Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus of

B.Tech. (AI & DS)

Effective from Academic Year 2024-25

Prepared by: Board of Studies in AI & DS

Approved by: Academic Board, Vishwakarma Institute of Technology, Pune

Chairman–BOS　　　　　　　　　　**Chairman–Academic Board**

Institute Vision

"To be globally acclaimed Institute in Technical Education and Research for holistic Socio- economic development".

Institute Mission

- To ensure that 100% students are employable and employed in Industry, Higher Studies, become Entrepreneurs, Civil / Defense Services / Govt. Jobs and other areas like Sports and Theatre.

- To strengthen Academic Practices in terms of Curriculum, Pedagogy, Assessment and Faculty Competence.

- Promote Research Culture among Students and Faculty through Projects and Consultancy.

- To make students Socially Responsible Citizen.

Department Vision

"To offer quality academic environment with the modern infrastructure to cater the demand of AI and DS careers with the research aptitude"

Department Mission

- To promote employability and entrepreneurship skills among students in the AI-DS and IT domains.

- To impart quality education with the focus on design, development and analysis using Interdisciplinary approach.

- To encourage students-faculty participation in research and development in collaboration with industry.

- To prepare students for solving problems of societal benefits and make them responsible citizens

Program Educational Objectives (PEO)

PEO	PEO Focus	PEO Statement
PEO1	Preparation	Graduates will be equipped with a strong foundation in mathematics, computational principles, and engineering practices to prepare for advanced studies, research, or successful careers in artificial intelligence, data science, and allied fields.
PEO2	Core competence	Graduates will develop expertise in core areas of artificial intelligence and data science, including machine learning, deep learning, big data analytics, and computational intelligence, enabling them to design and implement effective solutions to real-world challenges.
PEO3	Breadth	Graduates will acquire multidisciplinary knowledge by integrating concepts from engineering, natural sciences, social sciences, and management, enabling them to work on innovative and holistic solutions across diverse domains.
PEO4	Professionalism	Graduates will demonstrate ethical practices, leadership qualities, effective communication skills, and a commitment to teamwork while addressing societal and industrial challenges responsibly and sustainably.
PEO5	Learning Environment	Graduates will thrive in a learning environment that promotes curiosity, innovation, and continuous professional development, equipping them with the ability to adapt to technological advancements and pursue lifelong learning.

List of Programme Outcomes (PO)

Graduates will be able

PO	PO Statement
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and Research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles And commit to professional ethics and responsibilities And norms of the engineering practice.
PO9	**Individual and teamwork:** Function effectively as an individual, and as a member or Leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply the setoone's own work, as a member and leader in a team to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to Engage in independent and life-long learning in the broadest context of technological change**.**

Programme Specific Outcomes (PSO)

PSO	PSO Statement
PSO1	Solving the real-world problems with the application of Artificial Intelligence and Data Science concepts, theory and algorithms that adequately meet the challenges of the present and future.
PSO2	Ability to develop advanced knowledge and skill-sets to innovate technological tools and techniques with optimal use of resources and infrastructure in a competitive environment.
PSO3	Exhibit proficiency in computational knowledge and project development using Artificial Intelligence and data science techniques and tools for effective use in analysis, design and development in a multidisciplinary set-up.
PSO4	Develop high quality research and development aptitude for generation of knowledge and innovative business solutions which are socially and ethically acceptable and recognized by the industry and academia.

B.Tech. Artificial Intelligence & Data Science (applicable w.e.f. AY 24-25)
Index

19	AI2018	Engineering Design & Innovation – III	49
20	AI2021	Data Structures	51
21	AI2014	Web Technology	57
22	AI2003	Computer Network	65
23	AI2015	Digital Electronics and Microprocessor	70
24	AI2017	Automata Theory	76
25	AI2012	Design and Thinking – IV	80
26	AI2020	Engineering Design and Innovation-IV	82
27	AI3001	Artificial Intelligence	84
28	AI3002	Operating System	92
29	AI3003	Statistical Inference	98
30	AI3004	Machine Learning	103
31	AI3013	Design and Thinking-V	109
32	AI3014	Engineering Design and Innovation-V	111
33	AI3020	Coursera Courses	
34	AI3010	Deep learning	113
35	AI3011	Complexity Algorithm	117
36	AI3012	Software Design and methodologies	124
37	AI3015	Design and Thinking-VI	130
38	AI3016	Engineering Design and Innovation-VI	132
39	MD4206/ LL4001/ MD4227	OE1: Coursera Courses / OE1: Financial Management & Costing/ /Generative AI & its Applications/From campus to Corporate	134

40	AI4001	Blockchain & Cyber Security	136
41	AI4002	Optimization technique	141
42	CS4217	Human computer interaction	145
43	AI4004	Pattern recognition using fuzzy neural networks	150
44	AI4012/ AI4015/ AI4025	OE2:Augmented Reality and Virtual Reality / Network Security / High Performance Computing	154
45	AI4007/ AI4006/ AI4022	OE 3:Reinforcement Learning/Cyber Security and Privacy/Business Intelligence and Analytics	165
46	AI4017	Internet of things	172
47	AI4016	Predictive Analytics	176
48	IT4216	Data Management, Protection and governance	180
49	AI4231	Design and Thinking-VII	184
50	AI4005	Major Project	186
51	AI4008	Industry Internship	189
52	AI4011	International Internship	190
53	AI4010	Research Internship	191
54	AI4009	Project Internship	192
55		Assessment Guidelines AY 2024-25	

Nomenclature for Teaching and Examination Assessment Scheme AY 2024-25

Sr No.	Category	Head of Teaching/ Assessment	Abbreviation used
1	Teaching	Theory	Th
2	Teaching	Laboratory	Lab
3	Teaching	Tutorial	Tut
4	Teaching	Open Elective	OE
5	Teaching	Multi Disciplinary	MD
6	Teaching	Artificial Intelligence & Data Science	AI&DS
7	Assessment	Laboratory Continuous Assessment	CA
8	Assessment	Mid Semester Assessment	MSA
9	Assessment	End Semester Assessment	ESE
10	Assessment	Home Assignment	HA
11	Assessment	Course Project	CP
12	Assessment	Group Discussion	GD
13	Assessment	PowerPoint Presentation	PPT
14	Assessment	Class Test –1	CT1
15	Assessment	Class Test –2	CT2
16	Assessment	Mid Semester Examination	MSE
17	Assessment	End Semester Examination	ESE
18	Assessment	Written Examination	WRT
19	Assessment	Multiple Choice Questions	MCQ
20	Assessment	Laboratory	LAB

B.Tech. AI&DS Structure (Applicable w.e.f. AY 24-25)

SY AI&DS Module-III

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme											Total	Credits
			Theory	Lab	Tut	CA	Test-1	MSA	Test-2	ESA								
						Lab	CT1	MSE	CT2	CP	HA	GD/PPT	LAB	ESE	CVV			
S1	MD2201	Data Science	2	2	1	10		-	-	20	-	20		30	20	100	4
S2	CS2221	Internet of Things	2	2	1	10		-	-	20	-	20		30	20	100	4
S3	CS2218	Object Oriented Programming	2	2	1	10		-	-	20	-	-	50	-	20	100	4
S4	CS2227	Database Management Systems	2	2	1	10		-	-	20	-	20		30	20	100	4
S5	AI2018	Probability and Calculus	2			-	35	-	35	-	-	-		-	30	100	2
S6	AI2010	Design Thinking- III	-	-	-	-		-	-	-	-	-		100	-	100	1
S7	AI2018	Engineering Design & Innovation – III	-	8	-	-		30	-	-	-	-		70	-	100	4
S8	SH2001	Reasoning and Aptitude Development	1	-	-	-	-	-	-	-	-	-	-	100	-	100	1
	Total		11	16	4	40	35	30	35	80	-	60	50	360	110	800	24

B.Tech. AI&DS Structure (Applicable w.e.f. AY 24-25)

SY AI&DS Module-IV

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme										Total	Credits
						CA	Test-1	MSA	Test-2	ESA							
			Theory	Lab	Tut	Lab	CT1	MSE	CT2	CP	HA	GD/PPT	LAB	ESE	CVV		
S1	AI2021	Data Structures	2	2	1	10	-	-	-	20	-	-	50	-	20	100	4
S2	AI2014	Web Technology	2	2	1	10	-	-	-	20	20	-	-	30	20	100	4
S3	AI2003	Computer Network	2	2	1	10	-	-	-	20	-	-	50	-	20	100	4
S4	AI2015	Digital Electronics and Microprocessor	2	2	1	10	-	-	-	20	-	20	-	30	20	100	4
S5	AI2017	Automata Theory	2	-	-	-	35	-	35	-	-	-	-	-	30	100	2
S6	AI2010	Design Thinking- IV	-	-	-	-	-	-	-	-	-	-	-	100	-	100	1
S7	AI2018	Engineering Design & Innovation – IV	-	8	-	-	-	30	-	-	-	-	-	70	-	100	4
S8	SH2001	Reasoning and Aptitude Development	1	-	-	-	-	-	-	-	-	-	-	100	-	100	1
Total			11	16	4	40	35	30	35	80	20	20	100	330	110	800	24

B.Tech. AI&DS Structure (Applicable w.e.f. AY 24-25)

TY AI&DS Module-V

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme								Total	Credits
						CA	MSA	ESA							
			Theory	Lab	Tut	Lab	MSE	CP	HA	GD/PPT	LAB	ESE	CVV		
S1	AI3001	Artificial Intelligence	2	2	1	10		20	-	20	-	30	20	100	4
S2	AI3002	Operating System	2	2	1	10		20	-	-	50	-	20	100	4
S3	AI3003	Statistical Inference	2	2	1	10		20	20	-	-	30	20	100	4
S4	AI3004	Machine Learning	2	2	1	10		20	-	20	-	30	20	100	4
S5	AI3013	Engineering Design & Innovation – V	-	12	-	-	30	-	-	-	-	70	-	100	6
S6	AI3005	Design Thinking- V	-	-	-	-	-	-	-	-	-	100	-	100	1
S7	SH2001	Reasoning and Aptitude Development	1	-	-			-	-	-	-	100	-	100	1
Total			9	20	4	40		80	20	40	50	360	80	700	24

*Audit Courses:

MD3144 Basics of Game Development--offered by Zensar Technologies
MD3146: Mainframe Technologies –offered by BMC

B.Tech. AI&DS Structure (Applicable w.e.f. AY 24-25)
TY AI&DS Module-VI

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme								Total	Credits
			Theory	Lab	Tut	CA	MSA	ESA							
						Lab	MSE	CP	HA	GD/PPT	LAB	ESE	CVV		
S1	Coursera*	Coursera*	1	-	-	-	-	-	-	-	-	100	-	100	4
S2	AI3010	Deep Learning	2	2	1	10	-	20	-	20	-	30	20	100	4
S3	AI3011	Complexity Algorithm	2	2	1	10	-	20	20	-	-	30	20	100	4
S4	AI3012	Software Design and Methodologies	2	2	1	10	-	20	-	20	-	30	20	100	4
S5	AI3013	Engineering Design & Innovation – VI	-	12	-	-	30	-	-	-	-	70	-	100	6
S6	AI3005	Design Thinking- VI	-	-	-	-	-	-	-	-	-	100	-	100	1
S7	SH2001	Reasoning and Aptitude Development	1	-	-	-	-	-	-	-	-	100	-	100	1
Total			8	18	3	30	30	60	20	40	-	460	60	700	24

*Audit Courses:

MD3144 Basics of Game Development--offered by Zensar Technologies
MD3146: Mainframe Technologies –offered by BMC

Coursera Courses*

Subject Code	Subject Name
MD 4228	IBM Full Stack Software Developer
MD 4230	IBM Back-End Developer
MD 4233	Microsoft Power BI Data Analyst
MD 4234	Tableau Business Intelligence Analyst
MD 4237	IBM Cybersecurity Analyst
MD 4239	Google Cybersecurity
MD 4244	Meta Database Engineer
MD 4248	IBM DevOps and Software Engineering
MD 4251	IBM Front-End Developer
MD 4259	Akamai Network Engineering
MD 4260	Google Project Management
MD 4267	SAP technology Consultant
MD 4268	AWS Cloud Technology Consultant
MD 4269	Google UX Design
MD 4271	Meta iOS

B.Tech. AI&DS Structure (Applicable w.e.f. AY 24-25)

BTech AI&DS Module- VII (Department Module)

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme							Total	Credits
						CA			MSA	ESA				
			Theory	Lab	Tut	Lab	HA	MSE	PPT	ESE	GD	Viva		
OE1	Coursera*	Coursera Courses	-	-	-	-	-	-	-	100	-	-	100	4
OE2	AI4006/ AI4007/ AI4023	Cyber Security and Privacy/ Reinforcement Learning /AI/ML	2	-	-	-	10	30	-	20	-	30	100	2
	AI2017	Major Project	-	-	-	20	-	30	-	70	-	-	100	9
		Design Thinking -VII	-	-	-	-	-	-	-	100	-	-	100	1
Total			3	-	-	20	10	60	-	290	-	30	400	16

BTech AI&DS Module- VII (Internship)

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme							Total	Credits
						CA	MSA			ESA				
			Theory	Lab	Tut	Lab	HA	MSE	PPT	ESE	GD	Viva		
OE1	Coursera*	Coursera*	1	-	-	-	-	-	-	100	-	-	100	4
S1	AI4008	Industry Internship	-	32	-	-	-	30	-	70	-	-	100	11
S2	AI4011	International Internship	-	32	-	-	-	30	-	70	-	-	100	11
S3	AI4010	Research Internship	-	32	-	-	-	30	-	70	-	-	100	11
	AI4023	Design Thinking - VII	-	-	-	-	-	-	-	100	-	-	100	1
Total			1	32	-	-	-	30	-	270	-	-	300	16

Coursera Courses*

Subject Code	Subjet Name
MD 4228	IBM Full Stack Software Developer
MD 4230	IBM Back-End Developer
MD 4233	Microsoft Power BI Data Analyst
MD 4234	Tableau Business Intelligence Analyst
MD 4237	IBM Cybersecurity Analyst
MD 4239	Google Cybersecurity
MD 4244	Meta Database Engineer
MD 4248	IBM DevOps and Software Engineering
MD 4251	IBM Front-End Developer
MD 4259	Akamai Network Engineering
MD 4260	Google Project Management
MD 4267	SAP technology Consultant
MD 4268	AWS Cloud Technology Consultant
MD 4269	Google UX Design
MD 4271	Meta iOS

BTech AI&DS Module- VIII (Department Module)

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme							Total	Credits
						CA		MSA		ESA				
			Theory	Lab	Tut	Lab	HA	MSE	PPT	ESE	GD	Viva		
OE1	MD4206 /MD4227	Financial Management & Costing/ /From campus to Corporate	2	-	-	-	10	30	-	30	-	30	100	2
	LL4001	Generative AI & its Applications	2	-	-	-	10	30	-	30	-	30	100	2
OE2	AI4012	Augmented Reality and Virtual Reality	2	-	-	-	10	30	-	30	-	30	100	2
	AI4015	Network Security	2	-	-	-	10	30	-	30	-	30	100	2
	AI4025	High Performance Computing	2	-	-	-	10	30	-	30	-	30	100	2
	ET4230	Natural Language Processing	2	-	-	-	10	30	-	30	-	30	100	2
	IT4216	Data Management, Protection and Governance	2	-	-	-	10	30	-	30	-	30	100	2
	CS4217	Human Computer Interaction	2	-	-	-	10	30	-	30	-	30	100	2
OE3	AI4006/ AI4007/ AI4024	Cyber Security and Privacy/ Reinforcement Learning /AI/ML Credit Program	2	-	-	-	10	30	-	30	-	30	100	2
	AI4005	Major Project	-	20	-	-	-	30	-	70	-	-	100	10
Total			6	20	-	-	30	120	-	160	-	90	400	16

BTech AI&DS Module- VIII (Internship)

Sr. No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)			Examination scheme							Total	Credits
						CA		MSA		ESA				
			Theory	Lab	Tut	Lab	HA	MSE	PPT	ESE	GD	Viva		
S1	AI4008	Industry Internship	-	32	-	-	-	30	-	70	-	-	100	16
S2	AI4011	International Internship	-	32	-	-	-	30	-	70	-	-	100	16
S3	AI4010	Research Internship	-	32	-	-	-	30	-	70	-	-	100	16
Total			-	32	-	-	-	30	-	70	-	-	100	16

Coursera Courses*

Subject Code	Subjet Name
MD 4228	IBM Full Stack Software Developer
MD 4230	IBM Back-End Developer
MD 4233	Microsoft Power BI Data Analyst
MD 4234	Tableau Business Intelligence Analyst
MD 4237	IBM Cybersecurity Analyst
MD 4239	Google Cybersecurity
MD 4244	Meta Database Engineer
MD 4248	IBM DevOps and Software Engineering
MD 4251	IBM Front-End Developer
MD 4259	Akamai Network Engineering
MD 4260	Google Project Management
MD 4267	SAP technology Consultant
MD 4268	AWS Cloud Technology Consultant
MD 4269	Google UX Design
MD 4271	Meta iOS

MD2201: Data Science

Course Prerequisites:
1. Linear Algebra Basics

2. Central Tendency & Measures of Dispersion – Mean, Mode, Median

3. Probability

4. Some exposure to programming environment – C programming; Python

Course Objectives:
1. Understand data processing pipeline

2. Perform dimensionality reduction operations

3. Optimize the performance of functions

4. Apply descriptive statistics tools

5. Deduce meaningful statistical inferences

6. Use unsupervised classification algorithms

7. Use supervised classification algorithms

8. Utilize the data science principles for an entire project life cycle as a case study

Credits: 4   **Teaching Scheme Theory:** 2 Hours/Week
                                              Tut: 1 Hours/Week
                                              Lab: 2 Hours/Week

Course Relevance:
The course is offered in S.Y. B.Tech. to all branches of Engineering
Data Science is a multidisciplinary field. It uses scientific approaches, procedures, algorithms and frameworks to extract knowledge and insight from a huge amount of data.
Data Science uses concepts and methods which belong to fields like information technology, Mathematics, Statistics, Computer Science etc.
Data Science influences the growth and improvements of the product by providing a lot of intelligence about customers and operations, by using methods such as data mining and data analysis.
The course is relevant to all branches of Engineering and beyond, since data is generated as an obvious outcome of many processes.

Data science definition, raw data, processed data and their attributes, meta data, data cleaning, data science pipeline. **(3 Hours)**
Normal distribution, evaluating normal distribution, Binomial distribution, confidence Intervals, central limit Theorem, hypothesis testing **(6 Hours)**

Vector norms, Unconstrained Optimization **(4 Hours)**

Simple and multiple linear regression; Logistic regression, non-linear regression, polynomial regression **(4 Hours)**

Nearest Neighbor Classification – Knn approach, branch and bound algorithm, projection algorithm; Naïve Bayes Classification; Classification using decision trees, divisive and agglomerative clustering, K-means clustering **(6 Hours)**

Evaluation of model performance – Confusion matrices, sensitivity, specificity, precision, recall, F-measure, Classifier performance measurement metrics – Training & Testing strategies – Resubstitution, Hold-out, Cross validation, Bootstrap **(3 Hours)**

List of Tutorials:
1. Data Visualization

2. Distances and Projections

3. Singular Value Decomposition

4. Principal Component Analysis

5. Optimization

6. Normal & Binomial Distribution

7. Hypothesis Testing

8. ANOVA test

9. Linear Regression

10. Logistic Regression

11. Nearest Neighbor Classification

12. Decision Trees based classification

13. Naive Bayes classification

14. Clustering

15. Evaluation of model performance

16. Bagging & Boosting approaches

List of Practical's: (Any Six)
1. Data visualization

2. Unconstrained Optimization

3. Hypothesis Testing

4. Linear regression

5. Logistic Regression

6. Nearest Neighbor classification

7. Naive Bayes classification

8. Clustering

9. Classifier performance using Confusion matrix and other attributes

10. Cross Validation methods

List of Course Projects:
1. Movie recommendation system

2. Customer Segmentation using Machine Learning

3. Sentiment analysis

4. Uber Data analysis

5. Loan prediction

6. HVAC needs forecasting

7. Customer relationship management

8. Clinical decision support systems

9. Development of machine learning solutions using available data sets (multiple projects)

10. Fraud detection

List of Course Seminar Topics:
1. Data wrangling

2. Predictive modeling

3. Data analytics in life science (multiple topics)

4. Ensemble modeling techniques

5. Text pre-processing

6. Feature scaling for machine learning

7. Multivariate normal distribution applications

8. Distance metrics and their applications

9. Visualization techniques such as Chernoff's faces

10. Tree based algorithms

11. Ridge regression

12. LASSO

List of Course Group Discussion Topics:
1. PCA and ICA

2. Hierarchical and nonhierarchical systems

3. Linear - Non linear regression

4. Parametric-non parametric estimation

5. Overfitting and underfitting in the context of classification

6. Linear and Quadratic discriminant analysis

7. Regression v/s classification

8. Classifier performance measures

9. Supervised and unsupervised learning

10. Various clustering approaches

11. Classifiers and classifier combinations

12. Balancing errors in hypothesis testing

13. Standard sampling practices for a successful survey for reliable sample data

List of Home Assignments:

Case Study: A very large number of resources are available for data generated out of case study. Unique Home assignments will be set up for all groups

Surveys: Principles of surveying will be implemented by groups to demonstrate use of data science principles in home assignments

---

Text Books: (As per IEEE format)

1. *'A Beginner's Guide to R' – Zuur, Leno, Meesters; Springer, 2009*

2. *'Introduction to Data Science' – Igual, Segui; Springer, 2017*

3. *'Mathematics for Machine Learning' – Diesenroth, Faisal, Ong; Cambridge University Press, 2017*

4. *'Machine Learning with R' – Lantz, Packt Publishing, 2018*

Reference Books: (As per IEEE format)

1. *'Elements of Statistical Learning' - Hastie, Tibshirani, Friedman; Springer; 2011*

2. *'Data Science from Scratch' - Grus; Google Books; 2015*

3. *'The art of Data Science' - Matsui, Peng; 2016*

4. *'Machine Learning for absolute beginners' - Theobald; Google Books; 2017*

Moocs Links and additional reading material:

1. www.nptelvideos.in
2. https://www.edx.org/course/machine-learning-fundamentals-2

3. https://www.edx.org/course/foundations-of-data-analysis-part-1-statistics-usi

4. https://www.coursera.org/learn/statistical-inference/home/welcome

5. https://www.coursera.org/learn/data-scientists-tools/home/welcome

---

Course Outcomes:

Upon completion of the course, student will be able to –

1. Apply data processing and data visualization techniques
2. Perform descriptive and inferential statistical analysis
3. Utilize appropriate distance metrics and optimization techniques
4. Implement supervised algorithms for classification and prediction
5. Implement unsupervised classification algorithms
6. Evaluate the performance metrics of supervised and unsupervised algorithms

Future Courses Mapping:
1. Deep Learning

2. Reinforcement Learning

3. DBMS

4. Big Data

5. Data Mining

6. Information Retrieval

7. Recommendation Systems

8. Cloud Computing – AWS

9. IOT

10. Artificial Intelligence

11. Pattern Recognition

12. Natural Language Processing

13. Computer Vision

14. Machine Vision

15. Fault Diagnosis

16. Optimization

17. Bioinformatics

18. Computational Biology

19. Econometrics

20. Supply Chain

21. Ergonomics

22. Operations Research

23. Nano-informatics

Job Mapping:
Job opportunities that one can get after learning this course
1. Data Scientist

2. Data Analyst

3. AI Engineer

4. Data Architect.

5. Data Engineer.

6. Statistician.

7. Database Administrator.

8. Business Analyst

9. Business Intelligence Developer

10. Infrastructure Architect

11. Enterprise Architect

12. Machine Learning Engineering

13. Machine Learning Scientist

CS2221:Internet Of Things

Course Prerequisites:

Students should have a basic Understanding of the Internet, Cloud, Networking Concepts and Sensors

Course Objectives:

The student will be able to

1. Understand IoT Architecture and framework.

2. Recognize and differentiate between the various use cases of different sensors, actuators, solenoid valve etc

3. Learn about fundamental concepts of networking and protocols.

4. Understand IoT Physical, Datalink and Higherlayer Protocols.

5. Apply theoretical knowledge for Cloud computing.

6. Implement an IoT solution practically

Credits: 4   **Teaching Scheme Theory:** 2 Hours/Week
                                                               Tut: 1 Hours/Week
                                                               Lab: 2 Hours/Week

Course Relevance:

The Internet of Things is transforming our physical world into a complex and dynamic system of connected devices on an unprecedented scale. Interne of Things is a system of interrelated computing and sensing devices and has the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Advances in technology are making possible a more widespread adoption of IoT, from pill-shaped micro-cameras that can pinpoint thousands of images within the body, to smart sensors that can assess crop conditions on a farm, to the smart home devices that are becoming increasingly popular.

IoT is highly relevant in this growing ecosystem of internet-enabled devices. IoT offers increasing opportunities to collect, exchange, analyse and interpret data in real-time. This robust access to data will result in opportunities to further enhance and improve operations. In a world which is moving towards an increasingly connected future, Internet of Things (IoT) is the next big thing. Right from our homes to our cars to our cities, everything is being connected and the technology of IoT is right in the middle of it.

Introduction to IoT
Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels & Deployment Templates   **(4 Hours)**

IOT Platform Design Methodology
IoT Design Methodology Steps, Home Automation Case Study, Smart Cities, Health Care, Agriculture   **(4 Hours)**

IoT Devices
IoT System Design Cycle, Sensors - Terminologies, Calibration, Types, Specification, Use, Actuators - Types and Use, Prototype Development Platform - Arduino / Raspberry pi / Node MCU, Interface with Embedded System.   **(6 Hours)**

Introduction to Wireless Sensor Network
Sensor Node, Smart Sensor Network, Wireless Sensor Network, RFID - Principles and Components, Node MCU   **(4 Hours)**

Connectivity Technologies
Network Configuration in IoT, IoT Stack and Web Stack, IEEE 802.15.4 Standard, Zigbee, Bluetooth, MQTT, Cloud Architecture and Types, Cloud Service Providers   **(8 Hours)**

Case Studies (Any Two from following List to be covered
Smart lighting, Home Intrusion Detection, Smart Parking, Weather Monitoring System, Weather Report Bot, Air Pollution Monitoring, Forest fire Detection, Smart Irrigation, IoT Printer, IoT in Manufacturing Industry, IoT in Process Industry, IoT in Quality, Control Applications in Industry, IoT in Material Handling System in Industry, IoT in Automobile Industry, Navigation System, Connected Vehicles, Industry 4.0   **(4 Hours)**

List of Practical's: (Minimum Six)

1. Setting up Arduino / Raspberry Pi/ Node MCU ESP8266 : Basic handling , programming

2. LED Interfacing

3. Sensor interface to Node MCU/Arduino / Raspberry Pi Temperature measurement using LM35

4. Actuator interface to Node MCU /Arduino / Raspberry Pi Traffic Signal Control

5. Node MCU /Arduino / Raspberry Pi wireless communication Raspberry Pi as a web server

6. Node MCU/Arduino / Raspberry Pi Cloud interfacing and programming like Thingspeak Email alert using SMTP protocol

7. Sensor data acquisition on Mobile (Mobile APP) / Developing Application (WEB APP)

with Django Text transfer using MQTT protocol

8. Home Automation using Cisco Packet Tracer

List of Course Projects:
1. Smart Agriculture System

2. Weather Reporting System

3. Home Automation System

4. Face Recognition Bot

5. Smart Garage Door

6. Smart Alarm Clock

7. Air Pollution Monitoring System

8. Smart Parking System

9. Smart Traffic Management System

10. Smart Cradle System

11. Smart Gas Leakage Detector Bot

12. Streetlight Monitoring System

13. Smart Anti-Theft System

14. Liquid Level Monitoring System

15. Night Patrol Robot

16. Health Monitoring System

17. Smart Irrigation System

18. Flood Detection System

19. Mining Worker Safety Helmet

20. Smart Energy Grid

List of Course Seminar Topics:

1. IoT Architecture

2. Sensor Characteristics

3. IoT for supply chain management and inventory systems

4. IoT Ethics

5. Security in IoT

6. Cloud Computing Platform

7. IoT Best Practices

8. 5GinIoT

9. Middleware Technology

10. M2M energy efficiency routing protocol

11. IoT based Biometric Implementation

12. Complete IoT solution using AWS

13. A smart patient health monitoring system

14. IoT for intelligent traffic monitoring

15. Home automation of lights and fan using IoT

List of Group Discussion Topics:

1. Role of Internet of Things in development of India.
2. Manufacturing industries should make efforts to limit contribution to IoT.
3. Should countries put a ban on IoT for children?
4. Should IoT pay more attention to security rather than just expanding its horizon to the extremes?
5. IoT is the next big thing in technology.
6. IoT poses a huge risk to privacy, if they your system is hacked.
7. IoT is the next big thing for hackers trying to have access to your intimate data.
8. Pros and cons of over-usage of IoT at homes and offices.
9. IoT at battlefields will make life of soldiers safer and easier.
10. IoT will make way for robots to rule over humans one day.
11. IoT devices are making people lazier and obese.
12. IoT needs to be regulated before it goes out of limits and poses serious threat.

List of Home Assignments:
Design:

1. Smart City

2. Smart Transportation

3. Smart Healthcare

4. Smart Industry using IoT

5. Design of IoT framework

Case Study:

1. Open Source in IoT

2. IoT solutions for automobile

3. Cloud Computing

4. AWS

5. Microsoft Azure

Blog:

1. Network Selection for IoT

2. Need of secure protocols

3. Future of IoT

4. IIoT

5. IoT and Industry4.0

Surveys:

1. Autonomous Vehicles

2. List of Indian companies which offer IoT solutions for agriculture and farming. Describetheproblem they are addressing and their solution.

3. Make a list of Indian companies which offer IoT solutions for healthcare. Describe the problem they are addressing and their solution.

4. Make an exhaustive list of everything inside, just out side(immediatesurroundings)andon the auto body which must be "observed" for safe and comfortable driving using autonomous vehicles.

5. Compare different Cloud Service providers in the market.

Text Books: (As per IEEE format)
1. *Arshdeep Bahga and Vijay Madisetti, Internet of Things: A Hands-on Approach", (Universities Press)*
2. *Pethuru Raj and Anupama C. Raman,"The Internet of Things:Enabling Technologies, Platforms,and Use Cases", (CRC Press)*

Reference Books:
1. *Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", Wiley*
2. *OvidiuVermesan& Peter Friess"Internet of Things Applications-From Research and Innovationto Market Deployment", ISBN:987-87-93102-94-1,River Publishers*
3. *Joe Biron and Jonathan Follett, "Foundational Elements of an IoT Solution," by Joe Biron*

MOOCs Links and additional reading material:

1. https://proed.stanford.edu/course/view.php?id=191

2. https://nptel.ac.in/courses/106/105/106105166/

3. https://create.arduino.cc/projecthub/electropeak/getting-started-w-nodemcu-esp8266-on-arduino-ide-28184f

Course Outcomes

1. Demonstrate fundamental concepts of Internet of Things (CO Attainmentlevel:2)

2. Recognize IoT Design Methodology Steps(COAttainmentlevel:3)

3. Select sensors for different IoT applications (COAttainmentlevel:3)

4. Analyze fundamentals of networking (COAttainmentlevel:4)

5. Apply basic Protocols in IoT (CO Attainmentlevel:4)

6. Provide IoT solutions practically with the help of case study(COAttainmentlevel:5)

Future Courses Mapping:
Other courses that can be taken after completion of this course

1. Ad-Hoc Networks
2. Cyber Security
3. Wireless Networks
4. Industry 4.0
5. Big Data

Job Mapping:

The Internet of Things (IoT) is the most emerging field in today's world. It is revolutionizing every industry, from home appliances to agriculture to space exploration. Since the advent of cloud computing, there has been an exponential growth in the number of sensor-enabled devices connected to the internet and expecting further growth accelerating in the coming years. There are diversified career opportunities in this field. The various career positionsavailableasIoTResearchDeveloper,IoTDesignEngineer,IoTProductManager,IoTSoftwar eDeveloper, IoT Solution Architect, IoT Service Manager and many more.

CS2218 : Object Oriented Programming

Course Prerequisites:

1. Basic course on programming

Course Objectives:
1. Understand Object Oriented programming concepts
2. Demonstrate Object Oriented programming concepts by writing suitable Java programs
3. Model a given computational problem in Object Oriented fashion
4. To develop problem solving ability using Object Oriented programming constructs like multithreading
5. Develop effective solutions using for real world problems using the concepts such as file handling and GUI
6. Implement applications using Java I/O and event-based GUI handling principles

Credits: 4   **Teaching Scheme Theory:** 2 Hours/Week
                                                        Tut: 1 Hours/Week
                                                        Lab: 2 Hours/Week

Course Relevance:
This is an important course for engineering students. It develops computational problem solving and logic building capability of students. Acquiring programming skills has a high relevance in all branches of Engineering. Once the student gains expertise in coding, this course proves to be beneficial to them to excel in industry demanding coding in specific software.

SECTION – I

Introduction:

What is Object Oriented Programming (OOP)? The need of OOP, Characteristics of OOP.

Java overview: Classes and Objects, Java object storage, Access Modifiers, this reference, main method, Static vs Instance block, Static methods vs Instance methods in Java.

Constructors: Constructors in Java, Default constructor, Parameterized constructor.

Input and Output: Byte Stream vs Character Stream, use of Scanner Class.

Arrays in Java: Arrays in Java, initialization, Default Array values, multi-dimensional array, java.util.Arrays class, string class, string buffer, string builder.

Methods in Java: Methods, Parameters passing, Returning Multiple values.

Inheritance: Inheritance in Java, Types, Constructor in Inheritance , Using final with Inheritance,

---

Accessing superclass member, Parent and Child classes having same data member, Base vs derived class reference. Polymorphism: Method Overloading , Overloading main(), Static vs Dynamic Binding, Method Hiding. Private and final methods, Passing and Returning Objects in Java

SECTION - II

Exception Handling: Exceptions, types, types of handling exception, Checked vs Unchecked Exceptions, Throw and Throws, User-defined Exception.

Interfaces and Abstract Classes: Interface and its usage, Abstract Class and its usage, Difference between Abstract Class and Interface, Nested Interface, Nested Class, Inner class, Anonymous

Collection in Java: Collections Class, Using Iterators, Iterator vs Foreach, ArrayList, Vector, Map, Set.

Multithreading: Thread life Cycle, Thread Priority, Thread Methods.

File Handling: File Processing, Primitive Data Processing, Object Data Processing, Connecting Java with database (JDBC/ODBC).

Java GUI: Swing, Components. Layout Manager: Flow, Border, Grid and Card. Label, Button, Choice, List, Event Handling (mouse, key).

List of Practical's: (Any Six)
1. Implement Student class using following Concepts

   - All types of Constructors
   - Static variables and instance variables
   - Static blocks and instance blocks
   - Static methods and instance methods

2. There is a class Adder which has two data members of type 1D int array and int variable. It has two functions: getdata and numsum. Function getdata accepts non-empty array of distinct integers from user in 1D int array data member and a targetsum in another data member. The function numsum adds any two elements from an input array which is equal to targetsum and return an array of resulting two elements, in any order. If no two numbers sum up to the target sum, the function should return an empty array. Note that the target sum is to be obtained by summing two different integers in the array; you can't add a single integer to itself in order to obtain the target sum. You can assume that there will be at most one pair of numbers summing up to the target sum. Use constructor. Use extra variables if needed

   Input:

Array=[3,5,-4,8,11,1,-1,7]   targetsum=15
Output: [8,7]
Input:
Array=[3,5,-4,8,11,1,-1,6]   targetsum=15
Output: []

3. Write Java program to calculate area of triangle, square & circle using function overloading. Function parameter accept from user (Use function Overloading concepts and Inheritance).

4. Write a program for following exception, develop a suitable scenario in which the following exceptions occur:
    a. divide by zero
    b. Array index out of bounds exception
    c. Null pointer Exception

5. Write a java program to solve producer-consumer problem where there are two producer threads and one consumer thread.

6. Implement various operations using JDBC Connectivity.
7. Display bank account information (Use interface and inheritance using java)
8. Develop a GUI in java which reads, update the file.

List of Course Group Discussion Topics:

Section A

1. Introduction of Arrays and 1D Array programming examples
2. Multidimensional arrays
3. Variants of main () and command line arguments
4. Input and Output stream classes
5. String concepts and various methods of comparing strings
6. Methods in Java
7. Java String Methods
8. Passing array to a function and Jagged array examples
9. Reading input using Scanner and Buffer Reader Class
10. String, String buffer and String builder
11. Types of Inheritance in Java
12. Implementation of Types using Constructor in Inheritance
13. Using final with Inheritance
14. Base vs derived class reference in Inheritance
15. Using final with Inheritance, Accessing superclass member
16. Parent and Child classes having same data member
17. Overriding, Hiding Fields & Methods
18. Static vs Dynamic Binding & Hiding Methods
19. Private and final methods
20. Passing and Returning Objects in Java

21. Java Memory Management
22. File handling in Java vs C++
23. Data types used in Java vs C++
24. Java Object Serialization and Deserialization
25. Operator precedence
26. Use of Object Class Methods
27. Garbage collection in JAVA
28. Use of Static Blocks in various applications
29. Keywords used in JAVA
30. Types of Variables In JAVA
31. Data types used in java and Wrapper classes in java

Section B

1. Checked and unchecked exception, user defined and standard exception
2. Abstraction in Java and different ways to achieve Abstraction
3. Packages in Java – Types, Advantages & Techniques to Access Packages
4. Inner classes, nested interfaces in Java
5. Difference between Interfaces and abstract classes in Java
6. Exception Handling in Java Vs CPP
7. Difference between 1) throw and throws. 2) Final, finally and finalize in Java
8. Discuss Exception propagation and Discuss Exception handling with method overriding in Java
9. Discuss Packages, Access specifiers and Encapsulation in java.
10. Difference between abstraction and encapsulation in Java.
11. Daemon Threads Vs user threads
12. Preemptive scheduling Vs slicing
13. Is it possible to call the run()method directly to start a new thread? pls comment
14. Arraylist Vs Vector
15. Arrays Vs Collections
16. is Iterator a class or an Interface? what is its use?
17. List Vs Set
18. BufferedWriter and BufferedReader classes in java
19. BufferedReader Vs Scanner class in java
20. Buffered Reader Vs FileReader in java
21. Instanceofjava
22. Difference between CPP and JAVA
23. Difference between JDBC and ODBC connectivity
24. file processing in java
25. Difference between primitive data processing and object data processing
26. Creating GUI using swing
27. comparison between Swing, SWT, AWT, SwingX, JGoodies, JavaFX, Apache Pivot
28. Introduction To JFC And GUI Programming In Java
29. Introduction to wrapper classes
30. Why java uses Unicode System?

List of Home Assignments

Blog:
1. Single and Multidimensional arrays in Java
2. Comparison Inheritance & Polymorphism
3. Need of abstract classes and interfaces in Java
4. Multithreading concept in Java
5. Signed & Unsigned arithmetic operations using JAVA
6. Role of start() and run() methods in multithreading

Survey:
1. Strategies for Migration from C++ to Java
2. Product development using Inheritance and Polymorphism in Industry
3. in Java/OOP features popular amongst developers
4. Which other (non-JVM) languages does your application use?
5. How Java Impacted the Internet
6. How can a ArrayList be synchronised without using vector?

Design :
1. Implementation of Singleton design pattern in Java
2. Notes Repository System for Academic
3. Design for employee management system
4. Design for student management system
5. Inventory Management System
6. Write a program to delete duplicate numbers from the file

Case Study :
1. Java development milestones from 1.0 to 16.0
2. Implementation of Different Methods in Polymorphism
3. Real world systems which use java for its implementation
4. Drawing a flag using java
5. Use of different methods of Class object
6. Drawing a flag using java

Text Books: (As per IEEE format)

1. "JAVA- The Complete Reference", Herbert Schildt, 11th Edition, McGraw Hill Education.

Reference Books: (As per IEEE format)

1. "Thinking In Java – The Definitive Introduction to Object-Oriented Programming in the Language of the World-Wide Web", Bruce Eckel, Fourth Edition, Pearson Education, Inc.

2. "Java, java, Java – Object-Oriented Problem Solving", R. Morelli and R. Walde, 3rd edition, Pearson Education, Inc.

Moocs Links and additional reading material:
1. Programming using Java| Java Tutorial | By Infosys Technology https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01304972186110361645_shared /overview
2. An Introduction to Programming through C++ – Prof A.G. Ranade- NPTEL- computer science and engineering – NOC https://nptel.ac.in/courses/106/101/106101208/#

Course Outcomes:
Upon completion of the course, student will be able to –
1. Understand object-oriented programming features.
2. Apply the knowledge of Java IO and arrays to design real world problem.
3. Analyze and implement the complex real world problem using OOP concepts such as classes, inheritance and polymorphism.
4. Solve computing problems by applying the knowledge of Exception handling and Multithreading
5. Design solutions by choosing suitable data structures such as Array, Vector, Map etc
6. Implement applications using Java I/O and event-based GUI handling principles

Future Courses Mapping:
Advanced Data Structures, Advanced Java, Spring Frame Work, Grails Frame Work

Job Mapping:
Java Programmer, Application Developer, Design Engineer, Senior Software Developer

CO - PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2			2								3			
CO2	3		3		3	3	2	2	2						3	3
CO3	3		3		3	3	2	2	3				2		3	3
CO4	3	2	3		3	3	2	2	3			2		3		
CO5	3		3		3	2	2	2	2						3	
CO6	3	2	3	2	3	2		2	3		2	2				3
Average	3	1	2.5	0.33	2.50	2.50	1.33	1.67	2.17	0.00	0.33	0.67	0.83	0.50	1.50	1.50

CS2227 ::Database Management Systems

Course Prerequisites: Data structures, Discrete Mathematics

Course Objectives:

1. Learn the fundamentals of different data modeling techniques.

2. Design and development of relational database management systems.

3. Study the theory behind database systems, the issues that affect their functionality and performance

4. Design of query languages and the use of semantics for query optimization.

5. Understand the latest trends of data management systems.

Credits: 4   **Teaching Scheme** Theory: 2 Hours/Week

Lab: 2 Hours/Week

Course Relevance:

The course emphasizes on the fundamentals of database modelling and design, the languages and models provided by the database management systems, and database system implementation techniques. The goal is to provide an in-depth and up-to-date presentation of the most important aspects of database systems and applications, and related technologies.

SECTION-I

Topics and Contents

Introduction: Need of Database Management Systems, Evolution, Database System Conceptsand Architecture, Database Design Process

Data Modeling: Entity Relationship (ER) Model, keys, Extended ER Model, , Relational Model, Codd's Rules;

Database Design: Need of Normalization, Functional Dependencies, Inference Rules, Functional Dependency Closure, Minimal Cover, Decomposition Properties, Normal Forms: 1NF, 2NF, 3NF and BCNF, Multi-valued Dependency, 4NF

Query Languages: Relational Algebra, SQL: DDL, DML, Select Queries, Set, String, Date and Numerical Functions, Aggregate Functions ,Group by and Having Clause, Join Queries, Nested queries, DCL, TCL, PL/SQL: Procedure, Function, Trigger, Mapping of Relational Algebra to SQL

SECTION-II

Topics and Contents

Storage and Querying: Storage and File structures, Indexed Files, Single Level and Multi Level Indexes; Query Processing, Query Optimization

Transaction Management: Basic concept of a Transaction, ACID Properties, State diagram, Concept of Schedule, Serializability – Conflict and View, Concurrency Control Protocols, Recovery techniques

Parallel and Distributed Databases: Architecture, I/O Parallelism, Interquery, Intraquery, Intraoperation and Interoperation Parallelism, Types of **Distributed** Database Systems, Distributed Data Storage, Distributed Query Processing

NOSQL Databases and Big Data Storage Systems: Introduction to NOSQL Databases, Types of NOSQL Databases, BASE properties, CAP theorem, MapReduce.

Data Warehousing: Architecture and Components of Data Warehouse, OLAP

List of Practical's: (Any Six)
1) Choose a database application; you propose to work on throughout the course. Perform requirement analysis in detail for the same. Draw an entity-relationship diagram for theproposed database.
2) Create a database with appropriate constraints using DDL and populate/modify it with the help of DML.
3) Design and Execute "SELECT" queries using conditional, logical, like/not like, in/not in, between...and, is null/is not null operators in where clause, order by, group by, aggregate functions, having clause, and set operators. Use SQL single row functions for date, time, stringetc.
4) Write equijoin, non equijoin, self join and outer join queries. Write queries containing single row / multiple row / correlated sub queries using operators like =, in, any, all, exists etc. Write DML queries containing sub queries. Study a set of query processing strategies.
5) Write PL/SQL blocks to implement all types of cursor.
6) Write useful stored procedures and functions in PL/SQL to perform complex computation.
7) Write and execute all types of database triggers in PL/SQL.
8)Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.
9) Create a database with suitable example using MongoDB and implement Inserting andsaving document, Removing document, Updating document
10) Execute at least 10 queries on any suitable MongoDB database that demonstratesfollowing querying techniques: find and , Query criteria, Type-specific queries

11) Implement Map Reduce operation with suitable example using MongoDB.

List of Course Projects: (Any 1)

Following is the indicative list of projects but is not limited to. Student and teacher can also jointly decide project area other than specified in the list.

1. University/Educational institute database
2. Railway reservation/Show booking system
3. Finance management system
4. Travel/Tours management system
5. Blood bank management system
7. Sales management
8. Online retailer/payment systems
9. Hospital management system
10. Human resource management
11. Manufacturing/production management
12. Matrimonial databases for finding matches.
13. Online appointment booking

List of Course Seminar Topics:

1. Object and Object-Relational Databases
2. XML data model, XML documents and associated languages
3. Database Security
4. Modern Storage Architectures
5. Google Cloud- SQL Databases
6. Google Cloud- NOSQL Databases
7. Amazon Databases
8. Oracle NoSQL Database
9. Cassandra DB
10. Data Center Engineering
11. Google File System (GFS)

List of Home Assignments:
Design:

1. Suppose you want to build a video site similar to YouTube. Identify disadvantages of keeping data in a file-processing system. Discuss the relevance of each of these points to the storage of actual video data, and to metadata about the video, such as title, the user who uploaded it, tags, and which users viewed it.
2. Illustrate data model that might be used to store information in a social-networking system such as Facebook
3.Describe the circumstances in which you would choose to use embedded SQL rather than SQL alone or only a general-purpose programming language.
4. Give the DTD and XML Schema for Library Management System. Give a small example ofdata corresponding to this DTD and XML.Write ten queries in Xpath and XQuery
5.If you were designing a Web-based system to make airline reservations and sell airline tickets, which DBMS architecture would you choose? Why? Why would the other architectures not be a

good choice?Design a schema and show a sample database for that application. What types of additional information and constraints would you like to representin the schema? Think of several users of your database, and design a view for each.

Case Study:
1. PostgreSQL
2. Oracle
3. IBM DB2 Universal Database
4. Microsoft SQL Server
5. SQLite database

Blog
1.OLAP tools from Microsoft Corp. and SAP
2.Views in database
3. Dynamic SQL and Embedded SQL
4. Active databases and Triggers
5. SQL injection attack

Surveys
1. Keyword queries used in Web search are quite different from database queries. List key differences between the two, in terms of the way the queries are specified, and in terms of what is the result of a query.
2. List responsibilities of a database-management system. For each responsibility,explain the problems that would arise if the responsibility were not discharged
3. List reasons why database systems support data manipulation using a declarative query language such as SQL, instead of just providing a a library of C or C++ functions to carry out data manipulation
4. Consider a bank that has a collection of sites, each running a database system. Suppose the only way the databases interact is by electronic transfer of money between themselves, using persistent messaging.Would such a system qualify as a distributed database? Why?
4. Data warehousing products coupled with database systems

Suggest an assessment Scheme:
MSE:10 ESE:20 HA:10 CP:10 Lab:10 Seminar:20 CVV:20

Text Books: (As per IEEE format)

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan; "Database System Concepts"; 6th Edition, McGraw-Hill Education

2. Ramez Elmasri, Shamkant B. Navathe; "Fundamentals of Database Systems"; 7th Edition, Pearson

Reference Books: (As per IEEE format)

1. Thomas M. Connolly, Carolyn E. Begg," Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition ;Pearson

2. Raghu Ramakrishnan, Johannes Gehrke; "Database Management Systems", 3rd Edition; McGrawHill Education

3. Kristina Chodorow, MongoDB The definitive guide, O'Reilly Publications, ISBN: 978-93-5110-269-4, 2nd Edition.

4. Dr. P. S. Deshpande, SQL and PL/SQL for Oracle 10g Black Book, DreamTech.

5. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication.

6. Reese G., Yarger R., King T., Williums H, Managing and Using MySQL, Shroff Publishers and Distributors Pvt. Ltd., ISBN: 81 - 7366 - 465 – X, 2nd Edition.

7. Dalton Patrik, SQL Server – Black Book, DreamTech Press.

8. Eric Redmond, Jim Wilson, Seven databases in seven weeks, SPD, ISBN: 978-93-5023-918-6.

9. Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition.

Moocs Links and additional reading material:

https://nptel.ac.in/courses/106/105/106105175/ https://onlinecourses.nptel.ac.in/noc21_cs04/preview https://www.datacamp.com/courses/introduction-to-sqlOracle MOOC: PL/SQL Fundamentals - Oracle APEX

Course Outcomes:

The student will be able to –

1. Design data models as per data requirements of an organization

2. Synthesize a relational data model up to a suitable normal form

3. Develop a database system using relational queries and PL/SQL objects

4. Apply indexing techniques and query optimization strategies

5. Understand importance of concurrency control and recovery techniques

6. Adapt to emerging trends considering societal requirements

CO-PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3		2	3	2	2	2	2					2	2
CO2	2	3		3	3										2	2
CO3	3		3		3						2	3	3	3	3	3
CO4	3	2			3	2							3		2	3
CO5	2	3		2									2		2	2
CO6	3					3	3						3	3	2	3
Average	2.66	2.66	2.5	2.5	2.25	2.0						2.0	2.5		2.0	

AI2018 : Probability And Calculus

Course Prerequisites:

1. Basics of Mathematics.

Course Objectives:

1. To facilitate the students with a concrete foundation of probability and calculus.

2. To analyze problems in Science and Engineering applications through probability and calculus methods.

Credits: 02   **Teaching Scheme: Theory:** 2 Hours/Week

Course Relevance: The course is relevant to all branches of Engineering. Its an important foundation for computer science fields such as machine learning, artificial intelligence, computer graphics, randomized algorithms, image processing, and scientific simulations.

SECTION-I

UNIT 1: Probability Theory   04 Hours
Definition of probability: classical, empirical and axiomatic approach of probability, Addition theorem of probability, Multiplication theorem of probability, Baye's theorem of inverse probability and examples.

UNIT II: Random Variables and Mathematical Expectation   04 Hours
Random variable, Discrete Random Variable, Continuous Random Variable, Mathematical Expectation, Addition theorem of Expectation, Multiplication theorem of Expectation, Chebychev's Inequality.

UNIT III: Probability Distributions   06 Hours
Distribution Function, Probability Mass Function, Probability density function, Continuous Distributions: Normal Distribution, joint probability distribution, Discrete Distributions: Binomial distribution, Poisson's distribution-Illustrative examples.

SECTION-II

UNIT IV: Probability Densities   04 Hours
The Uniform Distribution, Log-normal distribution, Beta distribution, Gamma distribution.

UNIT V: Multivariable Calculus   06 Hours
Partial Differentiation and Its Applications: Functions of two or more variables, partial derivative, euler theorem, total derivative, Jacobian, Maxima and Minima of functions of two variables and problems.

UNIT VI: Fourier Series and Fourier Transforms   04 Hours
Definition of periodic function, Fourier expansion of periodic functions in a given interval of length 2, Determination of Fourier coefficients – Fourier series of even and odd functions, Fourier integral theorem.

Text Books:

1. S. C. Gupta, Fundamentals of Statistics, Himalaya Publishing House, 7th Revised and Enlarged Edition, 2016.

2. Miller & Freund's Probability And Statistics For Engineers 9th Edition Global Edition by Richard A. Johnson Pearson Publication.

3. Higher Engineering Mathematics B. S. Grewal Khanna Publishers, 4th Edition, 2017.

4. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Reference Books:

5. Advanced Engineering Mathematics C. Ray Wylie, Louis C.Barrett McGraw-Hill 6th Edition 1995.

6. G. V. Kumbhojkar, Probability and Random Processes, C. Jamnadas and Co., 14th Edition, 2010.

7. G. B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition,Pearson, Reprint, 2002.

8. Higher Engineering Mathematics, B. V. Ramana McGraw-Hil 11th Edition, 2010.

9. A Text Book of Engineering Mathematics, N. P. Bali and Manish Goyal Laxmi Publications, 2014.

Course Outcomes:

Upon completion of the course, student will be able to –

1. Illustrate basics of probability and Bayes rule.

2. Solve problems related to random variables and mathematical expectation.

3. Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.

4. Illustrate and analyze various probability densities.

5. Apply partial differentiation for two or more variables.

6. Identify Fourier concepts and techniques to provide mathematical models of real world situations.

Future Courses Mapping:

1. Machine Learning, Statistical Theory and Interference.

Job Mapping:

1. Financial Analytic.

CO - PO Mapping:

CO/PO	ProgramOutcomes(PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2		2				1				1	1	1		
CO2	2	2		2				1				1	1	1		
CO3	2	2		2				1				1	1	1		
CO4	2	2		2				1				1	1	1		
CO5	2	2		2				1				1	1	1		
CO6	2	2		2				1				1	1	1		
Average	1.88	2		2				1				1	1	1		

AI2010 : Design Thinking III

Course Prerequisites:

   Basic knowledge of research work, research paper and patent.

Course Objectives:

1. Understand the concepts of design thinking approaches
2. Apply both critical thinking and design thinking in parallel to solve problems
3. Apply some design thinking concepts to their daily work
4. To provide ecosystem for students and faculty for paper publication and patent filing

Credits: 1   **Teaching Scheme Tut:** 1 Hour/Week

Course Relevance:

The course is offered in S.Y. and T.Y. B.Tech. to all branches of Engineering.

Contents for Design Thinking :

Structure of The paper Journal List (Top 50

Journals) Selection of the journal

Use of various online journal selection tools

Plagiarism checking

Improving contents of the paper Patent

drafting

Patent search Filing of patent

Writing answers to reviewer questions Modification

in manuscript

Checking of publication draft

Assessment Scheme:

Publication of paper or patent

Course Outcomes:

On completion of the course, learner will be able to–

 CO1: Understand the importance of doing Research

 CO2: Interpret and distinguish different fundamental terms related to Research

 CO3: Apply the methodology of doing research and mode of its publication

 CO4: Write a Research Paper based on project work

CO5: Understand Intellectual property rights

CO6: Use the concepts of Ethics in Research

CO7: Understand the Entrepreneurship and Business Planning

CO-PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	2	1	3	1	3	2	2	2	1	2	2	3	3
CO2	2	2	3	3	2	2	2	3	2	2	1	3	2	3	3	3
CO3	2	2	2	2	2	2	2	3	2	2	3	3	2	3	3	3
CO4	2	2	2	2	2	2	1	3	2	2	2	1	2	3	3	3
CO5	2	2	2	2	2	2	2	3	2	2	2	3	3	2	2	3
CO6	2	2	2	2	2	2	2	3	2	2	2	1	3	2	2	2
CO7	2	2	2	2	2	2	2	3	2	2	2	3	3	3	3	3
Average	2	1.9	2.1	2.1	1.9	2.1	1.7	3.0	2.0	2.0	2.0	2.1	2.4	2.6	2.7	2.9

AI2018 - Engineering Design & Innovation III

Course Prerequisites:
   Problem Based Learning

Course Objectives:
1. To develop critical thinking and problem solving ability by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student-centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
6. To develop an ecosystem to promote entrepreneurship and research culture among the students.

Credits: 4   **Teaching Scheme : Theory: 1** Hours/Week
                                          Lab: 6 Hours/Week

Course Relevance:
Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Along with course-based projects, the curriculum can be enriched with semester-long Engineering Design and Development courses, in which students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy, and Swaccha Bharat Abhiyan. To gain the necessary skills to tackle such projects, students can select relevant online courses and acquire skills from numerous sources under guidance of faculty and enrich their knowledge in the project domain, thereby achieving project centric learning. Modern world sustained and advanced through the successful completion of projects. In short, if students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. Project based learning will also redefine the role of teacher as mentor in the learning process. The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to nalyze, design and apply categories of Bloom's Taxonomy.

SECTION I

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ED, laboratory course contents of "Trends in Engineering Technology" are designed as a ladder to extend connectivity of software technologies to solve real world problems using an interdisciplinary approach. The ladder in the form of gradual steps can be seen as below:

Industry Communication Standards, Single Board Computers and IoT, Computational Biology (Biomedical and Bioinformatics), Robotics and Drone, Industry 4.0 (Artificial Intelligence, Human-Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Text Books: (As per IEEE format)
1. *A new model of problem based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017*
2. *Problem Based Learning. By Mahnazmoallem, woei hung and Nada Dabbagh, Wiley Publishers. 2019.*
3. *Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert RobartCapraro, Mary Margaret Capraro*

Reference Books: (As per IEEE format)
1. *De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-basedlearning in engineering. Rotterdam: Sense Publishers. 2007.*
2. *Project management core textbook, second edition, Indian Edition , by Gopalan.*
3. *The Art of Agile Development. By James Shore & Shane Warden.*

Moocs Links and additional reading material:

1. www.nptelvideos.in

Course Outcomes:
On completion of the course, learner will be able to–
CO1: Identify the real life problem from a societal need point of view
CO2: Choose and compare alternative approaches to select the most feasible one
CO3: Analyse and synthesize the identified problem from a technological perspective
CO4: Select the best possible solution to solve the problem.
CO5: Design & Develop a working model of the proposed solution.
CO6: Testing and validating product performance

Future Courses Mapping:

Major Project

Job Mapping:

Software Engineer. Software Developer, IT Engineer, Research Associate.

CO - PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2					3	2	2	2	2			3
CO2	2	2	3	2	2		2		3	2	2	2	3	3	2	3
CO3	2	2	3	2	3		2		3	2	2	2	3	3	2	3
CO4	2	2	3	2	3	3		2	3	2	2	2	2	3	3	3
CO5	2	2	3	2	3	2			3	2	2	2	3	3	3	3
CO6	2	2	3	3	2				3		3	2	3	2		3
Average	2.0	2.0	2.83	2.16	2.6	2.5	2.0	2.0	3.0	2.0	2.16	2.0	2.66	2.8	2.5	3.0

AI2021 : Data Structures

Course Prerequisites:
Basic programming Skills (C/C++)

Course Objectives:
1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques.
3. To construct and implement various data structures and abstract data types including lists, stacks, queues, trees, and graphs.
4. To make understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.
5. To emphasize the importance of data structures in developing and implementing efficient algorithms.

Credits: 4   **Teaching Scheme Theory:** 2 Hours/Week
                                                           Tut: 1 Hours/Week
                                                           Lab: 2 Hours/Week

Course Relevance:
This is a basic Course for Computer allied branches. This course has a high relevance in all domains of computer based engineering such as in Industries, research etc as a basic prerequisite course. The course is offered in S.Y. B.Tech. to all branches of Engineering

---

SECTION-I
Arrays, Stacks, Queues and Linked Lists

Arrays: Representation and application of Single and Multidimensional arrays, Time & Space Complexity Analysis.

Sorting Techniques: Bubble, Selection, Insertion, Merge, Quick, Heap sort with Analysis.

Searching techniques: Linear Search, Binary search with Analysis.

Stack: Stack representation and Implementation using arrays and Linked lists. Applications of stack in Recursion, Expression conversions and evaluations.

Queues: Representation and implementation using array and Linked lists, Types of queues. Applications of Queues: Job Scheduling etc.

Linked Lists: Dynamic memory allocation, Singly Linked Lists, doubly linked Lists, Circular linked lists and Generalized linked lists, Applications of Linked list.

SECTION-II

Trees, Graphs, Hashing

Trees: - Basic terminology, representation using array and linked lists. Tree Traversals: Recursive and Non recursive, Operations on binary tree. Binary Search trees (BST).

Advanced Trees: Introduction, AVL tree, R-B tree, B tree and B+ tree.

Graphs: Terminology and representation using Adjacency Matrix and Adjacency Lists, Graph Traversals and Application: BFS and DFS, connected graph, Bipartite Graph, Detecting Cycle in graph. Minimum Spanning tree: Prims and Kruskal's Algorithm, Shortest Path Algorithms, Union Find.

Hashing: Hashing techniques, Hash table, Hash functions. Collision handling and Collision resolution techniques, Cuckoo Hashing.

List of Tutorials:

1. Sorting Techniques: Insertion, Merge sort, Bubble, Shell Sort, Radix Sort.

2. Searching Techniques: Ternary Search, Fibonacci Search.

3. Problem solving using stack (Maze problem, Tower of Hanoi).

4. Expression conversion like infix to prefix and postfix and vice versa.

5. Priority Queues and Job Scheduling Algorithms.

6. Generalized Linked Lists.

7. Threaded Binary tree and Stack less Traversals using TBT.

8. Applications of Graph in Network problems.

9. Design of Hashing Functions and Collision Resolution techniques.

10. Cuckoo Hashing.

List of Practical's: (Any Six)

1. Assignment based on Sorting and Searching.

2. Assignment based on Stack Application (Expression conversion etc.)

3. Assignment based on Queue Application (Job scheduling, resources allocation etc.)

4. Assignment based on linked list.

5. Assignment based on BST operations(Create, Insert, Delete and Traversals)

6. Assignment based on various operations on Binary Tree (Mirror image, Height, Leaf node display, Level wise display etc.)

7. Assignment based on AVL and R-B tree.

8. Assignment based on DFS and BFS

9. Assignment based on MST using Prim's and Kruskals Algorithm.

10. Assignment based on Finding shortest path in given Graph.

11. Assignment based on Hashing.

List of Course Projects:

1. Finding Nearest Neighbors.

2. Calendar Application using File handling.

3. Path finder in Maze

4. Word Completion Using Tire.

5. Bloom Filters.

6. Different Management Systems.

7. Scheduling Applications and Simulation.

8. Shortest Path Applications. (Kirchhoff's Circuit, TSP with Scenario.)

9. Efficient Storage and Data Retrieval Systems.

10. Different Gaming Application.

List of Course Seminar Topics:

1. Asymptotic Notations in Data structures.

2. Hash Table, Heaps and Their applications.

3. Analysis of Merge Sort, Quick Sort and Bubble Sort for Best, Average and Worst Case.

4. Solving N-queen and Josephus Problem using Backtracking , Stack and Queue respectively.

5. Priority Queue in Job Scheduling.

6. Application of Stack in Backtracking problems.

7. Priority Heap and min-Max Heap.

8. Data Structures for Languages and Libraries.

9. Multidimensional and Special Data Structures.

10. Algorithm Design using Divide and Conquer

List of Course Group Discussion Topics:

1. Application based comparison of Sorting Algorithms.

2. Graphs vs Tree Data Structures: Application based comparison? Which is best? Why? How?

3. Advanced trees: which is the best? (AVL,RB,B,B+) when? how? why?

4. Scenario Based Comparison: Kruskals vs Prims Algorithm.

5. Hashing application in today's technology. Is it necessary?

6. Application based comparison: Stack vs Queues.

7. B- Tress VS B+ Trees: Which is to be consider? When ? Why?

8. Need and Role of Different tree Traversals.

9. Graphs vs Tree Data Structures: Application based comparison? Which is best? Why? How?

10. Linked List application in today's technology. Is it necessary?

List of Home Assignments:

Design:

1. Design Single Source multiple destination Shortest Path Algorithm For Driving Application.

2. Expression Tree and Topological Sorting application in Problem solving.

3. Scheduling Algorithms using Queue.

4. Implementation of B and B+ trees for database management.

5. GLL application to Solve problems on Multivariable Polynomial. Consider suitable example.

Case Study:

1. Consider a Suitable Example for Hashing Application. Study its Merits, Demerits and Design.

2. Consider different real life examples where different sorting, Searching techniques have been used. Why used? How? Comparative study.

3. Why there is a need of different tree traversal algorithms? Consider different real life examples where they are used. Why? How?

4. Game Base study for data structures.

5. Compare different graph traversal algorithm by considering different real life examples where they have used.

Blog:

1. Comparative Application of Prims vs Kruskals Algorithm in real life scenarios.

2. AVL Tree vs RB Tree with applications

3. Need of different Sorting techniques.

4. How Hashing is useful in recent technologies? Consider any application related to it.

5. Role of Stacks and Queues in problem Solving.

Surveys:

1. How application of Graph Search Algorithms (DFS and BFS) is there in recent technologies? Consider some real life technologies.

2. How Advanced Trees Data structure plays important role in Database management?

3. Survey of Data Structures for computer Graphics applications.

4. A survey on different hashing Techniques in programming.

5. Graph algorithms in Network Application.

Text Books: (As per IEEE format)

1. E. Horwitz , S. Sahani, Anderson-Freed, " Fundamentals of Data Structures in C",Second Edition, Universities Press.

2. Y. Langsam, M.J. Augenstein, A.M.Tenenbaum, "Data structures using C and C++",Pearson Education, Second Edition.

3. Narasimha karumanchi, "Data Structures and Algorithm Made Easy", Fifth Edition, CareerMonk publication.

Reference Books: (As per IEEE format)
1. *J. Tremblay, P. soresan, "An Introduction to data Structures with applications", TMHPublication, 2nd Edition.*

2. *G. A.V, PAI , "Data Structures and Algorithms ", McGraw Hill, ISBN -13: 978-0-07-066726-6*

Moocs Links and additional reading material:

1. https://nptel.ac.in

2. https://www.udemy.com

3. https://www.coursera.org

4. www.geeksforgeeks.org

Course Outcomes:
Upon completion of the course, student will be able to –
1. To interpret and diagnose the properties of data structures with their memory representations and time complexity analysis.(2)
2. To use linear data structures like stacks, queues etc. with their applications (3)
3. To handle operations on various data structures with the help of dynamic storage representation.(4)
4. To demonstrate Non-linear data structures like tree and perform various operations on it.(5)
5. To handle the operations on Graph data structure and to solve the applications of Graph data structure.(4)
6. To design and analyze the appropriate data structure by applying various hashing Techniques.(2)

Future Courses Mapping: Following courses can be learned after successful completion of this course:
Design and Analysis of Algorithms, Operating Systems, Systems Programming, Data Science and similar courses.

Job Mapping: Data Structures and Algorithm is the necessary part of any programming job. Without Data structures it is not possible to be good in Competitive coding. All Industries always looks for a strong knowledge in Data structures. Without learning this course, one can't imagine a job in computer/IT related industries and research.

CO - PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2	2		1									
CO2	2	2	3									3				
CO3	3		3			2										
CO4	1			3	3				1		2					
CO5	2	3	2											3		
CO6	2		3					2	2	3			3		3	3
Average	2.1	1.3	2	0.33	0.83	0.83	0.1	0.33	0.5	0.5	0.33	0.5	0.5	0.5	0.5	0.5

AI2014: WEB TECHNOLOGY

Course Prerequisites:
1. Basics of Computer Programming

2. Database Management Systems

Course Objectives:
1. Understand and apply basic HTML5 tags and CSS to structure and style web pages.

2. Develop Proficiency in JavaScript for Client-Side Scripting as client-side technology in web development.

3. Understand & apply jQuery in designing dynamic and interactive websites to improve user experience

4. Implement Server-Side Technologies with PHP and with MySQL integration for database management.

5. Design Modern User Interfaces with React for building complex and dynamic user interfaces

6. Build Robust Backend Systems Using Node.js

7. Integrate Full-Stack Development Skills by combining client-side (JavaScript, jQuery, React) and server-side (PHP, MySQL, Node.js) technologies

Credits: 4   **Teaching Scheme :Theory: 2** Hours/Week
                                                     Tut: 1 Hours/Week
                                                     Lab: 2 Hours/Week

Course Relevance:
Web development is the work involved in developing a website for the Internet or an intranet. Web development can range from developing a simple single static page of plain text to complex web-based internet applications (web apps), businesses, social network services and enterprise application development. Apparently in today's technology-driven society, knowing the foundations of the website design is useful. Actually, it has grown into the world's most important site for research, education, networking, as well as entertainment. Most of the jobs available in the IT industries are web technology-related.

SECTION I

Introduction: Introduction to web technology, Internet and WWW, website planning and design issues, HTML5: structure of html document, commenting, formatting tags, list tags, hyperlink tags, image, table tags, frame tags, form tags, CSS, Bootstrap, JSON   **(6Hours)**

Client Side Technologies: JavaScript: Overview of JavaScript, Data types, Control Structures, Arrays, Functions and Scopes, Objects in JS, Form validation, DOM: Introduction, DOM levels, DOM Objects, their properties and methods, Manipulating DOM   **(6 Hours)**

JQuery: Introduction, Loading JQuery, selecting elements, changing styles, creating elements, appending elements, removing elements, handling events**.**   **(2 Hours)**

SECTION-II
ServerSide Technologies: Introduction, Features, PHP syntax, Control structures, Functions, Arrays, String,Form Handling, File Handling, Session and Cookies, Error Handling, MySQL with PHP **(6 Hours)**
React:Introduction,Architecture, Components, JSX, Class, State, Props, Events, Render function, Forms, Lists, Router, Flux.   **(4 Hours)**
NodeJS:Introduction, Installation of Node JS, Node JS Modules, Node Package Manager (npm), Creating Web server, File System, Express JS, Serving Static Resources, Database connectivity. **(4 Hours)**

List of Tutorials: (Any 6)

1. Learn various HTML tags

2. Use of Bootstrap to design a web page

3. Understand use of JavaScript in form validation

4. Study of Cookies in PHP

5. Study of Session in PHP

6. Study of different ways of working with PHP and MySQL

7. Express Framework

8. Laravel Framework

9. RESTful API

10. React Hooks

11. Node JS and relational databases

12. Node JS and NoSQL databases

List of Practical's: (Any Six)

1. Design and implement a web page to demonstrate the use of different HTML tags.

2. Design and develop a web page demonstrating the use of CSS tags.

3. Design a website that retrieves blog data from a local JSON file and displays it on the website using HTML, CSS, Bootstrap, and JSON.

4. Design and develop a web page to demonstrate various methods of objects in JavaScript like Array, String, Math, Date.

5. Design and develop a web page to demonstrate the use of jQuery, focusing on: a. Selecting elements using different jQuery selectors. b. Performing various DOM manipulations c. Attaching event handlers to elements and performing actions based on those events. d. Implementing basic animations using jQuery.

6. Develop a dynamic blogging website using PHP, allowing users to submit their own blog posts with images. The submitted posts will be stored in a JSON file

7. Installation, configuration and understanding working of XAMPP server for local host.

8. Design a dynamic web application using PHP and MYSQL as back-end to perform insert, delete, view and update operation.

9. Develop a beginner-level To-Do List application using React.

10. Design a web page demonstrating file handling operations like open, read, write, append copy, move, delete and rename using NodeJS.

List of Course Projects:

1. Student Registration System

2. Tours and Travel System

3. Canteen Food Ordering and Management System.

4. Online Personal Counseling

5. Online Recruitment System

6. Farming Assistant System

7. Hospital management System

8. Hostel management System

9. Online Event Management

10. Online Bus/Railway/Airways Booking System

11. Online Banking System

List of Course Seminar Topics:

1. Bootstrap

2. Spring Framework

3. Joomla

4. Sass

5. Java Servlets

6. Object Oriented PHP

7. Angular JS

8. VueJS

9. Django

10. Laravel

1. List of Course Group Discussion Topics:

2. Web Services

3. Client Side Frameworks

4. Server Side Frameworks

5. Relational and NoSQL Databases

6. AJAX

7. Client Side Technologies

8. Server Side Technologies

9. Template Engine

10. Progressive Web Apps

11. Markup Languages

List of Home Assignments:

Design:

1. Design, Develop and Deploy social web applications using Bootstrap.

2. Design, Develop and Deploy web applications using CMS.

3. Design, Develop and Deploy web application for Electricity Billing System

4. Design, Develop and Deploy web application for department

5. Design, Develop and Deploy web application for Medical Shop

Case Study:

1. Angular JS

2. VueJS

3. Django

4. Flask

5. Wordpress

Blog:

1. Recent Web Development Trends

2. Databases for Web Developers

3. Web Services

4. Web Security

5. Web Evolution

Surveys:
1. Comparison of Web Services

2. Frameworks for Web Development
3. Scripting languages for Web Designing
4. Web Server Vs Application Server
5. Current Technologies for Web Development

Text Books: (As per IEEE format)

1. *Thomas A. Powell; "Complete reference HTM"; 4th edition, Tata McGraw-Hill Publications*

2. *Black book; "Web Technologies:HTML,JS,PHP,Java,JSP,ASP.NET,XML and AJAX" ; Dreamtech Press, 2016.*

3. *Dave Mercer, Allan Ken; "Beginning PHP 5"; Dreamtech Publications.*

4. *Martin, M.G., "Programming for Beginners: 6 Books in 1 – Swift+PHP+Java+Javascript+Html+CSS: Basic Fundamental Guide for Beginners", independently published, 2018*

5. *Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS and HTML 5",5th Edition, O'Reilly publication*

Reference Books: (As per IEEE format)

1. *Jeremy McPeak& Paul Wilton, "Beginning JavaScript", 5th Edition, Wrox Publication.*

2. *Adam Bretz & Colin J Ihrig, "Full Stack Javascript Development with MEAN", SPD, ISBN-13: 978-0992461256*

3. *Shama Hoque "Full-Stack React Projects", 1st Edition,Packt Publishing, ISBN-13 978- 1788835534*

4. *Frank Zammetti ,"Modern Full-Stack Development",1st Edition,Apress,ISBN-13   978-1484257371*

Moocs Links and additional reading material:

1. https://www.w3schools.com

2. https://www.udemy.com/course/ultimate-web/

3. https://www.coursera.org/learn/html-css-javascript-for-web-developers?

4. https://nptel.ac.in/courses/106106222

5. https://nptel.ac.in/courses/106106156

6. https://www.udemy.com/course/full-stack-web-development-2021-guide-with-nodejs-mongodb/

Course Outcomes:

Upon completion of the course, student will be able to –

1) Design reliable, efficient, scalable front-end view of web pages using HTML5, CSS

   with Bootstrap framework.

2) Perform client-side web page validation and event handling using JavaScript.

3) Develop the web pages more dynamic and interactive using jQuery.

4) Deliver realistic and extensible lightweight web application using suitable server side web technology like PHP

5) Design and implement User Interface for complex web applications using React

7. Build server-side applications, real time applications, andcross platform applications using NodeJS framework

Future Courses Mapping:
1. Principles of UI/UX Design

2. Frontend Development

3. Backend Development

4. Apps Development

5. Data Development

6. JavaScript Algorithms and Data Structures

7. Mobile Development

8. Web and Multiplatform Mobile App Development

9. Version Control: Git and GitHub

10. Databases: SQL (MySQL, PostgreSQL) and NoSQL (MongoDB)

Job Mapping:
Job opportunities that one can get after learning this course
1. Frontend Developer

2. Backend Developer

3. DevOps and Software Developer

4. JavaScript Developer

5. MERN Stack Developer

6. Data Engineer

7. Full Stack Developer

CO-PO Mapping :

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2	2		1									
CO2	2	2	3									3				
CO3	3		3			2										
CO4	1				3	3			1		2					
CO5	2	3	2											3		
CO6	2		3					2	2	3			3		3	3
Average	2.1	1.33	2	0.33	0.83	0.83	0.1	0.33	0.5	0.5	0.33	0.5	0.5	0.5	0.5	0.5

FF No.: 654

AI2003: COMPUTER NETWORK

Course Prerequisites: Fundamentals of Computer, C/C++ programming.

Course Objectives:
1. Understand the importance of Computer Network and its usage.
2. Study error control and flow control techniques.
3. Solve real-world problems in the context of today's internet (TCP/IP and UDP/IP).
4. Distinguish and relate various physical Media, interfacing standards, and adapters.
5. Implement mathematically and logically the working of computer protocols in the abstract.

Credits: 4   **Teaching Scheme Theory:** 2 Hours/Week
                                             Tut: 1 Hours/Week
                                             Lab: 2 Hours/Week

Course Relevance:
A computer network is a system of interconnected computers and computerized peripherals such as printers. This interconnection among computers facilitates information sharing among them by using data communication. The main objective of a computer network is to enable seamless exchange of data between any two points in the world. This course will explore common network services and protocols such as email, web services, etc. Networking is an ever-growing domain in which there is a constant need for support. Networks are becoming progressively more and more convoluted as technology is advancing and flourishing.

SECTION 1

Introduction

Introduction to computer network, LAN, MAN, WAN, PAN, Ad-hoc Networks, Network Architectures- Client-Server, Peer To Peer, Network Topologies- Bus, ring, tree, star, mesh, hybrid. Communication Models- OSI Model, TCP/IP Model, Design issues for layers.   **(3 Hours)**

Physical Layer

Transmission media- Guided media, unguided media. Transmission Modes- Simplex, Half-Duplex and Full-Duplex. Network Devices- Hub, Repeater, Bridge, Switch, Router, Gateways and brouter. Spread spectrum signal, FHSS, DSSS.   **(3 Hours)**

Data Link Layer

Logical Link Layer- Services to Network Layer, Framing, Error Control and Flow Control. Framing in LLC- framing challenges, types of framing. Error Control in LLC- error detection, error correction, Parity Bits, Hamming Codes (11/12-bits) and CRC. Flow Control Protocols- Unrestricted Simplex, Stop and Wait, Sliding Window Protocol. WAN Connectivity- PPP and HDLC   .**(5 Hours)**

Medium Access Control

Channel Allocation-Static and Dynamic, Multiple Access Protocols- Pure and Slotted ALOHA, CSMA, CSMA/CD, WDMA, IEEE 802.3 Standards and Frame Formats**.**   **(4 Hours)**

SECTION 2

Network Layer
Switching techniques, IP Protocol, IPv4 and IPv6 addressing schemes, Subnetting, NAT, CIDR, ICMP, Routing Protocols- Distance Vector, Link State, Routing in Internet- RIP, OSPF, BGP, Congestion control and QoS.   **(6 Hours)**

Transport Layer
Services, Socket programming, Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, TCP and UDP, TCP Timer management, Quality of Service (QoS), Differentiated services, TCP and UDP for Wireless.   **(4 Hours)**

Application Layer
Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP).
(3 Hours)

List of Tutorials: (Any Three)

1. Identification of various network components
2. Establishing LAN
3. Installation of network device drivers
4. Use/installation of proxy server
5. Configuration of network devices in CISCO packet tracer (Windows/Linux)
6. Implement communication between various network devices using CISCO packet tracer (Windows/Linux)
7. Network traffic monitoring using Wireshark/Ethereal (Windows/Linux)

List of Practical's: (Any Six)

1. Study and implement various networking commands on the terminal.
2. Use Socket programming to create a Client and Server to send a Hello message.
3. Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes or CRC. Demonstrate the packets captured traces using the Wireshark Packet Analyzer Tool for peer-to-peer mode. (50% of students will perform Hamming Code and others will perform CRC)
4. Write a program to simulate Go back N and Selective Repeat Modes of Sliding Window Protocol in peer-to-peer mode
5. Write a program to find the class and type of a given IP address.
6. Write a program to demonstrate subnetting and find the subnet masks.
7. Write a program using a TCP socket for the wired network for the following:
   a. Say Hello to each other (For all students) b. File transfer (For all students)
   b. Calculator (Arithmetic) (50% students) d. Calculator (Trigonometry) (50% students)
   c.
8. Write a program using UDP Sockets to enable file transfer (Script, Text, Audio and Video on file each) between two machines.
9. Write a program to implement: a. Network Routing: Shortest path routing, AODV. b. Analysis of congestion control (TCP and UDP).

10. Write a program to analyze the following packet formats captured through Wireshark for wired networks.

1. Ethernet 2. IP 3. TCP 4. UDP

List of Course Projects:

1. Write a program using TCP sockets for wired networks to implement
   a. Peer-to-Peer Chat b. Multi User Chat Demonstrate the packets captured traces using Wireshark Packet Analyzer Tool for peer-to-peer mode.
2. Implementation of shortest path protocol
3. Implementation of string encryption and decryption
4. Implementation of character stuffing and de-stuffing
5. Execution and analysis of Network commands
6. To find out details of the network from the IP addressing scheme using the 'C' code
7. Implement real-time Internet route optimization.
8. Implement Broadcast Server System.
9. Implement a real-time voting System.
1. 10. Real-time packet capture and analysis for malware in wireless networks.

List of Course Seminar Topics:

1. Asynchronous Transfer Mode
2. Need Of Multiplexing for Signal Modulation
3. TDM with PAM a case study
4. Noise signal
5. Basic Network Protocols
6. Manchester Vs Differential Manchester coding technique
7. Amplitude Shift Keying: Working and Applications
8. Nyquist Sampling Theorem
9. CDMA
10. Line coding Techniques with example

List of Course Group Discussion Topics:

1. TCP/IP Model
2. Mobile IP
3. Congestion Control and QoS
4. Wireless Technology for Short range and long range
5. Application Protocols and its security
6. IP Protocols
7. Data Communication Issues in IP Networks and Solutions to it
8. Congestion control in hybrid networks
9. Issues in Real time Audio and video transmission protocol.
10. IPV6

List of Home Assignments:

1. Enumerate the challenges in Line coding. Draw the line code for the sequence 010011110 using Polar NRZ-L and NRZ-1 schemes.
2. Design the procedure to configure TCP/IP network layer services.
3. Simulation of Routing Protocols using NS2

4. Simulation of FTP based Protocols using CISCO packet Tracer/ NS2

10. Simulation of Congestion Control Protocols Using NS2

Case Study:

1. Amplitude and Frequency Modulation Technique
2. Digital to Analog and Analog to Digital converters
3. Study of Various VPNs
4. IoT Solutions to Current Network Requirements
5. Unix Solutions for Broadcast Systems

Blog:

1. Communication Protocol
2. Emerging Trends in Computer Networks
3. Use of IOT in Networks
4. Cloud-based Network Solutions for real-world problems
6. Recent Trends in Computer Security

Surveys:

1. Survey of Wireless Technologies
2. Survey of Congestion control methodologies
3. Survey of Bluetooth Technology
4. Survey of Virtual Private Networks
5. 5 Survey of ADHOC Networks

Assessment Scheme:

Practical End Semester Examination

Lab Assessment

Course Project CVV

Text Books:

1. James F. Kurose, and Keith W. Ross," A Top-Down Approach," 4th edition, Publisher: Addison-Wesley ISBN: 0-321-49770-8

*   *2.   Behrouz A. Forouzan ,"Data Communication and Networking", 4th edition, Tata McGraw Hill Andrew S. Tanenbaum, "Computer Networks" ,5th Edition,*

Pearson Education

Reference Books:

1. Kurose, Ross, "Computer Networking a Top Down Approach Featuring the Internet‖", Pearson; 6th edition (March 5, 2012), ISBN-10: 0132856204

2. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", Wiley, ISBN: 0-470-09510-5

3. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall, 2004 3.

Moocs Links and additional reading material:

1. https://nptel.ac.in/courses/106105183

2.https://www.my-mooc.com/en/categorie/computer-networking

COURSE OUTCOMES

1.   Select network architecture, topology and essential components to design computer networks.

2.   Estimate reliability issues based on error control, flow control by using bandwidth, latency, throughput and efficiency.

3.   Design mechanisms to demonstrate channel allocation in wired and wireless computer networks.

4.   Analyze data flow between peer-to-peer in an IP network using Application, Transport and Network Layer Protocols.

5.   Implement the client server application using socket. Develop Client-Server architectures and prototypes by the means of correct standards, protocols and technologies.

Future Courses Mapping:
1.   Network Security
2.   Cybersecurity
3.   Software Defined Network

Job Mapping:
Job opportunities that one can get after learning this course
1.   Network Administrator
2.   System Engineer
3.   Network Architect

CO – PO Mapping :

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
						Program Outcomes (PO)								PSO		
CO1	3	3	3										2		2	
CO2	3	2		3	2								2	2		2
CO3	2	2	3				2			2			2			
CO4	2	2		3			2					2		2		
CO5	2				3	3		2	2	2	2	2				
CO6			2		2	3			2	2						2
Average	2.40	2.25	2.67	3.00	2.33	3.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00

Subject Code : DIGITAL ELECTRONICS AND MICROPROCESSOR

Course Prerequisites:
>   Basic electronics system

Course Objectives:

1. Learn and illustrate the standard representation for logical functions
2. Explore the knowelege of digital electronics.
3. Design applications based on combinational and sequential circuits.
4. Demostrate the concept of microprocessor system.
5. Adopt the knowledge based on microprocessor instuctions.
6. Illustrate the concept of interrupts and service routine.

Credits: 4   **Teaching Scheme: 2 Hours / Week**
                                                           Lab: 2 Hours / Week
                                                           Tut: 1 Hours / Week

Course Relevance:

The course is offered in S.Y. B.Tech. (AI & DS) Engineering

SECTION-I

Digital Fundamentals

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1s and 2s complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization

(4 Hours)

Combinational Digital Circuits:

Standard representation for logic functions, simplification of logic functions using K-map, minimization of logical functions. Dont care conditions.BCD code,Gray code, Excess-3 code, Code converter, 4 bit binary adder & Sub-tractor:7483, Multiplexers & De-multiplexers, Encoder: Priority encoders, Decoders: 74138,ALU: 74181,Parity generator and checker.

(5 Hours)

Sequential Circuit:

Introduction of flip-flop (F.F), 1 bit memory cell, clocked S-R, J-K, T, DFlip-flop: Truth table, Excitation table,Characteristics table, Shift Register, Asynchronous and Synchronous counter,Sequence Generator, Sequences detector (Moore and Mealy).

(5 Hours)

SECTION-II

Introduction to 8086 microprocessor:

Internal Architecture, Generation of physical address8086,8086 memory segmentation, Register Organization,Addressing modes: Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing.

(4 Hours)

8086 Instructions types

Instruction types, formats, timings, Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. 8086 pin functions: Minimum & Maximum Mode System,Ready and Reset pin significance,

(5 Hours)

Interrupt Structure and Programmable Interval Timer:

Interrupt Structure, Interrupt service Routine, Interrupt Vector Table, Hardware and Software Interrupts, INTR, NMI, Interrupt Response, Execution of an ISR, Priority of Interrupts.8259-(Programmable Interval timer/counter) block diagram, control word, Operating modes of 8259, Interfacing with 8086 processor and Programming. **(5 Hours)**

1. **List of Tutorials:**
2. Evolution of Computing Devices

3.   Instructions types, formats and execution

4.   Interrupts in Microprocessor

5.   Trends in computer architecture

6.   RISC Vs CISC architecture: A Case Study

7.   ARM processor architecture

8.   Latest Technology in Embedded systems

9.   Multiplier Control Unit

10. Booth's Encoding Pattern for Fast Scalar Point Multiplication in ECC for Wireless Sensor Networks

11. Internet of Things (IoT) in 5G Wireless Communications

12. State of the art parallel processor design.

13. Memory management in mobile OS.

14. Evolution of processors.

15. Ultra SPARC Processor Architecture.

List of Practical's: (Any Six)
1. Verification of Logical Gates and Boolean Algebra.

2. Code converters e.g. Excess-3 to BCD and vice versa using logical gates.

3. Multiplexer - e.g. 16:1 Mux using 4:1 Mux (IC 74153).

4. Decoder – e.g. 2 bit comparator (IC 74138).

5. Synchronous Up /down counter using JK flip-flop.

6. Sequences detector using JK flip flop.

7. Study of 8086 Architecture and Execution of sample programs.

8. Write 8086 ALP to find and count negative and positive number from signed arraystored in memory and display magnitude of negative numbers.

9. Write 8086 ALP to access marks of 5 subjects stored in array and find overall percentage and display grade according to it.

10. Write 8086 ALP to perform block transfer operation. (Don't use string operations) .Data bytes in a block stored in one array transfer to another array.

11. Write 8086 ALP for following operations on the string entered by the user.(Use Extern Far Procedure).

    - String length
    - Reverse of String
    - Palindrome

1. List of Course Projects:
2. List of Course Projects:

3. Weather Imaging CubeSat with Telemetry Transmission.

4. Ebike Speed Controller System.

5. Air Water Pollution Sensing Smart Watch.

6. Solar Sea Weather and Pollution Transmitter Buoy.

7. Coin Operated Water ATM with Bottle Dispenser.

8. Multiple Cities Load Shedding Using ARM

9. Wireless Biomedical Parameter Monitoring System Using ARM9

10. ARM and RFID Based Security System (Home, Office, Industrial)

11. Advanced Electronic Voting Machine (EVM) using ARM)

12. Online Parallel Examination.

13. Machine Learning, Deep Learning, AI, Blockchain etc Based

14. Agriculture, Health Care, Education, Govt., Transportation, Banking, Insurance Based project topics

List of Course Seminar Topics:

1. GPU computing: CUDA

2. Memory System

3. Replacement Algorithms

4. Pipelining

5. Cache Coherence

6. Virtual Memory

7. Hazards in Pipelining

8. Super Computer

9. Modern computer generations

10. Parallel computing modelsRidge regression

Text Books: (As per IEEE format)
1. *G.K Kharate 'Digital Electronics' – Oxford University Press 2010 seventh impression*

   a. *2013*
2. *Douglas Hall, "Microprocessors and Interfacing",2nd Edition, Tata McGraw Hill Publications, ISBN 0-07-025742-6.*

3. *"Advanced 80386, programming techniques " , James Turley , Tata McGraw Hill Publications, ISBN – 0-07-881342-5*

4. *Intel 80386 Programmer's Reference Manual 1986, Intel Corporation, Order no.: 231630- 011, December 1995.*

5. *R.P. Jain, "Modern Digital Electronics,"3rdEdition, Tata McGraw-Hill, 2003, ISBN 0 - 07 - 049492 – 4.*

Reference Books: (As per IEEE format)

1. *Ray Duncan, "Advanced MS DOS Programming," 2nd Edition BPB Publications ISBN 0 – 07 – 048677 – 8.*

2. *M. Mano, "Digital Design", 3rd Edition, Pearson Education, 2002, ISBN - 81 - 7808 – 555 – 0.*

3. *A. Malvino, D. Leach, "Digital Principles and Applications", 5th Edition, Tata McGraw Hill, 2003, ISBN 0 - 07 - 047258 – 05.*

Course Outcomes:
Upon completion of the course, student will be able to –
1. Learn and illustrate the standard representation for logical functions
2. Explore the knowledge of Digital logic circuits.
3. Design applications based on combinational and sequential circuits.
4. Demonstrate the concepts of microprocessor systems
5. Adapt the knowledge based on microprocessor instructions
6. Illustrate the concept of interrupts and its service routine

---

Future Courses Mapping:
1. Reinforcement Learning

2. DBMS

3. Big Data

4. Data Mining

5. Information Retrieval

6. Recommendation Systems

7. Cloud Computing – AWS

8. IOT

9. Artificial Intelligence

Job Mapping:
Job opportunities that one can get after learning this course

1. AI Engineer

2. Data Architect.

3. Data Engineer.

4. Statistician.

5. Database Administrator.

6. Business Analyst

7. Business Intelligence Developer

8. Infrastructure Architect

9. Enterprise Architect

10. Machine Learning Engineering

CO - PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2				2		2				3			
CO2	2	3	2	1		2		3	2				3			
CO3	2		3	2	2	2	3		2		2				3	
CO4	2		2		3	3				2		2			3	
CO5	2	1	2		3	3				2		2			3	2
CO6	3				1		2			2	2	2			2	3
Average	2.33	1.67	2.20	1.50	2.25	2.50	2.33	3.00	2.00	2.00	2.00	2.00	3.00	3.00	2.67	2.50

AI2017: AUTOMATA THEORY

Course Prerequisites:
    Basic Mathematics and Programming

Course Objectives:

1. To design suitable computational model/s for accepting / recognizing a given formal language

2. To compare computational models with respect to their power in recognizing different types of languages

3. To understand notion of un/decidability of problems

Credits: 2   **Teaching Scheme Theory:** 2 Hours/Week
                                                    Tut: 1 Hours/Week
                                                    Lab: 2 Hours/Week

Course Relevance:

This course lays a strong foundation for higher studies as well as research. For higher studies there are different courses such as "Program Analysis and Verification" which are based on the concepts of computation theory. For Research scholars, it would help in understanding the type and class of problems, and to solve and prove certainty of the provided solution. It would also help software developers in building the logic of programs, exploring its mathematical proofs, generating hypothetical scenarios, designing various computing machines.

SECTION-I

Finite Automata:

Automaton as a model of computation, Alphabets, Strings, Languages, Deterministic Finite Automata (DFA), Nondeterministic finite Automata (NFA), State Minimization algorithm, NFA with epsilon transition, pumping lemma.   **(5 Hours)**

Regular Expression :

 Regular Expression (RE) Definition, Application, Kleene's Theoram; Equivalance of RE and DFA, Closure properties of Regular Languages, My hill-Nerode theorem and its applications.
                                                    (5 Hours)

Grammar:

Chomsky hierarchy, Context Free Grammars (CFG), Derivation, Languages of CFG, Constructing CFG, Derivation trees, Ambiguity in CFGs, Removing ambiguity, CNF, GNF, Chomsky hierarchy, Applications of CFG.   **(4 Hours)**

SECTION-II

Pushdown Automata:

Pushdown Automata (PDA), Acceptance by final state /empty stack, Deterministic and Non-deterministic PDAs, Equivalence of PDA and CFG, Context Sensitive Languages, Context

---

Sensitive Grammars, Linear Bounded Automata.   **(5 Hours)**
 Turing Machine:

(TM) definition, Instantaneous Description, Language acceptance, Robustness of TM, equivalence of TM variants, Universal Turing Machine. TM as enumerator, Recursive and Recursively Enumerable languages and their closure properties, Church-Turing thesis.   **(5 Hours)**

Undecidability:
Complexity classes, decidability, undecidability of halting problem, post correspondence problem.
                                                                                (4 Hours)

List of Tutorials:
1. Data Visualization

2. Distances and Projections

3. Singular Value Decomposition

4. Principal Component Analysis

5. Optimization

6. Normal & Binomial Distribution

7. Hypothesis Testing

8. ANOVA test

9. Linear Regression

10. Logistic Regression

11. Nearest Neighbor Classification

12. Decision Trees based classification

13. Naive Bayes classification

14. Clustering

15. Evaluation of model performance

16. Bagging & Boosting approaches

1. *Text Books: (As per IEEE format)*
2. *Hopcroft J, Motwani R, Ullman, Addison-Wesley, "Introduction to Automata Theory Languages and Computation" Second Edition, ISBN 81-7808-347-7*

3. *Michael Sipser, "Introduction to Theory of Computation", Third Edition, Course*

Technology, ISBN 10:053494728X

Reference Books: (As per IEEE format)

1. John Martin, "Introduction to Languages and The Theory of Computation", 2nd Edition, McGrawHill Education, ISBN-13: 978-1-25-900558-9, ISBN-10: 1-25-900558-5

2. J. Carroll & D Long, "Theory of Finite Automata", Prentice Hall, ISBN 0-13-913708-45.

3. Vivek Kulkarni, "Theory of Computation", Oxford University Press, ISBN 0-19-808458

Moocs Links and additional reading material: www.nptelvideos.in

1. https://nptel.ac.in/courses/106/104/106104148/

2. ttps://nptel.ac.in/courses/106/104/106104028/

---

1. **Course Outcomes:**

2. Students should be able to design Automata / Regular expression for given computational problems

3. Students should be able to correlate given computational model with its Formal Language

4. Students should be able to understand Chomsky hierarchy and write grammar for languages

5. Students should be able to design PDA / TM for given computational problem

6. Students should be able to analyze power of different computational models

7. Students should be able to understand complexity classes and un / decidability of problems

---

Future Courses Mapping:

1. System Programming

2. Compiler

Job Mapping:
Job opportunities that one can get after learning this course

1. Software Engineer

2. AI Engineer

3. Machine Learning Engineering

4. Machine Learning Scientist

CO-PO Mapping :

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	1	-	-	-	-	-	-	2	-	2	2	-
CO2	3	3	2	2	1	-	-	-	-	-	-	1	-	2	2	-
CO3	3	3	2	2	1	-	-	-	-	-	-	1	-	2	2	-
CO4	3	3	2	2	1	-	-	-	-	-	-	1	-	2	2	-
CO5	3	3	3	2	1	-	-	-	-	-	-	2	-	2	2	-
CO6	3	3	3	3	1	-	-	-	-	-	-	1	-	2	2	-
Average	3	3	2.33	2.1	1	-	-	-	-	-	-	1.33	-	1	1	-

AI2012 : Design Thinking IV

Course Prerequisites:

Basic knowledge of research work, research paper and patent.

Course Objectives:

1. Understand the concepts of design thinking approaches
2. Apply both critical thinking and design thinking in parallel to solve problems
3. Apply some design thinking concepts to their daily work
4. To provide ecosystem for students and faculty for paper publication and patent filing

Credits: 1   **Teaching Scheme Tut:** 1 Hour/Week

Course Relevance:

The course is offered in S.Y. and T.Y. B.Tech. to all branches of Engineering.

Contents for Design Thinking:

Structure of The paper Journal List (Top 50 Journals) Selection

of the journal

Use of various online journal selection tools

Plagiarism checking

Improving contents of the paper Patent

drafting

Patent search Filing of patent

Writing answers to reviewer questions Modification in

manuscript

Checking of publication draft

Assessment Scheme:

Publication of paper or patent

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Understand the importance of doing Research

CO2: Interpret and distinguish different fundamental terms related to Research

CO3: Apply the methodology of doing research and mode of its publication

CO4: Write a Research Paper based on project work

CO5: Understand Intellectual property rights

CO6: Use the concepts of Ethics in Research

CO7: Understand the Entrepreneurship and Business Planning

CO-PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
				Program Outcomes (PO)										PSO		
CO1	2	1	2	2	1	3	1	3	2	2	2	1	2	2	3	3
CO2	2	2	3	3	2	2	2	3	2	2	1	3	2	3	3	3
CO3	2	2	2	2	2	2	2	3	2	2	3	3	2	3	3	3
CO4	2	2	2	2	2	2	1	3	2	2	2	1	2	3	3	3
CO5	2	2	2	2	2	2	2	3	2	2	2	3	3	2	2	3
CO6	2	2	2	2	2	2	2	3	2	2	2	1	3	2	2	2
CO7	2	2	2	2	2	2	2	3	2	2	2	3	3	3	3	3
Average	2	1.9	2.1	2.1	1.9	2.1	1.7	3.0	2.0	2.0	2.0	2.1	2.4	2.6	2.7	2.9

AI2020 - Engineering Design & Innovation IV

Course Prerequisites:
    Problem Based Learning

Course Objectives:
1. To develop critical thinking and problem solving ability by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student-centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
6. To develop an ecosystem to promote entrepreneurship and research culture among the students.

Credits: 4   **Teaching Scheme : Theory: 1** Hours/Week
                                                                Lab: 6 Hours/Week

Course Relevance:
Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Along with course-based projects, the curriculum can be enriched with semester-long Engineering Design and Development courses, in which students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy, and Swaccha Bharat Abhiyan. To gain the necessary skills to tackle such projects, students can select relevant online courses and acquire skills from numerous sources under guidance of faculty and enrich their knowledge in the project domain, thereby achieving project centric learning. Modern world sustained and advanced through the successful completion of projects. In short, if students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. Project based learning will also redefine the role of teacher as mentor in the learning process. The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to nalyze, design and apply categories of Bloom's Taxonomy.

SECTION I

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ED, laboratory course contents of "Trends in Engineering Technology" are designed as a ladder to extend connectivity of software technologies to solve real world problems using an interdisciplinary approach. The ladder in the form of gradual steps can be seen as below:

Industry Communication Standards, Single Board Computers and IoT, Computational Biology (Biomedical and Bioinformatics), Robotics and Drone, Industry 4.0 (Artificial Intelligence, Human-Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Text Books: (As per IEEE format)
1. *A new model of problem based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017*

2. *Problem Based Learning. By Mahnazmoallem, woei hung and Nada Dabbagh, Wiley Publishers. 2019.*
3. *Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert RobartCapraro, Mary Margaret Capraro*

Reference Books: (As per IEEE format)
1. *De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-basedlearning in engineering. Rotterdam: Sense Publishers. 2007.*
2. *Project management core textbook, second edition, Indian Edition , by Gopalan.*
3. *The Art of Agile Development. By James Shore & Shane Warden.*

Moocs Links and additional reading material:

1. www.nptelvideos.in

Course Outcomes:
On completion of the course, learner will be able to–
CO1: Identify the real life problem from a societal need point of view
CO2: Choose and compare alternative approaches to select the most feasible one
CO3: Analyse and synthesize the identified problem from a technological perspective
CO4: Select the best possible solution to solve the problem.
CO5: Design & Develop a working model of the proposed solution.
CO6: Testing and validating product performance

Future Courses Mapping:
Major Project

Job Mapping:
Software Engineer. Software Developer, IT Engineer, Research Associate.

CO-PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2					3	2	2	2	2			3
CO2	2	2	3	2	2		2		3	2	2	2	3	3	2	3
CO3	2	2	3	2	3		2		3	2	2	2	3	3	2	3
CO4	2	2	3	2	3	3		2	3	2	2	2	2	3	3	3
CO5	2	2	3	2	3	2			3	2	2	2	3	3	3	3
CO6	2	2	3	3	2				3		3	2	3	2		3
Average	2.0	2.0	2.83	2.16	2.6	2.5	2.0	2.0	3.0	2.0	2.16	2.0	2.66	2.8	2.5	3.0

AI3001: Artificial Intelligence

Course Prerequisites:

1. A course on "Computer Programming and Data Structures"
2. A course on "Mathematical Foundations of Computer Science"
3. Some background in linear algebra, data structures and algorithms, and probability will be helpful

Course Objectives:

1. To learn the distinction between optimal reasoning Vs. human like reasoning
2. To understand the concepts of state space representation, exhaustive search, heuristic search togetherwith the time and space complexities.

3. To learn different knowledge representation techniques.

4. To understand the applications of AI, namely game playing, theorem proving, and machine learning

Credits: 04   **Teaching Scheme Theory: 02** Hours/Week
                                                           Tut: 01Hours/Week
                                                           Lab: 02Hours/Week

Course Relevance:

Technologies driven by artificial intelligence (AI) have transformed industries and everyday life. The possibilities for AI applications are virtually unlimited and sought after in practically every industry segment. That's why global organizations are actively recruiting professionals with specialized skills and proficiencies needed to develop future AI technological innovations.

SECTION-I

Topics and Contents:

Unit-I Title: Fundamentals of Artificial Intelligence

Introduction: A.I. Representation, Non-AI & AI Techniques, Representation of Knowledge,

Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics,

Types of production systems, Turing Test.

Intelligent Agents: Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. **Formulation of problems**: Vacuum world, 8 queens, Route finding, robot navigation.[CO1, CO2] [PO1, PO2]

Unit-II Title: UninformedSearch Strategies

Uninformed Search Methods: Depth First Search, Breadth First Search, Depth Limited Search,Iterative Deepening Depth First Search, Bidirectional Search, Comparison of Uninformed search Strategies.[CO3] [PO3, PSO1]

Unit-III Title: Informed Search Methods:

Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Means Ends Analysis, **Game playing:** Minimax Search, Alpha-Beta Cut offs, Waiting for Quiescence.[CO3, CO6] [PO3]

SECTION-II

Topics and Contents:

Unit-IV Title: Logical Agents:

Knowledge based agents, Wumpus world. **Propositional Logic**: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. **First order Logic**: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.

[CO4] [PO2]

Unit-V Title: Basics of PROLOG:

Representation, Structure, Backtracking. **Expert System**: Design, Implementation, Case study of Expert System in PROLOG.[CO4] [PO2]

Unit-VI Title: Planning:

Blocks world, STRIPS, Implementation using goal stack, **Planning with state space search:** Forward state space search, Backward state space search, Heuristics for state space search. Partial Order Planning, Planning Graphs, Hierarchical planning, Least commitment strategy.
Conditional Planning, Continuous Planning. [CO5] [PO4]

List of Tutorials:
1. AI problem formulation [CO1] [PO1]

2. Task Environment [CO1] [PO1]

3. AI Problem Characteristics [CO1] [PO1]

4. Missionaries and Cannibals Problem [CO2] [PO2]

5. Water Jug Problem [CO2] [PO2]

6. Monkey Banana problem [CO2] [PO2]

7. 8 Puzzle Problem [CO2] [PO2]

8. Magic Square problem [CO2] [PO2]

9. Tic-Tac Toe Problem [CO3] [PO3]

10. Robot Navigation [CO5] [PO4]

11. Propositional Logic Examples [CO5] [PO4]

12. Predicate Logic Examples [CO5] [PO4]

13. Mini Expert system examples [CO5] [PO4]

List of Practical's: (Any Six)
  1. Implementation of AI and Non-AI technique by implementing any two player game[

    CO1,CO2] [PO1,PO2]

  2. Implementation of Uninformed strategies [CO1,CO2] [PO1,PO2]

  3. Implementation of Informed strategies[CO2,CO3] [PO2,PO3]

  4. Implementation of CSP Problem [CO3] [PO3]

  5. Implementation predicate logic using PROLOG[CO5] [PO4]

  6. Implementation of Expert system using PROLOG[CO5] [PO4]

List of Course Projects:
 Course Project 01 Statement ----------------------------- [CO's Mapped] [PO Mapped]

  1. Inventory management E Commerce [CO1] [PO1]

  2. Stock market price prediction [CO1] [PO1]

  3. Object Identification / detection [CO2] [PO2]

  4. Product Delivery Drones [CO3] [PO3]

  5. Pick and drop robotic arm [CO4] [PO2]

6. Arrangement of blocks [CO2] [PO2]

7. Smart city water / light management system [CO2] [PO2]

8. Human Tracking system [CO2] [PO2]

9. Automatic Interview Conduction system [CO3] [PO3]

10. Student Information Chatbot Project. [CO3] [PO3]

11. Product Review Analysis For Genuine Rating. [CO3] [PO3]

12. Customer Targeted E-Commerce [CO4] [PO2]

13. College Enquiry Chat Bot [CO2] [PO2]

14. Artificial Intelligence HealthCare Chatbot System [CO3] [PO3]

15. Intelligent Tourist System Project [CO3] [PO3]

List of Course Seminar Topics:
1. Fundamentals of Artificial Intelligence [CO1] [PO1]

2. Intelligent Agents [CO1] [PO1]

3. Uninformed searching Techniques [CO2] [PO2]

4. Informed searching Techniques [CO2] [PO2]

5. Gaming Techniques [CO2] [PO2]

6. Planning Techniques [CO5] [PO4]

7. Applications of AI [CO6] [PO3]

8. Predicate Logic [CO4] [PO2]

9. Propositional Logic[CO4] [PO2]

10. Adversarial Search Techniques [CO4] [PO2]

List of Course Group Discussion Topics:

List of Home Assignments:
1. Design of intelligent algorithm for AI Accessibility [CO3] [PO3]

2. Design of AI algorithm for Robot Navigation. [CO3] [PO3]

3. Design of AI algorithm for Customer Experience [CO3] [PO3]

4. Design of AI algorithm for Data-Informed Design [CO3] [PO3]

5. Design of AI algorithm forAI Decision Making [CO3] [PO3]

6. Design of AI algorithm for any application for Children [CO3] [PO3]

7. Design of AI algorithm for problems of Senior Citizens [CO3] [PO3]

8. Design of AI algorithm for ecommerce Applications [CO3] [PO3]

9. Design of AI algorithm for Enterprise UX Design [CO3] [PO3]

10. Design of AI algorithm as Teaching Aid for teachers [CO3] [PO3]

List of Case Study Based Home Assignments
 HA_CS[CO's Mapped] [PO Mapped]

1. How Automobile Sector Is Preparing For The 4th Industrial Revolution using AI [CO3][PO3]

2. How Indian Retail Giant Is Using AI And Robots To Prepare For The 4th Industrial Revolution [CO3] [PO3]

3. Rolls-Royce And Google Partner To Create Smarter, Autonomous Ships Based On AI[CO3] [PO3].

4. The Amazing Ways Tesla Is Using Artificial Intelligence And Big Data [CO3] [PO3]

5. The Incredible Ways John Deere Is Using Artificial Intelligence To TransformFarming[CO3] [PO3]

6. Challenges/Issues in AI applications [CO3] [PO3]

7. Research problems in AI [CO3] [PO3]

8. AI in Search Engine [CO3] [PO3]

9. Future of AI [CO3] [PO3]

10. AI in Agriculture [CO3] [PO3]

List of Blog Based Home Assignment
1. AI Trends [CO3] [PO3]

2. AI Research [CO3] [PO3]

3. AI Chatbot [CO3] [PO3]

4. Chatbot Magazine [CO3] [PO3]

5. AI Medical / Agriculture [CO3] [PO3]

6. AI Challenges [CO3] [PO3]

7. Knowledge based Inference Engine [CO3] [PO3]

8. Rule based inference Engine [CO3] [PO3]

9. Truth maintenance system[CO3] [PO3]

10. AI in CSP problems [CO3] [PO3]

List of Survey Based Home Assignments
1. Adaption of AI in 2020 [CO3] [PO3]

2. AI in Industry [CO3] [PO3]

3. AI in Digital Marketing [CO3] [PO3]

4. AI in Gaming [CO3] [PO3]

5. AI after Covid-19 [CO3] [PO3]
6. AI in rule based systems [CO3] [PO3]

7. Analysis of Search Engines : AI perspective [CO3] [PO3]

8. Page rank algorithms in AI [CO3] [PO3]

9. AI in Ecommerce [CO3] [PO3]

10. Analysis of Expert systems in medical diagnosis [CO3] [PO3]

Suggest an assessment Scheme:
HA, Seminar, MSE, ESE, Lab, CVV

Text Books: (As per IEEE format)
1. Elaine Rich and Kevin Knight: "Artificial Intelligence." Tata McGraw Hill

2. Stuart Russell & Peter Norvig : "Artificial Intelligence : A Modern Approach", Pearson Education, 2nd Edition.

3. Deepak Khemani: "A First Course in Artificial Intelligence", Mc Graw Hill

4. Saroj Kaushik: "Artificial Intelligence" Cengage Publication

---

Reference Books: (As per IEEE format)

1. Ivan Bratko : "Prolog Programming For Artificial Intelligence" , 2nd Edition Addison Wesley,1990.

2. Eugene, Charniak, Drew Mcdermott: "Introduction to Artificial Intelligence.", AddisonWesley

3. Patterson: "Introduction to AI and Expert Systems", PHI

4. Nilsson: "Principles of Artificial Intelligence", Morgan Kaufmann.

5. Carl Townsend, "Introduction to turbo Prolog", Paperback, 1987

Moocs Links and additional reading material:
   1. *www.nptelvideos.in*

Course Outcomes:
 On the completion of course, student will able to

1. Understand the basics of the theory and practice of Artificial Intelligence as a disciplineand about intelligent agents capable of problem formulation.

2. Identify problems that are amenable to solution by AI methods, and which AI methodsmay be suited to solving a given problem.

3. Evaluation of different uninformed and informed search algorithms on well formulated problems along with stating valid conclusions that the evaluation supports.

4. Formulate and solve a given problem using Propositional and First order logic.

5. Analyze the AI problem using different planning techniques.
   Design and carry out an empirical evaluation of different algorithms on problemformalization, and state the conclusions that the evaluation supports.

Future Courses Mapping:

Job Mapping:
 Job opportunities that one can get after learning this course

CO - PO Mapping:

CO	Program Outcomes (PO)												PSO			
	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
CS3202.1	2															
CS3202.2		2														
CS3202.3			2										1			
CS3202.4		1														
CS3202.5				3												
CS3202.6			1													
Average	2	3	3	3									1			

AI3002 : Operating Systems

Course Prerequisites:
1. Basics of Computer System
2. Computer Organization
3. Data Structures
4. Any Programming Language.

Course Objectives:

1. To understand the basic concepts and functions of Operating Systems.

2. To gain knowledge of process synchronization and its mechanism.

3. To get familiar with CPU scheduling algorithms.

4. To discuss different deadlock handling mechanisms.

5. To learn memory management techniques and virtual memory.

6. To evaluate various disk scheduling algorithms.

Credits:04   **Teaching Scheme Theory:** 02 Hours/Week
                                                            Tut: 01 Hours/Week
                                                            Lab: 02 Hours/Week

Course Relevance:

This course focuses on functions of operating systems. Operating system is a System software that manages the resources of the computer system and simplifies applications programming. The Operating System acts as a platform of information exchange between your computer's hardware and the applications running on it.

SECTION-I

Introduction: What is OS?, Interaction of OS and hardware, Goals of OS, Basic functions of OS, OS Services, System Calls, Types of System calls, Types of OS: Batch, Multiprogramming, Time Sharing, Parallel, Distributed & Real-time OS.   **(4 Hours)**

Process management: Process Concept, Process States: 2, 5, 7 state models, Process Description, Process Control, Multithreading models, Thread implementations – user level and kernel level threads, Concurrency: Issues with concurrency, Principles of Concurrency, Mutual Exclusion: OS/Programming Language Support: Semaphores, Mutex, Classical Process Synchronization problems.   **(6 Hours)**

Scheduling: FCFS, SJF, RR, Priority**.**   **(4 Hours)**

SECTION-II

Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Deadlock Recovery.   **(4 Hours)**

Memory Management: Memory Management requirements, Memory Partitioning, Paging, Segmentation, Address translation, Placement Strategies: First Fit, Best Fit, Next Fit and Worst Fit. Virtual Memory, VM with Paging, VM with Segmentation, Page Replacement Policies: FIFO, LRU, Optimal.   **(5 Hours)**

I/O management: I/O Devices - Types, Characteristics of devices, I/O Buffering. Disk Scheduling: FCFS, SSTF, SCAN, C-SCAN   **(5 Hours)**

List of Tutorials:
1. Linux commands
2. Comparison of different OS
3. OS structures
4. Inter Process Communication
5. Symmetric Multiprocessor
6. Thread Scheduling
7. Translation Lookaside buffer
8. Secondary storage management
9. Linux Memory management
10. File System in Windows and Linux
11. Inter process communication in Linux using FIFO
12. Producer Consumer Problem
13. Reader Writer Problem

List of Practical's: (Any Six)
1. Execution of Basic Linux commands.
2. Any shell scripting program.
3. Write a program demonstrating use of different system calls.
4. Implement multithreading for Matrix Operations using Pthreads.
5. Implementation of Classical Process Synchronization problems using Threads and Mutex.
6. Implementation of Classical Process Synchronization problems using Threads and Semaphore.
7. Write a program to compute the finish time, turnaround time and waiting time for the following algorithms:

    a. First come First serve b) Shortest Job First (Preemptive and Non Preemptive)

    b. Priority (Preemptive and Non Preemptive) d) Round robin
8. Write a program to check whether a given system is in safe state or not using Banker's Deadlock Avoidance algorithm.
9. Write a program to calculate the number of page faults for a reference string for the following page replacement algorithms:
    a. FIFO   b) LRU   c) Optimal

10. Disk Scheduling Algorithms: SSTF, SCAN, C-Look considering the initial head position moving away from the spindle.

List of Course Projects:
1. Design and implementation of a Multiprogramming Operating System: Stage I
     i.   CPU/ Machine Simulation
     ii.   Supervisor Call through interrupt
2. Design and implementation of a Multiprogramming Operating System: Stage II
     i.   Paging
     ii.   Error Handling
     iii. Interrupt Generation and Servicing
     iv.   Process Data Structure
3. Design and implementation of a Multiprogramming Operating System: Stage III
     i.   Multiprogramming
     ii.   Virtual Memory
     iii. Process Scheduling and Synchronization
     iv.   Inter-Process Communication
4.I/O Handling, Spooling and Buffering

List of Course Seminar Topics:
List of Course Seminar Topics:
1. Different File Systems in Windows and Linux OS
2. Operating System generations
3. OS Structures
4. HDFS
5. Process Vs Threads
6. Virtual Machines
7. Real Time Scheduling
8. Booting Process of different Operating Systems.
9. RAID
10. Protection and Security in Operating System

List of Course Group Discussion Topics:
1. Flynn's taxonomy

2. Role of Operating system

3. 32 bit Vs 64 bit OS

4. Storage structures and their tradeoffs

5. Disk Scheduling

6. Desktop OS Vs Mobile OS

7. Security Vs Protection in OS

8. I/O processors
9. Linux Vs Windows OS
10. Best OS for smartphones

List of Home Assignments:

Design:

1. Report Generation using Shell Script and AWK
2. Library Management System using shell
3. Inter Process Communication in Linux
4. Design any real time application using job scheduling
5. Design any application using Android

Case Study:

1. Distributed Operating System
2. Microsoft Windows 11
3. VMware
4. Linux
5. Android

Surveys:

1. A survey of Desktop OS
2. Analysis and Comparison of CPU Scheduling Algorithms
3. Device Drivers for various devices
4. Parallel Computing
5. Malware Analysis, Tools and Techniques

Blog

1. Operating System Forensics
2. Open Source OS Vs Commercial OS
3. BIOS
4. Comparative study of different mobile OS
5. Operating Systems for IoT Devices

Text Books: (As per IEEE format)

1. *Stalling William; "Operating Systems"; 6th Edition, Pearson Education;*

2. *Silberschatz A., Galvin P., Gagne G.;"Operating System Concepts" ; 9th Edition; John Wiley and Sons;*

3. *Yashavant Kanetkar; "Unix Shell Programming"; 2nd Edition, BPB Publications*

4. *Sumitabha Das; "Unix Concepts and Applications"; 4th Edition, TMH.*

5. *D M Dhamdhere; "Systems Programming & Operating Systems"; Tata McGraw Hill Publications, ISBN – 0074635794*

6.John J Donovan; "Systems Programming"; Tata Mc-Graw Hill Edition, ISBN-13978-0-07-460482-3

Reference Books: (As per IEEE format)

1. *Silberschatz A., Galvin P., Gagne G; "Operating System Principles"; 7th Edition, John Wiley and Sons.*

2. *Forouzan B. A., Gilberg R. F.; "Unix And Shell Programming"; 1st Edition, Australia Thomson Brooks Cole.*

3. *Achyut S. Godbole , Atul Kahate; "Operating Systems"; 3rd Edition, McGraw Hill.*

Moocs Links and additional reading material:

1. www.nptelvideos.in

2.   https://www.udemy.com/

3.   https://learn.saylor.org/

4. https://www.coursera.org/

1. https://swayam.gov.in/

Course Outcomes:
Upon completion of the course, student will be able to –

1. Examine the functions of a contemporary Operating System with respect to convenience, efficiency and the ability to evolve.
2. Demonstrate knowledge in applying system software and tools available in modern operating systems for process synchronization mechanisms.
3. Apply various CPU scheduling algorithms to construct solutions to real world problems.
4. Identify the mechanisms to deal with Deadlock.
5. Illustrate the organization of memory and memory management techniques
    Acquire a detailed understanding of various I/O buffering techniques and disk scheduling algorithms.

Future Courses Mapping:
1. Advance Operating System
2. Unix Operating System

3. Linux programming
4. Distributed System/Computing
   System Programming

Job Mapping:

Job opportunities that one can get after learning this course
1. Linux Administration
2. Kernel Developers
3. Application Developers
4. System programmer
1. System architect

CO - PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2		3											
CO2	3	2	3		1							3		2		1
CO3	2	3	3	2		3								1		1
CO4	3	2					3			3						
CO5	3	3		2				3			3					
CO6	3	2		2					3					2		1
Average	2.83	2.33	2.66	2	2	3	3	3	3	3	3	3	-	1.66	-	1

FFNo.: 654

AI3003 : Statistical Inference

Course Prerequisites:
1. Basic knowledge of Statistics and Probability, Python

Course Objectives:
1. Get basic understanding about statistical models and their use.

2. Apply regression models with hyper-parameter tuning methods depending upon the problem context .

3. Get a better understanding of probabilistic models.

4. Derive inference from different statistical data sets.

Credits: 04   **Teaching Scheme Theory: 01** Hours/Week
                                                          Tut:01 Hours/Week
                                                          Lab:02 Hours/Week

Course Relevance:
Machine learning, Data Science

SECTION-I

Topics and Contents (4Hrs): Introduction, Basic concepts from statistics, definition and uses of models, how models are used in practice, key steps in the modeling process. Linear models and optimization, least square estimation,principal component analysis, linear discriminant analysis, Factor analysis, Concept of Outliers

Correlation, Regression and Generalization (4Hrs): Correlation and its type, Assessing performance of Regression – Error measures,Overfitting and Underfitting

Regression Types (6hrs):Univariate Regression ,Multivariate Linear Regression,Regularized Regression - Ridge Regression and Lasso, Theory of Generalization: Bias and Variance Dilemma, Training and Testing Curves, CaseStudy of Polynomial Curve Fitting, Cross validation

---

SECTION-II

Topicsand Contents(4hrs): Introduction to probabilistic models, some examples of probabilistic models, noisy channel model, source channel model, joint source channel models, Monte Carlo Simulation

Building blocks of probability models (5hrs), various distributions (Bernoulli, Binomial, Normal distribution), Key Concepts in Probability Distributions, mixture models, bootstrap maximum likelihood methods, Bayesian method, expectation maximization

Markov-chain models(5Hrs), Hidden Markov model, Conditional random fields, Latent variable probability models

List of Tutorials:(Any Three)
1. Consider the following set of points:{(-2,-1),(1,1),(3,2)}
a. Find the least square regression line
For the given data points.
b. Plot the given points and the regression line in the same rectangular system of axes.
2. Find the Standard Deviation,Variance,Mean,Median,Modeforthefollowingdata7,11,1
1,15,20,20,28.
3. A2-Ddatasetisgivenbelow.
4. C1=X1={(4,1),(2,4),(2,3),(3,6),(4,4)}
5. C2=X2={(9,10),(6,8),(9,5),(8,7),(10,8)}
6. Calculate the dimensionality reduction using linear discriminant analysis.
1. Find the coefficient of Regression for the following
dataX12 3 4 5 6 7 8 9
Y9 8 10 12 11 13 14 16 15
2. Find whether Null-Hypothesis is correct or not using One-Way ANNOVAABC
23 4
45 6
67 8
6. Solve Poisson Regression model problem using a workable example.

Find the Principal Components for Z1, Z2 for the following matrixA
$_T$ = 2 1 0 -1
4 3 1 0.5
8. ADieisthrown6-times.If getting an odd number is a success what is the probability of
i. 5-Success
ii. Atleast 5-Success
iii. Atmost 5-Success
9. If a fair coin istossed10timesthen find the probability of
i. Exactly 6 heads
ii. Atleast 6 heads
iii. Atmost 6 heads
10. In a bolt factory, Machines A, B and C manufacture respectively 25%, 35% and 40% of the total bolts. Out of their total output 5, 4 and 2 percentage are respectively defective bolts. A bolt is drawn at random from the product. If the bolt is defective, what is the probability that the Bolt is manufactured by Machine B.

List of Practical's: (Any Six)
1. Least square estimate
2. Ridge and Lasso
3. Cross Validation
4. Factor analysis
5. Principal component analysis
6. Noisy channel model
7. Source channel model
8. Maximum likelihood method
9. Expectation maximization
10. Markov chains

11. Hidden Markov model

List of Course Projects:
1. Implement linear regression to predict housing price using the Housing dataset of Boston.
2. Implement Logistic regression to do credit score prediction using German credits score dataset and perform cross validation.
3. Implement factoranalysis to find the important features out of all features present in the Student Performance Dataset.
4. Implement Principal Component analysis to identify the crucial features out Of all features present in the Breast cancer dataset.
5. Implement Regularization techniques to overcome overfitting and underfitting for the Melbourne housing dataset .
6. Perform comparision analysis using various models
7. Compare Budgets of National Film Awards-nominated Movies with the number Movies Winning These Awards (linear regression)
8. Implement different feature selection techniques on any data set.

List of Course Seminar Topics:
Least square estimation
2. Linear discriminantanalysis
3. Linear Regression
4. Logistic Regression
5. Anova
6. Ancova
7. Root mean square error
8. Poisson Regression
9. Principal Component analysis
10. Entropy estimation
11. Biased sample
12. Kappa statistics

List of Course Group Discussion Topics:
1.Noisy channel model
2. Source channel model
3. Monte carlo simulation
4. Binomial Distribution
5. Normal Distribution
6. Markov chain model
7. Bootstrap maximum likelihood methods
8. Bayesian Method
9. Performance Evaluation Metrics for Regression problems
10. Measures of central tendency vs measures of variability
11. Avoiding overfitting and underfitting in classifier

List of Home Assignments:
Design:
1. Heart disease prediction
2. Customer Review classification
3. Sensorless drive diagnosis
4. Default creditcard client classification
5. Devnagri handwritten character classification
Case Study:
1. Classification models
2. Regression models
3. Maximum likelihood
4. Generalized linear discriminantanalysis.
5. Conditional Randomfields
Blog
1.Logistic regression

2.Support vector machine
3. Types of error
4. Markov chain model
5. Latent variable probability model
Surveys
1. Random forest vs Decision tree
2. Principal Component analysis
3. Bayesian method
4. Types of distribution
5. Different variance models

Text Books: (As per IEEE format)
1.The Elements of Statistical Learning: Data Mining, Inference, and Prediction. By Trevor Hastie, Robert Tibshirani, Jerome Friedman, Hardcover: 745 pages, Publisher: Springer; 2nded.2009,ISBN-10:0387848576
2.Statistical   Models   by   A.C.DavisonPaperback:738pages,Publisher:Cambridge   University Press;1edition(30June2008)ISBN- 10:0521734495CambridgeUniversityPress

Reference Books: (As per IEEE format)
1. S.C.Gupta;"Fundamentals of Statistics 7ᵗʰ Edition"; Himalaya Publishing House Pvt.Ltd.
2.Abdul Hamid Khan, MANOJ KUMAR SRIVASTAVA, and NAMITASRIVASTAVA;"STATISTICAL INFE RENCE:THEORYOF ESTIMATION";PhiLearning

Moocs Links and additional reading material:
1.Statistics tutorial-https://www.youtube.com/channel/UCQKwruq0LY3cjvSx7_M5JAg
2.Inferential   Statistics-
https://www.youtube.com/watch?v=FtlH4svqx4&list=PLSQl0a2vh4HDl0hgK8nIBgBjLji5Eu9ar

Course Outcomes:
Upon completion of the course, student will be able to –
1. Demonstrate various statistical methods used for modeling purpose

2. Analyze various correlation methods that provides insights of the real world problem

3. Apply suitable linear and regression models to evaluate the performance of models

4. Formulate given problem using probabilistic models for concise representation

5. Demonstrate various distribution methods beneficial for model building

6. Apply Markov modeling to compute functions efficiently

Future Courses Mapping:
Machine learning, Deep Learning

Job Mapping:
Job opportunities that one can get after learning this course
1. For all jobs in the domain of AI&DS knowledge of statistical inference is prerequisite. To name a few Big Data Engineer, Business Intelligence Developer, Data Scientist, Machine Learning Engineer, Research Scientist, AI Data Analyst, Product Manager, AI Engineer, Robotics Scientist, Machine Learning Architect etc.

CO - PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	1	2	1					1	3	2	3	
CO2	3	2	2	1	1	1	1					2	3	2	3	
CO3	3	2	2	2	1	2	1					2	3	2	3	
CO4	3	2	2	2	1	1	1					2	3	2	3	2
CO5	3	2	2	1	1	1	1					1	3	2	3	
CO6	3	2	2	2	1	1	1					1	3	2	3	
Average	3	2	2	1.5	1	1.33	1					1.5	3	2	3	2

FFNo.: 654

AI3004 : MACHINE LEARNING

Course Prerequisites:
1. Linear Algebra, Statistics, Probability, Calculus, and Programming Languages

Credits:s 04   **Teaching Scheme Theory: 01** Hours/Week
                                      Tut: 01 Hours/Week
                                      Lab: 02 Hours/Week

Course Relevance:
Machine Learning is the applicable science of making computers work without being explicitly programmed. It is mainly an application of Artificial Intelligence (AI) that allows systems to learn and improve from experience, without any human intervention or assistance. Machine Learning keeps on innovating every aspect of the business and has been shaping up the futures even more powerfully now.Machine learning is the fuel we need to power robots, alongside AI. With ML, we can power programs that can be easily updated and modified to adapt to new environments and tasks- to get things done quickly and efficiently. Machine learning skills help you expand avenues in your career

---

SECTION-I

Types of Learning: Supervised, Unsupervised, Reinforcement**. Concept Learning:** Concept Learning, General-to-Specific Ordering: Task, search, Find S algorithm, Version space and the candidate elimination algorithm, inductive bias, Bias, Variance, Underfitting, Overfitting.

Decision Tree Learning: Representation, Basic decision tree learning algorithm, Issues in decision tree learning, and Random Forest Model.

Validation: Cross validation, Confusion matrix.

Bayesian Learning: Probability, Bayesian Learning: Bayes theorem,Naïve Bayes algorithm, Maximum likelihood hypothesis. **Ensemble Learning:** Bagging and boosting.

SVM: Kernel functions, Linear SVM, Nonlinear SVM, Hyper parameter tuning, Handling Imbalanced Data set. KNN Model.

SECTION-II

Clustering Algorithms- Unsupervised learning, clustering. Partition based clustering, K-means and K-medoid, Hierarchical clustering, Density based clustering algorithms.

Association rules mining – Apriori Algorithm, Confidence and Support parameters. Introduction to Hidden Markov model, Genetic algorithm.

Dimensionality Reduction Techniques: PCA, SVD etc.

Reinforcement learning: Exploration, Exploitation, Rewards, Penalties, Markov Decision Process, Q-Learning and Bellman Equation.

Artificial Neural Networks: Basics of ANN, Feed Forward Neural Networks, Deep neural networks etc.

List of Tutorials: (any six)
1. Feature Selection Techniques
2. Supervised Learning
3. Unsupervised Learning
4. Reinforcement Learning
5. SVM
7. Item based Recommender system
8. Shallow Neural Networks
10. Key concepts on Deep Neural Networks
11. Practical aspects of deep learning ,Optimization Algorithms
12. Hyperparameter tuning, Batch Normalization, Programming Frameworks
13. Bird recognition in the city of Peacetopia (case study)
14. Autonomous driving (case study)
15. The basics of ConvNets
16. Detection Algorithms
19. Special Applications: Face Recognition & Neural Style Transfer
20. Natural Language Processing and Word Embeddings
21. Sequence Models and Attention Mechanism

List of Practical's: (Any Six)

1. Apply data preprocessing techniques to make data suitable for machine learning.

2. Train the system using data set obtained from UCI ML repository. Use a partition of the same data set as a test set to determine accuracy using Decision Tree.

3. Train the system using data set obtained from UCI ML repository. Use a partition of the same data set as a test set to determine accuracy using Random Forest.

4. Train the system using data set obtained from UCI ML repository. Use a partition of the same data set as a test set to determine accuracy using Naïve Bayes.

5. Implement Find-S algorithm.

6. Train the system using data set obtained from UCI ML repository. Use a partition of the same data set as a test set to determine accuracy using SVM

7. Train the system using data set obtained from UCI ML repository. Use a partition of the same data set as a test set to determine accuracy using KNN classifier.

8. Train the system using data set obtained from UCI ML repository. Use a partition of the same data set as a test set to determine accuracy using Kmeans clustering

9. Implement the ANN algorithm on a data set obtained from UCI ML repository

10. Apply PCA and SVD on a data set obtained from UCI ML repository

11. Implement basic Natural Language Processing techniques.

12. Implement word2Vec Model for the problem of your choice.

List of Course Projects:
Following types of problem statements can be taken for course project.

1. Sentiment analysis of movie /restaurant dataset

2. Possibility of heart attack based on text data.

3. Market basket analysis

4. Credit Card Fraud Detection

5. Handwritten Digit Recognition

6. Image Caption Generator

7. Movie Recommendation System

8. Cancer Classification

9. Traffic Signs Recognition

10. Customer Segmentation using Machine Learning

11. Uber Data analysis

12. Loan prediction

13. HVAC needs forecasting

14. Customer relationship management

15. Clinical decision support systems

16. Fraud detection

17. Portfolio & Price Prediction

18. Smart Building Energy Management System

19. Quick analysis of quality of cereals, oilseeds and pulses

20. Building a Recurrent Neural Network

21. Operations on Word vectors

22. Neural Machine translation with attention

List of Course Seminar Topics:

1. Validation

2. Naive Bayes Algorithm

3. Machine and Privacy

4. Limitations of ML

5. Ensemble Learning

6. Dimensionality reduction algorithms

7. Comparison of Machine Learning algorithms

8. Feature Extraction In Machine Learning

9. Reinforcement Learning

10. Probabilistic Model

11.Dropout: a simple way to prevent neural networks from overfitting,

12.Deep Residual Learning for Image Recognition

13. Batch Normalization: Accelerating Deep Network Training by Reducing Internal Covariate Shift

14. Large-Scale Video Classification with Convolutional Neural Networks

15. Generative adversarial nets

16. High-Speed Tracking with Kernelized Correlation Filters

17. Do we need hundreds of classifiers to solve real world classification problems

18. A survey on concept drift adaptation

List of Course Group Discussion Topics:

1. Supervised Vs Unsupervised

2. Univariate Vs Multivariate analysis

3. Accuracy measuring methods

4. Bias Vs Variance Tradeoff

5. Data Reduction Vs Dimensionality reduction

6. Continuous Vs Discrete variables

7.Feature Extraction Vs Automatic Feature detection

Textbooks
1. T. Mitchell, ― Machine Learning, McGraw-Hill, 1997.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012

Reference Books: (As per IEEE format)

1. EthemAlpaydin, "Introduction to Machine Learning", MIT press, 2004.

2. "Data mining: concepts and techniques", Jiawei Han and Micheline Kamber the   Morghan Kaufman, 2001.

3. J. Gabriel, Artificial Intelligence: Artificial Intelligence for Humans (Artificial Intelligence, Machine Learning), Create Space Independent Publishing Platform, First edition , 2016

Moocs Links and additional reading material:
   1.

Course Outcomes:
The student will be able to –
   1. Demonstrate knowledge learning algorithms and concept learning.
   2. Evaluate Decision tree learning algorithm.
   3. Formulate a given problem within the Bayesian learning framework and SVM.
   4. Apply different clustering algorithms used in machine learning.
   5. Explore Association rule mining and dimensionality reduction.

   8. Analyze research-based problems using Machine learning techniques like Reinforcement Learning and ANN.

Future Courses Mapping:
   1.Deep Learning

Job Mapping:
Job opportunities that one can get after learning this course
1. ML Engineer

2. Data Scientist

CO - PO Mapping:

CO/PO	ProgramOutcomes(PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2				2						1	1				
CO2	3	3	3	3	2						2		2			
CO3	3	3	3	3	3				2		2		2			
CO4	3	2	2	2	2				2		2		3		3	
CO5	3	2	2	2	2						2		3			2
CO6	3	3	2	3	3				3		3	3	3		2	2
Average	2.83	2.6	2.4	2.6	2.3				2.3		2	2	2.6		2.5	2

AI2012 : Design Thinking V

Course Prerequisites:

Basic knowledge of research work, research paper and patent.

Course Objectives:

1. Understand the concepts of design thinking approaches
2. Apply both critical thinking and design thinking in parallel to solve problems
3. Apply some design thinking concepts to their daily work
4. To provide ecosystem for students and faculty for paper publication and patent filing

Credits: 1   **Teaching Scheme Tut:** 1 Hour/Week

Course Relevance:

The course is offered in S.Y. and T.Y. B.Tech. to all branches of Engineering.

Contents for Design Thinking:

Structure of The paper Journal List (Top 50 Journals) Selection of the journal

Use of various online journal selection tools Plagiarism checking

Improving contents of the paper Patent drafting

Patent search Filing of patent

Writing answers to reviewer questions Modification in manuscript

Checking of publication draft

Assessment Scheme:

Publication of paper or patent

Course Outcomes:

On completion of the course, learner will be able to– CO1:

Understand the importance of doing Research

CO2: Interpret and distinguish different fundamental terms related to Research

CO3: Apply the methodology of doing research and mode of its publication

CO4: Write a Research Paper based on project work

CO5: Understand Intellectual property rights

CO6: Use the concepts of Ethics in Research

CO7: Understand the Entrepreneurship and Business Planning

CO-PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	2	1	3	1	3	2	2	2	1	2	2	3	3
CO2	2	2	3	3	2	2	2	3	2	2	1	3	2	3	3	3
CO3	2	2	2	2	2	2	2	3	2	2	3	3	2	3	3	3
CO4	2	2	2	2	2	2	1	3	2	2	2	1	2	3	3	3
CO5	2	2	2	2	2	2	2	3	2	2	2	3	3	2	2	3
CO6	2	2	2	2	2	2	2	3	2	2	2	1	3	2	2	2
CO7	2	2	2	2	2	2	2	3	2	2	2	3	3	3	3	3
Average	2	1.9	2.1	2.1	1.9	2.1	1.7	3.0	2.0	2.0	2.0	2.1	2.4	2.6	2.7	2.9

AI2020 - Engineering Design & Innovation V

Course Prerequisites:
    Problem Based Learning

Course Objectives:
1. To develop critical thinking and problem solving ability by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student-centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
6. To develop an ecosystem to promote entrepreneurship and research culture among the students.

Credits: 4   **Teaching Scheme :   Theory: 1** Hours/Week
                                                           Lab: 6 Hours/Week

Course Relevance:

Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Along with course-based projects, the curriculum can be enriched with semester-long Engineering Design and Development courses, in which students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy, and Swaccha Bharat Abhiyan. To gain the necessary skills to tackle such projects, students can select relevant online courses and acquire skills from numerous sources under guidance of faculty and enrich their knowledge in the project domain, thereby achieving project centric learning. Modern world sustained and advanced through the successful completion of projects. In short, if students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. Project based learning will also redefine the role of teacher as mentor in the learning process. The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to nalyze, design and apply categories of Bloom's Taxonomy.

SECTION I

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ED, laboratory course contents of "Trends in Engineering Technology" are designed as a ladder to extend connectivity of software technologies to solve real world problems using an interdisciplinary approach. The ladder in the form of gradual steps can be seen as below:

Industry Communication Standards, Single Board Computers and IoT, Computational Biology (Biomedical and Bioinformatics), Robotics and Drone, Industry 4.0 (Artificial Intelligence, Human-Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Text Books: (As per IEEE format)
1. *A new model of problem based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017*

2. *Problem Based Learning. By Mahnazmoallem, woei hung and Nada Dabbagh, Wiley Publishers. 2019.*
3. *Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert RobartCapraro, Mary Margaret Capraro*

Reference Books: (As per IEEE format)
1. *De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-basedlearning in engineering. Rotterdam: Sense Publishers. 2007.*
2. *Project management core textbook, second edition, Indian Edition , by Gopalan.*
3. *The Art of Agile Development. By James Shore & Shane Warden.*

Moocs Links and additional reading material:

1. www.nptelvideos.in

Course Outcomes:
On completion of the course, learner will be able to–
CO1: Identify the real life problem from a societal need point of view
CO2: Choose and compare alternative approaches to select the most feasible one
CO3: Analyse and synthesize the identified problem from a technological perspective
CO4: Select the best possible solution to solve the problem.
CO5: Design & Develop a working model of the proposed solution.
CO6: Testing and validating product performance

Future Courses Mapping:
 Major Project

Job Mapping:
 Software Engineer. Software Developer, IT Engineer, Research Associate.

CO - PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2					3	2	2	2	2			3
CO2	2	2	3	2	2		2		3	2	2	2	3	3	2	3
CO3	2	2	3	2	3		2		3	2	2	2	3	3	2	3
CO4	2	2	3	2	3	3		2	3	2	2	2	2	3	3	3
CO5	2	2	3	2	3	2			3	2	2	2	3	3	3	3
CO6	2	2	3	3	2				3		3	2	3	2		3
Average	2.0	2.0	2.83	2.16	2.6	2.5	2.0	2.0	3.0	2.0	2.16	2.0	2.66	2.8	2.5	3.0

AI3010: DEEP LEARNING

Course Prerequisites:

Linear algebra, probability theory and statistics, Digital signal processing, Computer vision

Course Objectives:

1. To present the mathematical, statistical and computational concepts for stable representations of high-dimensional data, such as images ,text

2. To introduce NN and techniques to improve network performance

3. To introduce Convolutional networks

4. To introduce Sequential models of NN

5. To build deep nets with applications to solve real world problem

Credits: 4   **Teaching Scheme Theory:** 2 Hours/Week
                                                              Tutorial: 1 Hours/Week
                                                                   Lab: 2 Hours/Week

Course Relevance:

Deep learning is revolutionizing the technology and business world today. It is a subfield of machine learning concerned with algorithms to train computers to perform tasks by exposing neural networks to large amounts of data, its analysis and prediction. It is an incredibly powerful field with capacity to execute feature engineering on its own, uses multiple neural network layers to extract patterns from the data. Top applications of Deep learning involve, self-driving cars, natural language processing, robotics, finance, and healthcare.

SECTION-I
Foundations of neural networks and deep learning, Logistic regression as a neural network, different activation function, logistic regression cost function, logistic regression gradient descent, vectorizing logistic regression, forward and backward propagation, Techniques to improve neural networks: regularization and optimizations, hyperparameter tuning, batch normalization, data augmentation, deep learning frameworks, Implementation of neural network for a case study. Convolutional Neural Networks, padding, strided convolution, pooling layers, convolutional implementation of sliding windows

SECTION-II
Deep Learning Basics, Deep Feed forward Networks, Regularization of deep learning, Transfer Learning, Applications. Implementation of Long-Short Term Memory (LSTMs) with keras and tensor flow in python. Over fitting concepts, Stochastic gradient descent optimizer, encoders decoders, Generative network GANs, Memory nets, Attention models. Applications: object classification, object detection, face verification. ResNet, inception networks, bounding boxes, anchor boxes. Sequence modelling: recurrent nets, architecture, vanishing and exploding gradient problem, Applications & use cases.

List of Tutorials: (any six)
1. Deep learning for Stock Market Clustering
2. Application of Deep Networks in healthcare
3. Credit card fraud detection
4. Classification of skin cancer with deep neural networks
5. ALEXNET
6. VCGNET
7. Accelerating Deep Network Training by Reducing Internal Covariate Shift
8. Deep learning applications for predicting pharmacological properties of drugs
9. GAN (Generalised Adversial network)
10. Auto encoders
11. LSTM

List of Lab Assignments:
1. Write Python/R code to implement Neural Network.
2. Write Python/R code to implement Convolutional Neural Network.
3. Write Python/R code to implement Recurrent Neural Network.
4. Write Python/R code to perform Data Augmentation.
5. Write Python/R code to implement LSTM.
6. Write Python/R code to implement GAN.
7. Write Python/R code to implement Sequence Modelling.
8. Write Python/R code to implement Transfer Learning.
9. Write Python/R code to implement Deep Learning model for text analysis.
10. Write Python/R code to implement Deep learning model for Time Series analysis.

List of Course Group Discussion Topics:
1. Recurrent or Recursive Networks for sequential Modelling?

2. Initializing network weights vsperformance

3. Difficulty of training deep feedforward neural networks
4. Hyperparameter tuning: Is there a rule of thumb?
5. Problem of overfitting: How to handle?
6 Which cost function: Least squared error or binary cross entropy?
7. How to tackle with loss of corner information in CNN
8. Need of hundred classifiers to solve real world classification problem
9. Which optimization: Batch gradient descent of stochastic gradient descent
10. Activation functions: Comparison of trends
11. Remedy of problem of vanishing gradient and exploding gradient in RNN

List of Home Assignments:
Design:
1. Deep learning for library shelf books identification
2. Development of control system for fruit classification based on convolutional neural networks
3. Classifying movie review using deep learning
4.Sentiment analysis of the demonetization of economy 2016India
5. Predicting Students Performance in Final Examination

Case Study:
1. Deep learning for security
2. Bag of tricks for efficient text classification

3. Convolutional Neural Networks for Visual Recognition
4. Deep Learning for Natural Language Processing
5. Scalable object detection using deep neural networks

Blog :
1. Brain tumor segmentation with deep neural networks
2. Region-based convolutional networks for accurate object detection and segmentation
3. Human pose estimation via deep neural networks
4. Content Based Image Retrieval
5. Visual Perception with Deep Learning
6. Music genre classification system

Surveys:
1. Machine translation using deep learning -survey
2. Shaping future of radiology using deep learning
3. Training Recurrent Neural Networks
4. Text generation with LSTM
5. Deep learning applications in Biomedicine

Textbooks
1. Goodfellow, I., Bengio, Y., and Courville, A., Deeep Learning, MIT Press,2016.
2.Nikhil Buduma, Fundamentals of Deep Learning, O'Reilly, First Edition, ISBN No. 978-14-9192561-4

Reference Books
   1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd,2009.

   2. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
   3. 3.SatishKumar,NeuralNetworks:AClassroomApproach,TataMcGraw-HillEducation, 2004.

Moocs Links and additional reading material:

   1. www.nptelvideos.in
   2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs11
   3. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs50

Course Outcomes:

The student will be able to –

1) Illustrate logistic regression model, structured as a shallow Neural network

2) Build and train a deep Neural Network

3) Apply techniques to improve neural network performance

4) Demonstrate understanding of functionality of all layers in a convolutional neural network

5) Understand and Apply Architecture of Generative Adversarial Networks

6) Demonstrate Understanding of Recurrent nets and their applications

Job Mapping:
 Job opportunities that one can get after learning this course
   1. ML Engineer

   2. Data Scientist

CO - PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0
CO2	3	2	2	0	2	0	0	0	2	0	1	3	2	0	3	0
CO3	3	2	0	2	0	0	0	0	2	0	0	2	2	0	2	2
CO4	2	0	0	2	0	0	0	0	2	0	2	2	0	0	2	3
CO5	2	0	2	0	2	0	0	0	0	0	3	2	2	0	3	0
CO6	2	3	2	2	2	0	0	0	0	0	3	2	2	0	2	2
Average	2.33	2.3	2	2	2	0	0	0	2	0	2.25	2.3	2	0	2.4	2.33

AI3011 : Complexity Algorithms

Course Prerequisites:

1. Basic course on Programming, Data structures, Discrete structures

Course Objectives:

1. Formulate a given computational problem in an abstract and mathematically precise manner.

2. Choose a suitable paradigm to design algorithms for given computational problems.

3. Understand asymptotic notations and apply suitable mathematical techniques to find algorithms' asymptotic time and space complexities.

4. Understand the notion of NP-hardness and NP-completeness and the relationship with the intractability of decision problems.

5. Apply randomized, approximation algorithms for given computational problems.

Credits: 4   **Teaching Scheme Theory: 2** Hours/Week
                                                                Tut: 1 Hours/Week
                                                                Lab: 2 Hours/Week

Course Relevance:

This is an important course for AI-DS Engineering. It develops the algorithmic thinking capability of students. Designing algorithms using suitable paradigms and analyzing the algorithms for computational problems has a high relevance in all domains of IT(equally in Industry as well as research). Once the student gains expertise in Algorithm design and in general gains the ability of algorithmic thinking, it facilitates in systematic study of any other domain (in IT or otherwise) which demands logical thinking. This course is also relevant for students who want to pursue research careers in theory of computing, computational complexity theory, advanced algorithmic research.

SECTION-I

Basic introduction to time and space complexity analysis: Asymptotic notations (Big Oh, small oh, Big Omega, Theta notations). Best case, average case, and worst-case time and space complexity of algorithms. Overview of searching, sorting algorithms. Adversary lower bounds (for the comparison-based sorting algorithms, for finding second minima). Divide and Conquer: General strategy, Binary search and applications, Analyzing Quick sort ,Merge sort, Counting Inversions, finding a majority element, Order statistics(randomized and deterministic algorithms, simple dynamic programming based algorithms to compute Fibonacci Numbers, Optimal binary search tree(OBST)construction, 0- 1 Knapsack, Traveling Sales person Problem, All pair shortest path algorithm, Longest increasing subsequence problem

SECTION-II

Greedy strategy: General strategy, Analysis and correctness proof of minimum spanning tree and shortest path algorithms, fractional knapsack problem, Huffman coding, conflict free scheduling.
Backtracking strategy: General strategy, n-queen problem, backtracking strategy for some NP complete problems(e.g. graph coloring, subset sum problem, SUDOKU)
Introduction to Complexity Classes and NP-completeness: Complexity classes P, NP and their interrelation, Notion of NP-hardness and NP-completeness,
Introduction to Randomized and Approximation algorithms: Introduction to randomness in computation, Las-Vegas and Monte-Carlo algorithms, Abundance of witnesses/solutions and application of randomization, solving SAT for formulas with "many" satisfying assignments, randomized quick sort, majority search, coupon collector problem, randomized data structures (randomized BST, skip lists)

List of Tutorials:
1. Complexity analysis based on asymptotic notations, solution recurrences.

2. Complexity analysis based on Divide and Conquer strategy.

3. Complexity analysis based on Divide and Conquer strategy.

4. Complexity analysis based on Dynamic Programming strategy.

5. Complexity analysis based on Dynamic Programming strategy.

6. Complexity analysis based on Greedy strategy.

7. Complexity analysis based on Backtracking strategy.

List of Practical's: (Any Six)

1. **Basics:** Find out Big - Oh and Big – Omega of the function. Take necessary data like degree of the function, coefficients, etc… .

2. **Some Basic Algorithms:** Write an algorithm and find the efficiency of the same for following problems:

    a. Finding Factorial – Iterative Approach
    b. Finding Factorial – Recursive Approach
    c. Printing Fibonacci Series – Iterative Approach
    d. Printing Fibonacci Series – Recursive Approach

3. **Basic Sorting and Searching Techniques:** Assignment based on analysis of quick sort(deterministic and randomized variant).

4. **Divide and Conquer Approach:** Assignment based on Divide and Conquer Strategy(e.g. majority element search, finding k^{th} rank element in an array).

5. **Divide and Conquer Approach:** Assignment based on Divide and Conquer strategy (e.g. efficient algorithm for Josephus problem using recurrence relations, fast modular exponentiation).

6. **Dynamic Programming:** Assignment based on Dynamic Programming strategy(e.g., All pair shortest path, Traveling Sales Person problem).

7. **Greedy Approach:**

    Design an algorithm and implement a program to solve:
    a. Making Change Problem
    b. Knapsack Problem
    c. Huffman encoding

8. **Backtracking:** Assignment based on Backtracking(e.g. graph coloring-queen problem).

9. **Randomized Algorithms:** Assignment based on Las-Vegas and Monte-Carlo algorithm for majority element search.

10. **Approximation Algorithms:** Assignment based on factor-2 approximation algorithm for metric - TSP

List of Course Projects:
1. Applications of A* algorithm in gaming.

2. Pac-Man game.

3. Creation /Solution of Maze (comparing the back tracking based solution and Dijkstra's algorithm).

4. Different exact and approximation algorithms for Travelling-Sales-Person Problem.

5. Knight tour algorithms.

6. Network flow optimization and maximum matching.

7. AI for different games such as mine sweeper ,shooting games, Hex,connect-4,sokoban,etc.

8. SUDOKU solver.

9. Algorithms for factoring large integers. 10. Randomized algorithms for primality testing (Miller-Rabin, Solovay- Strassen).

List of Course Seminar Topics:
1. Complexity classes

2. Space complexity

3. Divide and Conquer Vs Dynamic Programming

4. Greedy strategy Vs Backtracking strategy

5. Dynamic Programming Vs Greedy

6. Computational Complexity

7. Comparison of P Vs NP problems

8. Compression Techniques

List of Course Group Discussion Topics:
1. Greedy Algorithms Vs. Dynamic Programming strategy

2. Dynamic Programming Vs Greedy

3. NP-completeness

4. P Vs NP problems

5. Paradigms for algorithm design

6. Different Searching techniques

7. Relevance of Cook-Levin theorem

8. Randomness in computation

List of Home Assignments:
1. **Design:**

    1. Divide and Conquer strategy for real world problem solving
    2. Dynamic Programming strategy for real world problem solving
    3. Problems on Randomized Algorithms
    4.Problems on NP completeness
2. **Case Study:**

    1. Encoding techniques
    2. Network flow optimization algorithms
    3. Approximation algorithms for TSP
    4. Sorting techniques
3. **Blog**

    1. When do Randomized Algorithms perform best
    2. Applications of Computational Geometry Algorithms
    3. Role of number-theoretic algorithms in cryptography
    4. Performance analysis of Graph Theoretic Algorithms
4. **Surveys**

    1. Primality Testing Algorithms
    2. Integer Factoring Algorithms
    3. Shortest Path Algorithms
    4. Algorithms for finding Minimum Weight Spanning Tree
    5. SAT solvers

Text Books: (As per IEEE format)
1. *Carmen, Leiserson, Rivets and Stein "Introduction to Algorithms",3nd edition,2009.ISBN81-203-2141- 3,PHI*

2. *JonKleinberg,EvaTardos"AlgorithmDesign",1stedition,2005.ISBN978-81-317-0310-6,Pearson*

3. *Dasgupta,Papadimitriu,Vazirani"Algorithms",1edition(September13,2006),ISBN10:9780073523408,ISBN-13:978-0073523408,McGraw-HillEducation*

Reference Books: (As per IEEE format)
1. *Motwani,Raghavan"RandomizedAlgorithms",CambridgeUniversityPress;1edition(August25,1995),ISBN-10:0521474655,ISBN-13:978-0521474658*

2. *Vazirani,"ApproximationAlgorithms",Springer(December8,2010),ISBN-10:3642084699,ISBN13:978-3642084690*

Moocs Links and additional reading material:
1. www.nptelvideos.in

Course Outcomes:
Upon completion of the course, students will be able to –
1. Understand the basic notation for analyzing the performance of the algorithms.

2. To apply appropriate algorithmic paradigms to design efficient algorithms for computational problems

3. To apply suitable mathematical techniques to analyze the asymptotic complexity of the algorithm for more complex computational problems.

4. To understand the significance of NP-completeness of some decision problems and its relationship with the tractability of the decision problems.

5. To understand the significance of randomness, and approximability in computation and design randomized and approximation algorithms for suitable problems

6. To incorporate appropriate data structures, and algorithmic paradigms to craft innovative scientific solutions for complex computing problems

---

Job Mapping:
Job opportunities that one can get after learning this course
1. Software Engineer

2. Data Scientist

3. Business Intelligence

CO - PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2		2	3									2		
CO2	3	2	2			3	2		3						2	
CO3	2	3			3											
CO4			3	2					2		2			2		
CO5	2	2			2	2				2	2		2		3	
CO6	2	3					3	2		2	3				3	
Average	2.2	2.4	2.5	2	2.66	2.5	2.5	2	2.5	2	2	2.0	2	2	2.66	

AI3012: SOFTWARE DESIGN AND METHODOLOGIES

Course Prerequisites:
Proficient of programming in a high-level, object-oriented language, Familiarity with data structures and algorithms.

Course Objectives:
1. Understanding object-oriented analysis and design.

2. Learn different software process models and principles and practices

3. Practicing UML to model OO systems

4. Familiarity with current models and standards for design.

5. Exposure to organizational issues in software design.

6. The skill to analyze problems critically, leveraging both theoretical and technical knowledge to devise solutions and systems

Credits: 4   **Teaching Scheme Theory:** 2 Hours/Week
Tut: 1 Hour/Week
Lab: 2 Hours/Week

Course Relevance: Software Architecture

SECTION-I

Overview of Software Engineering: Software Process Framework, Process Patterns, Process Models: Code-and-Fix, Waterfall Model, Incremental Models, Evolutionary Models, Iterative Development, The Unified Process, Agile process, Software Engineering Principles and Practices. **(4Hours)** \

Software Modeling: Introduction to Software Modeling, Advantages of modeling, Principles of modeling **(2Hours)**
Evolution of Software Modeling and Design Methods: Object oriented analysis and design methods, Concurrent, Distributed Design Methods and Real-Time Design Methods, Model Driven Architecture (MDA), 4+1 Architecture, Introduction to UML, UML building Blocks, COMET Use Case–Based Software Life Cycle.**(4 Hours)**
Requirement Study: Requirement Analysis, SRS design, Requirements Modeling. Use Case: Actor and Use case identification, Use case relationship (Include, Extend, Use case Generalization, Actor Generalization), Use case templat   **(2 Hours)**
Study of classes (analysis level and design level classes)
Methods for identification of classes: RUP (Rational Unified Process), CRC (Class, Responsibilities and Collaboration), Use of Noun Verb analysis (for identifying entity classes, controller classes and boundary classes).   **(2 Hours)**

SECTION-II

Class Diagram: Relationship between classes, Generalization/Specialization Hierarchy, Composition and Aggregation Hierarchies, Associations Classes, Constraints. Object diagram, Package diagram, Component diagram, Composite Structure diagram, Deployment Diagram. (**4 Hours)**

Activity diagram: Different Types of nodes, Control flow, Activity Partition, Exception handler, Interruptible activity region, Input and output parameters, Pins.**(2Hours)**

Interaction diagram: Sequence diagram, Interaction Overview diagram, State machine diagram, Advanced State Machine diagram, Communication diagram, Timing diagram. (**3 Hours)**

Architecture in the Life Cycle: Architectural styles, Architecture in Agile Projects, Architecture and Requirements, Designing an Architecture. (**2 Hours)**

Design Patterns: Introduction, Different approaches to select Design Patterns.**(1 Hour)**

Creational patterns: Singleton, Factory, Structural pattern: Adapter, Proxy. (**1 Hour)**

Behavioral Patterns: Iterator, Observer Pattern with applications**(1 Hour)**

List of Tutorials: (Any Three)
1. Goals of software engineering

2. Software process models, life cycle models

3. Process improvement, Capability Maturity Model

4. Unified Modeling Language(UML)

5. Design patterns

6. Frameworks, software product lines

7. Software architecture

8. Software measurements and metrics

9. Software estimation methods

10. Static and dynamic analysis

11. Version control, configuration management

12. Software quality, verification and validation, software testing

1. **List of Practical's: (Any Six)**
2. To study modeling methodologies and identify their applicability to various categories of projects

3. To understand Requirement Elicitation Techniques and recognize types of requirement while preparing System Requirement Specification.

4. To study MDD/MDA and identify the importance of Model Transformation.

5. To study types of MOF and metamodel concepts for various diagrams in UML2.0.

6. To identify System Scope, Actors, Use Cases, Use Case structuring for a given problem and perform Use Case narration in template form with normal/alternateflows.

7. ToidentifyEntity,Control,Boundaryobjectsandtraceobjectinteractionsforscenariosfrom use cases.

8. Prepare a state chart diagram for given object scenario.

9. TopreparedetailedActivitydiagramwithnotationalcompliancetoUML2.0indicatingclearuse of pins, fork-join, synchronization,datastores

10. To prepare Class diagram for a defined problem with relationships, associations, hierarchies, interfaces, roles and multiplicityindicators.

11. To prepare Component and Deployment diagram for a defined problem.

1. **List of Course Projects:**
2. Wheather prediction system management

3. Agricultural water management system

4. ERP system

5. Hospital Management

6. Railway Reservation

7. Stock market management

8. Parking automation

9. LibraryManagement

10. Online shopping

11. Content management

1. **List of Course Seminar Topics:**
2. Process Models

3. Requirement Engineering

4. Agile Methodology

5. Modelling using UML

6. Analysis and Design in OO systems

7. Principles and Practices of good Software Design

8. Collaborative software development

9. CMMI

10. Component diagram

11. Deployment diagram

List of Course Group Discussion Topics:
1. Traditional Vs Agile

2. Phases of SDLC. Which is more important?

3. UML modeling

4. Analysis Vs Design

5. Design Patterns

6. Design Vs Architecture

7. Architecture style

8. Design Vs Framework

9. Framework Vs Architecture

10. Archetype patterns

List of Home Assignments:
Design:
1. Requirement Engg steps
2. Analysis modeling
3. Design modeling
4. Architechtural styles
5. Design patterns

Case Study:
1. Imaging Software architecture
2. Banking Software architecture
3. ERP Software architecture
4. Online Shopping Software architecture
5. AI Software architecture

Blog:
1. Software Engg Do's and Don'ts
2. Which Process Model?
3. Scrum
4. Devops
5. Data ops

Surveys:
1. Software Design
2. Software Methodologies
3. Software Architectures
4. Design Patterns
5. Architechtural Patterns

Text Books: (As per IEEE format)
1. Hassan Gomaa, "Software Modeling and Design- UML, Use cases, Patterns and Software Architectures", Cambridge University Press, 2011, ISBN 978-0-521-76414-8

2. *Roger Pressman, "Software Engineering: A Practitioner's Approach"‖, McGraw Hill, ISBN 0–07–337597–7*

Reference Books: (As per IEEE format)
1. GardyBooch, James Rambaugh, Ivar Jacobson, "The unified modeling language user guide" , Pearson Education, Second edition, 2008, ISBN 0-321-24562

2. Ian Sommerville, "Software Engineering", Addison and Wesley, ISBN 0-13-703515-2

Moocs Links and additional reading material:
www.nptelvideos.in

Course Outcomes:

1. Upon completion of the course, student will be able to –
2. Summarize capabilities and impact of Software Development Process Models and justify process maturity through application of Software Engineering principles and practices focusing tailored processes that best fit the technical and market demands of a modern software project.
3. Discriminate competing and feasible system requirements indicating correct real world problem scope and prepare stepwise system conceptual model using stakeholder analysis and requirement validation.
4. Formulate system specifications by analyzing User-level tasks and compose software artifacts using agile principles, practices and Scrum framework.

5. Propose and demonstrate realistic solutions supported by well-formed documentation with application of agile roles, sprint management, and agile architecture focusing project backlogs and velocity monitoring.
6. Conform to Configuration Management principles and demonstrate cohesive teamwork skills avoiding classic mistakes and emphasizing on software safety adhering to relevant standards.
7. Analyze the target system properties and recommend solution alternatives by practicing project planning, scheduling, estimation and risk management activities.

Future Courses Mapping:
1. Testing and Quality Assurance
2. Agile and DevOps Methodologies
3. User Experience (UX) Design
4. Security in Software Design

Job Mapping:
Job opportunities that one can get after learning this course
1. Requirements Engineer
2. Software Architecht
3. Software Designer

CO - PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3			3	2							3			
CO2	2	3		2	2			2			2			2		
CO3	2	2		3	2										1	
CO4		3	3		3	2		2							2	
CO5	2	2							2					2		
CO6							2	2			2	3			3	3
Average	2.25	2.6	3	2.5	2.5	2	2	2	2		2	3	3	2	2	3

FF No.: 654

AI3015 : Design Thinking VI

Course Prerequisites:

Basic knowledge of research work, research paper and patent.

Course Objectives:

1. Understand the concepts of design thinking approaches
2. Apply both critical thinking and design thinking in parallel to solve problems
3. Apply some design thinking concepts to their daily work
4. To provide ecosystem for students and faculty for paper publication and patent filing

Credits: 1   **Teaching Scheme Tut:** 1 Hour/Week

Course Relevance:

The course is offered in S.Y. and T.Y. B.Tech. to all branches of Engineering.

Contents for Design Thinking :

Structure of The paper Journal List (Top 50 Journals) Selection of the

journal

Use of various online journal selection tools Plagiarism checking

Improving contents of the paper Patent drafting

Patent search Filing of patent

Writing answers to reviewer questions Modification in manuscript

Checking of publication draft

Assessment Scheme:

Publication of paper or patent

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Understand the importance of doing Research

CO2: Interpret and distinguish different fundamental terms related to Research

CO3: Apply the methodology of doing research and mode of its publication

CO4: Write a Research Paper based on project work

CO5: Understand Intellectual property rights

CO6: Use the concepts of Ethics in Research

CO7: Understand the Entrepreneurship and Business Planning

CO-PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	2	1	3	1	3	2	2	2	1	2	2	3	3
CO2	2	2	3	3	2	2	2	3	2	2	1	3	2	3	3	3
CO3	2	2	2	2	2	2	2	3	2	2	3	3	2	3	3	3
CO4	2	2	2	2	2	2	1	3	2	2	2	1	2	3	3	3
CO5	2	2	2	2	2	2	2	3	2	2	2	3	3	2	2	3
CO6	2	2	2	2	2	2	2	3	2	2	2	1	3	2	2	2
CO7	2	2	2	2	2	2	2	3	2	2	2	3	3	3	3	3
Average	2	1.9	2.1	2.1	1.9	2.1	1.7	3.0	2.0	2.0	2.0	2.1	2.4	2.6	2.7	2.9

AI3016 - Engineering Design & Innovation VI

Course Prerequisites:
Problem Based Learning

Course Objectives:
1. To develop critical thinking and problem solving ability by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student-centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
6. To develop an ecosystem to promote entrepreneurship and research culture among the students.

Credits: 4   **Teaching Scheme :   Theory: 1** Hours/Week
                                                  Lab: 6 Hours/Week

Course Relevance:
Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Along with course-based projects, the curriculum can be enriched with semester-long Engineering Design and Development courses, in which students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy, and Swaccha Bharat Abhiyan. To gain the necessary skills to tackle such projects, students can select relevant online courses and acquire skills from numerous sources under guidance of faculty and enrich their knowledge in the project domain, thereby achieving project centric learning. Modern world sustained and advanced through the successful completion of projects. In short, if students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. Project based learning will also redefine the role of teacher as mentor in the learning process. The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.

SECTION I

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. For all courses of ED, laboratory course contents of "Trends in Engineering Technology" are designed as a ladder to extend connectivity of software technologies to solve real world problems using an interdisciplinary approach. The ladder in the form of gradual steps can be seen as below:

Industry Communication Standards, Single Board Computers and IoT, Computational Biology(Biomedical and Bioinformatics), Robotics and Drone, Industry 4.0 (Artificial Intelligence, Human-Computer Interfacing, 5G and IoT, Cloud Computing, Big Data and Cyber Security etc).

Text Books: (As per IEEE format)
   1. *A new model of problem based learning. By Terry Barrett. All Ireland Society for higher education (AISHE). ISBN:978-0-9935254-6-9; 2017*

2. *Problem Based Learning. By Mahnazmoallem, woei hung and Nada Dabbagh, Wiley Publishers. 2019.*
3. *Stem Project based learning and integrated science, Technology, Engineering and mathematics approach. By Robert RobartCapraro, Mary Margaret Capraro*

Reference Books: (As per IEEE format)
1. *De Graaff E, Kolmos A., red.: Management of change: Implementation of problem-based and project-basedlearning in engineering. Rotterdam: Sense Publishers. 2007.*
2. *Project management core textbook, second edition, Indian Edition , by Gopalan.*
3. *The Art of Agile Development. By James Shore & Shane Warden.*

Moocs Links and additional reading material:

1. www.nptelvideos.in

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Identify the real life problem from a societal need point of view

CO2: Choose and compare alternative approaches to select the most feasible one

CO3: Analyse and synthesize the identified problem from a technological perspective

CO4: Select the best possible solution to solve the problem.

CO5: Design & Develop a working model of the proposed solution.

CO6: Testing and validating product performance

Future Courses Mapping:
     Major Project

Job Mapping:
     Software Engineer. Software Developer, IT Engineer, Research Associate.

CO - PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2					3	2	2	2	2			3
CO2	2	2	3	2	2		2		3	2	2	2	3	3	2	3
CO3	2	2	3	2	3		2		3	2	2	2	3	3	2	3
CO4	2	2	3	2	3	3		2	3	2	2	2	2	3	3	3
CO5	2	2	3	2	3	2			3	2	2	2	3	3	3	3
CO6	2	2	3	3	2				3		3	2	3	2		3
Average	2.0	2.0	2.83	2.16	2.6	2.5	2.0	2.0	3.0	2.0	2.16	2.0	2.66	2.8	2.5	3.0

FF No.: 654

IT4219 : FROM CAMPUS TO CORPORATE

Course Prerequisites:
1. Fundamental knowledge about Engineering
2. Basic knowledge about business concept
3. Management Knowledge

Course Objectives:
1. Understanding the evolution of technology
2. Understanding Innovation
3. Types of companies and typical organization - Who does What
4. Understanding companies - Domain, Offering, Customers, Strategy, Company Culture & Professionalism
5. Understanding companies financially

Credits: 2   **Teaching Scheme Theory:** 2 Hours/Week

Course Relevance:

The course is offered in B.Tech. to all branches of Engineering

The course is relevant to all branches of Engineering and beyond, since students work in different companies after graduation. So understanding the way different types of companies work is essential for students in final year.

SECTION I

Planning and Execution : Product Development - Understanding beyond the theory, Quality - Understanding beyond the theory, Product Management, Solutioning and Design - A key step between requirements and delivery, Site Reliability , Devops, Support - Understanding beyond the theory, Common metrics and measurements in a software delivery organization   **(6 Hours)**

Key Tool types and processes - End to End product lifecycle management, Issues Management and Lifecycle - A key aspect of customer Satisfaction, Software delivery models and Release cycles - how they work in the real world, Usability by end user - UI/UX and other key concepts and its importance   **(6 Hours)**

SECTION II

Useful Skills : Continuous learning and improvement - An essential skill, Ownership and Leadership, Analyzing ones career path and making educated judgements, Time management and multi tasking model, Being a effective Mentee and Mentor, Being Inquisitive: Why asking questions is more difficult than giving answers? Hands on exercise   **(6 Hours)**

Effective Articulation and Colaboration, Introducing yourself & Making Effective Presentations, Problem breakdown and resolving model, Effective project and program management, Mind Mapping - A powerful technique to learn, Must have tips to succeed in any career   **(8 Hours)**

List of Home Assignments:

Case Study: Unique Home assignments will be set up for all groups

Additional reading material:
  1. https://drive.google.com/drive/folders/1RmffPScbEnKLdz0_LhWJxoAYZL9mWiGs?usp=sharing

Course Outcomes:

Upon completion of the course, student will be able to –
  1. Understand essential skills to develop and thus the experience to look forward to for students joining the Industry
  2. Demystify the gap between theory and practice and learn via case studies on application of knowledge
  3. Understand Key concepts about the area Implement supervised algorithms for classification and prediction
  4. Understand and learn techniques and methods to imbibe and use

Job Mapping:
 Job opportunities that one can get after learning this course
  1. Business Analyst
  2. Infrastructure Architect
  3. Enterprise Architect
  4. Project Manager
  5. Design Engineer

AI4001: BLOCKCHAIN &CYBER SECURITY

Course Prerequisites:

Computer Networks, knowledge of any programming Language (C/C++/Java/Python)

Course Objectives:

1.To study basics of Blockchain Technology, its applications and different types of use cases

2.To acquire know ledge of smart contract sin ethereum Blockchain and Hyperledger fabric.

3. To acquire knowledge of standard algorithms and protocols employed to provide confidentiality, integrity and authenticity.

4. To deploy encryption techniques to ensure data in transit across data networks.

5. To enhance awareness about Personally Identifiable Information (PII),Information Management, cyber forensics

Credits:2   **Teaching Scheme Theory:**2Hours/Week

Course Relevance:

During the course, students will earn more about the history, the most important block chain concepts, the philosophy of decentralization behind blockchain, and main discussions happening with in the block chain environment. In addition, you will learn about (potential)applications of block chain and the impact it could have on the business world. This course Provides an in depth study of the rapidly changing and fascinating field of computer forensics. Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes. Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools E-evidence collection and preservation, investing at in operating systems and file systems, network forensics, art of steganography and mobile device forensics.

SECTION-I
Topics and Contents   **Introduction to Blockchain:**Features & Industry Applications of Blockchain, Centralized & Decentralized System with Examples, Decentralized System & Distributed Ledger Technology   Blockchain Computing Power, Hash & Merkle Tree with Handson Examples, Multiple Use-Cases of Block chain as per different industries and government, Blockchain for Technology: Blockchainin Technology, Business and Management, Different Types of Blockchain, Public Blockchain,

Private Blockchain, Federated Blockchain with Examples and Difference, Digital Signatures and Demo of Blockchain Tools, Blockchain Applications and usecases in Government

Real Time Use Case Applications in Blockchain: Consensus and Types of Consensus with examples Smart Contracts in Blockchain, Need of Smart Contracts with Examples Practical Hands-On with Smart Contracts, Developing   Smart Contracts, Industry use cases of Smart Contracts, Smart Contracts for Business and Professionals: Smart Contracts in Detail Developing own Smart Contracts, Programming basics of Solidity (DataTypes) and Advanced Solidity, EV Min relation with Smart Contracts and Gas Price, Running and Debugging Smart Contracts in Remix (Detailed),

Deploy and Debug Smart Contract with Truffle Smart Contracts in Ethereum Blockchain, Crypto-Economics and Cryptocurrency, Types of Cryptocurrency and Cryptography, Cryptonomics and Cryptocurrency Transactions, Validand Invalid Transactions, Previous use cases of Cryptocurrency, Bitcoin in detail: How Bitcoin System works, Decentralized Cryptocurrency and its use cases, Making your own Cryptocurrency with Development and deployment, Permissioned Blockchain (RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance), Blockchain for Enterprise–Overview, Blockchain Components and Concepts, Hyperledger Fabric–Transaction Flow Hyper ledger Fabric Details, Fabric–Membership and Identity Management, Hyperledger Fabric Network Setup, Fabric Demoon IBM Blockchain Cloud, Fabric Demoon IBM Blockchain Cloud continued., Fabric Demo, deploy from scratch, Hyperledger Composer–Application Development, Hyperledger Composer–Network Administration, Blockchain Use Cases.

SECTION-II

Topics and Contents

Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

CYBERCRIMEISSUES: Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses**.**

INVESTIGATION: Introductionto Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital   Evidence   Collection,   Evidence   Preservation,   Email Investigation, Email Tracking, IP Tracking, Email Recovery, Handson Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

DIGITAL FORENSICS: Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.

List of Course Seminar Topics:
1. Different Introduction to Blockchain

2. Types of Blockchain

3. Blockchain Applications and use cases in Government

4. Real Time Use Case Applications in Blockchain

5. Industry use cases of Smart Contracts

6. Smart Contracts in Ethereum Blockchain

7. Bitcoin

8. Blockchain for Enterprise

9. Hyperledger Fabric

10. Hyperledger Composer

List of Course Group Discussion Topics:
1. Introduction to Cyber Space

2. Classification of Malware, Threats

3. Vulnerability Assessment

4. Biometric Authentication Methods

5. Operating System Security

6. Web Security

7. Email Security

8. Mobile Device Security

9. Cloud Security

10. Different Types of Cyber Crimes, Scams and Frauds

11. Stylometry, Incident Handling

12. Digital Forensic Investigation Methods

13. Digital Forensic Investigation Methods

14. Evidentiary value of Email/ SMS, Cyber crimes and Offenses deal twith IPC

15. RBI Act and IPR Act in India

16. Jurisdiction of Cyber Crime, Cyber Security Awareness Tips

List of Home Assignments:
Design:
1.   TCP Scanning Using NMAP.

2.   Port scanning Using NMAP.

3.   TCP/UDP Connectivity using Netcat

4.   Creating wallets and sending cryptocurrency

5.   Starting a Wordpress website

Case Study:
1.   Network Vulnerability using Open VAS

2.   The Practice of Web Application Penetration Testing

To implement SQL injection manually using Damn Vulnerable Web App Crypto-anarchism and Cypherpunks Hash cryptography, mining and consensus Blog

1.   Practical Identification of SQL-Injection Vulnerabilities

2.   Stylometry, Incident Handling

3.   Investigation Methods

4.   Tokenization and trading cryptocurrencies

5.   Smart contracts and dApps

Surveys
1.   Digital Forensic Investigation Methods

2.   Digital Forensics

3.   Virtual Currency

4.   IoT Security

5.   The current state of the Blockchain landscap

Suggest an assessment Scheme: that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Bloom's Taxonomy.

MSE ESE   PPT   GD   VIVA HA

Text Books: (As per IEEE format)

1. Nelson Phillips and Enfinger Steuart,"Computer Forensics and nvestigations", Cengageearning, New De lhi, 2009.

2. Nihad Hassan, Rami Hijazi, Apress,"Digital Privacy and Security Using Windows: A Practical Guide".

3. "Digita lForensics ", DSCI-Nasscom,2012.

4. "Cybe rCrime Investigation",DSCI-Nasscom, 2013

5. Kevin Mandia, Chris Prosise, Matt Pepe,"Incident Response and Computer Forensics", Tata McGraw-Hill, New Delhi, 2006.

Reference Books: (As per IEEE format)

1. Robert M Slade,"Software Forensics", Tata McGraw-Hill, New Delhi,2005.

2. Bernadette H Schell, Clemens Martin,"Cyber crime", ABC–CLIOInc, California, 2004.3." Understanding Forensics in IT", NIIT Ltd, 2005.

Moocs Links and additional reading material:

www.nptelvideos.in

Course Outcomes:
1. Identify threads in cybersecurity.
2. Use tools for digital forensics.
3. Investigate and Analyze data of cybersecurity.
4. Use the blockchain technology for security in real life application.
5. Study and understand the blockchain concepts and tools required for its implementation.
6. Develop the applications of blockchain for solving social problems.

AI4002: OPTIMIZATION TECHNIQUES

Course Prerequisites:

Data structure, computer programming

Course Objectives:

1. To formulate mathematical models of business problems.
2. To learn effective project management and planning of resources.
3. To make optimal utilization of resources.
4. To reduce logistic costs of the supply chain.
5. To understand formulation of optimal strategies in a conflict and competitive environment.
6. To understand the significance and methods of inventory management.

Credits:2   **Teaching Scheme Theory:** 2Hours/Week

Course Relevance: This course is widely applicable in software and manufacturing industries to improve productivity and quality.

SECTION-I

Topics and Contents

Linear Programming: Essentials of Linear Programming Model, Properties of Linear Programming Model, Formulation of Linear Programming, General Linear Programming Model, Maximization & Minimization Models, Graphical Method for Solving Linear Programming problems, Unbounded LP Problem, Additional Variables Used In Solving LPP, Maximization Case, Minimization Problems, Big M Method, Degeneracy in LP Problems, Unbounded Solutions in LPP, Multiple Solutions in LPP.

CPM/ PERT: PERT/CPM Network Components, Rules in Constructing a Network, Scheduling of Activities: Earliest Time and Latest Time, Determination of Float and Slack Times, Critical Path method for project management, Project Evaluation Review Technique–PERT, Ganttchart (timechart). Terminology.

Sequencing: Types of Sequencing Problems, Algorithm for Solving Sequencing Problems, Proces sing n jobs through 2,3,mmachines. Processing 2 jobs through machines.

SECTION-II

Topics and Contents

Transportation: General Mathematical model of transportation problem, The transportation algorithm, Method of finding in itial solution: North west corner method, Least cost method, Vogel's Approximation method, Test   for optimality: MODI method, Variation in transportation problems.

Game Theory: Terminologies of game theory, Two-person-zero-sum-game, Game with pure strategy, Methods of solving game with mixed strategy, Dominance Property, Graphical method for 2xnandmx2games.Linear Programming approach for games theory,

Inventory Management: Inventory Control Models: Purchase model within stantaneous replenishment with and without shortages, calculate EOQ, classification of inventory like ABC-Always, Better, Control, FSN–Fast, Slowandnon-Moving, VED-Vital, Essential, Desirableetc

List of Course Seminar Topics:

1. Formulation of Linear Programming

2. Simplex Method of solving LP Pproblem.

3. Primal To duel with example and solution of problem

4. Degeneracy in LP Problems

5. Big M method

6. CPM/PERT

7. Sequencing-Processing n jobs through 2, 3 machines

8. Processing 2 jobs through m machines

9. Queuing

10. Sequencing Vs Queuing techniques

List of Course Group Discussion Topics:

1. Comparison of Transportation –N –W Corner method and Least cost cell method.

2. Transportation-VA Mmethod.

3. Two-person-zero-sum-game, Game with pure strategy.

4. Methods of solving game with mixed strategy.

5. Inventory-Purchase model within stantaneous replenishment with shortages and   without shortages.

6. Discuss inventory classification techniques

7. Comparative analyses of purchase models

8. EOQ

9. Inventory control models

Transportation-MODI method

List of Home Assignments:
Design:

1. Design network activity diagram using CPM for construction work of building.

2. Design network activity diagram using CPM for a research work.

3. Design a transportation model using VAM–Vogel's Approximation method.

4. Design optimal strategies for two players-Zero sum game.

5. Design mathematical model for a business problem.

Case Study:

1. Write a case study on goal programming for an IT startup company.

2. Case study on project crashingofa software development company.

3. Write a case study on special cases in linear programming.

4. Write a case study on project management.

5. Write a case study to improve a sales of a manufacturing company.

6. Write a case study on classification of inventory.

Blog

1. Optimization Techniques – A quantitative perspective to decision making.

2. The methodology to solve optimization problems.

3. Write a blog on non-linearing programming

4. Write a blog on applications of Optimization Techniques.

5. Write a blog on Linear Programming approach for games theory.

Surveys:

1. Take the survey of applications of linear programming.

2. Take the survey of different transportation models.

3. Take survey inventory classification models.

4. Take the survey of optimization techniques in data science Take the survey of optimization techniques in shortest path finding

Suggest an assessment Scheme:
Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Blooms Taxonomy.
MSE   ESE   PPT   GD   VIVA HA

Text Books :(As per IEEE format)

---

1. Kanti Swarup, Gupta P. K., Man Mohan,"Operations Research",12thEdition; Sultan Chand & Sons,New Dehli.

2.R.Panneerselvam,"Operations Research",2nd Edition, PHI Learning Private Ltd New Dehli.

3. Taha HA Operation Research and Introduction 9th Edition Pearson Education 2014

4. Gupta & Hira Operations Research Revised Edition Chand & Co. 2007

Reference Books:(As per IEEE format)
1. Billy E. Gillett,"A Computer–Oriented Algorithmic Approach",1979 Edition, Tata McGraw-Hill Publications Company Ltd., NewDehli.

2. Hiller Lieberman,"Introduction to Operations Research", 7th Edition; Tata McGrew-hill publishing Company Ltd., New Dehli

3. S. D. Sharma Operations Research 15th Edition Kedarnath, Ramnath & Co

4. J K Sharma Operations Research 3rd edition Laxmi Publications 2009

Moocs Links and additional reading material:
1. https://www.youtube.com/watch?v=Q2dewZweAtU

2. https://www.youtube.com/watch?v=h0bdo06qNVw

Course Outcomes:
The student will be able to–
1. Develop linear programming models to solve real life business problems. (3)

2. Analyze Critical path using CPM and PERT(3)

3. Use sequencing techniques for effective scheduling of jobs (4)

4. Solve transportation problems using various methods.(4)

5. Compute the value of the game using pure/mixed strategies and accordingly device optimal strategies to win the game(5)

6. Learn various models and techniques of inventory management.(5)

CS4217: HUMAN COMPUTER INTERACTION

Course Prerequisites:

Computer Programming, Web Technology

Course Objectives:

1. Understand the theoretical dimensions of human factors involved in the acceptance of computer interfaces.

2. Describe and use HCI design principles, standards and guidelines.

3. Identify the various tools and techniques for interface analysis, design, and evaluation.

4. Discuss tasks and dialogs of relevant HCI systems based on task analysis and dialog design.

5. Analyze and discuss HCI issues in groupware, ubiquitous computing and World Wide Web-related environments.

Credits:2   **Teaching Scheme Theory:**2Hours/Week

Course Relevance: This course provides an introduction to and overview of the field of human-computer interaction (HCI). HCI is an interdisciplinary field that integrates the ries and methodologies from computer science, cognitive psychology, design, and many other areas. Students will work on both individual and team projects to design, implement and evaluate computer interfaces. The course is open to students from all disciplines, providing them with experience working in interdisciplinary design teams.

SECTION-I

Topics and Contents

Introduction to Human-Computer Interaction (HCI)
Human, Definition of Human Computer Interaction, Interdisciplinary Nature, Goals, Human Factors, Measurable Factors–Learnability, Speed, Efficiency, Satisfaction. Early Focuson Users, Ergonomics, Usability, Types of Usability, User Interface(UI), Contexts-Web, Business, Mobile, Gaming Applications, Categorization of Applications based on Human Factors, Accessibility and Security.

Principles and Models
Eight Golden Rules of Interface Design,Principles of Good Design, Faulty Designs, Miller's

Principle, Norman's Action Model, Gulf of Execution and Evaluation, Errors–Mistakes, Slips, Lapses and Violations, Guidelines for Data Display, Guidelines for Data Entry, Conceptual, Semantic, Syntactic and Lexical Model, Task Analysis, GOMS, Keystroke-Level Model, User Persona,UI

Standards and GUI Libraries.

Design Process and Interaction Styles

Design, Three   Pillars of   Design, Process of   Design,   Ethnographic
        Observations,ContextualInquiry, Iterative Design, Participatory Design, Navigation Design, Visual Design, -Layout, Color, Fonts, Labeling, LUCID, Scenarios, Interaction Styles– Direct Manipulation, Menu Selection, Form-Filling, Commands, Natural Language, Internationalization, Interaction Design Patterns. s-Apex professional bodies, Industries, international curriculum, curriculum of IIT and other prominent Universities, etc. Make the course in 2 sections-Section I and Section II.

SECTION-II

Topics and Contents

Evaluation Techniques and Interface Categories
Expert-based Evaluation, User-based Evaluation, Heuristic Evaluation, Cognitive Walkthrough, Semiotic Analysis, Expert Reviews, Usability Testing, User Surveys, Interviews, Think A loud, Acceptance   Tests, Statistical Methods, Touch Interfaces, Public Place Interfaces, Wearable Interfaces, Tangible Interfaces, Intelligent Interfaces, Ubiquitous and Context-Aware Interaction.

Documentation and Groupware
Classification of Documents, Printed Manuals, Reading from Displays, Online Help, Tutorial, Error/Warning Messages, Groupware, Goals/Dimensions of Cooperation, Asynchronous Interactions, Synchronous Interactions, Online Communities, Communityware

Miscellaneous

Case Studies: Web Usability, Mobile Usability, Embedded Systems, Social Networking Sites, Messengers, E-Governance Sites, Security Tools, e-Health applications

List of Course Seminar Topics:
1. The Future of Smart Everyday Objects

2. Cooperative Artifacts

3. Intelligent Kitchen Utilities

4. Interacting with Smart Products

5. Intimate Interfaces

6. Multi touch Interfaces

7. Interactive Tables

8. Microsoft Surface Technology

9. Sense Cam

10. Spoken Dialogue Systems

List of Course Group Discussion Topics:
1. W3C Multimodal Interaction Activity

2. Multimodal Dialogue Systems

3. Tangible Interaction with Intelligent Virtual Agents

4. Mixed and Augmented Reality

5. Multimodal Generation for Virtual Characters

6. Expressive Virtual Characters

7. Recognizing and Expressing Affect
8. Emotional Interfaces and Input Devices
9. Natural Machines
10. Data Entry Interfaces

List of Home Assignments:
Design:
1. Apply Norman' saction model on the task–'To make online payment'.

2. Illustrate major models evolved in contextual enquiry with an example.

3. Design accommodation for visually impaired users in mobile applications

4. Design UI for Information Kiosk for a Metro Terminus Related UI sketches

5. Formulate a user person as of Indian User for IT product.

Case Study:

1. HCI guidelines/principles for designing home page for museum website.

2. Vitalethnographic observations in IT products.

3. Gulf of execution with respect to left-handed users.

4. User-based and expert-based usability evaluation methods.

5. Any mobile app highlighting its ethno-cultural and accessibility features.

Blog

1. Heuristic Evaluation using a Likert's scale.

2. Golden rules of interface

3. Effects of metaphors in design of social networking sites.

4. LUICD

5. Semioticanalysis.

Surveys

1. Investigate popularity of remote synchronous communication among user groups.

2. e-governance website

3. Ubiquitous and Context-Aware Interaction

4. Iterative Design, Participatory Design, Navigation Design, Visual Design

Cognitive Walk through evaluation technique

Suggest an assessment Scheme: Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Blooms Taxonomy.
MSE ESE PPT GD   VIVAHALAB

Text Books:(As per IEEE format)

1. "Human-Computer Interaction", AlanDix, JanetFinlay,   Gregory D. Abowd, Russell Beale, Pearson Education, ISBN 81-297-0409-9,3rd Edition.

2."Designing the User Interface", Ben Shneiderman, Pearson Education, ISBN81-7808-262-4,3rd Edition

---

Reference Books:(As per IEEE format)

1.The Design o fEveryday Things", Donald Norman, Basic Books, ISBN 100-465-06710-7,2002 Edition

2. "The Essential Guide to User Interface Design", Wilbert O. Galitz, Wiley-dreamtech India (P)Ltd., ISBN 81-265-0280-0, 2nd Edition.

3."Human-Computer Interaction in the New Millennium", John M. Carroll, Pearson Education, ISBN 81-7808-549-6

Moocs Links and additional reading material:
www.nptelvideos.in

Course Outcomes:
1. Identify human factors and usability issues related with computing applications

2. Differentiate computing applications into categories based on human factors

3. Design an user interface by applying suitable design principles, models and usability guidelines

4. Integrate ethno-cultural and accessibility computing aspects into the user interface design

5. Display the impact of usability evaluation and testing in computing applications

6. Follow required processes and standards while designing user interfaces

AI4004: PATTERN RECOGNITION USING FUZZY NEURAL NETWORKS

Course Prerequisites:

Data structure,computer programming, Linear algebra

Course Objectives:

1. To understand fundamentals of pattern recognition.

2. To understand the fuzzy set design

3. To learn fundamentals of fuzzy sets and their use in practice.

4. To learn training of hybrid system-fuzzy neural networks(FNN)

5. To apply trained fuzzy neural networks (FNN) for inferences.

6. To understand evaluating performance of FNNs.

Credits:2   **Teaching Scheme Theory:**2Hours/Week

Course Relevance: This course applicable for complex pattern recognition tasks

SECTION-I

Topics and Contents

Pattern recognition fundamentals:- Definition of a pattern, statistical and syntactic patterns, feature vector, feature dimensionality, pattern class, definition of classification, clustering, hybrid classification-clustering

Introduction to fuzzy set theory:- Definition of fuzzy set, membership function, types of fuzzy sets, operations on fuzzy sets like union, intersection, compliment, plot of fuzzy membership function, core and support parts of fuzzy sets

Introduction to Artificial Neural networks:- Biological neuron, McCulloch Pitts model, general neuron model, perceptron, activation function types, perceptron learning algorithm for 2-class classification, single layer perceptron classifiers and learning algorithms,brief intro to multilayers perceptrons

SECTION-II

Topics and Contents

Fuzzy min-maxneural network(FMN) architecture for classification-
Concept of hyper-box, hyper-box as a fuzzy set, hyperbox membership function-definition, interpretation and use,FMN learning algorithm-hyper-box expansion, overlap test and hyperbox contraction, FMN recall/testing algorithm, comments on hyperbox size, sensitivity parameter and performance evaluation.

Fuzzy min-max neuralnetwork (FMN) architecture for clustering-architecture, training algorithm and recall phase

Fuzzy Hyperline Segment Neural Network (FHLSNN) classifier:-

Concept of hyperline, hyperlineas a fuzzy set, fuzzy membership function design, FHLSNN training and testing algorithm,

Comparison of FMN and FHLSNN architectures.

Modified Fuzzy Hyperline Segment Neural Network (MFHLSNN) classifier:-
Modified fuzzy membership function design, convexity and normality roperties, training and testing algorithms, comparison of FHLSNN and MFHLSNN

List of Course Seminar Topics:
1. Drawbacks in the membership function design of FMN.

2. FHLSNN membership function design

3. FMN clustering algorithm

4. FMN classification algorithm

5. Fuzzy sets and applications

6. Fuzzy neural networks as hybrid system

7. Soft computing

8. Some other topics decided by instructor

List of Course Group Discussion Topics:
1. FHLSNN classifier drawbacks in membership function

2. FMN application in HCR

3. FHLSNN for heart disease detection

4. Fuzzy clustering technique

5. Comparison of K-NN classifier and FMN classifier

6. Some other topics decided by instructor

List of Home Assignments:
Design:
1. Design a fuzzy membership function for FMN for efficiency

2. Design a fuzzy membership function for FHLSNN with less costly operations

3. Design FMN architecture for 8-D input patterns for 4 classes

4. Design a fuzzy membership function for FHLSNN without using square root operations in ceit is costly

5. Some other topics decided by instructor

Case Study:
1. HCR using FHLSNN

2. Fourier Fuzzy neural network for pattern recognition

3. Fuzzy neural network by Kawnand Kai

4. UFHLSNN for pattern recognition

5. Some other to pics decided by instructor

Blog
1. Fuzzy neural networks as hybrid system

2. FMN for hybrid classification and clustering by Bargiala

3. FHLSNN membership function design

4. Flaws in the contraction of hyperboxes in FMN

5. Some other topics decided by instructor

Surveys
1. Evolution of Fuzzy neural networks

2. Fuzzy neural networks applications in healthcare/medical diagnosis

3. Developments in Fuzzy systems

4. Back propagation training algorithm

5. Some other topics decided by instructor

Suggest an assessment Scheme: Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Blooms Taxonomy.
MSE   PPT Presentation   ESE   GD   Viva   LAB

Text Books:(As per IEEE format)

1. Timothy J Ross, Fuzzy logic with engineering applications, 3rd edition, Wiley, 2010

2. Jacek M. Zurada, Introduction to artificial neural systems, Jaico publishing house, 1992

Reference Books/Papers (As per IEEE format)

1. P. K. Simpson, Fuzzy min-max neural networks Part-1. classification, IEEE Transactionson Neural Networks, Vol. 3(5), 1992, https://doi.org/10.1109/72.159066.

2. P. K. Simpson, Fuzzy min-max neural networks Part-2.clustering, IEEE Transactions on Fuzzy Systems, Vol.1(1), 1993

3. U. V. Kulkarni, T. R. Sontakke and G. D. Randale, Fuzzy hyperline segment neural network for rotation in variant And written character recognition, in Proc. Joint conf. on Neural Networks: IJCNN01, Washington DC, USA, pp .2918-2923,July2001.

4. Pradeep M Patil, P S Dhabe, Uday V Kulkarni, TR Sontakke, Recognition of handwritten characters using modified fuzzy hyperline segment neural network, The 12th IEEE International Conference on Fuzzy Systems,2003. FUZZ'03.

5.Priyadarshan Dhabe, Prashant Vyas, Devrat Ganeriwal, Aditya Pathak, Pattern classification using updated fuzzy hyper-line segment neural network and it's GPU parallel implementation for large datasets using CUDA, International Conference on Computing, Analytics and Security Trends (CAST), 2016

6.Priyadarshan S Dhabe, Sanman D Sabane, Improved UFHLSNN (IUFHLSNN) for Generalized Representation of Knowledge and Its CPU Parallel Implementation Using Open MP, Springers EAI International Conference on Big Data Innovation for Sustainable Cognitive Computing, 2020

Moocs Links and additional reading material:
1.https://www.youtube.com/watch?v=ZBCg_nH1hVQ (Video lecture on FMN by Prof. Biswas, IITKGP)

2.https://www.youtube.com/watch?v=0e0z28wAWfg (Backpropagation algorithm)

Course Outcomes:
The student will be able to–
1. Design fuzzy set for a given application

2. Decide architecture of FNN for a given real problem

3. Apply FMN for solving real world problems

4. Train FNN for pattern recognition

5. Test FNN for their recall in pattern recognition Evaluate performance of FNN

AI4012: AUGMENTED REALITY AND VIRTUAL REALITY

Course Prerequisites: Computer Graphics

Course Objectives:

1. Learning different components of Augmented and Virtual Reality Systems

2. Understanding VRmodel development

3. Understanding ARmodel development

4. Integrating different sensors with AR-VR systems

5. Understanding different applications of AR-VR

Credits:2   **Teaching Scheme Theory:** 2Hours/Week

Course Relevance: This subject is important in all domains to implement simulation or prototype of different systems.

SECTION-I
Topics and Contents   *Computer mediated reality: Augmented reality, Virtual reality, Mixed reality, Augmented Virtuality, Diminished reality. Comparative study with use-cases. Software and Hardware requirements.*   *3D Graphics and 3D modeling: Terminology and examples, Pixel, voxel, Colors and interpolation, Light, fog, opacity, projection, view volume, frustum, culling, texture mapping, bump mapping, ray tracing, path tracing, photon mapping.*   *Geometric transforms: Chain of Viewing transforms.*   *Introduction to Unity: Creating environment, manipulating camera, colliders, physics engine, standard assets and asset store. Creating solar system-Basic game objects, texture mapping, lighting effects and types.*   *C# scripting language and examples.*
SECTION-II
Topics and Contents   Visual perception: Depth, motion and color perception, Display properties: Minimum spatial resolution, minimum frame rate, LCD vs OLED for VR.   Visual rendering: Object order rendering, Image order rendering, Rasterization, pixel shading,

distortion shading.
Elements of image processing required for AR, Object recognition: SIFT, Object tracking.
Vuforia for marker based AR, Pose Estimation for marker based AR, Designing marker.
Case study and sample applications.

Lab Assignments

1. 3D objects display

2. Solar Model

3. Home interior

4. Vehicle Model

5. Hand-watch making and test on Hand

6. 2D Game

7. 3D Maze Game

8. 3D vehicle racing game

9. Ray tracing simulation

10. Photon mapping simulation

List of Course SeminarTopics:

1. 3D object creation

2. Camera projections

3. Geometric transformations

4. Viewing transformations

5. C# script raphics rendering

6. C# script interface for Unity software

7. Object order rendering in Unity software

8. Object tracking

9. Motion perception

10. Rasterization and pixel shading

List of Course Group Discussion Topics:

1. Virtual Vs Augmented reality

2. Virtual Vs Augmented Vs. Mixed reality

3. Diminished reality

4.   Mediated reality

5.   Vuforia

6.   Marker based AR

7.   Marker less tracking

8.   Euler rotation theorem and axis-anglerotation

9.   Quaternion

10. Visual and depth perception

List of Home Assignments:

Design:
1. Solar model

2. Library model

3. Classroom model

4. Carshowroom model

5. Livingroom model

Case Study:
1. Raytracing in Unity

2. Pixelshading in Unity

3. Distortionshading in Unity

4. Imageorderrendering in Unity

5. Poseestimation in AR

Blog
1. AR/VR models for Kids

2. AR/VR models to study machine design

3. AR/VR models to study networking

4. AR/VR models for space research

5. AR/VR models for wearing devices

Surveys
1. Image processing for VR/AR

2. Projections inVR/AR

3. Light effect in VR/AR

4. Texture mapping in AR/VR

5. Shadowing technique in AR/VR

Suggest an assessment Scheme:
Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Blooms Taxonomy.
HA   Seminar   GD   MSE   ESE   LAB   VIVA

Text Books:*(As per IEEE format)*

1. Alan B Craig, William R Sherman and Jeffrey D Will, Developing Virtual Reality Applications: Foundations of Effective Design, Morgan Kaufmann,2009.

2. Gerard Jounghyun Kim, Designing Virtual Systems:The Structured Approach, 2005.

Reference Books:(As per IEEE format)

1. Grigore C. Burdea, Philippe Coiffet, Virtual Reality Technology, Wiley 2016

2. Dieter Schmalstieg and Tobias Höllerer, Augmented Reality: Principles & Practice, Pearson Education India, 2016

3. Kent Norman (Ed), Wiley Handbook of Human Computer Interaction, Wiley 2017

4. Andy Field, "Discovering Statistics Using SPSS", SAGE Publications Ltd., 2009

Moocs Links and additional reading material:
www.nptelvideos.in

Course Outcomes:
1. Learn AR-VR graphics object creation

2. Design objects in AR-VR environment

3. Develop rendering algorithms

4. Understand modelling and viewing transformations

5. Apply various reality effects like lighting, texture mapping etc.

6. Develop different modelling, gaming applications

AI4015: NETWORK SECURITY

Course Prerequisites: Computer Networks
Course Objectives:
1. Analyze cryptographic techniques using a mathematical approach by examining nature of attack.
2. Establish type of attack on a given system.
3. Identify different types of attacks.
4. Justify various methods of authentication and access control for application of technologies to various sections of industry and society.
5. Design a secure system for protection from the various attacks for 7 layer model by determining the need of security from various departments of an organization.
6. Estimate future needs of security for a system by researching current environment on a continuous basis for the benefit of society.

Credits: 2   **Teaching Scheme Theory:** 2 Hours/Week

Course Relevance:
The course is offered in S.Y. B.Tech. to all branches of Engineering
Data Science is a multidisciplinary field. It uses scientific approaches, procedures, algorithms and frameworks to extract knowledge and insight from a huge amount of data.
Data Science uses concepts and methods which belong to fields like information technology, Mathematics, Statistics, Computer Science etc.
Data Science influences the growth and improvements of the product by providing a lot of intelligence about customers and operations, by using methods such as data mining and data analysis.
The course is relevant to all branches of Engineering and beyond, since data is generated as an obvious outcome of many processes.

Unit 1   **(5Hours)**
Introduction
Introduction to Security: Vulnerabilities, Threats, Threat Modeling, Risk, attack and attack types, Avoiding attacks, Security services.
key security properties - Confidentiality, Integrity, Availability.
Protocol Vulnerabilities: DoS and DDoS, session hijacking, ARP spoofing, Pharming attack, Dictionary Attacks.
Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting attack, Virus and Worm Features, Trojan horse, Social engineering attacks, ransomware, SYN-Flooding, SQL- injection, DNS poisoning, Sniffing

Unit 2:   **(4 Hours)**
Private key cryptography
athematical background for cryptography: modulo arithmetic, GCD (Euclids algorithm),
Role of random numbers in security, Importance of prime number, DES, AES.
Chinese remainder theorem

Unit 3:   **(5 Hours)**
Public key cryptography
RSA: RSA algorithm, Key generation in RSA, attacks on RSA.
Diffie-Hellman key exchange: Algorithm, Key exchange protocol, Attack.
Elliptic Curve Cryptography (ECC), Elliptic Curve arithmetic. Diffie-Hellman key exchange

Unit 4   (**5 Hours)**
Authentication and access control
Message authentication and Hash Function. Authentication: One-Way Authentication, Mutual Authentication, SHA-512, The Needham-Schroeder Protocol.
Kerberos, X.509 authentication service, public key infrastructure.
Access Control in Operating Systems: Discretionary Access Control, Mandatory Access Control, Role Based Access Control.
Unit 5:   **(5 Hours)**
Security application and design
Part A: Network layer security: IPSec for IPV4 and IPV6.
Transport layer security: SSL and TLS.
Application layer security: Security services, S/MIME, PGP, Https, Honey pots.
Security design: End-to-end security, Security composability, Open design, Cost and tradeoffs
Unit 6:   **(4 Hours)**
Cyber Security:
Cyber Attack, Cyber Reconnaissance, Crimes in Cyber Space-Global Trends & classification, e-commerce security, Computer forensics, facebook forensic, mobile forensic, cyber forensic, digital forensic

Text Books

1. *"*Cryptography and Network Security-Principles and Practices" by William Stallings, Pearson Education, 2006, ISBN 81-7758-774-9, 4th Edition

2. "Network Security and Cryptography", by Bernard Menezes, Cengage Learning, 2010, ISBN 81-315-1349-1, 1st Edition

Reference Books

1.   "Computer Security: Art and Science", by Matt Bishop, Pearson Education, 2002, ISBN 0201440997, 1st Edition.

2.   "Network security, private communication in a public world", by Charlie Kaufman, Radia Perlman and Mike Spencer, Prentice Hall, 2002, ISBN 9780130460196, 2nd Edition

3.   "Cryptography and Information Security", by V.K. Pachghare, PHI, 2015, ISBN-978-81-203-5082-3, Second Edition

Additional   **Reading**

1."Security architecture, design deployment and operations", by Christopher M. King, Curtis Patton and RSA press,   McGraw-Hill,   2001,   ISBN   0072133856,   1st   Edition.
2 'Inside Network Perimeter Security" by Stephen Northcott, Leny Zeltser, et al, Pearson Education Asia, ISBN 8178087618, 1st Edition.

Course Outcomes:

Upon completion of the course, the students will be able to:

1. Analyze cryptographic techniques using a mathematical approach by examining nature of attack.

2. Establish type of attack on a given system.

3. Identify different types of attacks.

4. Justify various methods of authentication and access control for application of technologies to various sections of industry and society.

5. Design a secure system for protection from the various attacks for 7 layer model by determining the need of security from various departments of an organization.

6. Estimate future needs of security for a system by researching current environment on a continuous basis for the benefit of society.

AI4025::HIGH PERFORMANCE COMPUTING

Course Prerequisites: Computer Organization, Operating System, Design & Analysis of Algorithms, Data Structure

Course Objectives:
Students will be able to
1. To introduce the basic concepts of High Performance Computing
2. To understand various GPU Architecture.
3. To write CUDA programs for parallel implementation
4. To organize the memory management in GPU
5. To optimize parallel programs on GPU using CUDA. To solve the scientific problems using GPUs

Credits: 2   Teaching Scheme **Theory:** 2 Hours/Week

Course Relevance: High Performance Computing, on the other hand, uses multiple processing elements simultaneously to solve a problem. This is accomplished by breaking the problem into independent parts so that each processing element can execute its part of the algorithm simultaneously with the others. This course is required in the industry & used to set up data centres.

SECTION-1

Introduction to Computing: High Performance, Parallel, Distributed; Motivation, Scope and Challenges; Parallelism vs Concurrency, Types and levels of parallelism, Different grains of parallelism, data dependence graph, data parallelism, functional parallelism, Flynn's classification of multi-processors,, Amdhal's law; Parallel computer architectures : PRAM, Distributed memory systems, Shared memory systems and cache coherence, thread and process, Parallel computing architectures (multi-core CPUs, GPUs, traditional multi-processor system, Xeon-Phi, Jetson Kit, Kilocore processor), multiprocessor and multicomputer systems, interconnection networks, Modern GPU architecture, Performance comparison: Speedup, Gain time and scalability.
GPU architecture and parallel algorithms
Introduction to Modern GPU Tesla architecture, Types of GPU memories: global, shared, texture memory and their properties and uses, Streaming processor (SP), Streaming multiprocessor (SM), Special Functional unit (SFU), SM instruction types Fosters Parallel algorithm design, Designing GPU parallel algorithm for pattern clustering.
Programming Model: Common Unified Device Architecture (CUDA), CUDA programming model: threads, blocks, grid, Kernel, Kernel definition and kernel launch configuration, Use of GPU memories: global, shared, texture and constant memories, shared memory: organization, bank conflicts, global memory coalesced accesses, CUDA APIs: for memory allocation, synchronization, Execution of a CUDA kernel on GPU: concept of warp, warp divergence, CUDA example programs (Vector dot product, Vector-Matrix multiplication and etc). Atomic operations in CUDA and their use.

SECTION-2

GPU Architecture: GPU architecture, Overview of the graphics pipeline, Components of GPU: Parallel streaming processors, Multiprocessors, Shared instruction caches ,Memory hierarchy – Global, Constant, Shared, and Texture memory; Case studies: NVIDIA Kepler K20/K40/K80/GP100/GV100/ Ampere.

Memory Organization and Optimization: Global, Shared, constant and texture memory. Memory coalescing, memory banks and bank conflicts, Page locked host memory. Reduction operation, CUDA code optimization. Need of profilers and analyzers, Introduction to CUDA Tools: MemCheck, Command line & Visual Profilers.

Scientific Computing and problem solving on GPU: Single vs. double precision, light weight scientific computing exercises, Image processing applications, Matrices etc. Parallel reduction on GPU and its applications. Compute intensive research-oriented problems and their GPU parallelization.

CUDA code optimization and Performance improvement CUDA code optimization: Memory optimization, Control flow optimization, Execution configuration optimization and Instruction optimization, Concept and application of page locked host memory, Single Vs. double precision computing on GPU: precision vss speed of computation, choosing correct precision for a real GPU application, memory leaks and associated problems, CUDA tools: cuda-memcheck and profiler.

List of Practical :

1. Parallel GPU implementation of vector-vector operations

2. Parallel GPU implementation of vector-Matrix operations

3. Parallel computation of binomial coefficient matrix

4. Parallel GPU implementation of Matrix-Matrix operations

5. Assignment focusing on optimization of data transfer between CPU and GPU: using page locked host memory and to avoid the data transfer

6. Assignment focusing on memory optimization: use of GPU shared, constant and texture memory.

7. Parallel GPU implementation involving kernel looping.

8. Use CUDA memcheck tool for knowing memory related errors in your source code

9. Profile your CUDA code using nvprof profiler tool for profiling your source code.

10. Write a program to know name of the GPU, its shared memory available and maximum CUDA block size.

11. Write a program to find the best GPU to execute your CUDA kernel, if multiple GPUs are connected to your system. Also set this device (GPU) for executing subsequent CUDA kernels.

12. A square matrix of size n x n contains either 1 or 0 in it. Write a CUDA kernel to compliment it without warp divergence.

List of Project areas:

The given list is indicative. A project area, other than listed here, can also be chosen but need to be mutually decided by student and teacher.

1. Pattern classification for large data sets

2. Clustering of patterns from large data set

3. processing of large images like MRI images

4. GPU Parallel acceleration of RDBMS queries using GPU

5. GPU Parallel acceleration of scientific tasks

6. GPU parallel acceleration of simulation of large systems

7. GPU parallel acceleration of global optimization algorithms

8. GPU parallel computations in Computer networks like cryptography, intrusion detection

9. GPU parallel computations in data analysis

10. Computationally intensive medical diagnosis

11. Regression analysis (linear and non-linear)

12. Artificial neural networks/deep learning/machine learning

List of Home Assignments:

Design:

1. Parallelizing Search Trees for Chess

2. Parallel Algorithm for Searching

3. Parallel Algorithm for sorting

4. Parallel Algorithm for Data mining

5.Parallel Algorithm for Image Processing

Case Study:

1. Nvidia DGX2

2. Jetson nano Developer Kit

3. GPU Accelerated Apache Spark

4.The Jetson Xavier NX Developer Kit

5.NVIDIA Ampere architecture

Blog

1.Cuda library

2.Turing mesh shaders

3.Low level GPU Virtual memory management

4. Memory Hierarchy of GPU

5. Comparison of Various GPUs

Surveys

1.Smart Hospitals through AI with GPUs

2.Clara Models to help fight with COVID 19

3. GPU Accelerated Molecular Dynamics Applications

4.Medical Imaging applications of GPU

5.Ray Tracing Applications of GPU

Suggest an assessment Scheme: MSE(30)+ESE(30)+HA(10)+CVV(20)

Text Books: (As per IEEE format)
1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar; Introduction to parallel computing; second edition., Addison-Wesley, 2003, ISBN: 0201648652
2. David Kirk, Wen-mei HwuCUDA: Programming Massively Parallel Processors: A Hands-On Approach. © ELSEVIER Inc.
3. Jason Sanders and Edward KandrotCUDA by Example: An Introduction to General-Purpose GPU Programming"

Reference Books: (As per IEEE format)
1. Hwang and Briggs,"Computer Architecture and Parallel Processing", Tata McGraw Hill Publication ISBN 13: 9780070315563.
2. John Cheng, Max Grossman, Ty McKercherProfessional CUDA C Programming,
3. CUDA C PROGRAMMING GUIDE by NVIDIA

Moocs Links and additional reading material:
www.nptelvideos.in
http://developer.nvidia.com/

Course Outcomes:
The student will be able to –
1) Recognize various parallel computing architectures and their fundamentals
2) Investigate parallel solutions to complex real world problems
3) Code the parallel programs on GPU using CUDA
4) Evaluate the performance on various GPU architectures
5) Optimize the parallel programs on GPU using CUDA
6) Design and develop new solutions to research problems

Future Courses Mapping: Parallel Computing, Distributed Computing

Job Mapping: What are the Job opportunities that one can get after learning this course Full Stack Architect-GPU Developer Technology Engineer Software Engineer Cloud Data Analytics Engineer Cloud Developer Senior Software Engineer HPC GPU Application Developer & Consultant GPU Programming Professional GPU Performance Analysis Lead / Architect GPU Advocate Associate

CO - PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1			3													
CO2					3											
CO3							3									
CO4											1					
CO5												1				
CO6															3	

AI4007: REINFORCEMENT LEARNING

Course Prerequisites: Proficiency in Python, Calculus, LinearAlgebra, Basic Probability and Statistics, Foundations of Machine Learning

Course Objectives:

1. To pursue basic knowledge of reinforcement learning techniques.

2. To understand foundation Techniques of Deep Reinforcement Learning.

3. To inculcate dynamic programming techniques.

4. To provide a clear and simple account of the key ideas and algorithms of reinforcement learning.

5. To explore how the learning is valuable to achieve goals in the real world.

6. To explore about how Reinforcement learning algorithms perform better and better in more ambiguous, real-life environments while choosing from an arbitrary number of possible actions.

Credits:2   **Teaching Scheme Theory:**2Hours/Week

Course Relevance: Reinforcement learning(RL) refers to a collection of machine learning techniques which solve sequential decision-making problems using a process of trial-and-error. It is a core are a of research in artificial intelligence and machine learning, and today provides one of the most powerful approaches to solving decision problems.

SECTION-1

The Reinforcement Learning Problem: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope
Finite Markov Decision Processes: The Agent–Environment Interface, Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation
Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming
Model-free solution techniques: Temporal difference learning, Monte Carlo Methods, Efficient Exploration and value updating

---

SECTION-2

Topics and Contents

Batch Reinforcement Learning: Introduction, Batch Reinforcement Learning Problem, Foundations of Batch RL Algorithms, Batch RL Algorithms, Batch RL in Practice

Learning and Using Model: What is Model, Planning: Monte Carlo Methods, Combining Models and Planning, Sample Complexity, Factored Domains, Exploration, Continuous Domains, Empirical Comparisons, Scaling Up

Planning and Learning with Tabular Methods: Models and Planning, Integrating Planning, Acting, and Learning, When the Model Is Wrong, Prioritized Sweeping, Full vs. Sample Backups, Trajectory Sampling, Heuristic Search, Monte Carlo Tree Search

List of Course Seminar Topics:

1. Naive REINFORCE algorithm

2. 2.TD Control methods – SARSA

3. 3.Probability Primer

4. 4.Bellman Optimality

5. 5.Imitation learning

6. 6.Sequential Decision-Making

7. 7.Michael Littman:The Reward Hypothesis

8. 8.multi-agent learning

9. 9.An n-Armed Bandit Problem

10. 10.Q-Learning

List of Course Group Discussion Topics:

13. Human Intelligence versus machine intelligence

14. Security and Privacy in Pervasive Network

15. Security of Smart devices

16. Future of Ubiquitous Computing

17. Online Least-Square Policy Iteration
18. Gradient-Descent Methods

19. Bellman Optimality

20. Reward Shaping

21. Hierarchical RL

22. Atari Reinforcement Learning Agent

List of Home Assignments:

Design:

1. Smart personal health assistant

2. Human activities sensor

3. Intelligent buildings

4. Data storage searching in IOT

5. Protocols in IOT

Case Study:

1. Challenges in age of Ubiquitous computing

2. Ethnography in Ubiquitous computing

3. Cyber Physical System

4.Approaches to Determining Location Ubiquitous computing

5.Q-Learning for Autonomous Taxi Environment

Blog

1. Smart Devices for smart life

2. 2.Mobile affective computing

3. IOT and Cloud Computing

4. 4.Deep Q-Learning for Flappy Bird

5. 5.Q-Learning for any game Surveys

6. Data Collection for Ubiquitous computing Field

7. Usage of smart devices in daily lifestyle

8. Video Summarization

9. Behaviour Suite for Reinforcement Learning

10. 5. Causal Discovery with Reinforcement Learning

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited For the course. Ensure 360-degree assessment and check if it covers all aspects of Blooms Taxonomy.

MSE ESE   PPT   GD   VIVA HA

Text Books:(As per IEEE format)

1. Ed. John Krumm; Ubiquitous Computing Fundamentals; Chapman & Hall/CRC 2009

2.Richard S. Sutton and Andrew G. Barto, Reinforcement learning: An introduction, Second Edition, MIT Press, 2019

Reference Books:(As per IEEE format)

1. Wiering ,Marco, and Martijn Van Otterlo. Reinforcement learning. Adaptation, learning, and optimization 12 (2012)

2. Mohammad S. Obaidatandet al; Pervasive Computing and Networking, Wiley

Moocs Links and additional reading material: www.nptelvideos.in

Course Outcomes:

The students should be able to
1)Define the key features of reinforcement learning that distinguishes it from AI and non-interactive machine learning

2) Formalize problems as Markov Decision Processes

3) Understand basic exploration methods and the exploration/exploitation trade-off

4) Understand value functions, as a general-purpose tool for optimal decision-making

5) Implement dynamic programming as an efficient solution approach to a real-world problem

6) Explain various tabular solution methods.

AI4022 : BUSINESS INTELLIGENCE AND ANALYTICS

Course Prerequisites:

1. Fundamental knowledge about Business Abalytics

2. Machine Learning

3. Database Management Systems

Course Objectives:

1. To Understand basics and architecture of Business Intelligence & Analytics

2. To understand concepts of relational databases, normalization, and SQL queries.

3. To explain descriptive analytics, and visualization, customer analytics, and survival analysis.

4. To Explain data mining process, introduction to statistical learning, data pre-processing, data quality, and overview of data mining techniques.

5. To understand classification techniques, scoring models, classifier performance, ROC and PR curves.

6. To Illustrate cluster analysis, measures of distance, clustering algorithms, K-means and other techniques, and cluster quality.

Credits:2   **Teaching Scheme Theory: 2** Hours/Week

Course Relevance:

Business Analytics and Business Intelligence together provide various industries with the opportunity to analyze their data which could help them in making more informed decisions. These informed decisions further impact the present and future operations of the industry.

SECTION-I

Introduction to Business Intelligence & Analytics (BIA), drivers of BIA, types of analytics: descriptive to prescriptive, vocabulary of business analytics, course plan and resources.Technical architecture of BIA, case analysis of AT&T Long distance, fundamentals of data management, OnLine Transaction Processing (OLTP), design process of databases

Relational databases, normalisation, SQL queries, ShopSense case of management questions, data warehousing, OnLine Analytical Processing (OLAP), data cube. Descriptive analytics, and visualization, customer analytics, survival analysis, customer lifetime value, case study. Data mining process, introduction to statistical learning, data pre-processing, data quality, overview of data mining techniques, case study using regression analysis

SECTION-II

Introduction to classification, classification techniques, scoring models, classifier performance, ROC and PR curves. Introduction to decision trees, tree induction, measures of purity, tree algorithms, pruning, ensemble methods. Tree implementation in Python: problem of targeted mailing. Cluster analysis, measures of distance, clustering algorithms, K-means and other techniques, cluster quality. A store segmentation case study using clustering, implementation in Python, profiling clusters, cluster interpretation and actionable insights, RFM sub- segmentation for customer loyalty. Machine learning, Artificial Neural Networks (ANN), topology and training algorithms, back propagation, financial time series modelling using ANN, implementation in Python. Text mining, process, key concepts, sentiment scoring, text mining using R-the case of a movie discussion forum, summary

List of Home Assignments:
Case Study: Unique Home assignments will be set up for all groups

1. Retail Customer Segmentation Case Study

2. Predictive Maintenance Case Study in Manufacturing

3. Market Basket Analysis Case Study for Grocery Stores

4. Churn Prediction Case Study in Subscription Services

5. Fraud Detection Case Study in Financial Transactions

6. Supply Chain Optimization Case Study in Manufacturing

7. Social Media Sentiment Analysis

8. E-commerce Recommendation Systems

9. Customer Support Text Mining

 10. Financial Forecasting for Companies

11. Disease Tracker

12. Marketing Lead Dashboard

Additional reading material:
  Tutorial: SQL tutorial on MySQL (https://www.mysqltutorial.org)

Text Books:(As per IEEE format)
1.Han, J., Pei, J. & Tong H. (2023). Data Mining Concepts and Techniques, 4th ed,New Delhi: Elsevier.

2. James, G., Witten, D., Hastie, T. and Tibshirani,R. (2013) An Introduction to Statistical Learning with Applications in R, Springer: NY

Course Outcomes:
Upon completion of the course, student will be able to –
1. Understand basics and architecture of Business Intelligence & Analytics
2. Apply concepts of relational databases, normalisation, and SQL queries.
3. Describe descriptive analytics, and visualization, customer analytics, and survival analysis.
4. Explain data mining process, introduction to statistical learning, data pre-processing, data quality, and overview of data mining techniques.
5. Describe classification techniques, scoring models, classifier performance, ROC and PR curves.
6. Illustrate cluster analysis, measures of distance, clustering algorithms, K-means and other techniques, and cluster quality.

Job Mapping:
 Job opportunities that one can get after learning this course
1. Business Analyst
2. Project Manager
3. Data Engineer
4. Business Intelligence Development Analyst

AI4017: INTERNET OF THINGS

Course Prerequisites:

Computer Networks, Computer Programming

Course Objectives:

1. Understand the IOT Terminology and Technology

2. Describe intelligent IOT systems.

3. Analyze Protocol standardization for IOT

4. Perform ananalys is of IOT security issues using AI technology.

5. Identify the role of cloud computing in IOT.

Credits:2　　　　　　　　　　　**Teaching Scheme Theory:**2Hours/Week

Course Relevance: IoT or Internet of Things is primarily a full system of all the interconnected computing devices, having all the mechanical and digital machines. The Internet of Things is getting smarter. Companies are in corporating artificial intelligence in particular, machine learning into their IoT applications. Vendors of IoT platforms—Amazon, GE, IBM, Microsoft, Oracle, PTC, and Salesforce are integrating AI capabilities IoT is beneficial because it makes our work easy and is very less time-consuming. IoT has got   a lot more scope in terms of making a career and even exploring more opportunities if starting up with their own business.

SECTION-I

Topics and Contents
Introduction to Internet of Things–Definition & Characteristics, Importance of IoT, Physical Design of IOT, Logical Design of IOT, IOT Enabling technologies, IOT Levels & Deployment Templates, IoT and M2M, The role of Artificial Intelligence in IOT, Introduction to A IOT, Applications of Artificial Intelligence in Internet of Things: Collaborative Robots, Digital Twins, Drones, Smart Retailing, Smart Cities, Smart Health, etc.
AI and the Internet of Thing: Real World Use-Cases: Automated vacuum cleaners, like that of the iRobotRoomba, Smart thermostat solutions, like that of Nest Labs
Design Methodology–Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information model Specification, Service specification, IOT level Speci fications, Functional View Specifications, Operational View Specification, device and component integration, application development, Embedded suite for IoT Physical device– Arduino/Raspberry Pi Interfaces

---

SECTION-II

Topics and Contents
Connectivity Technologies and Communication Protocols in IOT: RFID:Introduction, Principle of RFID,Components of an RFID system, RFID Protocols & NFC   protocols, Wireless Sensor Networks: WSN Architecture, the node, connecting nodes, Networking Nodes, Securing Communication WSN specific IoT applications
Protocols in IOT: CoAP, XMPP, AMQP, MQTT
Internet of things Challenges: Vulnerabilities of IoT, Security, Privacy & Trust for IoT, Security requirements   Threat analysis, Use cases and misuse cases,   Introduction   to cloud computing, Role of Cloud Computing in IoT, Cloud-to-Device Connectivity, Cloud data management, cloud data monitoring, Cloud data Exchange, ENHANCINGRISK MANAGEMENT by pairing IoT with AI

List of Course Seminar Topics:
1. Self-driving vehicles

2. Security and access devices

3. AI-powered IoT

4. Role of AI and IOT in Health and Medicine

5. RPi operating system features over Arduino

6. Arduino architecture and its interfacing techniques

7. IPv6 technologies for the IoT.

8. Sensors in IOT

9. IoT System Management

10.   Automated Commute and Transport

List of Course Group Discussion Topics:
1. Future of IOT: AI

2. THEAIKEYTOUNLOCK IoT POTENTIAL

3. IOT Protocols

4. WSN architecture

5. Role of cloud computing in IOT

6. Challenge in integration of IoT with Cloud.

7. RFID Vs NFC with real world example

8. Vulnerabilities of IoT

9. Cloud types; IaaS, PaaS, SaaS with real world example

10.	Resource Management In The Internet Of Things

List of Home Assignments:
Design:
1. Design a complete IOT architecture for Smart office based on AI technique

2. Design a complete IOT architecture for Smart garden based on AI technique

3. Design a complete IOT architecture for Smart industry based on AI technique

4. Provide a complete layered architecture for Weather monitoring system and explain the same

5. Develop the IOT security system for the applications, just to make sure that the data is collected safely and sound

Case Study:
1. Smart Retail

2. Fleet Management and Autonomous Vehicles

3. Smart Energy

4. Smart Campus

5. Classroom Monitoring System

Blog
1. Drone Traffic Monitoring

2. Intelligent Routing

3. Revolutionizing IoT Through AI

4. Internet of Business

5. AI in IOT for Healthcare

Surveys
1. Predictive Equipment Maintenance in Industries

2. Smart Agriculture

3. Rural Development using IOT

4. Tesla's Auto pilot

5. Smart Transportation

Suggest an assessment Scheme: Suggest an Assessment scheme that is best suited or the course. Ensure 360 degree assessment and check if it covers all aspects of Blooms Taxonomy.
 MSE ESE   Course Project GD/PPT

Text Books:(As per IEEE format)

1.Arshdeep Bahga, Vijay Madisetti,"Internet of Things –A hands-on approach", Universities Press, 2015

2 Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, ISBN-10:87929827353 JanHoller, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos,

3.David Boyle,"From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",1st Edition, Academic Press, 2014.

4Francisda Costa,"Rethinking the Internet of Things :A Scalable Approach to Connecting Everything", 1st Edition, A press Publications, 2013

Reference Books: (As per IEEE format)

1. Pethuru Raj, Anupama C. Raman, The Internet of Things Enabling Technologies, Platforms, and Use Cases, CRC Press Taylor & Francis Group, International Standard Book Number-13:978-1-4987-6128-4

2. Rajkumar Buyya, Amir Vahid Dastjerdi Internet of Things–Principals and Paradigms, Morgan Kaufmannisanimprin of Elsevier, ISBN: 978-0-12-805395-9 Hakima Chaouchi, "The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7,Willy Publications

3. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things : Key Applications and Protocols,ISBN:978-1-119-99435-0, 2nd Edition, Willy Publications

4.Daniel Kellmereit, Daniel Obodovski,"The Silent Intelligence:The Internet of Things",.Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700,ISBN-13:978-0989973700.

Moocs Links and additional reading material:
1.https://nptel.ac.in/courses/106/105/106105166/
2.https://swayam.gov.in/nd1_noc19_cs65/preview

Course Outcomes:
Upon the completion of the course, student will be able to
1. Design an application based on IOT Terminology and Technology

2. Differentiate the role of AI in IOT interms of A IOT.

3. Implement the connectivity technologies and protocols in IOT

4. Produce a solution for IOT security challenges using the concept of AI.

5. Apply Cloud technology concepts for developing IOT based prototype

6. Perform programming and data analysis to build and test a complete working Intelligence IoT system.

AI4016:PREDICTIVE ANALYTICS

Course Prerequisites:

Descriptive statistics, Probability Distribution, Hypothesis testing

Course Objectives:

1. To learn, how to develop models to predict categorical and continuous outcomes.

2. Usage of techniques such as neural networks, decision trees, logistic regression, support vector machines and Bayesian network models.

3. To know the use of the binary classifier and numeric predictor nodes.

4. To get familiarity on automation of model selection.

5. To advice on when and how to use each model.

6. To learn how to combine two or more models to improve prediction performance.

Credits:2   **Teaching Scheme Theory:**2Hours/Week

Course Relevance:

This course is widely applicable to all types of industries for improving productivity and quality.

SECTION-I
Topics and Contents Introduction to Data Mining Introduction, what is Data Mining? Concepts of Data mining,Technologies Used, Data Mining Process, KDD Process Model, CRISP – DM, Mining onvariouskinds ofdata, Applicationsof DataMining, Challenges ofData Mining. Data Understanding and Preparation Introduction, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables, Extent of Missing Data. Segmentation, Outlier detection, Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, MissingValues.
SECTION-II
Topics and Contents Model development & techniques Data Partitioning, Model selection, Model Development Techniques, Neural networks, Decision trees, Logistic regression, Discriminant analysis, Support vector machine, Bayesian Networks, Linear Regression, CoxRegression,

Association rules.

Model Evaluation and Deployment Introduction, Model Validation,Rule Induction Using CHAID, Automating Models for Categorical and Continuous targets, Comparing and Combining Models, Evaluation Charts for Model Comparison, Meta Level Modeling, Deploying Model, Assessing Model Performance,Updating a Model.

List of Course Seminar Topics:

1. Handling missing values

2. Handling outliers in data.

3. Principle Component Analysis.

4. Cross Validation.

5. Variable Importance.

6. Dealing with Nominal Predictors

7. Sampling Techniques.

8. Confusion Matrix

9. Predictive inference

10. Time series for casting

List of Course Group Discussion Topics:

1. BiasVarianceTrade off

2. Explain vs Predict

3. Classification vs Regression

4. Single model vs Ensemble model

5. Supervised vs Unsupervised approaches.

6. Accuracy vs explainability

7. Performance evaluation of classifier vs Performance evaluation of Regressor

8. Auto-regressive and moving average models.

9. Additive & Multiplicative models.

10.   SEMMA(SAS) and CRISP(IBM)

List of Home Assignments: Design:

1. Design ac lassifier for real world application.

   2. Design aregression model for real world application.

   3. Designs voting-based ensemble model for real world application.

4. Design a time series for ecasting model.

5. Designs stacked ensemble model for real world application.

Blog

1. Write a blog on data summaries.

2. Write a blog on data visualization.

3. Write a blog on data preprocessing.

4. Write a blog on model evaluation and comparison of models.

5. Write a blog on dimensionality reduction techniques.

Surveys:

1. Take the survey of applications of predictive analytics in banking sector.

2. Take the survey of different model deployment techniques.

3. Take survey inventory classification models using data mining techniques.

4. Take the survey of optimization techniques in data science.

5. Take a survey ont ime series forecasting.

Suggest an assessment Scheme:
Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Blooms Taxonomy.
MSE   ESE   PPT   GD   VIVA HA

Text Books: (As per IEEE format)

1. "An Introduction to Statistical Learning: with Applications in R" by James, Witten, Hastie and Tibshirani, Springer, 1st. Edition, 2013.

2. Regression Modeling with Actuarial and Financial Applications, Edward W. Frees, 2010, New York: Cambridge. ISBN: 978-0521135962.

3. E. Alpaydin, Introduction to Machine Learning, Prentice Hall Of India,2010

Reference Books: (As per IEEE format)
1. ASM Study Manual for SRM-Statistics for Risk Modeling /2nd Edition, Weishaus/ASM.ISBN:978-1-64756-065-2

2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data Mining, Inference, and Prediction, Second Edition ,Springer Verlag, 2009.

Moocs Links and additional reading material:

1. http://faculty.smu.edu/tfomby/

2. http://www-bcf.usc.edu/~gareth/ISL/

Course Outcomes:

The student will be able to–

1. Understand the process of formulating business objectives

2. Study dataselection/collection, preparation and process.

3. To successfully design, build, evaluate and implement predictive models for a various business application.

4. Compare the underlying predictive modeling techniques.

5. Select appropriate predictive modeling approaches to identify cases to progress with.

6. Apply predictive modeling approaches using a suitable packages.

IT4216: DATA MANAGEMENT, PROTECTION AND GOVERNANCE

Course Prerequisites:

Database Management System, Operating System

Course Objectives:

To facilitate the learner to–

1. Get acquainted with the high-level phases of data life cycle management.

2. Acquire knowledge about the various aspects of data storage, data availability, data protection.

3. Gain exposure to various solutions/reference architectures for various use-casesAI

4. Understand the technical capabilities and business benefits of data protection.

Credits:2   **Teaching Scheme   Theory:**2Hours/Week

Course Relevance: Since technology trends such as Machine Learning , Data science and AI rely on data quality, and with the push of digital transformation initiatives across the globe, data management, governance and security is very much important.

SECTION-I
Data Storage, Availability and Security : Introduction to data life cycle management (DLM):- Goals of data life cycle management, Challenges involved: Volume of data source, Ubiquity of data locations, User demand for access; Stages of data life cycle-creation, storage, usage, archival, destruction; Risks involved without DLM, benefits, best practices. Data storage and data availability :- Storage technology: Hard Disk Device (HDD), Solid StateDevices (SSD), memory devices, Data access - block, files, object ; Data center End to EndView – overview of complete stack including storage, network, host, cluster, applications,virtual machines, cloud storage ; Storage virtualization technologies - RAID level, storagepooling, storage provisioning ; Advance topics in storage virtualization – storage provisioning,thin provisioning; Cloud storage – S3, glacier, storage tiering; High Availability: Introduction to high availability,clustering, failover, parallel access Data Threats and Data center security:-Type of Threats: Denial of Service(DoS), man in the middle attacks, Unintentional data loss, Repudiation, Malicious attacks to steal data; Introduction to Ransomware; Understanding, Identification and Threat modelling tools Security: Authorization and authentication-access control, Transport Layer. Security(TLS), key management, security in cloud, Design and architecture considerations for security
SECTION-II

Data Protection, Regulation and Governance : Introduction to data protection:- Introduction-Need for data protection, basic of back-up/ restore; Snapshots for data protection, copy-data management (cloning, DevOps); De-duplication; Replication; Long Term Retention – LTR; Archival;

Design considerations: Systemrecovery, Solution architecture, Backup v/s Archival, media considerations and management (tapes, disks, cloud), challenges with new edge technology (cloud, containers)

Data regulation, compliance and governance:-Regulations requirements and Privacy Regulations: The Health Insurance Portability and Privacy Act of 1996 (HIPPA), PII (Personally Identifiable Information), General Data Protection Regulation (GDPR); Information Governance: Auditing, Legal Hold, Data classification and tagging (Natural Language Processing); India's Personal Data Protection bill
Applications uninterrupted: - Understand data management aspects of traditional and new edgeapplications; Reference architecture/best practices (pick 2-3 case studies from below topics):Transactional Databases (Oracle, MySQL, DB2), NoSQL Databases (MongoDB, Cassandra), Distributed applications (microservice architectures), Cloud applications–Platform as Service (PaaS), Software as Service(SaaS), Kubernetes, Multi-Tiered applications, ETL workloads, Data analytics (AI/ML)

List of Home Assignments:
Design:
  1. Design data management aspects for cloud applications.

  2. Designd at a management aspect for MongoDB/ Cassandra.

  3. Design data management aspect Distributed applications.

  4. Design data life cycle management for any application.

  5.Design data management for any Multi-Tiered application.

Case Study:
  1. Consider different Transactional and No SQL Databases. Comparative study.

  2. Compare various cloud applications based on Platform as service and Software as service.

  3. Data Analytics based study for data management.

  4. Studyof Multi-Tiered Applications

  5. Study data management in DevOps

Blog:

1. Comparative study of data protection schemes.

2. Study of The Health Insurance Portability and Privacy Act of 1996 (HIPPA)

3. Need of data management, protection and governance

4. How Threat modelling tools are useful? Consider any application related to it.

5. Role of storage Technology for cloud storage.

Surveys:

1. Survey on data protection challenges with new edge technology like cloud

2. Survey on General Data Protection Regulation (GDPR)

3. Surveyon Data classification and tagging in Natural Language Processing

4. Surveyon Ransomware data security.

5. Surveyon Kubernetes.

Suggest an assessment Scheme:
MSE, ESE, HA

TextBooks:(AsperIEEEformat)

1. Robert Spalding,'Storage Networks: The complete Reference'.

Vic(J.R.)Winkler,'Securing The Cloud: Cloud Computing Security Techniques and Tactics', Syngress/ Elsevier-978-1-59749-592-9

Reference Books:(As pe Rieee format)

1.Martin Kleppmann,'Designing Data-Intensive Applications', O'Reilly

WebReferences:

1. https://www.enterprisestorageforum.com/storage-hardware/storage-virtualization.html

2. https://searchstorage.techtarget.com/definition/data-life-cycle-management

3. https://www.hitechnectar.com/blogs/three-goals-data-lifecycle-management/

4. https://www.bmc.com/blogs/data-lifecycle-management/

5. https://www.dataworks.ie/5-stages-in-the-data-management-lifecycle-process/

6. https://medium.com/jagoanhosting/what-is-data-lifecycle-management-and-what-

phaseswould-it-pass-through-94dbd207ff54

7. https://www.spirion.com/data-lifecycle-management/

8. https://www.bloomberg.com/professional/blog/7-phases-of-a-data-life-cycle/

9. https://www.datacore.com/storage-virtualization/

10. https://www.veritas.com/content/dam/Veritas/docs/solutionoverviews/

11. V0907_SB_InfoScale-Software-Defined-Infrastructure.pdf

12. https://www.veritas.com/solution/digital-compliance

13. https://www.veritas.com/solution/data-protection

14. https://www.veritas.com/gdpr

Course Outcome:
By taking this course,the learner will be able to–

1. Understand the data management world, challenges and best practices.

2. Compare various concepts and technologies for enabling data storage and high availability.

3. Illustrate various types of data threats and approaches to ensure data center security.

4. Explain the various concepts related to data protection.

5. Outline different standards for compliance and governance of data.

Understand various approaches for designing data intensive enterprise applications and industry standard solutions in data management.

AI3015 : Design Thinking VII

Course Prerequisites:

Basic knowledge of research work, research paper and patent.

Course Objectives:

1. Understand the concepts of design thinking approaches
2. Apply both critical thinking and design thinking in parallel to solve problems
3. Apply some design thinking concepts to their daily work
4. To provide ecosystem for students and faculty for paper publication and patent filing

Credits: 1   **Teaching Scheme Tut:** 1 Hour/Week

Course Relevance:

The course is offered in S.Y. and T.Y. B.Tech. to all branches of Engineering.

Contents for Design Thinking :

Structure of The paper Journal List (Top 50 Journals) Selection of

the journal

Use of various online journal selection tools

Plagiarism checking

Improving contents of the paper Patent

drafting

Patent search Filing of patent

Writing answers to reviewer questions

Modification in manuscript

Checking of publication draft

Assessment Scheme:

Publication of paper or patent

Course Outcomes:

On completion of the course, learner will be able to– CO1:

Understand the importance of doing Research

CO2: Interpret and distinguish different fundamental terms related to Research

CO3: Apply the methodology of doing research and mode of its publication

CO4: Write a Research Paper based on project work

CO5: Understand Intellectual property rights

 CO6: Use the concepts of Ethics in Research

CO7: Understand the Entrepreneurship and Business Planning

CO-PO Mapping:

CO/PO	Program Outcomes (PO)												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	2	1	3	1	3	2	2	2	1	2	2	3	3
CO2	2	2	3	3	2	2	2	3	2	2	1	3	2	3	3	3
CO3	2	2	2	2	2	2	2	3	2	2	3	3	2	3	3	3
CO4	2	2	2	2	2	2	1	3	2	2	2	1	2	3	3	3
CO5	2	2	2	2	2	2	2	3	2	2	2	3	3	2	2	3
CO6	2	2	2	2	2	2	2	3	2	2	2	1	3	2	2	2
CO7	2	2	2	2	2	2	2	3	2	2	2	3	3	3	3	3
Average	**2**	**1.9**	**2.1**	**2.1**	**1.9**	**2.1**	**1.7**	**3.0**	**2.0**	**2.0**	**2.0**	**2.1**	**2.4**	**2.6**	**2.7**	**2.9**

AI4005: MAJOR PROJECT

Credits: 10   **Teaching Scheme Lab:** 20 hours/week

Course Relevance:

This is a culmination of four years of learning into Practical. This course is essential for Graduate Engineers to practice the successful management of a software development project. The course emphasizes on project life cycle phases requirement engineering, system analysis and system design and gives them the exposure to research in any area of their interest. A further aim is for students to heighten personal awareness of the importance of developing strategies for themselves and It is a way of increasing the student's maturity and preparing him/her for their future career. The students carry out cutting edge projects with a flexibility to balance between research- and application-oriented work as per their interest. The program enables the students to find opportunities for higher studies in top ranking universities abroad, and to find jobs in dream companies .

The Motivation for this Major Project is
  a. Synthesis of knowledge
  b. To demonstrate the aptitude of applying the own knowledge to solve a specific problem.
  c. To mature the knowledge.
  d. Preparation for joining the working world.

The Project Work can lead to:

  a. Novice algorithm development

  b. Optimization of existing system/method

  c. New state of the art application

  d. Some incremental work in any existing field of their choice

---

Overview of the Course:
  1. The Student Project Group is expected to make a survey of situation for identifying the requirements of selected Technological Problem. The Student Project Group will be monitored by Internal Guides and External Guides (if any).

  2. The project requires the students to conceive, design, implement and operate a mechanism (the design problem). The mechanism may be entirely of the student's own design, or it may incorporate off-the-shelf parts. If the mechanism incorporates off-the-shelf parts, the students must perform appropriate analysis to show that the parts are suitable for their intended purpose in the mechanism.

  3. The project must be open-ended – meaning that there is not a known correct answer to the design problem. Students are expected to apply their creativity (simply copying or re-creating something that already exists is not acceptable).

---

4. The project must have an experimental component. Students must conceive, design, implement and operate an appropriate experiment as part of the project. The

5. experiment might be to collect data about some aspect of the design (i.e., to verify that the design will work as expected). Alternatively, the experiment could be to verify that the final mechanism performs as expected.

6. Upon receiving the approval, the Student Project Group will prepare a preliminary project report consisting Requirement Definition Document, Feasibility Study Document, System Requirement Specification, System Analysis Document, Preliminary System Design Document. All the documents indicated will have a prescribed format.

7. The Project Work will be assessed jointly by a panel of examiners having more than Five Years experience. The Project Groups will deliver the presentation of the Project Work which will be assessed by the panel.

8. The Student Project Group needs to actively participate in the presentation. The panel of examiners will evaluate the candidate's performance based on presentation skills, questions based on the Project Work, understanding of the Project, analysis and design performed for the project.

9. The Student Project Groups are expected to work on the recommendations given by the panel of examiners. In no case any variation in Project Theme will be permitted.

10. The outcome of the project should be tangible in terms of paper publication/patent/SOP/prototype

11. The Project should justify the work worth 10 credits.

Assessment Scheme

Sr. No.	Content	Marks
1	Development of Prototype/ Model	20
2	Innovativeness and intellectual input	20
3	evaluation of literature review	10
4	Individual contribution	10
5	Usage of Modern Tool/ Technology and experimental competency	10
6	Presentation of the Project Work	10
7	Results and analysis	10
8	Quality Publication and Project Report	10

Note:

The student needs to identify a technological problem in the area of Computer Engineering or Information Technology of their choice like signal processing, computer vision, machine learning and artificial intelligence, control systems, game theory, and communication networksand address the problem by formulating a solution for the identified problem. The project work needs to be undertaken by a group of maximum FOUR and minimum of THREE

students. The Project work will be jointly performed by the project team members.

The Project Group will prepare a synopsis of the project work which will be approved by the concerned faculty member. The project should not be a reengineering or reverse engineering project. In some cases, reverse engineering projects will be permissible based on the research component involved in it. The project work aims at solving a real world technical problem. Hence ample literature survey is required to be done by the students. Application-oriented projects will not be acceptable. Low-level custom User Interface development and its allied mapping with a particular technology will not be accepted.

Following is the list of recommended domains for Project Work:

signal processing, computer vision, machine learning and artificial intelligence, IoT, Block Chain, Image Processing, data Science etc.

Course Outcomes:

Upon completion of the course, graduates will be able to -

1. Model the Real World Problem
2. Identify the Design within Specification and Available Resources
3. Realize the Solution within Defined references
4. Defend his Design with Technical and Ethical reasoning
5. Adapt to changing Technological and Human resource advances
6. Use the gained knowledge for other Real-World Problems
7. Project will involve development of a compact solution to current problem/s in chosen field.

AI4008: INDUSTRY INTERNSHIP

Credit: 16

Course Relevance: Implementation of technical knowledge acquired during previous three years of Internship and to get acquainted with Industry culture.

SECTION-1

Get used to corporate culture
 Realization of Internship as per problem statement
Design, Testing / Experimentation, Analysis / Validation
Documentation and Report Writing
Quality of Work
Performance in Question & Answers Session
Regular interaction with guide

SECTION-2

Problem Statement
 Literature Review
Clarity about the objectives of Internship activity
Requirement Analysis, Internship Planning
Knowledge of domain, Latest technology, andmodern tools used /to be used
Neat project documentation

Suggest an assessment Scheme:

MSE review for 50 marks converted to 30

ESE review for 100 marks converted to 70

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Explore career alternatives prior to graduation.
CO2: Integrate theory and practice.
CO3: Develop work habits and attitudes necessary for job success.
CO4: Develop communication, interpersonal and other critical skills in the job interview process.
CO5: Acquire employment contacts leading directly to a full-time job following graduation from college.
CO6: Practice Project Management and learn team dynamics

AI4011: INTERNATIONAL INTERNSHIP

Credit: 16

Course Relevance: Implementation of technical knowledge acquired during previous three years of Internship and to inculcate research culture.

SECTION-1

Realization of Internship as per problem statement

Design, Testing / Experimentation, Analysis / Validation

Documentation and Report Writing

Quality of Work

Performance in Question & Answers Session

Regular interaction with guide

SECTION-2

Problem Statement

Literature Review

Clarity about the objectives of Internship activity

Requirement Analysis, Internship Planning

Knowledge of domain, Latest technology, and modern tools used /to be used

Research Paper should be published in Peer Reviewed Journal/Conference or Patent should be published.

Suggest an assessment Scheme:

MSE review for 50 marks converted to 30

ESE review for 100 marks converted to 70

Course Outcomes: On completion of the course, learner will be able to–
CO1: Explore career alternatives prior to graduation.
CO2: Integrate theory and practice.
CO3: Develop work habits and attitudes necessary for job success.
CO4: Develop communication, interpersonal and other critical skills in the job interview process.
CO5: Acquire employment contacts leading directly to a full-time job following graduation from college.
CO6: Practice Project Management and learn team dynamics

AI4010: RESEARCH INTERNSHIP

Credit: 16

Course Relevance: Implementation of technical knowledge acquired during previous three years of Internship and to inculcate Industry culture.

SECTION-1

Realization of Internship as per problem statement

Design, Testing / Experimentation, Analysis / Validation

Documentation and Report Writing

Quality of Work

Performance in Question & Answers Session

Regular interaction with guide

SECTION-2

Problem Statement

 Literature Review

Clarity about the objectives of Internship activity

Requirement Analysis, Internship Planning

Knowledge of domain, Latest technology, and modern tools used /to be used

Suggest an assessment Scheme:

MSE review for 50 marks converted to 30

ESE review for 100 marks converted to 70

AI4009: PROJECT INTERNSHIP

Credit: 16

Course Relevance: Implementation of technical knowledge acquired during previous three years of Internship and to get acquainted with Industry culture.

SECTION-1

Get used to corporate culture and get sponsorship from the company

 Realization of Internship as per problem statement

Design, Testing / Experimentation, Analysis / Validation

Documentation and Report Writing

Quality of Work

Performance in Question & Answers Session

Regular interaction with guide

SECTION-2

Problem Statement

Literature Review

Clarity about the objectives of Internship activity

Requirement Analysis, Internship Planning

Knowledge of domain, Latest technology, and modern tools used /to be used

Neat project documentation

Suggest an assessment Scheme:

MSE review for 50 marks converted to 30

ESE review for 100 marks converted to 70

Course Outcomes: On completion of the course, learner will be able to–
CO1: Explore career alternatives prior to graduation.
CO2: Integrate theory and practice.
CO3: Develop work habits and attitudes necessary for job success.
CO4: Develop communication, interpersonal and other critical skills in the job interview process.
CO5: Acquire employment contacts leading directly to a full-time job following graduation from college.
CO6: Practice Project Management and learn team dynamics

Bansilal Ramnath Agarwal Charitable Trust's

VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE – 37

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Academic Year 2024 – 25 – Semester-I

Assessment Details

S.Y. B.Tech.

I.   Courses with Theory, Lab and Tutorial

Sr. No.	Type of Assessment	Conduction	Marks
1	Presentation / Group Discussion/ Home Assignment	Week 5,6,7 and 8	30 Marks assessment (Part A)
2	Presentation / Group Discussion/ Home Assignment	End Semester Assessment	70 Marks assessment (Part B) Total 100 Marks (Part A + Part B) converted to 20 equivalent Marks
3	Laboratory Work	End Semester Assessment	100 Marks converted to 10 equivalent Marks
4	Course Project	End Semester Assessment	100 Marks converted to 20 equivalent Marks
5	Written Examination / MCQ	End Semester Assessment	60 Marks converted to 30 equivalent Marks
6	Comprehensive Viva Voce	End Semester Assessment	100 Marks converted to 20 equivalent Marks

II.   Courses with Programming activity

Sr. No.	Type of Assessment	Conduction	Marks
1	Laboratory work	During laboratory turns	100 Marks converted to 10 equivalent Marks
2	Course Project	End Semester Assessment	100 Marks converted to 20 equivalent Marks
3	Comprehensive Viva Voce	End Semester Assessment	100 Marks converted to 20 equivalent Marks
4	Programming Practical	End Semester Assessment	100 Marks converted to 50 Marks

Note: Department wise list of courses is given separately in this document in Part IX.

III.   2 Credit Theory Course

Sr. No.	Type of Assessment	Conduction	Marks
1	Class Test-1	In 6th Week, based on unit 1 and unit 2	35 Marks converted to 35 equivalent Marks
2	Class Test-2	In 12th Week, based on unit 3 and unit 4	35 Marks converted to 35 equivalent Marks
3	Comprehensive Viva Voce	End Semester Assessment based on all Units	100 Marks converted to 30 equivalent Marks

IV.   Engineering Design and Innovation Project

Sr. No.	Type of Assessment	Conduction	Marks
1	Project activity Presentation	Mid Semester	50 Marks converted to 30 equivalent Marks
2	Project activity Presentation & Demonstration	End Semester	100 Marks converted to 70 equivalent Marks

V.   Reasoning and Aptitude Development

Sr. No.	Type of Assessment	Conduction	Marks
1	English Ability	In 14th Week	1000 Marks converted to 30 equivalent Marks
2	Logical Ability	In 14th Week	1000 Marks converted to 30 equivalent Marks
3	Quantitative Ability	In 14th Week	1000 Marks converted to 30 equivalent Marks
4	Automata Fix	In 14th Week	100 Marks converted to 5 equivalent Marks
5	Automata Pro	In 14th Week	100 Marks converted to 5 equivalent Marks

T.Y. B.Tech.

I.   Courses with Theory, Lab and Tutorial

Sr. No.	Type of Assessment	Conduction	Marks
1	Presentation / Group Discussion / Home Assignment	Week 5,6,7 and 8	30 Marks assessment (Part A)
2	Presentation / Group Discussion / Home Assignment	End Semester Assessment	70 Marks assessment (Part B) Total 100 Marks (Part A + Part B) converted to 20 equivalent Marks
3	Laboratory Work	End Semester Assessment	100 Marks converted to 10 equivalent Marks
4	Course Project	End Semester Assessment	100 Marks converted to 20 equivalent Marks
5	Written Examination / MCQ	End Semester Assessment	60 Marks converted to 30 equivalent Marks
6	Comprehensive Viva Voce	End Semester Assessment	100 Marks converted to 20 equivalent Marks

II.   Courses with Programming activity

Sr. No.	Type of Assessment	Conduction	Marks
1	Laboratory work	During laboratory turns	100 Marks converted to 10 equivalent Marks
2	Course Project	End Semester Assessment	100 Marks converted to 20 equivalent Marks
3	Comprehensive Viva Voce	End Semester Assessment	100 Marks converted to 20 equivalent Marks
4	Programming Practical	End Semester Assessment	100 Marks converted to 50 Marks

Note: Department wise list of courses is given separately in this document in Part IX.

III.   Engineering Design and Innovation Project

Sr. No.	Type of Assessment	Conduction	Marks
1	Project activity Presentation	Mid Semester	50 Marks converted to 30 equivalent Marks
2	Project activity Presentation & Demonstration	End Semester	100 Marks converted to 70 equivalent Marks

IV.   A. Reasoning and Aptitude Development
(For Computer, IT, AI&DS, CSE-AIML and CSE – AI Branches)

Sr. No.	Type of Assessment	Conduction	Marks
1	English Ability	In 14th Week	1000 Marks converted to 20 equivalent Marks
2	Logical Ability	In 14th Week	1000 Marks converted to 20 equivalent Marks
3	Quantitative Ability	In 14th Week	1000 Marks converted to 20 equivalent Marks
4	Automata Fix	In 14th Week	100 Marks converted to 10 equivalent Marks
5	Automata Pro	In 14th Week	100 Marks converted to 10 equivalent Marks
6	Domain Specific Component	In 14th Week	1000 Marks converted to 10 equivalent Marks
7	Node.JS	In 14th Week	1000 Marks converted to 5 equivalent Marks
8	React.JS	In 14th Week	1000ks converted to 5 equivalent Marks

IV.   B. Reasoning and Aptitude Development
(For E&TC, Instrumentation and Mechanical Branches)

Sr. No.	Type of Assessment	Conduction	Marks
1	English Ability	In 14th Week	1000 Marks converted to 20 equivalent Marks
2	Logical Ability	In 14th Week	1000 Marks converted to 20 equivalent Marks
3	Quantitative Ability	In 14th Week	1000 Marks converted to 20 equivalent Marks
4	Automata Fix	In 14th Week	100 Marks converted to 10 equivalent Marks
5	Automata Pro	In 14th Week	100 Marks converted to 10 equivalent Marks
6	Domain Specific Component	In 14th Week	1000 Marks converted to 20 equivalent Marks

I.   Final year B.Tech. Courses

Sr. No.	Type of Assessment	Conduction	Marks
1	MCQ Exam – Section I	Mid Semester	30 Marks converted to 30 equivalent Marks
2	Home Assignment	End of Semester	100 Marks converted to 10 equivalent Marks
3	MCQ Exam – Section II	End of Semester	30 Marks converted to 30 equivalent Marks
4	Comprehensive Viva Voce	End of Semester	100 Marks converted to 30 equivalent Marks

II.   Coursera Track Certification (In semester-I)

Sr. No.	Type of Assessment	Conduction	Marks
1	End of module Quiz, Assignment, Module Project, Course Project, Track Project as applicable	Continuous Assessment till Semester End	100 Equivalent Marks Student to choose appropriate Track specialization. Applicable Assessment scheme under consideration for earning 100 equivalent Marks

III.   <u>Major Project & Semester Internship</u>

Sr. No.	Type of Assessment	Conduction	Marks
1	Project / Internship activity Presentation	Mid Semester	50 Marks converted to 30 equivalent Marks
2	Project/ Internship activity Presentation & Demonstration	End Semester	100 Marks converted to 70 equivalent Marks

Assessment Rubrics

I.   Presentation Assessment

Details of Assessment – 100 Marks to be converted to 20 Marks.

Partial assessment to be conducted during the 5th, 6th ,7th and 8th week of the Academic Semester for 50 marks

Format for Assessment

Sr. No.	Parameter	Marks
1	Survey about the topic	15
2	Appropriateness and relevance of references	15
3	Technical content coverage	20
	TOTAL	**50**

50 marks to be converted to 30

AND

Summative assessment to be conducted during End of the Academic Semester for 100 marks

Format for Assessment

Sr. No.	Parameter	Marks
1	Contents of slides	25
2	Understanding of concepts	25
3	Presentation Skills	25
4	Performance in Question-and-Answer Session	25
	TOTAL	**100**

100 Marks to be converted to 70 marks

II.   Group Discussion

Details of Assessment – 100 Marks to be converted to 20 Marks.

Partial assessment to be conducted during the 5th, 6th, 7th and 8th week of the Academic Semester for 50 marks

Format for Assessment

Sr. No.	Parameter	Marks
1	Survey about the topic	15
2	Technical content coverage during discussion	20
3	Ability to express technical views	15
	TOTAL	**50**

50 Marks to be converted to 30 marks
AND
Summative assessment to be conducted during End of the Academic Semester for 100 marks

Sr. No.	Parameter	Marks
1	Level of Participation	25
2	Knowledge of the Topic	15
3	Communication skill and Vocabulary	25
4	Critical Thinking	25
5	Overall Impression of Examiner	10
	TOTAL	**100**

100 Marks to be converted to 70 marks

Guidelines for assessment:

a. <u>Level of Participation</u>: The student has enthusiastically demonstrated that the knowledge of the topic acquired from Theory, Tutorial, Laboratory, Project, Supplementary reading is reflected in the statements and arguments made during the Group Discussions. Has been an active orator and a passive listener at appropriate times during the course of the Group Discussion

b. <u>Knowledge of the Topic</u>: The student is thorough in the content and concepts associated with the fundamental and applied aspects of the Topic. The participant contributed to clarify or synthesize other Group Discussion members' ideas. If disagreeing with other Group Discussion members' ideas, the student stated disagreement or objections consistent with the underlying technical concept clearly, yet politely.

c. <u>Communication skill and vocabulary</u>: The student effectively and politely communicated with the peers and the Moderator faculty, articulating the thoughts using appropriate Academic and Technical words. The student avoided the use of mixed or non-English vocabulary

d. <u>Critical Thinking</u>: The student is able to think clearly, and rationally and is able to logically connect various aspects of the topic being discussed. The student retained the ability to reason and stay focused, despite distractions, clutter and diversion experienced, if any, during the progress of the Group discussion. The student was able to think about the facts that emerged during the Group Discussion spontaneously. This ability is not the ability acquired by accumulation of facts and knowledge learned once in the past and used for ever.

<u>Overall impression of the moderator faculty</u>: The moderator faculty would quantify their impression on the basis of parameters such as, but not limited to - Time management, response and respect to peers and moderator faculty, ethics followed, arguments and counter arguments losing the decorum of the activity etc.

III.   EDI Assessment

1. Mid Semester Assessment – 50 Marks to be converted to 30 Marks.
2. End Semester Assessment – 100 Marks to be converted to 70 Marks.

Format for Mid Semester Assessment

Sr. No.	Parameter	Marks
1	Problem Statement	10
2	Literature Review	10
3	Group formation and identification of individual responsibility	10
4	Objective of Project activity	10
5	Knowledge of domain, technology and tools being used	10
	TOTAL	**50**

Format for End Semester Assessment

Sr. No.	Parameter	Marks
1	Realization of project as per problem statement	10
2	Design & Testing	30
3	Documentation and Report Writing	20
4	Quality of Work	15
5	Performance in Question & Answers Session	15
6	Timely Completion of Project work	10
	TOTAL	**100**

IV. Final Year B.Tech. Major Project

1. Mid Semester Assessment – 50 Marks to be converted to 30 Marks.
2. End Semester Assessment – 100 Marks to be converted to 70 Marks.

Format for Mid Semester Assessment

Sr. No.	Parameter	Marks
1	Problem Statement	10
2	Literature Review	10
3	Group formation and identification of individual responsibility	10
4	Objective of Project activity	10
5	Knowledge of domain, latest technology and modern tools being used	10
	TOTAL	**50**

Format for End Semester Assessment

Sr. No.	Parameter	Marks
1	Realization of project as per problem statement	10
2	Design, Testing / Experimentation, Analysis / Validation	30
3	Documentation and Report Writing	20
4	Quality of Work	15
5	Performance in Question & Answers Session	15
6	Regular interaction with guide	10
	TOTAL	**100**

V.   Final Year Semester Internship

1. Mid Semester Assessment – 50 Marks to be converted to 30 Marks.
2. End Semester Assessment – 100 Marks to be converted to 70 Marks.

Format for Mid Semester Assessment

Sr. No.	Parameter	Marks
1	Problem Statement	10
2	Literature Review	10
3	Clarity about the objectives of Internship activity	10
4	Requirement Analysis, Internship Planning	10
5	Knowledge of domain, Latest technology and modern tools being used	10
	TOTAL	**50**

Format for End Semester Assessment

Sr. No.	Parameter	Marks
1	Realization of Internship as per problem statement	10
2	Design, Testing / Experimentation, Analysis / Validation	30
3	Documentation and Report Writing	20
4	Quality of Work	15
5	Performance in Question & Answers Session	15
6	Regular interaction with guide	10
	TOTAL	**100**

Note: For the End Semester Assessment, it is expected that the Internship company guide is also involved. The Department is required to set up communication with the Internship company guide regarding the End Semester Assessment, requesting their availability, in the interest of fair and rigorous assessment. No remuneration is to be paid to Internal company guide. They are expected to be involved along with Examiner/s in the finalization of Marks. The participation from the Internship company guide is voluntary. If the company guide opts not to join the assessment activity, it may then be done by the appointed examiner/s only.

VI.   Comprehensive Viva Voce

1. End Semester Assessment – 100 Marks to be converted to 20 Marks.

    Guidelines for assessment:

    - The CVV enables a dialectic communication between the examiner/s and the student, providing invaluable experience for career interviews in future.

    - The Comprehensive Viva Voce is a summative assessment. It is based on verbal interaction between Examiner/s and the students, covering the entire course contents.

    - The student may be encouraged to explain the applicable concepts, ideas, views with the help of pen and paper/ Whiteboard screen/ Paint etc. if required.

    - A balanced set of questions invoking diverse abilities such as analysis, synthesis, application, comparison, correlation, summary, classification, explanation, illustration, description etc. be set up, while covering entire course contents.

    - Sufficient time is to be given for every student during the Viva Voce, to demonstrate the requisite abilities before arriving at the summative assessment score.

VIII.   Design Thinking

Scope:
Applicable for S.Y. B.Tech. ,T.Y. B.Tech. in both Semesters and for Final Year B.Tech. students (in Seventh Semester only) as 1 credit group activity

Objective:
To provide ecosystem to students for paper publication and patent filing

Outcome:
Publication of paper or filing of patent

Assessment and Grading:
Students will be assessed on the basis of the outcome, i.e., published paper or status of patent.
Grades to be awarded at the end of the Semester will be on the following basis –

Grade	Basis for Grade allocation
A+	Paper published in High impact Journals (Top 50 journal list will be given) / Patent Granted
A	Paper published in any SCI/Scopus/Web of science Journal/conference or Patent Published
B+	Paper Accepted for publication in SCI/Scopus/Web of science Journal/conference or patent filed
B	Paper published in UGC Listed Journal
C+	International Conference Paper Publication (Non-Scopus and Non-SCI)
C	National Conference Paper Publication (Non-Scopus and Non-SCI)
D	Paper submitted to any Journal / Conference
F	No publication / No patent

IX.   Courses with Programming activity

Program	Course Code	Course Name
IT	IT 2265	Advanced Data Structures
	IT 3221	Operating System
AI & DS	AI2021	Data Structures
	AI 2003	Computer Network
	AI 3002	Operating System
Computer	CS 3051	Operating System
	CS 3215	Web technology
	CS 2202	Data Structures
E & TC	ET 2270	Advanced Data Structure
	ET 3272	Design and Analysis of Algorithm
	ET 3221	Computer Vision
Mechanical	Nil	Nil
Instrumentation	IC 2222	Advanced Data Structure
Chemical	Nil	Nil
SY Common (DOME)	CS 2218	Object Oriented Programming Systems

Prof. (Dr.) Ashutosh Marathe
Dean - Academics