Course Code: **16ECSE705**	Course Title: **Compiler Design**	
L-T-P: **3-1-0**	Credits:4	Contact Hrs: 5hrs/week
ISA Marks: 50	ESA Marks: 100	Total Marks: 100
Teaching Hrs: 42		Exam Duration: 03

No	Content	Hrs
1	**Introduction** Why compilers, Programs Related to compilers, Translation process, Major Data structure in compiler, Bootstrapping and porting.	**06**
2	Lexical analysis :Scanning process, Regular Expressions, Finite Automata, From regular expressions to DFA, Specifications of Tokens, Recognition of Tokens	**06**
3	**Syntax Analysis:** Parsing process, context free grammars, parse tree ,ambiguity. Top-down Parsing: Recursive descent parsing, LL(1) parsing	**07**
4	**Bottom-up Parsing** Overview of Bottom-up Parsing, Simple LR Parser(SLR(1),	**06**
5	**More powerful parsers:** LR(1),LALR(1) parsing	**06**
6	**Semantic Analysis** Attributes and Attributes grammars, Algorithm for attribute computation, Symbol table, data types and Data checking	**06**
7	**Code Generation** Intermediate Code and data structure for code generation, Code generation of data structure references, code generation of control statements and expressions.	**05**

Text Book:

1. Kenneth C Louden: Compiler Construction Principles & Practice, Cengage Learning, 1997
2. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman: Compilers - Principles, Techniques and Tools, 2nd Edition, Pearson, 2007.

References:

1. Andrew W Apple: Modern Compiler Implementation in C, Cambridge University Press, 1997
2. Charles N. Fischer, Richard J. leBlanc, Jr.: Crafting a Compiler with C, Pearson, 1991.
3. Peter Linz: An Introduction to formal languages and Automata, IV edn, Narosa,2009.

Course Code: **16ECSE707**	Course Title: **Cryptography and Network Security**	
L-T-P: **3-0-0**	Credits: 3	Contact Hrs: 42
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 3		Exam Duration: 3 hrs

Ch. No	Content	Hrs
1	**Network Security Overview** **Common Attacks and Defense Mechanisms:** Eavesdropping, Cryptanalysis Password Pilfering, Identity Spoofing, Buffer-Overflow Exploitations, Repudiation, Intrusion, Traffic Analysis, Denial of Service Attacks, Marvelous Software. **Attacker Profiles:** Hackers, Script Kiddies, Cyber Spies, VICIOUS Employees, Cyber Terrorists, Hypothetical Attackers. **Basic Security Model.**	**05**
2	**Data Encryption Algorithms** **Data Encryption Algorithm Design Criteria:** ASCII Code, XOR Encryption, Criteria of Data Encryptions, implementation Criteria. **Data Encryption Standard :** Feistel's Cipher Scheme , DES Subkeys, DES Substitution Boxes , DES Encryption , DES Decryption and Correctness Proof., DES Security Strength. **Multiple DES**. **Advanced Encryption Standard:** AES Basic Structures., AES S-Boxes 60, AES-128 Round Keys , Add Round Keys Substitute-Byt, Shift-Ro, Mix-Colum, AES-128 Encryption, AES-128 Decryption and Correctness Proof, Galois Fields, Construction of the AES S-Box and Its Inverse , AES Security Strength. **Standard Block-Cipher Modes of Operations:** Electronic-Codebook Mode, Cipher-Block-Chaining Mode, Cipher-Feedback Mode Output-Feedback Mode, Counter Mode. **Stream Ciphers:** RC4 Stream Cipher, RC4 Security Weaknesses. **Key Generations.**	**07**
3	**Public-Key Cryptography and Key Management** **Concepts of Public-Key Cryptography, Elementary Concepts and Theorems In Number Theory**: Modular Arithmetic and Congruence Re1attons, Modular Inverse. **Diffie-Hellman Key Exchange**, Key Exchange Protocol , Man-in-the-Middle Attacks , Elgamal PKC. **RSA Cryptosystem :** RSA Key Pairs, Encryptions, and Decryptions , RSA Parameter Attacks RSA Challenge Numbers. **Key Distributions and Management**: Master Keys and Session Keys , Public-Key Certificates CA Networks, Key Rings.	**05**
4	**Data Authentication** **Cryptographic Hash Functions:** Design Criteria of Cryptographic Hash F Unctions , Quest for Cryptographic Hash Functions, Basic Structure of Standard Hash Functions , SHA-512 , WHIRLPOOL , **Cryptographic Checksums**: Exclusive-OR Cryptographic Checksums , Design Criteria of MAC Algorithms , Data Authentication Algorithm. **HMAC :** Design Criteria	**07**

	of HMAC , HMAC Algorithm, **Offset Codebook Mode of Operations**: Basic Operations , OCB Encryption and Tag Generation , OCB Decryption and Tag Verification. **Birthday Attacks**: Complexity Upper Bound of Breaking Strong Collision, Resistance, Set Intersection Attack. **Digital Signature Standard, Dual Signatures and Electronic Transactions:** Dual Signature Applications, Dual Signatures and Electronic Transactions, **Blind Signatures and Electronic Cash:** RSA Blind Signatures , Electronic Cash .	
5	**Network Security Protocols in Practice** **Crypto Placements in Networks:** Crypto Placement at the Application Layer , Crypto Placement at the Transport Layer , Crypto Placement at the Network Layer , Crypto Placement at the Data-Link Layer , Hardware versus Software Implementations of, Cryptographic Algorithms. **Public-Key Infrastructure**: X.509 Public-Key Infrastructure , X.509 Certificate Formats **, IPsec: A Security Protocol at the Network Layer:** Security Association, Application Modes and Security Associations , AH Format , ESP Format Secret Key Determination and Distribution.	**06**
6	**Security Protocols at Transport and Application Layers** SSL Handshake Protocol , SSL Record Protocol. **PGP and SIMIME**: **Email Security Protocols**: Basic Email Security Mechanisms. PGP, S/MIME. **Kerberos' An Authentication Protocol:** Basic Ideas , Smgle-Realm Kerberos , Multiple-Realm Kerberos , **SSH: Security Protocols for Remote Logins .**	**04**
7	**Wireless Network Security -1:** **Wireless Communications and 802 11 WLAN Standards:** WLAN Architecture, 802.11 Essentials Wireless Security Vulnerabilities. **WEP**: Device Authentication and Access Control, Data Integrity Check LLC Frame Encryption, Security Flaws of WEP. **WPA:** Device Authentication and Access Controls, TKIP Key Generations, TKIP Message Integrity Code , TKIP Key Mixing , WPA Encryption and Decryption , WPA Security Strength and Weaknesses.	**04**
8	**Wireless Network Security -2 :** **IEEE 802.11i/WPA2:** Key Generations 230, CCMP Encryptions and MIC 802.11i Security Strength and Weaknesses , **Bluetooth Security:** Piconets , Secure Pairings SAFER+ Block Ciphers, Bluetooth Algorithms E_1, E_{2l}, and E_{22}, Bluetooth Authentication, A PIN Cracking Attack , Bluetooth Secure Simple Pairing. **Wireless Mesh Network Security.**	**04**

Text Book:

1. Jiewang, "Network Security Theory and Practices", Springer Higher Higher Education, 2009

References:

1. William Stallings, Cryptography and Network Security Principles And Practices, 5th Edition, Pearson Publication, 2011.
2. Mark Stamp And Richard M Low, Applied Cryptanalysis, John Wiley & Sons, 2007

School of Computer Science and Engineering

Course Code: 16ECSC711	Course Title: Distributed and Cloud Computing	
L-T-P: 4-0-0	Credits: 4	Contact Hrs: 4
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 55		Exam Duration: 3 hrs

Content	Hrs
Chapter No. 1: Distributed System Models and Enabling Technologies Scalable Computing over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds.	6 hrs
Chapter No. 2: Virtual Machines and Virtualization of Clusters and Data Centers Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resources Management, Virtualization for Data-center Automation.	8 hrs
Chapter No. 3: Cloud Platform Architecture over Virtualized Data Centers Cloud Computing and Service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms.	8 hrs
Chapter No. 4: Cloud Programming and Software Environments Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine, Emerging Cloud Software Environments.	10 hrs
Chapter No. 5: Cloud Resource Management and Scheduling PoliISAs and mechanisms for resource management, Applications of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based web services. Resource bundling; combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds. Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic application scaling.	12 hrs
Chapter No. 6: Cloud Security Cloud security risks, Security; the top concern for cloud users, Privacy; privacy impact assessment, Trust, Operating system security, Security of virtualization. Security risks posed by shared images, Security risks posed by a management OS, Xoar - breaking the monolithic design of the TCB, A trusted virtual machine monitor.	11 hrs

Text Books:

1. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing from Parallel Processing to the Internet of Things", Morgan Kaufman, Elsevier- 2012.
2. Dan C. Marinescu "Cloud Computing Theory and Practice", Morgan Kaufman, Elsevier-2013.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi "Mastering Cloud Computing", McGraw Hill Education (India) Pvt. Limited, 2013.
2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter: Cloud Computing, A Practical Approach, McGraw Hill, 2010.

School of Computer Science and Engineering

Course Code: 16ECSC713	Course Title: Software Testing	
L-T-P :3-0-0	Credits: 4	Contact Hrs: 4 hrs/week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42		Exam Duration: 3 hrs

Content	Hrs
Chapter No. 1. Principles of Testing Context of testing in producing software: About the chapter, The incomplete Car, Dijkstra's Doctrine, A test time , The cat and the saint, Test the test first, The pesticide paradox, The convoy and the rags, The police man on the bridge, The Ends of Pendulum, Men in black, Automation syndrome, Putting it all together.	3 hrs
Chapter No. 2. Software Development Life Cycle Models Phases of Software Project: Requirements gathering and analysis, Planning, Design, Development or coding, Testing, Development and Maintenance, Quality, Quality assurance, and Quality Control, Testing, Verification and validation, Process model to represent different phases: Life cycle Models, Waterfall model, Prototyping and Rapid Application Development models, Spiral or Iterative model, The V model, Comparison of various life cycle models, References.	5 hrs
Chapter No. 3. Defect Testing White Box Testing: What is white box testing, Static testing, Static testing by humans, Static analysis tools: Structural testing, Unit /code fundamental testing, Code coverage testing, Code complexity testing, Black Box Testing: What is black box testing?, Why black box testing?, When to do black box testing?, How to do black box testing?, Requirement based testing, Positive and negative testing, Boundary value analysis, Decision tables, Equivalence participating , State based or graphic based testing, Compatibility testing, User documentation testing, Domain testing.	5 hrs
Chapter No. 4. Regression Testing What is regression testing?, Types of regression testing, When to do regression testing?, How to do regression testing?, Performing an initial "smoke" or "sanity" test, Understanding the criteria for selecting the test cases, Classifying the test cases, Methodology for selecting test cases, Resetting the test cases for regression testing, Concludes the results of regression testing, Best practices in regression testing.	4 hrs
Chapter No. 5. Unit Testing & Integration Testing What is integration testing?, Types of integration testing, Top-down integration, Bottom– up integration, Bi-directional integration, System integration, Choosing integration method, Integration testing as a phase of testing, Scenario testing, System scenarios, Use case scenarios, Defect bash, Choosing the frequency and duration of defect bash, Selecting right product build, Communicating the object of defect bash, Setting up monitoring lab, Taking action and Fixing issues, Optimizing the effort involved in defect bash.	5 hrs
Chapter No. 6. System and Acceptance Testing System Testing overview: Why is System testing done?, Functional versus Non-Functional testing, Functional system testing, Design/Architecture verification, Business vertical testing, Development testing, Beta testing, Certification, Standards and testing compliance, Non – Function testing, Setting up the configuration, Coming up with entry/exit criteria, Balancing key resources, Scalability testing, Reliability testing, Stress testing, Interoperability testing, Acceptance testing, Acceptance criteria, Selecting test cases for acceptance testing, Executing acceptance tests, Summary of testing phases, Multiphase testing model.	5 hrs
Chapter No. 7. Performance Testing Introduction, Factors governing performance testing, Methodology for performance testing, Collecting requirements, Writing test cases, Automating performance test cases, Executing performance test cases, Analyzing the performance test results, Performance tuning,	5 hrs

Performance bench marking, Capacity planning, Tools for performance testing, Processes for performance testing, Challenges, Problems and Exercises.	
Chapter No. 8. Test Planning, Management and Execution Introduction, Test planning, Preparing a test plan, Scope management – deciding features to be tested / not tested, Deciding test approach/strategy, Setting up criteria for testing, Identifying responsibilities, Staffing, and Training needs, Identifying resource requirements, Identifying test deliverables, Testing tasks – Size and effort estimation, Activity breakdown and scheduling, Communication management, Risk management: Test management, Choice of standards, Test infrastructure management, Test people management, Integration with product release, Test process, Putting together and base lining a test plan, Test case specifications, Update of traceability matrix, Identifying possible candidates for automation, Developing and base lining test cases. Executing test cases and keeping traceability matrix current, Collecting and analyzing matrix	5 hrs
Chapter No. 9. Reporting and Software Test Automation Preparing test summary report, Recommending product release criteria: Test reporting, Recommending product release, Best practices, Process related best practices, People related best practices, Technology related best practices, What is Test automation?, Terms used in automation, Skills needed for automation, What to automate?, Scope of automation- Identifying the types of testing amenable to automation, Automating areas less prone to change, Automate tests that pertain to standards, Management aspects in automation, Design and architecture for automation.	5 hrs
Text Book: 1. Desikan Srinivasan and Gopalswamy, Ramesh, Software Testing- Principles and Practices, Published by Person Education, 2nd edition, Pearson Education, 2007. ***References:*** 1. Edward Kit, Software Testing in the Real World Improving the Process, Published by Person Education, 1995. 2. Ron, Patton, Software Testing, 2nd edition Person Education, 2004. 3. Marnie, Hutcheson L., Software Testing Fundamentals, Wiley India, 2003. **4.** Roger S. Pressman, Software Engineering A Practitioners Approach, 5th edition McGraw Hill.	

School of Computer Science and Engineering

Course Code: 16ECSE715	Course Title: **Applied Parallel Computing**	
L-T-P: **3-1-0**	Credits: **4**	Contact Hrs:**5 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42 hrs**		Exam Duration: **3 hrs**

1	**Introduction and History** GPUs as Parallel Computers; Architecture of a Modem GPU; Parallel Programming Languages and Models; Overarching Goals; Evolution of Graphics Pipelines; The Era of Fixed- Function; Graphics Pipelines; Evolution of Programmable Real-Time Graphics; Unified Graphics and Computing Processors; GPGPU; An Intermediate Step; GPU Computing; Scalable GPUs Recent Developments; Future Trends	**05 Hrs**
2	**Introduction to CUDA** Data Parallelism; CUDA Program Structure; A Matrix-Matrix Multiplication Example; Device Memories and Data Transfer; Kernel Functions and Threading; Function declarations; Kernel launch; Predefined variables; Runtime API.CUDA Thread Organization; Using b1ock Id x and thread Id x ; Synchronization and Transparent Scalability; Thread Assignment ; Thread Scheduling and Latency Tolerance	**07 Hrs**
3	**CUDA Memories, Performance Considerations and Floating Point Considerations** Importance of Memory Access EffiISAncy; CUDA Device Memory Types; A Strategy for Reducing Global Memory Traffic; Memory as a Limiting Factor to Parallelism; Global Memory Bandwidth; Dynamic Partitioning of SM Resources; Data Prefetching; Instruction Mix; Thread Granularity; Measured Performance; More on thread execution, Global memory bandwidth, dynamic partitioning of SM resources, Floating point format, Arithmetic Accuracy and rounding	**07 Hrs**
4	**Floating Point Considerations** Floating-Point Format, Normalized Representation of M, Excess Encoding of E, Representable Numbers, Special Bit Patterns and Precision, Arithmetic Accuracy and Rounding, Algorithm Considerations	**05 Hrs**
5	**Introduction to OPENCL** Introduction to OPENCL; Background; Data Parallelism Model; Device Architecture; Kernel Functions; Device Management and Kernel Launch; Electrostatic Potential Map in OpenCL;	**05 Hrs**
6	**Parallel Programming and Computational Thinking** Goals of Parallel Programming, Problem Decomposition, Algorithm Selection, Computational Thinking	**03 Hrs**
7	**Introduction to Embedded GPU Computing** Architecture, Programming Model, Programs, Configuration etc.	**05 Hrs**
8	**Case Study /Projects** Concepts of Game Design, Applications like Matrix multiplication, MRI reconstruction Molecular Visualization and Gaming	**05 Hrs**

Text book:

1. Programming Massively Parallel Processors: A Hands on Approach; David B. Kirk, Wen-mei W. Hwu; Morgan Kaufmann /Elsevier India reprint 2010

Reference Books:

1. *Heterogeneous Computing with OpenCL, by Benedict R. Gaster, Lee Howes, David R. Kaeli, Perhaad Mistry & Dana Schaa*; Morgan Kaufmann 2011

School of Computer Science and Engineering

Course Code: 16ECSE716	Course Title: Internet of Things	
L-T-P-SS: 3-1-0	Credits: 3	Contact Hrs: 40
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42		Exam Duration: 3 hrs

Content	Hrs
Chapter No 1. Introduction to Internet of Things (IoT) Definition & Characteristics of IoT, Physical Design of IoT: IoT protocols, Logical Design of IoT: IoT functional blocks, communication models and APIs.	4 hrs
Chapter No 2. IoT Enabling Technologies Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels and Deployment Templates.	6 hrs
Chapter No 3. Domain specific IoTs Home Automation ,Cities, Environment ,Energy, Retail, Logistics, Agriculture, Industry ,Health and Lifestyle	6 hrs
Chapter No 4. IoT Platforms Design Methodology IoT Design Methodology, Case Study on IoT System for Weather Monitoring.	4 hrs
Chapter No 5. IoT systems – Logical design using Python Introduction to Python, Data types, data structures, Control of flow, functions modules, packages, file handling, data/time operations, classes, Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib.	6 hrs
Chapter No 6. IoT Physical Devices and Endpoints Basic building blocks of an IoT device, Exemplary device: Rasyberry Pi, interface (serial, SPI, I2C), Programming Rasyberry Pi with Python. Tutorial: • Programming Inputs and Outputs with Python: Reading a Button • Working with Webcams: Testing Webcams, Displaying an Image,Modifying an Image, Accessing the Webcam • Python and The Internet: Serving Pi (Be a Web Server) Connecting the Web to the Real World	6 hrs
Chapter No 7. IoT Physical Servers & Cloud Offerings Introduction to Cloud Storage models and communication APIs ,Webserver – Web server for IoT, Cloud for IoT, Python web application framework, Designing a RESTful web API	5 hrs
Chapter No 8. Case Studies Illustrating IoT Design: Home Automation-smart lighting, home intrusion detection, Cities-smart parking.	5 hrs

Text Book (List of books as mentioned in the approved syllabus)

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

References

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

Course Code: 16ECSC801	Course Title: **Data Mining and Business Analytics**	
L-T-P: **4-0-0**	Credits: **4**	Contact Hrs:**4 hrs/week**
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: **50 hrs**		Exam Duration: **3 hrs**

1	**Introduction to Data Mining** Fundamentals of data mining, Data mining Functionalities, Classification of Data Mining Systems, Major issues in Data Mining, Data Warehouse and OLAP Technology for Data mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture.	**06 hrs**
2	**Association Rule Mining** Mining Frequent Patterns, Associations: Basic Concepts, EffiISAnt and Scalable Frequent Itemset Mining methods (Apriori Algoithm, improving effiISAncy of Apriori, Mining frequent Itemsets without Candidate generation, using vertical data formats). Mining various kinds of association rules, from association analysis to Correlation analysis.	**06hrs**
3	**Analytical Characterization & Statistical Measures:** Analytical Characterization: Analysis of Attribute Relevance, Mining Descriptive Statistical Measures in Large Databases	**04 hrs**
4.	**Classification and Prediction** Classification, Prediction, Classification by Decision tree Induction, Bayesian classification, Associative classification, Prediction: Linear Regression, non-linear regression.	**08 hrs**
5	**Cluster Analysis** Types of data in cluster analysis, Categorization of major clustering methods, Classical Partitioning methods : k-Means and k-Medoids.	**08 hrs**
6	**Graph Mining & Social Network Analysis** Graph mining: Methods for Mining Frequent Subgraphs, Mining Variant and Constrained substructure patterns, Social Network Analysis: Social networks, Characteristics of Social Networks,Link Mining, Mining on Social networks	**08 hrs**
7	**Business Analytical Modeling** Analytical Modeling by Factor and Cluster Analysis, Analytical Modeling by Logistics Regression and Discriminant Analysis.	**05 hrs**
8	**Segmentation of Target Market** Segmentation of primary target market by Heuristic Modeling such as RFM (Recency, Frequency, Monetary) analysis, Segmentation of target market based on large databases using Decision Tree approaches such as CHAID (Chi-square Automatic Interaction Detection) and other Classification and Regression Trees.	**05hrs**

Text Book

1. Jiawei Han and MichelineKamber, Data Mining: Concepts and Techniques, Second Edition, Elsevier.
2. Purba Halady Rao, Business Analytics: An Application Focus, PHI, New Delhi, 2013.

References

1. Michael Berry and Gordon Linoff, *Data Mining Techniques,*Wiley Publishing, 2004.
2. Kimball and Ross, The Data Warehouse Toolkit, Second Edition, John Wiley & Sons, 2002.
3. T. Davenport, “Competing on Analytics,” Harvard Business Review (Decision Making), January 2006.

Course Code: 16ECSE803	Course Title: **Image and Video Processing**	
L-T-P: **3-1-0**	Credits: **4**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42 hrs**		Exam Duration: **3 hrs**

1	**Introduction:** 2D systems, Mathematical preliminaries – Fourier Transform, Z Transform, Optical & Modulation transfer function, Matrix theory, Random signals, Discrete Random fields, Spectral density function.	**05 hrs**
2	**Image Perception:** Light, Luminance, Brightness, Contrast, MTF of the visual system, Visibility function, Monochrome vision models, Fidelity criteria, Color representation, Chromaticity diagram, Color coordinate systems, Color difference measures, Color vision model, Temporal properties of vision.	**05 hrs**
3	**Image Sampling and Quantization:** Introduction, 2D sampling theory, Limitations in sampling &reconstruction, Quantization, Optimal quantizer, Compander, Visual quantization.	**05 hrs**
4	**Image Transforms:** Introduction, 2D orthogonal & unitary transforms, Properties of unitary transforms, DFT, DCT, DST, Hadamard, Haar, Slant, KLT, SVD transform.	**05 hrs**
5	**Image Enhancement:** Point operations, Histogram modeling, spatial operations, Transform operations, Multi-spectral image enhancement, false color and Pseudo-color, Color Image enhancement. **Image Filtering & Restoration:** Image observation models, Inverse & Wiener filtering, Fourier Domain filters, Smoothing splines and interpolation, Least squares filters, generalized inverse, SVD and Iterative methods, Maximum entropy restoration, Bayesian methods, Coordinate transformation & geometric correction, Blind de-convolution.	**07 hrs**
6	**Image Analysis & Computer Vision:** Spatial feature extraction, Transform features, Edge detection, Boundary Extraction, Boundary representation, Region representation, Moment representation, Structure, Shape features, Texture, Scene matching & detection, Image segmentation, Classification Techniques.	**05 hrs**
7	**Video Processing:** Fundamental Concepts in Video – Types of video signals, Analog video, Digital video, Color models in video, Video Compression Techniques – H.261, H.263, MPEG I, MPEG 2, MPEG 4, MPEG 7 and beyond, .	**05 hrs**

8	**Video Segmentation and Tracking :** Scene change detection, Spatiotemporal change detection, Motion segmentation, Motion tracking , Motion tracking in video : Rigid object tracking and articulated object tracking	**05 hrs**

Text Book

1. A. K. Jain, “Fundamentals of Digital Image Processing," Pearson Education (Asia) Pte. Ltd./Prentice Hall of India, 2004.

2. Alan C Bovik “ Essential Guide to Video Processing”, AP Elsevier publication, 2009

References:

1. Z. Li and M.S. Drew**,** “Fundamentals of Multimedia,” Pearson Education (Asia) Pte. Ltd., 2004.
2. R. C. Gonzalez and R. E. Woods, “Digital Image Processing,” 2nd edition, Pearson Education(Asia) Pte. Ltd/Prentice Hall of India, 2004.
3. M. Tekalp, “Digital Video Processing,” Prentice Hall, USA, 1995.

School of Computer Science and Engineering

Course Code: 16ECSE804	Course Title: **Wireless Networks**	
L-T-P: 3-1-0	Credits: 4	Contact Hrs: 3
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hrs: 42		Exam Duration: 3 hrs

Content	Hrs
Chapter No.1 Introduction. Fundamentals of Wireless Communication Technology. Characteristics of the Wireless Channel. Modulation Techniques. Multiple Access Techniques. Voice Coding. Error Control. Fundamentals of WLANs. IEEE 802.11 Standards. HIPERLAN Standard. Bluetooth. HomeRF.	6 hrs
Chapter No. 2: Wireless WANS AND MANS. Introduction. The Cellular Concept. Cellular Architecture. 1G,2G and 3G Cellular Systems. Wireless in Local Loop. Wireless ATM. IEEE 802.16 Standard. HIPERACCESS. Wireless Internet, Mobile IP. TCP in Wireless Domain. WAP. Optimizing Web Over Wireless. Ad Hoc Wireless Networks. Issues in Ad Hoc Wireless Networks.	8 hrs
Chapter No. 3: MAC Protocols for Ad Hoc Wireless Networks. Introduction. Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks. Design Goals of a MAC Protocol for Ad Hoc Wireless Networks. Classifications of MAC Protocols. Contention-Based Protocols. Contention-Based Protocols with Reservation Mechanisms. Contention-Based MAC Protocols with Scheduling Mechanisms.	8 hrs
Chapter No. 4: Routing Protocols for Ad Hoc Wireless Networks. Introduction. Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks. Classifications of Routing Protocols. Table-Driven Routing Protocols. On-Demand Routing Protocols. Hybrid Routing Protocols. Routing Protocols with EffiISAnt Flooding Mechanisms. Hierarchical Routing Protocols. Power-Aware Routing Protocols.	8hrs
Chapter No.5: Transport Layer and Security Protocols for Ad Hoc Wireless Networks. Introduction. Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks. Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks. Classification of Transport Layer Solutions. TCP Over Ad Hoc Wireless Networks. Other Transport Layer Protocols for Ad Hoc Wireless Networks. Security in Ad Hoc Wireless Networks. Network Security Requirements. Issues and Challenges in Security Provisioning. Network Security Attacks. Key Management. Secure Routing in Ad Hoc Wireless Networks.	8 hrs
Chapter No. 6. Quality of Service in Ad Hoc Wireless Networks. Introduction. Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks. Classifications of QoS Solutions. MAC Layer Solutions. Network Layer Solutions. QoS	4 hrs

Frameworks for Ad Hoc Wireless Networks.	

Text Book:

C. Siva Ram Murthy,B.S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall. 2012.

References:

1. Clint smith, Daniel Collins, “Wireless networks”, 3rd Edition, Mc Graw Hill Publication 2014.
2. Jim Geier, "Designing and Deploying 802.11n Wireless Networks" Cisco Press.2010.

Program: Master of Technology		
Course Title: **Applied Mathematics**		Course Code: **18ECSC701**
L-T-P: **3-0-1**	Credits: **4**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**Introduction to Statistics** Statistical Thinking, Collecting data, Statistical Modeling Framework, Measure of Central Tendency and Variance, Importance of Data symmetry and Display, Graphical and Tabular Display.	**04 hrs**
2	**Discrete Random Variables and Probability Distribution** Discrete Random variables, Probability distributions and Probability mass function, Cumulative distribution function, Mean and Variance of a discrete random variable, Discrete Uniform distribution, Binomial distribution, Geometric distribution, Poisson distribution, Applications.	**07 hrs**
3	**Continuous Random Variables and Probability Distributions** Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, Uniform distribution, Normal Distribution, Normal approximation to Binomial and Poisson distribution, Exponential distribution.	**07 hrs**
4	**Testing of Hypothesis** Estimation theory, Hypothesis testing, Inference on the mean of population (variance known and unknown) Inference on the variance of a normal population, Inference on a population proportion, Testing for Goodness of fit, Inference for a difference in Means(variances known), Inference for a difference in means of two normal distributions (variances unknown), Inference on the Variances of two normal populations, Inference on two population proportions.	**08 hrs**
5	**Simple Linear Regression and Correlation** Simple Linear Regression, Properties of Least square Estimators and Estimation of Variances, Transformations to a Straight line, Correlation, Multiple linear regression model, Least square Estimation of parameters, Matrix approach to multiple linear regression, Properties of least square estimators and estimation of variance.	**06 hrs**
6	**Queuing Theory 1 :** Basics of queuing models, Model I (M /M/ 1): (∞/FIFO), Single Server with Infinite Capacity, Model II (M/M/s): (∞/FIFO), Multiple Server with Infinite Capacity	**05 hrs**
7	**Queuing Theory 2:** Model III (M/M/1): (k/FIFO), Single Server with Finite Capacity, Model IV (M/M/s): (k/FIFO), Multiple Server with Finite Capacity.	**05 hrs**

Text Books:

References:

1. Douglas C Montgomery, George C Runger, Applied Statistics for Engineers, 2nd Edition,John Wiley and Sons, ISBN-0-471-170027-5.
2. Richard I Levin, David S Rubin, Statistics for Management, 6th Edition, Prentice Hall India.
3. Willian W Hines, Douglas C Montgomery, Probability and Statistics in Engineering, 2nd Edition, John Wiley and Sons.
4. V. Sundarapandian, Probability, Statistics and Queuing theory, PHI, 2009.
5. Arnold Oral Allen, Probability, statistics, and queuing theory: with computer science applications, Gulf Professional Publishing, Edition: 2 ,28-Aug-1990

School of Computer Science and Engineering

Program: Master of Technology		
Course Title: **Internet Of Things**		Course Code: **18ECSC702**
L-T-P: **3-0-0**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**Introduction to Internet of Things (IoT):** Definition & Characteristics of IoT, Physical Design of IoT: IoT protocols, Logical Design of IoT: IoT functional blocks, communication models and APIs.	**04 hrs**
2	**IoT Enabling Technologies:** Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels and Deployment Templates.	**06 hrs**
3	**Domain specific IoTs:** Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.	**06 hrs**
4	**IoT Platforms Design Methodology:** IoT Design Methodology, Case Study on IoT System for Weather Monitoring.	**04 hrs**
5	**IoT systems – Logical design using Python:** Introduction to Python, Data types, data structures, Control of flow, functions modules, packages, file handling, data/time operations, classes, Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib.	**06 hrs**
6	**IoT Physical Devices and Endpoints:** Basic building blocks of an IoT device, Exemplary device: Rasyberry Pi, interface (serial, SPI, I2C), Programming Rasyberry Pi with Python.	**06 hrs**
7	**IoT Physical Servers & Cloud Offerings:** Introduction to Cloud Storage models and communication APIs ,Webserver – Web server for IoT, Cloud for IoT, Python web application framework, Designing a RESTful web API	**05 hrs**
8	**Case Studies Illustrating IoT Design:** Home Automation-smart lighting, home intrusion detection, Cities-smart parking.	**05 hrs**

Text Books:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

References:

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

School of Computer Science and Engineering

Program: Master of Technology		
Course Title: **Computer Networks**		Course Code: **18ECSC704**
L-T-P: **3-0-1**	Credits: **4**	Contact Hrs: **5 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**Fundamental Concepts of computer Networks** Basic Definitions in Data Networks, Applications, Requirements, Network Architecture, Packet Size and Optimizations, Performance.	**04 hrs**
2	**Data Link Layer** Perspectives on Connecting, Encoding (NRZ, NRZI,Manchester, 4B/5B), Framing, Error Detection, Reliable Transmission, Ethernet and Multiple Access Networks	**08 hrs**
3	**The Network Layer: Data Plane** Overview of Network Layer, Router Architecture, The Internet Protocol (IP): IPv4, Addressing, IPv6, Generalized Forwarding and SDN	**08 hrs**
4	**The Network Layer: Control Plane** Introduction, Routing Algorithms, Intra-AS Routing in the Internet: OSPF, Routing Among the ISPs: BGP, The SDN Control Plane, ICMP: The Internet Control Message Protocol, Multicast, Multiprotocol Label Switching (MPLS)	**08 hrs**
5	**Transport Layer** Introduction and Transport-Layer Services, Multiplexing and De-multiplexing, connectionless Transport: UDP, Connection-Oriented Transport: TCP , Principles of Congestion Control, TCP Congestion Control	**08 hrs**
6	**Application Layer** Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications, Video Streaming and Content Distribution Networks	**06 hrs**

Text Books:

1. J. F. Kurose and K. W. Ross, , Computer Networking, A Top-Down Approach, 7th Ed, , Pearson , 2017
2. Larry L Peterson & Bruce S Davien, Computer Networks A System Approach, 5th Ed , Morgan Kaufmann (Elsevier),, 2011

References:

1. Nader F. Mir, Computer and Communication Networks, 2nd Edition, Pearson Prentice-Hall, 2015
2. Behrouz Forouzan, Data Communications and Networking, 5th Ed, McGraw Hill, 2012.
3. A S Tanenbaum, D J Wetherall, Computer Networks, 5th Ed., Prentice-Hall, 2010.

School of Computer Science and Engineering

Program: Master of Technology		
Course Title: **Distributed and Cloud Computing**		Course Code: **18ECSC710**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**Distributed System Models and Enabling Technologies** Scalable Computing over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing	**04 hrs**
2	**Virtual Machines and Virtualization of Clusters** Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resources Management.	**06 hrs**
3	**Cloud Platform Architecture over Virtualized Data Centers** Cloud Computing and Service Models, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms.	**06 hrs**
4	**Cloud Programming and Software Environments** Challenges and Opportunities in cloud application, architectural styles, workflows: co-ordination of multiple activities, MapReduce programming model.	**06 hrs**
5	**Cloud Resource Management** Policies and mechanisms for resource management, Applications of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers.	**08 hrs**
6	**Cloud Resource Scheduling** Resource bundling; combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds. Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines.	**06 hrs**
7	**Cloud Security** Cloud security risks, Security; the top concern for cloud users, Privacy; privacy impact assessment, Trust, Operating system security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, Xoar - breaking the monolithic design of the TCB, A trusted virtual machine monitor.	**06 hrs**

Text Books:

1. 1. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Distributed and Cloud Computing from Parallel Processing to the Internet of Things, 1, Elsevier, 2012
2. Dan C. Marinescu , Cloud Computing Theory and Practice, 1, Elsevier, 2013

References:

1. RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi , Mastering Cloud Computing, 1, McGraw Hil, 2013
2. 2. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, 1, McGraw Hil, 2010

School of Computer Science and Engineering

Program: Master of Technology		
Course Title: **Machine Learning**		Course Code: **18ECSC711**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**Introduction & Data Pre-Preprocessing** Introduction to data mining, Introduction to Machine Learning, Applications of Machine Learning, Major tasks in data preprocessing - data reduction, data transformation and data Discretization, data cleaning and data integration.	**08 hrs**
2	**Mining Frequent Patterns, Associations and Correlations: Concepts and Methods** Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, finding interesting Patterns, Pattern Evaluation Methods, Applications of frequent pattern and associations, Advanced Frequent Pattern Mining- Frequent Pattern and Association Mining: A Road Map, Mining Various Kinds of Association Rules. Pattern Mining in Multilevel, Multidimensional Space.	**07 hrs**
3	**Supervised Learning: Classification** Model Evaluation and Selection, Techniques to Improve Classification Accuracy: ensemble Methods; Bayesian belief networks, Introduction to perceptron learning, Back propagation algorithm.	**08 hrs**
4	**Unsupervised Learning: Cluster Analysis** Partitioning methods, Hierarchical Methods, Density based methods, Outlier Detection.	**07 hrs**
5	**Regression Analysis** ANOVA, Linear Discriminant Analysis, Support Vector Machines	**06 hrs**
6	**Reinforcement Learning** Introduction to Reinforcement Learning (RL), Sequential Decision Problems, Passive RL, Active RL, Generalization in RL, Applications of RL	**06 hrs**

Text Books:

1. Jiawei Han, MichelineKamber, and Jian Pei, Data Mining: Concepts and Techniques, 3rd, Morgan Kaufmann, 2011
2. Pang-Ning, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education, 2007

References:

1. Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining - Practical Machine Learning Tools and Techniques, 3rd, Elsevier Inc, 2011.
2. M. H. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education. 2008.

School of Computer Science and Engineering

Program: Master of Technology		
Course Title: **Software Engineering**		Course Code: **18ECSC712**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

	Content	**Hrs**
1	**Introduction to Software Engineering** Introduction to Software Engineering and A Generic view of process	4 hrs
2	**Process Models** Prescriptive Models, The waterfall model, Incremental process models, Evolutionary process models, Specialized process models, The Unified process. Agile view of process.	6 hrs
3	**Requirements engineering :**Requirements Engineering tasks, Initiating Requirements Engineering Process Eliciting Requirements, Elicitation Work Products ,Developing Use-Cases , Analysis Model, Negotiating Requirements and Validating requirements.	5 hrs
4	**Design Engineering** Design within the context of SE, Design process and design quality, Design concepts, The design Model, Pattern based software design, Architectural design: Software Architecture, Data design, Architectural styles and patterns, Architectural design,	4 hrs
5	**Overview of object-oriented concepts** Unified Modeling Language (UML). Class Model, State Model and Interaction Models: Use case, sequence and activity diagrams.	6 hrs
6	**Object Oriented System Design** Reuse Plan, Breaking a system into sub-systems and organizing. Allocation of sub-systems to hardware and software. High Level Class Design: Design Optimization, Adjustment of Inheritance and Organizing a class design.	7 hrs
7	**Testing Strategies:** A strategic approach to software testing, Test strategies for conventional software, validation testing, system testing. Testing tactics: White box testing, basis path testing, control structure testing, black box testing, testing for specialized environments, architectures and applications.	5 hrs
8	**Project Management and Metrics:** Management spectrum, The people, product, process , metrics in the process and project domains, soft ware measurements, metrics for software quality. Project Estimation: Observations on estimation, the project planning process , software scope and feasibility , resources, software project estimation, Decomposition techniques, empirical estimation models	5 hrs

References:

1. Roger S Pressman, Software Engineering A practitioner Approach, Seventh Edition, McGrawHill International Edition, 2009
2. Blaha M, Rumbaugh, Object Oriented Modeling and Design with UML, Second, Pearson, 2008
3. Ian Sommerville, Software Engineering, Seventh Edition, Pearson education, 2004.
   Ali Bahrami, Object Oriented System Development using U M Languages, Mc-Grawhill, 2008

Program: Master of Technology		
Course Title: **Image and Video Processing**		Course Code: **18ECSC713**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**Fundamentals of Image processing and Image Transforms:** Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels. Image Transforms: 2 D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms.	**07 hrs**
2	**Image Enhancement:** Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters. Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering.	**08 hrs**
3	**Image Analysis:** Spatial feature extraction, Transform features, Edge detection Boundary Extraction, Boundary representation, Region representation, Moment representation, Structure, Shape features, Texture, Scene matching & detection, Image segmentation and Classification Techniques.	**08 hrs**
4	**Basics of Video Processing**: Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filtering operations	**07 hrs**
5	**2-D Motion Estimation:** Optical flow, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation.	**06 hrs**
6	**Video Segmentation and Tracking :** Change detection, Spatiotemporal change detection, Motion segmentation, Motion tracking in video : Rigid object tracking and articulated object tracking	**06 hrs**

Text Books:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing," 3rd edition, Pearson Education(Asia) Pte. Ltd/Prentice Hall of India, 2009.
2. M. Tekalp, "Digital Video Processing", 2nd edition, Prentice Hall, USA, 2015.

References:

1. Anil K. Jain, "Fundamentals of Digital Image Processing," Pearson Education (Asia) Pte. Ltd./Prentice Hall of India, 2004.
2. Alan C Bovik " Essential Guide to Video Processing", AP Elsevier publication, 2009
3. Z. Li and M.S. Drew**,** "Fundamentals of Multimedia," Pearson Education (Asia) Pte. Ltd., 2004.

School of Computer Science and Engineering

Program: Master of Technology		
Course Title: **Cryptography and Network Security**		Course Code: **18ECSC714**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**Network Security Overview** Computer Security Principles, The OSI Security architecture: Security attacks, services and mechanisms, A model for Network Security, Classical Encryption techniques: Substitution ciphers- Caesar, Monoalphabetic, Playfair and Hill ciphers, Substitution ciphers, Taxonomy of Cryptography and Cryptanalysis.	**08 hrs**
2	**Data Encryption Algorithms** Traditional block cipher structure, Data Encryption Standard, DES example, strength of DES, Multiple DES, block cipher design prinicples, Advanced Encryption Standard, block-cipher modes of operation, Stream Ciphers: RC4 and A5/1.	**08 hrs**
3	**Public-Key Cryptography and Key Management** Elementary Concepts and Theorems In Number Theory, principles of public-key cryptosystems, The RSA algorithm, Diffie-Hellman Key Exchange, Elliptic curve arithmetic, Elliptic key cryptography, Key Distributions and Management, X.509 certificates, public key infrastructure	**08 hrs**
4	**Data Authentication** Cryptographic Hash Functions: applications and requirements, Hash functions based on cipher block chaining, Secure Hash algorithm, SHA3, Message authentication codes: requirements and functions, HMAC, Digital Signatures, and Digital Signature Standard.	**06 hrs**
5	**Application, Transport and Network layer Security** Web security considerations, Pretty Good Privacy and S/MIME,Secure Sockets Layer, HTTPs, Kerberos, SSH, DomainKeys Identified Mail (DKIM), IPSec overview, Encapsulating security payload, combining security associations, Internet key exchange	**06 hrs**
6	**Wireless Network Security** Wireless security threats and measures, mobile device security, IEEE 802.11 WLAN Standard, IEEE 802.11i Wireless Lan Security: Services and phases of operation, WPA and WPA2	**06 hrs**

Text Books:

1. William Stallings, Cryptography and Network Security Principles And Practices, 6th Edition, Pearson, 2014.

References:

2. Behrouz A. Forouzan, "Cryptography and Network Security**",** 6th Edition, Tata McGraw-Hill, 2014.
3. Mark Stamp, "Information Security: Principles and Practices", 2nd Edition, John Wiley and Sons, 2011.

Lab Plan

Expt./Job No.	***Brief description about the experiment/job***	***No. of Lab. Slots***
1.	Demo and practice on Crypto Library	1
2.	Implementation of symmetric key algorithm algorithms	1
3.	Implementation of asymmetric key algorithm algorithms, Hash algorithms	2
4.	Web Security using SSL certificates	1

5.	Secure access to resources to Kerberos	2
6.	Web server security using CAPTCHA	1
7.	Implemenetation of access Control	1
8.	Configuring Firewall, IDS	1

School of Computer Science and Engineering

Program: Master of Technology		
Course Title: **Embedded Systems**		Course Code: **18ECSE715**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**The 8051 Architecture** Introduction, 8051 Microcontroller hardware, input/output pins, ports & circuits, External memory.	**06 hrs**
2	**Addressing modes and operations of 8051** Introduction, addressing modes, external data Moves. Code Memory Read Only Data Moves / Indexed Addressing mode, PUSH and POP opcodes, Data exchanges, example programs. Byte level logical Operations, Bit level Logical Operations, Rotate and Swap Operations, Example Programs. Arithmetic Operations: Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal Arithmetic, Example Programs.	**06 hrs**
3	**Jump and Call Instructions** The JUMP and CALL Program range, jump calls and Subroutines, Example programs	**04 hrs**
4	**8051 Programming in C** Data Types and Time delays in 8051C, I/O Programming, Logic operations, Data Conversion programs, Data serialization.	**04 hrs**
5	**8051 Timer/Counter Programming in Assembly and C** Programming 8051 Timers, Counter Programming, Programming Timer 0 and Timer1 in 8051.	**04 hrs**
6	**8051 Serial Port Programming in Assembly and C** Basics of Serial Communication, 8051 connection to RS232, 8051 serial port Programming in Assembly, 8051 serial port Programming in C.	**04 hrs**
7	**8051 Interrupts Programming in Assembly and C** 8051 Interrupts, Programming Timer Interrupts, Programming external hardware interrupts, Programming the Serial Communication Interrupts, Interrupt Priority in the 8051, Interrupt programming in assembly and C.	**04 hrs**
8	**8051 Interfacing techniques using ATMEGA32 microcontroller** Interfacing 8051 to LEDs, DIP switches, BCD Decoder display, 7 Segment Display, Timers hyperterminal (Serial Communication)	**05 hrs**
9	**8051 Interfacing to peripheral devices using ARM microcontroller** Interfacing 8051 to LCD, Keypad, DAC, parallel and serial ADC, Stepper Motor and DC Motor	**05hrs**

Text Books:

3. Ayala.K.J, “The 8051 Microcontroller Architecture, Programming & Applications”, 2ed., Penram International, 2006
4. Mazidi.M.A, Mazidi.J.G and McKinlay.R.D, “The 8051 Microcontroller and Embedded Systems- using Assembly and C”, 2ed, PHI 2006/Pearson, 2006

References:

3. Hall.D.V, “Microprocessors and Interfacing”, Revised 2ed., TMH,2006

School of Computer Science and Engineering

Program: Master of Technology		
Course Title: **Computer Graphics and Vision**		Course Code: **18ECSE716**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**Basic Raster Graphics Algorithms for Drawing 2d Primitives.** Overview, Scan Converting Lines, Scan Converting Circles, Filling Rectangles. Filling Polygons, Filling Ellipse Arcs, Pattern Filling, Thick Primitives, Line Style and Pen Style.	**08 hrs**
2	**Clipping in a Raster World.** Clipping Lines, Clipping Circles and Ellipses, Clipping Polygons. Antialiasing	**04 hrs**
3	**Texture Mapping: The Basics** Loading Textures, Using the Color Buffer , Updating Textures, Mapping Textures to Geometry ,Texture Matrix , A Simple 2D Example ,Texture Environment ,Texture Parameters, Basic Filtering, Texture Wrap, Mipmapping, Texture Objects: Managing Multiple Textures	**05 hrs**
4	**Geometric Objects and Transformations** Frames in OpenGL. Modeling a Colored Cube, Affine Transformations, Translation, Rotation, and Scaling, Transformations in Homogeneous Coordinates, Concatenation of Transformations, OpenGL Transformation Matrices	**06 hrs**
5	**Viewing** Classical and Computer Viewing, Viewing with a Computer, Positioning of the Camera Simple Projections, Projections in OpenGL, Interactive Mesh Displays, Parallel- Projection Matrices, Perspective-Projection Matrices, Projections and Shadows	**05 hrs**
6	**Representing Curves** Polygon Meshes,Parametric Cubic Curves: Hermit curves,Bezier curves, B-Splines	**04 hrs**
7	**Introduction to Computer Vision** Fundamentals of image formation, camera imaging geometry, feature detection and matching, multiview geometry including stereo, motion estimation and tracking, and classification.	**05 hrs**
8	**Basic methods for applications** Finding known models in images, depth recovery from stereo, camera calibration, image stabilization, automated alignment (e.g. panoramas), tracking and recognition	**05 hrs**

Text Books:

4. Computer Graphics: Principles and Practice, James D. *Foley* , Andries *van Dam* ,Steven K. Feiner, John F. Hughes ,2nd Edition, Pearson Education, 2008
5. Interactive Computer Graphics - A Top-Down Approach Using OpenGL (5/e), Edward Angel , 5th Edition Pearson Education, 2009.
6. Computer Vision: Algorithms and Applications, Richard Szeliski, springer 2010

References:

1. Computer Graphics using OpenGL , F. S. Hill Jr. and S. M. Kelley , 3rd Edition ,Pearson Education, 2009
2. Computer Graphics with OpenGL ,D. D. Hearn and M. P. Baker, 3rd Edition
3. Dictionary of Computer Vision and Image Processing, Fisher,2nd edition,Weily,2014

School of Computer Science and Engineering

Program: Master of Technology		
Course Title: **Parallel Computing**		Course Code: **18ECSE802**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **3 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**Introduction and History** GPUs as Parallel Computers; Architecture of a Modem GPU; Parallel Programming Languages and Models; Overarching Goals; Evolution of Graphics Pipelines; The Era of Fixed- Function; Graphics Pipelines; Evolution of Programmable Real-Time Graphics; Unified Graphics and Computing Processors; GPGPU; An Intermediate Step; GPU Computing; Scalable GPUs Recent Developments; Future Trends	**05 hrs**
2	**Introduction to CUDA** Data Parallelism; CUDA Program Structure; A Matrix-Matrix Multiplication Example; Device Memories and Data Transfer; Kernel Functions and Threading; Function declarations; Kernel launch; Predefined variables; Runtime API.CUDA Thread Organization; Using b1ock Id x and thread Id x ; Synchronization and Transparent Scalability; Thread Assignment ; Thread Scheduling and Latency Tolerance	**07 hrs**
3	**CUDA Memories, Performance Considerations and Floating Point Considerations** Importance of Memory Access Efficiency; CUDA Device Memory Types; A Strategy for Reducing Global Memory Traffic; Memory as a Limiting Factor to Parallelism; Global Memory Bandwidth; Dynamic Partitioning of SM Resources; Data Prefetching; Instruction Mix; Thread Granularity; Measured Performance; More on thread execution, Global memory bandwidth, dynamic partitioning of SM resources, Floating point format, Arithmetic Accuracy and rounding	**07 hrs**
4	**Floating Point Considerations** Floating-Point Format, Normalized Representation of M, Excess Encoding of E, Representable Numbers, Special Bit Patterns and Precision, Arithmetic Accuracy and Rounding, Algorithm Considerations	**06 hrs**
5	**Introduction to OPENCL** Introduction to OPENCL; Background; Data Parallelism, Model; Device, Architecture, Kernel Functions, Device Management and Kernel Launch; Electrostatic Potential Map in OpenCL;	**06 hrs**
6	**Parallel Programming and Computational Thinking** Goals of Parallel Programming, Problem Decomposition, Algorithm Selection, Computational Thinking	**02 hrs**
7	**Introduction to Embedded GPU Computing** Architecture, Programming Model, Programs, Configuration etc.	**04 hrs**
8	**Case Study /Projects** Concepts of Game Design, Applications like Matrix multiplication, MRI reconstruction Molecular Visualization and Gaming	**05 hrs**

Text Books:

1. Programming Massively Parallel Processors: A Hands on Approach; David B. Kirk, Wen- mei W. Hwu; Morgan Kaufmann /Elsevier India reprint 2010

References:

1. *Heterogeneous Computing with OpenCL, by Benedict R. Gaster, Lee Howes, David R. Kaeli, Perhaad Mistry & Dana Schaa*; Morgan Kaufmann 2011

School of Computer Science and Engineering

Program: Master of Technology		
Course Title: **Social Network Analysis**		Course Code: **18ECSE803**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**Introduction:**Aspects of Networks, Network Datasets: An Overview. Strong and Weak Ties :Triadic Closure , The Strength of Weak Ties , Tie Strength and Network Structure in Large-Scale Data, Tie Strength, Social Media, and Passive Engagement , Closure, Structural Holes, and Social Capital	**06 hrs**
2	**Networks in Surrounding Contexts :**Homophily ,Mechanisms Underlying Homophily: Selection and Social Influence , Tracking Link Formation in On-Line Data, Spatial Model of Segregation	**06 hrs**
3	**Positive and Negative Relationships :**Structural Balance Characterizing the Structure of Balanced Networks , Applications of Structural Balance . . . A Weaker Form of Structural Balance ,Advanced Material: Generalizing the Definition of Structural Balance	**06 hrs**
4	**Link Analysis and Web Search :**Searching the Web: The Problem of Ranking , Link Analysis using Hubs and Authorities , PageRank , Applying Link Analysis in Modern Web Search , Applications beyond the Web , Spectral Analysis, Random Walks, and Web Search .	**06 hrs**
5	**Cascading Behavior in Networks :**Diffusion in Networks , Modeling Diffusion through a Network , Cascades and Clusters , Diffusion, Thresholds, and the Role of Weak Ties , Extensions of the Basic Cascade Model , Knowledge, Thresholds, and Collective Action, The Cascade Capacity .	**06 hrs**
6	**Power Laws and Rich-Get-Richer Phenomena :**Popularity as a Network Phenomenon , Power Laws , Rich-Get-Richer Models , The Unpredictability of Rich-Get-Richer Effects , The Long Tail , The Effect of Search Tools and Recommendation Systems , Advanced Material: Analysis of Rich-Get-Richer Processes .	**06 hrs**
7	**The Small-World Phenomenon :**Six Degrees of Separation , Structure and Randomness , Decentralized Search , Modeling the Process of Decentralized Search , Empirical Analysis and Generalized Models , Core-Periphery Structures and Difficulties in Decentralized Search , Analysis of Decentralized Search	**06 hrs**

Text Books:

1. Networks, Crowds and Markets by David Easley and Jon Kleinberg, Cambridge University Press, 2010
2. Social and Economic Networks by Matthew O. Jackson, Princeton University Press, 2010.

References:

1. Peter R. Monge, Noshir S. Contractor, Theories of communication networks. Oxford University Press, 2003.
2. Duncan Watts. Six degrees: the science of a connected age. Norton, 2004.
3. Stanley Wasserman, Katherine Faust. Social network analysis: methods and applications. Cambridge University Press, 1994.

School of Computer Science and Engineering

Program: Master of Technology		
Course Title: **Wireless and Mobile Networks**		Course Code: **18ECSE804**
L-T-P: **2-0-1**	Credits: **3**	Contact Hrs: **4 hrs/week**
ISA Marks: **50**	ESA Marks: **50**	Total Marks: **100**
Teaching Hrs: **42**	Exam Duration: **3 hrs**	

1	**Introduction:** Characteristics of Cellular Systems, Fundamentals of Cellular Systems, Cellular System Infrastructure, Satellite Systems, Network Protocols, Ad Hoc Networks, Sensor Networks, Wireless LANs, MANs and PANs	**04 hrs**
2	**Mobile Radio Propagation :** Introduction, Types of Radio Waves, Propagation, Mechanisms, Free Space Propagation, Land Propagation, Path Loss , Slow Fading, Fast Fading , Statistical Characteristics of Envelope, Characteristics of Instantaneous Amplitude, Doppler Effect, Delay Spread, Intersymbol Interference, Coherence and width Cochannel Interference	**06 hrs**
3	**Cellular Concept :** Introduction, Cell Area. Signal Strength and Cell Parameters, Capacity of a Cell, Frequency Reuse, How to Form a Cluster, Cochannel interference, Cell Splitting , Cell Sectoring	**07 hrs**
4	**Traffic Channel Allocation :** Introduction , Static Allocation versus Dynamic Allocation , Fixed Channel Allocation (FCA) , Simple Borrowing Schemes, Complex Borrowing Schemes, Dynamic Channel Allocation (DCA) , Centralized Dynamic Channel Allocation Schemes , Distributed Dynamic Channel Allocation Schemes , Hybrid Channel Allocation (HCA), Hybrid Channel Allocation (HCA) Schemes, Flexible Traffic Channel Allocation Schemes, Allocation in Specialized System Structure, Channel Allocation in One-Dimensional Systems , Reuse Partitioning–Based Channel Allocation, Overlapped Cells–Based Channel Allocation	**04 hrs**
5	**Mobile Communication Systems:** Introduction, Cellular System Infrastructure, Registration, Handoff Parameters and Underlying Support, Parameters Influencing Handoff , Handoff Underlying Support, Roaming Support, Home Agents, Foreign Agents, and Mobile IP, Rerouting in Backbone Routers, Multicasting.	**06 hrs**
6	**Mobile network and transport layer:**Mobile IP Packet delivery-Tunneling-Reverse tunneling, IPV6-Dynamic host routing protocol, Traditional TCP-Congestion control-classical TCP-Snooping Mobile TCP, Transaction oriented TCP-TCP over 2.5/3G Wireless Networks,	**07 hrs**
7	**Emerging wireless technologies:** Femtocell Network : Introduction, Technical Features, Challenges Push-to-Talk (PTT) Technology for SMS : PTT Network Technology , PTT in iDEN Cellular Networks, PTT in Non-iDEN Cellular Networks: PoC Multicast in Wireless Networks : Recent Advances in Multicast over Mobile IP , Reliable Wireless Multicast Protocols, Broadcasting, Multicasting, and Geocasting in Ad HocNetworks	**04 hrs**

Text Books:

1. Dharma PrakashAgrawal , Qing –An Zeng , " Introduction to wireless and mobile systems", Cengage Learning, 2014.
2. Roy Blake, "Wireless communication technology",Cengage Learning, sixth Indian reprint 2013.
3. Singal T.L., "Wireless communication", Tata McGraw Hill Education private limited , 2011.

References:

1. Wireless telecommunications systems and networks by Gray J.Mullet, CengageLearning,Reprint 2014.
2. UpenaDalal, "Wireless communication" Oxford University press, first edition 2009.
3. MartynMallick, "Mobile and Wireless Design Essentials", Wiley Dreamtech India Pvt. Ltd., 2004.
4. Jochen Schiller, "Mobile Communications", Addision Wesley, 2nd Edition, 2011.