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 2019-2020)

Sr	Course Code	Course	Teaching Scheme				Semester End Examination						Continuous Assessment							Aggregate (A+B)	Credits earned	
																Termwork						
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (Hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Laboratory Work	Tutorial / Mini project / Presentation/ Journal	Term Work Total	CA Total (B)			
1	DJ19CEPGC101	Advanced Algorithm and Complexity	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	4
	DJ19CEPGL101	Advanced Algorithm and Complexity Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	15	10	25	25	50	1	
2	DJ19CEPGC102	Advanced Soft Computing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
3	DJ19CEPGC103	Advanced Computer Network and Design	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	4
	DJ19CEPGL103	Advanced Computer Network and Design Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	15	10	25	25	50	1	
4	DJ19CEPGC104	Internet of Things	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
5@	DJ19CEPGE101	Ethical Hacking and Digital Forensics	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19CEPGE102	Big Data Infrastructure	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19CEPGE103	Natural Language Processing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
6#	DJ19OPGC1021	Cyber Security and Laws	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19OPGC1022	System Dynamics	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19OPGC1023	Operation Research	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19OPGC1024	Wavelets	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
	DJ19OPGC1025	Digital Marketing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	--	--	25	100	3	3
		Total	**18**	**4**	**0**	**20**	**--**	**450**	**50**	**0**	**0**	**500**	**150**	**150**	**150**	**30**	**20**	**50**	**200**	**700**	**20**	

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

1.
2.
Prepared by

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Checked by

Head of Dept

Vice Principal

Principal

Scheme for First Year M.Tech Program in Computer Engineering: Semester II (Autonomous) (Academic Year 2019-2020)

(Academic Year 2019-2020)

Syllabus for First Year M.Tech Program in Computer Engineering: Semester I (Autonomous)
(Academic Year 2019-2020)

Program: First Year M.Tech Computer Engineering	**Semester : I**
Course : Advanced Algorithm and Complexity	**Course Code:DJ19CEPGC101**
Course : Advanced Algorithm and Complexity Laboratory	**Course Code:DJ19CEPGL101**

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**	**Avg.**	
				75			**25**	**25**	**25**	**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. Data structure.
2. Analysis of Algorithms.
3. 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, Growth of Functions, Recurrences, The substitution method, The recursion-tree method, The master method, Complexity of Recursive algorithms, Proving Techniques	**05**
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. Analyze various sorting techniques for the time taken by each algorithm. The program should take random inputs and calculate the time taken by each algo. Plot a graph for each algorithm for their times.
2. To find out the shortest path in a network using various techniques and analyze them.
3. Ford Fulkerson
4. Bellman Ford
5. Djikstra's Algorithm
6. Implement Floyd Warshall's algorithm to depict all pair shortest path.
7. Implement bipartite algorithm and analyze it.
8. Implement the algorithm for matrix chain multiplication and analyze it.
9. To find out LCS from two sequences & its length and also analyze time required for it.
10. Implement RabinKarp algorithm to perform string matching
11. Program to Implement Fibonacci Heap
12. Program to implement Count Sketch algorithm
13. Program to implement randomized Monte Carlo Algorithm.

Books Recommended:

Text books:

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

Reference Books:

1. The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
2. "Algorithm Design" by Kleinberg and Tardos.
3. "Data Structures and Algorithm Analysis in C" by Mark Allen Weiss, Pearson

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 10 experiments, and/or Power Point Presentation and/or assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

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

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<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester : I</td></tr>
<tr><td colspan="8">Course : Advanced Soft Computing</td><td colspan="3">Course Code:DJ19CEPGC102</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme
(Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
<tr><td colspan="5">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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</table>

Pre-requisite: Knowledge of

1. Knowledge of mathematical structures
2. Proficiency in algorithms

Objectives:

1. To become familiarized with advanced Neural network.
2. To be able to design Fuzzy Inference systems and familiarized with Fuzzy Rough set theory and hybrid systems.
3. To become familiarized with reinforcement learning, associative memories and adaptive resonance theory.
4. To become familiarized with applications of advanced soft computing.

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

1. Understand the constituents and characteristics of soft computing.
2. Design fuzzy logic controller for various systems.
3. Understand and apply fuzzy rough sets.
4. Design neural networks for applications using supervised, unsupervised and reinforcement learning.
5. Understand and apply hybrid systems to real world problems.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction:** Soft computing constituents, from conventional AI to Computational Intelligence, Soft computing characteristics	03
2	**Fuzzy Systems:** Fuzzy sets, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference systems, Fuzzy Controller: Table based controller, Mamdani fuzzy controller, Takagi-Sugeno controller.Rough Set theory: Concept of Discernibility, Vagueness in Rough Sets, Uncertainty in Rough Sets Introduction to type-2 fuzzy sets	10
3	**Neural Network:**Fundamentals of Neural Networks:Types of Learning, Linear Separability, Learning rules Supervised Learning: Error Back propagation training algorithm Unsupervised Learning: Self-Organizing Maps, Learning Vector Quantization, Radial Basis Function Networks Reinforcement Learning: Learning through Awards, Model-Free Reinforcement Learning Model, Neural Networks and Reinforcement Learning	10
4	**Pattern Association** Associative Memory Network: Description, Auto-associative Memory, Bidirectional Associative memory, Hetero-associative memory, Hopfield networkAdaptive Resonance Theory: Stability Plasticity Dilemma, ART Networks, Iterative Clustering, Unsupervised ART Clustering	08
5	**Hybrid System:** Neuro Fuzzy hybrid systems: ANFIS, CANFIS, Fuzzy Associative Memories, simplified Fuzzy ARTMAP	04
6	**Applications:**TSP using Hopfield network, Traffic light control using Reinforcement learning, Face recognition using Associative memory, Applications of ANFIS/CANFIS	04

Books Recommended:

Text books:

1. Introduction to Artificial Neural Systems, Jacek M. Zurada, West Publication.
2. Neuro-Fuzzy and Soft Computing, J.S.R Jang, C.T. Sun and E. Mizutani, PHI.
3. Fundamentals of Neural Networks, LaureneFausett, Pearson.
4. Principles of Soft Computing, S. N. Sivanandam, S.N. Deepa, Wiley, 2nd edition.

Reference Books:

1. Neural Networks A Classroom Approach, Satish Kumar, Second Edition, McGrawHill. 2. Elements of Artificial Neural Networks, KishanMehrotra, Shilkuri K. Mohan, Sanjay Ranka, Second Edition, PRI.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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<tr><td colspan="8">Course : Advanced Computer Network and Design</td><td colspan="3">Course Code:DJ19CEPGC103</td></tr>
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<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
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<tr><td>25</td><td>--</td><td>--</td><td>15</td><td>10</td><td>25</td></tr>
</table>

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, 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.

Evaluation Scheme:

Semester End Examination (A):

Theory:

3. Question paper will be based on the entire syllabus, summing up to 75 marks.
4. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 10 experiments, and/or Power Point Presentation and/or assignments.

The distribution of marks for term work shall be as follows:

iii. Laboratory work (Performance of Experiments): 15 Marks

iv. Journal Documentation (Write-up, Power Point Presentation and Assignments: 10 marks

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

<table>
<tr><td colspan="6">Program: First Year M.Tech Computer Engineering</td><td colspan="6">Semester : I</td></tr>
<tr><td colspan="6">Course : Internet of Things</td><td colspan="6">Course Code:DJ19CEPGC104</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="12">Evaluation Scheme</td></tr>
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</table>

Pre-requisite: Knowledge of

1. Wireless Network.
2. Embedded Systems.

Objectives:

1. Provide an overview of concepts, main trends and challenges of Internet of Things.
2. Provide the knowledge of sensors and WSN.
3. Develop the ability to use hardware and software technologies related to Internet of Things.
4. Provide the knowledge of IoT communication models and protocols.
5. Provide the 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 inIoT, servo motors, solenoid, relays. Wireless Sensor networks: History and Context, The Node, Connecting and Networking Nodes, RFID + NFC, Bluetooth, RTLS + GPS, Agents + Multi – Agent Systems	08
3	**Controller in IOT:**Introduction of microcontroller boards: Arduino, ESP8266, Raspberry PI, beaglebone and PcDuinoArduino: 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	**Security of Internet of Things:** Security and Privacy issues:IoT Security Requirements, IoT system security at network application and other IoT system layers, Lightweight cryptography for IoT systems: Elliptical Curve Cryptography (ECC) Attack Models - Attacks to Sensors, RFIDs, Network and Back-end Systems, Best Practices for IoT System Security. Use case example	08
6	**Key applications of IoT and Use Cases:** Concrete Applications and Use Cases: Energy Management and Smart Homes, Ambient Assisted Living, Intelligent Transport, M2M, Industrial IoT Applications.	05

Books Recommended:

Text books:

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

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.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
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</table>

Pre-requisite: Knowledge of

1. Cryptography and System Security.
2. Computer Network.

Objectives:

1. To comprehend principles and techniques associated with Ethical Hacking.
2. To explore and analyze various hacking methodology and digital forensics techniques.
3. To inculcate digital forensic procedures for Hardware and Software.

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

1. Understand the basic concept of ethical hacking and various techniques.
2. Apply hacking principles for Windows Operating System.
3. Acquire knowledge of network and internet forensics.
4. Understand and explore mobile for forensics procedures.
5. Understand android mobile forensics.
6. Investigate and analyze android applications and forensics.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Ethical Hacking** Introduction, Hacker Classes, Hacking Phases: Planning, Reconnaissance, Scanning, Exploitation, post exploitation and result reporting. Scope and Limitations of Ethical Hacking Skills of an Ethical Hacker Ethical Hacking Tool: Metasploit	06
2	**Hacking Windows:** BIOS Password, windows Login Password, Changing Windows Visuals, Track Cleaning, Cookies, Baby Sitter Programs, Editing Explorer, Cleaning Recent Docs Menu and RUN MRU.	06
3	**Network & Internet Forensics:** Applying Forensic Science to Networks: Preparation and Authorization, Identification, Documentation, Collection and Preservation, Filtering and Data Reduction, Class/Individual Characteristics and Evaluation of Source, Evidence Recovery, Investigative Reconstruction, Reporting Results, Using the Internet as an Investigative Tool, E-mail Forgery and Tracking, Usenet Forgery, TCP/IP-Related Digital Evidence.	08
4	**Mobile Forensic & Investigation Reporting:** Crime and mobile phones, evidences, forensic procedures, files present in SIM cards, device data, external memory dump, and evidences in memory card Investigative Report Template, Layout of an Investigative Report, Guidelines for Writing a Report.	06
5	**Android Forensics:** Android Forensics Techniques: Types of Investigations, Logical and Physical Techniques, Modification of the Target Device. Android Handling Procedure, Imaging Android, Logical Techniques and Physical Techniques.	06
6	**Android Applications & Forensics Analysis:** Analysis Techniques: Timeline Analysis, File System Analysis, File Carving, Strings, Hex, Fat Forensics Analysis, YAFFS2 Analysis, Android App Analysis and Reference: Messaging, Browser, Contacts, Media Scanner, YouTube, Cooliris Media Guide, Google Maps, Gmail, Facebook, Android Reader.	07

Books Recommended:

Text books:

1. The Basics of Hacking and Penetration Testing, Patrick Engebrtson, Syngress.
2. Ethical Hacking and Penetration Testing, RafayBaloch, CRC Press.
3. Digital Evidence and Computer Crime by Eoghan Casey, Academic Press, Elsevier.
4. Android Forensics: Investigation, Analysis and Mobile Security for Google Android by Andrew Hoog, Syngress Press, Elsevier.

Reference Books:

1. Incident Response & Computer Forensics by Kevin Mandia, Chris Prosise, Wiley.
2. Building Virtual Pentesting Labs for Advanced Penetration Testing by Kevin Cardwell.
3. Computer Forensics: Evidence Collection and Preservations by EC Council Press
4. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester : I</td></tr>
<tr><td colspan="8">Course : Big Data Infrastructure</td><td colspan="3">Course Code:DJ19CEPGE102</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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</table>

Pre-requisite: Knowledge of

1. Java/Python programming
2. Basics of SQL
3. Data mining and machine learning algorithms

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. Design and develop cloud based applications with virtualization.

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, Hadoopdistribution 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:** NoSQL: Structured and Unstructured Data, Taxonomy and NoSQL Implementation, NoSQL Architectural Patterns, Using NoSQL to manage BigData,MongoDb: Basic architecture of MongoDb Types of NoSqlDatabases,Searching and Indexing Big Data.NoSQL Case Studies: Google's BigTable, Mongo DB,Neo4J,Amazon DynamoDB	08
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	06
5	**Cloud Infrastructure:** Cloud Infrastructure:Iaas, Saas, Paas Configuration of public and Private Cloud Case Study:Eucalyptus Cloud	05
6	**Introduction to Virtualization, Types of Virtualization:** Introduction to Virtualization, Types of VirtualizationVarious forms of virtualization: Desktop, Application, Server, Hardware, Storage, Memory and I/O virtualizationVM 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 Algorithms9Cloud Infrastructure:Iaas, Saas, PaasCase Study:Private and Public Cloud Virtualization	06

Books Recommended:

Text books:

1. Big Data For Dummies, By Judith S. Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufma, Wiley.
2. Practical Hive: A Guide to Hadoop's Data Warehouse System By Scott Shaw, Andreas François Vermeulen, Ankur Gupta, David Kjerrumgaard, Apress.
3. Enterprise NoSQL for Dummies, MarkLogic Special Edition. Wiley
4. Spark: The Definitive Guide: Big Data Processing Made Simple by Bill Chambers, MateiZaharia, O'Rielly.
5. Cloud Computing Bible, Barrie Sosinsky, Wiley publication

6. Mastering Cloud Computing, RajkumarBuyya, Christian Vecchoila and S thamaraselvi, Tata McGraw Hill publication.

Reference Books:

1. Mining of Massive Datasets By Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, Cambridge University Press
2. Handbook of Big Data Technologies, edited by Albert Y. Zomaya, SherifSakr,Springer.
3. Hadoop Application Architectures: Designing Real-World Big Data Applications By Mark Grover, Ted Malaska, Jonathan Seidman, Gwen Shapira, O'Reily.
4. Apache Spark Quick Start Guide: By ShreyMehrotra, Akash Grade, Packt Publishing Ltd.
5. A Handbook of Statistical Analyses Using R, By TorstenHothorn, Brian S. Everitt, CRC Press.
6. OpenStack Operations, David Stilson,O'Rielly

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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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 : Natural Language Processing</td><td colspan="2">Course Code:DJ19CEPGE103</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme
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</table>

Pre-requisite: Knowledge of

1. Data Structures and Algorithms.
2. Theory of Computer Science.
3. Probability Theory.

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 the NLP techniques to IR applications

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

1. Design an innovative application using NLP components.
2. Implement a rule based system to tackle morphology/syntax of a language.
3. Design a tag set to be used for statistical processing for real-time applications.
4. Compare and contrast the use of different statistical approaches for different types of NLP applications

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction:** 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	08
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.	08
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.	06
4	**Semantics And Pragmatics:** 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.	06
5	**Discourse Analysis And Lexical Resources:**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).	06
6	**Applications**:Machine Translation, Information Retrieval and Extraction, Text Categorization, Generation and Summarization.	05

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 HinrichSchutze, "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. NitinIndurkhya 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".

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester : I</td></tr>
<tr><td colspan="8">Course : Cyber Security and Laws</td><td colspan="3">Course Code:DJ19OCEC1021</td></tr>
<tr><td colspan="4" rowspan="3">Teaching Scheme
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</table>

Pre-requisite: Knowledge of

1. Cryptography and System Security.
2. Computer Network.

Objectives:

1. To understand and identify different types cybercrime and cyber law.
2. To learn various tools and methods used in cybercrime.
3. To recognized Indian IT Act and its latest amendments.
4. To learn various types of security standards compliances.

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

1. Understand the concept of cybercrime and its effect on outside world.
2. Interpret and apply IT law in various legal issues.
3. Distinguish different aspects of cyber law.
4. Apply Information Security Standards compliance during software design and development.

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.	4
2	**Cyber offenses & Cybercrime:** How criminal plan the attacks, Social Engg, Cyber Bulling & stalking, Email Fraud ,E-mail Spoofing ,Cyber café and Cybercrimes, , Botnets, Attack vector, Cloud computing& its security, Attack on Mobile Phone.	8
3	**Tools and Methods Used in Cybercrime:**Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft) .	8
4	**The Concept of Cyberspace:**Domain Name abuse, Campaign – Targeted Phishing, Malicious Code and Security Risks, Denial of Service attacks, Cognitive Election Hacking, Public Voters Information Sources, Intercepting Voice Communication.	7
5	**Indian IT Act:** Cyber Crime and Cyber Security : The Legal Perspectives, Introduction ,Why do we Need Cyber laws : The Indian Context , The Indian IT Act, ,Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signature and the Indian IT Act, Amendmentsto the Indian IT Act.	8
6	**Information Security Standard compliances:**SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.	4

Books Recommended:

Text books:

1. Nina Godbole, SunitBelapure, *Cyber Security*, Wiley India, New Delhi
2. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai

Reference Books:

1. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
2. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
3. Nina Godbole, *Information Systems Security*, Wiley India, New Delhi
4. Kennetch J. Knapp, *Cyber Security* &*Global Information Assurance* Information Science Publishing.
5. William Stallings, *Cryptography and Network Security*, Pearson Publication

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester : I</td></tr>
<tr><td colspan="8">Course : System Dynamics</td><td colspan="3">Course Code:DJ19OCEC1022</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="7">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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</table>

Pre-requisite: Knowledge of

1. Organizational behavior
2. Supply chain dynamics
3. Project delay and cost overruns

Objectives:

1. To understand systems concept and systems approach to engineering problems of long term nature.
2. To develop perspective of strategic decision making and long range planning in industries.

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

1. Understand the concept of cybercrime and its effect on outside world.
2. Demonstrate understanding of system concepts, system thinking and system archetypes.
3. Demonstrate understanding of sources of system complexity and counterintuitive behavior.
4. Verify and validate selected models.
5. Apply system dynamics concepts to real world problems.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	System Concepts, holism, Synergy and Emergence	06
2	System thinking, System Archetypes, Subsystem and suprasystem	07
3	Sources of system complexity, counterintuitive behavior, causal structure and feedback loops, positive and negative feedback loops, Causal loop diagram and stock-flow diagram	07
4	Level, rate and auxiliary variables, physical and information flows, nonlinearity and delay, exponential smoothing, first order and higher order systems	07
5	Table function and multipliers, discussion of industrial case problems, model verification and validation	06
6	Sensitivity analysis and policy experimentations. Application to real world problems	06

Books Recommended:

Reference Books:

1. John Sterman, Business Dynamics: Systems Thinking and Modeling for a Complex World, Irwin/McGraw-Hill, 2000
2. Michael R. Goodman, Study Notes in System Dynamics, Pegasus Communications (1989)
3. Sushil, System Dynamics: A Practical Approach for Managerial Problems, Wiley Eastern, 1993.
4. R.G. Coyle, System Dynamics Modeling: A Practical Approach, Chapman & Hall/CRC, 1996.
5. Craig W. Kirkwood, System Dynamics: A Quick Introduction, Arizona State University, 1998

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
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<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester : I</td></tr>
<tr><td colspan="8">Course : Operation Research</td><td colspan="3">Course Code:DJ19OCEC1023</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
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</table>

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	**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, Special cases, Principle of Duality, Case studies in Resource allocations, Production Scheduling	**09**
2	**Transportation problem:** Formulation - Finding Optimal solution, Degeneracy. Assignment problem: Formulation - Finding Optimal solution. Sequencing: Processing of n Jobs through Two Machines and m Machines, Graphical Method for processing of n Jobs through Two Machines	**06**
3	**Queuing Models:** 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 Replacement Models: Introduction - Replacement of items that deteriorate with time – when value of money does not change with time and changes with time. Replacement of items that fail suddenly – Individual and Group replacement.	**06**
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 MethodInventory Models: Introduction - Single item - EOQ – Overview of Deterministic modelsStochastic models - demand may be discrete variable or continuous variable	**06**
5	**Simulation:** Definition - Methodology of simulation – Monte Carlo Simulation Technique - applications to Inventory and Queuing problems – Advantages and Limitations of SimulationSimulation Languages.	**06**
6	**Dynamic programming:** Introduction - Bellman's Principle of optimality -Applications of dynamic programming to capital budgeting, inventory, employment smoothening, cargo loading and shortest path problem – Minimum Spanning Tree.	**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.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

<table>
<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester : I</td></tr>
<tr><td colspan="8">Course : Wavelets</td><td colspan="3">Course Code:DJ19OCEC1024</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="7">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>
<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>Avg.</td></tr>
<tr><td colspan="4">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">--</td><td rowspan="3">--</td><td rowspan="3">3</td><td colspan="3">Laboratory Examination</td><td colspan="2">Term work</td><td rowspan="2">Total Term work</td><td rowspan="3">--</td></tr>
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</table>

Pre-requisite: Knowledge of

1. Digital signal Processing.

Objectives:

1. To familiarize with wavelet theory, its implementation and representation.
2. To understand the fundamentals of multirate signal processing and its applications.
3. To study the theory and construction of wavelets and its practical implementations.

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

1. Implement multiphase and polyphase representation.
2. Classify various wavelet transform and explain importance of it.
3. Describe Continuous Wavelet Transform (CWT) and Discrete Wavelet Transform (DWT).
4. Explain the properties and application of wavelet transform.
5. Develop and realize computationally efficient wavelet based algorithms for signal and image processing.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to multirate systems and wavelets** Fundamentals of multirate systems: Basic multirate operations and their spectral representation, Fractional Sampling rate alteration, Interconnection of building blocks, Noble identities, poly phase representations, Efficient structures for decimation and interpolation filters. Wavelets as a mathematical tool, Classification: continuous and discrete wavelet transforms	08
2	**Discrete wavelet transform and orthogonal wavelet decomposition:** Approximations of vectors in nested linear vector subspaces, Multi-resolution Analysis of L^2(R), Haar Scaling function Haar wavelet, Haar wavelet decomposition, Haar wavelet packets and application.	06
3	**MRA Ortho-normal wavelets and their relationships to filter banks**: Construction of an ortho-normal MRA, Wavelet basis for the MRADigital filtering interpretation, Examples of orthogonal basis generating wavelets, Interpreting ortho-normal MRA for discrete time signals, Generating scaling functions and wavelets from filter coefficients.	07
4	**Continuous wavelet transform :** Definition of CWT, Continuous wavelet transform and short time Fourier transform, Scaling functions and wavelet functions, Uncertainty principle and time-frequency tiling	07
5	**Biorthogonal wavelets**: Biorthogonality in vector space, Biorthogonal Wavelet systems, Construction of biorthogonal wavelet systems. Frequency domain approach for designing wavelets: derivation of Daubechies wavelets, Wavelet Packets	06
6	**Wavelength Transform and applications**: DTWT for image compression, audio compression, JPEG 2000 standard, Wavelet based de-noising, Speckle removal, Edge detection and object isolation, Image fusion, Object detection.	05

Books Recommended:

Text Books:

1. Sanjit k. Mitra Digital signal processing 4th edition.
2. K. P. Soman, K. I. Ramachandran, N. G. Resmi, PHI-2006, Insight into wavelets From theory to practice.
3. S.V.Narasimhan,NandiniBassumalick,S.Veena ,Narosa publication Introduction to Wavelet Transform.

Reference Books:

1. P. P. Vaidyanathan, Multirate Systems & Filter banks , Prentice Hall.
2. RaguveerM.Rao and AjitS.Bopardikar-Wavelet Transforms –Introduction and applications-Pearson Education, 2008.
3. MallatS,Academic press 1996 -Wavelet signal Processing.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

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<tr><td colspan="8">Program: First Year M.Tech Computer Engineering</td><td colspan="3">Semester : I</td></tr>
<tr><td colspan="8">Course : Digital Marketing</td><td colspan="3">Course Code:DJ19OCEC1025</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</td><td colspan="7">Evaluation Scheme</td></tr>
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Pre-requisite: Knowledge of

1. Basics 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:** Plan Your Content Strategy, Create Content, Distribute & Promote Content, Optimize Website UX & Landing Pages, Measure Impact	08
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, 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 Bussiness 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

Reference Books:

1. Digital Marketing for Dummies By Ryan Deiss and Russ Hennesberry, 2017
2. Digital Marketing Handbook: A Guide to Search Engine Optimization – ShivaniKarwal
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

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus, summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

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1. Two term tests of 25 marks each will be conducted during the semesterout of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
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