studio: 1.5 -1- 3

Target Students: Open elective for UG, DD and PG Humanities, and across CS and EC programme

Pre-requisite: No

Class size: 30 Students max.

Course Objectives & Outcomes

A Positive and Delightful User Experience and High Usability is critical for the successful acceptance and adoption of any software and digital products by their targeted users. This course focuses on the principles and techniques in the design of an easy to use, safe, trustworthy, efficient and comfortable interaction between human and computers under the overall goal of delivering a delightful user experience, which is the key success factor for any software and digital products.

This course introduces the fields of Interaction Design, User Experience (UX) Research, UX Design, and Usability of software and digital products & systems. Students will learn about the Human-Centred Software Development Lifecycle including gaining an understanding of what is involved in Designing Interactions and User Experience (Human-computer Interaction-HCI, Human-Centred Design - HCD, Digital Anthropology, Cognitive/Mental Models, Human-Action Cycle, Perception, Attention and Memory, Gestalt Principles/laws, Information Architecture, Task/User Flows, etc.), UX Research (understanding User Needs & Requirements, Ethnography Research, Contextual Inquiries, Interviews, Qualitative and Quantitative Research, User Personas, Use Cases diagrams, etc.), Software Usability (Including Low Fidelity and High-Fidelity Prototyping, Heuristic Review, Usability Matrix, Usability Evaluation/Testing in the development cycle, etc.) using principles of interaction design, user experience, and usability engineering. The course will also investigate technology trends such as AI influence on User Interfaces and UX, Conversational User Interfaces (Chatbots.),etc., and their influence on the interactions between users and computers.

A significant number of students graduating from the CS and ECE backgrounds serve as software engineers and developers in the IT, Software and other industry working on designing and developing software and digital products and systems. This course will not only help them better prepare to design and develop human-centered, easy to use & usable software and digital products and system leading to higher acceptance and adoption of those products but also to work with the product managers and designers more collaboratively and effectively.

Learning Outcomes

LO-1: Demonstrate good understanding and implementation of User-centered design, HCI. Software interaction Design, Principles of User Experience and Software Usability in software development lifecycles.

LO-2: Demonstrate good understanding of Interaction design and user experience from the perspectives of human-centered design and human/social sciences including digital anthropology and cognitive sciences, Cognitive Modeling, Human-Action Cycle (HAC), Designer Models, User Workflows, Task analysis and Modelling and System Images.

LO-3: Demonstrate good understanding and skills to conduct User Experience Research, collect User Requirements, User Personas, Use Cases, and evaluate acceptance and adoption of software and digital products and services amongst the targeted user group.

LO-4: Demonstrate the ability and skills for Information and Data Visualization, Information Architecture, Interaction Models, User Interface Elements, Wireframes and Rapid Prototyping and to articulate new trends in HCI/UX and UI - including AI Influence on UI/UX, Conversational UI or chatbot interfaces

LO-5: Demonstrate good understanding of software usability, usability matrix and skills to conduct usability evaluations including heuristics reviews, usability testing of the software and

digital products along with documenting deliverables and communicating course project outcomes

LO- 6: Exhibit aptitude for working in teams and deliver task outcomes effectively.

LO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
LO1	1	1	3	3												2
LO2				3		3										2
LO3							1	3					3			
LO4					3								3	3		
LO5										3			3	3		
LO6									3		2	3			2	

Teaching-Learning Strategies

To enhance the learning and making it interesting and motivating, other than lecture sessions this course will include lots of interactive and hands-on activities, quizzes, classroom, fieldwork, and studio assignments and experiments both individual and group. Accordingly in the beginning, this course will run like a lecture and tutorial format but later it will transform into a studio format with students working on a project exploring Human-centered Software Design and Development Lifecycle, User Experience and UX in domain of their interest including, software/IT products including Mobility, Healthcare, Learning, E-commerce, and Utility etc. to experience the full HCI /UX cycle. The course will introduce and discuss a few case studies to HCI, User Experience and UI Design of software/IT/digital products, applications, and services. Other than attending lectures and doing classroom exercises & assignments, students need to spend 4 hours per week on home/field assignments.

Lesson Plans

- The Course will be divided into lectures (around 24, around 12 in each part) and hands-on work including assignments, classroom exercises and homework.
- The course will also include fieldwork, hand on activities, learning by doing, to practice the learning from the lectures.
- Introduce and discuss a couple of case studies including cases related to the new product development and ICT domain.
- It will introduce and discuss a couple of case studies including cases related to HCI, User Experience and UI Design of software products.
- Design Project covering Interaction Design, User Experience Design and =project to practice HCI, UX, UI and Usability learnings.
- Other than attending lectures and doing classroom exercises & assignments students need to spend around four to five hours per week on home/field assignments.

This course will consist of the following units.

UNIT 1: Introduction to User Experience	UNIT 2: Understanding Human-Machine System
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<ul style="list-style-type: none"> • What is User Experience and UX Design? • How User interact with outside world? • Human Conceptual/Mental models • Conflict between Mental Models and Design Models. 	<ul style="list-style-type: none"> • Understanding Human-Machine System • Human-Action Cycle (HAC) • 7 stages of Human-action cycle • User Experience Research
UNIT 3: Social and Human Science in Interaction, UX and Usability	UNIT 4: User-Centered approach to Software Design
<ul style="list-style-type: none"> • Digital Anthropology • Ethnographic Design • Attention and Memory • Gestalt theory and principles • UI Elements including color and interaction models. 	<ul style="list-style-type: none"> • Perceived Usefulness & Ease of Use • Understanding User Persona • Why user person is important • Use cases, User stories • Task Flows & Task Analysis • Human-centered software Design Workflow • UX/UI Qualitative Research
UNIT 5: User Experience and UI Design	UNIT 6: New Trends and Project Documentation
<ul style="list-style-type: none"> • Information Architecture • Wireframes and Storyboards • Interaction Design and UX Project 	<ul style="list-style-type: none"> • AI influence on User Interface/Intelligent Interfaces • Chat Bots - Conversational User Interfaces • Project Work-in-progress Document
UNIT 7: Software/Digital Product Usability	UNIT 8: Prototyping
<ul style="list-style-type: none"> • Introduction to Software Usability? • Why should we evaluate usability? • Usability Goals 	<ul style="list-style-type: none"> • Why prototype • Low Fidelity prototypes • High Fidelity Prototypes • Rapid Prototyping tools
UNIT 9: Usability Evaluation	UNIT 10: Planning for Usability Evaluation
<ul style="list-style-type: none"> • Types of Usability Evaluation • Usability Reviews, • Heuristic Evaluation • Usability Testing 	<ul style="list-style-type: none"> • Usability Testing Process • Usability Matrix • Defining Test Cases and usability goals and matrix • Test user screener and recruiting test users
UNIT 11: Conducting Usability Evaluation	UNIT 12: Project document and submission
<ul style="list-style-type: none"> • Usability evaluation protocol including test questioner and data sheets. • Briefing and debriefing questioner • How to run the usability test? • Test data collection and analysis • Identifying usability problems 	<ul style="list-style-type: none"> • Redesign recommendation based on usability evaluation • Usability Testing Documentation including test findings • Project Document/Project Report • Submission and Evaluation

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3. Lean UX: Designing Great Products with Agile Teams, by Jeff Gothelf & Josh Seiden
4. Sketching User Experiences: Getting the Design Right and the Right Design, by Bill Buxton
5. Interaction Design: Beyond Human-Computer Interaction, By Helen Sharp, Jennifer Preece & Yvonne Roger
6. Designing User Interfaces: Exploring User Interfaces, UI Elements, Design Prototypes and the Figma UI Design Tool, Dario Calonaci
7. Designing Interfaces: Patterns for Effective Interaction Design, By Jennifer Tidwell, Charles Brewer and Aynee Valencia
8. UX for XR: User Experience Design and Strategies for Immersive Technologies (Design Thinking), by Cornel Hillmann
9. AI and UX: Why Artificial Intelligence Needs User Experience, by Gavin Lew, Robert M. Schumacher Jr.
10. Information Visualization: Design for Interaction, by Prof. Robert Spence
11. Moderating Usability Test: Principles and Practices for Interacting, by Dumas, Joseph
12. Ethnography and Virtual Worlds: A Handbook of Method [Tom Boellstorff](#), [Bonnie Nardi](#), [Celia Pearce](#), and [T.L. Taylor](#)
13. Rethinking Users: The Design Guide to User Ecosystem Thinking, Mike Youngblood & Benjamin Chesluk
14. [Designing with Data: Improving the User Experience with A/B Testing](#), Rochelle King, Elizabeth Churchill & Caitlin Tan
15. [Design + Anthropology](#), Christine Miller
16. [Quantified: Biosensing Technologies in Everyday Life](#), edited by Dawn Nafus
17. Case study: Design of a complex software system- CMS of a media organization
18. Case study: Defining a Mainframe System
19. Case Example: Conversational UI's.
20. Case Study: Designing Everyday Mobility

Assessment methods and weightage

	Assessment Methods	Weightage
1	Classroom /Home activities & assignments	30%
2	Project Individual/Group	50%
3	Final Exam	20%
	Total	100%

Title of the Course

: VALUE EDUCATION – 2

Faculty Name

: Radhika Mamidi + Anil Kumar Vuppala

Course Code

: OC3.102

L-T-P

:12-6-0 (Total hours)

Credits

: 2

(L= Lecture hours, T=Tutorial hours, P=Practical hours)

Name of the Academic Program: B. Tech. in ECE, BTech in CSE

1.Prerequisite Course / Knowledge: -NIL-

2.Course Outcomes (COs) :

After completion of this course successfully, the students will be able to:

CO-1: Apply the basic framework of universal human values to understand oneself

CO-2: Explain the relation of self with family, society and nature

CO-3: Explain the concept of living in harmony at all the levels

CO-4: Demonstrate the right understanding of relationships and Right utilization of physical facilities

CO-5: Realise the long-term goal of being happy and prosperous

3.Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs) – Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	-	-	3	2	3	2	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	3	3	3	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	3	3	2	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	3	3	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	3	3	3	2	-	-	-	-	-	-	-

Note: '3' in the box for 'High-level' mapping, 2 for 'Medium-level' mapping, 1 for 'Low'-level mapping

4.Detailed Syllabus:

Unit 1: Revisiting goal in life - short term and long term goals; Basic aspirations - Happiness and Prosperity; Role of education and human conduct; Self-exploration; Developing a holistic view

Unit 2: Self-reflection and reflecting on relationships; understanding value-based life

Unit 3: Living in harmony at 4 levels: self-self, self-family, self-society, self-nature

Unit 4: Harmony in Society; Broadening one's perceptions;

Unit 5: Nature and Sustainability; Our role in protecting Nature;

Reference Books:

1. R.R. Gaur, R. Sangal, G. P. Bagaria. 2009. A Foundation course in Human Values and Professional Ethics. Excel books, New Delhi.

2. Randy Pausch. 2008. The Last Lecture. Hachette Books.

3. E. F. Schumacher. 1973. Small is beautiful: a study of economics as if people mattered. Blond & Briggs, Britain.

4. P. L. Dhar, R. R. Gaur. 1990. Science and Humanism. Commonwealth Publishers.

5.Teaching-Learning Strategies in brief (4 to 5 sentences):

This is a discussed based course. The instructor shares information on a topic and guides the discussion in the class by asking the right questions. By keeping the objectives in mind, the instructor adopts different techniques including smaller group discussions, role-play/skit, use of video clips/films or images to analyse and some activities to keep the students engaged in class throughout. Talks by experts who made a difference are also organised for the batch.

6.Assessment methods and weightages in brief (4 to 5 sentences):

This is a Pass/Fail course. The assessment methods include submissions of assignments and term papers. Critical thinking is expected from watching relevant short films or by reading assigned books. The classroom participation is also taken into consideration for evaluation. There are a few community-based activities and projects also. Participation in them is also important.

Title of the Course : Values, Ethics and AI

Faculty Name : Shatrunjay Rawat + Rajeev Sangal

Course Code : HSo.211

CREDITS : 2

L - T - P : 3-0-0

(L - Lecture hours, T-Tutorial hours,

P - Practical hours)

Name of the Program: B.Tech. and other programmes

Semester, Year : Spring 2023

Pre-Requisites : Basic Understanding of Ethics and IT Systems

Course Outcomes :

- CO-1 Understanding of basic human values, its connect with ethics, and their application in the domain of IT systems, AI, Big Data.
- CO-2 Develop the basic ability to identify whether an IT system is aligned to basic human values and adhere to ethical norms.
- CO-3 Develop the ability to design systems that adhere to values and ethics.

Course Topics :

Unit 1 Universal Values (based on Co-Existential Philosophy): a) Values in individual, b) Values in relationship, c) Values in society

Unit 2 Relating Values with ethics: a) Relationship between values and ethics, b) Trusteeship principle

Unit 3 Ethics of technology – Dimensions: a) Development and empowerment of User, Family, Society, b) Sustainability with nature

Unit 4 AI and big data: a) Issues, b) Privacy of Individuals, c) Ownership of my personal data - Who? Exploitation, d) Explainability, e) Empowerment

Preferred Text Books :

No single text book. Required study material will be shared/identified as course progresses.

Reference Books :

Will be identified as course progresses

E-book Links :

Grading Plan :

Type of Evaluation	Weightage (in %)
Participation in Class Discussions	20
Quiz	25
Assignments	20
End of the Course Examination	35

Mapping of Course Outcomes to Program Objectives: (1 – Lowest, 2—Medium, 3 – Highest, or a “-” dash mark if not at all relevant).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	3	-	-	3	1	3	-	2	-	1	1	1	1	2
CO2	1	1	1	2	-	3	1	3	-	2	-	1	1	1	1	2
CO3	2	1	2	2	-	3	2	3	-	2	1	1	2	2	2	2

Teaching-Learning Strategies in brief (4-5 sentences):

Course will be primarily driven by classroom discussions, readings, exploratory assignments. It will involve a lot of critical thinking and active learning by the students. Students will be asked to make presentations on topics assigned to them for exploration/experiment.
