St. Johns College of Engineering & Technology

(AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

St. JOHNS COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

Yerrakota, YEMMIGANUR - 518360, Kurnool Dt., Andhra Pradesh, India

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COMPUTER SCIENCE & ENGINEERING

Syllabus

(SJCET R25 Regulations)

for

M.Tech (Regular-Full time)

(Effective for the students admitted into I year from the Academic Year 2025-26 onwards)

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

M.TECH.-COURSE STRUCTURE– R25

(Applicable from the academic year 2025-26 on-wards)

I M. Tech – I Semester

SNO	Course Code	Course Title	L/D	T	P	Credits
1	25G3D58101	Advanced Data Structures & Algorithms	3	0	0	3
2	25G3D58102	Distributed Operating Systems	3	0	0	3
3	25G3D58103a 25G3D58103b 25G3D58103c	**Program Elective-I** 1. Advanced Computer Architecture 2. Cloud Computing 3. Applied Machine Learning	3	0	0	3
4	25G3D58104a 25G3D58104b 25G3D58104c	**Program Elective-II** 1. Natural Language Processing 2. Smart Sensor Networks &IoT 3. Computing for Data Analytics	3	0	0	3
5	25G3D58105	Advanced Data Structures & Algorithms Lab	0	0	4	2
6	25G3D58106	Distributed Operating Systems Lab	0	0	4	2
7	25G3DRM101	Research Methodology and IPR	2	0	0	2
8	25G3D58107	Full stack Development Using MERN	0	1	2	2
9	25G3DAC101a 25G3DAC101b 25G3DAC101c	Audit Course – I English for Research Paper Writing Disaster Management Essence of Indian Traditional Knowledge	2	0	0	2
Total						20

I M. Tech – II Semester

SNO	Course Code	Course Title	L/D	T	P	Credits
1.	25G3D58201	Advances in Software Engineering	3	0	0	3
2.	25G3D58202	Advanced Databases	3	0	0	3
3.	25G3D58203a 25G3D58203b 25G3D58203c	**Program Elective – III** 1. Block Chain Technology 2. Advanced Computer Networks 3. Deep Learning and Applications	3	0	0	3
4.	25G3D58204a 25G3D58204b 25G3D58204c	**Program Elective – IV** 1. Generative AI 2. Digital Forensics 3. Robotic Process Automation	3	0	0	3
5.	25G3D58201P	Advances in Software Engineering Lab	0	0	4	2
6.	25G3D58202P	Advanced Databases Lab	0	0	4	2
7.	25G3D58205	Quantum Technologies And Applications	2	0	0	2
8.	25G3D58206	Comprehensive Viva Voce	0	1	2	2
9	25G3DAC201a 25G3DAC201b	Audit Course – II Pedagogy Studies Personality Development Through	2	0	0	2

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	25G3DAC201c	Life Enlightenment Skills Yoga For Stress Management				
Total						20

****Students have to undergo an Industry Internship after I Year II Semester for duration of 6 to 8 weeks**

SEMSTER - III

S.No.	Course code	Course Name	Category	Hours per			Credits
				L	T	P	
1.	25G3D58301a 25G3D58301b 25G3D58301c	**Program Elective – V** 1. Software Defined Networks 2. Reinforcement Learning 3. Data Science	PE	3	0	0	3
2.		**Open Elective-I**	OE	3	0	0	3
3.	25G3D58303	Dissertation Phase – I	PR	0	0	20	10
4.	25G3D58304	Industry Internship		0	0	0	2
5.	25G3D58305	Co- Curricular Activities		0	0	0	1
Total							**19**

Open Elective-I

S.No.	Course Code	Course Name	Offered by the Dept.
1	25G3D20302	Green Buildings	Civil
2	25G3D93203b	Road Safety Engineering	
3	25G3D06302	IoT and its Applications	ECE
4	25G3D07302	Photovoltaic Systems	EEE
5	25G3D15302	Integrated Product Design and Development	ME
6	25G3DOE301a	Advanced Numerical Methods and Computational Mathematics	Mathematics
7	25G3DOE301b	Mathematics for Machine Learning and Data Science	
8	25G3DOE301c	Statistical Learning Theory and Mathematical Foundations of AI	
9	25G3DOE301d	Chemistry Of Nanomaterials And Applications In Engineering	Chemistry
10	25G3DOE301e	Photonics For Engineers	Physics

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SEMESTER - IV

S.No.	Corse Codes	Course Name	Category	Hours per			Credits
				L	T	P	
1.	25G3D58401	Dissertation Phase – II	PR	0	0	32	16
Total							16

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Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58101	Engineering Science	3	0	0	3	40	60	100

Course Objectives:

To understand concepts of dictionaries and hash tables.

- To implement lists and trees.
- To analyze usage of B trees, Splay trees and 2-3 trees.
- To understand the importance of text processing and computational Geometry.

Course Outcomes: A student after completion of the course will be able to

CO1: Illustrate the working of the advanced tree data structures and their applications
CO2: Understand the Graph data structure, traversals and apply them in various contexts.
CO3: Use various data structures in the design of algorithms
CO4: Analyse algorithms with respect to space and time complexities
CO5: Design new algorithms

UNIT-1
Dictionaries : Definition, Dictionary Abstract Data Type, Implementation of Dictionaries, Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.
UNIT-1I
Skip Lists : Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists, Trees: Binary Search Trees (BST), AVL Trees, Red Black Trees: Height of a Red Black Tree, Red Black Trees Bottom-Up Insertion, Top-Down Red Black Trees, Top-Down Deletion in Red Black Trees, Analysis of Operations
UNIT-III
2-3 Trees , Advantage of 2-3 trees over Binary Search Trees, Search and Update Operations on 2-3 Trees, Analysis of Operations, B-Trees: Advantage of B- trees over BSTs, Height of B-Tree, Search and Update Operations on 2-3 Trees, Analysis of Operations, Splay Trees: Splaying, Search and Update Operations on Splay Trees, Amortized Analysis of Splaying.
UNIT-IV
Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, TheHuffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem
UNIT-V
Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees

Text books:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh 2nd Edition Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran2nd Edition University Press

Reference Books:

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill 3. The Art of
3. Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein&Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures &Programs:,N.Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni& Mehta, Galgottia Pub.
7. Data structures in Java:, Thomas Standish, Pearson Education Asia

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Online Links:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html 3. Abdul Bari,1. Introduction to Algorithms (youtube.com)

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

DISTRIBUTED OPERATING SYSTEMS

I M. Tech – I Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58102	Professional Core	3	0	0	3	40	60	100

Course Objectives:

- Introduce the architectures, principles, and design issues of distributed, database, and multiprocessor operating systems.
- Develop an understanding of communication, synchronization, deadlock handling, and agreement protocols in distributed environments.
- Explain distributed resource management, shared memory, scheduling, and fault tolerance techniques.
- Provide knowledge of security and protection models, and cryptographic methods for secure distributed computing.
- Explore the structure and design issues of multiprocessor and database operating systems with concurrency control mechanisms.

Course Outcomes: At the end of the course, Student will be able to

- CO1: Explain the architectures, limitations, and synchronization mechanisms (logical clocks, mutual exclusion) in distributed systems.
- CO2: Analyze distributed deadlock detection methods, agreement protocols, and distributed resource management techniques.
- CO3: Apply concepts of distributed shared memory, scheduling, and fault-tolerance techniques for reliable system design.
- CO4: Evaluate models of protection, access control, and cryptographic algorithms for ensuring data security in distributed systems.
- CO5: Compare multiprocessor and database operating systems, and analyze concurrency control algorithms for distributed databases.

UNIT-I
Architectures of Distributed Systems, System Architecture types, issues in distributed operatingsystems,communicationnetworks,communicationprimitives.TheoreticalFoundations,inherentlimitations of a distributed system, lamp ports logical clocks, vector clocks, casual ordering of messages, global state, cuts of a distributed computation, termination detection. Distributed Mutual Exclusion, introduction, the classification of mutual exclusion and associated algorithms, a comparative performance analysis
UNIT-II
Distributed Deadlock Detection, Introduction, deadlock handling strategies in distributed systems, issues in deadlock detection and resolution, control organizations for distributed deadlock detection, centralized and distributed deadlock detection algorithms, hierarchical deadlock detection algorithms. Agreement protocols, introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, and applications of agreement algorithms. Distributed resource management: introduction-architecture, mechanism for building distributed file systems design issues, log structured file systems
UNIT-III
Distributed shared memory, Architecture, algorithms for implementing DSM, memory coherence and protocols, design issues. Distributed Scheduling, introduction, issues in load distributing, components of a load distributing algorithm, stability, load distributing algorithm, performance comparison, selecting a suitable load sharing algorithm, requirements for load distributing, task migration and associated issues. Failure Recovery and Fault tolerance: introduction, basic concepts, classification of failures, backward and forward error recovery, backward error recovery, recovery in concurrent systems, consistent set of check points, synchronous and asynchronous check pointing and recovery, check pointing for distributed data base systems, recovery in replicated distributed databases.

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UNIT-1V
Protection and security, preliminaries, the access matrix model and its implementations. -safetyin matrix model, advanced models of protection. Data security, cryptography: Model of cryptography, conventional cryptography modern cryptography, private key cryptography, data encryption standard public key cryptography, multiple encryptions, authentication in distributed systems
UNIT-V
Multiprocessor operating systems, basic multiprocessor system architectures, inter connection networks for multiprocessor systems, caching hypercube architecture. Multiprocessor Operating System, structures of multiprocessor operating system, operating system design issues, threads, process synchronization and scheduling. Concurrency control model of database systems, the problem of concurrency control, serializability theory, distributed database systems, concurrency control algorithms, introduction, basic synchronization primitives, lock based algorithms, time stamp based algorithms, optimistic algorithms, concurrency control algorithms, data replication.

Textbooks:

1. Advanced concepts in operatingsystems: Distributed,Databaseandmultiprocessoroperating systems",MukeshSinghal, Niranjan andG.Shivaratri,TMH, 2001
2. Andrew S. Tanenbaum, Maarten Van Steen, Distributed Systems: Principles and Paradigms, Pearson Education, 2nd Edition, 2006.

Reference Books:

1. Andrew S. Tanenbaum, Maarten Van Steen, Distributed Systems: Principles and Paradigms, Pearson Education, 2nd Edition, 2006.
2. Silberschatz, Galvin, Gagne, Operating System Concepts, Wiley, 9th Edition, 2018.
3. M. Mitzenmacher, E. Upfal, Probability and Computing: Randomized Algorithms and Probabilistic Analysis, Cambridge University Press, 2005.
4. Alan Tucker, Applied Combinatorics, John Wiley & Sons, 5th Edition, 2007.
5. Nancy A. Lynch, Distributed Algorithms, Morgan Kaufmann, 1996.
6. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, Distributed Systems: Concepts and Design, Pearson, 5th Edition, 2011.

Online Links:

https://onlinecourses.nptel.ac.in/noc21_cs87/preview
https://onlinecourses.nptel.ac.in/noc22_cs80/preview

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

ADVANCED COMPUTER ARCHITECTURE

I M. Tech – I Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58103a	PE-1	3	0	0	3	40	60	100

Course Objectives:

- To impart the concepts and principles of parallel and advanced computer architectures.
- To develop the design techniques of Scalable and multithreaded Architectures.
- To apply the concepts and techniques of parallel and advanced computer architectures to design modern computer systems

Course Outcomes: At the end of the course, Student will be able to

- Analyze various parallel computer models, program partitioning techniques, and system interconnect architectures to evaluate conditions for parallelism.
- Apply performance metrics and scalability analysis to assess parallel processing applications using advanced processor and memory technologies.
- Design and differentiate linear, non-linear, instruction, and arithmetic pipelines to enhance execution performance in modern processors.
- Examine multiprocessor and multicomputer architectures, cache coherence protocols, and synchronization mechanisms for scalable system design.
- Evaluate vector and SIMD processing principles through case studies like CM-5 to identify their effectiveness in solving computationally intensive applications.

UNIT-I: Micro Processors
Theory of Parallelism, Parallel computer models, The State of Computing, Multiprocessors and Multi computers, Multi vector and SIMD Computers, PRAM and VLSI models, Architectural development tracks, Program and network properties, Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnect Architectures.
UNIT-II: Parallel Processing
Principles of Scalable performance, Performance metrics and measures, Parallel Processing applications, Speed up performance laws, Scalability Analysis and Approaches, Hardware Technologies, Processes and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors
UNIT-III: Pipeline Processors
Shared-Memory Organizations, Sequential and weak consistency models, Pipelining and superscalar techniques, Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design.
UNIT-1V: Architecture of Microprocessors
Parallel and Scalable Architectures, Multiprocessors and Multi computers, Multiprocessor system interconnects, cache coherence and synchronization mechanism, Three Generations of Multi computers, Message-passing Mechanisms, Multi vector and SIMD computers.
UNIT-V: Applications
VectorProcessingPrinciples, MultivectorMultiprocessors,CompoundVectorprocessing, SIMDcomputer Organizations, The connection machine CM-5.

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Textbooks:

1. Advanced Computer Architecture, Kai Hwang, 2nd Edition, Tata McGraw Hill Publishers.

Reference Books:

1. Computer Architecture, J.L. Hennessy and D.A. Patterson, 4th Edition, ELSEVIER.
2. Advanced Computer Architectures, S.G.Shiva, Special Indian edition, CRC, Taylor &Francis.
3. Introduction to High Performance Computing for Scientists and Engineers, G. Hager and G.Wellein, CRC Press, Taylor & Francis Group.
4. Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education.
5. Computer Architecture, B. Parhami, Oxford Univ. Press.

Online Links:

https://onlinecourses.nptel.ac.in/noc23_cs07/preview
https://nptel.ac.in/courses/106103206
https://www.youtube.com/playlist?list=PLeIwGZPgtiz4dVGeK2OJDIIuX4rp72JXJ

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CLOUD COMPUTING

I M. Tech – I Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D25104b	PE-2	3	0	0	3	40	60	100

Course Objectives:

- Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure. Compare the advantages and disadvantages of various cloud computing platforms.
- Investigate how a global storage solution can be optimized so that it can be delivered successfully from the cloud
- Evaluate information storage management design in a cloud environment and how it relates to the business objectives of an organization
- Analyze how best to provide reliable access to information both locally and remotely using storage technologies
- Critically appraise the opportunities and challenges of information management in complex business environments.

Course Outcomes: At the end of the course, Student will be able to

CO1: Deploy applications over commercial cloud computing infrastructures such as Amazon Web Services, Windows Azure, and Google App Engine.

CO2: Program data intensive parallel applications in the cloud.

CO3: Analyze the performance, scalability, and availability of the underlying cloud technologies and software.

CO4: Identify security and privacy issues in cloud computing.

CO5: Solve a real-world problem using cloud computing through group collaboration

UNIT-I
Definition, characteristics, components, Cloud service provider, the role of networks in Cloud computing, Cloud deployment models- private, public & hybrid, Cloud service models, multitenancy, Cloud economics and benefits, Cloud computing platforms - IaaS: Amazon EC2, PaaS: Google App Engine, Microsoft Azure, SaaS.
UNIT-II
Virtualization concepts, Server virtualization, Storage virtualization, Storage services, Network virtualization, Service virtualization, Virtualization management, Virtualization technologies and architectures, virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, VMware hypervisors and their features
UNIT-III
Relational databases, Cloud file systems: GFS and HDFS, Bigtable, HBase and Dynamo. MapReduce and extensions: Parallel computing, the map -Reduce model, Parallel efficiency of Map Reduce.
UNIT-IV
Advanced Cloud Concepts :Containers and Docker, Kubernetes and Cloud-native AI Workflows, Serverless Computing: AWS Lambda, Azure Functions, CI/CD Pipelines for AI Models in Cloud, Scaling AI Applications using Load Balancers and Auto-Scaling. Monitoring and Logging in Cloud for AI Workflows.
UNIT-V
Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud. Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security. Issues in cloud computing Implementing real time application over cloud platform, Issues in Inter - cloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware.

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Textbooks:

1. Enterprise Cloud Computing by Gautam Shroff, Cambridge publication
2. Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.
3. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing, McGraw-Hill.

Reference Books:

1. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley -India
2. Dr. Kumar Saurabh, "Cloud Computing", Wiley Publication
3. Dimitris N. Chorafas, "Cloud Computing Strategies" CRC Press; 1 edition [ISBN: 1439834539],2010
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw Hill Osborne Media; 1 edition [ISBN: 0071626948], 200
5. RajkumarBuyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley Publication, 2011
6. Tim Mather, SubraKumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", O'ReillyMediaInc, 2009

Online Links:

https://onlinecourses.nptel.ac.in/noc21_cs14/preview
https://nptel.ac.in/courses/106105167
https://onlinecourses.swayam2.ac.in/nou25_cs33/preview

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

APPLIED MACHINE LEARNING

I M. Tech – I Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58103c	PE-1	3	0	0	3	40	60	100

Course Objectives:

- To know the fundamental concepts of Machine Learning.
- To understand linear, distance based, and decision tree based models
- To explore tools and practices for Machine learning in Real world situation.
- To know the Artificial Neural Network and Reinforcement Learning.

Course Outcomes: At the end of the course, Student will be able to

1. CO1: Understand the fundamental concepts of machine learning
2. CO2: Apply linear, distance based, and decision tree based models
3. CO3: Analyze probabilistic, neural network models
4. CO4: Design a suitable machine learning model for a given scenario

UNIT-I
Introduction to Machine Learning: Introduction. Different types of learning, Examples of Machine Learning Applications Supervised Learning: Learning a Class from Examples, Probably Approximately Correct Learning, Learning multiple classes, Model selection and generalization Regression: Linear regression, Multiple Linear regression, Logistic Regression.
UNIT-II
The ingredients of machine learning: Tasks, Models, Features Binary classification and related tasks: Classification, Assessing classification performance, Visualizing classification performance Beyond binaryclassification: Multi-class classification, Regression, Unsupervised and descriptive learning
UNIT-III
Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Inductive bias in decision tree, Issues in decision tree learning. Linear models: The least-squares method, Multivariate linear regression, The perceptron, Support vector machines, Soft margin SVM, Going beyond linearity with kernel methods
UNIT-1V
Distance Based Models: Introduction, Neighbours and exemplars, Nearest Neighbours classification, K-Means algorithms, Clustering around medoids Probabilistic Models: Using Naïve Bayes Model for classification, Expectation Maximization, Gaussian Mixture models
UNIT-V
Artificial Neural Networks: Introduction, Neural network representation, appropriate problems for neural network learning, Multilayer networks and the back propagation, Advanced topics in Artificial Neural Networks Reinforcement Learning: Introduction, Learning tasks, Q-learning

Textbooks:

1. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 2012
2. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education

Reference Books:

1. AurélienGéron, Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition
2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014

3. EthemAlpaydın, Introduction to machine learning, second edition, MIT press.
4. T. Hastie, R. Tibshirani and J. Friedman, “Elements of Statistical Learning”, Springer Series, 2nd edition

Online Links:

https://onlinecourses.nptel.ac.in/noc23_cs18/preview
https://nptel.ac.in/courses/106106198

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

NATURAL LANGUAGE PROCESSING

I M. Tech – I Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58104a	PE-2	3	0	0	3	40	60	100

Course Objectives:

- Introduce the fundamental concepts of human language, linguistic structures, and their computational representation for Natural Language Processing.
- Develop knowledge of grammars, parsing strategies, semantic interpretation, and language modelling techniques for designing NLP systems.
- Explore advanced NLP applications such as machine translation, multilingual information retrieval, and cross-lingual language processing.

Course Outcomes: At the end of the course, Student will be able to

CO1:Understand linguistic foundations of English syntax and various levels of language analysis for Natural Language Processing.

CO2:Apply parsing techniques such as top-down, bottom-up, ATNs, and feature-based systems for grammatical analysis of natural language.

CO3:Analyse different grammar formalisms and parsing approaches to handle language phenomena like movement, ambiguity, and human preferences in parsing.

CO4:Construct semantic representations using logical forms, thematic roles, and speech acts, and apply n-gram and statistical models for language modeling.

CO5:Evaluate and compare machine translation approaches and demonstrate understanding of systems like Anusaraka for multilingual language processing.

UNIT-I
The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.
UNIT-II
Grammars and Parsing- Top-Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayes Rule, Shannon game, Entropy and Cross Entropy.
UNIT-III
Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.
UNIT-1V
Semantic Interpretation: Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts &embedded sentences, Defining semantics structure model theory. Language Modelling: Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross lingual Language Modelling.
UNIT-V
Machine Translation Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in

AnusarsakaOutput, Language Bridges.
Multilingual Information Retrieval: Introduction, Document Pre-processing, Monolingual Information Retrieval,CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources.

Textbooks:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications: From TheoryTo Practice-Daniel M.Bikeland ImedZitouni, Pearson Publications.
3. Natural Language Processing, Apaninian perspective, AksharBharathi, Vineetchaitanya, Prentice–Hall of India.

Reference Books:

1. Charniack, Eugene, Statistical Language Learning, MITPress, 1993.
2. Jurafsky,Danand Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopherand Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Online Links:

https://nptel.ac.in/courses/106101007
https://nptel.ac.in/courses/106106211
http://www.digimat.in/nptel/courses/video/106101007/L01.html

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

SMART SENSOR NETWORKS & IOT

I M. Tech – I Semester								SJCET-R25
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
25G3D58104b	PE-2	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100

Course Objectives:

- To provide an in-depth understanding of IoT concepts, applications, and research areas in domains such as smart cities, smart health, smart energy, and smart transportation.
- To analyze IoT system architectures, design constraints, physical devices, communication protocols, and middleware for advanced implementation.
- To explore industrial and commercial IoT applications, including automation, sensor networks, and emerging trends like edge computing, cloud of things, and digital twins.

Course Outcomes: At the end of the course, Student will be able to

CO1:Explain the fundamental concepts, applications, and research areas of IoT across various domains.

CO2:Analyze IoT reference architectures, functional and deployment views, and real-world design constraints including hardware, technical, and operational limitations.

CO3:Demonstrate practical knowledge of IoT devices, programming, operating systems, communication protocols, network security, and database management.

CO4:Apply IoT principles to industrial automation and enterprise integration using frameworks such as SOCRADES and IMC-AESOP.

CO5:Evaluate case studies in commercial building automation and emerging IoT trends, including edge/fog computing, predictive maintenance, and digital twin technologies.

UNIT-I
UNIT I: Introduction and Applications: smart transportation, smart cities, smart living, smart energy, smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.
UNIT-II
Real-World Design Constraints- Introduction, Technical Design constraints, hardware, Data representation and visualization, Interaction and remote control.
UNIT-III
IOT Physical Devices & Endpoints: What is an IOT Device, Exemplary Device Board, Linux on Raspberry, Interface and Programming & IOT Device. Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases
UNIT-1V
Industrial Automation-Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation-Introduction,
UNIT-V
Casestudy: phase one-commercial buildingautomationtoday. Case study: phase two commercial building automation in the future. Recent trends in sensor network and IOT

architecture, Automation in Industrial aspect of IOT.

Textbooks:

1. Mandler, B., Barja, J., MitreCampista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publication
2. Internet of Things: A Hands-On Approach Paperback– 2015, byArsheepBahga (Author), VijayMadisetti (Author)
3. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things by Pearson Paperback – 16 Aug 2017 ,by Hanes David (Author), Salgueiro Gonzalo (Author), Grossetete Patrick (Author), Barton Rob (Author).

Reference Books:

IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things by Pearson Paperback – 16 Aug 2017 ,byHanes David(Author), Salgueiro Gonzalo(Author), GrossetetePatrick(Author), Barton Rob(Author).

Online Links:

https://onlinecourses.nptel.ac.in/noc22_cs53/preview
https://onlinecourses.nptel.ac.in/noc20_cs22/preview
https://www.youtube.com/watch?v=WUYAjxnwjU4

St. Johns College of Engineering & Technology

(AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COMPUTING FOR DATA ANALYTICS

I M. Tech – I Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58104c	PE-2	3	0	0	3	40	60	100

Course Objectives:

- Provide knowledge of the data analytics lifecycle, including business understanding, data science roles, and project deliverables.
- Develop a strong foundation in statistical methods, probability, and hypothesis testing for data-driven decision-making.
- Equip students with skills to apply predictive analytics, regression, time series forecasting, and experimental design techniques to real-world datasets.

Course Outcomes: At the end of the course, Student will be able to

CO1:Understand the data analytics lifecycle and identify the roles and responsibilities of data scientists in business analytics projects.

CO2:Apply statistical techniques such as measures of central tendency, variation, skewness, and kurtosis for data summarization and interpretation.

CO3:Analyze probability distributions (binomial, Poisson, normal, exponential, gamma, etc.) and apply them in modeling uncertain events.

CO4:Perform hypothesis testing and predictive analytics using t-tests, chi-square tests, regression, correlation, and multiple correlation methods.

CO5Design forecasting models (moving average, exponential smoothing, seasonal trends) and conduct **design of experiments** (ANOVA, Latin square, factorial design) for analytical problem solving.

UNIT-I: DATA ANALYTICS LIFE CYCLE
UNIT – I DATA ANALYTICS LIFE CYCLE Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists - Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders.
UNIT-II: STATISTICS
Sampling Techniques - Data classification, Tabulation, Frequency and Graphic representation - Measures of central value - Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median, Quartiles, Deciles, Percentile - Measures of variation – Range, IQR, Quartile deviation, Mean deviation, standard deviation, coefficient variance, skewness, Moments & Kurtosis.
UNIT-III: PROBABILITY AND HYPOTHESIS TESTING
Random variable, distributions, joint probability function, marginal density function. Random vectors - Some special probability distribution - Binomial, Poison, Geometric, uniform, exponential, normal, gamma and Erlang - Normal distribution.
UNIT-1V: PREDICTIVE ANALYTICS
Sampling distribution – Estimation - point, confidence - Test of significance, 1& 2 tailed test, uses of t-distribution, F-distribution, $\chi 2$ distribution - Predictive modeling and Analysis - Regression Analysis, Correlation analysis, Rank correlation coefficient, Multiple correlation.
UNIT-V: TIME SERIES FORECASTING AND DESIGN OF EXPERIMENTS
Forecasting Models for Time series : MA, SES, TS with trend, season - Design of Experiments, one way classification, two way classification, ANOVA, Latin square, Factorial Design.

Textbooks:

1. Chris Eaton, Dirk Deroos, Tom Deutsch et al., —Understanding Big Data, Mc Graw Hill, 2012.
2. Alberto Cordoba, —Understanding the Predictive Analytics Lifecycle, Wiley, 2014.
3. Eric Siegel, Thomas H. Davenport, —Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, Wiley, 2013.

Reference Books:

1. James R Evans,—Business Analytics – Methods, Models and Decisions, Pearson 2013.
2. R. N. Prasad, Seema Acharya, —Fundamentals of Business Analytics, Wiley, 2015.
3. S M Ross, —Introduction to Probability and Statistics for Engineers and Scientists||, Academic Foundation, 2011.
4. David Hand, HeikiMannila, Padhria Smyth, —Principles of Data Mining, PHI 2013.
5. Spyros Makridakis, Steven C Wheelwright, Rob J Hyndman, —Forecasting methods and applications Wiley 2013(Reprint).
6. David Hand, HeikkiMannila, Padhraic Smyth, —Principles of Data mining, PHI 2013.

Online Links:

https://onlinecourses.nptel.ac.in/noc21_cs45/preview
https://nptel.ac.in/courses/106107220
https://onlinecourses.swayam2.ac.in/ntr24_ed70/preview

St. Johns College of Engineering & Technology

(AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

ADVANCED DATA STRUCTURES AND ALGORITHMS LAB

I M. Tech – I Semester								SJCET-R25
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
25G3D58105	Professional Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	4	2	60	40	100

Course Objectives:

1. acquire practical skills in constructing and managing Data structures
2. apply the popular algorithm design methods in problem-solving scenarios

Course Outcomes: At the end of the course, Student will be able to

CO1: Design and develop programs to solve real world problems with the popular algorithm design methods.
CO2: Demonstrate an understanding of Non-Linear data structures by developing implementing the operations on AVL Trees, B-Trees, Heaps and Graphs.
CO3: Critically assess the design choices and implementation strategies of algorithms and data structures in complex applications
CO4: Utilize appropriate data structures and algorithms to optimize solutions for specific computational problems.
CO5: Compare the performance of different of algorithm design strategies.

List of Experiments:

1. **Implementation of Dictionary ADT using Arrays**
   Perform insert, delete, search and update operations.
2. **Dictionary Implementation using Linked Lists**
   Compare efficiency with array-based implementation.
3. **Hash Table Implementation with Separate Chaining**
   Resolve collisions using linked list chaining.
4. **Hash Table using Linear Probing**
   Implement open addressing with linear probing.
5. **Hash Table using Quadratic Probing**
   Handle collisions using quadratic probe sequence.
6. **Hash Table using Double Hashing**
   Implement and analyze second hash function usage.
7. **Rehashing Technique in Hash Tables**
   Dynamically resize hash table when load factor exceeds threshold.
8. **Extendible Hashing Implementation**
   Simulate directory-based dynamic hashing.
9. **Implementation of Skip List**
   Perform randomized insertion, deletion and searching.
10. **Probabilistic Analysis of Skip Lists**
    Measure search performance experimentally.
11. **Binary Search Tree (BST) Operations**
    Insert, delete and traverse nodes.
12. **AVL Tree Implementation**
    Implement rotations and balance factor maintenance.
13. **Red-Black Tree Bottom-Up Insertion**
    Demonstrate color fixing and rotations.
14. **Red-Black Tree Top-Down Deletion**
    Implement deletion algorithm with rebalancing.
15. **2-3 Tree Implementation**

Insert and search operations with node splitting.

16. B-Tree Implementation

Implement order-m B-tree with insertion and deletion.

17. Comparative Study of BST, AVL and B-Tree Heights

Analyze performance based on height and search time.

18. Splay Tree Implementation

Demonstrate splaying during access operations.

19. **Pattern Matching Algorithms Implementation**

Implement and compare:

- Brute Force
- Boyer-Moore
- KMP

20. **Text Processing Applications**

a) Huffman Coding for File Compression
b) Longest Common Subsequence (LCS) using Dynamic Programming
c) Construction of Suffix Tries and Compressed Tries

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson- Freed, Silicon Press, 2008

Reference Books:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2ndEdition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, 2ndEdition, University Press
3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia 4. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill

St. Johns College of Engineering & Technology

(AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

DISTRIBUTED OPERATING SYSTEMS LAB

I M. Tech – I Semester								SJCET-R25
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
25G3D58106	Professional Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	4	2	60	40	100

Course Objectives:

- To provide hands-on experience in implementing synchronization, deadlock detection, and resource management algorithms in distributed and multiprocessor systems.
- To develop the ability to design and simulate mechanisms for fault tolerance, load balancing, task migration, and secure communication using cryptographic techniques.
- To enable students to apply concurrency control methods in distributed databases and critically analyze the performance of various distributed algorithms.

Course Outcomes: At the end of the course, Student will be able to

C01:Implement and analyze synchronization mechanisms in distributed environments.
CO2:Develop and evaluate distributed deadlock detection techniques.
CO3:Design and implement distributed shared memory models and scheduling algorithms.
CO4:Apply security and cryptographic techniques to distributed systems.
CO5:Implement concurrency control algorithms in database operating systems.

List of Experiments:

Unit I: Architectures & Synchronization

1. Implementation of Lamport's Logical Clocks – Simulate logical clock updates in a distributed system.
2. Vector Clocks and Causal Ordering – Implement vector clocks and analyze message ordering.
3. Distributed Mutual Exclusion Algorithms – Implement Ricart-Agrawala and Maekawa's mutual exclusion algorithms.

Unit II: Deadlock Detection & Resource Management

4. Simulation of Distributed Deadlock Detection Algorithms – Implement centralized and distributed deadlock detection techniques.
5. Hierarchical Deadlock Detection – Implement a hierarchical approach to detecting deadlocks in a distributed system.

Unit III: Shared Memory, Scheduling & Fault Tolerance

6. Implementation of Load Balancing Algorithms – Compare load balancing techniques (static and dynamic).
7. Task Migration Mechanism – Implement and analyze task migration in a distributed system.

Unit IV: Security & Cryptography

8. Access Matrix Model Implementation – Simulate access control using an access matrix.
9. Implementation of Data Encryption Standard (DES) Algorithm – Encrypt and decrypt messages using DES.
10. Public Key Cryptography using RSA – Implement RSA encryption and authentication mechanisms.

Unit V: Multiprocessor & Database OS

11. Process Synchronization in Multiprocessor Systems – Implement and analyze thread synchronization.
12. Concurrency Control using Lock-Based Algorithms – Implement two-phase locking protocol.
13. Timestamp-Based Concurrency Control – Develop a timestamp-based concurrency control mechanism.
14. Optimistic Concurrency Control Algorithm – Implement an optimistic concurrency control protocol.

References

1. MukeshSinghal and Niranjan G. Shivaratri – Advanced Concepts in Operating Systems: Distributed, Database, and Multiprocessor Operating Systems, McGraw Hill, 2001.
2. Andrew S. Tanenbaum and Maarten Van Steen – Distributed Systems: Principles and Paradigms, Pearson Education, 2nd Edition, 2007.
3. George Coulouris, Jean Dollimore, Tim Kindberg, and Gordon Blair – Distributed Systems: Concepts and Design, Pearson Education, 5th Edition, 2012.
4. Pradeep K. Sinha – Distributed Operating Systems: Concepts and Design, PHI Learning, 2008.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

RESEARCH METHODOLOGY AND IPR

(Common to M.Tech CSE, CN, SE,AI & ML)

I M. Tech – I Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3DRM101		2	0	0	2	60	40	100

Course Objectives:

- Identify an appropriate research problem in their interesting domain.
- Understand ethical issues understand the Preparation of a research project thesis report.
- Understand the Preparation of a research project thesis report
- Understand the law of patent and copyrights.
- Understand the Adequate knowledge on IPR.

Course Outcomes (CO): Student will be able to

CO1:Analyze research related information

CO2:Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO3:Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

CO4:Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT - I
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, scope, and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations
UNIT - II
Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.
UNIT - III
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.
UNIT - IV
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.
UNIT - V
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction".

Reference Books:

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
3. Mayall, “Industrial Design”, McGraw Hill, 1992.
4. Niebel, “Product Design”, McGraw Hill, 1974.
5. Asimov, “Introduction to Design”, Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

FULL STACK DEVELOPMENT USING MERN

I M. Tech – I Semester								SJCET-R25
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
25G3D58107	Skill Enhancement Course	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	1	2	2	60	40	100

Course Objectives:

The course aims to:

- Provide strong foundations in web development technologies (HTML, CSS, JavaScript, ES6).
- Introduce server-side programming with Node.js and Express.js for building scalable applications.
- Enable students to work with relational (MySQL) and non-relational (MongoDB) databases.
- Impart skills to design and develop interactive user interfaces using ReactJS.
- Enhance problem-solving abilities through full-stack web application development experiments.

Course Outcomes: At the end of the course, Student will be able to

CO1: Apply fundamental web technologies (HTML, CSS, JavaScript, ES6) to design responsive web pages.
CO2: Develop server-side applications using Node.js and Express.js with REST API integration.
CO3: Perform database operations using MySQL and MongoDB and integrate them with backend services.
CO4: Design and implement dynamic, component-based user interfaces using ReactJS.
CO5: Develop and deploy full-stack applications by combining frontend, backend, and database skills.
CO6: Demonstrate problem-solving, debugging, and version control skills in web development projects.

Module 1: Web Development Fundamentals

Fundamentals of Web Design, Webpage and Website, Web application HTML Typography, Images, Tables, Lists, Hyperlinks etc. CSS Syntax and usage, CSS Selectors, CSS on body, CSS on Text, CSS on Links, CSS on Tables, CSS on Lists, CSS on Forms, CSS on Images, CSS on DIV, W3.CSS Framework

List of Experiments :

- **HTML & CSS Basics** – Create a personal portfolio webpage using HTML (headings, lists, tables, hyperlinks, forms) and style it with CSS selectors.
- **Responsive Layout** – Develop a responsive webpage using DIV, CSS box model, and W3.CSS framework.
- **Styled Components** – Design a webpage for a college event with images, tables, and styled navigation menu using CSS.

Module 2: JavaScript and ECMA Script 6

JavaScript Fundamentals - Grammar and types, Control flow and error handling - Loops, Function - Objects, Arrays, Promises - ES6 Let and const, Template literals - Arrow Function, Default parameter, Async Await

List of Experiments :

- **JavaScript Fundamentals** – Build a simple calculator app using functions, loops, and control flow.
- **Array & Object Manipulation** – Write a program using ES6 features (let/const, arrow functions, template literals) to manage student records.
- **Async Programming** – Create a webpage that fetches and displays random user data from a public API using Promises and Async/Await.

Module 3: Node.js

overview, Node.js - basics and setup - Node.js console, Node.js command utilities - Node.js modules, concepts - Node.js events, database access - Node.js with Express.js, Express.js Request/Response - Express.js Get, Express.js Post - Express.js Routing, Express.js Cookies - Express.js File Upload, Middleware - Express.js Scaffolding, Template

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List of Experiments:

- **Node.js Basics** – Write a Node.js script to create a local server and display "Hello World" in the browser.
- **Express.js Routing** – Build a REST API with Express.js that handles GET and POST requests for a student information system.
- **File Handling** – Develop a Node.js application to upload, read, and display a text/JSON file using Express middleware.

Module 4: MySQL and MongoDB

MySQL Concepts - Create, Read, Update, Delete Operation - SQL and NoSQL concepts - Create and manage MongoDB - Migration of data into MongoDB - MongoDB with NodeJS - Services offered by MongoDB

List of Experiments :

- **MySQL CRUD** – Create a MySQL database for employee records and perform Create, Read, Update, Delete (CRUD) operations.
- **MongoDB CRUD with Node.js** – Build a Node.js application that connects to MongoDB and manages student data.
- **Migration Project** – Write a script to migrate data from MySQL to MongoDB and display it through a Node.js API.

Module 5: React JS

ReactJS introduction and overview - ReactJS installation and environment setup - Introducing JSX, Rendering Elements - Components and Props - State and Lifecycle - Handling Events - Conditional Rendering - Lists and Keys, Forms - Lifting State Up

List of Experiments :

- **React Components** – Build a React app to display a list of courses using functional components and props.
- **State & Events** – Create a counter and a form component in React using useState and event handling.
- **Conditional Rendering & Lists** – Develop a React to-do list application with add/delete functionality and conditional rendering of completed tasks.

Textbooks

1. **Alex Banks, Eve Porcello** – *Learning React: Modern Patterns for Developing React Apps*, O'Reilly.
2. **StoyanStefanov** – *React Up & Running: Building Web Applications*, O'Reilly.
3. **Mario Casciaro, Luciano Mammino** – *Node.js Design Patterns*, Packt.
4. **Seyed M.M. Iravani** – *Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics*, O'Reilly.

Reference Books

1. **Robin Wieruch** – *The Road to React*, Leanpub.
2. **Carl Rippon** – *React 18 Design Patterns and Best Practices*, Packt.
3. **KirupaChinnathambi** – *Learning React: A Hands-On Guide to Building Web Applications*, Addison-Wesley.
4. **Ethan Brown** – *Web Development with Node and Express: Leveraging the JavaScript Stack*, O'Reilly.
5. **Kristina Chodorow** – *MongoDB: The Definitive Guide*, O'Reilly.
6. **Ben Forta** – *SQL in 10 Minutes, Sams Teach Yourself*, Sams Publishing.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

AUDIT COURSE-I

St. Johns College of Engineering & Technology

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

ENGLISH FOR RESEARCH PAPER WRITING

I M. Tech – I Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3DAC101a	AC	2	0	0	0	60	40	100

Course Objectives: This course will enable students:

- Understand the essentials of writing skills and their level of readability
- Learn about what to write in each section
- Ensure qualitative presentation with linguistic accuracy

Course Outcomes (CO): Student will be able to

CO1: Understand the significance of writing skills and the level of readability
CO2: Analyze and write title, abstract, different sections in research paper
CO3: Develop the skills needed while writing a research paper

UNIT - I
1Overview of a Research Paper- Planning and Preparation- Word Order- Useful Phrases - Breaking up Long Sentences-Structuring Paragraphs and Sentences-Being Concise and Removing Redundancy -Avoiding Ambiguity
UNIT - II
Essential Components of a Research Paper- Abstracts- Building Hypothesis-Research Problem - Highlight Findings- Hedging and Criticizing, Paraphrasing and Plagiarism, Cauterization
UNIT - III
Introducing Review of the Literature – Methodology - Analysis of the Data-Findings - Discussion-Conclusions-Recommendations.
UNIT - IV
Key skills needed for writing a Title, Abstract, and Introduction
UNIT - V
Appropriate language to formulate Methodology, incorporate Results, put forth Arguments and draw Conclusions

Suggested Reading:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books) Model Curriculum of Engineering & Technology PG Courses [Volume-I]
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

St. Johns College of Engineering & Technology

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

DISASTER MANAGEMENT

I M. Tech – I Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3DAC101b	AC	2	0	0	0	60	40	100

Course Objectives: This course will enable students:

- Learn to demonstrate critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of human Italian response and practical relevance in specific types of disasters and conflict situations
- Critically understand the strengths and weaknesses of disaster management approaches, planningand programming in different countries, particularly their home country or the countries they work in

UNIT - I
Introduction: Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post- Disaster Diseases and Epidemics
UNIT - II
Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.
UNIT - III
Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering A Disasteror Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.
UNIT - IV
Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.
UNIT - V
Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Suggested Reading

1. R.Nishith, Singh A K, "Disaster Management in India: Perspectives, issues and strategies
2. "'New Royal book Company. .Sahni, Pardeep Et.Al.(Eds.), "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S.L., Disaster Administration And Management Text And Case Studies", Deep & Deep

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Publication Pvt. Ltd., New Delhi

SANSKRIT FOR TECHNICAL KNOWLEDGE

I M. Tech – I Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3DAC101c	AC	2	0	0	0	60	40	100

Course Objectives: This course will enable students:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- LearningofSanskrittodevelopthelogicinmathematics,science&othersubjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge Knowledge from ancient literature

Course Outcomes (CO): Student will be able to

CO1: Understanding basic Sanskrit language

CO2: Ancient Sanskrit literature about science &technology can be understood

CO3: Being a logical language will help to develop logic in students

UNIT - I
Alphabets in Sanskrit,
UNIT - II
Past/Present/Future Tense, Simple Sentences
UNIT - III
Order, Introduction of roots
UNIT - IV
Technical information about Sanskrit Literature
UNIT - V
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Suggested Reading

1. "Abhyaspustakam" –Dr.Vishwas, Sanskrit-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha- VempatiKutumbshastri, RashtriyaSanskrit Sansthanam, New Delhi Publication
3. "India's Glorious ScientificTradition" Suresh Soni, Ocean books (P) Ltd.,New Delhi

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

ADVANCES IN SOFTWARE ENGINEERING

I M. Tech – II Semester								SJCET-R25
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
25G3D58201	Engineering Science	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100

Course Objectives: To understand advanced software engineering principles, models, and methodologies used in modern software development.

Course Outcomes: A student after completion of the course will be able to

CO1: Demonstrate understanding of advanced software process models and project management practices.

CO2: Apply requirement engineering and advanced modeling techniques to software system design.

CO3: Develop robust designs using object-oriented, component-based, and aspect-oriented approaches.

CO4: Evaluate software quality through systematic testing, reviews, and maintenance strategies.

CO5: Analyze emerging research challenges and apply metrics, configuration management, and agile practices in modern software engineering.

UNIT-1: Software Process and Project Management
Software Engineering – A Layered Technology, Process Models: Waterfall, Incremental, Evolutionary, Spiral, Agile Development, Unified Process Framework. Software Project Management Concepts: Estimation, Scheduling,Risk Analysis, Process Improvement and Capability Maturity (CMMI, ISO Standards).
UNIT-II: Requirements Engineering and Modeling
Requirement Engineering Tasks: Inception, Elicitation, Elaboration, Negotiation, Specification, Validation. System Modeling with UML, Scenario-based, Flow-oriented, Behavioral and Class-based modelling, Design Concepts and Principles, Architectural Design – Styles and Patterns.
UNIT-III: Advanced Design and Development Concepts
Component-level Design, Object-Oriented Design using UML, Design Patterns and Frameworks, Aspect-Oriented Software Engineering, Reuse-oriented Software Engineering.
UNIT-IV: Software Quality, Testing and Maintenance
Quality Concepts and Quality Assurance, Software Reviews, Formal Technical Reviews, Software Testing Strategies: Unit, Integration, System, Regression Testing, Black-box and White-box Testing, Software Maintenance and Reengineering.
UNIT-V: Advanced Topics and Emerging Trends
Software Configuration Management (SCM) and Version Control, Software Reliability and Safety Engineering, Agile Software Development and DevOps, Software Metrics and Measurement. Emerging Areas: AI in Software Engineering, Cloud-based SE, Secure Software Development.

Text books:

1. Software Engineering A Practitioner's Approach, Roger S. Pressman, 9th Edition McGrawHill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Fifth Edition, PHI.

Reference Books:

1. Software Engineering, Ian Sommerville, Tenth Edition, Pearson education.
2. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
3. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
4. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

St. Johns College of Engineering & Technology

(AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

ADVANCED DATABASES

I M. Tech – II Semester								SJCET-R25
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
25G3D58202	Engineering Science	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100

Course Objectives:

Knowledge on concepts of Distributed Databases, Object-Based Databases, advanced database models

Course Outcomes: A student after completion of the course will be able to

CO1: Understand Database system Architectures and parallel databases
CO2: Analyze transactions, Concurrency Control in Distributed Databases
CO3:Understand the importance of Data Warehousing and Mining
CO4:Illustrate concepts of object based databases

UNIT-1
Database System Architectures Centralized and Client –Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems, Network Types Parallel Databases: Introduction, I/O Parallelism, Interquery Parallelism, Intra Query Parallelism, Intraoperation Parallelism, Interoperation Parallelism, Query Optimization, Design of Parallel Systems, Parallelism on Multicore Processors.
UNIT-1I
Distributed Databases Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases, Availability, Distributed Query Processing, Heterogeneous Distributed Databases, Cloud-Based Databases, Directory Systems.
UNIT-III
Data Warehousing and Mining Decision-Support Systems, Data Warehousing, Data Mining, Classification, Association Rules, Other Types of Associations, Clustering, Other Forms of Data Mining
UNIT-IV
Object-Based Databases Introduction, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multiset Types in SQL, Object-Identity and Reference Types in SQL, Implementing O-R Features, Persistent Programming Languages, Object-Relational Mapping, Object-Oriented versus Object-Relational.
UNIT-V
Motivation, Structure of XML Data, XML Document Schema, Querying and Transformation, Application Program Interfaces to XML, Storage of XML Data, XML Applications Applications Advanced database models and applications: Active Database Concepts and Triggers, Temporal database concepts, Spatial database concepts, Multimedia database concepts, Deductive databases

Text books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan Database System Concepts, Sixth Edition

Reference Books:

1. RamezElmasri, Shamkant B. Navathe, Database systems- Models, Languages, Design and Application Programming

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

BLOCKCHAIN TECHNOLOGY

I M. Tech – II Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58203a	PE-III	3	0	0	3	40	60	100

Prerequisites:

1. Knowledge in information security and applied cryptography.
2. Knowledge in Computer Networks

Course Objectives:

1. To learn the fundamentals of Blockchain and various types of block chain and consensus mechanisms.
2. To understand the public block chain system, Private block chain system and consortium blockchain.
3. Able to know the security issues of blockchain technology.

Course Outcomes: A student after completion of the course will be able to

CO1: Understanding concepts behind crypto currency
CO2: Applications of smart contracts in decentralized application development
CO3: Understand frameworks related to public, private and hybrid blockchain
CO4: Create blockchain for different application case studies

UNIT-1

Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain,The Technology and the Future. Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol. Cryptocurrency – Bitcoin, Altcoin and Token: Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT-1I

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain. Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT-III

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Why We Need Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E- commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain.

Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Why We Need Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda. Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT-IV

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain In Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT-V

Blockchain Case Studies: Case Study 1 – Retail, Case Study 2 – Banking and Financial Services, Case Study 3 – Healthcare, Case Study 4 – Energy and Utilities.

Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.

Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric Java SDK.

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Text books:

1. ―Blockchain Technology‖, Chandramouli Subramanian, Asha A.George, Abhilasj K A and MeenaKarthikeyan , Universities Press.

Reference Books:

1. Michael Juntao Yuan, Building Blockchain Apps, Pearson, India.
2. Blockchain Blueprint for Economy, Melanie Swan, SPD O'reilly.
3. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gaur, Pearson.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

ADVANCED COMPUTER NETWORKS

I M. Tech – II Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58203b	PE-III	3	0	0	3	40	60	100

Course Objectives:

This course aims to provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computer networks.

Course Outcomes: A student after completion of the course will be able to

CO1: Understanding of holistic approach to computer networking

CO2: Ability to understand the computer network protocols and their applications

CO3: Ability to design simulation concepts related to packet forwarding in networks

UNIT-1
Data-link protocols: Ethernet, Token Ring and Wireless (802.11). Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs), Multiple access schemes Routing and Internetworking: Network–Layer Routing, Least-Cost-Path algorithms, Non- Least-Cost-Path algorithms, Intra-domain Routing Protocols, Inter-domain Routing Protocols, Congestion Control at Network Layer.
UNIT-1I
Transport and Application Layer Protocols: Client-Server and Peer-To-Peer Application Communication, Protocols on the transport layer, reliable communication. Routing packets through a LAN and WAN. Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, TCP Congestion Control. Principles of Network Applications.
UNIT-III
The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, building a Simple Web Server Creating simulated networks and passing packets through them using different routing techniques. Installing and using network monitoring tools.
UNIT-IV
Wireless and Mobile Networks: Introduction, Wireless links and Network Characteristics - CDMA, Wifi: 802.11 Wireless LANS, Cellular internet access, Mobility management: Principles.
UNIT-V
Multimedia networking: Multimedia networking applications, streaming stored video, Voice-over- IP, Protocols for real-time conversational applications.

Text books:

1. Computer Networking: A Top-Down Approach, James F. Kuros and Keith W. Ross, Pearson, 6th Edition, 2012.

2. Computer Networks and Internets, Duglas E. Comer, 6th Edition, Pearson.

Reference Books

1. A Practical Guide to Advanced Networking, Jeffrey S. Beasley and PiyasatNilkaew, Pearson, 3rd Edition, 2012

2. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Prentice Hall.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

DEEP LEARNING AND APPLICATIONS

I M. Tech – II Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58203c	PE-III	3	0	0	3	40	60	100

Course Objectives:

1. To understand complexity of Deep Learning algorithms and their limitations
2. To be capable of performing experiments in Deep Learning using real-world data.

Course Outcomes: A student after completion of the course will be able to

CO1: Implement deep learning algorithms, understand neural networks and traverse the layers of data

CO2: Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces

CO3: Understand applications of Deep Learning to Computer Vision

CO4: Understand and analyze Applications of Deep Learning to NLP

UNIT-1
Introduction: Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout.
UNIT-1I
Convolutional Neural Networks: Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models, Dynamic Memory Models.
UNIT-III
Applications of Deep Learning to Computer Vision: Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention Models for computer vision tasks.
UNIT-IV
Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity.
UNIT-V
Analogy reasoning: Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs

Text books:

1. Deep Learning by Ian Goodfellow, YoshuaBengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

Reference Books

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan, C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Online References:

1. http://www.deeplearning.net
2. https://www.deeplearningbook.org/
3. https://developers.google.com/machine-learning/crash-course/ml-intro
4. www.cs.toronto.edu/~fritz/absps/imagenet.pdf
5. http://neuralnetworksanddeeplearning.com/

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

GENERATIVE AI

I M. Tech – II Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58204a	PE-IV	3	0	0	3	40	60	100

Course Objectives:

1. To introduce the foundations, evolution, and core concepts of AI, ML, DL, NLP, and Generative AI.
2. To develop understanding of advanced neural architectures and generative models such as GANs, VAEs, and Transformers.
3. To explore Large Language Models, prompt engineering, and their real-world applications.
4. To familiarize learners with frameworks, multimodal applications, and ethical considerations in Generative AI.

Course Outcomes: A student after completion of the course will be able to

1. Demonstrate knowledge of AI foundations, generative models, and advanced neural architectures.
2. Apply generative AI techniques to create solutions for text, image, video, and multimodal tasks.
3. Design, fine-tune, and optimize Large Language Models for specific applications.
4. Evaluate ethical, social, and legal implications of Generative AI deployments and propose mitigation strategies.

UNIT-1
Foundations of AI and Generative Models Introduction and historical evolution to Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP)and Deep Learning (DL), Structure of Artificial Neural Networks (ANNs), Mathematical and computational foundations of generative modeling, Overview of generative models and their applications across various domains; Importance of Generative AI in modern applications, Transfer learning and in advancing Generative AI.
UNIT-1I
Advanced Neural Architectures for Generative AI VariationalAutoencoders (VAEs): principles and applications, Generative Adversarial Networks (GANs): architecture and working principles; Transformer architecture and attention mechanisms (in detail); Long Short-Term Memory Networks (LSTMs) and the limitations of traditional RNNs/LSTMs, Advanced Transformer architectures and techniques, Pre-training and transfer learning strategies for generative models.
UNIT-III
Large Language Models and Prompt Engineering Overview of Large Language Models (LLMs), GPT architecture, variants, and working principles, Prétraining and fine-tuning GPT models for applications (e.g., chatbots, text generation), Case study: GPT-based customer support chatbot, BERT architecture, pre-training objectives, and fine- tuning, Prompt Engineering: Designing effective prompts, controlling model behavior, and improving output quality, Fine-tuning language models for creative writing and chatbot development.
UNIT-IV
Multi-Agent Systems and Generative AI Applications Introduction to Multi-Agent Systems (MAS),Types of agents: reactive, deliberative, hybrid, and learning agents, Multi-agent collaboration and orchestration for generative tasks, Use cases: autonomous research assistants, cooperative creative generation, distributed problem-solving, Frameworks and tools: AutoGen, CrewAI, Hugging GPT for LLM-powered multi-agent systems, Generative AI applications: Art, Creativity, Image/Video generation, Music composition, Healthcare, Finance, Real-world case studies and deployment challenges.
UNIT-V
Frameworks, Multimodal Applications, and Ethics LangChain framework: components and LLM application development, Retrieval-Augmented Generation (RAG), Embeddings, Indexing networks, and Vector databases, Generative AI across modalities: Text, Code, Image, and Video generation, Image and Video generation using GANs and VAEs, Multimodal Generative AI: integration and training strategies, Ethical considerations: bias, fairness, trust, and responsible AI deployment, Social and legal implications of Generative AI, Risk mitigation

strategies and real- world ethical case studies.

Text books:

1. AltafRehmani, Generative AI for Everyone: Understanding the Essentials and Applications of This Breakthrough Technology.
2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook. Joseph Babcock, Raghav Bali, Generative AI with Python and TensorFlow 2, 2024.

REFERENCE BOOKS

1. Josh Kalin, Generative Adversarial Networks Cookbook.
2. Jesse Sprinter, Generative AI in Software Development: Beyond the Limitations of Traditional Coding, 2024.

ONLINE REFERENCES

1. Fabian Gloeckle et al., Better & Faster Large Language Models via Multi-token Prediction, arXiv:2404.19737v1, 2024.Vaswani et al., Attention Is All You Need, NeurIPS 2017.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

DIGITAL FORENSICS

I M. Tech – II Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58204b	PE-IV	3	0	0	3	40	60	100

Course Objectives:

1. provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
2. Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
3. Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
4. E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics

Course Outcomes: A student after completion of the course will be able to

On completion of the course the student should be able to

1. Understand relevant legislation and codes of ethics.
2. Computer forensics and digital detective and various processes, policies and procedures.
3. E-discovery, guidelines and standards, E-evidence, tools and environment.
4. Email and web forensics and network forensics.

UNIT-1
Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber criminalistics area, holistic approach to cyber-forensics.
UNIT-1I
Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.
UNIT-III
Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.
UNIT-IV
Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.
UNIT-V
Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.

TEXT BOOKS:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications.

REFERENCES

1. William Oettinger, Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence, Packt Publishing; 1st edition (30 April 2020), ISBN : 1838648178.
2. Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, Cybercrime and Digital Forensics: An Introduction, Routledge.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

ROBOTIC PROCESS AUTOMATION

I M. Tech – II Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
25G3D58204c	PE-IV	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objectives:

Aim of the course is to make learners familiar with the concepts of Robotic Process Automation.

Course Outcomes:

1. Describe RPA, where it can be applied and how it's implemented.
2. Identify and understand Web Control Room and Client Introduction
3. Understand how to handle various devices and the workload
4. Understand Bot creators, Web recorders and task editors

UNIT-1
Introduction to Robotic Process Automation & Bot Creation Introduction to RPA and Use cases – Automation Anywhere Enterprise Platform – Advanced features and capabilities – Ways to create Bots.
UNIT-1I
Web Control Room and Client Introduction - Features Panel - Dashboard (Home, Bots, Devices, Audit, Workload, Insights) - Features Panel – Activity (View Tasks in Progress and Scheduled Tasks) - Bots (View Bots Uploaded and Credentials)
UNIT-III
Devices (View Development and Runtime Clients and Device Pools) - Workload (Queues and SLA Calculator) - Audit Log (View Activities Logged which are associated with Web CR) - Administration (Configure Settings, Users, Roles, License and Migration) - Demo of Exposed API's – Conclusion – Client introduction and Conclusion.
UNIT-IV
Bot Creator Introduction – Recorders – Smart Recorders – Web Recorders – Screen Recorders - Task Editor – Variables - Command Library – Loop Command – Excel Command – Database Command - String Operation Command - XML Command
UNIT-V
Terminal Emulator Command - PDF Integration Command - FTP Command - PGP Command - Object Cloning Command - Error Handling Command - Manage Windows Control Command - Workflow Designer - Report Designer

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition.

REFERENCES:

1. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

ADVANCES IN SOFTWARE ENGINEERING LAB

I M. Tech – II Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58201P		3	0	0	3	40	60	100

Course Outcomes (COs):

CO1: Apply various software process models and project management techniques (estimation, scheduling, risk management) to plan and manage software development effectively.

CO2: Perform requirements elicitation, documentation, and system modeling using UML to capture, analyze, and validate software requirements.

CO3: Design software systems using object-oriented principles, design patterns, and component- based approaches for modularity, reusability, and maintainability.

CO4: Implement software testing strategies, maintenance techniques, and reengineering practices to ensure software quality, reliability, and evolution.

CO5: Utilize modern software engineering tools and practices such as version control, DevOps pipelines, software metrics, and AI-based analysis to enhance development efficiency and quality assurance.

List of Experiments:

Experiment 1: Comparative Study of Process Models

Implement a simple project using **Waterfall** and **Incremental models**; compare effort, defects, and time taken.

Experiment 2: Agile Development Simulation

Develop a small software system using **Scrum methodology** with sprints, product backlog, sprint backlog, and daily scrums.

Experiment 3: Project Estimation and Scheduling

Perform **Function Point Analysis (FPA)** or **Use Case Points (UCP)** to estimate size and effort, then prepare a Gantt chart and PERT chart.

Experiment 4: Risk Analysis in Software Projects

Conduct risk identification, qualitative/quantitative assessment, and develop a **risk mitigation plan** for a given case study.

Experiment 5: Requirement Elicitation and SRS Document

Conduct requirement gathering for a mini-project and prepare a **Software Requirement Specification (SRS)** document.

Experiment 6: UML Modeling (Scenario-based & Structural)

Create **Use Case diagrams, Activity diagrams, and Sequence diagrams** for a given problem domain.

Experiment 7: UML Modeling (Class &Behavioral)

Create **Class diagrams, State machine diagrams, and Component diagrams** to represent system architecture.

Experiment 8: Object-Oriented Design Using UML

Design a software module using **OO principles** (encapsulation, inheritance, polymorphism) and illustrate with UML diagrams.

Experiment 9: Design Patterns Implementation

Implement **at least three design patterns** (e.g., Singleton, Factory, Observer) in Java/Python.

Experiment 10: Reuse-Oriented Software Engineering

Use existing **open-source libraries/frameworks** to develop a component-based application (e.g., web app using Django/Flask).

Experiment 11: Black-box and White-box Testing

Perform **equivalence partitioning and boundary value analysis** (black-box) and **basis path testing** (white-box) for a given program.

Experiment 12: Software Maintenance and Reengineering

Take an **existing open-source project** (small module), analyze it, and perform **refactoring/reengineering** for improvement.

Experiment 13: Version Control and DevOps Pipeline

Use **Git & GitHub/GitLab** for version control and demonstrate **CI/CD pipeline** setup with Jenkins/GitHub Actions.

Experiment 14: Software Metrics and AI in SE

Compute **software metrics** (complexity, coupling, cohesion) for a given project and explore an **AI tool** (e.g., GitHub Copilot, SonarQube) for software quality analysis.

Text Books :

1. Software Engineering A Practitioner's Approach, Roger S. Pressman, 9th Edition McGrawHill International Edition.
2. Fundamentals of Software Engineering, Rajib Mall, Fifth Edition, PHI.

Reference Books :

1. Software Engineering, Ian Sommerville, Tenth Edition, Pearson education.
2. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
3. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India,2010.
4. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

ADVANCED DATABASES LAB

I M. Tech – II Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58202P		3	0	0	3	40	60	100

Course Objectives:

Knowledge on concepts of Distributed Databases, Object-Based Databases, advanced database models

Course Outcomes:

1. Understand Database system Architectures and parallel databases
2. Analyze transactions, Concurrency Control in Distributed Databases
3. Understand the importance of Data Warehousing and Mining
4. Illustrate concepts of object based databases

List of Experiments

1. Write a program to implement RDBMS - Cursors, Triggers
2. Write a Program to implement Range Partitioning sort.
3. Write a program to implement parallel hash join
4. Write a program to implement parallel nested join loop
5. Write a program to implement parallelize duplicate elimination by partitioning the tuples
6. Perform data fragmentation of distributed data(Horizontal, Vertical, Hybrid fragmentation)
7. Implement deadlock detection in distributed databases
8. Implement Semi Join algorithm.
9. DataCube Implementation - Aggregation
10. Perform data Integration - Extraction, Transformation, Loading
11. Implement any one classifier
12. Implement vector space models for Text corpus
13. Demonstrate type inheritance, table inheritance in object based databases
14. Write queries in XQueries on DTD
15. Write queries in SQL/XML to convert University data - XML Schema

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan Database System Concepts, Sixth Edition
RamezElmasri, Shamkant B. Navathe, Database systems- Models, Languages, Design and Application Programming

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

QUANTUM TECHNOLOGIES AND APPLICATIONS

I M. Tech – II Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58205		3	0	0	3	40	60	100

Course Objectives

1. Present core quantum principles such as superposition and entanglement without mathematical formalism.
2. Develop conceptual clarity on qubits, quantum states, and information frameworks.
3. Examine the theoretical challenges in realizing scalable quantum systems.
4. Introduce foundational ideas in quantum communication and computing.
5. Highlight applications, industrial adoption, and future research directions in quantum technologies.

Course Outcomes

Upon completion, the learner will be able to:

CO1: Explain fundamental quantum concepts conceptually.

CO2: Distinguish classical information systems from quantum information frameworks. Identify the

CO3: principal theoretical limitations in building quantum computers.

CO4: Describe the conceptual basis of quantum communication and computation.

CO5: Discuss current applications, technological trajectories, and career opportunities in the quantum domain.

UNIT-1: Foundations of Quantum Theory and Technologies
Transition from classical to quantum physics. Key conceptual principles: Superposition, Entanglement, Uncertainty, Wave-particle duality. Quantum states and measurement; the role of the observer. Representative quantum systems: electrons, photons, atoms. Concept of quantization and discrete energy levels. Strategic relevance of quantum technologies. Overview of major domains: Computing, Communication, Sensing. Global quantum initiatives: India's National Quantum Mission, EU Quantum Flagship, USA, China.
UNIT-II: Conceptual Structure of Quantum Information
Qubits: qualitative understanding using spin and polarization. Classical bits vs quantum bits: distinctions and implications. Quantum systems (non-engineering perspective): trapped ions, superconducting qubits, photonics. Coherence and decoherence mechanisms. Abstract notions: quantum states, measurement operators, Hilbert space—interpretation without mathematics. Entanglement and non-locality as foundational resources. Quantum vs classical information principles; philosophical considerations.
UNIT-III: Building a Quantum Computer – Challenges and Requirements
Conceptual prerequisites for functional quantum hardware. Fragility of quantum states: decoherence, noise, stability issues. Requirements: isolation, error resilience, scalability, control. Why maintaining entanglement is difficult; theoretical necessity of quantum error correction. Comparative overview of hardware platforms (superconducting circuits, trapped ions, photonics).Current progress vs scientific constraints; conceptual view of quantum software's role
UNIT-IV: Quantum Communication and Computing
(Redundant explanations removed, retaining only unique themes.)Quantum vs classical communication paradigms. Essentials of Quantum Key Distribution (QKD) and its security rationale. Entanglement-enabled communication protocols. Concept of the Quantum Internet and secure global networking. Introduction to quantum computing and quantum parallelism. Conceptual comparison of classical and quantum gate operations. Challenges: decoherence, noise, and the necessity of error correction frameworks.
UNIT-V: Applications, Industry, and Future Directions
Application domains: Healthcare and drug discovery, Material science and chemistry, Optimization and logistics, Quantum sensing and precision timing. Case studies: IBM, Google, Microsoft, PsiQuantum. Ethical, societal, and policy considerations. Barriers to adoption: cost, skilled workforce, standards. Emerging research and career landscapes; India's strategic opportunity in the global quantum ecosystem.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Textbooks

1. Nielsen & Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 2010.
2. Rieffel & Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Kaye, Laflamme, Mosca, An Introduction to Quantum Computing, OUP, 2007. Scott Aaronson, Quantum Computing Since Democritus, CUP, 2013.
3. Susskind & Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books, 2014. Rosenblum & Kuttner, Quantum Enigma, OUP, 2011.
4. Benenti et al., Principles of Quantum Computation and Information, World Scientific, 2004. DST India and MeitY: Official Quantum Mission Reports, 2020 onwards.
5. Quantum Flagship EU: Roadmaps and Strategy Documents.

Online Learning Resources

1. IBM Quantum Experience & Qiskit Textbook Coursera – Quantum Mechanics and Quantum
2. Computation (UC Berkeley) edX – Quantum Internet & Quantum Computers YouTube – Quantum Computing for the Determined (Michael Nielsen).

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25G3DAC201a	PEDAGOGY STUDIES	L	T	P	C
		2	0	0	0
	Semester	II			

Course Objectives:

1. To enable the students to understand the aims, rationale, policy background, and conceptual frameworks in pedagogy, curriculum, and teacher education research.
2. To develop an understanding of diverse pedagogical practices
3. To make them learn the methodologies for assessing the effectiveness of pedagogical practices and teacher education models.
4. To enable them to learn professional development strategies, including peer support, community engagement, and alignment with curriculum and assessment.

Course Outcomes(CO):Students will be able to

1. Define and explain key concepts, frameworks, and methodologies in pedagogy and teacher education research.
2. Critically analyze pedagogical practices used in diverse classroom settings, with reference to teacher education and curriculum design.
3. Evaluate the effectiveness of pedagogical approaches using quality assessment tools and theory of change models.
4. Apply evidence-based strategies to improve classroom practices, curriculum alignment, and teacher professional development.
5. Identify and address barriers to learning through innovative pedagogical strategies.
6. Design and propose research studies that contribute to filling gaps in pedagogy, curriculum, and teacher education, with focus on dissemination and impact.

UNIT -I	Foundations of Pedagogy	

Introduction to pedagogy and its importance in education - Historical and philosophical foundations of pedagogy - Theories of learning and teaching (behaviorist, cognitive, constructivist) - Role of pedagogy in shaping educational practices - Role of technology in modern pedagogy (ICT, e-learning, blended learning)

UNIT - II	Teaching-Learning Processes	

Understanding the teaching-learning process - Lesson planning and curriculum design - Strategies for effective teaching and learning (expository, collaborative, experiential) - Use of technology to enhance teaching-learning processes (multimedia, simulations, gamification)

UNIT - III	Technology Integration in Education	

Educational technology and system design - Instructional design models (ADDIE, ASSURE, Dick and Carey Model) - Emerging trends in e-learning (social learning, MOOCs, mobile learning) - ICT tools for teaching and learning (Learning Management Systems, online resources)

UNIT - IV	Pedagogy and Assessment	

Pedagogy, pedagogical analysis, and assessment - Types of assessment (placement, formative, diagnostic, summative) - Technology-based assessment tools (online quizzes, polls, discussions) - Rubrics for self and peer evaluation- Reflective Practices

UNIT - V	Contemporary Issues and Trends	

Inclusive education and technology (assistive technology, accessibility) - Change management and innovation in education - Quality assurance and evaluation in education (TQM, Six Sigma) - Future trends in pedagogy and technology (AI, AR, VR in education) - Personalized learning and adaptive teaching

Textbooks

1. Alexander, R. J. *Essays on Pedagogy*. Routledge, 2008.
2. Shulman, L. S. *The Wisdom of Practice: Essays on Teaching, Learning, and Learning to Teach*. Jossey-Bass, 2004

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Reference Books

1. *Teaching for the Future: Effective Teacher Education and Pedagogical Practices*. OECD Publishing., 2021
2. Fullan, M., & Edwards, M. *System Change in Education: Sustainability and Impact*. Routledge, 2022.
3. Coe, R., Rauch, C., Kime, S., & Singleton, D. *Great Teaching Toolkit: Evidence Review*. Evidence Based Education., 2020
4. Zeichner, K. M. *The Struggle for the Soul of Teacher Education*. Routledge, 2024
5. UNESCO. *Global Education Monitoring Report: Pedagogy, Teachers and Learning*. UNESCO Publishing, 2024
6. Hattie, J. *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*. Routledge., 2009
7. Darling-Hammond, L. *Teacher Education Around the World: What Can We Learn from International Practice?* Routledge, 2007

Online Resources

- **UNESCO Education Resources** – https://www.unesco.org/education
- **OECD Education and Skills** – https://www.oecd.org/education
- **ERIC (Education Resources Information Center)** – https://eric.ed.gov (peer-reviewed papers, reports).
- **World Bank Education** – https://www.worldbank.org/en/topic/education (research reports on teacher development in developing countries).
- **NPTEL/SWAYAM MOOCs** – Teacher education and pedagogy-focused courses.
- **Google Scholar Alerts** – set alerts for "pedagogical practices", "teacher education", "curriculum research" for the latest academic papers.

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25G3DAC201b	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C
		2	0	0	0
	Semester	II			

CourseObjectives:This course will enable students:

- To develop students' self-awareness by identifying their strengths, weaknesses, opportunities, and challenges (SWOC analysis).
- To enable students to understand and apply the principles of emotional intelligence and effective interpersonal communication.
- To cultivate positive thinking, resilience, mindfulness, and a growth-oriented mindset.
- To enhance verbal and non-verbal communication skills, including confidence in public speaking and professional presentations.
- To familiarize students with leadership styles, teamwork strategies, and collaborative problem-solving in personal and professional contexts.

Course Outcomes(CO):Student will be able to

1. Define and explain key concepts of self-awareness, personality, and personal growth.
2. Identify and apply strategies of emotional intelligence to regulate emotions and build effective interpersonal relationships
3. Demonstrate positive thinking, gratitude, and resilience to overcome personal and professional challenges
4. Analyze barriers to effective communication and apply verbal and non-verbal communication techniques in diverse contexts.
5. Prepare, deliver, and evaluate effective presentations and public speeches with confidence
6. Develop leadership and teamwork skills to collaborate, negotiate, and solve problems in group settings.

UNIT –I **Self-Awareness and Personal Growth**

Understanding personality and its development- Identifying strengths, weaknesses, opportunities, and challenges (SWOC analysis)- Setting personal and professional goals- Practicing Self-Reflection and Journaling
(Activities: Personalitya assessments, self reflection exercises, group discussions, SWOC analysis worksheet, Action Plan, SMART goal activities, Reflective journaling, Self-care Planning)

UNIT – II **Emotional Intelligence and Interpersonal Skills**

Understanding emotional intelligence and its importance - Developing self-awareness, self-regulation, and motivation - Building effective communication and interpersonal skills
- Conflict resolution and negotiation strategies.
(Activities: Emotional Intelligence Quiz, Self-Reflection exercises, feedback sessions, mindfulness exercises, Positive self-talk, Active Listening exercises, conflict-resolution Role-play, Case studies & Group activities)

UNIT – III **Positive Thinking and Attitude**

Understanding the power of positive thinking- Developing a growth mindset and resilience - Practicing gratitude and mindfulness- Overcoming negative thoughts and behaviors
(Activities on positive thinking, growth mindset, mindfulness and self-care plan for overcoming negative thoughts)

UNIT – IV **Effective Communication and Presentation Skills**

Understanding the importance of effective communication- Developing verbal and non-verbal communication skills- Preparing and delivering effective presentations- Building confidence and public speaking skills
(Activities: Group discussions, Case studies, Role-Play, Non-verbal communication exercises, Practice presentations, Peer feedback, Public speaking exercises, Storytelling, Debates)

UNIT – V **Leadership and Teamwork**

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Understanding leadership styles and qualities - Developing leadership skills and qualities- Building effective teams and teamwork strategies- Practicing collaboration and problem-solving
(Activities: Case studies, Group discussions, Debates, Leadership role-playing, team building activities, Group projects, Collaborative problem-solving exercies, feedback sessions)

Prescribed Books

1. Daniel Goleman,Emotional Intelligence: Why It Can Matter More Than IQ, Bantam Books, 2017.
2. Stephen R. Covey, The 7 Habits of Highly Effective People, Simon & Schuster, 2020.

Reference Books

1. Dale Carnegie, How to Win Friends and Influence People, Simon & Schuster, 2020.
2. Brian Tracy, Goals!: How to Get Everything You Want Faster Than You Ever Thought Possible, Berrett-Koehler Publishers, 2021.
3. Robin Sharma, The 5 AM Club: Own Your Morning, Elevate Your Life, HarperCollins, 2020.
4. Carol S. Dweck, Mindset: The New Psychology of Success, Random House, 2016.
5. Daniel H. Pink,Drive: The Surprising Truth About What Motivates Us, Riverhead Books, 2018.
6. John C. Maxwell, Leadershift: 11 Essential Changes Every Leader Must Embrace, HarperCollins, 2019.

Online Resources

1. Coursera – Personal Development Specialization (https://www.coursera.org)
2. edX – Leadership and Emotional Intelligence Courses (https://www.edx.org)
3. FutureLearn – Mindfulness and Resilience Training (https://www.futurelearn.com)
4. MindTools – Practical resources on leadership, communication, and emotional intelligence (https://www.mindtools.com)
5. Positive Psychology – Articles and tools on resilience, gratitude, and well-being (https://positivepsychology.com)
6. TED Talks – Inspirational talks on leadership, communication, and self-growth (https://www.ted.com)
7. Harvard Business Review (HBR) – Leadership, negotiation, and workplace communication (https://hbr.org)

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25G3DAC201c	YOGA FOR STRESS MANAGEMENT	L	T	P	C
		2	0	0	0
	Semester	II			

Course Objectives:

1. To make the students understand the foundational concepts of Yoga, including Ashtanga (eight limbs) as prescribed in classical texts.
2. To enable them analyze the principles of Yama and Niyama, and their role in ethical, personal, and social development.
3. To make them learn do's and don'ts of life through the practice of ahimsa, satya, astheya, brahmacharya, aparigraha, shaucha, santosh, tapa, swadhyaya, and ishwar-pranidhana.
4. To make them practice asanas and pranayama techniques for physical fitness, mental balance, and spiritual awareness.
5. To make them understand the holistic lifestyle through regular yoga practice, leading to personality development.

Course Outcomes(CO):Student will be able to

1. Explain the eight limbs of Yoga (Ashtanga) and their interrelationship in holistic development.
2. Demonstrate understanding of Yama and Niyama as ethical guidelines and apply them in personal and professional life.
3. Differentiate between do's and don'ts in daily life with reference to Yogic principles like ahimsa, satya, and swadhyaya.
4. Perform selected asanas and pranayama techniques with correct posture, breathing, and awareness.
5. Evaluate the physical, mental, and emotional benefits of yoga practices in stress reduction, concentration, and self-discipline.
6. Integrate yoga philosophy and practices into a personal routine for sustainable health and inner growth.

UNIT -I		
Definitions of Eight parts of yoga.(Ashtanga)		
UNIT - II		
Yam and Niyam.		
UNIT - III		
Do's and Don'tsin life. i) Ahinsa,satya,astheya,bramhacharya and aparigraha ii)Shaucha,santosh,tapa,swadhyay,ishwarpranidhan		
UNIT - IV		
Asanand Pranayam		
UNIT - V		
i) Various yoga poses and their benefits for mind and body ii) Regularization of breathing techniques and its effects-Types of pranayam		

Textbooks

1. Swami Prabhavananda and Christopher Isherwood (translation & commentary), *Patanjali Yoga Sutras*,Sri Ramakrishna Math, 1953.
2. B.K.S. Iyengar, *Light on Yoga*, Thorsons, 2003.

Reference Books

1. T.K.V. Desikachar, *The Heart of Yoga: Developing a Personal Practice*, Inner Traditions 2nd Edition, 1999.

2. Acharya Yatendra, *Yoga & Stress Management*, Fingerprint Publishers, 2019

3. Yamini Muthanna, *The Power of Yoga*, Om Books International, 2015.

4. Nayaswami Devarshi, *Kriya Yoga: Spiritual Awakening for the New Age*, Ananda Sangha Publications, 2023.

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Online Resources

- NPTEL / SWAYAM Online Courses – Yoga and Physical Education modules.
- AYUSH Ministry Website: https://yoga.ayush.gov.in – official yoga resources, protocols, and research.
- Yoga Journal: https://www.yogajournal.com – practical guides, research updates, asana tutorials.
- Art of Living Foundation: https://www.artofliving.org – pranayama, meditation, and wellness practices.
- YouTube Channels (scholarly & practice-based):
    - Sivananda Yoga Vedanta Centre
    - Yoga with Adriene (for practical asana guidance)

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

SOFTWARE DEFINED NETWORKS

I M. Tech – III Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58301a	PE-V	3	0	0	3	40	60	100

Course Objectives:

- Understand the evolution of Software Defined Networks (SDN) and its interoperability.
- Examine the characteristics of SDN and its devices and controllers. Understand the OpenFlow specifications and its limitations.
- Comparison of SDN, Overlays and APIs.
- Design of network virtualization tunnels and offloading flows in data centers.
- Design and development of switch and controller in SDN application

Course Outcomes:

- Analyze the implications of SDN for research and innovation data centers.
- Brief the OpenFlow basics and optical transport protocols.
- Develop the tunneling and path technologies for real world data center.
- Implementation of the access control for the campus and traffic engineering for service providers. Simulation and testing of SDN in open-source cloud software.
- Implementation of switch and controller in SDN applications

UNIT-1
Introduction: Evolution of Switches and Control Planes, SDN Implications for Research and Innovation, Data Center Innovation, Data Center Needs. The Evolution of Networking Technology, Forerunners of SDN, Legacy Mechanisms Evolve Toward SDN, Software Defined Networking Is Born,Sustaining SDN Interoperability, Open Source Contributions, Network Virtualization.
UNIT-II
Fundamental Characteristics of SDN, SDN Operation, SDN Devices, SDN Controller, SDN Applications, Alternate SDN Method. The OpenFlow Specification, OpenFlow Overview, OpenFlow 1.0 and OpenFlow Basics, OpenFlow 1.0 to 1.5, Improving OpenFlow Interoperability, Optical Transport Protocol Extensions, OpenFlow Limitations.
UNIT-III
Alternative Definitions of SDN: Potential Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays, SDN via Opening Up the Device, Network Functions Virtualization and Alternatives Overlap and Ranking.
UNIT-IV
SDN in the Data Center: Data Center Demands, Tunnelling Technologies for the Data Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center, Comparison of Open SDN, Overlays, and APIs, Real-World Data Center Implementations.
UNIT-V
SDN Applications: Application Types, A Brief History of SDN Controllers, Using Floodlight for Training Purposes, A Simple Reactive Java Application, Controller Considerations, Network Device Considerations,12.9. Creating Network Virtualization Tunnels, Offloading Flows in the Data Center, Access Control for the Campus, Traffic Engineering for Service Providers

Text Books:

1. Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black, Morgan Kaufmann Publications, 2014 .

Reference :

1. SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013
2. Software Defined Networking with OpenFlowBySiamakAzodolmolky, Packt Publishing, 2013

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

REINFORCEMENT LEARNING

I M. Tech – III Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58301b	PE-V	3	0	0	3	40	60	100

Course Objectives:

Knowledge on fundamentals of reinforcement learning and the methods used to create agents that can solve a variety of complex tasks.

Course Outcomes

1. Understand basics of RL
2. Understand RL Framework and Markov Decision Process
3. Analyzingning through the use of Dynamic Programming and Monte Carlo
4. Understand TD(0) algorithm, TD(λ) algorithm

UNIT-1
Basics of probability and linear algebra, Definition of a stochastic multi-armed bandit, Definition of regret, Achieving sublinear regret, UCB algorithm, KL-UCB, Thompson Sampling.
UNIT-II
Markov Decision Problem, policy, and value function, Reward models (infinite discounted, total, finite horizon, and average), Episodic & continuing tasks, Bellman's optimality operator, and Value iteration & policy iteration.
UNIT-III
The Reinforcement Learning problem, prediction and control problems, Model-based algorithm, Monte Carlo methods for prediction, and Online implementation of Monte Carlo policy evaluation.
UNIT-IV
Bootstrapping; TD(0) algorithm; Convergence of Monte Carlo and batch TD(0) algorithms; Model- free control: Q-learning, Sarsa, Expected Sarsa.
UNIT-V
n-step returns; TD(λ) algorithm; Need for generalization in practice; Linear function approximation and geometric view; Linear TD(λ). Tile coding; Control with function approximation; Policy search; Policy gradient methods; Experience replay; Fitted Q Iteration; Case studies.

TEXT BOOKS:

1. —Reinforcement learning: An introduction,‖ First Edition, Sutton, Richard S., and Andrew G. Barto, MIT press 2020
2. —Statistical reinforcement learning: modern machine learning approaches,‖ First Edition, Sugiyama, Masashi. CRC Press 2015

REFERENCES:

1. —Bandit algorithms,‖ First Edition, Lattimore, T. and C. Szepesvári. Cambridge University Press. 2020
2. —Reinforcement Learning Algorithms: Analysis and Applications,‖ Boris Belousov, Hany Abdulsamad, Pascal Klink, Simone Parisi, and Jan Peters First Edition, Springer 2021
3. Alexander Zai and Brandon Brown —Deep Reinforcement Learning in Action,‖ First Edition, Manning Publications 2020

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DATA SCIENCE

I M. Tech – III Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D58301c	PE-V	3	0	0	3	40	60	100

Course Outcomes

- To understand about Data Science
- To understand big data, to learn the analytics of Big Data how data is stored and processed in Hadoop
- To learn about Machine Learning Algorithms
- To learn model evaluation and how data is analyzed using R features.

UNIT-1
Introduction to Data, Data Science, Data Process: Introduction to Data Science and data science process – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields ,data science profile , Types of Digital data: Classification of Digital Data, Introduction to Big Data: What is big data, Evolution of Big Data, Traditional Business Intelligence vs Big Data, Coexistence of Big Data and Data Warehouse.
UNIT-II
Data Collection and Data Preprocessing: Processing data with hadoop, interfacing with hadoop ecosystem. Hadoop: Features of Hadoop, Key advantages of hadoop, versions of hadoop, overview of hadoop ecosystem, Hadoop distributions. Why hadoop? RDBMS vs Hadoop, Distribution computing challenges, History of hadoop, Hadoop overview,HDFS NoSQL: Where it is used? What is it? Types of NoSQL Databases, Why NoSQL? Advantages of NoSQL, What we miss with NoSQL? Use of NoSQL in industry,SQL vs NoSQL.
UNIT-III
Exploratory Data Analytics: Descriptive Statistics – Mean, Standard Deviation, dispersion, Skewness and Kurtosis , statistical-interference-Correlation Statistics – ANOVA.
UNIT-IV
Algorithms/Model Development: Basic machine learning algorithms, Simple and Multiple Regression – naivebayes, k-.means ,KNN ,decision tree, random forest, LDA ,Prediction and Decision Making, Evaluation Metrics – Cross Validation – Overfitting.
UNIT-V
Data Visualization: using R, What is R? Why use R for analytics? How to run R? First R example, functions a short programming example, some important R data structures, vectors, matrices, lists, R programming structures, Charts, pie –charst, Barchart, boxplots, scatterplots ,linechart, Histograms, scatterplots ,Box plot.

TEXT BOOKS:

1. BIG DATA and ANALYTICS, Seema Acharya, SubhashiniChellappan, Wiley Publications. 2. Cathy O'Neil and Rachel Schutt , ―Doing Data Science‖, O'Reilly, 2015.

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GREEN BUILDINGS

I M. Tech – III Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D20302	OE-1	3	0	0	3	40	60	100

Course Objectives (COs)

The objectives of this course are:

1. To understand the fundamental concepts of green buildings, their necessity, and sustainable features.
2. To analyze green building concepts, rating systems, and their benefits in India. (Analyzing - Level 4)
3. To apply green building design principles, energy efficiency measures, and renewable energy sources.
4. To evaluate air conditioning systems, HVAC designs, and energy modeling for sustainable buildings.
5. To assess material conservation strategies, waste management, and indoor environmental quality in green buildings

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO1: Understand the importance of green buildings, their necessity, and sustainable features.

CO2: Analyze various green building practices, rating systems, and their impact on environmental Sustainability.

CO3: Apply principles of green building design to enhance energy efficiency and incorporate renewable energy Sources.

CO4: Evaluate HVAC systems, energy-efficient air conditioning techniques, and their role in sustainable building design.

CO5:Assess material conservation techniques, waste reduction strategies, and indoor air quality management in green buildings.

UNIT-1
Introduction to Green Building – Necessity of Green Buildings, Benefits of Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing a Green Building, Important Sustainable Features for Green Buildings.
UNIT-II
Green Building Concepts and Practices – Indian Green Building Council, Green Building Movement in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities and Benefits: Opportunities of Green Buildings, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy-Saving Approaches in Buildings, LEED India Rating System, and Energy Efficiency.
UNIT-III
Green Building Design – Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximizing System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources, Eco-friendly Captive Power Generation for Factories, Building Requirements.
UNIT-IV
Air Conditioning – Introduction, CII Godrej Green Business Centre, Design Philosophy, Design Interventions, Energy Modeling, HVAC System Design, Chiller Selection, Pump Selection, Selection of Cooling Towers, Selection of Air Handling Units, Pre-cooling of Fresh Air, Interior Lighting Systems, Key Features of the Building, Eco-friendly Captive Power Generation for Factories, Building Requirements.
UNIT-V
Material Conservation – Handling of Non-Process Waste, Waste Reduction During Construction, Materials with Recycled Content, Local Materials, Material Reuse, Certified Wood, Rapidly Renewable Building Materials and Furniture. Indoor Environment Quality and Occupational Health – Air Conditioning, Indoor Air Quality, Sick Building Syndrome, Tobacco Smoke.

Text Books:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by Tomwoolley and Samkimings, 2009.

Reference :-

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009
3. Energy Conservation Building Code –ECBC-2020, published by BEE

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

ROAD SAFETY ENGINEERING

I M. Tech – III Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D93203b	OE-1	3	0	0	3	40	60	100

Course Objectives (COs)

1. Discusses the fundamentals causes of road accidents & some of the statistical methods To analyze the traffic safety.
2. The accident investigation and risk management are dealt.
3. Introduction of Road Safety as an integral part of Road Design is emphasized.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO1: To understand the basic causes of road accidents
CO2: To conduct accident investigations and identify black spots
CO3: To design & plan road geometrics incorporating road safety
CO4: To understand the importance of Road Signs and Markings
CO5: To conduct Road Safety Audit

UNIT-1
Accident Investigations and Risk Management, Collection of Accident Data, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction, Condition and Collision Diagram.
UNIT-II
Traffic Engineering Studies; Statistical Methods In Traffic Safety Analysis –Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons- Traffic Management Measures And Their Influence On Accident Prevention.
UNIT-III
Road Safety in ` Transport Planning and Geometric Design: Vehicle and Human Characteristics, Road Design and Safety Elements, Redesigning Junctions, Cross Section Improvements, Traffic Control, Traffic Calming Measures, Road Safety Furniture
UNIT-IV
Role of Signs and Markings in ` Safety: Types of Signs – Design Specifications – Guidelines for Installation – Role of Signs in `Safety; Types of Road Markings – Design Specifications – Role of Road Markings in `Safety.
UNIT-V
Traffic Management Systems for Safety, Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Road Safety Improvement Strategies, ITS and Safety.

Textbooks:

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
2. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.
3. Road Safety by NCHRP

Reference Books:

1. Transportation Engineering – An Introduction, C.Jotin Khisty, B. Kent Lall
2. Fundamentals of Traffic Engineering, Richardo G Sigua
3. Handbook of Road Safety Measures, Second Edition, Rune Elvik, Alena Hoye, TrulsVaa, Michael Sorenson

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

IOT AND ITS APPLICATIONS

I M. Tech – III Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D06302	OE-1	3	0	0	3	40	60	100

Course Objectives (COs)

To apply the Knowledge in IOT Technologies and Data management.

1. To determine the values chains Perspective of M2M to IOT.
2. To implement the state of the Architecture of an IOT.
3. To compare IOT Applications in Industrial & real world.
4. To demonstrate knowledge and understand the security and ethical issues of an IOT.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO1: Apply the Knowledge in IOT Technologies and Data management.
CO2: Determine the values chains Perspective of M2M to IOT.
CO3: Implement the state of the Architecture of an IOT.
CO4: Compare IOT Applications in Industrial & real world.
CO5: Demonstrate knowledge and understand the security and ethical issues of an IOT.

UNIT-1
Fundamentals of IoT: Evolution of Internet of Things, Enabling Technologies, IoT Architectures, oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects. IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.
UNIT-II
IoT Protocols: IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.
UNIT-III
Design and Development: Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.
UNIT-IV
Data Analytics and Supporting Services: Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG.
UNIT-V
Case Studies/Industrial Applications: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino).

Textbooks:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.
2. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press,2015

Reference Books:

1. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
2. ―From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence‖, Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
3. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.

St. Johns College of Engineering & Technology

(AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

PHOTOVOLTAIC SYSTEMS

I M. Tech – III Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D07302	OE-1	3	0	0	3	40	60	100

Course Objectives (COs)

1. To introduce photovoltaic systems.
2. To deal with various technologies of solar PV cells.
3. To understand details about manufacture, sizing and operating techniques.
4. To have knowledge of design considerations.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO1: Identify photovoltaic system components and system types.

CO2: Calculate electrical energy and power.

CO3: Correctly size system components, design considerations of solar equipment.

CO4: Design a basic grid-tie PV system.

UNIT-1: SOLAR ENERGY
Sun and Earth, Solar Spectrum, Solar Geometry, Solar radiation on horizontal and inclined planes, Instruments for measurement of solar radiation, Solar cell, Equivalent circuit, V-I characteristics, Performance improvement.
UNIT-II: SOLAR CELLS
Manufacture of Solar Cells-Technologies, Design of Solar cells, Photovoltaic modules, Design requirements, Encapsulation systems, Manufacture, Power rating, Hotspot effect, Design qualifications.
UNIT-III: PROTECTION AND MEASUREMENTS
Flat plate arrays, Support structures, Module interconnection and cabling, Lightning protection, Performance measurement using natural sun light and simulator, Determination of temperature coefficients, Internal series resistance, Curve correction factor.
UNIT-IV: PHOTOVOLTAIC SYSTEMS
Photovoltaic systems, Types, General design considerations, System sizing, Battery sizing, Inverter sizing, Design examples, Balance of PV systems.
UNIT-V: MAXIMUM POWER POINT TRACKERS
Maximum power point trackers, Perturb and observe, Incremental conductance method, Hill climbing method, Hybrid and complex methods, Data based and other approximate methods, Instrument design, Other MPP techniques, Grid interactive PV system.

Textbooks:

1. F.C.Treble, ―Generating electricity from Sun‖, Pergamon Press.
2. A.K.Mukherjee, Nivedita Thakur,‖ Photovoltaic systems: Analysis and design‖, PHI, 2011.

Reference Books:

1. C.S.Solanki,‖ Solar Photovoltaic's: Fundamentals, Technologies and applications‖, PHI, 2009.

Online Learning Resources:

1. https://nptel.ac.in/courses/117108141

St. Johns College of Engineering & Technology

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

INTEGRATED PRODUCT DESIGN AND DEVELOMENT

I M. Tech – III Semester								SJCET-R25
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
25G3D15302	OE-1	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100

Course Objectives (COs)

1. To know the design concepts, product development planning and customer requirements
2. To generate the concept using creative problem solving methods, concept generation and testing
3. To understand product teardown, specifications, portfolios and Architecture, configurations and detailed design with prototyping
4. To acquaint DFN process and know design aspects for risk, reliability and safety and environments
5. To do industrial design, intellectual property and robust design and product development economics

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO1: Understand To know the design concepts, product development planning and customer requirements

CO2: Generate the concept using creative problem solving methods, concept generation and testing

CO3: Realize Product Teardown, Specifications, Portfolios and Architecture, configurations and prototyping

CO4: Demonstrate and classify The Design aspects for Risk, Reliability and Safety and environments

CO5: Do industrial design, understand intellectual property, robust design and product development economics

UNIT-1: PRODUCT DEVELOPMENT CONCEPTS

Design Concepts: Design process – Considerations of a good design – Description of good design process – Design codes and standards. Product Development and Planning Process: Characteristics and challenges of product development – Concept development – Generic product development – Product development process flows –Tyco product development – Product development organizations – Organizational structure and design – Product and process cycles – Technological innovation – Structure of opportunity – Opportunity identification – Product planning process – Types of product development projects. Identifying Customer Needs: Process of identifying customer needs – Customer requirements.

UNIT-II: CONCEPT SELECTION, GENERATION AND TESTING

Concept Generation: Activity – Concept generation process – Creativity and problem solving – Creative thinking methods and design – Functional decomposition and synthesis – Morphological methods – Axiomatic design. Concept Selection and Testing: Development process – Choosing a concept – Concept screening and scoring – Decision making and evaluation – Methods for testing product concepts.

UNIT-III: EMBODIMENT AND DETAIL DESIGN

Product Teardown, Specifications, Portfolios and Architecture: Teardown process, methods and applications – Post teardown report – Benchmarking approach and support tools for benchmarking process – Product portfolios architecture – Architecture type – Platform architecture – Target Specifications – Setting the final specifications – Modularity – Implications of the architecture – Establishing the architecture – Delayed differentiation – Platform planning – Related system-level design. Configuration and Detail Design: Generating, analyzing and evaluating configuration design – Best practices for configuration design – Design for X – Design and manufacturing information – Final design review – Activities beyond detail design. Prototyping: Principles, types and technologies – Understanding prototypes and planning.

UNIT-IV: DESIGN FOR ENVIRONMENT, MANUFACTURING AND SAFETY

Design for Manufacture and Environment: Cross-functional team – Overview of DFM process – Life cycles – Environmental impacts – Design for environment process. Design for Risk, Reliability and Safety: Classification of societal hazards – Standards – Risk assessment – Design for reliability – Causes of unreliability – Minimizing failure – FMEA – Fault tree analysis – Defects and failure modes – Potential dangers – Guidelines for design for safety – Warning labels.

UNIT-V: INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ECONOMICS

Industrial Design: Need – Impact – Industrial design process – Management of the industrial design process – Assessing the quality of industrial design. Robust Design: Robust design process. Intellectual Property: Disclosure – Process of pursuing a patent. Product Development Economics: Elements of economic analysis and process. Managing Projects: Understanding and representing tasks – Baseline project planning – Accelerating

projects – Project execution – Postmortem project evaluation - Project Portfolio Management (PPM) - Earned Value Management (EVM) - Sustainability and ESG in Project Management.

Textbooks:

1. Product Design and Development, Karl T Ulrich, Steven D Eppinger and Maria C. Yang, 7/e, 2020,McGraw-Hill Education Pvt.Ltd., Noida.
2. Engineering Design, George E.Dieter and Linda C.Schmidt, 4/e, 2013, McGraw-Hill Education Pvt.Ltd.,Noida.

Reference Books:

1. Product Design, Kevin Otto and Kristin Wood, 1/e, 2003, Pearson Education, India.
2. Product Development, Anil Mital, Anoop Desai, Anand Subramanian and Aashi Mital, 1/e, 2007, Butterworth-Heinemann, Elsevier.
3. Integrated Product and Process Design and Development: the Product Realization Process (Special Indian Edition), Edward B. Magrab, Satyandra K. Gupta, F. Patrick McCluskey and Peter A. Sandborn, 2/e, 2010, CRC Press, Taylor & Francis Group, LLC.
4. Product Design for Engineers, Devdas Shetty, 1/e, 2016, Cengage Learning, India.
5. Introduction to Product Design and Development for Engineers, Ali Jamnia, 2018, CRC Press,Taylor & Francis Group, LLC.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc25_me121/preview
2. https://onlinecourses.swayam2.ac.in/imb25_mg123/preview

St. Johns College of Engineering & Technology

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

ADVANCED NUMERICAL METHODS AND COMPUTATIONAL MATHEMATICS

I M. Tech – III Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
25G3DOE301a	OE-1	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objectives (COs)

1. Equip students to analyze, design, and implement stable, accurate, and efficient numerical algorithms for large- scale models across engineering domains.
2. Develop mastery in discretization, linear algebra, and optimization techniques, supported by modern
3. scientific computing tools and reproducible workflows.
4. Integrate high- performance computing paradigms to solve realistic, data- and compute- intensive problems.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO1: Analyze conditioning, stability, and error behavior of numerical linear algebra routines for dense and sparse Problems (L3, L4).

CO2: Derive and apply finite difference for BVP for linear and nonlinear models (L3, L4, L5).

CO3: Derive and apply finite difference for PDE models; assess consistency and stability with Lax equivalence and CFL ideas(L3, L4).

CO4: Optimize engineering models via unconstrained/constrained methods; justify algorithm selection and tuning using theory and diagnostics (L4, L5).

CO5: Integrate GPU/MPI paradigms and the SciPy stack to build scalable, reproducible computational workflows; profile and validate results (L4, L5).

UNIT-1: Numerical Linear Algebra

Floating- point arithmetic, conditioning, stability, backward/forward error. • Direct solvers: LU/Cholesky/QR; pivoting and orthogonality. • SVD, low- rank approximations, pseudoinverses. • Iterative solvers: Jacobi/Gauss–Seidel/CG/GMRES; basic preconditioning. • Sparse matrix formats and operations for large- scale systems. • Krylov subspace and Arnoldi/Lanczos overviews.

UNIT-II: Discretization of linear and nonlinear ODEs

Numerical solutions of initial value problems: (single step and multi -step methods) • Stability of the numerical methods for initial value problems. • Boundary value problems; shooting method. • Finite difference for BVP (second and higher order methods), for linear and nonlinear problems

UNIT-III: Discretization of linear and nonlinear PDEs

Finite difference methods for parabolic problems explicit and implicit methods, • Finite difference for hyperbolic explicit and implicit methods, Elliptic PDE. R25 Regulations • Consistency, Stability and convergence. • Lax equivalence and CFL (Courant–Friedrichs–Lewy) ideas. • Iterative solvers and multigrid overview for discretized systems.

UNIT-IV: Numerical Optimization and Inverse Problems

Unconstrained methods: gradient, Newton, quasi- Newton, trust- region. • Constrained methods: KKT conditions, interior- point, SQP principles. • Nonlinear least squares: Gauss–Newton and Levenberg–Marquardt. • Regularization (Tikhonov/L1) and model selection concepts. • Scientific Python stack:scipy.optimize.minimize, scipy.optimize.linprog, and scipy.optimize.curve_fit; solver choice and diagnostics.

UNIT-V: High- Performance Scientific Computing

Parallel paradigms: data/task parallelism; domain decomposition fundamentals. • GPU programming model: threads/warps/memory hierarchy; CUDA libraries. • MPI and PETSc for scalable sparse linear algebra and time- steppers. • Performance engineering: profiling, locality, and roofline- style thinking. • Python at scale: NumPy/SciPy sparse andvectorization; brief Numba/CuPy ecosystem. • End- to- end case sketches in CFD/structures/machine learning numerics.

Textbooks:

1. Trefethen, L. N., and D. Bau III, Numerical Linear Algebra, Twenty- Fifth Anniversary Edition, SIAM, 2023.
2. LeVeque, R. J., Finite Difference Methods for Ordinary and Partial Differential Equations: Steady- State and Time- Dependent Problems, SIAM, 2007.
3. Nocedal, J., and S. J. Wright, Numerical Optimization, 2nd ed., Springer, 2006.

References:

1. Hwu, W.- M. W., and D. B. Kirk, Programming Massively Parallel Processors: A Hands- on Approach, 4th ed., Elsevier, 2022.
2. B. N. dutta, ―Numerical linera algebra and Application, - Springer Publications
3. SciPy Project. ―Optimization (scipy.optimize) — SciPy Manual‖ and ―Optimization and Root Finding — SciPy 1.16.2 (stable) Reference.‖
4. Balay, S., et al. PETSc/TAO Users Manual. Argonne National Laboratory, ANL-21/39 Rev 3.18release documentation.
5. Logg, A., K.- A. Mardal, and G. N. Wells (eds.). Automated Solution of Differential Equations by the Finite Element Method: The FEniCS Book. Berlin: Springer, 2012.
6. David Kincaid Ward Chenery, ― Numerical analysis Mathematics of scientific computing, - AMS Book publishers.
7. M. K. Jain, S. R. K. Iyengar and R. K. Jain, ― Computational Methods for Partial Differential Equations, - New Age publications.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

MATHEMATICS FOR MACHINE LEARNING AND DATA SCIENCE

I M. Tech – III Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3DOE301b	OE-1	3	0	0	3	40	60	100

Course Objectives (COs)

1. Equip students with rigorous linear algebra, optimization, and probabilistic tools that underpin modern ML and data science across engineering domains.
2. Enable cross- disciplinary modeling, inference, and decision- making using mathematically principled methods and uncertainty quantification.
3. Develop capability to analyze, formulate, and validate algorithms with provable properties and computational efficiency for real- world applications.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO1: Analyze linear models and matrix factorizations for dimensionality reduction and feature Representation (L3, L4)

CO2: Formulate and solve convex and constrained optimization problems; compare first- and Second- order methods (L4,L5)

CO3: Apply probabilistic modeling, Bayesian inference, and information- theoretic measures to estimation and generalization (L3, L4, L5)

CO4: Prove convergence properties or error bounds for selected learning algorithms such as SGD and regularized estimators (L4, L5)

CO5: Evaluate and integrate methods into applications such as PCA, SVMs, and neural networks with appropriate regularization (L3, L4, L5)

UNIT-1: Linear Algebra Foundations
Vector spaces, norms, inner products, orthogonality, and projections o Eigenvalues/eigenvectors, spectral theorem, and invariant subspaces, Vector spaces, norms, inner products, orthogonality, and projections o Eigenvalues/eigenvectors, spectral theorem, and invariant subspaces
UNIT-II: Optimization for Learning
Unconstrained methods: gradient descent, line search, Newton/quasi- Newton o Constrained optimization: Lagrange multipliers, projected and barrier methods o Convex sets/functions, KKT conditions for nonlinear programing problems. o Regularization: l1/l2penalties, bias–variance trade- offs in risk minimization o Convergence rates and step- size strategies in deterministic models.
UNIT-III: Probability and Statistical Learning
Random variables, expectations, covariance; exponential family basics o Bayesian inference: conjugacy, MAP vs. MLE, posterior predictive analysis o Hypothesis testing and confidence intervals for model comparison o Information measures: entropy, KL divergence, mutual information in learning o Generalization, overfitting, and model selection criteria(e.g., AIC/BIC/VC-style capacity). o Concentration and uncertainty quantification for predictions
UNIT-IV: Models and Algorithms
Linear and kernel methods: least squares, logistic regression, and SVMs o Dimensionality reduction: PCA, kernel PCA, and manifold intuition o Probabilistic models: Naive Bayes, Gaussian mixtures, EM overview o Neural network mathematics: backpropagation, initialization, normalization o Regularization schemes: weight decay, early stopping, dropout perspectives
UNIT-V: Integrative Applications and Worked Examples
End- to- end ML pipelines: preprocessing, scaling/whitening, and feature engineering o PCA- based exploration and anomaly detection in high- dimensional data o SVMs and convex models for fault diagnosis and predictive maintenance o Bayesian A/B testing and decision- making under uncertainty o Neural network design trade- offs: capacity, optimization, and generalization o Model evaluation: calibration, ROC/PR analysis, and uncertainty reporting

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Textbooks

1. Deisenroth, M. P., Faisal, A. A., & Ong, C. S. Mathematics for Machine Learning. Cambridge University Press, 2020
2. Murphy, K. P. Probabilistic Machine Learning: An Introduction. MIT Press, 2022
3. Boyd, S., & Vandenberghe, L. Convex Optimization. Cambridge University Press, 2004

References

1. Goodfellow, I., Bengio, Y., & Courville, A. Deep Learning. MIT Press, 2016
2. Shalev- Shwartz, S., & Ben- David, S. Understanding Machine Learning: From Theory to Algorithms. Cambridge University Press, 2014
3. Jolliffe, I. T., & Cadima, J. Principal component analysis: a review and recent developments. Phil. Trans. R. Soc. A, 2016
4. Cover, T. M., & Thomas, J. A. Elements of Information Theory, 2nd ed. Wiley, 2006
5. Murphy, K. P. Probabilistic Machine Learning: Advanced Topics. MIT Press, 2023.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

STATISTICAL LEARNING THEORY AND MATHEMATICAL FOUNDATIONS OF AI

I M. Tech – III Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3DOE301c	OE-1	3	0	0	3	40	60	100

Course Objectives (COs)

1. Build rigorous probabilistic, information-theoretic, and optimization foundations that support modern AI across engineering domains.
2. Unify theory and algorithms to enable principled design and analysis of learning systems for cross- disciplinary problems.
3. Connect generalization theory with practice through concise formulations and proofs suited to PG research contexts.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO1: Analyze probabilistic models, convergence theorems, and stochastic processes underlying learning Algorithms (L3, L4).

CO2: Formulate and prove generalization bounds using VC dimension, Rademacher complexity, and stability (L4, L5).

CO3: Derive and optimize loss/regularization for linear, kernel, and deep models; justify selections by convexity and smoothness properties (L4, L5).

CO4: Evaluate algorithms via bias–variance, PAC guarantees, and information- theoretic criteria such as KL and mutual information (L4, L5).

CO5: Integrate theory to design robust AI solutions for multi- domain engineering applications and communicate findings effectively (L5).

UNIT-1: Probability and Measure Foundations
Probability spaces, σ- algebras, random variables; expectation and conditional expectation. • Inequalities and concentration: Markov, Chebyshev, Hoeffding; LLN and CLT. • Modes of convergence and Borel–Cantelli; almost sure vs in- probability convergence. • Random processes and martingale basics; optional stopping; Doob's inequality (overview). • Markov chains: ergodicity, mixing, stationary distributions for modeling sequences.
UNIT-II: Statistical Learning Theory
Probability spaces, σ- algebras, random variables; expectation and conditional expectation. • Inequalities and concentration: Markov, Chebyshev, Hoeffding; LLN and CLT. • Modes of convergence and Borel–Cantelli; almost sure vs in- probability convergence. • Random processes and martingale basics; optional stopping; Doob's inequality (overview). • Markov chains: ergodicity, mixing, stationary distributions for modeling sequences.
UNIT-III: Optimization for Learning
Convex analysis: Lipschitzness, smoothness, strong convexity; implications for rates. • Gradient, stochastic, and variance- reduced methods; step- size and convergence trade- offs. • Proximal methods and projected gradients; sparsity via $\ell 1$ (Lasso) and shrinkage via $\ell 2$ (ridge). • Duality and KKT conditions; constrained learning formulations. • Nonconvex landscapes in deep networks—saddle points, over-parameterization, and implicit regularization. • Generalization–optimization interplay: implicit bias of optimizers.
UNIT-IV: Kernel and Probabilistic Models
Reproducing kernel Hilbert spaces, kernel trick, representer theorem. • Large- margin methods: SVMs, soft margins, hinge loss; primal–dual views. • Gaussian processes: kernels as priors; posterior prediction and uncertainty quantification. • Graphical models—Bayesian networks and Markov/conditional random fields for structured prediction; exact inference (variable elimination, junction tree) and approximate methods (loopy belief propagation, variational). • Hidden Markov models; EM for latent- variable learning. • Variational inference and message passing for scalable probabilistic AI.
UNIT-V: Deep Learning and Information Theory

Backpropagation (chain rule), initialization, normalization, and activation design. • Loss functions and calibration; cross- entropy, margin losses, and robust objectives. • Generalization in deep nets: margins, flat minima, compression, and stability views. • Information- theoretic tools: entropy, mutual information, KL divergence. • Information bottleneck and representation learning, with links to PAC- Bayes. • Worked examples: applying theory to vision, language, and control tasks in engineering.

Textbooks:

1. Shalev- Shwartz, S., Ben- David, S., Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, first edition, 2014.
2. Goodfellow, I., Bengio, Y., Courville, A., Deep Learning, MIT Press, 2016.
3. Bishop, C. M., Pattern Recognition and Machine Learning, Springer, 2006.

References:

1. Vapnik, V. N., The Nature of Statistical Learning Theory, Springer, 1995/1998.
2. Cover, T. M., Thomas, J. A., Elements of Information Theory, 2nd ed., Wiley, 2006.
3. Mohri, M., Rostamizadeh, A., Talwalkar, A., Foundations of Machine Learning, 2nd ed., MIT Press, 2018.
4. Schölkopf, B., Smola, A. J., Learning with Kernels: Support Vector Machines, Regularization, Optimization, and Beyond, MIT Press, 2002.
5. Rasmussen, C. E., Williams, C. K. I., Gaussian Processes for Machine Learning, MIT Press, 2006.

St. Johns College of Engineering & Technology

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CHEMISTRY OF NANOMATERIALS AND APPLICATIONS IN ENGINEERING

I M. Tech – III Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
25G3D93203b	OE-1	3	0	0	3	40	60	100

Course Objectives (COs)

1. Understand the fundamentals of nanoscience and nanotechnology.
2. Learn different methods for synthesis and characterization of nanomaterials.
3. Study the chemical properties and surface chemistry of nanomaterials.
4. Analyze the physical and mechanical properties of nanostructured materials.
5. Explore engineering and industrial applications of nanomaterials.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO1: Explain the basics, classification, importance, and natural occurrence of nanomaterials.

CO2: Apply suitable top-down and bottom-up synthesis methods to prepare nanomaterials.

CO3: Analyze nanomaterials using diffraction, spectroscopy, microscopy, and particle size techniques.

CO4: Evaluate the properties and applications of carbon-based, magnetic, and functional nanomaterials.

CO5: Design and implement nanomaterial-based solutions for engineering, medical, and environmental applications

UNIT-1
Basics of Nanomaterials:Introduction, Scope of nanoscience and nanotechnology, nanoscience in nature, classification of nanostructured materials, importance of nanomaterials.
UNIT-II
Synthesis of nanomaterials: Top-Down approach,Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapor deposition method, electrode position method, high-energy ball milling method. Synthetic Methods: Bottom-Up approach, Sol-gel synthesis, microemulsions or reverse micelles, co precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.
UNIT-III
Techniques for characterization: Diffraction techniques, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.
UNIT-IV
Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials: fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials.
UNIT-V
Advanced Engineering Applications of Nanomaterials: Applications of nanoparticles, nanorods, nano wires inWater treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

TEXT BOOKS:

1. NANO: The Essentials:T Pradeep, MaGraw-Hill, 2007.
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, Baldev Rai, BB Rath and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nano chemistry; LudovicoCademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Wiley-VCH, 2011.
2. Nanostructures &Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.
3. Nanomaterials Chemistry, C. N. R. Rao, Achim Muller, K.Cheetham, Wiley-VCH, 2007.

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

PHOTONICS FOR ENGINEERS

I M. Tech – III Semester								SJCET-R25
Course Code	Category	Hours/Week			Credits	Maximum Marks		
25G3DOE301e	OE-1	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100

Course Objectives (COs)

- Understand the fundamental nature of light, wave propagation, and basic optical phenomena such as interference, diffraction, and polarization.
- Learn the principles and working of photonic devices such as LEDs, laser diodes, and photodetectors.
- Study nonlinear optical effects and modulation techniques used in modern photonic systems.
- Analyze optical waveguides and fiber-optic communication systems for data transmission applications.
- Explore advanced photonic systems, sensors, quantum photonics, and emerging technologies such as plasmonics and terahertz photonics.

Course Outcomes (COs)

The objectives of this course are to:

CO 1: gain the ability to describe how light behaves and propagates in optical media.

CO 2: explain light–matter interaction mechanisms and analyze the working, characteristics, and applications of LEDs, laser diodes, quantum well lasers and various photodetectors.

CO 3: explain key nonlinear effects and analyze the operation of optical modulators and switches such as the Mach–Zehnder Interferometer.

CO 4: analyze fiber parameters and explain the functioning of transmitters, receivers, WDM systems, couplers and resonator-based communication devices.

CO 5: describe the working of photonic sensors and emerging quantum and ultrafast photonic technologies used in sensing, computation and communication.

UNIT-1
Unit I – Fundamentals of Photonics: Nature of light: wave-particle duality, polarization, coherence. Maxwell's equations and wave propagation in dielectric media. Reflection, refraction, (vector notation) interference, diffraction, dispersion and birefringence.
UNIT-II
Unit II – Photonic Devices and Components – I :Absorption, spontaneous and stimulated emission. Einstein coefficients, population inversion, optical gain. Semiconductor light sources: LEDs, laser diodes, quantum well lasers. Photodetectors: PIN, avalanche photodiodes, photomultiplier tubes.
UNIT-III
Unit III – Photonic Devices and Components – II :Nonlinear optical effects – second-harmonic generation, Kerr effect, four-wave mixing. Electro-optic Magneto optic and acousto-optic modulation principles. Optical modulators and switches (Mach ZehnderInterferometer).
UNIT-IV
Unit IV – Optical Waveguides and Applications: Optical fibers – numerical aperture, V-number, modes, attenuation, dispersion.Fiber-optic communication systems: transmitters, receivers, multiplexing (WDM), optical couplers, ring resonators.
UNIT-V
Unit V – Photonic Systems and Applications: Photonic sensors – interferometric, fiber Bragg gratings, biosensing. Optical signal processing and computing. Introduction to quantum photonics: single-photon sources, entanglement, and photonic qubits.Plasmonics and metamaterials, Ultrafast and terahertz photonics.

Textbooks:

1. B.E.A. Saleh& M.C. Teich — Fundamentals of Photonics (Wiley)
2. J. Singh — Semiconductor Optoelectronics: Physics and Technology
3. A. Yariv& P. Yeh — Photonics: Optical Electronics in Modern Communications
4. G. Keiser — Optical Fiber Communications

References:

1. J. Wilson & J.F.B. Hawkes — Optoelectronics: An Introduction
2. R.W. Boyd — Nonlinear Optics
3. Electromagnetic waves and radiating systems ------ E. Jordan