Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Course Structure and Syllabus

of

M.Tech

in

Computer Engineering

Prepared by:- Board of Studies in Computer Engineering

Recommended by:- Academic Council of D. J. Sanghvi College of Engineering

Approved by:- Governing Body of D. J. Sanghvi College of Engineering

Revision: 2 (2024)

With effect from the Academic Year: 2024-2025

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Scheme for First Year M. Tech Program in Computer Engineering: Semester I (Autonomous)
(Academic Year 2024-2025)

Sr	Course Code	Course	Teaching Scheme				End Semester Examination						Continuous Assessment			Aggregate (A+B)	Credits earned
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	ESE Total (A)	Term Test	Term Work	CA Total (B)		
1	DJS24CPC501	Algorithm and Complexity	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPC501L	Algorithm and Complexity Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
2	DJS24CPC502	Natural Language Processing	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPC502L	Natural Language Processing Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
3	DJS24CPE501	Computer Network and Design	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPE501L	Computer Network and Design Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24CPE502	Computer Vision	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPE502L	Computer Vision Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24CPE503	Internet of Everything	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPE503L	Internet of Everything Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24CPE504	System Security and Digital Forensics	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPE504L	System Security and Digital Forensics Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24CPE505	Web Technology	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPE505L	Web Technology Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
4	DJS24CSC501P	Mini Project-I	--	4	--	2	--	--	50	--	--	50	--	50	50	100	2
5#	DJS24XOE511	Data Analytics	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24XOE512	Intellectual Property & Patenting	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24XOE513	Cyber Security and Laws	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24XOE514	Agile Frameworks	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24XOE515	Design of Experiments	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24XOE516	Operations Research	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
		Total	**12**	**10**	**--**	**17**	**--**	**240**	**125**	**--**	**--**	**365**	**160**	**125**	**285**	**650**	**17**

@ Any 1 Department Level Elective
# Any 1 Institue Level Elective

Prepared by **Checked by** **Head of Dept** **Vice Principal** **Principal**

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
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Scheme for First Year M. Tech Program in Computer Engineering: Semester II (Autonomous)
(Academic Year 2024-2025)

Sr	Course Code	Course	Teaching Scheme				End Semester Examination						Continuous Assessment				
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	ESE Total (A)	Term Test	Term Work	CA Total (B)	Aggregate (A+B)	Credits earned
1	DJS24CPC551	Computational Intelligence	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPC551L	Computational Intelligence Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
2	DJS24CPC552	Computational Linguistics	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPC552L	Computational Linguistics Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
3@	DJS24CPE551	Reinforcement Learning	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPE551L	Reinforcement Learning Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24CPE552	Data Storage Technology	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPE552L	Data Storage Technology Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24CPE553	Big Data Infrastructure	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPE553L	Big Data Infrastructure Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24CPE554	Computing Infrastructure	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPE554L	Computing Infrastructure Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24CPE555	Blockchain Technology	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPE555L	Blockchain Technology Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
	DJS24CPE556	Secure Coding	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24CPE556L	Secure Coding Laboratory	--	2	--	1	--	--	25	--	--	25	--	25	25	50	1
4	DJS24CSC551P	Mini Project-II	--	4	--	2	--	--	50	--	--	50	--	50	50	100	1
5#	DJS24XOE561	Machine Learning	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24XOE562	Brand Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24XOE563	Digital Marketing	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24XOE564	Project Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24XOE565	Research Methodology	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
	DJS24XOE566	Product Life Cycle Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3
		Total	**12**	**10**	**--**	**17**	**--**	**240**	**125**	**--**	**--**	**365**	**160**	**125**	**285**	**650**	**17**

@ Any 1 Department Level Elective
# Any 1 Institue Level Elective

Prepared by **Checked by** **Head of Dept** **Vice Principal** **Principal**

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
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Scheme for Second Year M. Tech Program in Computer Engineering: Semester III (Autonomous)
(Academic Year 2024-2025)

Semester III

Sr	Course Code	Course	Teaching Scheme				End Semester Examination						Continuous Assessment			Aggregate (A+B)	Credits earned
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	ESE Total (A)	Term Test (TT)	Term Work Total	CA Total (B)		
1@	DJS24PCCVS31	*Skill Development Course	3	--	--	3	--	--	--	--	--	--	--	50	50	50	3
2	DJS24PCLEL32	Internship/On Job Training/Special topic Research Seminar	--	12	--	6	--	--	50	--	--	50	--	50	50	100	6
3	DJS24PCPEL33	Dissertation Phase I	--	12	--	6	--	--	--	--	--	--	--	100	100	100	6
		Total	**3**	**24**	**--**	**15**	**--**	**--**	**50**	**--**	**--**	**50**	**--**	**200**	**200**	**250**	**15**

*Skill Development Course specific to the Thesis topic

Scheme for Second Year M. Tech Program in Computer Engineering: Semester IV (Autonomous)
(Academic Year 2024-2025)

Semester IV

Sr	Course Code	Course	Teaching Scheme				End Semester Examination						Continuous Assessment			Aggregate (A+B)	Credits earned
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	ESE Total (A)	Term Test (TT)	Term Work Total	CA Total (B)		
1	DJS24PCPEL41	Dissertation Phase II	--	30	--	15	--	--	100	--	--	100	--	100	100	200	15
		Total	**--**	**30**	**--**	**15**	**--**	**--**	**100**	**--**	**--**	**100**	**--**	**100**	**100**	**200**	**15**

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Continuous Assessment (A):

Course	Assessment Tools	Marks	Time (mins)
Theory	a. Term Test 1 (based on 40 % syllabus)	15	45
	b. Term Test 2 (on next 40 % syllabus)	15	45
	c. Assignment / course project / group discussion / presentation / quiz/ any other.	10	--
	Total marks (a + b + c)	40	--
Audit course	Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool.	--	As applicable
Laboratory / Tutorial	Performance in the laboratory, tutorial & / assignment. (ICA Component Evaluation).	25	

The final certification and acceptance of term work will be subject to satisfactory performance upon fulfilling minimum passing criteria in the term work / completion of audit course.

Semester End Assessment (B):

Course	Assessment Tools	Marks	Time (hrs.)
Theory	Written paper based on the entire syllabus.	60	2
Oral	Questions based on the entire syllabus.	25	As applicable
Practical	Performance of the practical assigned during the examination and the output / results obtained.	25	2
Oral & Practical	Project based courses - Performance of the practical assigned during the examination and the output / results obtained. Based on the practical performed during the examination and on the entire syllabus.	As per the scheme	2

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Syllabus for First Year M.Tech Program in Computer Engineering: Semester I (Autonomous) (Academic Year 2024-25)

<table>
<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="2">Semester : I</td></tr>
<tr><td colspan="8">Course: Algorithm and Complexity</td><td colspan="2">Course Code: DJS24CPC501</td></tr>
<tr><td colspan="8">Course: Algorithm and Complexity Laboratory</td><td colspan="2">Course Code: DJS24CPC501L</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="6">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td>Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Assign ment</td><td>Total</td><td rowspan="2"></td></tr>
<tr><td colspan="3">60</td><td>15</td><td>15</td><td>10</td><td>40</td><td>100</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">50</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">2</td><td rowspan="2">--</td><td rowspan="2">4</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>25</td><td>--</td><td>--</td><td>15</td><td colspan="2">10</td><td>25</td></tr>
</table>

Pre-requisite: Knowledge of

1. Data structures
2. Analysis of Algorithms
3. Discrete structures and Set Theory

Objectives:

1. To analyze the algorithms using space and time complexity.
2. To acquire knowledge of various applied algorithms.
3. To understand algorithms that have applications in areas such as geometric modelling, graphics, robotics, vision, computer animation, etc.

Outcomes:

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

1. Analyze the correctness and running time of the algorithms that are implemented in several domains.
2. Apply the algorithms and design techniques to formulate the optimized solution.
3. Understand and apply various advanced data structures to solve computing problems.
4. Introduce and practice advanced algorithms and programming techniques necessary for developing sophisticated computer application programs

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Fundamentals of Algorithms:** Introduction to Algorithms, analyzing algorithms (Big Oh, small Oh, Omega, small Omega, Theta, Tilde), Growth of Functions, Recurrences, the substitution method, the recursion-tree	05

	method, the master method, Complexity of Recursive algorithms, Proving Techniques. Amortized Analysis (Aggregate, Accounting and Potential Method)	
2	**Dynamic Programming and Linear Programming:** Elements of dynamic programming, Matrix-chain multiplication, Weighted Job Scheduling Algorithm, Graphical Method, Simplex Method, Standard and slack forms, Formulating problems as linear programs.	06
3	**Advanced Data Structures:** Top-Down Splay Tree, Skew Heaps, Fibonacci Heaps, van Emde Boas Trees, AA-Trees, Treaps, Data Structures for Disjoint Sets.	06
4	**Graph Algorithms:** Applications of DFS- Undirected Graphs, Biconnectivity, Euler circuits, Directed Graphs, Cyclic Graphs: Hamiltonian and Eulerian Cycles, Single-Source Shortest Paths-The Bellman-Ford algorithm, All-Pairs Shortest Paths-The Floyd-Warshall algorithm.	08
5	**Streaming Algorithms:** Basic Definitions, Sampling, Sketching, Counting distinct Items, Heavy Hitters Problem, CountSketch Algorithm.	06
6	**Advanced Algorithms:** Multithreaded Algorithms, String Matching - The naive string-matching algorithm, The Rabin-Karp algorithm, String matching with finite automata, The Knuth-Morris Pratt algorithm, Number-Theoretic Algorithms- Elementary number-theoretic notions, Greatest common divisor, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element, Randomized Algorithms-Monte Corlo& Las Vegas Algorithms	08

List of Laboratory Experiments:

1. Implement various sorting algorithms and analyze them w.r.t. Time and Space complexity.
2. Implement Matrix chain multiplication.
3. Implement Weighted Job scheduling.
4. Implement Linear Programming Simplex method.
5. Implement Single-Source Shortest Paths-The Bellman-Ford algorithm.
6. Implement All-Pairs Shortest Paths-The Floyd-Warshall algorithm.
7. Implement Naïve String matching and Rabin Karp algorithm.
8. Study research paper on Advanced Data Structures and Streaming Algorithms.

Books Recommended:

Text books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, PHI, India Second Edition, February 2010.
2. H. S. Wilf, “Algorithms and complexity”, Prentice hall, Summer 1994.
3. Horowitz, Sahani and Rajsekaran, Fundamentals of Computer Algorithms”, Galgotia, January 2008.

Reference Books:

1. The Design and Analysis of Computer Algorithms” by Aho, Hopcroft, Ullman, 1974.

2. “Algorithm Design" by Kleinberg and Tardos, 16 March 2005.
3. “Data Structures and Algorithm Analysis in C” by Mark Allen Weiss, Pearson, September 1996.

Web Resources (For our Reference):

1. https://www.geeksforgeeks.org/difference-between-big-o-notations-and-tilde/

2. https://www.tutorialspoint.com/Amortized-Analysis

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Program: First Year M.Tech Computer Engineering	Semester : I
Course: Natural Language Processing	Course Code: DJS24CPC502
Course: Natural Language Processing Laboratory	Course Code: DJS24CPC502L

Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assign ment	Total	
				60			15	15	10	40	100
				Laboratory Examination			Term work			Total Term work	
3	2	--	4	Oral	Practical	Oral & Practical	Laborat ory Work	Tutorial / Mini project / presentation/ Journal			50
				25	--	--	15	10		25	

Pre-requisite: Knowledge of Probability and Calculus

Objectives:

1. To learn the fundamentals of natural language processing
2. To understand the use of CFG and PCFG in NLP
3. To understand the role of semantics of sentences and pragmatics
4. To apply deep learning models on NLP applications

Outcomes:

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

1. Design an innovative application using NLP components
2. Implement probabilistic models for word level analysis of a language
3. Perform Syntactic and Semantic level analysis of a language
4. Use the embedding algorithms for NLP applications
5. Compare and contrast the use of different statistical approaches for different types of NLP applications

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Basics of NLP:** Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance	04
2	**Word Level Analysis:** Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.	06

3	**Syntactic Analysis** Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.	08
4	**Semantics, Pragmatics & Discourse Segmentation:** Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods. **Discourse segmentation** Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).	08
5	**Feature Extraction and Embeddings:** Extract features from text, Usage of embedding algorithms, such as Word2Vec and Glove. Problems with resources like WordNet, Representing words by their context, Optimization: Gradient Descent, Gensim word vector visualization.	06
6	**Computing with Natural Language:** Modeling: Uses of deep learning models in NLP-machine translation, topic models, and sentiment analysis, Question Answering Systems, text summarization, and image captioning.	08

List of Laboratory Experiments:

1. Perform text preprocessing (tokenisation, POS Tagging. stemming, lemmatisation) using NLP libraries
2. Perform morphological analysis for any regional text
3. Implement Hidden Markovian Model to predict the next word
4. Generate probabilistic CFG and Perform dependency parsing on a given text
5. Perform WSD using semi supervised techniques
6. Perform Anaphoric resolution for a given paragraph.
7. Extract features from text using word embedding algorithms
8. Perform sentimental analysis using word vectors
9. Perform image captioning using word vectors.
10. Evaluate different deep learning models on text summarization.

Books Recommended:

Text books:

1. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, OReilly Media, 2009.
3. Christopher D.Manning and Hinrich Schutze, "Foundations of Statistical Natural Language Processing ", MIT Press, 1999.

Reference Books:

1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, ―Natural Language Processing with Java, OReilly Media, 2015.

3. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
5. Jurafsky, David, and James H. Martin. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition. Upper Saddle River, NJ: Prentice-Hall, 2000. ISBN: 0130950696.
6. Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor) "The Handbook of Computational Linguistics and Natural Language Processing", July 2010

Web Resources:

1. http://cse24-iiith.virtual-labs.ac.in/#
2. https://web.stanford.edu/class/archive/cs/cs224n/cs224n.1184/lectures/
3. https://pythonprogramming.net/tokenizing-words-sentences-nltk-tutorial/
4. https://www.amazon.com/Handbook-Language-Processing-Learning-Recognition/dp/1420085921
5. https://web.stanford.edu/class/archive/cs/cs224n/cs224n.1184/lectures/lecture1.pdf

Prepared by Checked by Head of the Department Principal

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<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="2">Semester : I</td></tr>
<tr><td colspan="8">Course: Computer Network and Design</td><td colspan="2">Course Code: DJS24CPE501</td></tr>
<tr><td colspan="8">Course: Computer Network and Design Laboratory</td><td colspan="2">Course Code: DJS24CPE501L</td></tr>
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Pre-requisite: Knowledge of

1. Computer Network.
2. Data Communication.

Objectives:

1. To understand advanced networking techniques and design methodology.
2. To study, analyze and evaluate various congestion control techniques.
3. To design networking model as per the requirements.

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

1. Understand IPV6 Protocol and advantages over IPV4
2. Understand IP multicasting protocols and various TCP techniques
3. Analyze various congestion control and avoidance techniques.
4. Understand Ethernet networking and design new networking model.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**IPv6:** Introduction of IPv4 and IPv6. Transition from IPv4 to IPv6. Why IPv6, basic protocol, extensions and options, support for QoS, security, etc., neighbor discovery, auto-configuration, routing. Changes to other protocols.	08
2	**IP Multicasting:** IP Multicasting. Multicast routing protocols, adder's assignments, session discovery, etc.TCP extensions for high-speed networks, transaction-oriented applications. Other new options in TCP.	07
3	**Internetworking:** Congestion control and Resource allocation: Issues of Resource Allocation, Queuing Disciplines: FIFO, Fair Queuing, TCP Congestion Control: Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery. Congestion-Avoidance Mechanisms: DECbit, Random Early Detection (RED), Source-Based Congestion Avoidance, Quality of Service: Application Requirements, Integrated Services (RSVP), Differentiated Services (EF, AF).	07
4	**Introduction to Network Design:** Goal of network design, QoS Attributes, Network Performance, Characterizing Network Traffic Server Placement	06
5	**The Art of Network Design:** Making Technology Choices, Ethernet vs. ATM, Ethernet Switching, VLAN and Layer 3 Switching, Cabling, Network Components, Deployment and Migration, Reliability, Redundancy, & Routing.	07
6	**Enterprise LAN Design:** Enterprise LAN Design: Ethernet Design Rule. Gigabit Ethernet Design Rules.	04

List of Laboratory Experiments:

1. Design of enterprise network for any application.
2. Design wired network topologies and experiment data sending and reception using NS2.
3. Design wireless network topologies and experiment data sending and reception using NS2.
4. Study of Wireless Sensor Network Data Acquisition, Transmission, and Aggregation using VLab(http://vlab.amrita.edu/index.php?sub=78&brch=256&sim=1557&cnt=3665)
5. Analysis of live network using Packet Tracer / Wireshark.
6. Implement LED glow mechanism in IoTtinkercad.
7. Simulate traffic light scenario using IoTtinkercad.
8. Implement piezoelectric sensor that uses the piezoelectric effect, to measure changes in pressure, temperature using IoTtinkercad.
9. Simulate functionality of ultrasonic sensor with delay of 2 microseconds using IoTtinkercad.
10. Implement IR remote control sensor using IoTtinkercad.

Books Recommended:

Text books:

1. W. R. Stevens.*TCP/IP Illustrated, Volume 1: The protocols,*Addison Wesley, 1994.
2. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, Elsevier, Fourth Edition.
3. Pete Loshin, IPv6: Theory, Protocols and Practice, Morgan Kaufmann, 2nd Edition, 2004

Reference Books:

1. Philip M. Miller, TCP / IP: The Ultimate Protocol Guide Applications, Access and Data, Security - Vol 2, Wiley
2. James F. Kurose, Keith W. Ross, “Computer Networking, A Top-Down ApproachFeaturing the Internet”, Third Edition, Addison Wesley, 2004.
3. J. McCabe, "Practical Computer Network -- Analysis and Design," Morgan Kaufmann Publishers, Inc.
4. T. Mann-Rubinson and K. Terplan, "Network Design: Management and Technical Perspectives," CRC Publication.
5. R. Breyer and S. Riley, "Switched, Fast, and Gigabit Ethernet," Macmillan Technical Publishing, 3rd Ed.

Prepared by Checked by Head of the Department Principal

<table>
<tr><td colspan="5">Program: First Year M.Tech Computer Engineering</td><td colspan="8">Semester : I</td></tr>
<tr><td colspan="5">Course: Computer Vision</td><td colspan="8">Course Code: DJS24CPE502</td></tr>
<tr><td colspan="5">Course: Computer Vision Laboratory</td><td colspan="8">Course Code: DJS24CPE502L</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="9">Evaluation Scheme</td></tr>
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</table>

Pre-requisite: Knowledge of Computer Graphics, Image Processing

Objectives:

Computer Vision focuses on the development of algorithms and techniques to analyze and interpret the visible world around us. Explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

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

1. Identify basic concepts, terminology, theories, models and methods in the field of computer vision.
2. Describe basic methods of computer vision related to edge detection and detection of other primitives, stereo, motion and object recognition.
3. Developed the practical skills necessary to build computer vision applications.
4. To have gained exposure to feature based alignment.
5. To understand the dense motion estimation.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction** What is computer Vision, Image Formation: Geometric Primitives, 2D transformation, 3 D transformation, 3D rotation, 3D to 2D Projection, Lens Distortion Photometric Image Formation: Lighting, reflectance and shading The digital camera: sampling and aliasing, color, compression	04
2	**Feature Detection and Matching** Points and Patches: Feature detectors, feature discriptors, feature matching, feature tracking, Edges: Edge detection, edge linking Lines: Successive approximation, hough transform, vanishing points	06

3	**Segmentation** Active Contours: snakes, dynamic snakes and condensation, scissors, level sets Split and Merge techniques: Region splitting, region merging, graph based segmentation, Normalized cuts, Graph cuts and energy based methods	08
4	**Feature Based Alignment** 2D and 3D Feature Based Alignment: 2 D alignment using least square, Iterative algorithms, Robust least squares and RANSAC, 3 D alignment Pose Estimation: Linear algorithms, Iterative algorithms Geometric Intrinsic Calibrations: Calibration Patterns, Vanishing Points, Rotational Motion, Radial Distortion	08
5	**Structure from Motion** Triangulation, Two Frame Structure from Motion: Projective (uncalibrated) reconstruction, self-calibration Factorization: Perspective and Projective Factorization Bundle Adjustment: Exploiting sparcity, Uncertainties and Ambiguities	06
6	**Dense Motion Estimation** Translational Alignment: Hierarchical Motion Estimation, Fourier based alignment, Incremental refinement Applications of Dense motion estimation: Video stabilization, video denoising and de interlacing, Frame Interpolation	07

List of Laboratory Experiments:

1. Perform Edge Editing and Enhancement of an Image
2. Perform Contour Tracking and rotoscoping
3. Perform medical image segmentation
4. Perform View Morphing
5. Convert 2D Image to 3D
6. Perform reconstruction of a distorted image
7. Perform frame interpolation
8. Mini project

Books Recommended:

Text books:

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, 2nd ed., Springer,2022
2. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I, II, Addison- Wesley, 1993.
3. David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach", 2nd ed.© 2022 Richard Szeliski, The University of Washington

Reference Books:

1. Milan Sonka,Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision" Thomson Learning
2. Mark Nixon and Alberto S. Aquado, ―Feature Extraction & Image Processing for Computer Vision‖, Third Edition, Academic Press, 2012.

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Program: First Year M.Tech Computer Engineering	Semester : I
Course: Internet of Everything	Course Code: DJS24CPE503
Course: Internet of Everything Laboratory	Course Code: DJS24CPE503L

Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assign ment	Total	
				60			15	15	10	40	100
				Laboratory Examination			Term work			Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal			
				25	--	--	15	10		25	

Pre-requisite: Knowledge of

1. Computer networks
2. Wireless sensor Networks
3. Embedded Systems

Objectives:

1. Provide an overview of concepts, main trends and challenges of Internet of Things.
2. Provide knowledge of sensors and WSN.
3. Develop the ability to use hardware and software technologies related to Internet of Things.
4. Provide knowledge of IoT communication models and protocols.
5. Provide knowledge of IoT security issues, challenges and controls.
6. Develop skills to relate the IoT technologies for practical IoT applications.

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

1. Comprehend the Internet of Things concepts and investigate the challenges.
2. Gain knowledge of sensors and Design WSN.
3. Develop IoT system prototype with enhanced IoT Technologies.
4. Use IoT communication models and protocols.
5. Implement best practices for IoT Security.
6. Design and develop small IoT applications to create smart objects

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Overview of IoT**: IoT: Brief History and evolution IoT Reference Architecture and Protocols like MQTT, COAP, REST, LoWIPv6. Enabling Technologies: WSN, Cloud computing, Big data Security and privacy concepts of Web of Things Societal Benefits and applications of IoT	04

2	**Sensors, Actuators and Wireless Sensor Networks:** Sensors: Working Principles and types of sensors such as Temperature, Pressure, Humidity, Toxic Gas, biometric sensors, ultrasonic etc. Actuators: Commonly used actuators in IoT, servo motors, solenoid, and relays. Wireless Sensor networks: History and Context, The Node, Connecting and Networking Nodes, RFID + NFC, Bluetooth, RTLS + GPS, Agents + Multi – Agent Systems	08
3	**Controllers in IOT:** Introduction of microcontroller boards: Arduino, ESP8266, Raspberry PI, beaglebone and PcDuino Arduino: Basic and extended Arduino Programming Interfacing IoT sensors and Actuators Arduino –Based Internet Communication Raspberry Pi: Introduction to IDE, Pi programming for Raspberry Pi, Introduction to Beaglebone, and PcDuino boards. Prototyping IoT applications: Selection of Sensors, Actuators and System on Chip (SoC) platform for a Practical Application. Physical and logical design, writing efficient embedded code using IDE and online APIs	08
4	**IoT Communication Models and protocols:** IoT Communication models: Request-Response, Publish-Subscribe, Push-Pull Application Protocols: CoAP, MQTT, AMQP Network Layer: IPv4, IPv6, 6LoWPAN Data exchange formats: -JSON Communication APIs: REST-based, Web Socket-based	06
5	**IoT in Cloud, Fog and Edge Computing:** Overview of Cloud and Fog Computing, Definition, Difference between Fog and Cloud, Related Paradigms and Technologies like MCC, MEC, Edge Computing, Taxonomy of Fog Computing, Different dimensions of Fog computing, Advantages and Applications. Edge Computing: Architecture of Edge Computing, Benefits, Applications	08
6	**Key applications of IoT and Use Cases:** Energy Management and Smart Homes, Ambient Assisted Living, Intelligent Transport, Industrial IoT Applications. **Artificial Intelligence in IoT**: Real world examples: Tesla Motors – Self Driving Cars, WildTrack – Endangered Species Preservation, Nest Labs – Smart thermostat, Automated vacuum cleaner – iRobot Roomba **IoT companies and vendors:** Commercially available IoT devices from vendors, Google Home Voice Controller, Amazon Echo Plus Voice Controller, August Doorbell Cam, August Smart Lock	05

List of Laboratory Experiments:

Arduino based experiments:

1. Simulation of traffic signals
2. Seven segment display
3. Working with Piezo, PIR, ultrasonic, IR sensor
4. Working with ESP8266 WiFi Module
5. Project using ThingSpeak Platform
6. Project using Blynk App
7. Working with Own Cloud Server (Hosting)
8. Creating a platform to control home appliances with own server

R-pi based experiments:

1. Controlling GPIO Outputs using a Web Interface

2. Create a user interface to control Servo motor
3. Camera Interfacing and Programming
4. Playing an Audio File
5. GSM/GPS interfacing and programming

Books Recommended:

Textbooks:

1. The Internet of Things Key applications and Protocols, 2ndEdition, (Wiley Publication) by Olivier Hersent, David Boswarthick and Omar Elloumi, 2nd edition
2. The Internet of Things (MIT Press) by Samuel Greengard, revised edition
3. The Internet of Things (Connecting objects to the web) by HakimaChaouchi ,Wiley, 1st edition
4. Internet of Things (A Hands-on-Approach) by ArshdeepBhaga and Vijay Madisetti. 1st edition
5. Fei HU, "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations", CRC Press, 2016, 1st edition

Reference Books:

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing
3. Mandler, B., Barja, J., MitreCampista, M.E., Cagá_ová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publishing
4. IoT –From Research and Innovation to Market development, River Publication by OvidiuVermesan and Peter Friess.
5. Building Internet of Things with Arduino by CharalamposDoukas.
6. Russell, Brian and Drew Van Duren, "Practical Internet of Things Security", Packt Publishing, 2016.
7. Ollie Whitehouse, "Security of Things: An Implementers' Guide to Cyber-Security forInternet of Things Devices and Beyond", NCC Group, 2014

Web Resources (For our Reference):

1. *https://www.slideshare.net/urvishnu/iot-control-units-and-communication-models*
2. *https://www.slideshare.net/sanjucsrf/iot-security-49646611*
3. *https://www.slideshare.net/vineshgowda/applications-of-iot-internet-of-things*

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<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="2">Semester : I</td></tr>
<tr><td colspan="8">Course: System Security and Digital Forensics</td><td colspan="2">Course Code: DJS24CPE504</td></tr>
<tr><td colspan="8">Course: System Security and Digital Forensics Laboratory</td><td colspan="2">Course Code: DJS24CPE504L</td></tr>
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Pre-requisite: Knowledge of

1. Computer Networks
2. Databases
3. Operating Systems

Objectives:

1. To understand cyber-attacks and defense strategies.
2. To understand underlying principles of access control mechanisms.
3. To explore software vulnerabilities, attacks, and protection mechanisms of wireless networks and protocols, mobile devices, and web applications.
4. To develop and mitigate security management and policies.
5. To understand and explore techniques used in digital forensics.

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

1. Understand cyber-attacks, apply access control policies, and control mechanisms.
2. Identify malicious code and targeted malicious code.
3. Detect and counter threats to web applications.
4. Understand the vulnerabilities of Wi-Fi networks and explore different measures to secure wireless protocols, WLAN and VPN networks.
5. Understand the ethical and legal issues associated with cybercrimes and be able to mitigate impact of crimes with suitable policies.
6. Use different forensic tools to acquire and duplicate data from compromised systems and analyse the same.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction & Access Control:**	08
	1.1 Introduction: Need for Cyber Security, what is Cybercrime, Types of Cybercrime, Threats vs Vulnerabilities, Defense Strategies and Techniques, Authentication Methods, and Protocols	
	1.2 Access Control Policies: DAC, MAC, Rule Based Access Control, Role Based Access Control, Multi-level Security Models: Biba Model, Bell La Padula Model, Single Sign on, Federated Identity Management.	
2	**OS Security:**	05
	2.1 Separation, Memory and Address Protection: Fencing, Relocation, Base/Bound Registers, Segmentation and Paging.	
	2.2 Linux and Windows Vulnerabilities, File System Security	
3	**Web Application Security:**	08
	3.1 OWASP Top 10 Web Vulnerabilities, Cookies and their role in Cyber Attacks, SSL/TLS, HTTP vs HTTPS, SSH, Privacy on the Web, Web Browser Attacks, Account Harvesting, Web Bugs, Clickjacking, Cross Site Scripting(XSS) vs Cross-Site Request Forgery (CSRF), Session Hijacking , Phishing vs Vishing vs SMShing vs Pharming, Web Service Security: SOAP Protocol, OAuth 2.0	
4	**Digital Forensics and Incident Response:**	06
	4.1 **Digital Forensics:** Introduction to Digital Forensics, The Need for Digital Forensics, Types of Digital Forensics.	
	4.2 **Incident and Initial Response:** Introduction to Computer Security Incident, Goals of Incident response, Incident Response Methodology, Initial Response, Formulating Response Strategy.	
5	**Forensic Duplication and Analysis**	08
	5.1 **Forensic Duplication:** Introduction to Forensic Duplication, Types of Forensic Duplicates, Introduction to Forensic Duplication Tools.	
	5.2 **Data Acquisition:** Introduction to Static and Live/Volatile Data, Static Data Acquisition from Windows (FTK Imager), Static Data Acquisition from Linux (dd/dcfldd), Live Data Acquisition from Windows (FTK Imager)	
	5.3 **Forensic Investigation and Analysis:** Forensic Analysis of acquired data in Linux/Windows, Investigating Logs and Registry files.	
6	**Evidence Handling and Forensic Reporting**	04
	6.1 **Evidence Handling:** Digital Evidence: Types and characteristics, Challenges for Evidence Handling, Evidence Handling Methodology, Chain of Custody,	
	6.2 **Forensic Reporting:** Goals of a Report, Layout of an Investigative Report, Guidelines for writing a report, Sample Forensic Report	

List of Laboratory Experiments:

1. Static Code Analysis using open-source tools. Recommended Tool: Flawfinder Python Distribution
2. Web Application Vulnerability Scanning and Auditing using open-source tools. Recommended Tools: Nikto / Wapiti / Burpsuite
3. Study and exploit database flaws and vulnerabilities using SQL Injection Attack. Recommended Tool: SQLMap
4. Study and Implement Packet Sniffing using Open-Source Tools. Recommended Tools: Wireshark, TCP Dump
5. Study and implement Session Hijacking / Man in the Middle (MiTM) attack in a controlled virtual environment. Recommended Tools: Ettercap / Bettercap
6. Penetration Testing and Vulnerability Exploitation. Recommended Tool: Metasploit (Kali Linux)
7. Exploring Router and VLAN security, setting up access lists. Recommended Tool: Cisco Packet Tracer (Student Edition)
8. Static and Live Data Acquisition from Windows Recommended Tool: FTK Imager , TCP Dump
9. Static Data Acquisition from Linux Recommended Tool: dd, dcfldd
10. Analysis of Forensic Duplicates (Recommended Tool: Autopsy)

Books Recommended:

Text books:

1. Computer Security Principles and Practice, William Stallings, Fourth Edition, Pearson Education, 2019
2. Cryptography and Network Security – Principles and Practice, William Stallings, Seventh Edition, Pearson Education, 2017
4. Security in Computing, Charles P. Pfleeger, Fifth Edition, Pearson Education, 2018
5. Network Security and Cryptography, Bernard Menezes, Cengage Learning, 2010
6. Network Security Bible, Eric Cole, Second Edition, Wiley, 2009

Reference books:

1. Incident Response & Computer Forensics by Kevin Mandia, Chris Prosise, Wiley, 2nd Edition. 2014
2. Computer Security, Dieter Gollman, Third Edition, Wiley,3rd Edition, 2011
3. Digital Forensic by Nilakshi Jain & Kalbande, Wiley, 2016
4. Cyber Security. Nina Godbole, Sunit Belapure, Wiley, 2011
5. Build your own Security Lab, Michael Gregg, Wiley India, 2012
6. CCNA Security, Study Guide, Tim Boyles, Sybex, 2010
7. Web Application Hacker's Handbook, Dafydd Stuttard, Marcus Pinto, Wiley India, 2008
8. Network Infrastructure Security, Randy Waver, Dawn Weaver, Cengage Learning, 2009

Web Resources (For our Reference):

1. http://www.opentechinfo.com/learn-use-kali-linux/
2. https://www.owasp.org/index.php/Category:OWASP_Top_Ten_Project

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<tr><td colspan="8">Course: Web Technology</td><td colspan="3">Course Code: DJS24CPE505</td></tr>
<tr><td colspan="8">Course: Web Technology Laboratory</td><td colspan="3">Course Code: DJS24CPE505L</td></tr>
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</table>

Pre-requisite: Basic understanding of fundamentals of Web Technologies

Objectives:

1. Create simple website based on HTML/ CSS
2. Create simple websites based on React.js features
3. Create simple websites based on Node.js features
4. Demonstrate database connectivity and operations
5. Learn how to deploy a website

Outcomes:

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

1. Build simple websites making use of various Node.js features
2. Build applications using React JS
3. Design a dynamic web application enabled with database connectivity
4. Deploy a full-fledged website

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**HTML 5** Anatomy of HTML syntax, Lists. Images, hyperlinks, tables, forms, Divs **CSS:** CSS selectors and properties, inline, internal and external CSS. CSS sizing methods, Class vs. Ids, layout. CSS static, relative and absolute positioning systems. Font styling, web safe fonts, Website design fundamentals and typography, combine CSS selectors and understand selector priority. **DOM:**	6

	Learn the tree structure of HTML based websites. Traverse through the document using object notation. Separation of concerns and coding best practices. Manipulate and change the HTML elements using your understanding of the DOM.	
2	**Java Script:** Variables and Data Types, strings, numbers, logical operators, Loops, collections and Conditionals. Functions and invocation patterns, Discussion of ECMA Scripts Intermediate JavaScript, JS Expressions, Operators, Statements and Declarations Object-Oriented Programming JS Objects and Prototypes `This`, Scope and Closures, Objects and Prototypes, Refactoring and Debugging	6
3	**React JS:** Front-end development with React, when and how to use React Components, passing and working Props, JSX, React DOM, State Management in React, React Hooks, Conditional rendering in React, Class and functional components	6
4	**Node.js :** Node.js, Setup Development Environment: Installation of Node.js, Working in REPL, Node JS Console, working with an MVC framework, apply concepts like data types, objects, methods, object-oriented programming, and classes in the context of backend development, Server-Side JavaScript Using Node on the command line NPM JavaScript Build Processes, Event Loop and Emitters, File System Interaction, Modules, Native Node drivers.	8
5	**Databases:** Database Fundamentals, Working with Database Schemas, Create-Read-Update-Destroy (CRUD), Database Joins, Querying SQL databases, Serialization, how to model NoSQL data, Document Databases (MongoDB), Create-Read-Update-Destroy (CRUD), NoSQL Best Practices, Mongo Shell and command line use, installing MongoDB, Mapping relationships with MongoDB, using an object-data modelling library (Mongoose)	6
6	**Deployment and Building RESTful api:** Understand hosting and deployment. Hosting static websites with GitHub Pages. Deploying server-based applications with Heroku. Deploying Databases with Mongo Atlas. Understand REST and guiding principles behind API design. Learn to work with a MongoDB GUI Robo 3T Implementing GET, POST, PUT, PATCH and DELETE by creating a public API from scratch. Understand and use chained route handlers from Express.	7

List of Laboratory Experiments:

Add list of experiments

Books Recommended:

Text books:

1. Powell TA, Powell TA**.** HTML & CSS: the complete reference. New York: McGraw-Hill; 2010.
2. Haverbeke M. Eloquent Javascript: A modern introduction to programming No Starch Press; 2018.
3. Teixeira P. Professional Node.js: Building Javascript based scalable software John Wiley & Sons; 2012 4. Brown E. Web development with node and express: leveraging the JavaScript stack. O'Reilly Media; 2014.

4. Shannon Bradshaw, Eoin Brazil, Kristina Chodorow MongoDB: The Definitive Guide - Powerful and Scalable Data Storage, Third Edition, Oreilly Publication

Reference Books:

1. Robert W. Sebesta, Programming the Worldwide Web, 4th Edn, Pearson, 2012 Francis Shanahan: Mashups, Wiley India, 2012
2. Shama Hoque Full-Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js, 2nd Edition Packt Publication

Web Resources (For our Reference):

1. https://www.w3schools.com/
2. https://www.tutorialspoint.com/internet_technologies/websites_development.htm
3. https://www.geeksforgeeks.org/web-development/

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<tr><td colspan="6">Course: Mini Project-I</td><td colspan="6">Course Code: DJS24CSC501P</td></tr>
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(Hours / week)</td><td colspan="12">Evaluation Scheme</td></tr>
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<tr><td>50</td><td>--</td><td>--</td><td>--</td><td colspan="3">50</td><td>50</td></tr>
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Pre-requisite:

1. Domain knowledge of any Program Specific Outcome (PSO) of the Computer Engineering curriculum.

Objectives:

1. Project Implementation with reference to the subjects in the various domains of Computer Engineering, UG & PG curriculum, with a view to strengthen research.
2. To explore and identify real-world social and industrial problems, to realize feasible solutions with added business value, based on conventional or innovative methods/practices.

Outcomes:

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

1. Identify problem statement, design and develop project in predefined timeline.
2. Provide problem solutions by learning/exploring various ideas from multi-disciplinary domains across different disciplines.
3. Draw proper inferences through theoretical/ simulations/ experimental and analyze the impact of the proposed method towards design and development of the product.
4. Develop and enhance skills associated with literature survey, hardware and software co-integrations, documentation, development and testing leading to innovative product or a paper publication in a reputed journal.

Syllabus:

Domain knowledge (any field of knowledge and beyond) needed from the following areas for the effective implementation of the product:

Algorithms, Data structures, Networking and Internet of Things, Data science and Big Data, Robotics, Artificial Intelligence (AI), Machine learning (ML), Image Processing, Security, Natural Language Processing.

The above areas can be updated (expanded), based on the needs of technological innovations and development needed for a specific project/product.

Evaluation scheme:

Every student will be reviewed individually once in a semester by review panel based on the following criteria:

1. Innovative ideas and Motivation
2. Objectives, Expected outcome and long-term social impact
3. Literature survey and Comparative Methodology
4. Timeline, progress and execution (Project Implementation)
5. Documentation/ synopsis of project report.
6. Overall presentation

Marks scored in the mid semester review will be considered as part of term work.

The final certification and acceptance of Term work ensure satisfactory performance and the outcome of evaluation centered about evaluation scheme.

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Program: First Year M.Tech Computer Engineering								Semester : I				
Course: Data Analytics								Course Code: DJS24XOE511				
Teaching Scheme (Hours / week)				Evaluation Scheme								
				Semester End Examination Marks (A)				Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory				Term Test 1	Term Test 2	Assign ment	Total	
				60				15	15	10	40	100
				Laboratory Examination				Term work			Total Term work	
3	--	--	3	Oral	Practical	Oral & Practical		Laboratory Work	Tutorial / Mini project / presentation/ Journal			--
				--	--	--		--	--		--	

Pre-requisite: Knowledge of

1. Fundamentals of probability
2. Applied Mathematics

Objectives:

To build the strong foundation in statistics which can be applied to analyze data and make predictions

Outcomes:

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

1. Interpret data using descriptive statistics
2. Demonstrate sampling distributions and estimate statistical parameters
3. Develop hypothesis based on data and perform testing using various statistical techniques.
5. Perform analysis of variance on data
6. Examine relations between data

Module No.	Unit No.	Topics	Hrs.
1		**Introduction to Statistics**	06
	1.1	Types of statistics, population vs sample Measures of Central Tendency: arithmetic mean, properties, weighted mean, properties, median, mode, grouped and ungrouped data, empirical relation between the mean, median and mode, geometric mean, harmonic mean, relation between arithmetic, geometric and harmonic mean, outlier.	
	1.2	Measures of dispersion: range, quartile deviation, mean deviation, standard deviation, properties, variance, root mean square deviation, empirical relations between measures of dispersion, absolute and relative dispersion, coefficient of variation, moments, Pearson's β and γ coefficients, skewness, kurtosis,	

		population parameters and sample statistics, histogram, frequency polygon Measures of position: quartiles, interquartile range, semi interquartile range, percentiles, percentile rank, 10–90 percentile range, box and whisker plot	
2		**Sampling distribution and Estimation**	08
	2.1	Sampling distribution: Central limit theorem, population distribution, chi-square distribution, Z - distribution, student's t-distribution, F-Distribution.	
	2.2	Statistical Estimation: Characteristics of estimators, consistency, unbiasedness, unbiased estimates, efficient estimates, sufficient estimators, point estimates, interval estimates, determination of sample size for estimating mean and proportions, estimates of population parameters, probable error	
3		**Hypothesis Testing for data driven decision making**	12
	3.1	Hypothesis testing: Test of significance, null and alternative hypothesis, type I and type II error, factors affecting Type II error, probability of Type II error, power of test, p-Value, critical region, level of significance	
	3.2	Confidence interval: Population mean, difference between two population means, population proportion, difference between two population proportions, variance, ratio of variances of two populations Goodness of fit test using Kolmogorov-Smirnov test and Anderson Darling test	
	3.3	Tests using z-statistics: difference between sample proportion and population proportion, difference between two sample proportion, difference between sample mean and population mean with known σ and unknown σ, difference between two sample means, one tailed and two tailed tests Test using t-statistics: difference between sample mean and population mean, difference between two independent sample means, difference between means from the same group; Test using F-statistics: equality of population variance Test using chi-square statistics: test of independence, goodness of fit	
4		**Analysis of Variance (ANOVA) for data analysis**	08
	4.1	Sample size calculation, one way ANOVA, POST-HOC Analysis (Tukey's Test), randomized block design, two way ANOVA	
5		**Examining Relationship**	08
	5.1	Correlation: Scatter plot, covariance, Karl Pearson's coefficient of correlation, hypothesis test for correlation, correlation vs causation, extreme data values, limits of correlation coefficient, Rank correlation, Spearman's rank correlation coefficient, Repeated ranks, partial and multi correlation	
	5.2	Regression: linear regression analysis, lines of regression, regression coefficients, scatter plot with regression lines, hypothesis test for regression, multiple regression, coefficient of determination, residuals, collinearity, influential observations	

Books Recommended:

Text Books:

1. Ken Black, *Business Statistics for Contemporary Decision Making*, John Wiley & Sons, Inc. Sixth Edition.
2. Anderson Sweeney Williams, *Statistics for Business and Economics*, Cengage Learning, 2011.

Reference Books:

1. Jay L. Devore, *Probability and Statistics for Engineering and the Sciences*, Cengage Learning, 2011.
2. Douglas C. Montgomery, George C. Runger, *Applied Statistics & Probability for Engineering*, John Wiley & Sons, Inc, 2002

Prepared by Checked by Head of the Department Principal

<table>
<tr><td colspan="5">Program: First Year M.Tech Computer Engineering</td><td colspan="5">Semester : I</td></tr>
<tr><td colspan="5">Course: Intellectual Property & Patenting</td><td colspan="5">Course Code: DJS24XOE512</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme
(Hours / week)</td><td colspan="10">Evaluation Scheme</td></tr>
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<tr><td rowspan="2">Lectures</td><td rowspan="2">Practical</td><td rowspan="2">Tutorial</td><td rowspan="2">Total Credits</td><td colspan="4">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Assign ment</td><td>Total</td></tr>
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<tr><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>--</td><td>--</td><td>--</td><td>--</td><td colspan="2">--</td><td>--</td></tr>
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Objectives:

1. Understanding, defining and differentiating different types of intellectual properties (IPs)
2. Assessing different IP management (IPM) approaches
3. Exposure to the Legal management of IP and understanding of real life practice of IPM.

Outcomes:

At the end of course, a student will be able to:

1. Recognize the crucial role of IP for the purposes of product and technology development.
2. Understand how and when to file a patent
3. Apply the knowledge to understand the entire ecosystem
4. Derive value from IP and leverage its value in new product and service development

Unit No.	Topics	Hrs.
1	**Intellectual Property Law** Introduction and the need for intellectual property right (IPR), Intellectual Property laws, IPR in India: Genesis and development, Major International Instruments concerning Intellectual Property Rights: Paris Convention, the Berne Convention, the Universal Copyright Convention, the WIPO Convention, the Patent Cooperation Treaty, the TRIPS Agreement, Types of IPR	05
2	**Patents and Trademarks** Elements of Patentability: Novelty, Non Obviousness, Industrial Application, Non Patentable Subject Matter, Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties, Patent office and Appellate Board, Case study of existing patents related to software, healthcare, devices. Concept of Trademarks, Different kinds (brand names, logos, signatures, symbols, well known marks, certification marks and service marks), Non Registrable Trademarks,	08

	Registration of Trademarks, Rights of holder and assignment and licensing of marks, Infringement, Remedies & Penalties, Trademarks registry and appellate board.	
3	**Copyrights and Design** Copyrights: Nature, Subject matter: original literary, dramatic, musical, artistic works, cinematograph films and sound recordings, Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright, Infringement, Remedies & Penalties, Related Rights, distinction between related rights and copyrights Design: meaning and concept of novel and original, procedure for registration, effect of registration and term of protection	**10**
4	**Patenting** Introduction to the Indian Patent System , Patent Law as Concepts, IPR as a group of rights, Patent Rights, Fundamental of Patents, Patent Law in India, Understanding the Patents Act and the Rules.	**08**
5	**Patent Drafting and Searching** Anatomy of a patent application, Adequate disclosure, The art of drafting patent claims Patent searching: A. Purposes and techniques B. Available On-line tools	**06**
6	**Actions for patent infringement** Interpretation of claims, Doctrine of equivalents, Product testing as a possibly infringing use Doctrine of exhaustion, Legal and equitable remedies for infringement	**05**

Books Recommended:

Text Books:

1. Feroz Ali, *The Law of Patents -With A Special Focus On Pharmaceuticals In India*, LexisNexis, 2011.
2. Ronald D. Slusky, *Invention Analysis and Claiming – A Patent Lawyer's Guide*, Second Edition, American Bar Association, 2012.
3. Feroz Ali, *The Touchstone Effect – The Impact of Pre-grant Opposition on Patents*, LexisNexis, 2009.

Reference Books:

1. Drucker. F. Peter, *Innovation and Entrepreneurship*, Harper business, 2006.
2. Deborah. E. Bouchoux, *Intellectual Property Rights*, Cengage Learning, 2013.
3. Prabuddha Ganguli, *Intellectual Property Rights– Unleashing The Knowledge Economy*, Tate Mc Graw Hill Publishing Company Ltd. 2001.
4. Martin Roger, *The Design of Business*, Harvard Business Publishing, 2009.

Prepared by Checked by Head of the Department Principal

Program: First Year M.Tech Computer Engineering								Semester : I				
Course: Cyber Security and Laws								Course Code: DJS24XOE513				
Teaching Scheme (Hours / week)				Evaluation Scheme								
				Semester End Examination Marks (A)				Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory				Term Test 1	Term Test 2	Assign ment	Total	
				60				15	15	10	40	100
				Laboratory Examination				Term work			Total Term work	
3	--	--	3	Oral	Practical	Oral & Practical		Laboratory Work	Tutorial / Mini project / presentation/ Journal			--
				--	--	--		--	--		--	

Pre-requisite: Knowledge of

1. Computer Network
2. Information Security

Objectives:

1. To understand and identify distinct types of cybercrime and cyber offences.
2. To recognized Indian IT Act 2008 and its latest amendments
3. To learn several types of security standards compliances

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

1. Understand the distinct types of cybercrime and security issues E Business.
2. Analyses distinct types of cyber threats and techniques for security management.
3. Explore the legal requirements and standards for cyber security in various countries to regulate cyberspace.
4. Impart the knowledge of Information Technology Act and legal framework of right to privacy, data security and data protection.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Cybercrime**: Cyber Crime, Cyber Law, Cyber Security, History of Cyber Crime, Hacking, Data Theft, Cyber Terrorism ,Virus & Worm's ,Email Bombing ,Pornography ,online gambling ,Forgery ,Web Defacements, Web Jacking, Illegal online Selling, Cyber Defamation,,Software Piracy, Electronics/ Digital Signature, Phishing ,Password Cracking, Key loggers and Spywares, Steganography, DoS and DDoS attacks,SQL Injection, Buffer Over Flow ,Attacks on Wireless Networks ,Phishing Identity Theft (ID Theft). **Cyber offenses: How** criminal plan the attacks, Social Engg, Cyber stalking, Cybercafe and Cybercrimes, Botnets, Attack vector.	12
2	**Cyber Threats Analysis** Knowledge of Dynamic and Deliberate Targeting, Knowledge of Indications and Warning. Knowledge of Internal Tactics to Anticipate and/or,Emulate Threat	08

	Capabilities and Actions. Knowledge of Key Cyber Threat Actors and their Equitie, Knowledge of Specific Target. Identifiers and Their Usage **Cyber Security Management** Knowledge of Emerging Security Issues, Risks, and Vulnerabilities	
3	**Electronic Business and legal issues** Evolution and development in Ecommerce, Policy Frameworks for Secure Electronic Business, paper vs paper less contracts, E-Commerce models- B2B, B2C,E security. E-Payment Mechanism; Payment through card system, E-Cheque, E-Cash, E-Payment Threats & Protections, Security for E-Commerce.	06
4	**Indian IT Act** Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments. **Security aspect in cyber-Law** The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law.	08
5	**Security Industries Standard Compliances** IT Security v/s IT Compliance, Cyber Security Standards, critical security controls for cyber security, GRC (Governance, Risk Management, and Compliance). SOX, GLBA, HIPAA, ISO/IEC 27001, NIST Cyber Security Framework (CSF), PCI-DSS. OWASP Top Ten Project., GDPR (General Data Protection Regulation), NIST (National Institute of Standards and Technology), CIS Controls (Center for Internet Security Controls).	08

Books Recommended:

Reference Books

1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi.
4. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
5. E-Commerce Security and Privacy", Anup K. Ghosh, Springer Science and Business Media, 2012
6. Izzat Alsmadi , The NICE Cyber Security Framework Cyber Security Intelligence and Analytics, Springer
7. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai
8. Nina Godbole, Information Systems Security, Wiley India, New Delhi
9. Kennetch J. Knapp, Cyber Security &Global Information Assurance Information Science Publishing.
10. William Stallings, Cryptography and Network Security, Pearson Publication

Web Resources :

1. The Information Technology ACT, 2008- TIFR : https://www.tifrh.res.in
2. Website for more information, A Compliance Primer for IT professional: https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538

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Program: First Year M.Tech Computer Engineering										Semester : I				
Course: Agile Frameworks										Course Code: DJS24XOE514				
Teaching Scheme (Hours / week)				Evaluation Scheme										
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)					Total marks (A+ B)		
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assignment	Total				
				60			15	15	10	40		100		
				Laboratory Examination			Term work			Total Term work		--		
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal						
				--	--	--	--	--		--				

Pre-requisite: Knowledge of

1. Software Engineering

Objectives:

1. To focus on the phases of agile project management.
2. To equip the student on the scaling techniques for agile projects.
3. To analyze the performance of agile projects.
4. To develop the skills of the students on product development.
5. To equip the students on agile delivery and risk mitigation.

Outcomes:

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

1. Understand and Demonstrate basic knowledge in Software Engineering
2. Summarize the concepts of agile practices and business objectives and phases of agile development framework.
3. Have an exposure on the scaling factors and models to be developed for agile projects.
4. Acquire knowledge on the agile performance measurement.
5. Develop the product based on agile factors with risk mitigation.
6. Describe the role of agile in enterprise management and incremental delivery.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Agile Frameworks:** **1.1** Agile definitions and historical context, Agile Values and Principles found in the Agile Manifesto, Misconceptions about Agile **1.2** Selecting an Approach that Fits: Choosing between an Agile or Traditional Approach, Selecting the Right Agile Approach	05

2	**Agile Methodologies:**	06
	2.1 The Agile Methodologies: Common Themes, Methodology Descriptions, Extreme Programming, Scrum, Feature Driven Development, The Crystal Methodologies, Adaptive, Software Development, Dynamic Systems Development Method, Lean Software Development, Starting Monday: Investigate Further	
3	**Extreme Programming (XP):**	07
	3.1 Understanding XP (Extreme Programming) - XP life cycle, XP team, XP Concepts, Adopting XP - Knowing whether XP is suitable, Implementing XP, assessing Agility, Practicing XP - Thinking - Pair Programming, Energized work, Informative Workspace, Root cause Analysis, Retrospectives	
4	**Planning Agile Projects:**	10
	4.1 Planning for Agile Teams, Scrum Teams, XP Teams, General Agile Teams, Collaboration Rooms, Team Distribution **4.2** Agile Project Lifecycles, Typical Agile Project Lifecycles, Activities within each Phase, create product vision, Producing a Minimum Marketable Feature **4.3** Release Planning, Creating the Product Backlog, User Stories, Prioritizing and Estimating, Creating the Release Plan **4.4** Monitoring and Adapting, Task Boards and Information Radiators, Control Limits, Variance and Trend Analysis, Managing Risks and Issues, Retrospectives	
5	**Agile Estimations and Leading Agile Teams**	07
	5.1 Introduction to Agile Estimations, Needs, Stakeholders, Estimation Stages, Estimation Styles and Process. Velocity, Sprint Velocity **5.2 Skills** needed by Agile Leaders, Emotional Intelligence, Listening Skills, Command and Control vs. Servant Leadership, Adaptive Leadership, Collaboration, Facilitation, Problem Solving and Participatory Decision-Making Skills, Coaching and Mentoring Teams, Conflict Resolution	
6	**Advanced Emerging Techniques and Case Studies**	04
	6.1 Learn, value streams and Kanban models, Lean, Crystal, DevOps and continuous deployment strategies, Scaling agile processes, Case study	

Books Recommended:

Text books:

1. Roger Pressman, “Software Engineering: A Practitioner’s Approach”, McGraw-Hill Publications 7th Edition.
2. The art of Agile Development, James Shore and Shane Warden, 11th Indian Reprint, O'Reilly, 2018

References Books:

1. Ugrasen Suman, “Software Engineering-Concepts and Practices”, Cengage Learning
2. Learning Agile, Andrew Stellman and Jennifer Greene, O’Reilly, 4th Indian Reprint, 2018
3. Practices of an Agile Developer, Venkat Subramaniam and Andy Hunt, SPD, 5th Indian Reprint, 2015
4. Agile Project Management - Jim Highsmith, Pearson Low price Edition 2004

Web Resources (For our Reference):

1. https://www.xpand-it.com/blog/top-5-agile-methodologies/
2. https://apc01.safelinks.protection.outlook.com/GetUrlReputation

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<table>
<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="2">Semester : I</td></tr>
<tr><td colspan="8">Course: Design of Experiments</td><td colspan="2">Course Code: DJS24XOE515</td></tr>
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(Hours / week)</td><td colspan="6">Evaluation Scheme</td></tr>
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<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Assignment</td><td>Total</td><td rowspan="2"></td></tr>
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</table>

Pre-requisite: Knowledge of

1. Applied Statistics.
2. Regression and Analysis of Variance.

Objectives:

1. To understand the issues and principles of Design of Experiments (DOE).
2. To list the guidelines for designing experiments.
3. To become familiar with methodologies that can be used in conjunction with experimental designs for robustness and optimization.

Outcomes:

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

1. Plan data collection, to turn data into information and to make decisions that lead to appropriate action.
2. Apply the methods taught to real life situations.
3. Plan, analyze, and interpret the results of experiments.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction:** Strategy of Experimentation, Typical Applications of Experimental Design, Guidelines for Designing Experiments, Response Surface Methodology.	**06**
2	**Fitting Regression Models:** Linear Regression Models, Estimation of the Parameters in Linear Regression Models. Hypothesis Testing in Multiple Regression, Confidence Intervals in Multiple Regression, Prediction of new response observation, Regression model diagnostics, Testing for lack of fit.	**06**
3	**Two-Level Factorial Designs and Analysis:**	**07**

	The 2^2 Design, The 2^3 Design, The General 2^k Design, A Single Replicate of the 2^k Design, The Addition of Center Points to the 2^k Design, Blocking in the 2^k Factorial Design, Split Plot Designs.	
4	**Two-Level Fractional Factorial Designs and Analysis:** The One-Half Fraction of the 2^k Design, The One-Quarter Fraction of the 2^k Design, The General 2^{k-p} Fractional Factorial Design, Resolution III Designs, Resolution IV and V Designs, Fractional Factorial Split-Plot Designs.	**07**
5	**Conducting Tests:** Testing Logistics, Statistical aspects of conducting tests, Characteristics of good and bad data sets, Example experiments, Attribute Vs Variable data sets.	**07**
6	**Taguchi Approach:** Crossed Array Designs and Signal-to-Noise Ratios, Analysis Methods, Robust design examples.	**06**

Books Recommended:

Reference Books:

1. Raymond H. Mayers, Douglas C. Montgomery, Christine M. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, 3rd edition, John Wiley & Sons, New York, 2001
2. D. C. Montgomery, Design and Analysis of Experiments, 5th edition, John Wiley & Sons, New York, 2001
3. George E P Box, J Stuart Hunter, William G Hunter, Statics for Experimenters: Design, Innovation and Discovery, 2nd Ed. Wiley
4. W. J. Dimond, Practical Experiment Designs for Engineers and Scientists, John Wiley and Sons Inc. ISBN: 0-471-39054-2
5. Design and Analysis of Experiments (Springer text in Statistics), Springer, A. M. Dean, and D. T. Voss

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Program: First Year M.Tech Computer Engineering										Semester : I				
Course: Operations Research										Course Code: DJS24XOE516				
Teaching Scheme (Hours / week)				Evaluation Scheme										
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)					Total marks (A+ B)		
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assignment	Total				
				60			15	15	10	40		100		
				Laboratory Examination			Term work			Total Term work		--		
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal						
				--	--	--	--	--		--				

Pre-requisite: Knowledge of

1. Fundamental concepts of Mathematical statistics

Objectives:

1. To formulate a real-world problem as a mathematical programming model.
2. To understand the mathematical tools that are needed to solve optimization problems.
3. To use mathematical software to solve the proposed models.

Outcomes:

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

1. Convert a real-world problem in to a Linear Programming Problem and Interpret the solution obtained using Simplex method or other algorithms.
2. Understand reasons of formation of queues, classify various queuing systems and Apply performance parameters defined for various queuing systems for decision making in real life situations.
3. Describe concept of simulation and Apply Monte Carlo Simulation technique to systems such as inventory, queuing and Develop solutions for them.
4. Explain the need for replacement of components or machines in most economical way and Infer optimal replacement age.
5. Identify the decision situations which vary with time and Analyse them using principle of dynamic programming to real life situations.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Linear Programming Problem** Introduction to Operations Research (OR), Decision situations, Decision making process, Concept of Optimization, Mathematical Models. Linear Programming: Linear Programming Problem - Mathematical Formulation, Finding Optimal solution using Graphical method, Simplex method, Big-M method, Two Phase method, Special cases, Principle of Duality.	09

2	**Special Cases of LPP** Transportation problem: Formulation - Finding Optimal solution, Degeneracy. Assignment problem: Formulation - Finding Optimal solution. Travelling Salesman Problem.	07
3	**Dynamic Programming** Introduction - Bellman's Principle of optimality - Applications of dynamic programming to capital budgeting, inventory, employment smoothening, cargo loading and shortest path problem.	08
4	**Game Theory** Introduction - Minimax (Maximin) Criterion and optimal strategy - Solution of games with saddle points – 2 x 2 games - dominance principle - m x 2 & 2 x n games, Iterative Method.	06
5	**Queuing Model** Introduction - Poisson arrivals - Exponential service time. Single Channel – Single server - Infinite population and finite population models, Multichannel - Single server - Infinite population models. Constant Service rate - Single Channel – Single server - Infinite population.	06
6	**Simulation** Definition - Methodology of simulation – Monte Carlo Simulation Technique - applications to Inventory and Queuing problems – Advantages and Limitations of Simulation. Simulation Languages.	06

Books Recommended:

Reference Books:

1. Taha, H.A. "Operations Research - An Introduction", Prentice Hall, (7th Edition), 2002.
2. Ravindran, A, Phillips, D. T and Solberg, J. J. "Operations Research: Principles and Practice", John Willey and Sons, 2nd Edition, 2009.
3. Hiller, F. S. and Liebermann, G. J. "Introduction to Operations Research", Tata McGraw Hill, 2002.
4. Operations Research, S. D. Sharma, KedarNath Ram Nath-Meerut.
5. Operations Research, KantiSwarup, P. K. Gupta and Man Mohan, Sultan Chand & Sons.

Prepared by Checked by Head of the Department Principal

Syllabus for First Year M.Tech Program in Computer Engineering: Semester II (Autonomous) (Academic Year 2024-25)

<table>
<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="2">Semester : II</td></tr>
<tr><td colspan="8">Course: Computational Intelligence</td><td colspan="2">Course Code: DJS24CPC551</td></tr>
<tr><td colspan="8">Course: Computational Intelligence Laboratory</td><td colspan="2">Course Code: DJS24CPC551L</td></tr>
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(Hours / week)</td><td colspan="6">Evaluation Scheme</td></tr>
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<tr><td colspan="3">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">50</td></tr>
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<tr><td>25</td><td>--</td><td>--</td><td>15</td><td colspan="2">10</td><td>25</td></tr>
</table>

Pre-requisite: Knowledge of Basic Mathematics, Neural Network basics, Fuzzy sets and Fuzzy Logic basic

Objectives:

1. To explore the various Computational Intelligence techniques
2. To become familiarized with Learning techniques, Fuzzy systems & evolutionary computation
3. To become familiarized with Artificial Immune System.
4. To learn to apply Computational Intelligence to different applications

Outcomes:

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

1. Conceptually understand different intelligent algorithms.
2. Understand nature inspired optimization techniques.
3. Design and implement various intelligent system.
4. Choose appropriate CI methods to solve a problem.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Computational Intelligence paradigms:** Artificial Neural Networks, Fuzzy Systems, Genetic Algorithms, Swarm Intelligence, Ant Colony, Artificial Immune System, Probabilistic Learning, Applications	03
2	**Learning Techniques:** **Supervised Learning**: Perceptron Network: SDPTA, SCPTA, MCPTA, EBPTA **Unsupervised Learning**: Self-Organizing Maps, Learning Vector Quantization	08

	Support Vector Machine: Binary SVM **Probabilistic Learning**: Bayesian learning, Bayesian Belief networks, Hidden Markov Models.	
3	**Fuzzy Set Theory:** Fuzzy set theory, Fuzzy set versus crisp set, Fuzzy set operations & properties, Crisp relation & Fuzzy relations, Membership functions, **Fuzzy Systems:** Fuzzification, Fuzzy Inference systems, Defuzzification, Rough Set theory	06
4	**Evolutionary Computing – Genetic Algorithms** Basic Principles of Genetics, Fitness Function; Selection: Selective Pressure, Random Selection, Proportional Selection, Tournament Selection, Rank-Based Selection, Boltzmann Selection, Elitism; Reproduction Operators: Crossover operator, Mutation; Application: Pattern Recognition, Numerical Function Optimization.	06
5	**Swarm Intelligence**: Particle Swarm Optimization: Basic Particle Swarm Optimization: Global Best PSO, Local Best PSO, Velocity Components; Basic PSO parameters, Single Solution Particle Swarm Optimization: Guaranteed Convergence PSO, Social-Based Particle Swarm Optimization, Hybrid Algorithms, Sub-Swarm Based PSO, Multi-Start PSO Algorithms, Repelling Methods, Binary PSO; Application **Ant Algorithm**: Simple Ant Colony Optimization, Ant Colony Optimization Meta-Heuristic, Cemetery Organization and Brood Care, Division of Labor, Application: Travelling Salesman Problem	10
6	**Artificial Immune Models:** Natural Immune System: Classical view, Antibodies and Antigens, White Cells, Immunity types, Network Theory, Danger Theory; Artificial Immune Models: Artificial Immune system algorithm, classical view models, Clonal Selection Theory: CLONALG; Network Theory Models; Danger Theory Models; Application: Intrusion Detection	06

List of Laboratory Experiments:

1. Implement Perceptron (SDPTA/ SCPTA / MCPTA) training algorithm.
2. Implement back propagation training algorithm (EBPTA).
3. Implement an unsupervised training algorithm (KSOFM / LVQ)
4. Implement Bayesian Belief Networks.
5. Implement Hidden Markov Models.
6. To design an FIS for a given application (Air Conditioner / washing machine / etc)
7. To solve a real time application using Genetic Algorithm
8. To implement TSP using Ant colony optimization technique
9. To implement PSO algorithm for solving a real time problem
10. Study of Artificial Immune Models for solving real time problems.

Books Recommended:

Text Books:

1. L. N. de Castro, “Fundamentals of Natural Computing: Basic Concepts, Algorithms and Applications”, 2006, CRC Press, ISBN-13: 978-1584886433
2. Andries P. Engelbrecht, “Computational Intelligence an Introduction”, Wiley, 2nd Edition

3. Tom Mitchell, Machine Learning, McGraw Hill, 1997, 0-07-042807-7
4. Jacek M. Zurada, “Introduction to Artificial Neural Systems”, Jaiko Publishing House, 2004
5. S. N. Sivanandanam, S. N. Deepa Principle of Soft Computing,; 3/e, Wiley Publications, India.

Reference Books:

1. D. Floreano and C. Mattiussi, “Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies”, 2008, MIT Press, ISBN-13: 978-0262062718
2. Russell C. Eberhart, Yuhui Shi, James Kennedy, “Swarm Intelligence: The Morgan Kaufmann Series in Evolutionary Computation”, 1st Edition, ISBN-13: 978- 1558605954
3. Sam Jones (Editor), “Bio Inspired Computing-Recent Innovations and Applications”, Clanrye International; 2nd edition (2 January 2015), ISBN-10: 1632400812
4. Yang Xiao (Editor), “Bio-Inspired Computing and Networking”, CRC Press,
5. G. A. Vijayalakshmi Pai, Sanguthevar Rajasekaran, “Neural Networks, Fuzzy Logic, and Genetic Algorithms”, PHI Learning Pvt Ltd, 2011
6. Laurene V. Fausett, “Fundamentals of Neural Network”, Pearson Education, 2004

Web Resources (For our Reference):

1. https://www.geeksforgeeks.org/
2. https://www.tutorialspoint.com/

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Program: First Year M.Tech Computer Engineering	Semester : II
Course: Computational Linguistics	Course Code: DJS24CPC552
Course: Computational Linguistics Laboratory	Course Code: DJS24CPC552L

Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assign ment	Total	
				60			15	15	10	40	100
				Laboratory Examination			Term work			Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal			
				25	--	--	15	10		25	

Pre-requisite: Knowledge of

1. Machine Learning
2. Natural Language Processing

Objectives:

1. To design Computational Linguistic models for real world applications.

Outcomes:

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

1. Apply classification techniques on linguistic data.
2. Apply machine Learning and deep learning techniques to build language model.
3. Develop applications based on natural language processing.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Text Classification**: Text classification definition and datasets, Generative text classifiers (naive Bayes) Discriminative text classifiers (logistic regression), Bag-of-words Generative Classifier, BOW Discriminative Model , Multi-class Classification: Softmax, Gradient Descent, Statistical significance testing, Dataset understanding and creation	05
2	**Language models using Deep Learning Architectures**: Language Modelling Problem Definition, Count-based Language Models, Measuring Language Model Performance: Accuracy, Likelihood, and Perplexity, Log-linear Language Models, Recurrent Networks: RNNs as Language, RNNs for Sequence Classification, Stacked and Bidirectional RNNs, Managing Context in RNNs: LSTMs and GRUs, Self-Attention Networks: Transformers, Transformers as Autoregressive Language Models	08

3	**Machine Translation and Encoder-Decoder Models**: Encoder-Decoder with RNNs, Conditioned Generation and Search, Ensembling, Evaluation, Types of Data to Condition On Attention mechanism , Beam Search, Encoder-Decoder with Transformers, Some practical details on building MT systems, MT Evaluation, Bias and Ethical Issues Improvements to Attention, Specialized Attention Varieties	08
4	**Multi-task, Multi-domain, and Multi-lingual Learning**: Pre-training Methods: Simple overview of multi-task learning, Sentence embedding's, BERT and variants, Other language modelling objectives Multi-task, Multi-domain, and Multi-lingual Learning: Multi-task Learning, Domain Adaptation and Robustness, Multi-lingual Learning Prompting, Sequenceto-sequence Pre-training: Prompting Methods, Sequence-to-sequence Pre-training, Prompt Engineering, Answer Engineering, Multi-prompt Learning, Prompt-aware Training Method.	08
5	**Information Extraction**: Relation Extraction, Relation Extraction Algorithms, Extracting Times, Extracting Events and their Times, Template Filling.	04
6	**Question Answering**: Information Retrieval, IR-based Factoid Question Answering, Entity Linking, Knowledge-based Question Answering, Using Language Models to do QA, Classic QA Models, Evaluation of Factoid Answers.	06

List of Laboratory Experiments:

1. Implement a Spam classifier using Naïve Bayes classifier
2. Implement a Sentiment Analysis on linguistic data
3. Implement Fake News Classifier using LSTM-Deep Learning Model
4. Implement Information Retrieval for extracting Text from Webpages and Image
5. Implement Language translator using Encoder Decoder model
6. Implement Document Classifier on multi-category dataset
7. Implement text Summarization using BERT
8. Implement Spelling Check, Spelling Correction and Auto complete using Language models
9. Implement Question Answering System using Deep Learning

Books Recommended:

Text books:

1. Jurafsky and Martin, Speech and Language Processing, Prentice Hall, 3rd Edition, 2020.
2. Uday Kamath, Deep Learning for NLP and Speech Recognition, 1st Edition, 2019.

Reference Books:

1. Jelinek, F., Statistical Methods for Speech Recognition, The MIT Press, 2022.
2. Yuli Vasiliev, Natural Language Processing with Python and spaCy - A Practical Introduction, No Starch Press, 2022.
3. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana, Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems, O'Reilly, 1st Edition, 2020.
4. Lewis Tunstall, Leandro von Werra, Thomas Wolf, Natural Language Processing with Transformers, O'Reilly Media, Inc, 2022.
5. Ashish Bansal, Advanced Natural Language Processing with Tensor Flow 2, Packt Publishing Ltd, 2022

Web Resources (For our Reference):

1. Virtual Lab: - https://nlp-iiith.vlabs.ac.in/
2. Virtual Lab: http://vlabs.iitb.ac.in/vlabsdev/vlab_bootcamp/bootcamp/The_Bing_Bang_Nerds/index.html
3. Nptel Course: - https://nptel.ac.in/courses/106105158

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<table>
<tr><td colspan="5">Program: First Year M.Tech Computer Engineering</td><td colspan="6">Semester : II</td></tr>
<tr><td colspan="5">Course: Reinforcement Learning</td><td colspan="6">Course Code: DJS24CPE551</td></tr>
<tr><td colspan="5">Course: Reinforcement Learning Laboratory</td><td colspan="6">Course Code: DJS24CPE551L</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td>Total marks (A+ B)</td></tr>
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Pre-requisite: Fundamentals of Neural Networks and Mathematics

Objectives:

1. To understand the foundations of reinforcement learning.
2. To learn algorithms for reinforcement learning.
3. To successfully implement, test relevant learning algorithms in TensorFlow.
4. To apply reinforcement learning on various applications

Outcomes:

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

1. Understand the basics of reinforcement learning paradigms.
2. Learn methods and algorithms for bandit problems
3. Apply the concept of dynamic programming and temporal differences to RL algorithms.
4. Understand and analyse advanced RL techniques like DQN, POMDPs etc.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Module 1: Introduction to Reinforcement Learning** **Introduction to Reinforcement Learning:** Definition, history, and applications **Components of RL:** agent, environment, actions, rewards **Markov Decision Processes (MDPs):**Formal definition and properties of MDPs, State transitions, rewards, and discount factor	06

2	**Module 2: Bandit Algorithms** **Upper Confidence Bound (UCB):** Introduction to UCB algorithm, Exploration-exploitation trade-off **Probably Approximately Correct (PAC) Learning:** Introduction to PAC learning framework, PAC guarantees for bandit algorithms	06
3	**Module 3: Advanced Bandit Algorithms** Median Elimination Algorithm, Overview of Median Elimination algorithm, Exploration and elimination in bandit problems **Policy Gradient Methods for Bandits** Introduction to policy gradient methods, REINFORCE algorithm for bandit problems	06
4	**Module 4: Introduction to Full Reinforcement Learning** Transition from bandits to full RL, Components of full RL: policies, value functions, models **Bellman Optimality Equation:** Derivation and interpretation of Bellman optimality equation, Solving MDPs using Bellman optimality equation	06
5	**Module 5: Dynamic Programming and TD Methods** Policy evaluation, iteration, and improvement Value iteration and policy iteration algorithms **Temporal-Difference Learning** TD prediction and TD control SARSA and Q-learning algorithms	06
6	**Module 6: Advanced RL Techniques** Eligibility Traces and Function Approximation, Introduction to eligibility traces Function approximation in RL **Least Squares Methods and Fitted Q Iteration** Least squares methods for function approximation, Fitted Q iteration for large state spaces **Deep Q-Network (DQN) and Policy Gradient for Full RL** Introduction to DQN for deep RL, Policy gradient methods for full RL problems **Hierarchical RL and Partially Observable MDPs (POMDPs):** Introduction to hierarchical RL, Modeling and solving POMDPs	06

List of Laboratory Experiments:

1. Implement a simple grid world environment using Python and visualize state transitions, rewards, and the discount factor.
2. Implement and analyze the UCB algorithm for bandit problems.
3. Implement the REINFORCE algorithm in Python and compare its performance with other bandit algorithms.
4. Implement value iteration and policy iteration algorithms in Python to solve a simple grid world problem.

5. Implement SARSA and Q-learning algorithms in Python and compare their convergence rates and final performance.
6. Implement TD(λ) with eligibility traces in Python and compare its performance with traditional TD methods.
7. Use TensorFlow or PyTorch to implement a DQN for playing Atari games and analyze its performance.
8. Implement Fitted Q Iteration in Python to solve a grid world problem with a large state space.
9. Design a hierarchical RL framework in Python to solve a navigation task with multiple levels of abstraction.
10. Implement a POMDP solver in Python and apply it to a navigation task with limited sensor information.

Books Recommended:

Text books:

1. R. Sutton and A. Barto, "Reinforcement Learning: An Introduction", MIT Press, 2018
2. Maxim Lapan, "Deep Reinforcement Learning Hands-On", Packt Publishing, 2018

Reference Books:

1. Csaba Szepesvári, Algorithms for Reinforcement Learning, Morgan & Claypool Publishers,2010
2. Dimitri P. Bertsekas, Reinforcement Learning and Optimal Control, Athena Scientific, 2019
3. S. Ravichandiran, Hands-on Reinforcement Learning with Python: Master reinforcement and deep reinforcement learning using OpenAI Gym and TensorFlow, Packt Publishing, 2018
4. N. Buduma, N. Locascio, Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms, O'Reilly.
5. G. Ciaburro, Keras Reinforcement Learning Projects, Packt Publishing, 2018
6. C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer, 978-3-031-29641-3, 2023.

Web Resources (For our Reference):

1. https://www.coursera.org/learn/fundamentals-of-reinforcement-learning#syllabus
2. https://onlinecourses.nptel.ac.in/noc20_cs74/preview
3. https://onlinecourses.nptel.ac.in/noc21_cs24/preview
4. https://nptel.ac.in/courses/106/106/106106143/

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<table>
<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester : II</td></tr>
<tr><td colspan="8">Course: Data Storage Technology</td><td colspan="3">Course Code: DJS24CPE552</td></tr>
<tr><td colspan="8">Course: Data Storage Technology Laboratory</td><td colspan="3">Course Code: DJS24CPE552L</td></tr>
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</table>

Pre-requisite: Knowledge of

1. Computer Architecture
2. Operating System
3. Computer Network

Objectives:

1. To motivate business stakeholders and IT teams to recognize the critical role of ‘information’ infrastructure.
2. To differentiate, select, and deploy various storage networking solutions based on application requirements.
3. To discuss backup, recovery, and archival requirements and solutions for business-critical data.
4. To discover, monitor, and report information in real-time pertaining to storage infrastructure and implement third platform-centric processes to support on-going management operations.

Outcomes:

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

1. Acquire the basic knowledge of storage and Data center.
2. Analyze various network and infrastructure used for data storage.
3. Understand business continuity and various methods of data Back-ups.
4. Introduce about storage management and virtualization and storage security.
5. Differentiate cloud and network storage visualization.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Information Storage:** Digital data and its types, Information Storage, Data Centre Infrastructure, Building blocks of a data center, Key Challenges, Information Life Cycle, Data Protection: RAID, RAID Implementation, RAID Levels.	08
2	**Storage Networking**: SCSI, Parallel SCSI, Storage Area Networks: Fibre Channel, Software-defined networking, FC SAN components and architecture, iSCSI protocol, network components, and connectivity Network Attached Storage, IP SAN,	06
3	**Business Continuity and Storage Security:** Impact of information unavailability, Introduction to business continuity, data replication, data backup architecture and methods, and an overview of storage infrastructure security.	06
4	**Storage Infrastructure Management:** Introduction to storage infrastructure, Storage management activities, Challenges, Developing an ideal solution: Storage management initiative, enterprise management platform	08
5	**Storage Virtualization:** Definition, benefits, Storage Virtualization: Forms, Challenges, Taxonomy, challenges, Types of Storage virtualization, Advantage and Disadvantages, FABRIC, Switched FABRIC	05
6	**Cloud Virtualization and Storage Networking:** Sever and Storage I/O fundamentals, Virtualization: Server, Storage and Networking, Networked Storage: Public and Private Cloud, Infrastructure Resource Management, Cloud and Solution Packages, Management and Tools	06

List of Laboratory Experiments:

1. To build your own Storage area networks (SAN)
2. To understand deployment models, service models and advantages of cloud computing
3. Creating and Running Virtual machine On Hosted Hypervisor like virtual Box.
4. Creating and Running Virtual machine On Linux kernel using KVM.
5. Creating and Running Virtual machine On a Bare Metal Hypervisor Vmware Exsi.

Books Recommended:

Textbooks:

1. G. Somasundaram and Alok Shrivastava -Information Storage and Management by, EMC Education Services, Wiley Publishing, 2009.
2. IT Infrastructure Landscape Overview, Student Guide by IBM
3. Greg Schul-Cloud and Virtual Data Storage Networking by, CRC Press, 2012.

Reference Books:

1. Nigel Poulton -Data Storage Networking by, SYBEX, Wiley Publication.
2. Richard Barker and Paul Massiglia -Storage Area Network Essential, Wiley Publication.

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<table>
<tr><td colspan="5">Program: First Year M.Tech Computer Engineering</td><td colspan="5">Semester : II</td></tr>
<tr><td colspan="5">Course: Big Data Infrastructure</td><td colspan="5">Course Code: DJS24CPE553</td></tr>
<tr><td colspan="5">Course: Big Data Infrastructure Laboratory</td><td colspan="5">Course Code: DJS24CPE553L</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
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</table>

Pre-requisite: Knowledge of Databases, Java, Python

Objectives:

1. To introduce students to current scenarios and various facets of big data and also to create an awareness on the concepts of cloud computing and virtualization.
2. To equip them with necessary knowledge to use the tools for solving various big data problems in different domains
3. To enable students to have skills that will help them to solve complex real-world problems in for decision support.

Outcomes:

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

1. Develop problem solving and critical thinking skills in fundamental enabling techniques like Hadoop and Mapreduce in big data analytics.
2. Develop Data management capabilities for large scale data processing by using various bigdata technologies and APIs.
3. To work and evaluate Data at scale-Working with Big Data
4. Analysis of statistical data using various analytical tools.
5. Visualise data using various tools

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Big Data and Hadoop Infrastructure** Big data definition, enterprise / structured data, social / unstructured data, unstructured data needs for analytics, what is Big Data? **Introduction of Big data programming** Hadoop, History of Hadoop, The ecosystem and stack, The Hadoop Distributed File System (HDFS), Components of Hadoop, Design of HDFS, Java interfaces to HDFS, Architecture overview, Development **Environment, Hadoop distribution and basic commands.** Developing a Map Reduce Application, How Map Reduce Works, The MapReduce Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features, Real-World MapReduce.	08
2	**NoSQL Databases:** **NoSQL Vs SQL** - Structured and Unstructured Data, Taxonomy and NoSQL Implementation, NoSQL Architectural Patterns, Using NoSQL to manage BigData, **MongoDb** - Basic architecture of MongoDb Types of NoSql Databases, Searching and Indexing Big Data. **NoSQL Case Studies**- Google's BigTable, Mongo DB, Neo4J, Amazon DynamoDB	06
3	**Programming with Hive/Pig:** Data warehouse system for Hadoop, Optimizing with Combiners and Partitioners, Bucketing, More common algorithms: sorting, indexing and searching, Relational manipulation: map-side and reduce-side joins, evolution, purpose and use, Engine for executing data flows in parallel on Hadoop: Overview, comparison and architecture, Latin scripting and statements, data types, UDF's, built in functions and use cases.	06
4	**Introduction to Apache Spark and Use Cases** **Apache Spark APIs for large-scale data processing**: Overview, Linking with Spark, Initializing Spark, Resilient Distributed Datasets (RDDs), External Datasets, RDD Operations, Passing Functions to Spark, Working with Key-Value Pairs, Shuffle operations, RDD Persistence, Removing Data, Shared Variables, deploying to a Cluster Spark Streaming, Spark MLlib and ML APIs, Spark Data Frames/Spark SQL, Integration of Spark and Kafka, Map reduce, Mongodb with spark	08
5	**Data Streams and Streaming Analytics** Data streams and stream analytics. Spark architecture and components. Popular Spark platforms, DataBricks. Spark programming and tools, SparkML library for Machine Learning.	05
6	**Dashboard Creation and Visual Story Telling:** Dashboard Design principles, Effective Dashboard Display Media, Dashboard creation using visualization tools for the use cases: Finance- marketing-insurance-healthcare etc.,	06

List of Laboratory Experiments:

1. Installing Hadoop Framework on a Linux based Platform
2. Implement Map reduce program to perform sorting of numbers
3. Install MongoDB and perform CRUD operations
4. Install Neo4j and perform CRUD operations
5. Performing Hive Commands
6. Implementing PIG scripting for data handling
7. Perform Map reduce using Apache Spark
8. Configure a public cloud
9. Perform Data Stream Analytics
10. Perform data visualisation using tools like Gephi, Google API etc.

Books Recommended:

Text Book:

1. Big Data for Dummies, By Judith S. Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufma, Wiley,1st Edition, 2013
2. Practical Hive: A Guide to Hadoop's Data Warehouse System by Scott Shaw, Andreas François
3. Vermeulen, Ankur Gupta, David Kjerrumgaard, Apress, August 2016
4. Enterprise NoSQL for Dummies, Mark Logic Special Edition. Wiley, Nov 2017
5. Spark: The Definitive Guide: Big Data Processing Made Simple by Bill Chambers, Matei Zaharia, O'Reilly, Feb 2018
6. "Cloud Computing Bible", Barrie Sosinsky, Wiley publication, Jan 2011
7. "Mastering Cloud Computing", Rajkumar Buyya, Christian Vecchiolla and S Thamara Selvi, Tata Mc Graw Hill publication, 2013

Reference Book:

1. Mining of Massive Datasets by Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press ,2010
2. Handbook of Big Data Technologies, edited by Albert Y. Zomaya, Sherif Sakr,Springer, 2017
3. Hadoop Application Architectures: Designing Real-World Big Data Applications by Mark Grover, Ted Malaska, Jonathan Seidman, Gwen Shapira, O'Reily, 2015
4. Apache Spark Quick Start Guide: By Shrey Mehrotra, Akash Grade, Packt Publishing Ltd., 2019
5. A Handbook of Statistical Analyses Using R, By Torsten Hothorn, Brian S. Everitt, CRC Press, 2006
6. OpenStack Operations, David Stilson, O'Reilly, 2017.

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Program: First Year M.Tech Computer Engineering	Semester : II
Course: Computing Infrastructure	Course Code: DJS24CPE554
Course: Computing Infrastructure Laboratory	Course Code: DJS24CPE554L

Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assign ment	Total	
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				Laboratory Examination			Term work			Total Term work	50
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				25	--	--	15	10		25	

Pre-requisite: Knowledge of

1. Computer and Wireless Networks
2. Network Security

Objectives:

1. Learn core concepts of cloud computing paradigm.
2. Apply virtualization in the cloud ecosystem.
3. Learn the concept of Grid Computing and its security aspects.
4. Learn the overview of Fog Computing and its architecture, challenges and applications in different context.
5. Acquaint with some of the fundamental concepts and state-of-the-art research in the areas of ubiquitous computing.
6. To design enterprise network for given user requirements in an application.

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

1. Understand the cloud computing fundamentals and its deployment models.
2. Compare the various techniques and types of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
3. Describe how the distributed computing environments known as Grids can be built from lower level services.
4. Explore frameworks and applications in fog computing.
5. Explain the general principles of Ubiquitous Computing and the key technical and social factors driving the change towards post-desktop paradigms.
6. Compare Openflow controllers and switches with other enterprise networks.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Cloud Computing**: Definition, Evolution of Cloud Computing, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and other Organizational scenarios of clouds, Administering & Monitoring cloud services, Benefits and limitations	04

2	**Virtualization**: Introduction to Virtualization, Types of Virtualization; Various forms of virtualization: Desktop, Application, Server, Hardware, Storage, Memory and I/O virtualization; VM Management: VM lifecycle, Process and system level VMs, VM configurations, VM migrations, Migration types and process, VM provisioning, Scaling, VM scheduling; Load balancing: Significance, Types and Algorithms; Case Study: Private and Public Cloud Virtualization	08
3	**Grid Computing**: Introduction, What is Grid?, Elements of Grid, Overview of Grid Architecture, Introduction to Open Grid Services Architecture (OGSA), Data intensive grid service models, OGSA services, Open source grid middleware packages, Globus Toolkit (GT4) Architecture, Configuration, Usage of Globus , Main components and Programming model, Trust models for Grid security environment, Authentication and Authorization methods, Grid security infrastructure	08
4	**Fog Computing**: Introduction, Characteristics, Application Scenarios, Issues and challenges; Fog Computing Architecture: Communication and Network Model, Fog Protocols, Programming Models, Fog Architecture for smart cities, healthcare and vehicles; Fog Computing Communication Technologies: Introduction, IEEE 802.11, 4G, 5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.	07
5	**Ubiquitous Computing:** Overview, Challenges, NFC, Wireless LAN, Location in ubiquitous computing**:** Personal assistants, Location aware computing, Location tracking, Architecture, Location based service and applications, Location based social networks (LBSN), LBSN Recommendation, **Context-aware computing:** Context and Context-aware Computing, Issues and Challenges, Developing Context-aware Applications, System Architecture, **Privacy and security in ubiquitous computing**, **Wearable computing**, Glass and Augmented Reality, Eye-Tracking, Digital Pen and Paper, Mobile social networking & crowd sensing, Event based social network	08
6	**Software Defined Networking**: Understanding SDN and Open Flow : SDN – SDN Building, Blocks, OpenFlow messages – Controller to Switch, Symmetric and Asynchronous messages, Implementing OpenFlow Switch, OpenFlow controllers , POX and NOX, Open Flow in Cloud Computing, Case study: How SDN Changed Traditional Enterprise Network Design	04

List of Laboratory Experiments:

1. Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.
2. Develop a Guestbook Application using Google App Engine.
3. Install Oracle Virtual box and create two VMs on your laptop.
4. Install and configure Hosted / Bare-metal Hypervisors.
5. Program to create one Grid Resource with three machines using GridSim Software.
6. Program to create one or more Grid users. A Grid User contains one or more Gridlets.
7. Install and explore Fogify Framework.
8. Create and deploy application using the FogifySDK through a Jupyter notebook.
9. Create application using Ubiquitous Computing.
10. Case Study on OpenFlow Controllers in SDN.

Books Recommended:

Text books:

1. Barrie Sosinsky, “Cloud Computing Bible”, Wiley, 2010.

2. Joshy Joseph & Craig Fellenstein, “Grid Computing”, PHI, 2003.
3. Rajkumar Buyya and Satish Narayana Srirama, “Fog and Edge Computing: Principles and Paradigms”, Wiley Series on Parallel and Distributed Computing, 2019.
4. John Krumm, “Ubiquitous Computing”, CRC Press, 2010
5. Thomas D. Nadeau, Ken Gray, “SDN: Software Defined Network”, O’Reilly Media Inc, 2013.

Reference Books:

1. Ahmar Abbas, “Grid Computing: A Practical Guide to technology and Applications”, Charles River Media, 2004.
2. Assad Abbas, Samee U. Khan, Albert Y. Zomaya, “Fog Computing: Theory and Practice”, John Wiley and Sons,2020.
3. Stefan Poslad, “Ubiquitous Computing: Smart Devices, Environments and Interactions”, Wiley, 2011.

Web Resources:

1. https://nptel.ac.in/courses/106104182
2. https://nptel.ac.in/courses/106105167
3. https://ucy-linc-lab.github.io/fogify/
4. https://cse.iitkgp.ac.in/~bivasm/UB2016.html#Lecture

Prepared by Checked by Head of the Department Principal

Program: First Year M.Tech Computer Engineering										Semester : II
Course: Blockchain Technology										Course Code: DJS24CPE555
Course: Blockchain Technology Laboratory										Course Code: DJS24CPE555L
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assignment	Total
				60			15	15	10	40
				Laboratory Examination			Term work			Total Term work
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10		25

Pre-requisite: Knowledge of

1. Cryptography and System Security

Objectives:

1. To understand the concept of Blockchain and its relevance with cryptography.
2. To acquire knowledge of various techniques used in Blockchain.
3. To apply the Blockchain concept in real life applications.

Outcomes:

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

1. Acquire the basic knowledge of Blockchain technology.
2. Analyze various algorithms used in Blockchain.
3. Introduce about cryptocurrency and various regulations.
4. Aware about privacy and security issues in Blockchain.
5. Design and understand various applications using Blockchain.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Blockchain Basics:** Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.	07

2	**Basic Crypto primitives and Distributed Computing:** Introduction, advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public Blockchain.	**07**
3	**Cryptocurrency:** History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Name coin	**06**
4	**Cryptocurrency Regulations:** Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service, and future of Blockchain.	**06**
5	**Privacy and Security Issues in Blockchain:** Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of Algor and, and Shading based consensus algorithms to prevent these attacks.	**07**
6	**Blockchain Applications and Technology Contributions by Industries:** Applications of Blockchain in Healthcare, Automotive, Government, Insurance, Media and Entertainment. The Linux Foundation's Hyperledger Fabric and Microsoft Azure's Blockchain as a Service.	**06**

List of Laboratory Experiments:

1. Design and Implement Trusted Crowdfunding Platform Using a Smart Contract. A smart contract helps to block the funds within blockchain until the project or startup founder makes progress in the project.
2. Implement a system that collects location data from many interconnected systems and deliver exact location details to the customers.
3. Implement blockchain application where both riders and drivers can get connected directly to provide safe and reliable transportation.
4. Design and Implement Fake Product Identification System, by embedded a 2D barcode on the product which is tied to a blockchain system.
5. Design and Implement Electronic voting systems where a blockchain-based system can ensure transparent and publicly verifiable elections in the country. Voting can be done using a mobile application that is attached to a blockchain system.
6. Design and Implement Transparent and Genuine Charity Application. The blockchain system can bring transparency to online charity trusts. Contributors can see the journey of the donation in realtime and confirm if it's reaching the deserving hands or not.
7. Design and Implement A Decentralized Web Hosting System. The way web hosting works today is by hosting all the web content including textual content, code and media content on a centralized location which can then be accessed over the world wide web. With blockchain, you can split website content into granules and distribute it all over the internet and then link them together using a blockchain registry.
8. Design and Implement Disk Space Renting System. The idea is to allow everybody on the planet to rent out their unused disk space which can be attached to a blockchain registry to create a massive worldwide cloud.

9. Design and Implement Loyalty Points Exchange System. With block chain, you can implement a project that allows consumers to combine and transparently trade loyalty rewards.
10. Design and Implement Food Trackback System. Using block chain technology, you can implement a system that can help consumers trace back the journey of fresh produce or meat to its source.

Books Recommended:

Text books:

1. Josh Thompson, - Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming, Create Space Independent Publishing Platform, 2017.
2. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Blockchain Technology: Cryptocurrency and Applications, Oxford University Press, 2019.

Reference Books:

1. Dr. Gavin Wood, -ETHEREUM: A Secure Decentralized Transaction Ledger, Yellow paper, 2014

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Program: First Year M.Tech Computer Engineering	Semester : II
Course: Secure Coding	Course Code: DJS24CPE556
Course: Secure Coding Laboratory	Course Code: DJS24CPE556L

Teaching Scheme (Hours / week)				Evaluation Scheme							
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assign ment	Total	
				60			15	15	10	40	100
				Laboratory Examination			Term work			Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laborat ory Work	Tutorial / Mini project / presentation/ Journal			
				25	--	--	15	10		25	

Pre-requisite: Knowledge of

1. Cryptography and System Security

Objectives:

1. To learn principles of secured coding and design.
2. To learn various secure access control mechanism with access privileges.
3. To understand cryptographic foibles and data security.
4. To determine various threats to system.
5. To learn security issues in network programming.

Outcomes:

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

1. Write secure programs and identify various risk in the software.
2. Design secure system by threats modeling.
3. Determine appropriate secure access control mechanism and access privileges.
4. Learn common mistake made while using cryptography and data protection.
5. Design secure network program.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Contemporary Security** The Need for Secure Systems, The Proactive Security Development Process, Security Principles to Live By, Threat Modelling. **Threat Modelling.** Secure Design Through Threat Modeling, Security Techniques, Mitigating the Sample Payroll Application Threats, Cornucopia of Threats and Solutions	05

2	**Secure Coding Technique** Public Enemy #1: The Buffer Overrun**,** Unicode and ANSI Buffer Size Mismatches, Preventing Buffer Overruns.	**04**
3	**Determine Appropriate Access Control** Why ACLs Are Important, What Makes Up an ACL, A Method of Choosing Good ACLs, Creating ACLs, Getting the ACE Order Right, Be Wary of the Terminal Server and Remote Desktop SIDs, NULL DACLs and Other Dangerous ACE Types, Other Access Control Mechanisms.	**06**
4	**Running with Least Privilege** Least Privilege in the Real World, Brief Overview of Access Control, Brief Overview of Privileges, Brief Overview of Tokens, How Tokens, Privileges, SIDs, ACLs, and Processes Relate, Three Reasons Applications Require Elevated Privileges, Solving the Elevated Privileges Issue, A Process for Determining Appropriate Privilege.	**06**
5	**Cryptographic Foibles** Using Poor Random Numbers, Using Passwords to Derive Cryptographic Keys, Key Management Issues, Creating Your Own Cryptographic Functions, Using the Same Stream-Cipher Encryption Key, Bit-Flipping Attacks Against Stream Ciphers, Reusing a Buffer for Plaintext and Ciphertext. **Protecting Secret Data** Attacking Secret Data, Sometimes You Don't Need to Store a Common Denominator Solution, Managing Secrets in Memory, Locking Memory to Prevent Paging Sensitive Data, Protecting Secret Data in Managed Code, Raising the Security Bar Secret,	**07**
6	**Socket Security** Avoiding Server Hijacking, TCP Window Attacks, Choosing Server Interfaces, Accepting Connections, Writing Firewall-Friendly Applications, Spoofing and Host-Based and Port-Based Trust, IPv6 Is Coming! **Protecting Against Denial of Service Attacks** Application Failure Attacks , CPU Starvation Attacks , Memory Starvation Attacks, Resource Starvation Attacks, Network Bandwidth Attacks	**06**

List of Laboratory Experiments:

1. Design and Implement static buffer overrun approach.
2. Design and Implement URL validation technique.
3. Design and Implement E-mail validation technique.
4. Design and Implement Input validation of User Interface (UI) and also check strength of password.
5. Implement prevention mechanism of SQL Injection attack.
6. Create Salted Hash mechanism to authenticate user credential.
7. Implement random sequence password and OTP generation technique.
8. Case study on ACL and least privileges on windows system.

Books Recommended:

Text books:

1. J. M. Howard, D. LeBlanc. Writing Secure Code, Microsoft Press (2e), 2003.
2. Viega, M. Messier. Secure Programming Cookbook for C and C++, O'Reilly Media, Inc, 2003.

Reference Books:

1. J. Viega, G. McGraw. Building Secure Software, Addison-Wesley Professional Computing Series (1e), 2010.

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<table>
<tr><td colspan="5">Program: First Year M.Tech Computer Engineering</td><td colspan="5">Semester : II</td></tr>
<tr><td colspan="5">Course: Mini Project-II</td><td colspan="5">Course Code: DJS24CSC551P</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
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<tr><td colspan="4"></td><td>50</td><td>--</td><td>--</td><td>--</td><td colspan="2">50</td><td>50</td></tr>
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Pre-requisite:

1. Domain knowledge of any Program Specific Outcome (PSO) of the Computer Engineering curriculum.

Objectives:

1. To realize the functional solution as per the project requirements.

Outcomes:

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

1. Incorporate project-based learning that allows students to identify and transfer existing ideas into new applications.
2. Present their project work in a technical report improving their documentation skills.
3. Integrate inter-disciplinary concepts, which help them to get internships, jobs, admissions for higher studies.
4. The project will serve as a pre cursor to the student's M. Tech thesis dissertation topic.

Syllabus:

Domain knowledge (any field of knowledge and beyond) needed from the following areas for the effective implementation of the product:

Algorithms, Data structures, Networking and Internet of Things, Data science and Big Data, Robotics, Artificial Intelligence (AI), Machine learning (ML), Image Processing, Security, Natural Language Processing.

The above areas can be updated (expanded), based on the needs of technological innovations and development needed for a specific project/product.

Evaluation scheme:

Every student will be reviewed individually once in a semester by review panel based on the following criteria:

1. Project progress
2. Documentation/Technical paper writing
3. Overall presentation and Teamwork
4. Validation of results (functional testing results)
5. Project Development with a view leading to his/her M. Tech thesis.

Marks scored in the mid semester review will be considered as part of term work.

The final certification and acceptance of Term work ensure satisfactory performance and the outcome of evaluation centered about evaluation scheme.

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Program: First Year M.Tech Computer Engineering										Semester : II				
Course: Machine Learning										Course Code: DJS24XOE561				
Teaching Scheme (Hours / week)				Evaluation Scheme										
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)					Total marks (A+ B)		
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assignment	Total				
				60			15	15	10	40		100		
				Laboratory Examination			Term work			Total Term work		--		
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal						
				--	--	--	--	--		--				

Pre-requisite: •Statistical Signal Processing

Objectives:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To become familiar with regression methods, classification methods and clustering methods.
3. To introduce students to the basics of Genetic Algorithms.

Outcomes:

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

1. Analyze the applications, which can use Machine Learning Techniques.
2. Understand and Apply regression, classification and clustering methods to the database.
3. Interpret the difference between supervised and unsupervised learning methods.
4. Understand the working of Reinforcement learning.
5. Understand basic concepts of Genetic Algorithms

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Machine Learning** Machine Learning Terminologies, Types of ML, Goals and Applications of ML, Choosing the right Algorithm. Designing a Learning System: The concept learning task, concept learning as search General to specific ordering of hypothesis, Find-S, Candidate elimination Algorithm.	06
2	**Regression and Tree based Learning** Linear Regression, Logistics Regression Introduction, Decision tree representation ,appropriate problems for decision tree learning, basic decision tree algorithm, hyper space, search in decision tree learning, issues in decision tree learning	10

3	**Probability and Instance based Learning** Probability theory and Bayes rule, Naive Bayes learning algorithm, Introduction, K-nearest neighbor learning, case based learning, radial basis functions	08
4	**Clustering and Unsupervised Learning** Learning from unclassified data, K-means Clustering, Expectation maximization Algorithm, Semi supervised learning with EM using labelled and unlabelled data Supervised Learning after clustering, Choosing number of clusters.	08
5	**Supervised and Reinforcement Learning** Techniques of Supervised Learning: Supervised Learning Overview, Linear Model (Numerical Functions), Perceptron Learning Algorithm (PLA) – Classification, From Linear to Nonlinear, Adaptive Perceptron Learning Algorithm (PLA), Classification, Support Vector Machine (SVM), Extension to Multi-class Problems. Reinforcement Learning: Overview, Example and Uses	10
6	**Genetic Algorithms** Genetic Algorithms: Introduction, genetic operators, genetic programming, models of evolution & learning, parallelizing genetic algorithm.	06

Books Recommended:

Text Books:

1. Peter Harrington, Machine Learning In Action, DreamTech Press, 2012.
2. Ethem Alpaydın, Introduction to Machine Learning, MIT Press, 2014.
3. Tom M.Mitchell, Machine Learning, McGraw Hill Science, 1997.
4. Stephen Marsland, Machine Learning An Algorithmic Perspective CRC Press 2014.
5. Christopher Bishop, Pattern recognition and machine learning, Springer, 2006.
6. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach, 2nd Edn, Pearson Education.
7. George F Luger, Artificial Intelligence, Low Price Edn, 4th Edn, Pearson Education.

Reference Books:

1. William W.Hsieh, Machine Learning Methods in the Environmental Sciences: Neural Networks and Kernels, Cambridge, 2009.
2. Han Kamber, Data Mining Concepts and Techniques, 3rd Edn, Morgann Kaufmann Publishers.
3. Margaret H. Dunham, Data Mining Introductory and Advanced Topics, Pearson Education, 2006.
4. Elaine Rich and Kevin Knight, Artificial Intelligence, 3rd Edn, Pearson Education.

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<table>
<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="2">Semester : II</td></tr>
<tr><td colspan="8">Course: Renewable Energy</td><td colspan="2">Course Code: DJS24XOE562</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="6">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="4">Continuous Assessment Marks (B)</td><td>Total marks (A+ B)</td></tr>
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</table>

Pre-requisite:

Objectives:

1. Understand the renewable energy resources availability, potential and suitability as a substitute for conventional energy resources in future energy demand.

Outcomes:

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

1. Identify sustainable energy solutions for sustainable development
2. Analyze renewable energy resources availability and utilization
3. Demonstrate competency in renewable systems analysis independently

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction** Renewable and non-renewable energy sources, global and Indian scenario. **Energy alternatives** The solar option, nuclear option, tar sands and oil shale, tidal energy, geothermal energy.	05
2	**Solar energy** Solar radiation, availability, measurement and estimation, solar thermal conversion devicessuch as flat plate collector, tubular collector, solar air collector, solar concentrator and storage. **Applications** Crop drying, distillation, water heating, electric power generation. **Solar photovoltaic**	10

	Photovoltaic cell technologies, generations of solar cell, electrical characteristics, photovoltaic module and array, photovoltaic module system components and design.	
3	**Biomass energy conversion** Biomass characteristics and their availability, biofuel production processes, bio-methane, bio-hydrogen, alcoholic fermentation, biodiesel, microbial fuel cell, biomass based steam power plant, combined cycle power plant, cogeneration plant, Energy from Waste.	08
4	**Wind energy** Wind turbines, aerodynamics, types of turbines wind energy conversion system, wind turbine generator types, advantages and disadvantages. **Hydro power** Water turbines, hydroelectric system theory, measurement and components, advantages anddisadvantages of hydroelectric system.	08
5	**Geothermal energy** Structure of earth, geothermal resources, exploration of geothermal energy. **OTEC** Principle, applications. **Tidal** Principle, power calculation, tidal modes of operation. **Wave** Wave motion, energy conversion and devices applications.	06
6	**Economic analysis** Initial and annual costs, present worth calculation, annual savings, payback period.	05

Books Recommended:

Text Books:

1. Vaughn C. Nelson, Kenneth L. Starcher, Introduction to Renewable Energy (Energy and theEnvironment, CRC Press, UK, 2016.
2. B. K Khan, *Non-Conventional Energy Resources*, TMH New Delhi, 2013.
3. J. A. Duffie and W. A. Beckman, *Solar Engineering of Thermal Processes*, John Wiley, NewYork, 2013.

Reference Books:

1. D. Y. Goswami, F. Kreith and J. F. Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia, 2015.
2. S. P. Sukhatme, Solar Energy - Principles of thermal collection and storage, Tata McGraw-Hill, New Delhi, 2008. (Classic Book)
3. J. Twidell and T. Weir, Renewable Energy Resources, E & F N Spon Ltd, London, 1986. (Classic Book)

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Program: First Year M.Tech Computer Engineering										Semester : II				
Course: Digital Marketing										Course Code: DJS24XOE563				
Teaching Scheme (Hours / week)				Evaluation Scheme										
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)					Total marks (A+ B)		
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assignment	Total				
				60			15	15	10	40		100		
				Laboratory Examination			Term work			Total Term work		--		
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal						
				--	--	--	--	--		--				

Pre-requisite: Knowledge of Marketing

Objectives:

1. To learn the fundamentals of Digital marketing.
2. To understand the use of content strategy and social media marketing and email marketing.
3. To understand the role of Search Engine Optimization.
4. To apply techniques in display advertising

Outcomes:

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

1. Apply B2B and B2C contexts to plan content marketing.
2. Develop and measure impact of content that works well for your target audience.
3. Manage social media presence, and create effective content for each platform.
4. Optimize search engine presence through on-site and off-site activities, develop target keyword list, optimize website UX and design, and execute a link building campaign.
5. Create, execute, and optimize an effective Ad campaign. Display and set up advertising works.
6. Create an email marketing strategy, create and execute email campaigns, and measure the results.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Marketing Fundamentals:** Welcome to Digital Marketing, The Digital Marketing Framework, What: Your Business Welcome to Digital Marketing, The Digital Marketing Framework, What: Your Business Who& When: Your Customer, Where: Marketing Channels, why: Marketing Objectives & KPIs.	08
2	**Content Strategy:**	08

	Plan Your Content Strategy, Create Content, Distribute & Promote Content, Optimize Website UX & Landing Pages, Measure Impact.	
3	**Social Media Marketing:** Social Media Marketing (Organic), Social Media Landscape, Social Media Channels, Social Media Content, Implement & Monitor Campaigns, Measure Impact, Social Media Advertising (Paid), Intro to Social Media Advertising, Platforms for Social Ads, Facebook – Getting Started, Facebook - Create Ad Sets, Facebook - Create and Manage Ads	06
4	**Search Engine Optimization (SEO):** Search Engine Marketing with AdWords (SEM), How Search Works Keywords, On-Site SEO: Optimize UX & Design, Off-Site SEO:Link-building, SEO Audit & Future of SEO, Adwords & Keyword Selection, Create Text Ads, CPC Bidding, Navigate AdWords, SEM Metrics & Optimization	06
5	**Display Advertising:** How Do Display Ads Work? Display Ads &Targeting, Sales Models, Display Ads in AdWords, Video Advertising	06
6	**Email Marketing:** Email List Generation, Create an Effective Email Campaigns, and Create an Email Plan, Measure Results.	05

Books Recommended:

Text Books:

1. B2B Digital Marketing: Using the Web to Market Directly to Businesses – Miller
2. Digital Marketing: An Integrated Marketing approach –Star Business series.2019
3. Social Media Marketing All-In-One for Dummies by Jan Zimmerman and Deborah Ng, 2017
4. Google Adwords for Beginners: A Do-It-Yourself Guide to PPC Advertising
5. Digital Marketing, 1st edition, Vandana Ahuja, Oxford University Press.

Reference Books:

1. Digital Marketing for Dummies by Ryan Deiss and Russ Hennesberry, 2017
2. Digital Marketing Handbook: A Guide to Search Engine Optimization – Shivani Karwal
3. Introduction to Programmatic Advertising by Dominik Kosorin, 2016
4. The Webinar Way: The Single Most Effective Way to Promote Your Services, Drive Leads & Sell a Ton of Product by Sherri Rose, 2012
5. Social Media Marketing: Strategies for Engaging in Facebook, Twitter & Other Social Media by Liana Evans, (2010), Que Publishing.

Web Resources:

1. https://learndigital.withgoogle.com/digitalgarage/course/digital-marketing
2. https://onlinecourses.swayam2.ac.in/cec22_mg01/preview
3. https://onlinecourses.swayam2.ac.in/cec21_mg09/preview

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<table>
<tr><td colspan="6">Program: First Year M.Tech Computer Engineering</td><td colspan="6">Semester : II</td></tr>
<tr><td colspan="6">Course: Project Management</td><td colspan="6">Course Code: DJS24XOE564</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="12">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="5">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="4">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Assign ment</td><td>Total</td></tr>
<tr><td colspan="4">60</td><td>15</td><td>15</td><td>10</td><td>40</td><td>100</td></tr>
<tr><td colspan="4">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="2">Total Term work</td><td rowspan="3">--</td></tr>
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<tr><td>--</td><td>--</td><td>--</td><td>--</td><td colspan="2">--</td><td>--</td></tr>
</table>

Objectives:

1. Identify key areas of concern over Project Life Cycle (PLC) and use of project management principles across all the phases of PLC.
2. Make them understand the importance and necessity of project plan.
3. Make them understand the importance of team and how to work as a team member, share best project management practices.

Outcomes:

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

1. Assess a project by establishing a business case and accordingly prepare a project proposal.
2. Develop a project plan.
3. Identify task inter-dependencies, construct and analyze a network diagram
4. Monitor and control the performance of the project.
5. Demonstrate Team work and team spirit and resolve conflicts.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**An overview of Project Management:** What is project? Characteristics of project, Project Vs Operations, Project Goals, Project Life Cycle (typical & atypical), Evolution of Project Management, Need of Project Management, Different forms of Project Management, Project Environment, PMBOK. Remote (Virtual) Project Management: Introduction, benefits, challenges, tools for remote project management.	05
2	**Project Initiation and Planning:** Project Feasibility, Request for Proposal (RFP), Business Case, Project selection and approval process, Project Proposal, Project Contracting. Planning steps, Project	05

	Management Process, Project Charter, Project Planning Framework, Work Breakdown Structure (WBS), Linear Responsibility Chart, Gantt Chart.	
3	**Project Time Management**: Network Diagrams (AOA &AON), Critical Path, PDM network, PERT, CPM, Resource Loading, Resource Leveling, Goldratt's Critical Chain.	**07**
4	**Project Cost Management:** Cost estimating, Cost escalation, Cost estimating and system development cycle, Cost estimating process, Elements of budgets and estimates, Top down and bottom-up budgeting, Project cost accounting and MIS, Budgeting using cost accounts, Cost schedules and forecasts.	**04**
5	**Project Human Resource Management:** Formal & Informal organization, project team, multidisciplinary teams, project leadership, ethics in projects, multicultural projects, Role of project manager. The nature of change, the change management plan, dealing with resistance and conflicts. Remote collaboration and its current state, future prospect of remote collaboration, managing remote teams effectively.	**06**
6	**Project Communication Management:** Monitoring and controlling the project, the project communications plan, project metric – Earned Value Management, data collection and reporting, reporting performance and progress, information distribution.	**04**
7	**Project Risk Management, Project Quality Management:** Basic concepts, Identification, Assessment, and Response plan. Quality Planning, Quality Assurance, Quality Control	**04**
8	**Project Procurement Management and Project Closure:** Introduction, project procurement management, outsourcing. Project implementation, administrative closure, project evaluation.	**04**

Books Recommended:

Text books:

1. John M. Nicholas, Project Management for Business and Technology, 4th edition, Pearson Education.
2. Jack T. Marchewka, Information Technology Project Management, 4th edition, Wiley India, 2009.

Reference Books:

1. E-Book –A Guide to Project Management Body of Knowledge (PMBOK ® Guide), 5th edition, Project Management Institute PA, USA.
2. Claudia M. Baca, Patti M. Jansen, PMP: Project Management Professional Workbook, Sybex Publication.
3. S. J. Mantel, J. R. Meredith and etal., Project Management 7th edition, Wiley India, 2009.
4. Joel Henry, Software Project Management, A real-world guide to success, Pearson Education, 2008.
5. Gido and Clements, Successful Project Management, 2nd edition, Thomson Learning
6. Hughes and Cornell, Software Project Management, 3rd edition, Tata McGraw Hill
7. Joseph Phillips, IT Project Management, end edition, Tata McGraw Hill
8. Robert K. Wyzocki, Effective Project Management, 5th edition, Wiley
9. Brown, K. A. Project Management, McGraw Hill, 2002.
10. Dinsmore, P. C. (Ed.), The AMA Handbook of Project Management. AMACOM, 1993.

Web Resources:

1. https://www.pmi.org
2. https://www.projectmanager.com

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<table>
<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="5">Semester : II</td></tr>
<tr><td colspan="8">Course: Research Methodology</td><td colspan="5">Course Code: DJS24XOE565</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="9">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="4">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Assign ment</td><td>Total</td></tr>
<tr><td colspan="3">60</td><td>15</td><td>15</td><td>10</td><td>40</td><td>100</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="2">Total Term work</td><td rowspan="3">--</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">--</td><td rowspan="2">--</td><td rowspan="2">3</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>--</td><td>--</td><td>--</td><td>--</td><td colspan="2">--</td><td>--</td></tr>
</table>

Pre-requisite: Knowledge of

1. Research concepts

Objectives:

1. To understand Research and Research Process
2. To acquaint students with identifying problems for research and develop research strategies
3. To familiarize students with the techniques of data collection, analysis of data and interpretation

Outcomes:

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

1. Prepare a preliminary research design for projects in their subject matter areas
2. Accurately collect, analyze and report data
3. Present complex data or situations clearly
4. Review and analyze research findings

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction and Basic Research Concepts:** Meaning of Research, Objectives of Research, Types of Research, Significance of Research, Research Methods versus Methodology, Criteria ofGood Research, Problems Encountered by Researchers in India. **Creating Research Profile:** Google Scholar, ResearchGate, ORCID and Publons.	07

2	**Defining the Research Problem**: Identifying and Selecting the Research Problem, Necessity of Defining the Research Problem, Technique Involved in Defining a Problem, Importance of literature review in defining a Research Problem, Literature review from primary and secondary sources, research databases, institution repository, searching the web, critical literature review, identifying research gap areas from the literature, developing theoretical background and researchframework. **Research Design:** Meaning, Types and Significance. **Research Questions and Hypothesis:** Variables and their linkages, characteristics of a good Hypothesis, Research question and formulation of Research hypotheses, Basis for hypotheses.	09
3	**Sample Design:** Sample Design – Meaning and Significance, Essentials of a good sampling.Stages in Sample Design, Sampling methods/techniques, Sampling Errors. **Measurement and Scaling:** Classifications of Measurement Scales, Sources of Error in Measurement, Scaling, Scale Classification Bases, Scaling techniques, Deciding the Scale.	07
4	**Data Collection and Analysis:** Sources of Data, Types of Data, Methods of Collecting Data, data processing and analysis withstatistical packages, hypothesis testing, generalization and interpretation.	06
5	**Research Writing:** Synopsis, Article/Research Paper, Research Proposal for funding agencies, Thesis, Dissertation, Book-Chapter. Layout, structure and format of a Research Report, Criteria of Good Research Writing, Precautions for Writing Research Reports, Patent possibilities. Software for paper formatting, like LaTeX/MSOffice. **Indexation & Citation Style:** Concept of Indexing, Indexed by Scopus, PubMed, EBSCO, Web of Science, ISI Indexing, etc. MLA, APA, IEEE, ISO, Chicago, etc. style of citation in Bibliography, Reference Management Software like, Zotero, Mendeley, etc. **Publications from Research:** Identifying the relevant journal and its publisher, predatory journals, Journal Rankings, Research presentation in Conferences, Conferences proceedings.	07
6	**Research Ethics:** Research Ethics, Importance of Research Ethics, Scientific Misconduct, Similarity check (Turnitin, Quetext, Plagiarism Detector, Ouriginal software) and Their Prevention, Acknowledgement. **IPR:** Intellectual Property Rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS).	06

Books Recommended:

Reference Books:

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C. R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nded), Singapore, Pearson Education.

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Program: First Year M.Tech Computer Engineering										Semester : II				
Course: Product Life Cycle Management										Course Code: DJS24XOE566				
Teaching Scheme (Hours / week)				Evaluation Scheme										
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)					Total marks (A+ B)		
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Assignment	Total				
				60			15	15	10	40		100		
				Laboratory Examination			Term work			Total Term work		--		
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal						
				--	--	--	--	--		--				

Pre-requisite: Knowledge of

1. Product development process
2. Environmental science

Objectives:

1. To familiarize the students with the need, benefits and components of PLM
2. To acquaint students with Product Data Management & PLM strategies
3. To give insights into new product development program and guidelines for designing and developing a product
4. To familiarize the students with Virtual Product Development

Outcomes:

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

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Understand the need for Product Life Cycle Assessment (LCA) and Life Cycle Cost Analysis.
4. Demonstrate the various PLM Applications, Modules, and virtual product development tools for components, machining and manufacturing plant.
5. Appreciate the significant effect of effective marketing strategies and integration of PLM with other business modules.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Fundamentals of Product Life Cycle Management (PLM):** Overview of product and product life cycle (PLC), background and concept of product life cycle management (PLM), Need for PLM, Elements/components of PLM, PLM paradigm and environment, Internal and external factors affective PLM, phases involved in PLM, PLM life cycle model and implementation (case study) PLM strategies and principles, organization's visions in line with PLM, strategy identification and selection, change management for PLM etc**.**	10

2	**Product Design and Development:** Product, Product structure, product design process and product analysis, New Product design and it's need, organization and decomposition in product design, Design for X and Robust design, Strategies for recovery at end of life, recycling, human factors in product design and concurrent engineering etc. What is product development? New product development – strategies and process, and successful product development.	08
3	**Product Life Cycle Assessment (LCA) and Life Cycle Cost Analysis:** Detailed methodology, ISO framework and phases of LCA, Application, benefits and limitations of LCA, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis.	07
4	**PLM applications and software solutions:** Industry/Product specific Applications of PLM. Product Data Management (PDM) – concept and implementation, Product portfolio management, computer aided design and manufacturing, Digital manufacturing, Product modelling and simulations. (Industry case studies and examples to explain the benefits of PLM and related software tools)	06
5	**Integrating PLM Systems with other Aspects of Business and Environment:** Integration of PLM systems with Supply Chain Management, Enterprise resource planning, industry 4.0, Sustainable product development and Design for environment etc.	07
6	**Effective Marketing Strategies to Improve Life Cycle of Product:** Understanding marketing, Role of marketing in PLC and organization performance, Identifying business opportunities through market analysis, Consumer/Buyer behavior pattern etc. Developing effective marketing strategies – Differentiating and Positioning product, developing new product, product lines and width, pricing strategies, Market	04

Books Recommended:

Reference Books:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realisation", Springer-Verlag, 2004. ISBN: 1852338105
2. Fabio Giudice, Guido La Rosa, Antonino Risitano, "Product Design for the environment-A life cycle approach", Taylor & Francis 2006, ISBN: 0849327229
3. Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, ISBN: 3540257314
4. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265

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Syllabus for Second Year M. Tech. (Computer Engineering) Semester III and IV (Autonomous) - Academic Year 2024-2025

<table>
<tr><td colspan="8">Program: Second Year M.Tech Computer Engineering</td><td colspan="4">Semester : III</td></tr>
<tr><td colspan="8">Course: Skill Development Course</td><td colspan="4">Course Code: DJS24PCCVS31</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="8">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
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<tr><td colspan="4">--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
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<tr><td colspan="4"></td><td>--</td><td>--</td><td>--</td><td>--</td><td colspan="2">--</td><td>50</td><td></td></tr>
</table>

Guidelines for Skill Development Course:

1. The NPTEL online credit course should to be finalized by the student in consultation with the project guide/supervisor.
2. The course shall be of advanced or recent topics and should be relevant to the area of the project selected.
3. The selected NPTEL course should have a duration of 12 weeks or more.
4. The NPTEL course will be considered equivalent to 3 credits for course mentioned in 3 above.
5. NPTEL courses of 4 or 8 weeks will not be considered for credit transfer.
6. Students should register and complete the course and examination in semester III itself.
7. Only scores above 40% will be considered for grant of credits.
8. The student is required to share his exam score with the institute.

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Syllabus for Second Year M. Tech. (Computer Engineering) Semester III and IV (Autonomous) - Academic Year 2024-2025

<table>
<tr><td colspan="8">Program: Second Year M.Tech Computer Engineering</td><td colspan="3">Semester : III</td></tr>
<tr><td colspan="8">Course: Internship/On Job Training/Special topic Research Seminar</td><td colspan="3">Course Code: DJS24PCLEL32</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
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<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Assign ment</td><td>Total</td><td rowspan="2"></td></tr>
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<tr><td>50</td><td>--</td><td>--</td><td>--</td><td colspan="2">50</td><td>50</td></tr>
</table>

Guidelines for Internships/On Job Training:

1. Students can take up internship/training programme in industry related to their Computer Engineering.
2. The number of hours required to be engaged should be a minimum of 12 hours weekly.
3. The duration of the internship should be 3 months at least.
4. Students should compile the report in standard format and present it in front of a Panel of Examiners.

Guidelines for Assessment of Internships:

1. Work done during the internship should be assessed jointly by a panel of Internal Examiners.
2. A power point presentation along with report should be presented in from of the panel members.
3. Feedback from the reporting manager of the student in the industry should evaluated.
4. Internship should be assessed based on the following points:
    - Quality of work done during the internship
    - Students understanding of the work
    - Quality of Report and Oral Presentation
    - Feedback from Internal guide and Reporting manager from industry.

Guidelines for Special Topic Research Seminar:

1. Special Topic Seminar should be based on thrust areas in Computer Engineering.
2. Students should do literature survey, identify the topic of seminar and finalize it with consultation of Guide/Supervisor.
3. Students should use multiple literatures (at least 10 papers from Refereed Journals/conferences) and understand the topic and research gap.
4. Students should compile the report in standard format and present it in front of a Panel of Examiners (Pair of Internal and External examiners).

Guidelines for Assessment of Special Topic Research Seminar:

5. Special Topic Seminar should be assessed jointly by a pair of Internal and External Examiners.
6. Special Topic Seminar should be assessed based on the following points:
    - Quality of Literature survey and Novelty in the topic
    - Relevance to the specialization
    - Understanding of the topic
    - Quality of Written and Oral Presentation

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Syllabus for Second Year M. Tech. (Computer Engineering) Semester III and IV (Autonomous) - Academic Year 2024-2025

<table>
<tr><td colspan="8">Program: Second Year M. Tech. Computer Engineering</td><td colspan="3">Semester: III</td></tr>
<tr><td colspan="8">Course: Dissertation Phase I</td><td colspan="3">Course Code: DJS24PCPEL33</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
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<tr><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Tutorial / Mini project/ Presentation</td></tr>
<tr><td>--</td><td>--</td><td>--</td><td>--</td><td>100</td><td>100</td></tr>
</table>

Guidelines for Dissertation Phase I

Students should do literature survey and identify the problem for Dissertation and finalize it in consultation with Guide/Supervisor. Students should use multiple literatures and understand the problem. Students should attempt solution to the problem by analytical/simulation/experimental methods. The report should be compiled strictly as per the standard report writing guidelines.

Guidelines for Assessment of Dissertation Phase I

1. Dissertation Phase I will be assessed by a panel of internal examiners. The assessment will consist of a mid-semester review/progress evaluation for 50 marks and an end semester progress evaluation for 50 marks.

2. Dissertation Phase I should be assessed based on the following points:
   - Quality of Literature survey and Novelty in the problem
   - Clarity of Problem definition and Feasibility of problem solution
   - Relevance to the specialization
   - Clarity of objective and scope

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Syllabus for Second Year M. Tech. (Computer Engineering) Semester III and IV (Autonomous) - Academic Year 2024-2025

<table>
<tr><td colspan="8">Program: Second Year M. Tech. Computer Engineering</td><td colspan="2">Semester: IV</td></tr>
<tr><td colspan="8">Course: Dissertation Phase II</td><td colspan="2">Course Code: DJS24PCPEL41</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="6">Evaluation Scheme</td></tr>
<tr><td colspan="3">Semester End Examination Marks (A)</td><td colspan="3">Continuous Assessment Marks (B)</td><td rowspan="2">Total marks (A+ B)</td></tr>
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<tr><td>100</td><td>--</td><td>--</td><td>50</td><td>50</td><td>100</td></tr>
</table>

Guidelines for Dissertation Phase II

Students should attempt solution to the identified problem by analytical/simulation/experimental methods. The solution is to be validated with proper justification and the thesis should be compiled strictly as per the standard report writing guidelines.

Guidelines for Assessment of Dissertation Phase II

Dissertation phase II will be assessed by a panel of internal examiner/guide and external examiner, appointed by the Research Approval Committee (RAC). The assessment will be based on the final thesis and the presentation. Prior to evaluation of the final thesis, assessment at the institute level will be carried out by the Research Approval Committee.

The final presentation and the thesis should highlight the following points of the project:

- Literature survey
- Problem definition
- Research and Design
- Execution
- Experimental and Simulation results
- Conclusion and future work
- Published material (Publications in reputed conference / journals is mandatory)

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