

CNS 205(D) : MOBILE COMPUTING

3 hours per week	L-3	T-0	P-0	C-3
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Module 1 - Mobile Computing Architecture[12 Hrs.]: Internet - The ubiquitous network; Schematic representation of mobile computing environment - The three layer mobile computing architecture - Design considerations of mobile computing - Mobile computing through internet - Making existing applications mobile-enabled - Mobile Computing through Telephony - Multiple Access Procedures - Satellite Communication Systems - Mobile Computing through telephone - developing an IVR application - Voice XML, Telephony Application Programming Interface; Emerging technologies – RFID, WIMAX, Mobile IP, IPv6, Java Card.

Module 2 - Mobile Communications[13 Hrs.]: Introduction - The GSM Architecture - GSM Entities - Call Routing in GSM - PLMN interfaces - GSM Addresses and identifiers - Network Aspects in GSM - Mobility Management - GSM Frequency allocation - Personal Communications services - Authentications and security - Short message service - Mobile Computing over SMS - Value added services through SMS - Accessing the SMS Bearer;

GPRS: GPRS and Packet Data Network - GPRS Network Architecture - GPRS Network Operations - Data Services in GPRS - Limitations in GPRS - Applications for GPRS.

Module 3 - Mobility Management & Intelligent Networks[15 Hrs.]: CDMA - Spread Spectrum Technology – DSSS - Walsh Function – IS-95 - Speech and Channel Coding - IS-95 Architecture - Channel Structure - Call Processing - Handoff and Roaming - Channel Capacity - CDMA and Data protocol Stack - Intelligent Networks and Internetworking - Fundamentals of call processing - Intelligence in the network - SS#7 Signalling - SS#7 Protocol Stack - SS#7 Signal Unit - IN Conceptual Model, IN services - Virtual Calling Card service - Local Number Portability.

Module 4 - Mobile Device Operating System[10 Hrs.]: Introduction to Symbian Operating System - Symbian OS Architecture - Applications for Symbian - Controls and Compound Control - Active Objects - Localization, Security in Symbian OS.

IP Multimedia Subsystems: Architecture of IMS Networks - Protocols Used in IMS - Building Blocks of IMS networks - Call Session Control Function - Identities in IMS - Call flow in IMS Network - IMS Charging - IMS service Architecture - Security in IMS.

References:

1. Asoke K. Talukder and Roopa R. Yavagal; Mobile Computing- Technology Application, and service creation; TMH Publication, 2006
2. T Rappaport, “Wireless Communication: Principle and Practice”; Pearson Education.
3. G. S. Rao “Mobile Cellular Communication”, Pearson Learning.
4. Gonzalo camarillo, Miguel-Angel Garcia- Martin “The 3G IP Multimedia Subsystem(IMS)” Merging the internet and the cellular worlds.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 205(E) : SECURITY THREATS AND MANAGEMENT

3 hours per week	L-3	T-0	P-0	C-3
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Module 1 – Introduction[9 Hrs.]: Security threats - Sources of security threats - Motives - Target Assets and vulnerabilities – Consequences of threats- E-mail threats - Web-threats - Intruders and Hackers, Insider threats, Cyber crimes.

Module 2 – Network Threats[10 Hrs.]: Active / Passive – Interference – Interception – Impersonation – Worms – Virus – Spam’s – Ad ware - Spy ware – Trojans and covert channels – Backdoors – Bots – IP Spoofing - ARP spoofing - Session Hijacking – Sabotage - Internal treats- Environmental threats - Threats to Server Security.

Module 3 - Threats to Wireless networks[10 Hrs.]: ESM - ECM and ECCM - Proliferation of device and technologies - Practical aspects - Wireless availability - Privacy Challenges - Risks: Denial of Service, Insertion Attacks - Interception and monitoring wireless traffic - MIS configuration - Wireless Attacks – Surveillance - War Driving, Client-to-Client Hacking - Rogue Access Points - Jamming and Denial of Service.

Module 4 - Security Threat Management[10 Hrs.]: Risk Assessment - Forensic Analysis - Security threat correlation – Threat awareness - Vulnerability sources and assessment - Vulnerability assessment tools - Threat identification - Threat Analysis - Threat Modeling - Model for Information Security Planning.

Module 5 - Security Elements[11 Hrs.]: Authorization and Authentication - types, policies and techniques – Security certification - Security monitoring and Auditing - Security Requirements Specifications - Security Policies and Procedures - Firewalls, IDS, Log Files, Honey Pots - Access control - Trusted Computing and multilevel security - Security models - Trusted Systems - Software security issues - Physical and infrastructure security - Human factors – Security awareness - training - Email and Internet use policies.

References:

1. Joseph M Kizza, “Computer Network Security”, Springer Verlag, 2005.
2. Swiderski, Frank and Syndex, “Threat Modeling”, Microsoft Press, 2004.
3. William Stallings and Lawrie Brown, “Computer Security: Principles and Practice”, Prentice Hall,2008.
4. Thomas Calabres and Tom Calabrese, “Information Security Intelligence: CryptographicPrinciples & Application”, Thomson Delmar Learning, 2004.
5. Cyrus Peikari and Seth Fogie, "Maximum Wireless Security" Sams, 2002.

6. Stallings William, "Wireless Communications and Networks" Second Edition, Pearson Education Ltd, 2009.

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 205(F) : HIGH PERFORMANCE SCIENTIFIC COMPUTING

3 hours per week	L-3	T-0	P-0	C-3
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Module 1 - High performance through parallelism[11 Hrs]:

Flynn's taxonomy - Need for parallel architecture - convergence of parallel architectures - fundamental design issues - evolution of super computing - modern parallel computers - parallel architectures - interconnection networks - processor arrays - multiprocessors, multi computers.

Module 2 - Multi core architecture and openMP [14 Hrs]:

Introduction to multi core architecture system overview of threading - fundamental concepts of parallel programming - threading and parallel programming constructs - openMP-a portable solution for threading - hyper threading technology - multiprocessors and multi-core processors.

Module 3 - Parallel algorithms and MPI[14 Hrs]:

Parallel algorithm design - Task channel model - Foster's design methodology - Boundary value problem - Finding the maximum - Message passing programming-model and interface - Circuit satisfiability using MPI,The sieve of Eratosthenes - Data decomposition options parallel algorithm, All pair shortest path problem - point to point communication - Matrix multiplication - Solving linear equations - monte-carlo methods - finite difference methods - vibrating string - Performance analysis – Correctness issues

Module 4 - Parallel computing with CUDA [11 hrs]:

CUDA programming model - Introduction, timing your kernel - CUDA execution model - Nature of wrap execution - Exposing parallelism - Avoiding branch divergence - Dynamic parallelism - CUDA memory model - matrix addition with unified memory - CUDA shared memory - Reducing global memory access - Streams and concurrency.

Text books:

1. David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture : A hardware/software approach" , Morgan Kaufmann/Elsevier Publishers, 2004.
2. Michael J Quinn, "Parallel programming in C with MP1 and OpenMP", Tata McGraw Hill, 2003.
3. Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2006.
4. "Professional Cuda C programming" by John Cheng, Max Grossman, Ty McKercher, Wiley, 2014

References:

1. Wesley Petersen and Peter Arbenz, "Introduction to Parallel Computing", Oxford University Press, 2004.
2. Jason Sanders, Jason Sanders, CUDA by Example: An Introduction to General-Purpose GPU Programming, Pearson, 2010

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules.

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CNS 205(G) : MANAGING BIG DATA

3 hours per week	L-3	T-0	P-0	C-3
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Module 1 - Understanding BigData[12 HOURS]: What Is Big Data - Why Big Data - Challenges Of Conventional Systems - convergence Of Key Trends – Structured, Semistructured And Unstructured Data, Industry 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 - Introduction To Hadoop - Open Source Technologies - Cloud And Big Data - Mobile Business Intelligence - Crowd Sourcing Analytics - Inter And Trans Firewall Analytics

Module 2 - Basics of Hadoop and MapReduce[17 HOURS]: What Is Hadoop - Why Hadoop, Data Format - Comparison With Other Systems - Analysis Data With Hadoop - Scaling Out - Hadoop Streaming - Hadoop Pipes - Hadoop Distributed File System(Hdfs) - Hadoop I/O - Devoleping A Mapreduce Application - Mapreduce Working - Yarn-Mapreduce Formats - Resource Management - Map-reduce Scheduler

Module 3 - Hadoop Related Tool[10 HOURS]: Introduction to Hbase – Data Model And Implementations – Hbase Clients – Hbase Examples – Praxis - Hbase Vs Rdms.Introduction to Cassandra – Cassandra Data Model – Cassandra Examples – Cassandra Clients – Hadoop Integration.Introduction to Pig – Grunt – Pig Data Model – Pig Latin – Developing And Testing Pig Latin Scripts - Sql Vs Pig.Introduction to Hive – Data Types And File Formats – Hive Architecture - Hiveql Data Definition – Hiveql Data Manipulation – Hiveql Queries - Hive Vs Rdbms.

Module 4 - Introduction to NoSQL[9 HOURS]: Aggregate Data Models – Aggregates – Key - Value And Document Data Models – Relationships – Graph Databases – Schemaless Databases – Materialized Views – Distribution Models – Sharding – Master-Slave Replication – Peer-Peer Replication – Sharding And Replication – Consistency – Relaxing Consistency – Version Stamps. Case Study: Mongodb

Textbooks:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012

3. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
4. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
5. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
6. Alan Gates, "Programming Pig", O'Reilley, 2011.
7. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
8. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison Wesley Professional, 2012

References:

1. Vignesh Prajapati "Big Data Analytics with R and Hadoop", Set up an integrated infrastructure of R and Hadoop to turn your data analytics into Big Data analytics
2. "MongoDB vs Hadoop Big Solutions for Big Problems", Deep Mistry, Open Software Integrators
3. Shashank Tiwari," Professional NoSQL", 2011, Wrox press.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 205(H) : LANGUAGE TECHNOLOGIES

3 hours per week	L-3	T-0	P-0	C-3
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Module1 – Introduction[12Hrs.]:

Introduction to natural Language Processing – Mathematical foundations – Elementary Probability Theory – Essential Information Theory – Linguistic Essentials – Parts of Speech and Morphology – Phrase Structure – Semantics and Pragmatics – Corpus based Work

Module 2 – Words[12 Hrs.]:

Collocations, Frequency, Mean and Variance, Hypothesis Testing, Mutual Information – Statistical Inference, n-gram models, Statistical Estimators, Combining Estimators – Word Sense Disambiguation, Methodological Preliminaries, Supervised Disambiguation, Dictionary Based Disambiguation, Unsupervised Disambiguation – Lexical Acquisition

Module 3 – Grammar[10 Hrs.]:

Hidden Markov Models, Implementation, Properties, Variants – Parts-of-speech Tagging, Markov Model Taggers, Uses of Taggers – Probabilistic Context free Grammars – Probabilistic Parsing, Parsing for Disambiguation

Module 4 – Information Retrieval[8 Hrs.]:

Information Retrieval Architecture, indexing, storage, Compression Techniques, Retrieval approaches, evaluation – Search Engines, Commercial search engine features, comparison , Performance measures – Document processing, NLP based information retrieval, Information Extraction

Module 5 – Text Mining[8 Hrs.]:

Categorization, Extraction based categorization – Clustering, Hierarchical clustering – Document Classification and routing – Finding and organizing answers from Text search – Text categorization and Efficient summarization using Lexical chains – Machine translation, Transfer metaphor, Interlingual and statistical approaches.

Text books:

1. Christopher D. Manning and Hinrich Schutze, “ Foundations of statistical Natural Language Processing”, MIT Press, 1999
2. Tomek Strzalkowski, “Natural Language Information Retrieval”, Kluwer academic publishers,1999.

References:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing”, Pearson, 2008
2. Ron Cole, J.Mariani, et.al “Survey of the state of the art in Human Language Technology”, Cambridge University Press,1997
3. Michael W. Berry, “Survey of Text Mining: Clustering, Classification and Retrieval”, Springer Verlag,2003

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 205(I) : CLOUD COMPUTING

3 hours per week	L-3	T-0	P-0	C-3
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Module 1[10 Hrs.]:

Understanding Cloud Computing: History of Cloud Computing – Cloud Architecture - Cloud Storage- Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing- Companies in the Cloud today- Public vs Private cloud - Cloud Services;

Understanding cloud services: Pros and Cons of Cloud Service Development - Types of Cloud Service Development - Software as a Service - Platform as a Service - Infrastructure as a Service - On-Demand Computing - Discovering Cloud Services Development Services and Tools - Amazon Ec2 - Google App Engine – IBM Clouds.

Module 2[14 Hrs.]:

Web services, AJAX and mashups - Web services: SOAP and REST, SOAP versus REST - AJAX: asynchronous ‘rich’ interfaces - Mashups: user interface services - Virtualization Technology: Virtual machine technologies - virtualization applications in enterprises - pitfalls of virtualization - Multitenant Software: Multi entity support, Multi schema approach,multi tennance using cloud data stores - Cloud Software environment - Eucalyptus, CloudStack, OpenStack, Aneka, Cloudsim.

Module 3[12 Hrs.]:

Cloud Security fundamentals: Vulnerability assessment tool for cloud - Privacy and Security in cloud - Cloud computing security architecture: Architectural Considerations - General Issues - Trusted Cloud Computing - Secure Execution Environments and Communications - Micro Architectures;

Identity Management and access control: Identity management - Access control - Autonomic Security - Cloud computing security challenges - Virtualization security management virtual threats - VM Security Recommendations - VM-specific Security techniques - Secure Execution Environments and Communications in cloud

Module 4[14 Hrs.]:

Communicating with the cloud - media and streaming - managing cloud services: Examining Organizations issues, Looking at the technical interface - Managing cloud resources - Administering cloud services - Cloud management standards - Monitoring the cloud - Migrating to the Cloud: cloud services for individuals - Enterprise class cloud offerings - Migration - Broad Approaches to migrating into the cloud - The seven-step

model of migration into a cloud - Mobile clouds and mobile web services - best practices - Enterprise cloud computing ecosystem.

Refereneces:

1. Michael Miller, Cloud Computing: Web-Based Applications That change the Way You Work and Collaborate Online, Que Publishing, August 2008.
2. Sosinky B., “Cloud Computing Bible” , Wiley India.
3. Gautam shroff “Enterprise Cloud Computing”, Cambridge university press.
4. Ronald Krutz and Russel Dean Vines,”Cloud Security – a comprehensive Guide to secure cloud computing, Wiley-India.
5. Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, John Wiley and Sons.
6. Kai Hwang, Geoffery C Fox, Jack G Dongarra, “ Distributed and Cloud computing, from parallel Processing to the Internet of things”, Morgan Kaufmann Publishers, 2012.
7. Tim Malhar, S. Kumaraswamy, S. Latif, “ Cloud Security & Privacy”, (SPD, O’REILLY)
8. Judith Hurwitz, R.Bloor, M. Kanfman, F. Halper, “Cloud Computing for Dummies”(Wiley India Edition).
9. Antohy T Velte,et.al, “ Cloud Computing: A Practical Approach,” McGraw Hill.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 205(J) : REAL TIME SYSTEMS

3 hours per week	L-3	T-0	P-0	C-3
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Module 1 – Introduction[7 Hrs.]:

Real time systems - Applications, Basic Model, Characteristics - Safety and reliability - Real time tasks - Timing constraints - Modelling timing constraints

Module 2 - Handling Real Time Tasks[15 Hrs.]:

Scheduling RT: Concepts - Type of RT task and their characteristics - Task scheduling - Clock driven scheduling - Hybrid schedulers - Event-Driven scheduling - EDF scheduling - RMA, Issue with RMA - Issue in using RMA in practical situation.

Sharing Among RT Tasks: Resource sharing among RT tasks - Priority inversion - PIP, HLP, PCP - Type of priority inversion under PCP, Feature of PCP - Issue in using resource sharing protocols - Handling task dependencies

Module 3 – RT tasks in commercial systems[14 Hrs.]:

Scheduling RT in Multiprocessor and Distributed System: Multi-processor task allocation - Dynamic allocation of task - Fault-tolerance scheduling of task - Clocks in distributed RT systems - Centralized and distributed clock synchronization.

Commercial RT Operation System: Time services - Features of RT OS - Unix as a RT OS, Unix based RT OS - Windows as a RT OS - POSIX, VRTX, VxWork, QNX, μ C/OS-II, RT Linux, Lynx, Window CE - Benchmarking RT system.

Module 4: RT Communication and Databases[14 Hrs.]:

RT Communication: Example of applications requiring RT communication - Basic concepts - RT communication in a LAN - Soft and hard RT communication in a LAN, -Bounded access protocol for LAN - Performance comparison - RT communication over packet switched networks - QoS framework - Routing - Resource reservation - Rate control - QoS Models

RT Database: Example application of RT database - RT databases - Characteristics of temporal data - Concurrency control in RT database - Commercial RT database

Textbook:

1. Rajib Mall, “Real Time System: Theory and Practice”, Pearson 2008

References

1. Jane W Liu, “Real-Time Systems”, Pearson Education, 2001
2. Resource Management in Real-Time System and Network, C.Siva Ram Murthy and G. Maninaram, MIT Press, March 2001
3. Phillip A Laplante, Seppo j Ovask , “Real Time System Design and Analysis: Tools for the Practitioner”, John Wiley and Sons, 2012

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(A) : ADVANCED OPERATING SYSTEMS
Same as MCS 202

3 hours per week	L-3	T-0	P-0	C-3
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Module I[11 Hrs.]: Uniprocessing operating system: Review of Operating system concepts. Process Concept – Threads process Scheduling – process synchronization – Interprocess Communication - semaphores – Messages – Monitors – critical Regions – conditional critical regions – dead Locks. Real and virtual Memory management Schemes.

Module II[9 Hrs.]: Multiprocessor Operating System: Multiprocessor UNIX design goals - Master slave and multithreaded UNIX - Multicomputer UNIX extensions.

Module III[11 Hrs.]: Distributed Operating System: Introduction - Design Issues. Communication in distributed systems Layered protocols – ATM - client server model - remote Procedure call – Group communication.

Module IV[11 Hrs.]: Synchronization distributed systems: Clock Synchronization – Mutual Exclusion – Election algorithms – Atomic transactions - Deadlocks in distributed systems. Processes and processors in distributed systems: Threads – system models - Processor allocation - Scheduling in distributed Systems.

Module V[8 Hrs.]: Distributed file system – Design and implementation – Trends in distributed file systems. Case study AMOEBA, MACH, Recent trends and developments

References:

1. A.S.Tanenbaum, “Modern Operating Systems”, PHI Edition, 1992
2. A.S.Tanenbaum, “Distributed Operating systems”, PHI.
3. M. Singhal and N.G.Sivarathri, “Advanced Concepts in Operating Systems”, M.C.Grawhill Inc. 1994.System Concepts, Wiley, 2000.
4. J.L.Peterson and A. Silberchatz, “Operating System Concepts”
5. M.Maekawa, A.E.Oldehoeft And R.R. Oldehoeft, “Operating systems.”

6. M.Milenkovic, “Operating Systems : Concepts and Design” , McGrawhill Inc Newyork, 1992
7. K.Khawng, “Advanced Computer Archiecture : Parallelism , Scalability, Programmability”, M.C.Grawhill Inc, 1993
8. C.Crowley, “Operating Systems – A design Oriented Approach”, Irwin 1997.

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 206(B) : MULTI-OBJECTIVE OPTIMIZATION TECHNIQUES

3 hours per week	L-3	T-0	P-0	C-3
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Module 1 – Introduction and Classical Approaches[10 Hrs.]:

Introduction – Multi objective optimization problem - principles – Difference between single and multi objective optimization – Dominance and Pareto Optimality , Classical Methods – Weighted Sum – ϵ - Constraint method – Weighted Metric methods – Benson’s method - Value Function - Goal Programming methods – Interactive Methods

Module 2 – MOP Evolutionary Algorithms[10 Hrs.]:

Generic MOEA - Various MOEAs: MOGA, NSGA-II, NPGA, PAES, SPEA2, MOMGA, micro

GA - Constrained MOEAs: Penalty Function approach - Constrained Tournament – Ray – Tai –Seow’s Method.

Module 3 – Theoretical Issues[10 Hrs.]:

Fitness Landscapes - Fitness Functions - Pareto Ranking - Pareto Niching and Fitness Sharing - Recombination Operators - Mating Restriction - Solution Stability and Robustness

– MOEA Complexity - MOEA Scalability - Running Time Analysis - MOEA Computational Cost - No Free Lunch Theorem.

Module 4 – MOEA Testing, Analysis and Parallelization[10 Hrs.]:

MOEA Experimental Measurements – MOEA Statistical Testing Approaches – MOEA Test Suites - MOEA Parallelization: Background – Paradigms – Issues - MOEA Local Search Techniques.

Module 5 – Application and Alternative Meta-heuristics[10 Hrs.]:

Scientific Applications: Computer Science and Computer Engineering - Alternative Metaheuristics: Simulated Annealing – Tabu Search and Scatter Search – Ant System – Distributed Reinforcement Learning – Particle Swarm Optimization – Differential Evolution – Artificial Immune Systems - Other Heuristics.

REFERENCES:

1. Carlos A. Coello Coello, Gary B. Lamont, David A. Van Veldhuizen, “Evolutionary Algorithms for Solving Multi-objective Problems”, Second Edition, Springer, 2007.
2. Kalyanmoy Deb, “ Multi-Objective Optimization Using Evolutionary Algorithms”, John Wiley, 2002.
3. Aimin Zhoua, Bo-Yang Qub, Hui Li c, Shi-Zheng Zhaob, Ponnuthurai Nagaratnam Suganthan b, Qingfu Zhangd, “Multiobjective evolutionary algorithms: A survey of the state of the art”, *Swarm and Evolutionary Computation* (2011) 32–49.
4. E Alba, M Tomassini, “Parallel and evolutionary algorithms”, *Evolutionary Computation*, *IEEE Transactions on* 6 (5), 443-462.
5. Crina Grosan, Ajith Abraham, “Hybrid Evolutionary Algorithms: Methodologies, Architectures, and Reviews”, *Studies in Computational Intelligence*, Vol. 75, Springer, 2007.
6. Christian Blum and Andrea Roli. 2003. Metaheuristics in combinatorial optimization: Overview and conceptual comparison. *ACM Comput. Surv.* 35, 3 (September 2003), 268-308.

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

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CNS 206(C) : CRYPTANALYSIS

3 hours per week	L-3	T-0	P-0	C-3
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Module 1 - CRYPTANALYSIS OF CLASSICAL CIPHERS[13 Hrs.]: Vigenere cipher - Affine cipher – Hill-cipher - Linear Shift Register Random Bit Generator - Berlekamp-Massey algorithm for the cryptanalysis of LFSR - Correlation attack on LFSR based stream ciphers - Cryptanalysis of ORYX - Fast algebraic attack.

Module 2 - CRYPTANALYSIS OF BLOCK CIPHERS[9 Hrs.]: Man in the middle attack - Double DES - Linear and Differential cryptanalysis - Algorithmic Number theory: Stein’s binary greatest common divisor algorithm - Shanks Tonelli algorithm for square root in F_p - Stein’s greatest common divisor algorithm for polynomials.

Module 3 - ALGORITHM FOR DLP[13 Hrs.]: Pollard Rho method for DLP - Shank’s baby step and Giant step algorithm for DLP - Silver-Pohling-Hellman algorithm for DLP - Index calculus for DLP algorithms: Trial division method - Fermat method - Legendre-convergence method - Continued fraction method - Elliptic curve method - Quadratic sieve method.

Module 4 - LATTICE BASED CRYPTANALYSIS[15 Hrs.]: Direct attacks using lattice reduction - Coppersmith’s attacks - Attacks on cryptographic hash functions: Birthday paradox - Birthday paradox for multi collisions - Birthday paradox in two groups - Applications of Birthday paradox in Hash functions – Multi collision attack on hash functions.

References:

1. Antoine Joux, “Algorithmic Cryptanalysis”, Chapman & Hall/CRC Cryptography and Series, 2009.
2. Song Y Yang, “Number Theory for Computing”, Second Edition, Springer Verlag, 2010.
3. Gregory V. Bard “Algebraic Cryptanalysis “Springer 2009.

4. Hffstein, Jeffray Piper, Jill and Silverman, “An Introduction to Mathematical Cryptography”, Springer 2010.
5. “Applied Cryptanalysis –Breaking ciphers in the real world”-Mark Stamp and Richard M.Low, Wiley-IEEE press, 2007.
6. Cryptography & Net work security, principles & practices, William Stallings, Fifth Edition, Pearson Education.
7. <https://eprint.iacr.org/2009/457.pdf>

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(D) : NEXT GENERATION NETWORKS

3 hours per week	L-3	T-0	P-0	C-3
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Module 1 – Introduction[9 Hrs.]:

Evolution of public mobile services - motivations for IP based services, wireless IP network architecture – 3GPP packet data network architecture; Introduction to next generation networks - Changes, Opportunities and challenges, Technologies, Network, and Services, Next generation society, future trends.

Module 2 - IMS AND CONVERGENT MANAGEMENT[12 Hrs.]:

IMS Architecture - IMS services - QoS Control and Authentication - Network and Service management for NGN - IMS advantages - Next generation OSS Architecture - standards important to OSS Architecture - Information framework - OSS interaction with IMS - NGN OSS function/ information view reference model - DMTF CIM.

Module 3 - MPLS AND VPN[11 Hrs.]:

Technology overview – MPLS & QoS - MPLS services and components- layer 2 VPN, layer 2 internetworking - VPN services – Signalling - layer 3 VPN - Technology overview - Remote Access and IPsec integration with MPLS VPN.

Module 4 – MULTICAST[9 Hrs.]:

MPLS Multicast VPN overview- Applications, examples, IPV6 and MPLS – Technology overview, Future of MPLS- Integrating IP and optical networks, Future layer 3 services, future layer 2 services.

Module 5 – Next Generation Network Management[9 Hrs.]:

Management and Provisioning - Configuration, Accounting, performance, security - case study for MPLS - Future enhancements - Adaptive self healing networks.

REFERENCE:

1. Thomas Plavky, "Next Generation Telecommunication networks, Services and Management.", Wiley & IEEE Press Publications, 2012.
2. Neill Wilkinson, "Next Generation Network Services", John Wiley Publications, 2002.
3. Robert Wood, "MPLS and Next Generation Networks: Foundations for NGN Enterprise Virtualizations", CISCO Press 2006.
4. Monique J Morrow, "Next Generation Networks", CISCO Press, 2007.

5. Ina Minie, Julian Lucek, “MPLS Enabled Applications- Emerging Developments and New Technology” 3rd Edition, Wiley,2011.

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 206(E) : BIOMETRIC TECHNOLOGIES

3 hours per week	L-3	T-0	P-0	C-3
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Module 1 – Biometrics[12 Hrs.]: Introduction - Benefits of biometrics over traditional authentication systems - Benefits of biometrics in identification system - Selecting a biometric system – Application - Key biometric terms and processes - Biometric matching methods - Accuracy in biometric system.

Module 2 – Physical Biometric Technology[13 Hrs.]: Fingerprints - Technical description - Characteristics - Competing technology - Strengths, Weaknesses, Deployments - Facial scan technical description - Characteristics, Weaknesses, Deployments - Retina vascular pattern Technical description - Characteristics, Strength, Weaknesses, Deployments - DNA biometrics.

Module 3 – Behavioral Biometric Technologies[14 Hrs.]: Handprint biometrics - Signature and handwriting technology - Technical description – Classification - Comprehensive packet logging - Keyboard or keystroke dynamics - Voice, Data acquisition, Feature extraction - Characteristics, Strength, Weakness, Deployment.

Module 4 - Multi Biometrics[11 Hrs.]: Multi biometrics and multi factor biometrics - Two factor authentication with password - Tickets and tokens - Executive decision - Implementation plan - Case study on physiological, Behavioural and multifactor biometrics in identification system.

Textbooks:

1. Samir Nanavathi, Michel Thieme, and Raj Nanavathi, “Biometrics- identity verification in a network”, Wiley Eastern 2002
2. John Chirillo and Scott Blaul, “Implementing Biometric Security”, Wiley Eastern Publication, 2005

References:

1. John Berger, “Biometrics for Network Security”, Prentice Hall, 2004

2. Julian Ashbourn, " Guild to Biometric for Large Scale System: Technological, Operational and User Related Factor", Springer Data London Limited, 2011

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules.

However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(F) : DISTRIBUTED ALGORITHMS

3 hours per week	L-3	T-0	P-0	C-3
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Module 1[9 Hrs.]: Introduction to model of synchronous distributed computing system - Leader election in a General Network - Simple Flooding Algorithm - Basic Breadth-First Search Algorithm – Bellman-Ford algorithm.

Module 2[17 Hrs.]: Algorithms in Synchronous Networks - Minimum Spanning Tree - Leader Election in a Synchronous Ring - LCR algorithm - HS algorithm - Time Slice Algorithm - Variable Speeds Algorithm – Lower Bound for Comparison-based Algorithms

Maximal Independent Set - LubyMIS algorithm - Distributed Consensus with Link Failures and Process Failures – Basics

Module 3[10 Hrs.]: Introduction to model of asynchronous distributed computing system - Send/Receive systems - Broadcast systems - Multicast systems - Basic algorithms - Peterson Leader - Election Algorithm – Local Synchronizer - Safe Synchronizer.

Module 4[14 Hrs.]: Asynchronous System Model. Shared Memory Systems - Environment Model - Shared Variable Types, Mutual Exclusion - Asynchronous Shared Memory Model - Dijkstra's Mutual Exclusion Algorithm;

Resource Allocation - Nonexistence of Symmetric Dining Philosophers Algorithms – Right-Left Dining Philosophers Algorithm - Mutual exclusion and consensus - Relationship between shared memory and network models Asynchronous networks with failures

Text books:

1. Nancy A. Lynch, "Distributed Algorithms", Morgan Kaufmann Publishers, Inc, 1996

References:

1. Sukumar Ghosh, "Distributed Systems: An Algorithmic Approach ", 2nd Edition, CRC Press, 2014
2. Wolfgang Reisig, W. Reisig, "Elements Of Distributed Algorithms: Modeling And Analysis With Petri Nets", Springer-verlag, 1998
3. Tel Gerard , "Introduction To Distributed Algorithms", 2nd Edition, Cambridge UniversityPress, 2000
4. Sukumar Ghosh, "Distributed Systems: An Algorithmic Approach", Chapman &Hall / CRC Press, 2006
5. Valmir C. Barbosa,"An Introduction To Distributed Algorithms", MIT Press, 2003
6. Randy Chow, Theodore Johnson, "Distributed Opearating Systems and Algorithm Analysis, Pearson Education, 1997
7. Santoro N., Nicola Santoro, "Design And Analysis Of Distributed Algorithms", Wiley-Interscience, 2006
8. Ajay D. Kshemkalyani, Mukesh Singhal, "Distributed Computing - Principles, Algorithms,And Systems", Cambridge University Press, 2011

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(G) : SOCIAL NETWORK ANALYSIS

3 hours per week	L-3	T-0	P-0	C-3
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Module 1 - Introduction[11 Hrs.]: Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks - Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

Module 2 – Evolution[12 Hrs.]: Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities-Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - With Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction - Bayesian Probabilistic Models - Probabilistic Relational Models.

Module 3 - Modeling and Visualization[12 Hrs.]: Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation – Centrality – Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix based Representations - Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications – Use of Hadoop and MapReduce - Ontological representation of social individuals and relationships.

Module 4 – Mining[15 Hrs.]:

Mining Communities: Aggregating and reasoning with social network data - Advanced Representations - Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

Text and Opinion Mining: Text Mining in Social Networks - Opinion extraction – Sentiment classification and clustering - Temporal sentiment analysis - Irony detection in opinion mining - Wish analysis - Product review mining – Review Classification – Tracking sentiments towards topics over time.

Textbooks:

1. Charu C. Aggarwal Social Network Data Analytics”, Springer; 2011
2. Peter Mika , “Social Networks and the Semantic Web”, Springer,1st edition2007.
3. BorkoFurht, “Handbook of Social Network Technologies and Applications”, Springer, 1st edition, 2010
4. GuandongXu , Yanchun Zhang and Lin Li, “ Web Mining and Social Networking–Techniques and applications”, Springer, 1st edition, 2011.
5. Giles, Mark Smith, John Yen, “Advances in Social Network Mining and Analysis”, Springer, 2010.

References:

1. Panagiotis Karampelas “Techniques and Tools for Designing an Online Social Network Platform”, Springer, 2013
2. Bo Pang, Lillian Lee “Opinion Mining and Sentiment Analysis”, Now publishers Inc, 2008

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(H) : MACHINE LEARNING TECHNIQUES

3 hours per week	L-3	T-0	P-0	C-3
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Module 1 – Foundations of Learning[11 Hrs.]: Components of learning – learning models – geometric models – probabilistic models – logic models – grouping and grading – learning versus design - binary and multiclass classification – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization – generalization bound – approximation generalization tradeoff – bias and variance – learning curve

Module 2 – Linear Models and Distance-based Models[15 Hrs.]: Linear classification – regularized regression – Logistic regression – perceptrons – multilayer neural networks – learning neural networks structures - Kernel Methods and the Evolution of SVM - Support Vector Machines - Non Linear SVM and Kernel Trick - Nearest neighbor models – K-means – clustering around medoids – silhouettes – hierarchical clustering – kernels to distance – locality sensitive hashing – non-parametric regression – Principal component analysis(PCA) - PCA algorithm - PCA and nearest neighbours - High Dimensional data - PCA via singular value decomposition(SVD) - ensemble learning – bagging and random forests – boosting – meta learning

Module 3 – Tree and Rule Models[14 Hrs.]: Decision trees – learning decision trees – ranking and probability estimation trees – regression trees – clustering trees – learning ordered rule lists – learning unordered rule lists – descriptive rule learning – association rule mining – first-order rule learning

Module 4 – Reinforcement Learning[10 Hrs.]: Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal difference learning – active reinforcement learning – exploration – learning an action-utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in Robot control

Text Books:

1. Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, “Learning from Data”, AMLBook Publishers, 2012.
2. P. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, 2012.
3. K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.

4. S. Russel and P. Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Prentice Hall, 2009
5. D. Barber, "Bayesian Reasoning and Machine Learning", Cambridge University Press, 2012.

References:

6. K.P. Soman, R. Loganathan, V. Ajay, "Machine Learning with SVM and Other Kernel Methods", PHI Learning Pvt. Ltd., 02-Feb-2009
7. K. P. Murphy, "Machine Learning: A probabilistic perspective", MIT Press, 2012.
8. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
9. M. Mohri, A. Rostamizadeh, and A. Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.
10. T. M. Mitchell, "Machine Learning", McGraw Hill, 1997.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks (covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks (covering all modules, one question from one module, 5 questions x 20 marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus, this question paper will have first four questions to cover the four modules respectively while the 5th question (choice question) may refer to multiple modules.

CNS 206(I) : SOFTWARE DEFINED NETWORKING

3 hours per week	L-3	T-0	P-0	C-3
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Module 1[12 Hrs.]:

Basics and History: Central Control - Programmable Networks - Network Virtualization - Control Plane Evolution - Control and Data Plane Separation - Opportunities in various domains - Challenges in Realizing Control and Data Plane Separation - Routing Control Platform (RCP) - The 4D Network Architecture;

Motivation: SDN / Openflow Applications - The mini-net emulation platform.

Module 2[12 Hrs.]:

Overview of Control Plane - Examples of SDN Controllers (Nox, Pox, Floodlight, Ryu, Open Daylight) - Customizing the control plane behavior with mininet - What is network virtualization and how is it implemented? - Examples of network virtualization and applications - Virtual networking in Mini-net - Slicing network control - Virtualization in multi-tenant data centers.

Module 3[14 Hrs.]:

Programmable Software Data Planes: Click - Making Software Faster: RouteBricks - Making Hardware Programmable: RMT - Protocol Independent Forwarding: P4 (and POF) - Building a Programmable Data Plane: NetASM - Motivation for "Northbound APIs" and SDN Programming Languages - Frenetic: A Programming Language for SDN - Composing SDN Control: The Pyretic Programming Language - Event Based SDN Control - Data Centers Internet Exchange Points (IXPs) - Wide-Area Backbone Networks - Home Networks.

Module 4[12 Hrs.]:

Configuration Verification: rcc (pre-SDN) - Data-Plane Verification: Veriflow - Header Space Analysis - Control-Plane Verification: Kinetic - Quality of Service : QoS issues in SDN - QoS oriented design of SDN – Multimedia on SDN -Traffic Classification – SDN in Optical Networks – Security issues - Anycast Implementation

References:

1. Paul Goransson, Chuck Black, "Software Defined Networking- A Comprehensive Approach", Morgan Kauffman, 1st edition, 2014
2. Ken Gray, " Software Defined Networking", Oreilly, 2013
3. Patricia A Morreale, James M Anderson, "Software Defined Networking-Design and Deployment", CRC Press, 2014
4. Fei Hu, "Network Innovation through OpenFlow and SDN", CRC press, 2014
5. Vishal Shukla, "Introduction to Software Defined Networking: OpenFlow & VxLAN", CreateSpace Independent Publishing Platform, 2013
6. Course Notes on SDN by Nick Feamster, School of Computer Science, Georgia Institute of Technology
7. Mininet.org <https://github.com/mininet/mininet/wiki/Documentation>
8. Tennenhouse, David L., et. al., " A survey of active network research", Communication Magazine IEEE 35.1 (1997), 80-86
9. Van der Merwe et. al., " The tempest – a practical framework for network programmability", Network, IEEE 12.3, (1998): 20-28
10. Bavier Andy et. al., "In VINI veritas: realistic and controlled network experimentation", ACM SIGCOMM Computer Communication Review, Vol 36, No.4, ACM 2006
11. Nick Feamster., et al., "How to lease the internet in your spare time", ACM SIGCOMM Computer Communication Review, 37.1, (2007): 61-64.
12. Feamster et. al. "The case of separating routing from routers", Proceeding os SIGCOMM, ACM 2004
13. Albert Greenberg, " A clean slate 4D approach to network control and a management", ACM SIGCOMM Communication Review 2005.
14. www.noxrepo.org
15. <http://osrg.github.io/ryu>
16. <http://www.projectfloodlight.org/>
17. <http://opendaylight.org>
18. <http://www.opennetworking.org>
19. Koponen Teemu, "Network virtualization in multi-tenant Data center", NSDI April 2014.

20. Mihai Dobrescu, et. al. "RouteBricks: exploiting the parallelism to scale software routers", 22nd ACM SIGOPS, 2009
21. Foster Nateet. al., "Frenetic: A network programming language", ACM SIGPLAN Notices 46.9 (2011)
22. Mosanto Christophper et. al., "Composing Software defined networks", NSDI 2013.

Question pattern:

This is a 4 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 5 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 5 questions x 20marks out of which 4 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules. However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first four questions to cover the four modules respectively while the 5th question(choice question) may refer to multiple modules.

CNS 206(J) : INTERNET OF THINGS

3 hours per week	L-3	T-0	P-0	C-3
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Module 1 – Introduction to Internet of Things[8 Hrs.]: Introduction – Definition - phases – Foundations – Policy - Challenges and Issues – identification - security – privacy;

Components in internet of things: Control Units -Sensors -Communication modules - Power Sources - Communication Technologies - RFID - Bluetooth – Zigbee – Wifi – RF links - Mobile Internet - Wired Communication.

Module 2 – Programming the Microcontroller for IoT[9 Hrs.]: Basics of Sensors and actuators - examples and working principles of sensors and actuators - Cloud computing and IOT - Arduino/Equivalent Microcontroller platform- Setting up the board - Programming for IOT- Reading from Sensors;

Communication: Connecting microcontroller with mobile devices - communication through Bluetooth and USB - connection with the internet using wifi / Ethernet.

Module 3 – Resource Management in the Internet of Things[11 Hrs.]: Introduction - Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines - Software Agents for Object - Data Synchronization - Types of Network Architectures - Fundamental Concepts of Agility and Autonomy - Enabling Autonomy and Agility by the Internet of Things - Technical Requirements for Satisfying the New Demands in Production - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things - Agents for the Behavior of Objects.

Module 4 – Business Models for the Internet of Things[11 Hrs.]: The Meaning of DiY in the Network Society - Sensor-actuator technologies and Middleware as a basis for a DiY Service Creation Framework - Device Integration - Middleware Technologies Needed for a DiY Internet of Things - Semantic Interoperability as a Requirement for DiY Creation – Ontology - Value Creation in the Internet of Things - Application of Ontology Engineering in the Internet of Things - Semantic Web-Ontology - The Internet of Things in Context of EURIDICE Business Impact.

Module 5 – Internet of Things, Web of Things[11 hrs]: Resource-oriented Architecture and Best Practices - Designing REST ful Smart Things - Web-enabling Constrained Devices - The Future Web of Things - Setting up cloud environment - send data from

microcontroller to cloud - Case studies - Open Source e-Health sensor platform - **BeClose**, a monitoring based Safety System for Elderly people - Other recent projects.

References:

1. Charalampos Doukas, Building Internet of Things with the Arduino, Create space, April 2002
2. Dieter Uckelmann et.al, “Architecting the Internet of Things”, Springer, 2011
3. Luigi Atzor et.al, The Internet of Things: A survey, Journal on Networks, Elsevier Publications, October, 2010
4. <http://postscapes.com/>
5. <http://www.theinternetofthings.eu/what-is-the-internet-of-things>

Question pattern:

This is a 5 module course. It will have Part A of 20 marks(covering all modules, one question from one module, 4 mark per question). Part B will have 80 marks(covering all modules, one question from one module, 6 questions x 16marks out of which 5 need to be answered). If essays are asked, limit it to one sub-part question with at most 12 marks; remaining marks are for analytic questions given as additional sub-parts, probably related to the essay, to test the analytical skills using the related theory.

The question setter has the freedom to fix the additional choice question in Part B; it may belong to one of the modules in its entirety or may have parts covering multiple modules or may have questions spanning the use of theories belonging to several modules.

However, **it need to be the last question always** to avoid any confusion regarding its coverage. Thus , this question paper will have first five questions to cover the five modules respectively while the 6th question(choice question) may refer to multiple modules.

CNS 207(P) : SECURE COMPUTING LABORATORY

2 hours per week	L-0	T-0	P-2	C-2
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The experiments included in this syllabus broadly serves the following purpose:

Case studies in Security to understand the following points

- 1) Using IPTABLES on linux for filtering rules
- 2) Using NMAP for ports monitoring
- 3) Understanding Firewalls
- 4) Ethical hacking
- 5) Using open ssl for web-browser communication
- 6) Configuring S/MIME for email communication
- 7) Distributed denial of service attack

Experiments in Security to gain experience in programming/evaluating/trouble-shooting solutions to problems in security

- 8) Programs using AES algorithm for 128 bit key
- 9) Elliptic curve cryptography algorithm
- 10) Digital signature algorithm
- 11) RSA algorithm
- 12) Secure hash algorithm
- 13) Working with sniffers for monitoring network communication
- 14) Performance evaluation of various cryptographic algorithms
- 15) Bluetooth attacks
- 16) Secure Password storage

Following is the actual list of experiments

- 1) Java/C Program to calculate MD5 and SHA hash values in java.
- 2) Java Code Implementation to generate a public key in an elliptic curve algorithm using a given private key.
- 3) Implementation of digital signature using RSA algorithm
- 4) Implement a protocol for authenticated delivery of data by Considering the Encryption and decryption using AES 128 bit key.
- 5) Implementation of web-browser communication using SSL by ensuring strong encryption, authentication and data integrity.
- 6) Java program to sign messages which conform to the S/MIME standard and verify its digital signatures based on certificates containing RSA keys.
- 7) Implementation of sniffer for monitoring network communication.
- 8) Implement java program to send an encrypted string via Bluetooth from a PC as client to a mobile as server.
- 9) Java program for secure password storage
- 10) Java program for distributed Denial of service
- 11) Implement a technique using Java/C to extract the database information through web application(SQL Injection)
- 12) Performance Evaluation of Cryptographic Algorithms: AES and DES
- 13) Using IPTABLES/NETFILTER on linux for
 - Displaying the status of the firewall
 - Stop/start/restart the firewall
 - Delete/insert firewall rules
 - Drop private network address on public interface
 - Block incoming port request/IP address
 - Drop or accept traffic from MAC address
 - Block or allow ICMP ping request
 - Block or open common ports
 - Restrict the no: of parallel connections to a server per client IP.
- 14) Using NMAP for ports monitoring
 - Scan ports consecutively.
 - Scan for specific port
 - Scan a TCP port

- Scan a UDP port
- Scan multiple ports
- Scan ports by network range
- Scan remote host for specific ports with TCP ACK
- Scan remote host for specific ports with TCP SYN
- Check most commonly used ports with TCP syn

Mapping of experiments to purpose is provided to understand scope/usage/compliance of each experiments listed above

Exp No	IPTABLES	NMAP	Firewalls	Ethical Hacking	Open SSL	S/MIME	DDOS	AES	ECC	Digital Signatures	RSA	Secure Hash	Sniffers	Performance eval.	Bluetooth	Password security
1												Y				
2									Y							
3										Y	Y					
4								Y								
5					Y											
6						Y					Y					
7													Y			
8															Y	
9																Y
10							Y									
11				Y												
12								Y						Y		
13	Y		Y													
14		Y	Y													

References:

https://www.suse.com/documentation/sles11/book_sle_admin/data/sec_apache2_ssl.html

<http://linuxconfig.org/apache-web-server-ssl-authentication>

<http://www.tomcatexpert.com/knowledge-base/using-openssl-configure-ssl-certificates-tomcat>

http://linuxcommand.org/man_pages/openssl1.html

https://www.owasp.org/index.php/Digital_Signature_Implementation_in_Java

<https://www.openssl.org/docs/apps/smime.html>

http://fedoraproject.org/wiki/How_to_edit_iptables_rules

<https://www.frozentux.net/iptables-tutorial/iptables-tutorial.html>

<https://www.frozentux.net/iptables-tutorial/iptables-tutorial.html>

<http://nmap.org/bennieston-tutorial/>

CNS 208(P) : TERM PAPER

2 hours per week	L-0	T-0	P-2	C-2
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Prerequisite:

Knowledge on leading magazines, journals and conferences on networks and security and the habit of reading technical magazines, conference proceedings and journals.

Objective:

To develop the skill of technical presentation, documentation and to give motivation for doing research work.

The student is expected to present a report on the literature survey conducted as a prior requirement for their thesis. Thesis preliminary will commence soon after the presentation of the term paper. The students should execute the project work using the facilities of the institute. However, external projects can be taken up, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work. Project evaluation committee should study the feasibility of each project work before giving consent. A paper should be prepared based on the project for possible publication in refereed Conferences/Journals. Grades will be awarded on the basis of contents of the paper and the presentation.

Sessional work assessment:

Presentation (Evaluation committee)	: 25 marks
Report (Guide)	: 25 marks
Total marks	: 50 marks

CNS 301(P) : THESIS PRELIMINARY

22 hours per week	L-0	T-0	P-22	C-8
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This shall comprise of two seminars and submission of an interim thesis report. This report shall be evaluated by the evaluation committee. The fourth semester Thesis(final) shall be an extension of this work in the same area. The first seminar would highlight the topic, objectives, methodology and expected results. The first seminar shall be conducted in the first half of this semester. The second seminar is presentation of the interim thesis report of the work completed and scope of the work which is to be accomplished in the fourth semester.

Weightages for the 8 credits allotted to Thesis-Preliminary:

Evaluation of the Thesis-Preliminary work: by the guide - 50% (200 Marks)

Evaluation of the Thesis–Preliminary work: by the Eval. Committee - 50% (200 Marks)

CNS 401(P) : THESIS

22 hours per week	L-0	T-0	P-22	C-12
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Towards the middle of the semester there shall be a pre-submission seminar to assess the quality and quantum of the work by the evaluation committee. This shall consist of a brief presentation of Third semester interim thesis report and the work done during the fourth semester. The comments of the examiners should be incorporated in the work and at least one technical paper is to be prepared for possible publication in journals / conferences. The final evaluation of the thesis shall be an external evaluation.

Weightage for the 12 credits allotted to thesis:

Internal Evaluation of the Thesis work:

by the guide - 200 Marks

by the Evaluation Committee - 200 Marks

Final Evaluation of the Thesis work by the Internal and External Examiners:

in the pattern Evaluation of Thesis + Viva Voce : 100 + 100 Marks

MODEL QUESTION PAPERS
**M.TECH. COMPUTER SCIENCE & ENGINEERING(NETWORK &
SECURITY)**

CNS 101 : MATHEMATICAL FOUNDATIONS

5 MODULE COURSE

PART – A

[Answer all 5 questions, each with 4 marks : 4*5=20]

1. Prove that if $(a, b) = 1$ then b/ac implies b/c
2. Explain about non- Markovian queue model
3. Explain any four rules of inference in statement calculus
4. Explain Floyd- Warshall algorithm to determine shortest distance between all pairs of vertices in a graph
5. Prove that intersection of two subgroups of a group G is again a subgroup of G

PART B

(Answer any five questions, each carry 16 marks)

6.
 - (a) State and prove Euler's theorem (6 marks)
 - (b) Find x and y such that $GCD(42823, 6409) = 42823x + 6409y$ (5 marks)
 - (c) Find the least positive integer that satisfy $x \equiv 5 \pmod{7}$ and $x \equiv 11 \pmod{17}$ (5 marks)
7.
 - (a) In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate the following:
 - i) The mean queue size.
 - ii) The probability that the queue size exceeds 10.
 - iii) If the input of trains increases to an average 33 per day, what will be the changes in (i) & (ii)?(6 Marks)
 - (b) State and prove Burkes Theorem. (6 marks)

(c) Explain about M/G/ 1 queuing system. (4 marks)

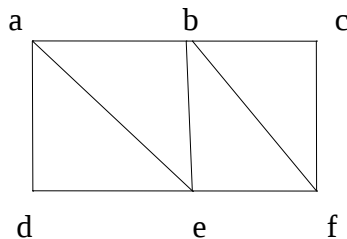
8.

- Obtain the prenex conjunctive normal form of $\forall x \forall y (p(x, y) \rightarrow \exists z (p(x, y) \wedge p(y, z)))$ (5 marks)
- Check the validity: From $\exists x (F(x) \wedge S(x)) \rightarrow \forall y (M(y) \rightarrow W(y))$ and $\exists y (M(y) \wedge \neg W(y))$ the conclusion $\forall x (F(x) \rightarrow \neg S(x))$ follows. (5 marks)
- Explain any three methods of proof (6 marks)

9.

(a) State and prove Euler's theorem on planar graphs. (5 marks)

(b) Apply DFS algorithm to determine the spanning tree of the following graph



(4 marks)

(c) Let $G=(V,E)$ be a loop free connected undirected graph with $T=(V,E')$ a DFS spanning tree for G . Let r be the root of T and let $v \in V, v \neq r$. Then show that v is an articulation point of G iff there exists a child c of v with no back edge relative to T in G from a vertex in T_c , the sub tree rooted at c , to an ancestor of v . (7 marks)

10.

- (a) State and prove Lagrange's theorem (6 marks)
- (b) Prove that in a group identity and inverse are unique (5 marks)
- (c) Prove that the set of all integers under the operations defined by $x \oplus y = x + y - 1$ and $x \otimes y = x + y - xy$ is a ring (5 marks)

11

- a) Find the GCD of the polynomials x^4+x^2+1 and x^2+1 over F_2 (6 marks)
- b) Construct a syndrome look up table for the code defined by the check matrix
- $$\begin{bmatrix} 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 \end{bmatrix} .$$
- (6 marks)
- c) Explain with examples: i) Irreducible polynomials ii)Cyclic codes(4 marks)

CNS 102 : ADVANCED ALGORITHMS AND ANALYZES

4 MODULE COURSE

PART – A

[Answer all 4 questions, each with 5 marks : 4*5=20]

1. Solve the recurrence

$$T(n)=2 T(n/3)+n \log n$$

$$T(n)=T(n/2)+1$$

$$T(n)=4 T(n/2)+n^3$$

$$T(n)=T(\text{sqrt}(n))+(\lg \lg n)$$

2. State Cook's theorem and explain with an example.
3. State Chinese Remainder Theorem and explain with an example.
4. Briefly explain Distributed Algorithms.

PART – B

[Answer any 4 questions, each with 20 marks : 4*20=80]

5. a. Write a short note about Asymptotic Notations & State the properties used for the comparison of asymptotic functions. 7
- b. Take the following list of functions and arrange them in ascending order of growth rate. That is, if it is the case that $f(n)$ is $O(g(n))$, then, function $g(n)$ should follows function $f(n)$ in your list. 5

$$f_1(n) = 10^n$$

$$f_2(n) = n^{(1/3)}$$

$$f_3(n) = n^n$$

$$f_4(n) = \log_2 n$$

$$f_5(n) = 2(\text{sqrt}(\log_2 n))$$

n is sufficiently large in size.

- c. Explain Recurrence Analysis in Algorithm Analysis Techniques with example. 8
6. a. Explain B-Trees with Example. 5

- b. Write and explain an algorithm to delete a key from B-Tree. 7
 - c. Construct a B-Tree and perform the delete operations in it, considering all cases in the textbook. 8
- 7.
- a. Explain Randomized Algorithm Analysis Techniques with Example. 6
 - b. Explain Randomized Divide and Conquer Approach with appropriate example and perform its complexity analysis. 8
 - c. Prove that Independent Set reduces to Vertex Cover problem. 6
- 8
- a. State and Prove GCD Recursion Theorem. 8
 - b. Write Euclid recursive algorithm and Explain with an Example. 6
 - c. Compute the values (d,x,y) that the call EXTENDED-EUCLID (899,493) returns. 6
- 9.
- a. What are P-class, NP-class and NP-Complete problems? 5
 - b. Explain Vertex Cover problems and write Approx-Vertex-Cover algorithm. 6
 - c. Prove that Approx-Vertex-Cover is a polynomial-time 2–approximation algorithm. 9

CNS 103 : TOPICS IN NETWORKING

5 MODULE COURSE

PART A

(Answer all questions, each carry 4 marks)

1. Explain the various communication protocol development methods.
2. How is IP addressing done in IPv6?
3. Explain how RED prevents the congestion with the help of algorithm.
4. State the requirements for remote monitoring.
5. State the network issues in doing audio/video conferencing over internet.

PART B

(Answer any five questions, each carry 16 marks)

- 1 a) Explain various Protocol validation approaches **[8 marks]**
b) What is service specification? Explain service specification for reliable data transfer using any formal approach **[8 marks]**
- 2 a) How troubleshooting can be done in IPV6 connection? **[8 marks]**
b) Explain briefly about
 i) Routing information protocol **[4 marks]**
 ii) Network address translation **[4 marks]**
- 3 a) Write a short note on Link level flow and error control **[6 marks]**
b) Explain the Evaluation criteria for both effective and fair resource allocation **[10 marks]**
- 4 a) Explain briefly about any two applications of network management? **[8 marks]**
b) Write a brief description about the following concepts of Network Management tools
 i) NMS Design
 ii) Network management systems **[8 marks]**
- 5 a) Explain the multimedia applications in WWW and multimedia transport across ATM networks. **[10 marks]**
b) Give a brief description about IPv4/IPv6 Interoperability of networks in multimedia communications? **[6 marks]**
- 6 a) Give a brief description of Integrated services and differentiated services of QOS in IP networks. **[8 marks]**
 Briefly explain the issues in resource allocation **[8 marks]**

CNS 104 : NETWORK DESIGN AND PERFORMANCE EVALUATION

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. Differentiate service requests and service offerings.
2. Given an MTBCF requirement of 8000 hours and an MTTR requirement of 4 hours. Calculate an availability requirement
3. Explain *flowspec* algorithms.
4. Explain convolution algorithm

PART B

(Answer any four questions, each carry 20 marks)

5. a) Explain the tactical and strategically significance of network analysis architecture and design. (12)
- b) How system methodology is applicable to network design? (8)
6. a) Explain application types with respect to service metrics. (12)
- b) Show how performance boundaries and thresholds could be used in the following Scenarios.
 - (i) An application has a service requirement for round-trip delay to be less than 100 ms. If delay is greater than 100 ms, notify the network administrator.
 - (ii) A user requires capacity of up to 512 Kb/s but may not exceed 1.5 Mb/s. You want to keep track of how much time the user's capacity is between 512 Kb/s and 1.5 Mb/s (8)
7. a) Explain in detail different network architectural models (11)
- b) For each requirement mentioned below, which one do you prefer from options DiffServ, IntServ? Give reasons (9)

Requirement 1. Two clearly different sets of network performance requirements: one high RMA, the other low RMA (for that network)

Requirement 2. A requirement to bill subscribers for network service, and to provide accounting of subscriber billing information

Requirement 3. Combining a customer's voice and data traffic over a common network.

8. a) Which are the different queuing models for networks (12)

b) Explain queuing of a space division packet switching network. (8)

9. a) explain the significance of hierarchy and interconnectivity in networks (12)

b) What is the significance of modelling behaviour of components in networks? How it could be explained from system approach

(8)

CNS 105(A) : LAWS AND ETHICS IN COMPUTING

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. Explain moral and legal issues in computing?
2. Discuss the need for data protection in India.
3. What is computer forensics? Explain the steps taken by computer forensic specialists?
4. Explain about E-Governance under Indian Perspective.

PART B

(Answer any four questions, each carry 10+10=20 marks)

5. a) Explain characteristics of professional ethics and how it see computing as professional relationship
b) Provide a sample code of ethics and professional conducts, pertaining to this area
6. a) Examine the scope of copyright protection to computer programs in the light of the provisions of the Copyright Act, 1957.
b) Discuss in detail the provisions of TRIPS Agreement for trademarks and patent protection of Cyber World Technologies.
7. a) Explain the types of business computer forensic technology
b) Discuss about collecting the evidence in private-sector incident scenes.
8. a) How and in what manner is users protected from computer misuse and computer crimes under the Information Technology Law?
b) Discuss the history and evolution of cyber space.
9. a) Discuss the protection of software copyright
b) Explain the system of obtaining patents to designs and protection of semi-conductors chips with reference to the Patents Act, 1970.

CNS 105(B) : CYBER LEGISLATION AND SECURITY POLICIES

4 MODULE COURSE

PART A

(Answer all questions each carry 5 marks)

1. How to keep track of authorized users using directory services?
2. A tort is a civil injury but all civil injuries are not torts. Discuss?
3. Explain the different tools for information security.
4. Explain about web Policies

PART B

(Answer any four questions, each carry 20 marks)

5. a) Explain Computer Security mandates and legislation. **[10 marks]**
b) What are the needs for Security? Explain threats to security. **[10 marks]**
6. a) Explain importance of security goals and illustrate the points you present by using one such goal as an example **[4 + 8 marks]**
b) Give a note on Information Protection and need for Access Controls. Give one example to access control and show how is it useful to protection of information. **[4 + 4 marks]**
7. a) Discuss the need for legal protection against the programs and data. State two such provisions. **[5 + 6 marks]**
b) Write note on employee responsibilities in implementing the legal protection for program and data. **[9 marks]**
8. a) What are the advantages of Asset classification policy? Explain with the help of one example to such policy **[5+5 marks]**
b) Explain different steps required for Planning and preparation of policies **[10 marks]**
9. a) Describe the Corporate security policies in detail, ensuring proper implementation of digital infrastructure **[10 marks]**
b) Show how to write security polices for an organization, taking any two security requirements as example **[10 marks]**

CNS 106(C) : ETHICAL HACKING

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. What do you mean by banner grabbing? Discuss the importance of banner grabbing in Ethical Hacking?
2. What is social engineering? Explain in detail any two social engineering attack and its Implication on an organization?
3. What is DoS attack? What are the types of DoS attacks?
4. What is the difference between Session Hijacking and Back Doors?

PART B

(Answer any four questions, each carry 20 marks)

5. a. Define the seven-step information gathering process in foot printing? (8)
b. How to find open ports and access points using port scanning in detail? (12)
6. a. What is war-dialing and what are the tools used for war-dialing? (8)
b. What do you mean by Voice over IP (VoIP) and state one attack of VoIP? (12)
7. a. Explain the difference between wireless foot printing and wireless scanning? (8)
b. How to exploit WEP Weakness? (12)
8. a. Explain about Web server hacking and web application hacking? (8)
b. Discuss the various modes of Ethical Hacking in detail? (12)
9. a. What do you mean by Metasploit? Explain some of the features and advantages of using framework like MSF? (8)
b. Explain SMTP enumeration in detail? (12)

CNS 106(D) : WIRELESS NETWORKS

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. Explain about the carrier sensor mechanism in ieee802.11 WLAN?
2. In what way hand-off and mobility support achieved in wireless network?
3. How does WSN differ from mobile Adhoc network?
4. Explain about the components and characteristics of WSN?

PART B

(Answer any four questions, each carry 20 marks)

5. a. WiMax may be the alternative solution of fixed broadband services in real time application. Comment on the issue? (8)
b. Explain in detail about the architecture and reference model of HIPERLAN? (12)
6. a. Explain the following protocols in brief
i. AODV routing protocol (12)
ii. DSDV (8)
7. a. Write briefly about the applications of WSN? (8)
b. Explain flat routing and hierarchical routing protocol in WSN? (12)
8. a. What are the different types of WSN network architecture?
Distinguish between them? (8)
b. Explain in detail about the communication architecture of UWSN? (12)
9. a. State the importance of QoS in Adhoc network. Explain with example? (12)
b. With a neat diagram explain about the network architecture of WMSN? (8)

CNS 106(I) : VIRTUALIZATION TECHNIQUES

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. What are the benefits of using virtualization
2. How to backup virtual guest operating system
3. Write a short note on WAN virtualization
4. What is the role of Hypervisor. Give example

PART B

(Answer any 4 questions, each carry 20 marks)

5. a) Explain different types of virtualization techniques. Name the hypervisor used in each technique (12)
b) Explain type 1 and type 2 hypervisor with neat diagram and compare their performance (8)
6. a) Differentiate between Para virtualization , Container Virtualization and Full Virtualization. Name the hypervisor used in each case. Which one is faster and why? (12)
b) How to avoid the "all your eggs in one basket" syndrome (8)
7. a) Explain Virtual Enterprise Transport virtualization (12)
b) Design a Virtual lab for your college. Explain in detail the components and tools you are going to use for this purpose(Type of virtualization technology, which hypervisor, number of servers and clients) (8)
8. a) Describe the SNIA shared storage model. (12)
b) How many classes of services are available in fibre channel (8)
9. a) Give a brief overview of Hardware Virtualization. (12)
b) What are the points to be considered when integrating virtualization into computing environment (8)

CNS 202 : TOPICS IN SECURITY

6 MODULE COURSE

PART – A

[Answer all questions, 2 marks + 4 marks*5=22 marks]

1. Show the relationship between Security services and Security Mechanism in a tabular form. [2 marks]
2. Brief the security of Hash functions and MAC.
3. What are OS Security Violations
4. Differentiate DES and AES algorithm
5. State the applications of PKI
6. Briefly explain RFID

PART B

(Answer any six questions, each carry 13 marks)

7. a. What do you mean by Security Service? Brief the Security Services defined in X.800. [7 marks]
b. Brief the Security Mechanism defined in X.800. [6 marks]
8. a. What is MAC? With a neat diagram brief the uses of MAC and state its requirements. [4 marks]
b. Explain HMAC [6 marks]
c. Suppose $H(m)$ is a collision-resistant hash function that maps a message of arbitrary bit length into an n -bit hash value. Is it true that, for all messages x, x' with $x \neq x'$, we have $H(x) \neq H(x')$? Explain your answer. [3 marks]
9. a. Brief OS Security Violations and Techniques to Prevent Them [8 marks]
b. Brief Secure Programming Techniques [5 marks]
- 10.a. Explain Group Key Establishment Protocols [7 marks]
b. Consider a Diffie-Hellman scheme with a common prime $q=11$, a primitive root $\alpha = 2$.

- i) If user A has public key $Y_A=9$, what is A's Private Key X_A ?
- ii) If user B has public key $Y_B=3$, what is the shared secret key K ? [6 marks]
- 11a. Explain X.509 Authentication Service. [7 marks]
- b. In ElGamal given the prime $p=31$:
- i) Choose an appropriate e_1 and d . Then calculate e_2 .
- ii) Encrypt message 'HELLO'; use 00 to 25 for encoding. Use different blocks to make $P < p$.
- iii) Decrypt the cipher text to obtain the plain text. [6 marks]
- 12a. What are the Security issues in Electronic Voting? Explain. [7 marks]
- b. Brief VoIP [6 marks]
- 13a. What are the security issues in Databases [8 marks]
- b. Create a linear feedback shift register with 5 cells in which $b_5 = b_4 \oplus b_2 \oplus b_0$. Draw its diagrammatic representation. [5 marks]

CNS 203 : INTERNET INFORMATION AND APPLICATION SECURITY

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. How hidden contents within an application can be discovered?
2. Explain the concept of locking down the application data?
3. Explain briefly the concept of HTTP fingerprinting?
4. Explain the concept of web crawling and source code disclosure?

PART B

(Answer any four questions, each carry 20 marks)

5. a. Describe the various design flaws commonly employed in web applications which is relevant for authentication? [10 marks]

b. Compare and contrast the basic spidering approach with user directed spidering and make an analysis on how burp spider can be used to map part of an application? [10 marks]

6. a. Explain the term SQL injection and explain how ModSecurity prevents SQL injection?

[10 marks]

b. Explain briefly about

i) Dynamic String Binding [5 marks]

ii) Web server Filters [5 marks]

7. a. Write a short note on directory traversal attacks and null byte attack? [10 marks]

b. How can you detect the real IP address of an attacker, stating also the context? [10 marks]

8. a. How can you detect an attacker who is hacking a web server? [8 marks]

b. Write a brief description about the following [6+6 marks]

i) Canonicalization attacks

ii) Database vulnerabilities

9. a. How can you analyze an application's functionality, behaviour, and technologies employed in order to identify the key attack surface that it exposes? [10 marks]

b. Briefly explain the architecture of database-driven web architecture? [10 marks]

CNS 204(A) : RESEARCH METHODS AND TECHNIQUES

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. Define research and discuss the objectives of research.
2. Suggest a research strategy for identifying the employee motivating factors in an MNC
3. State the difference between Null and Alternate hypothesis
4. Describe, in brief, the layout of a research report, covering all relevant points

PART B

(Answer any four questions, each carry 20 marks)

5. a) There are various steps involved in research process and they vary based on the research problem. Explain the steps involved in the research process keeping in mind the contexts of the research problem. [10 marks]
b) Explain the Limitations of test of significance. [10 marks]
6. a) How will we examine a research proposal? [10 marks]
b) “The first stage in research is discovering where to look for information and opinions on your topic” Discuss [10 marks]
7. a) “Ethics in research is the need of the hour”. Justify the statement. [11 marks]
b) The heights in inches of 30 students are as follows: 66, 68, 65, 70, 67, 64, 68, 64, 66, 64, 70, 72, 71, 69, 69, 64, 67, 63, 70, 71, 63, 68, 67, 65, 69, 65, 67, 66, 69, 67 Prepare a frequency distribution table showing relative frequency, cumulative frequency and percent frequencies.
[9 marks]
8. a) What are the different steps for writing final research report? [8 marks]

b) Mention the different types of reports, particularly pointing out the difference between a technical report and a popular report. [12 marks]

9. a) What is meant by measurement in research ? What difference does it make whether we measure in terms of nominal, ordinal, interval or ratio scale ? Explain giving examples. [8 marks]

b) i) If you are conducting an interview survey of around 500 respondents in Hyderabad, what type of probability sampling you choose and why? [6 marks]

ii) What is Likert's Scale ? Why it is used? How to construct it ? Explain [6 marks]

CNS 206(H) : MACHINE LEARNING TECHNIQUES

4 MODULE COURSE

PART A

(Answer all questions, each carry 5 marks)

1. What assumptions does Naive Bayesian method make about the attributes and the classification? Give an example where this assumption is not justified.
2. In most learning algorithms, the computation time required for training is large and the time required to apply the classifier is short. The reverse is true of the nearest neighbor's algorithm. How can the computation time required for queries be reduced?
3. What is the difficulty with evaluating learning methods that do not address classification, such as association rules and clusters?
4. How to programming a robot by physically moving it through the trajectory?

PART B

(Answer any four questions, each carry 20 marks)

5. a) What is learning?. Write any four learning techniques and in each case give the expression for weight- updating [12 marks]
b) What is the difference between “supervised” and unsupervised” learning scheme.[8 marks]
6. a) What is the intuitive relationship between SVD and PCA, Explain? [10 marks]
b) What are the different models of artificial neurons? [10 marks]
7. a) How can a decision tree be converted into a rule set? Illustrate with an example. What are the advantages of the rule set representation over the decision tree representation? [12 marks]
b) Explain classification by Decision tree induction? [8 marks]
8. a) Explain the importance of Markov decision process in dynamic programming? [12 marks]
b) What is a task environment? How it is specified? [8 marks]
9. a) Explain the method of ID3 decision tree classification algorithm with an example . Explain tree pruning with an example. [12 marks]

b) Give an example of decision tree induction. [8 marks]