2019-20

जम्मू केंद्रीय विश्वविद्यालय

Central University of Jammu

राया सूचानी बागला, जिला सांबा - 181143 जम्मू, जम्मू एवं कश्मीर

Rahya – Suchani (Bagla), District Samba – 181143, Jammu (J&K)

No. CUJ/ACAD/CSIT-M.TECH/2019/108

18th June, 2019

NOTIFICATION No. 51 /2019

Sub: Course Scheme and Syllabus of **1st** to **4th Semester** of M. Tech. in Computer Science and Technology w.e.f. Academic Session **2019 – 20** – Reg.

Ref: i) Notification No. 61 of 2018 dated 29.10.2018
ii) Notification No. 24 of 2019 dated 04.04.2019
iii) Notification No. 25 of 2019 dated 04.04.2019

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It is hereby notified for the information of all concerned that on the recommendation of the Board of Studies, Department of Computer Science and Information Technology, and Dean, School of Basic & Applied Sciences, the Vice Chancellor in anticipation of Academic Council has approved the following **Course Scheme** and **Syllabus** of **1st** to **4th semester** of M. Tech. in Computer Science and Technology w.e.f. Academic Session **2019 – 20**.

Semester – I

Course Code	Course Title	Credit	CIA	MSE	ESE	Max. Marks
Core courses						
PGMTH1C014T	Advanced Data Structures & Algorithms	4	25	25	50	100
PGMTH1C015T	Data Communication and Computer Networks	4	25	25	50	100
PGMTH1C013L	Advanced Data Structures & Algorithms Lab	2	12.5	12.5	25	50
Elective – I Course (Any One)						
PGMTH1E018T	Distributed Computing	4	25	25	50	100
PGMTH1E019T ✓	Information Security					
PGMTH1E020T	Advanced Computer Architecture					
PGMTH1E021T ✓	Modelling Simulation & Optimization					
Elective – II Course (Any One)						
PGMTH1E022T ✓	Soft Computing	4	25	25	50	100
PGMTH1E023T ✓	Android & iOS based Application Development					
PGMTH1E024T	PHP and My SQL					
PGMTH1E025T	Advanced Web Technologies					
PGMTH1E001L	Lab based on Elective – II	2	12.5	12.5	25	50
Interdisciplinary Course						
MOOC course available on SWAYAM		4	-	-	-	100
Total		**24**	-	-	-	**600**

Semester – II

Course Code	Course Title	Credit	CIA	MSE	ESE	Max. Marks
Core courses						
PGMTH2C009T	Advanced Database Management Systems	4	25	25	50	100
PGMTH2C010T	Advanced Software Design, Development and Testing	4	25	25	50	100
PGMTH2C006L	Advanced Database Management Systems Lab	2	12.5	12.5	25	50
Elective – III Course (Any One)						
PGMTH2E021T	Network & Cyber Security ✓	4	25	25	50	100
PGMTH2E022T	Big Data Analytics					
PGMTH2E023T	Computer Vision					
PGMTH2E024T	Computing System for Robotics ✓					
PGMTH2E025T	Agile Software Development					
PGMTH2E026T	Cloud Computing.					

Elective – IV (Any One)						
PGMTH2E027T	Machine Learning	4	25	25	50	100
PGMTH2E028T	Wireless Sensor Networks					
PGMTH2E029T	Data Warehousing and Mining					
PGMTH2E030T	Advanced Java Programming					
PGMTH2E001L	Lab based on Elective – IV	2	12.5	12.5	25	50
Interdisciplinary Course						
MOOC course available on SWAYAM		4	-	-	-	100
Total		**24**	-	-	-	**600**

Semester – III

Course Code	Course Title	Credit	CIA	MSE	ESE	Max. Marks
Core courses						
PGMTH3C009T	Advances in Operating Systems	4	25	25	50	100
PGMTH3C007D	Dissertation – Part I	8	50	50	100	200
PGMTH3C001P	Seminar (Research Methodology Presentation)	2	12.5	12.5	25	50
Elective – V Course (Any One)						
PGMTH3E014T	Pattern Recognition	4	25	25	50	100
PGMTH3E015T	Internet of Things					
PGMTH3E016T	Parallel Computing					
PGMTH3E017T	Digital Forensics					
PGMTH3E018T	Enterprise Software Development					
Total		**18**	-	-	-	**450**

Semester – IV

Course Code	Course Title	Credit	CIA	MSE	ESE	Max. Marks
Core courses						
PGMTH4C003D	Dissertation – Part II	18	75	150	225	450
Total		**18**	-	-	-	**450**

18/6/

Deputy Registrar
(Admin – HR)

Encl: Syllabus of 1st to 4th Semester

To:
Head, Department of CS&IT

Copy to:
OSD (Exam)

Department of Computer Science and Information Technology

Programme Educational Objectives (PEOs)

We focus on the following objectives to realize our vision.

PEO-1: To gain in-depth knowledge of Computer Science and Technology and acquire capabilities to compete at the global level with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge to conduct research in theoretical, practical, and policy contexts.

PEO-2: Have in-depth knowledge and research skills to professionally practice in a variety of fields including Security, Machine Learning, Internet of Things (IoT), Natural Language Processing, and Ubiquitous Computing.

PEO-3: Acquire professional and intellectual integrity and ethics, learn independently and continuously to upgrade the knowledge and competence with enthusiasm.

Programme Outcomes (POs)

A postgraduate of the Computer Science and Technology Program will demonstrate

PO-1: An ability to independently carry out research and development work to solve practical problems.

PO-2: Ability to write and present a substantial technical report/document.

PO-3: A degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO-4: An ability to use modern computational tools in modeling, simulation, and analysis with effective participation in multi-disciplinary teams and contribute towards achieving the common goals of the team.

PO-5: An ability to work with integrity and ethics in their professional practice having an understanding of responsibility towards society with sustainable development for a lifetime.

SEMESTER-I

ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Code: PGMTH1C014T

Course Title: ADVANCED DATA STRUCTURES AND ALGORITHMS

Semester: I

Credits: 04

COURSE OBJECTIVES

- The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- Students should be able to understand the necessary mathematical abstraction to solve problems.
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
- Student should be able to come up with analysis of efficiency and proofs of correctness

COURSE OUTCOMES

After completion of course, students would be able to:

- Understand the implementation of symbol table using hashing techniques.
- Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
- Develop algorithms for text processing applications.
- Identify suitable data structures and develop algorithms for computational geometry problems.

ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Code: PGMTH1C014T

Course Title: ADVANCED DATA STRUCTURES AND ALGORITHMS

Semester: I

Credits: 04

Contents	NO. OF LECTURES
Unit - I **Algorithm Analysis:** Analyzing Algorithms; Time Complexity Analysis of Iterative and Recursive Program, Introduction to Asymptotic Notations; Big (Oh),Big Omega , Big theta. **Basic Data Structures**: Stacks, Queues, Linked List	**10**
Unit - II **Hashing**: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.	**10**
Unit -III **Trees**: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees	**10**
Unit - IV **Text Processing**: String Operations, Brute-Force Pattern Matching, The BoyerMoore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.	**10**
Unit - V **Computational Geometry**: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees. **Recent Trends** in Hashing, Trees and various computational geometry methods for efficiently solving the new evolving problem. .	**10**

TEXT/REFERENCES BOOKS

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.
3. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.
4. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
5. R. S Salaria, " Data Structures & Algorithms using C", Fifth Edition.
6. S. Sridhar," Design and Analysis of Algorithms", Oxford Publication.

7. Seymour Lipschutz "Theory and problems of Data Structures", Tata McGraw- Hill Edition
8. Sartaj Sahni, "Handbook of DATA STRUCTURES and APPLICATIONS", Chapman & Hall/CRC,2005.
9. Alfred V. Aho, John E. Hopcroft, "Data Structures and Algorithms"
10. Anany Levitin , " Introduction to the Design and Analysis of Algorithms", 3rd Edition , Pearson.
11. Rajesh K. Shukla, "Data Structures Using C & C++", Wiley 2013.
12. Yedidyah Langsam "Data Structures Using C And C++", Pearson Education Asia.
13. Thomas H. Cormen, " Introduction to Algorithms" ,PHI, Third Edition.

Data Communication and Computer Networks

Course Code: PGMTH1C015T

Course Title: Data Communication and Computer Networks

Semester: I

Credits: 04

Course Overview

This course covers a set of advanced topics in computer networks. The focus is on principles, architectures, and protocols used in modern networked systems, such as the Internet itself, wireless and mobile networks, high performance networks and data center networks.

Course Objectives

- To provide an understanding of the tradeoffs and existing technology in building large, complex networked systems.
- To introduce wireless networks and mobility issues at the network and transport layer.

Course Outcomes

Upon successful completion of this course, candidates will be able to:

- Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols.
- Have an understanding of the issues surrounding Mobile and Wireless Networks.
- Have a working knowledge of datagram and internet socket programming.

Data Communication and Computer Networks

Course Code: PGMTH1C015T

Course Title: Data Communication and Computer Networks

Semester: I

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Transmission Control Protocol (TCP): Error Control, Flow Control, Congestion Control, Timers, And TCP Options: NOP, MSS, Window Scale Factor, Timestamp, SACK-Permitted And SACK Options Stream Control Transmission Protocol (SCTP): Introduction, Services, Features, Packet Format, Association, State Transition Diagram, Flow Control, Error Control, Congestion Control	**10**
Unit-II Congestion Control and Resource Allocation: Issues In Resource Allocation: Network Model, Taxonomy, Evaluation Criteria; Queuing Disciplines: FIFO, Fair Queuing; TCP Congestion Control: Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery; Congestion-Avoidance Mechanisms: DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance; Quality of Service: Application Requirements, Integrated Services (RSVP), Differentiated Services (EF 516, AF), Equation-Based Congestion Control	**10**
Unit-III Next Generation Network: Unicast Routing Protocols: RIP, OSPF; Multicasting And Multicast Routing Protocols: Introduction, Multicast Addresses, IGMP, Multicast Routing, Routing Protocols, MBone	**10**
Unit-IV Internet Protocol Version 6: IPV6 Addressing: Introduction, Address Space Allocation, Global Unicast Addresses, Auto configuration, Renumbering; IPV6 Protocol: Packet Format, Transition from Ipv4 TO Ipv6; Generic Routing Encapsulation (GRE) For Tunnelling. ICMPv6: Error Messages, Informational Messages, Neighbours-Discovery Messages, Group Membership Messages.	**10**
Unit-V Wireless LAN: Infrared vs. Radio Transmission, Infrastructure and Ad Hoc Networks. IEEE 802.11, System Architecture, Protocol Architecture, Physical Layer, Medium Access Control Layer, MAC Management, Future	**10**

Development, HIPERLAN, Protocol Architecture, Physical Layer, Channel Access Control Sublayer, Medium Access Control Sublayer, Information Bases and Networking, Bluetooth, User Scenarios, Physical Layer, MAC Layer, Networking, Security, Link Management.	

Text/Reference Books

1. Behrouz A. Forouzan , "TCP/IP Protocol Suite", McGraw- Hill, 4/e, 2009.
2. Larry L. Peterson & Bruce S. Davie, "Computer Network: A System Approach", Morgan Kaufmann, 5/e, 2012.
3. Jochen Schiller, "Mobile Communications", Pearson Addison-Wesley, 2/e, 2003.
4. James F. Kurose, Keith W. Ross, "Computer Networking", Pearson, 2012.
5. Charles M. Kozierok, "The TCP/IP Guide", No starch press, 2005.
6. Behrouz A. Forouzan , "Introduction to Computer Networks McGraw- Hill, 4/e, 2009
7. ANDREW S. TANENBAUM J. WETHERALL, "Computer Networks", 5th Edition, Pearson, 2011.

Distributed Computing

Course Code: PGMTH1E018T

Course Title: Distributed Computing

Semester: I

Credits: 04

Course Overview

The course is intended to provide basic foundation with fundamental concepts and mechanisms of distributed computing systems. Topics will include inter process communication, remote procedure call, synchronization, distributed shared memory and security.

Course Objectives

- Understand foundations of Distributed Systems.
- Introduce the idea of peer to peer services and file system.
- Understand in detail the system level and support required for distributed system.
- Understand the issues involved in studying process and resource management.

Course Outcomes

After completion of course, students would be able to:

- Identify models of distributed computing
- Analyze algorithms for coordination, communication, security and synchronization in distributed systems
- Classify distributed shared memory models
- Design distributed algorithms for deadlocks

Distributed Computing

Course Code: PGMTH1E018T

Course Title: Distributed Computing

Semester: I

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I **Concepts of Distributed Systems:** Concepts of Distributed Systems : Introduction, Distributed computing models, Software concepts, Design issues in distributed systems, Client-server model, WWW 1.0 and 2.0 **Network Communication**: Network Communication: LAN and WAN technologies, OSI Model and Internet protocols, ATM, Protocols for Distributed systems	**10**
Unit-II **Inter Process Communication:** Message Passing and its features, IPC message format, IPC synchronization, Buffering, multi datagram messaging, process addressing techniques, failure handling, Formal Models for message passing systems, Broadcast and converge cast on a spanning tree, Flooding and building a spanning tree, Constructing a DFS spanning tree with and without a specified root	**10**
Unit-III **Remote Communication**: Introduction, RPC basics, RPC implementation, RPC Communication and Other issues, Sun RPC, RMI basics, RMI Implementation, Java RMI **Transaction and concurrency control Synchronization:** Clock synchronization, Logical clocks, Global state, Mutual exclusion, Election algorithms: Bully algorithm, Ring algorithm, Leader election in rings, anonymous rings, Asynchronous rings, synchronous rings, election in wireless networks, Deadlocks in Distributed systems, Deadlocks in Message communication	**10**
Unit-IV **Distributed System Management:** Resource management, Task management approach, Load balancing approach, Load sharing approach, Process Management, Process migration, threads, fault tolerance. **Distributed Shared Memory:** Concepts, Hardware DSM, Design issues in DSM systems, Implementation issues, Heterogeneous and other DSM systems	**10**
Unit-V **Distributed system Security:** Overview of security techniques, Cryptographic algorithms, Digital Signatures **Distributed Object Based Systems:** Architecture, Distributed Objects,	**10**

Example: Enterprise Java Beans Distributed Shared Objects Case Study CORBA	

Text/Reference Books

1. George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, "Distributed Systems: Concepts and design", Pearson Education Asia, 5/e, 2011.
2. A.S. Tanenbaum, "Modern operating Systems", Prentience Hall, 3/e, 2007.
3. Randy Chow and Theodore Johnson, "Distributed Operating Systems and Algorithm Analysis", Addison-Wesley, 1997.
4. Gerald Tel, "Introduction to Distributed Algorithms", Cambridge Iniversity Press, 2/e, 2000.
5. Nancy Lynch, "Distributed Algorithms", Morgan Kaufmann, 1996.

Information Security

Course Code: PGMTH1E019T

Course Title: Information Security

Semester: I

Credits: 04

Course Overview

Information security (infosec) is a set of strategies for managing the processes, tools and policies necessary to prevent, detect, document and counter threats to digital and non-digital information. Infosec programs are built around the core objectives of the CIA triad: maintaining the confidentiality, integrity and availability of IT systems and business data.

Course Objectives

- To understand the fundamentals of Cryptography.
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology.

Course Outcomes

After completion of course, students would be able to develop basic understanding of security, cryptography, system attacks and defences against them.

Information Security

Course Code: PGMTH1E019T

Course Title: Information Security

Semester: I

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I **Information Security Overview:** Services, Mechanisms, Attacks and its types, counter-measures, the OSI Security Architecture, A Model for Network Security, Trade-offs related to Information Security. **Cryptography:** Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography.	**10**
Unit-II **Data Encryption Standard**: DES cipher, Block Cipher Principles, The Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operation. Advanced Encryption Standard: Evaluation Criteria for AES, The AES Cipher, Triple DES, RC5	**10**
Unit-III **Key Management and Other Public-Key Cryptosystems**: Key Management, Diffie-Hellman Key Exchange Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACs. Hash Algorithms: MD5 Message Digest Algorithm, Secure Hash Algorithm and HMAC. Digital Signatures: Digital Signatures, Digital Signature Standard.	**10**
Unit-IV **Network Security Practice:** Authentication Applications: Kerberos, X.509 Authentication Service, Electronic Mail Security: Pretty Good Privacy, S/MIME. IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management, Web Security: Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.	**10**

Unit-V	10
System Security: Intruders: Intruders, Intrusion Detection, Password Management, Malicious Software: Viruses and Related Threats, Virus Countermeasures, Firewalls: Firewall Design Principles, Trusted Systems.	

Text/Reference Books

1. William Stallings, "Network Security Essentials", Pearson
2. Trappe & Washington, *"Introduction to Cryptography with Coding Theory*", Prentice-Hall 2001
3. Behrouz A Forouzan, "Data Communications and Networking", McGrawHill
4. D Stinson, "Cryptography: Theory and Practice", Second Edition Chapman & Hall 2002.
5. Kaufman, Perlman, and Speciner, "Network Security", Prentice-Hall Second Edition 2001.
6. Michael E. Whitman, "Principles of information Security" , Cengage Learning, New Delhi
7. Chwan-Hwa (John) Wu (Author), J. David Irwin "Introduction to Computer Networks and Cybersecurity"
8. Roberta Bragg "Network Security: The Complete Reference" McGraw Hill
9. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education

Advanced Computer Architecture

Course Code: PGMTH1E020T

Course Title: Advanced Computer Architecture

Semester: I

Credits: 04

Course Overview

This course is about the principles of computer design, instruction set design concepts, performance enhancements, new and alternative computer architectures, and the design and implementation of high performance computing systems. It equips you with the skills to undertake performance comparisons, improve the performance of applications, and develop applications to solve computationally intensive problems.

Course Objectives

- A broad and deep knowledge of contemporary computer architecture issues and techniques.
- Knowledge of advanced hardware-based techniques for exploiting instruction level parallelism.
- Knowledge of various architectures and techniques used for building high performance scalable multithreaded and multiprocessor systems.

Course Outcomes

After completion of course, students would be able to:

- Describe the principles of computer design.
- Classify instruction set architectures.
- Describe the operation of performance enhancements such as pipelines, dynamic scheduling, branch prediction, caches, and vector processors.
- Account and argue for the design and programming of multiprocessor systems and shared memory, especially taking coherence and memory modules into account.
- Describe the operation of virtual memory.
- Describe modern architectures such as RISC, Super Scalar, VLIW (very large instruction word), multi-core and multi-CPU systems.
- Compare the performance of different architectures.

Advanced Computer Architecture

Course Code: PGMTH1E020T

Course Title: Advanced Computer Architecture

Semester: I

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Usage Trends, Cost and Trends in Cost, Measuring and Reporting Performance, Benchmarks and metrics. **Instruction Set Principles and Examples:** Classification of Instruction Set Architectures, Instruction Formats and Semantics, Memory Addressing Modes, Operations in the Instruction Set, Encoding and Instruction Set, The Role of Compilers.	**10**
Unit-II **Advanced Pipelining and Instruction-Level Parallelism:** Basic Pipeline Operations, Data and Control Pipeline Hazards, Instruction-Level Parallelism, Dynamic Instruction Scheduling and Branch Prediction.	**10**
Unit-III **Memory-Hierarchy Design:** Cache Design Issues, Performance Evaluation, Virtual Memory Addressing, Memory Protection Mechanisms, Memory coherency techniques. **Storage Systems:** Types of Storage Devices, Buses-Connecting I/O Devices to CPU/Memory, I/O Performance Measures, Reliability, Availability, and RAID, Interfacing to an Operating System	**10**
Unit-IV **Interconnection Networks:** Interconnection network Media, Connecting More Than Two Computers, Practical Issues for Commercial Interconnection Networks, Examples of Interconnection Networks	**10**
Unit-V **Multiprocessors (Time Permitting):** Characteristics of Application Domains, Centralized Shared-Memory Architectures, Distributed Shared-Memory Architectures, Execution Synchronization, Models of Memory Consistency	**10**

Text/Reference Books

1. John L. Hennessy and David A. Patterson, "**Computer Architecture: A Quantitative Approach"**, Morgan Kaufmann, 5/e, 2011.
2. William Stallings, "Computer Organization and Architecture", Prentice Hall, 9/e, 2012
3. Alexander Klaiber, "The Technology Behind Crusoe Processors", Transmeta's Website.

Modeling Simulation and Optimization

Course Code: PGMTH1E021T

Course Title: Modeling Simulation and Optimization

Semester: I

Credits: 04

Course Overview

The course provides introduction to simulation, its significance and important applications. It explains how simulation models can be classified and how simulation procedures can be developed based on the models. Students will learn the different methods to generate random numbers and the statistical techniques required for measuring the quality of generators. Further, students will be exposed to the different networking simulation tools.

Course Objectives

- Introduce computer simulation technologies and techniques, provides the foundations for the student to understand computer simulation needs, and to implement and test a variety of simulation and data analysis libraries and programs. This course focuses what is needed to build simulation software environments, and not just building simulations using pre-existing packages.
- Introduce concepts of modelling layers of society's critical infrastructure networks.
- Build tools to view and control simulations and their results.

Course Outcomes

After completion of course, students would be able to:

- Understand the meaning of modeling and simulation.
- Know what is GPSS model and understand different statistical tests for measuring quality of generators
- Understand the concept of random numbers and the method to generate random numbers
- Understand random processes and different queuing models
- Network simulation tools.

Modeling Simulation and Optimization

Course Code: PGMTH1E021T

Course Title: Modeling Simulation and Optimization

Semester: I

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Introduction: Systems, models, deterministic and stochastic systems, static and dynamic systems, discrete event simulation, continuous simulation, Monte Carlo simulation. Discrete Event Simulation: Time-advance mechanisms, event modeling of discrete dynamic systems, event graphs, process oriented and event oriented approaches, single-server single queue model.	**10**
Unit-II GPSS: Program model, entities and transactions, blocks in GPSS, user defined functions, SNA, logic switches, save locations, user chains, tabulation of result, programming examples. Random Number Generation: Congruence generators, long period generators, statistical quality measures of generators, uniformity and independence testing, chi-square and other hypotheses testing, runs testing	**10**
Unit-III Random Variable Generation: random variable, probability density and distribution functions, Location, scale and shape parameters, discrete and continuous probability distributions; Inverse transform method, composition and acceptance-rejection methods, efficiency and quality measures of generators; Input Modelling, selection of distribution for a random source, fitting distributions to data, constructing empirical distributions from data.	**10**
Unit-IV Random Processes and Queuing Models: random process, discrete/continuous time processes, Markovian property, Markov chain, state transition diagrams, birth-death process, Little's theorem, steady state analysis of M/M/1 model; multi-server models, M/G/1 and other queuing models, Burke's theorem, network of queues, Jackson theorem.	**10**
Unit-V Network Simulation: SimEvent tool box in R/Python/Octave, general features of network simulation packages, case study of OMNET++/ns2/ns3/NetSim.	**10**

Text/Reference Books

1. Network Simulation: SimEvent tool box in R/Python/Octave, general features of network simulation packages, case study of OMNET++/ns2/ns3/NetSim.
2. Banks, J., Carson, L.S., Nelson, B.L. and Nicol, D.M., "Discrete Event System Simulation", 4th Ed., Pearson Education

3. Law, A.M. and Kelton, W.D., "Simulation, Modeling and Analysis", 3rd Ed., Tata McGraw-Hill.
4. Alberto Leon-Garcia, "Probability and Random Processes for Electrical Engineers", 2nd Ed., Pearson Education

Soft Computing

Course Code: PGMTH1E022T

Course Title: Soft computing

Semester: I

Credits: 04

Course Overview

Soft computing is an emerging approach to computing which parallel the remarkable ability of the human mind to reason and learn in an environment of uncertainty and imprecision. Soft computing is based on some biological inspired methodologies such as genetics, evolution, one's behaviour, particles swarming, human nervous systems, etc. It has enormous applications in many application areas such as medical diagnosis, computer vision, hand written character recondition, pattern recognition, machine intelligence, weather forecasting, network optimization, VLSI design, etc.

Course Objectives

- To provide an introduction to the basic principles, techniques, and applications of soft computing.
- The student should be able to choose appropriate soft computing technique and use it to solve a specific problem.
- Students should be able to understand the necessary mathematical abstraction to solve problems.
- Upon successful completion of the course, students will have an understanding of the basic areas of Soft Computing including Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms
- Student should be able to come up with analysis of efficiency.

Course Outcomes

After completion of course, students would be able to learn:

- Identify and describe soft computing techniques and their roles in building intelligent machines
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem.
- Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.

Soft Computing

Course Code: PGMTH1E022T

Course Title: Soft computing

Semester: I

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Soft Computing: Introduction, soft computing vs. hard computing, various types of soft computing techniques, Applications of soft computing techniques, Introduction, Structure and function of a neuron, Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural networks, Difference between ANN and human brain, Characteristics and applications of ANN.	**10**
Unit-II Learning rules, Thresholds and activation functions, Single layer network, Perceptron and its training algorithm, Linear Separability, XOR problem, ADALINE, MADALINE. Introduction to multilayer layer Perceptron, Back propagation neural(BPN) networks,	**10**
Unit-III Counter propagation network, Hopfield/ Recurrent network, Associative memory, Hopfield v/s Boltzman machine, competitive learning, Kohonen's self organizing networks, Adaptive Resonance Theory(ART).	**10**
Unit-IV Introduction to Fuzzy Logic: Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations, Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic: FIS, Fuzzification and de-Fuzzification.	**10**
Unit-V Genetic algorithms(GA): Basic concepts, Conventional Vs. GA, Simple, GA working, encoding, fitness function, reproduction, Selection, crossover, mutation, schema analysis, analysis of selection algorithms; convergence; Reproduction, Crossover, and mutation, Mapping objective functions to fitness form, Fitness scaling. Meta-heuristic search: Overview of ACO, PCO	**10**

Text/Reference Books

1. S, Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication.
2. S.N. Sivanandam & S.N. Deepa, Principles of SoftComputing , Wiley Publications.
3. Rich E and Knight K, Artificial Intelligence, TMH, New Delhi.
4. Bose, Neural Network fundamental with Graph , Algo.& Appl, TMH.
5. Kosko: Neural Network & Fuzzy System, PHI Publication.
6. Klir & Yuan ,Fuzzy sets & Fuzzy Logic: Theory & Appli.,PHI Pub.
7. Genetic Algorithm, Goldberg

Android and iOS based Application Development

Course Code: PGMTH1E023T

Course Title: Android and iOS based Application Development

Semester: I

Credits:04

Course Overview

This course provides a two main mobile application development platforms namely Android and iOS. Students will learnemerging technologies and tools used to design and implement feature-rich mobile applications for smart phones and tablets. Further, students will be exposed totechnical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile.

Course Objectives

- Student should understand the two main mobile platforms and their ecosystems, namely Android and iOS.
- Student should explores emerging technologies and tools used to design and implement feature-rich mobile applications for smart phones and tablets.
- Students should be able to understand the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, user interface, context and profile of Android and iOS.

Course Outcomes

After completion of course, students would be able to:

- identify the target platform and users and be able to define and sketch a mobile application
- understand the fundamentals, frameworks, and development lifecycle of mobile application platforms including iOS, Android
- Design and develop a mobile application prototype in one of the platform (challenge project)

Android and iOS based Application Development

Course Code: PGMTH1E023T

Course Title: Android and iOS based Application Development

Semester: I

Credits:04

Course Outlines

Contents	No of Lectures
Unit-I Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User	**10**
Unit-II More on Uis: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal Uis, Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider	**10**
Unit-III Communications via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony Notifications and Alarms: Performance, Performance and Memory management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics	**10**
Putting It All Together : Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia	**10**
Unit-V Platforms and Additional Issues : Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking , Active Transactions, More on Security, Hacking Android	**10**

Text/Reference Books

1. Wei-Meng Lee, Beginning Android™ 4 Application Development, 2012 by John Wiley & Sons
2. The iOS 5 Developer's Cookbook - Erica Sadun – Addison-Wesley 2012
3. Android in Practice - Charlie Collins, Michale Galpin, Matthias Kaeppler – Manning Publications 2012
4. Mobile Computing – 2nd edition – Devi Kamal – Oxford University Press 2012

PHP and My SQL

Course Code: PGMTH1E024T

Course Title: PHP and My SQL

Semester: I

Credits: 04

Course Overview

This course provides a basic understanding to scripting language PHP. This training course is for web designers and developers who plan to create dynamic websites using PHP and MySQL. Learners will be able to apply their knowledge to the creation of dynamic Web applications such as content management, user registration, and e-commerce.

Course Objectives

- Understand how server-side programming works on the web.
- PHP Basic syntax for variable types and calculations.
- Creating conditional structures
- Storing data in arrays
- Using PHP built-in functions and creating custom functions
- Create a database in phpMyAdmin.
- Read and process data in a MySQL database.

Course Outcomes

After completion of course, students would be able to:

- Ability to design web pages using features of PHP
- Acquire programming skills using scripting languages
- Create a database in phpMyAdmin.
- Read and process data in a MySQL database.

PHP and My SQL

Course Code: PGMTH1E024T

Course Title: PHP and My SQL

Semester: I

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Introduction to PHP Evaluation of Php, Basic Syntax, Defining variable and constant, Php Data type, Operator and Expression, Decisions and loop Making Decisions, Doing Repetitive task with looping, Mixing Decisions and looping with Html.	**10**
Unit-II Function: Introduction to function, function definition, Call by value and Call by reference, Recursive function, String Creating and accessing, String Searching & Replacing String, Formatting String, String Related Library function	**10**
Unit-III Anatomy of an Array, Creating index based and Associative array Accessing array, Element Looping with Index based array, Looping with associative array using each () and foreach(), Some useful Library function.	**10**
Unit-IV Capturing Form, Data Dealing with Multi-value filed, and Generating File uploaded form, redirecting a form after submission. Introduction to Session Control, Session Functionality, Cookie, Setting Cookies with PHP. Using Cookies with Sessions, Deleting Cookies, Registering Session variables, Destroying the variables and Session.	**10**
Unit-V Introduction to RDBMS, Connection with MySql Database, Performing basic database operation(DML) (Insert, Delete, Update, Select), Setting query parameter, Executing queryJoin (Cross joins, Inner joins, Outer Joins, Self joins.) Understanding Exception and error, Try, catch, throw. Error tracking and debugging	**10**

Text/Reference Books

1. Learning PHP, MySQL, books by ‘ O’ riley Press
2. Beginning PHP and MySQL , 3rd Edition , Jason Gilmore,Apress Publications (Dream tech.).
3. Learning PHP and MySQL, Second Edition by Michele E. Davis and Jon A. Phillips
4. MySQL: The Complete Reference by Vikram Vaswani.
5. PHP: A Beginner's Guide by Vikram Vaswani.

Advanced Web Technologies

Course Code: PGMTH1E025T

Course Title: Advanced Web Technologies

Semester: I

Credits: 04

Course Overview

This course deals with how to make web sites that serve "dynamic content": content that is based on returning or updating results in a database. Example systems include travel reservations, online shopping.

Course Objectives

- To provide an insight to WWW, Servlets.
- Understand how to apply a framework to help identify strategic uses of Internet.
- Compare the fundamental types of web technologies and how they can be used to provide real business benefit.
- Upon successful completion of the course, students will have an understanding of the web services, java server pages,.NET framework.

Course Outcomes

After completion of course, students would be able to:

- Define the fundamental ideas and standards underlying Web Service Technology.
- Work with .NET framework,ASP.NET.
- Understand and use the basics of the XML based technologies.
- Understand and define and utilize the Web Services .

Advanced Web Technologies

Course Code: PGMTH1E025T

Course Title: Advanced Web Technologies

Semester: I

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Introduction: The World Wide Web, WWW Architecture, Web Search Engine, Web Crawling, Web Indexing, Web Searching, Search Engine Optimization and Limitations, Introduction to the Semantic Web	**10**
Unit-II Introduction to Servlets, Servlet Life Cycle, Servlet Classes, Servlet, Servlet Request, Servlet Response, Servlet Context, Threading Models, Http Sessions	**10**
Unit-III Java server pages : JSP Development Model ,Components of JSP page , Request Dispatching , Session and Thread Management	**10**
Unit-IV Introduction to Web Services: Software as a Service, Web Service Architectures, SOA(Service Oriented Architecture), XML Syntax, DTDs and XML Schema, XPath, XSLT, Sax and DOM	**10**
Unit-V Introduction to .NET Framework : Evolution of .NET, Comparison of Java and .NET, Architecture of .NET Framework, Common Language Runtime, Common Type System, Meta Data, Assemblies, Application Domains, CFL, Features of .NET, Advantages and Applications. Web applications in ASP.NET: ASP.NET Coding Modules, ASP.NET Page directives, Page Events and Page Life Cycle, Post Back and Cross Page Posting, ASP.NET Application Compilation Models, ASP.Net, Server Controls, HTML Controls, Validation Controls, Building Databases.	**10**

Text/Reference Books

1. ASP.NET: The Complete Reference Book, Matthew Macdonald, McGraw Hill education.
2. Web Technology & Design, C.Xavier, New Age International Publication, Delhi.
3. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.
4. Papazoglou, Web Services: Principles and Technology (2nd edition); ISBN: 978-0-273-73216-7, Prentice Hall, 2012.

SEMESTER-II

Advanced Database Management Systems

Course Code: PGMTH2C009T

Course Title: Advanced Database Management Systems

Semester: II

Credits: 04

Course Overview

This course provides s a detailed insight into implementation aspects of relational systems and tests the candidates' knowledge of the current enhancements to relational database systems. Students will learn about the advanced concepts of the databases such as data FD, concurrency, Recovery, XML and security aspects of databases.

Course Objectives

- To understand the basic concepts and terminology related to DBMS and Relational Database Design
- To the design and implement Distributed Databases.
- To understand advanced DBMS techniques to construct tables and write effective queries, forms, and reports

Course Outcomes

Upon successful completion of this course, candidates will be able to demonstrate their competence in, and their ability to:

- Exposure for students to write complex queries including full outer joins, self-join, sub queries, and set theoretic queries.
- Knowhow of the file organization, Query Optimization, Transaction management, and database administration techniques

Advanced Database Management Systems

Course Code: PGMTH2C009T

Course Title: Advanced Database Management Systems

Semester: II

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I An overview of database management system, database system Vs file system, Database system concepts and architecture, data models schema and instances ER Model, Database models, Representation and Evaluation of Relationship Review of Relational Database Design, Storage, Access Structures.	**10**
Unit-II Formal review of relational database and FDs Implication, Closure, its correctness. 3NF and BCNF, 4NF, 5NF, Decomposition and synthesis approaches, Review of SQL99, Basics of query processing, external sorting, file scans.	**10**
Unit-III Processing of joins, materialized vs. pipelined processing, query transformation rules, DB transactions, ACID properties, interleaved executions, schedules, serializability.	**10**
Unit-IV Correctness of interleaved execution, Locking and management of locks, 2PL, deadlocks, multiple level granularity, CC on B+ trees, Optimistic CC	**10**
Unit-V Multiversion approaches, Comparison of CC methods, dynamic databases, Failure classification, recovery algorithm, XML and relational databases, Base properties, No SQL:MOMO DB.	**10**

Text/Reference Books

1. R. Ramakrishnan, J. Gehrke, Database Management Systems, McGraw Hill, 2004
2. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill
3. Elmasri, Navathe, "Fundamentals Of Database Systems", Addision Wesley
4. Date C J, "An Introduction To Database System", Addision Wesley
5. Bipin C. Desai, "An introduction to Database Systems", Galgotia Publication
6. Rob and Coronel, "Database Systems 5th Edition",Cengage Learning, New Delhi
7. U. M. Fayyad, G. P. Shapiro, P. Smyth and R. Uthurusamy, "Advances in Knowledge Discovery and Data Mining", The M.IT. Press, 1996.
8. Jiawei Han and MichelineKamber, "Data Mining Concepts and Techniques", Morgan Kauffmann Publishers, 3/e, 2011.
9. Sean Kelly, "Data Warehousing in Action", John Wiley & Sons Inc., 1997.
10. Michael J. A. Berry, Gordon S. Linoff, "Mastering Data Mining", Wiley, 1999.

Advanced Software Design, Development & Testing

Course Code: PGMTH2C010T

Course Title: Advanced Software Design, Development and Testing

Semester: II

Credits: 04

Course Overview

Generic techniques for modelling, design and implementation of modular software, focussing on industrial techniques and domains. Component-based design, component-based architectures and frameworks, distributed component-based systems. Model-driven development of software, code generation and domain-specific languages. Testing, continuous integration, deployment and governance.

Course Objectives

- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
- To learn the process of improve the quality of software work products.
- To gain the techniques and skills on how to use modern software testing tools to support software testing projects.
- To expose Software Process Improvement and Reengineering

Course Outcomes

After completion of course, students would be able to:

- Be able to design analyse, implement, test and deliver real-world software systems
- Be able to design software engineering processes appropriate to a specific problem or set of non-functional requirements
- Be able to research, understand and apply cutting edge computing technology to the solution of complex problems in software engineering
- Be able to work with external stakeholders to develop quality requirements specifications
- Be able to effectively manage large teams utilising a variety of software engineering processes

Advanced Software Design, Development & Testing

Course Code: PGMTH2C010T

Course Title: Advanced Software Design, Development and Testing

Semester: II

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Process and product quality, Process classification, Process measurement, Process analysis and modelling and Process change. The CMMI process improvement framework, Configuration management planning, Change management, Version and release management, System building and CASE tools for configuration management.	10
Unit-II Metrics in the Process and Project Domains, Software Measurement, Metrics for software quality, Integrating metrics within the software process, Metrics for small organizations and Establishing a software metrics program.	10
Unit-III The reuse landscape, Design patterns, Generator-based reuse, Application frameworks and Application system reuse. Components and component models, Component Based Software Engineering (CBSE) process and Component composition. User interface design issues, The UI design process, User analysis, User interface prototyping and Interface evaluation. Software maintenance, Business process reengineering, Software reengineering, Reverse engineering, Restructuring, Forward engineering and The economics of reengineering.	10
Unit-IV Services as reusable components, Service engineering, Software development with services, Aspect-Oriented Software Development. The separation of concerns, Aspects, join points and point-cuts and Software engineering with aspects.	10
Unit-V The Cleanroom Strategy, Functional specification, Cleanroom design, Cleanroom testing; Formal methods and concepts, Applying mathematical notation for	10

formal specification, Formal specification languages and Various types of advanced testing strategies: Regression Testing Random testing, Web Based Testing etc..	

Text/Reference Books

1. Roger S.Pressman Software engineering- A practitioner's Approach, Publisher : McGraw-Hill International
2. Ian Sommerville Software engineering, Publisher : Pearson education Asia
3. Pankaj Jalote Software Engineering, Publisher : A Precise Approach Wiley
4. Ali Behhforoz & Frederick Hudson Software Engineering Fundamentals, Publisher : OXFORD

Network and Cyber Security

Course Code: PGMTH2E021T

Course Title: Network and Cyber Security

Semester: II

Credits: 04

Course Overview

Cyber security, a subset of information security, is the practice of defending an organization's networks, computers and data from unauthorized digital access, attack or damage by implementing various processes, technologies and practices. Network security, a subset of cyber security, aims to protect any data that is being sent through devices in your network to ensure that the information is not changed or intercepted.

Course Objectives

- To understand the need of network and cyber security
- To understand the need and working of cryptography.
- To understand how network threats materialize into attacks.
- To understand the tools for threats, attacks, exploits.

Course Outcomes

After completion of course, students would be able to:

- Analyze the vulnerabilities in the network.
- Identify the security issues in networks
- Working of various tools for attacks and defence

Network and Cyber Security

Course Code: PGMTH2E021T

Course Title: Network and Cyber Security

Semester: II

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Introduction: Information Security, OSI security architecture, Threats, Vulnerabilities, Attacks-active and passive attacks, malware and its types, obfuscation and mutations in malware, rootkits, zero day vulnerabilities, Hacking and its types, ethical hacking process.	**10**
Unit-II Cryptography: Cryptographic principles, Classical encryption techniques, cipher types, Symmetric Key Cryptography: DES, AES, Cipher modes. Asymmetric key Cryptography: RSA, Diffie-Hallman Introduction to Hash Functions.	**10**
Unit-III Cybercrimes: Introduction, classification of cybercrimes, types of cybercriminals,3P's in cybercrime-phishing, pharming and phoraging, cyberstalking; internet bots, botnet attacks and defence, network reconnaissance, attack vectors ,advanced persistent threat(APT)	**10**
Unit-IV Tools and Techniques: Introduction, Proxy servers, Anonymizers, Keyloggers, Steganography, DoS, DDoS, SQL Injections, Buffer overflow, Attacks on wireless Networks, Web based attacks-web service protection, HTTP response splitting attacks, database defensive measures	**10**
Unit-V Cyber Threats and defense: Firewalls and its types, Intrusion Detection System (IDS) Intrusion Prevention System (IPS), Virtual Private Networks (VPN) and Access Control, Domain Name system protection-Cache poisoning attack, Honeypots and its working, analysing honeypot data.	**10**

Text/Reference Books

1. Behrouz A. Forouzan, "Cryptography and Network Security", Tata McGraw-Hill
2. William Stalling, "Network Security Essentials",Pearsons
3. Tannenbaum, " Computer Networks",Pearsons
4. Cyber Security, Nina Godbole ,SunitBelapure ,Wiley India.

5. Introduction to Computer Networks And Cyber Security, Ist Edition ,Chwan-Hwa(John) Wu (Author),J.David Irwin.

Big Data Analytics

Course Code: PGMTH2E022T

Course Title: Big Data Analytics

Semester: II

Credits: 04

Course Overview

With the expansion of computer and internet technology, and more recently the Internet of Things, previously unthinkable amounts of data are now regularly being collected and used for knowledge extraction to support day-to-day operations as well as strategic planning of businesses and organizations. Together with huge benefits, Big Data also introduced security and privacy concerns. This course introduces students to Big Data and the benefits it can provide to business. Students learn the main concepts in relation to Big Data storage and analytics, and security issues that arise in relation to Big Data.

Course Objectives

- Understand the Big Data Platform and its Use cases
- Provide an overview of Apache Hadoop
- Provide HDFS Concepts and Interfacing with HDFS
- Understand Map Reduce Jobs
- Apply analytics on Structured, Unstructured Data.
- Exposure to Data Analytics with R.

Course Outcomes

After completion of course, students would be able to:

- Understand what Big Data is and why classical data analysis techniques are no longer adequate
- Understand the benefits that Big Data can offer to businesses and organizations
- Understand conceptually how Big Data is stored
- Understand how Big Data can be analyzed to extract knowledge

Big Data Analytics

Course Code: PGMTH2E022T

Course Title: Big Data Analytics

Semester: II

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Big Data:Introduction, Characteristic Features , unstructured data, Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems convergence of key trends, examples of big data (web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics. Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis vs Reporting - Modern Data Analytic Tools.	**10**
Unit-II Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peerpeer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations	**10**
Unit-III Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, file-based data structure. MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output format	**10**
Unit-IV Statistical Methods: Regression modelling, Multivariate Analysis - Classification: SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data - Predictive Analytics – Data analysis using R.	**10**
Unit-V Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra	**10**

clients, Hadoop integration. .	

Text/Reference Books

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of
4. Polyglot Persistence", Addison-Wesley Professional, 2012.
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
6. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
7. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
8. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.

Computer Vision

Course Code: PGMTH2E023T

Course Title: Computer Vision

Semester: II

Credits: 04

Course Overview

This course provides an introduction to computer vision including fundamentals of image formation, feature extraction, feature analysis, pattern analysis and dimensionality reduction. The focus of the course is to develop the intuitions and mathematics of the methods in lecture, and then to learn about the difference between theory and practice in the problem sets.

Course Objectives

- Be familiar with both the theoretical and practical aspects of computing with images.
- Have described the foundation of image formation, measurement, and analysis.
- Understand the geometric relationships between 2D images and the 3D world.
- Grasp the principles of state-of-the-art deep neural networks.

Course Outcomes

After completion of course, students would be able to:

- Developed the practical skills necessary to build computer vision applications.
- To have gained exposure to object and scene recognition and categorization from images

Computer Vision

Course Code: PGMTH2E023T

Course Title: Computer Vision

Semester: II

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis	**10**
Unit-II Edge detection, Edge detection performance, Hough transform, corner detection	**10**
Unit-III Segmentation, Morphological filtering, Fourier transform Recent trends in Activity Recognition, computational photography, Biometrics.	**10**
Unit-IV Feature extraction, shape, histogram, colour, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data pre-processing.	**10**
Unit-V Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods.	**10**

Text/Reference Books

1. Richard Szeliski, Computer Vision: Algorithms and Applications 3rd Edion , 2015.
2. Good fellow, Bengio, and Courville :Deep Learning, 1st edion 2016.
3. Fisher et al: Dictionary of Computer Vision and Image Processing, 1st Edion 2014.

Computing Systems for Robotics

Course Code: PGMTH2E024T

Course Title: Computing Systems for Robotics

Semester: II

Credits: 04

Course Overview

The course is about the basics of Robot operating systems (ROS) and Robot Simulations.

Course Objectives

1. To understand ROS publisher-subscriber strategy.
2. To understand working of Simulated Robots.
3. To implement Robot navigation algorithms

Course Outcomes

After completion of course, students would be able to:

- Create their own publisher and subscriber in ROS.
- The students would also be able to send and receive messages to the simulated robots

Computing Systems for Robotics

Course Code: PGMTH2E024T

Course Title: Computing Systems for Robotics

Semester: II

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Introduction to ROS, publisher-subscribers in ROS, creating user node in ROS. Communication between on ROS nodes through messages. Select and implement the appropriate ROS components for a robotics problem.	**10**
Unit-II Working with turtlesim and turtlebot-gazebo simulators. Building a user defined world in Gazebo. Translation, rotation, scaling of models. Saving and loading of a world. Communicating with the simulators.	**10**
Unit-III Visualize the simulated robot in rviz. Visualizing Sensor Data with rviz. Creating map of the environment in Gazebo. Saving and Loading of the map.	**10**
Unit-IV Apply algorithms for robotic perception, planning, navigation, localization, and manipulation. Implement and use algorithms for controlling mobile robots.	**10**
Unit-V Program and navigate mobile robots: robot and map representations, motion planning.	**10**

Text/Reference Books

1. Jason M. O'Kane, A Gentle Introduction to ROS, independently published, Updated on 2016.
2. Programming Robots with ROS: A Practical Introduction to the Robot Operating System.
3. Carol Fairchild, Dr. Thomas L. Harman, ROS Robotics By Example, Second Edition: Learning to control wheeled, limbed, and flying robots using ROS Kinetic Kame Paperback November 30, 2017.

Agile Software Developement

Course Code: PGMTH2E025T

Course Title: Agile Software Developement

Semester: II

Credits: 04

Course Overview

This course imparts knowledge to students in the basic concepts of Agile Software Process, methodology and its development. The scheme of the course develop the basic concepts of Agile Software Process to gain knowledge in the area of various Agile Methodologies. One third of the course explains the basic concepts while the other two third familiarize with the development of Agile Software Process and principles of Agile Testing.

Course Objectives

- To introduce the students with the basic features in software development
- To provide students with a theoretical as well as practical understanding of agile software development practices
- To make the students understand how small teams can apply development practices to create high-quality software.
- To familiarize students with advanced paradigms associated with software development.

Course Outcomes

After completion of course, students would be able to:

- Work on an iterative, incremental development process leading to faster delivery of more useful software
- Understand the essence of agile development methods
- Deal with the principles and practices of extreme programming

Agile Software Developement

Course Code: PGMTH2E025T

Course Title: Agile Software Developement

Semester: II

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Process, Project, Product, Method, Tool, Modern Life cycle, Traditional development approaches. Introduction to Agile Software Development: Understanding how traditional software development works and it's problems; Role of Agile practices in the world of software development & Tools used.	**10**
Unit-II Model, Component based development model, Agile Development Model, Unified Process Model, Extreme Programming, Feature Driven development, Lean Software Development, Service Oriented Architecture, Aspect Oriented Development.	**10**
Unit-III Agile Project Planning And Management: Agile Scrum Framework, Project Planning, Scheduling, Agile Estimation, Iterative Planning, Roles, Requirement Analysis, Estimation techniques, Iteration planning, Introduction to development practices: TDD : Test Driven Development & Pair Programming, Introduction to QA Practices: Fail Fast & Automated functional testing, Introduction to Continuous Integration New paradigms in software specification and design, Agile Specification, Short review of UML.	**10**
Unit-IV Software architecture, Object-oriented Design, Software Patterns, Pattern-oriented Design, Component-oriented design. Software Frameworks, Agile Design Coding and testing practices: Practicing TDD and pair programming as alternative to traditional documentation; Configuring Continuous Integration tools; automated function testing in detail, Source Control Agile Software development and deployment: Iterative and incremental software development, Automated and scripted deployment strategies, Handling change requests.	**10**
Unit-V . The Agile lifecycle and its impact on testing, Test-Driven Development (TDD),	**10**

Unit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester	

Text/Reference Books

1. Ken Schwaber, Mike Beedle, Agile Software Development with Scrum, Pearson. 2008.
2. Roger S. Pressman, Software Engineering, A practitioner's Approach, 7th edition. McGraw Hill International Edition.
3. Sommerville, Software Engineering,7th edition, Pearson education.
4. Robert C. Martin, Agile Software Development, Principles, Patterns and Practices, Prentice Hall, 2002.

Cloud Computing

Course Code: PGMTH2E026T

Course Title: Cloud Computing

Semester: II

Credits: 04

Course Overview

Cloud Computing is a large-scale distributed computing paradigm which has become a driving force for information technology over the past several years. The exponential growth data size in scientific instrumentation/simulation and social media has triggered the wider use of cloud computing services. This course covers topics and technologies related to Cloud Computing, different architectural models of cloud computing, the concepts of virtualisation and cloud orchestration. Advanced cloud programming paradigms such as Hadoop's MapReduce is also included in the course.

Course Objectives

- Understand various basic concepts related to cloud computing technologies
- Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
- Understand big data analysis tools and techniques
- Understand the underlying principle of cloud virtualization, cloud storage, data management and data visualization.
- Understand different cloud programming platforms and tools
- Understand the core issues of cloud computing such as security, privacy, and interoperability
- Learn basic concepts of Map Reduce programming models for big data analysis on cloud

Course Outcomes

After completion of course, students would be able to:

- Understand cloud computing models, namely, infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS).
- Understand security implications in cloud computing.
- Analyse the operation, implementation and performance of cloud computing systems, and the relative merits and suitability of each for complex data-intensive applications.
- Analyse the trade-offs inherent in Cloud Computing.

Cloud Computing

Course Code: PGMTH2E026T

Course Title: Cloud Computing

Semester: II

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Distributed Computing and Enabling Technologies. Vision of Cloud Computing, Defining a Cloud. Desired features and benefits, issues and challenges of cloud computing. Exploring the Cloud Computing Stack, Architecture, Applications, deployment models, and service models. .	**10**
Unit-II Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Need for Virtualization, Pros and Cons of Virtualization Types of Virtualization: Hardware, Storage and Network virtualization, Concept of Hypervisors, Virtual machines provisioning and manageability: VM provisioning process	**10**
Unit-III Distributed Management of Virtual Infrastructures, Server consolidation, Dynamic provisioning and resource management, Resource Optimization and Load Balancing, various load balancing techniques Broad Aspects of Migration into Cloud, Migration of virtual Machines and techniques. Fault Tolerance Mechanisms.	**10**
Unit-IV Cloud Storage definition, Provisioning cloud storage: unmanaged cloud storage, managed cloud storage. Introduction, Apache Hadoop: Framework to process big data, Master/ Slave architecture, Core components, Map-Reduce Programming Model: Map reduce working, working of mapper, working of reducer, Running Hadoop on cloud, Design of data applications based on Map Reduce in Apache Hadoop.	**10**
Unit-V Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud – Cloud Computing Risk Issues- Security Challenges- Cloud Security and Trust Management Grid of Clouds, Green Cloud, Mobile Cloud Computing	**10**

Text/Reference Books

1. Cloud Computing Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley Publishers 2011.
2. Cloud Computing Bible, Barrie Sosinsky, Wiley Publishers 2010.
3. Cloud Computing: Web-based Applications that change the way you work and collaborate online, Michael Miller, Pearson Education 2008.
4. Mastering Cloud computing, Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, McGraw Hill 2013.
5. Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide, David S. Linthicum 2010.
6. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly 2010.
7. Cloud Computing : A Practical Approach, Toby Velte, Antohy T Velte, Robert Elsenpeter, McGraw Hill 2009.

Machine Learning

Course Code: PGMTH2E027T

Course Title: Machine Learning

Semester: II

Credits:04

Course Overview

This course provides understanding of machine learning algorithms. Students will learn the Supervised and Unsupervised type of learning. Further, students will be exposed to the recent trends in machine learning along with the introduction to the deep learning.

Course Objectives

- To learn the concept of how to learn patterns and concepts from data without being explicitlyprogrammed in various IOT nodes.
- To design and analyse various machine learning algorithms and techniques with a modernoutlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.
- To explore Deep learning technique and various feature extraction strategies.

Course Outcomes

After completion of course, students would be able to:

- Extract features that can be used for a particular machine learning approach in various IOT applications.
- To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
- To mathematically analyse various machine learning approaches and paradigms.

Machine Learning

Course Code: PGMTH2E027T

Course Title: Machine Learning

Semester: II

Credits:04

Course Outlines

Contents	No of Lectures
Unit-I **Supervised Learning (Regression/Classification)** Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive BayesLinear models: Linear Regression, Logistic Regression, Generalized LinearModels,Support Vector Machines, Nonlinearity and Kernel Methods, Beyond Binary Classification: Multi-class/Structured Outputs, Ranking	**10**
Unit-II **Unsupervised Learning** Clustering: K-means/Kernel K-means Dimensionality Reduction: PCA and kernel PCA Matrix Factorization and Matrix Completion Generative Models (mixture models and latent factor models)	**10**
Unit-III Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests), Deep Learning and Feature Representation Learning	**10**
Unit-IV Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference	**10**
Unit-V Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.	**10**

Text/Reference Books

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning,Springer 2009
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

Wireless Sensor Networks

Course Code: PGMTH2E028T

Course Title: Wireless Sensor Networks

Semester: II

Credits:04

Course Overview

This course provides a basic understanding of wireless sensor networks by the study of Architect sensor networks for various application setups. Students will learn the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers. Further students will be exposed to the techniques for performance evaluation of sensor networks and identify bottlenecks. The students will acquaint themselves with the Understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.

Course Objectives

- Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model links cost.
- Understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
- Evaluate the performance of sensor networks and identify bottlenecks

Course Outcomes

After completion of course, students would be able to:

- Describe and explain radio standards and communication protocols for wireless sensor networks.
- Explain the function of the node architecture and use of sensors for various applications.
- Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.

Wireless Sensor Networks

Course Code: PGMTH2E028T

Course Title: Wireless Sensor Networks

Semester: II

Credits:04

Course Outlines

Contents	No of Lectures
Unit 1: **Introduction to Wireless Sensor Networks:** Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors **Network Architecture:** Traditional layered stack, Cross-layer designs, Sensor Network Architecture **Hardware Platforms:** Motes, Hardware parameters	**10**
Unit-II **Introduction to ns-3: I**ntroduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example.	**10**
Unit III **Medium Access Control Protocol design:** Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled **Introduction to Markov Chain:** Discrete time Markov Chain definition, properties, classification and analysis **MAC Protocol Analysis:** Asynchronous duty-cycled. X-MAC Analysis (Markov Chain)	**10**
Unit IV: **Routing protocols:** Introduction, MANET protocols **Routing protocols for WSN**: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast **Opportunistic Routing Analysis**: Analysis of opportunistic routing (Markov Chain) Advanced topics in wireless sensor networks.	**10**
Unit-V **Security**: Possible attacks, countermeasures, SPINS, Static and dynamic key Distribution	**10**

Text/Reference Books

1. W. Dargie and C. Poellabauer, “Fundamentals of Wireless Sensor Networks –Theory andPractice”, Wiley 2010
2. KazemSohraby, Daniel Minoli and TaiebZnati, “wireless sensor networks - Technology,Protocols, and Applications”, Wiley Interscience 2007
3. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, “Wireless Sensor NetworkTechnologies for the Information Explosion Era”, springer 2010

Data Warehousing and Mining

Course Code: PGMTH2E029T

Course Title: Data Warehousing and Mining

Semester: II

Credits: 04

Course Overview

This course gives an introduction to methods and theory for development of data warehouses and data analysis using data mining, data quality and methods and techniques for preprocessing of data. Mining of data streams, time series, pattern mining web mining and distributed data mining.

Course Objective

- To introduce Data Warehousing and Mining techniques.
- To give detailed application of data mining in web mining, pattern matching and cluster analysis.

Course Outcomes

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

- Study different sequential pattern algorithms
- Study the techniques to extract the patterns from the time series data and its application in real world.

Data Warehousing and Mining

Course Code: PGMTH2E029T

Course Title: Data Warehousing and Mining

Semester: II

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Introduction to Data Warehousing :Data mining, data mining versus knowledge discovery in databases, basic data mining tasks, process of data mining (CRISP-DM), data mining issues, data mining techniques for analysis	**10**
Unit-II Statistical based: Logistic Regression, Bayes classification,Distance based, Simple approach, K Nearest Neighbour, Decision tree Induction, Rule based Classification, Support Vector Machine. Case Study: Prediction of Diabetes using Classification Algorithm.	**10**
Unit-III Clustering: K means Clustering, Agglomerative Hierarchial Clustering, Partitional Algorithms, Squared- Error Clustering, K means Clustering, Anomaly or Outlier Detection, Association Rules, Apriori Algorithm	**10**
Unit-IV Introduction, Working of Predictive analytics, Models: Predictive and Descriptive, Stages of Predictive Analysis, Data Collection, Data Analysis, Statistics, Modelling, Deployment and Monitoring, Graph Mining.	**10**
Unit-V Recent trends in Data Mining: Web Mining, Temporal Mining/Spatial Mining, Distributed Data mining, Oracle Data mining, Data mining in Bio Informatics, Data mining as a service (DMaaS)	**10**

Text/Reference Books

1. Jiawei Han and M Kamber, Data Mining Concepts and Techniques, Second Edition, Elsevier Publication, 2011.
2. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley, 2006.
3. Parteek Bhatia, Data Mining and Data Warehousing: Principles and Practical Techniques., Cambridge , 2019.

Advanced Java Programming

Course Code: PGMTH2E030T

Course Title: Advanced Java Programming

Semester: II

Credits: 04

Course Overview

Java is platform independent language and Object oriented Programming language. Using advanced Java programming language students can learn how to design dynamic web applications using Java Server Pages and Java Servlet and how to connect to data base drivers. Advanced java course consist JDBC, Servlet, JSP and JSTL. Using JDBC concept students can learn database concepts in depth and perform all CRUD operations easily. Using Servlet and JSP students can develop dynamic web pages.

Course Objectives

The goal of this course is to take students from core java to the advanced level of java programming .

This course covers the advanced topics of java programming (Advanced Class Design, JAVA Stream,

File and I/O Fundamentals, Generics and Collections Multithreaded Programming, AWT and event handling, Swing and GUI, Applet etc.)

Course Outcomes

After completion of course, students would be able to:

- use the Java programming language for various programming technologies (understanding)
- develop software in the Java programming language, (application)
- evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)
- propose the use of certain technologies by implementing them in the Java programming language to solve the given problem

Advanced Java Programming

Course Code: PGMTH2E030T

Course Title: Advanced Java Programming

Semester: II

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I The structure of a Java class ,Working With Java Data Types, Using Operators and Decision, operators Creating and Using Arrays, Using Loop, Working with Methods and, Encapsulation Working with Inheritance Class designing, Encapsulation and Visibility Modifiers, Formal and Actual Parameters, Scope of a Parameter, Call by Value, & Primitive Parameters Object Parameters, Overload methods, Use the instance of operator and casting.	**10**
Unit-II I/O Basics Streams, Byte Streams and Character Streams, Read and write data from the console, Use streams to read and write files, Use the Path class to operate on file, and directory paths Process, Thread, Defining a Thread, Instantiate a Thread, Starting Threads, Thread Life-cycle, Thread Priorities, Methods for Threads Implementation, Multithreading.	**10**
Unit-III Basic socket overview, client/server, reserved sockets, proxy servers, internet addressing, networking classes and interfaces, Internet address, TCP/IP Client Sockets, URL connection, TCP/IP server sockets. Java as a Database frontend, Database client/server methodology, Two-Tier Database Design, Three-Tier Database Design. The API Components, Limitations Using JDBC(Applications vs. Applets) ,Security Considerations , JDBC Drivers , JDBC-ODBC Bridge, Current JDBC Drivers.	**10**
Unit-IV Background, The Life Cycle Of a Servlet, The Java Servlet Development Kit, The Simple Servlet, The Servlet API, The Javax Servlet Package, Reading Servlet, Parameters Reading Initialization Parameters, The Javax. Servlet. http package, Handling HTTP Requests and responses, Using Cookies, Session Tracking, Security Issues, Exploring Servlet.	**10**
Unit-V **Applets:** Applet basics, Including an Applet on a Web Page, Graphics, animation, painting in applet. Java server pages : JSP Development Model ,Components of JSP page , Request Dispatching , Session and Thread Management.	**10**

Text/Reference Books

1. Herbert Schildt, Java - The Complete Reference, Tata McGraw- Hill, Seventh Edition(2008).

2. Jim Keogh, J2EE- The Complete Reference; Tata Mcgraw-Hill, Edition(2002).
3. Alur Deepak, Malks Dan and Crupi John, Core J2EE Patterns: Best Practices and Design Strategies, Prentice Hall India (2001).
4. Austin and Pawlan, Advanced Programming for JAVA 2 Platform, Pearson Education (2004).
5. Geary M. David , Core JSTL Mastering the JSP standard Tag Library, Pearson Education(2007).

SEMESTER-III

Advances in Operating Systems

Course Code: PGMTH3C009T

Course Title: Advances in Operating Systems

Semester: III

Credits:04

Course Overview

This course covers general issues of design and implementation of advanced modern operating systems. The focus is on issues that are critical to the applications of distributed systems and computer networks, which include inter-process communication, distributed processing, sharing and replication of data and files. Approximately one third of the course will be devoted to basic concepts and techniques, and the remaining two third will be on assorted current topics in modern operating systems and distributed systems.

Course Objectives

- To introduce the students with the basic features in distributed operating systems.
- To make the students understand the necessary message and Stream-Oriented communication.
- To familiarize students with advanced paradigms associated with code migration and scheduling in various operating systems.
- To provide a platform for students to understand and develop hands-on knowledge of advanced operating systems.

Course Outcomes

After completion of course, students would be able to:

- Have strong hands-on grasp of operating systems at the level of distributed operating system
- Analyze the security parameters in case of distributed systems.
- Implement a real/simulated operating system

Advances in Operating Systems

Course Code: PGMTH3C009T

Course Title: Advances in Operating Systems

Semester: III

Credits:04

Course Outlines

Contents	No of Lectures
Unit-I Operating System Introduction, Structures - Simple Batch, Multi programmed, time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, System services, System Calls, Virtual Machines, System Design and Implementation. Process and CPU Scheduling - Process concepts and scheduling, Operation on processes, Threads, and Inter-process Communication, Scheduling Criteria, Scheduling Algorithm, Multiple -Processor Scheduling, Real-Time Scheduling.	**10**
Unit-II Memory Management and Virtual Memory - Paging, Segmentation, Segmentation with Paging. Demand Paging, Performance of Demand Paging, Page Replacement, Page Replacement Algorithm, Allocation of Frames, Thrashing. Deadlocks - Methods for Handling Dead locks Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock. Process Management and Synchronization - The Critical Section Problem, Synchronization Hardware, Semaphores, Critical Regions, Monitors.	**10**
Unit-III Introduction to Distributed systems: Goals of distributed system, hardware and software Concepts, design issues. Lamport's logical clocks, vector clocks, causal ordering of messages.	**10**
Unit-IV Distributed mutual exclusion: Lamport's algorithm, Ricart-Agrawala Algorithm, Distributed deadlock detection: centralized algorithms	**10**
Unit-V .	**10**

Failure recovery and fault tolerance: classification of failures, Checkpoints, Synchronous and asynchronous check-pointing and recovery Operating System Security Issues- Introduction to the topic of Security in Operating Systems, Access Control Fundamentals and Generalized Security Architectures.	

Text/Reference Books

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, JohnWiley.
2. Singhal, M and Shivaratri, N. Advanced Concepts in Operating Systems. Tata McGraw Hill., 2001.
3. Kskhemkalyani, A and Singhal, M. Distributed computing: Principles, Algorithms, and systems.Cambridge University Press, 2011.
4. Silberschatz & Galvin, Operating System Concepts, 6th ed.
5. Coulouris et al., Distributed Systems: Concepts and Design, 3rd ed., - Lynch.
6. Ananda & Srinivasan, Distributed Computing Systems: Concepts and Structures Mullender, Distributed Systems.
7. Filman & Friedman, Coordinated Computing: Tools and Techniques for Distributed Software, - Andrews.
8. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001.
9. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
10. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

Pattern Recognition

Course Code: PGMTH3E014T

Course Title: Pattern Recognition

Semester: III

Credits: 04

Course Overview

This course covers the statistical, neural and structural approaches for the recognition and matching of various patterns in images. The focus is on issues that are critical to develop systems which are based on unsupervised learning techniques. The course deals with parametric and linear models for classification. Some part of the course reviews the theory of probability and statistics and then rest of the course covers the major approaches of pattern recognition.

Course Objective

- To discuss and compare different methods for pattern recognition along with their strengths and weaknesses
- To expose parametric and linear models for classification
- To make the students understand pattern recognition theories such as Bayes classifier, HMM, etc.
- To learn the various Statistical, Syntactical and Neural Pattern recognition techniques.
- To learn how to use pattern recognition for biometrics system.

Course Outcomes

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

- Identify and describe existing pattern recognition approaches for different human interaction modalities (voice, gesture, etc.)
- Evaluate and select the best approach for the recognition and identification of various patterns.
- Compare and identify the best technological solution for designing and implementing a complete recognition system based on pattern matching approach
- Identify a set of business use--cases using pattern based technology and discuss related advantage and drawbacks

Pattern Recognition

Course Code: PGMTH3E014T

Course Title: Pattern Recognition

Semester: III

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Introduction to pattern recognition Learning paradigms, Supervised and unsupervised learning; Probability: independence of events, conditional and joint probability, Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra. Introduction to Statistical, Structural and Neural Approaches.	10
Unit-II Statistical Pattern Recognition: Patterns and classification, discriminant functions, Bayes Decision Theory: Minimum-error-rate classification. Classifiers, Discriminant functions, Decision surfaces. Normal density and discriminant functions. Discrete features. Parameter Estimation Methods: Maximum-Likelihood Estimation: Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods.	10
Unit-III Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbour method. Linear discriminant functions: Perceptron and training, LMSE approaches. Feature extraction.	10
Unit-IV Biometrics as a Pattern Recognition tool, Evolution, Biometric traits, Biometrics Vs traditional recognition techniques, Characteristics of a good biometrics, Benefits of biometrics, Key biometric processes: verification, identification and biometric matching, Performance measures in biometric systems: FAR, FRR, FTE, FTA rate, EER, ROC, DTE etc., Biometrics applications, Challenges to biometrics systems.	10
Unit-V Overview of Uni biometric systems, Fingerprint, Fingerprint Classification, Overview and working of Iris, Hand geometry, Face recognition biometrics systems, comparison of various biometrics, Limitations of Uni-biometrics, Taxonomy of multi-biometrics, Issues in Designing a Multibiometric System,	10

Normalization strategy, Fusion techniques	

Text/Reference Books

1. C. M. Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
2. V. N. Vapnik, The Nature of Statistical Learning Theory, Springer, 2000.
3. N. Cristianini and J. Shawe-Taylor, An Introduction to Support Vector Machines, Cambridge University Press, 2000.
4. R. J. Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, Wiley, 1992.
5. Classification and Scene Analysis, Wiley, New York, 1973. L. Miclet, Structural Methods in Pattern Recognition North Oxford 3. Academic, London, 1986.
6. Anil K Jain, Patrick Flynn, Arun A Ross, "Handbook of Biometrics", Springer, 2008.
7. Arun A. Ross , Karthik Nandakumar, A.K.Jain, "Handbook of Multibiometrics", Springer, New Delhi, 2006.
8. Samir Nanavathi, Michel Thieme, and Raj Nanavathi, "Biometrics -Identity verification in a network", Wiley Eastern, 2002.
9. John Chirillo and Scott Blaul," Implementing Biometric Security", Wiley Eastern Publications, 2005

Internet of Things (IoT)

Course Code: PGMTH3E015T

Course Title: Internet of things (IOT)

Semester: III

Credits: 04

Course Overview

Internet of Things (IoT) actually refers to uniquely identifiable objects or things and their virtual representations in an internet-like infrastructure. The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit.

Course Objectives

- Able to understand the application areas of IOT.
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
- Able to understand building blocks of Internet of Things and characteristics.

Course Outcomes:

On completion of the course the student should be able to

- Understand the vision of IoT from a global context.
- Analyze various protocols for IoT.
- Determine the Market perspective of IoT
- Use of Devices, Gateways and Data Management in IoT.
- Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

Internet of Things (IoT)

Course Code: PGMTH3E015T

Course Title: Internet of things (IOT)

Semester: III

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Evolution of Internet of Things ,Enabling Technologies ,IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models ,Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT ,Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects	10
Unit-II IOT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN ,Network Layer: IP versions, Constrained Nodes and Constrained Networks , Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks ,Application Transport Methods: Supervisory Control and Data Acquisition ,Application Layer Protocols: CoAP and MQTT.	10
Unit-III Design Methodology ,Embedded computing logic ,Microcontroller, System on Chips , IoT system building blocks ,Arduino ,Board details, IDE programming ,Raspberry Pi ,Interfaces and Raspberry Pi with Python Programming.	10
Unit-IV Structured Vs Unstructured Data and Data in Motion Vs Data in Rest , Role of Machine Learning , No SQL Databases ,Hadoop Ecosystem – Apache Kafka, Apache Spark , Edge Streaming Analytics and Network Analytics ,Xively Cloud for IoT, Python Web Application Framework ,Django AWS for IoT , System Management with NETCONF-YANG	10
Unit-V Cisco IoT system, IBM Watson IoT platform, Manufacturing, Converged Plant-wide Ethernet Model (CPwE), Power Utility Industry, Grid Blocks Reference Model, Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control	10

Text/Reference Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.
2. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach".
3. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

Parallel Computing

Course Code: PGMTH3E016T

Course Title: Parallel Computing

Semester: III

Credits: 04

Course Overview

This course is practically oriented introduction to programming paradigms for parallel computers. The course considers definitions of program efficiency on parallel computers, addresses the modelling, analysis and measurement of program performance. The focus is on the issues corresponding to Description, implementation and use of parallel programming with parallel features, parallel communication operations, library routines and applications.

Course Objective

- To introduce the students with the basic features in parallel computing systems.
- Students should be able to understand the necessary classification of parallel computing structures with static and dynamic pipelining
- To familiarize students with advanced paradigms associated with Fundamental theoretical issues in designing parallel algorithms and architectures.
- To provide a platform for students to focus on research issues in areas like parallel computation models, parallel algorithms, Parallel Computer architectures and interconnection networks.

Course Outcomes

- Be proficient at programming multiple parallel machines in more than one special programming language or programming system
- Be able to descriptively compare the performance of different programs and methods on one machine
- Demonstrate advanced knowledge of the elements of parallel programming, parallel communication and system implementation
- Recall the history of parallel systems, principles of parallel algorithms and describe the developments in the field of parallel computing.

Parallel Computing

Course Code: PGMTH3E016T

Course Title: Parallel Computing

Semester: III

Credits: 04

Course Outlines

Contents	No of Lectures
Unit-I Introduction: Paradigms of parallel computing: Synchronous - vector/array, SIMD, Systolic; Asynchronous - MIMD, reduction paradigm. Hardware taxonomy: Flynn's classifications, Handler's classifications. Software taxonomy: Kung's taxonomy, SPMD. Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques.	10
Unit-II Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Mapping Techniques for Load Balancing Abstract parallel computational models: Combinational circuits, Sorting network, PRAM models, Interconnection RAMs. Parallelism approaches - data parallelism, control parallelism	10
Unit-III Basic Communication Operations: One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations.	10
Unit-IV Analytical Modelling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems: Laws governing performance measurements. Metrices - speedups, efficiency, utilization, communication overheads, single/multiple program performances, bench marks. The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs	10
Unit-V Programming Using the Message-Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: the Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation	10

Operations, Groups and Communicators. Scheduling and Parallelization: Scheduling parallel programs. Loop scheduling. Parallelization of sequential programs. Parallel programming support environments.	

Text/Reference Books

1. Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes. F. T. Leighton. Morgan Kaufmann Publishers,
2. San Mateo, California. 1991. An Introduction to Parallel Algorithms. Joseph JaJa. PEARSON Education.
3. M. J. Quinn. Parallel Computing: Theory and Practice, McGraw Hill, New York, 1994.
4. T. G. Lewis and H. El-Rewini.Introduction to Parallel Computing, Prentice Hall, New Jersey, 1992.
5. T. G. Lewis.Parallel Programming: A Machine-Independent Approach, IEEE Computer Society Press, Los Alamitos, 1994.

Enterprise Software Development

Course Code:

Course Title: Enterprise Software Development

Semester: III

Credits:04

Course Overview

This course will cover the issues in designing and engineering large enterprise software systems. Such systems are typically distributed and require increasingly complex inter-enterprise as well as intra-enterprise coordination. Technologies such as Web Services and cloud computing provide platforms for building such systems, and architectures such as service-oriented architecture, event driven architecture.

Course Objective

- To make the students understand how small teams can apply development practices to create high-quality software.
- To familiarize students with advanced paradigms associated with software development.

Course Outcomes

After completion of course, students would be able to:

- Classify the business processes and the business models underlying the ERP system Understand
- Differentiate the software lifecycle for traditional and ERP software
- Define object, property, method, and event as these terms are used in object-oriented programming (OOP).
- State characteristics and advantages of a modular approach to application development.
- Define encapsulation, abstraction, inheritance and polymorphism and give examples.

Enterprise Software Development

Course Code:

Course Title: Enterprise Software Development

Semester: III

Credits:04

Course Outlines

Contents	No of Lectures
Unit-I Business functions, business processes, and functional areas of business operation. Data needs of each functional area of business. Data production by each functional area of business. Definition of integrated information system. Enterprise information system? Enterprise resource planning (ERP)? History of ERP Definition of Enterprise Resource Planning system. Modular nature of ERP systems ERP pros and cons. Current issues with respect to ERP implementation, security and privacy, global.	10
Unit-II Characteristics of web applications versus web sites. Accepted design principles for web sites. Accepted design principles for web applications. Factors that impact the quality of a web application. Review of Internet and World Wide Web technologies OOP basic terminology. Development platform/environment used in the course.	10
Unit-III Modular approach to application development. Modular approach to ERP systems Terminology of object-oriented programming. Reusable objects for business processes. Multitier applications. Creating classes. Variable scope. Constructors (parameterized and not) and destructors. Error handling. Model-view-controller architecture. Creating an n-tier web-based user interface. Server controls in a web application. Systems development life cycle (SDLC). ERP implementation life cycle.	10
Unit-IV Database access objects. Server controls for user-friendly data display. Application of XML in database-driven applications. Building a data tier Using the application to protect the data. Using the RDBMS to protect the data Privacy and security issues.	10
Unit-V Event-Driven Architecture (EDA). Complex event processing. Semantic Data Modeling. Introduction to RDF and RDFS. Message-Oriented Middleware (MOM). Asynchronous enterprise integration pattern. Cloud Data Stores. Relational vs. object data models. Algebras and co-algebras. Petri Nets and Workflow. Place-transition and workflow nets	10

Text/Reference Books

1. Dominic Duggan , Enterprise Software Architecture and Design: Entities, Services, and Resources , Wiley, 2012
2. Ken Schwaber, Mike Beedle, Agile Software Development with Scrum, Pearson. 2008.
3. Roger S. Pressman, Software Engineering, A practitioner's Approach, 7th edition. McGraw Hill International Edition.
4. Sommerville, Software Engineering,7th edition, Pearson education.
5. Robert C. Martin, Agile Software Development, Principles, Patterns and Practices, Prentice Hall, 2002.

Digital Forensics

Course Code: PGMTH3E017T

Course Title: Digital Forensics

Semester: III

Credits:04

Course Overview

This course provides an awareness of current methods of reducing the effectiveness of anti-forensics. The students would be able to understand the implications of anti-forensics to the digital forensics investigator. One third of the course deals with the study of rapidly changing field of digital forensics. Another one third explains anti-forensic methods/tools and their use and the last one third explain guidelines for investigation reporting.

Course Objective

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

Course Outcomes

After completion of course, students would be able to:

- Utilize a systematic approach to computer investigations.
- Utilize various forensic tools to collect digital evidence.
- Understand the core concepts related to malware, hardware and software vulnerabilities and their causes
- Understand ethics behind hacking and vulnerability disclosure
- Appreciate the Cyber Laws and impact of hacking
- perform digital forensics analysis upon Windows, MAC and LINUX operating systems

Digital Forensics

Course Code: PGMTH3E017T

Course Title: Digital Forensics

Semester: III

Credits:04

Course Outlines

Contents	No of Lectures
Unit-I Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.	10
Unit-II Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime. Unauthorized Access to Computers, Computer Intrusions, Digital laws and legislation, Law Enforcement Roles and Responses.	10
Unit-III Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking. Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case	10
Unit-IV Forensics analysis- validating forensics data, data hiding techniques. Forensics auditing – step-by-step, how-to process for securing, investigating, and auditing or assessing various IT environments.	10
Unit-V Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data. Mobile Forensics: mobile forensics techniques, mobile forensics tools.	10

Text/Reference Books

6. Shon Harris, Allen Harper, Chris Eagle and Jonathan Ness, Gray Hat Hacking: The Ethical Hackers' Handbook, TMH Edition
7. Jon Erickson, Hacking: The Art of Exploitation, SPD
8. Nelson Phillips and Enfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.
9. Kevin Mandia, Chris Prosise, Matt Pepe, “Incident Response and Computer Forensics”, Tata McGraw -Hill, New Delhi, 2006.
10. Robert M Slade, “Software Forensics”, Tata McGraw - Hill, New Delhi, 2005.
11. Bernadette H Schell, Clemens Martin, “Cybercrime”, ABC – CLIO Inc, California, 2004.
12. 5. Nelson, B, Phillips, A, Enfinger, F, Stuart, C, “Guide to Computer Forensics and Investigations”, 2nd Ed, Thomson Course Technology, 2006.

Seminar

Course Code:
Course Title: Seminar
Semester: III
Credits: 02

Course Overview

Each student is required to make a seminar presentation on any chosen topic connected with the field of specialisation twice in a semester. Preparation and presentation of a seminar is intended to investigate an in-depth review of literature, prepare a critical review and develop confidence to present the material by the student. The seminar shall be evaluated by a faculty members assigned to this course, based on the two presentations a report submitted by the candidate and a viva-voce conducted. The marks of both the presentation will be recorded in Seminar Evaluation Performa.

Seminar Evaluation Performa

Name of Student:_____Roll No:_____
Name of Evaluater:_____
Topic of Seminar:_____
Date(s) of Seminar_____

SN	Evaluation Criteria	Explanation	Max. Marks	1st Presen.	2nd Presen.
1	**Knowledge and Content Organization of presentation**	Information presented as interesting story in logical, easy to follow sequence	**5 (2.5+2.5)**		
2	**Background content**	Material sufficient for clear understanding **AND** exceptionally presented	**5 (2.5+2.5)**		
3	**Methods**	Sufficient for understanding **AND** exceptionally presented	**5 (2.5+2.5)**		
4	**Results (figures, graphs, tables, etc.)**	All figures clear, All appropriately formatted, Exceptionally explained	**5 (2.5+2.5)**		
5	**Contribution of work**	Significance exceptionally well explained	**5 (2.5+2.5)**		
6	**Knowledge of subject**	Demonstrated full knowledge; answered all questions with elaboration	**5 (2.5+2.5)**		
7	**Presentation Skills Graphics (use of Power-point)**	Uses graphics that explain and reinforce text and presentation	**4 (2+2)**		
8	**Mechanics**	Presentation has no misspellings or grammatical errors	**4 (2+2)**		
9	**Eye Contact**	Refers to slides to make points; engaged with audience	**4 (2+2)**		
10	**Elocution -**not ability to speak English language	Correct, precise pronunciation of all terms, Voice is clear and steady; audience can hear well at all times	**4 (2+2)**		
11	**Length and Pace**	Appropriate (30-35 min) Well-paced throughout	**4 (2+2)**		
Total			**50**		
Grand Total (1st Presentation +2nd Presentation) (Out of 50)					

Signature of Evaluator with Date

Dissertation Part-I

Course Code:

Course Title: Dissertation Part-I

Semester: III

Credits: 08

Supervisor Evaluation Performa

Confidential (to be used by Supervisors & not to be shared with others)

M.Tech CST Dissertation Evaluation Sheet to be filled in by all Supervisors and communicated to M.Tech. Coordinator/HoD *before semester evaluation*:

Name of the Student:_____ Roll Number:_____

Title of the Dissertation:_____

Research Area & subarea to which the topic belongs:_____

Name of the Supervisor:_____

Supervisor's evaluation:

Day-to-Day work assessment in III semester: (marks to be awarded out of 100)

Problem Formulation and Identification of Objectives (out of 40)	Literature Surveyed and Schedule of work followed as suggested (out of 40)	Meetings with the supervisor & continuous reporting on progress (out of 20)	Final marks on day-to-day work evaluation out of 100 (sum of marks awarded col:1-3))

Signature of the supervisor with date:

Notes:
i. All students are required to maintain a diary where meeting dates (at least twice a week) with the supervisor and weekly progress work done are to be recorded in brief and endorsed by the supervisor's signature. This diary is required to be submitted at the time of evaluation.
ii. The supervisor will communicate to the student any suggestions made by the external expert and get them implemented

Dissertation Part-I

Course Code:

Course Title: Dissertation Part-I

Semester: III

Credits: 08

External Expert Evaluation Performa

1. Name of External Expert (*Block Letters*): .....
2. Dissertation Title: .....

   .....
3. Research Area & subarea: _____
4. Dissertation Supervisor(s): .....
5. Thesis Viva Date and Time: .....

Roll No. of Student (s)	Name of Student(s)	Literature Review (25)	Identificatio -n of Objectives (25)	Dissertation Design/Plan (20)	Presentation (15)	Viva (15)	Total out of 100 (Sum of cols. 3 to 7)

Comments required for justification if work is **Exceptionally Bad (≤50%)/ Outstanding (≥80%):**

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Suggestions to be communicated to the students & supervisor(s)

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Signature of External Expert with date

SEMESTER-IV

Dissertation Part-II

Course Code:

Course Title: Dissertation Part-II

Semester: IV

Credits: 18

Supervisor Evaluation Performa

Confidential (to be used by Supervisors & not to be shared with others)

M.Tech IV Semester CST Dissertation
Evaluation Sheet to be filled in by all Supervisors and communicated to M.Tech Program Coordinator/HoD ***before final evaluation (end-semester):***

Name of the Student:_____ Enrollment No:_____

Title of the Dissertation:_____
_____

Research Area & subarea to which the topic belongs:_____

Name of the Supervisor:_____

Supervisor's evaluation:

Day-to-Day work assessment during iV semester evaluation: (marks to be awarded out of 225)

Meetings with the supervisor & continuous reporting on progress (out of 75)	External expert suggestions implemented and quality of work done (out of 150)	Final marks on day-to-day work evaluation out of 225

Would you like further work on this Dissertation Topic to be offered to the next batch of the students? YES/NO
Do you plan to communicate a paper and/or file an IPR on the work done? YES /NO
Did you publish a paper in peer reviewed Journal? YES NO (UGC Approved/Scopus/SCI, Communicated/Under Review)

Signature of the supervisor with date:

Notes: i. All students are required to maintain a diary where meeting dates (at least twice a week) with the supervisor and weekly progress work done are to be recorded in brief and endorsed by the supervisor's signature. This diary is required to be submitted at the time of evaluation.
ii. Students be advised to prepare a paper (in IEEE format) based on the work for communication.

Dissertation Part-II

Course Code:

Course Title: Dissertation Part-II

Semester: IV

Credits: 18

External Expert Evaluation Performa

1. Name of External Expert (*Block Letters*): .....

2. Dissertation Title: .....

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3. Research Area & subarea: _____

4. Dissertation Supervisor(s): .....

5. Viva Date and Time: .....

Roll No of Student	Name of the Student	Quality Literature Reviewed (30)	Thesis Plan/Design/Algorithm (50)	Experimental results & its analysis (75)	Presentation (20)	Viva (20)	Report (30)	Total (225)

Comments required for justification if work is **Exceptionally Bad (≤50%)/ Outstanding (≥80%):**

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Suggestions to be communicated to the students & supervisor(s)

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Signature of External Expert with date