

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

*Curriculum
For
M. Tech.(Computer Networks and Information Security)*



**SHRI GURU GOBIND SINGHJI
INSTITUTE OF ENGINEERING AND TECHNOLOGY,
VISHNUPURI, NANDED
(MAHARASHTRA STATE)
PIN 431 606 INDIA**

M. Tech. (Computer Networks and Information Security)

CURRICULA First Year (*With effect from academic year 2015-16*)

(L-P-C) indicates L-Lecture P-Practical and C-Credit)

Semester I (20 Credits)		Semester II (20 Credits)	
Course Code	Course Name	Course Code	Course Name
CSN501	Computer Architecture and Parallel Processing (3-0-3)	CSN506	Advanced Computer Algorithms (3-2-4)
CSN502	Advanced Computer Networks (3-2-4)	CSN507	Information Security (3-2-4)
CSN503	Number Theory and Cryptography (3-2-4)	CSN508	Stochastic Processes (3-0-3)
CSN504x	Elective-I (3-2-4)	CSN509x	Elective-III (3-2-4)
CSN504x	Elective-II (3-2-4)	CSN509x	Elective-IV (3-2-4)
CSN505	Seminar -I (0-2-1)	CSN510	Seminar-II (0-2-1)
Elective-I and Elective-II (3-2-4)		Elective-III and Elective-IV (3-2-4)	
CSN504A	Advanced Operating Systems	CSN509A	Mobile and Wireless Networks
CSN504B	Wireless Sensor Network	CSN509B	Security Threats and Vulnerabilities
CSN504C	Web Engineering	CSN509C	Information Retrieval
CSN504D	Data Warehousing and Data mining	CSN509D	Knowledge Based Systems
CSN504E	Artificial Neural Network	CSN509E	Software Project Management
CSN504F	Advanced Compilers	CSN509F	Distributed Systems
CSN504G	Information System Security for Professionals- Part I (<i>With effect from academic year 2016-17</i>)	CSN509G	Information System Security for Professionals- Part II (<i>With effect from academic year 2016-17</i>)

CURRICULA Second Year (*With effect from academic year 2016-17*)

Semester III (24 Credits)		Semester IV (24 Credits)	
Course Code	Course Name	Course Code	Course Name
CSN 601	Dissertation Part -I (0-24-24)	CSN 602	Dissertation Part -II (0-24-24)

Practical:

The practical component wherever included in the courses, shall have at least eight practical exercises designed by the course coordinator. Additionally the teachers shall set up the practical exercises every year as per the current and latest trends.

Semester I

CSN501 Computer Architecture and Parallel Processing

Overview and history of computing. Architectural Classification schemes. High performance computing, overview and performance quantification criteria, limits on performance Design of high performance architecture, parallel vs. pipeline architectures. Pipeline processing. Theory of pipeline scheduling and implementation. Hazards in Pipeline processors. Hazard detection and resolution techniques. Static and dynamic schedules. Evolution of RISC ISAs and pipeline hazards. Interconnection Networks. Topics of current research in High performance computing.

References:

1. *K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, McGrawHill, 1984.*
2. *John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, 3rd Edition, Morgan Kaufmann Publishers, 2002.*

CSN502 Advanced Computer Networks

Internetworking, IP Addressing, Subnetting, IP, Address resolution problem, ARP, RARP, Internet control and message Protocols, Network layer level protocols, Transport layer protocols, Sockets, client/server computing, Routing and routing protocols, dynamic host configuration DHCP, Multicasting and group management, domain name systems, Issues of Multimedia Networking, Application protocols, network address translation, virtual private networks, proxy servers, issues of Network programming, IPv6, Network performance analysis, High Performance Networks, any relevant topic decided by teacher, Network management, topics of current research.

References:

1. *Youlu Zheng / Shakil Akhtar, "Networks for Computer Scientists and Engineers", Oxford University Press*
2. *Forouzan, "TCP/IP Protocol Suite", Tata McGraw Hill.*
3. *Walrand & Varaiya, "High Performance Communication Networks", 2/e, Elsevier", 2003.*
4. *James D. McCabe, "Network Analysis, Architecture & Design, 2/e, Elsevier India", 2004.*

CSN503 Number Theory and Cryptography

Elementary number theory, Finite fields, Arithmetic and algebraic algorithms, Secret key and public key cryptography, Pseudo random bit generators, Block and stream ciphers, Hash functions and message digests, Public key encryption, Probabilistic encryption, Authentication, Digital signatures, Zero knowledge interactive protocols, Elliptic curve cryptosystems, Formal verification, Hard problems, Randomness and Pseudo randomness & Testing, topics of current research.

References:

1. *Koblitz, N. Course on Number Theory and Cryptography, Springer Verlag, 1986*
2. *David M. Burton, Elementary Number Theory, TMH.*
3. *Menezes, A, et.al. Handbook of Applied Cryptography, CRC Press, 1996*
4. *Ivan Niven, Herbert S. Zuckerman, Hugh L. Montgomery, An Introduction to the Theory of Numbers.*
5. *Thomas Koshy, Elementary Number Theory with applications, Elsevier India, 2005.*

Semester-I Electives

CSN504A Advanced Operating Systems

Real time Operating System, Distributed Operating System, Network Operating System, Kernel development, Protection and Security, Current trends.

References:

1. Doreen L Galli, *Distributed Operating System- Concepts and Practice*, Prentice-Hall, 2000.
2. A. Silberschatz, *Applied Operating System Concepts*, Wiley, 2000.
3. Lubemir F. Bic & Alan C. Shaw, *Operating Systems Principles*, Pearson Education, 2003.

CSN504B Wireless Sensor Network

Ad hoc Networks: Introduction. Routing protocols (proactive and reactive methods, backbone and position based, and power efficient routing). Sensor Networks: Introduction and applications. Design issues and architecture. Routing protocols: data centric, hierarchical, location based, energy efficient routing etc. Sensor deployment, Scheduling and coverage issues, self configuration and topology control. Querying, data collection and processing, Collaborative information processing and group connectivity. Target tracking, localization and identity management. Future research Challenges.

References:

1. Azzedine Boukerche, *Handbook of Algorithms for Wireless Networking and Mobile Computing*, Chapman & Hall/CRC, 2006
2. Mohammad Ilyas and Imad Mahgoub, *Handbook of Sensor Networks: Compact Wireless and Wired sensing systems*, CRC Press, 2005.
3. Anna Hac, *Wireless Sensor Network Designs*, John Wiley & Sons Ltd., 2003.
4. Nirupama Bulusu and Sanjay Jha, *Wireless Sensor Networks : A systems perspective*, Artech House, August 2005.
5. Jr., Edgar H. Callaway, *Wireless Sensor Networks : Architecture and Protocols*, Auerbach, 2003.

CSN504C Web Engineering

Perspectives on Web Engineering, Requirements specifications & web based system dev. Methodologies, migration of legacy systems to web environments-technology and solutions, web-based real time application development, Web engineering- the new paradigm with multi disciplinary facts, user-centered web design & applications, web metrics, HCI, Testing, verification and validation, topics of current research.

References:

1. *Journal of Web Engineering*, Rinton Press & IEEE and ACM publications on these areas.
2. *User centered Web design-* Cato & John, Pearson Education, 2001.
3. Zimmermann, Olaf; Tomlinson, Mark R.; Peuser, Stefan, *Perspectives on Web Services*, Allied Publishers, 2004.

CSN504D Data Warehousing and Data Mining

Introduction to data mining. Data preprocessing and cleaning. Data visualization and exploratory data analysis. Data mining techniques. Performance evaluation. Finding patterns and rules. Predictive and descriptive modeling. Issues relating to large data sets. Applications to Web Mining and

Bioinformatics. Design - Dimensional Modeling - Meta data - Performance issues and indexing-VLDB issues - Development life cycle - Merits. Tools - Applications - Case Studies.

References:

1. *George M. Marakas, "Modern Data Warehousing, Mining & Visualization", Pearson Education, 2003.*
2. *Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Elsevier publication.*
3. *Margaret H. Dunham, "Datamining: Introductory & Advanced Concepts", Pearson Education, 2003.*

CSN504E Artificial Neural Network

Feedforward networks: Fundamental concepts- Models of artificial neural network (ANN); Learning and adaption; Learning rules, Classification model, Features and decision regions, Perceptron networks, Delta learning rules for multi-perceptron layer, Generalized learning rule, Error backpropagation training, Learning factors.

Recurrent networks: Mathematical foundation of discrete time and gradient type Hopfield networks, Transient response and relaxation modeling.

Self-organizing networks: Hamming net and MAXNET, Unsupervised learning of clusters, Counterpropagation network, Feature mapping, Self organizing feature maps, Cluster discovery network (ART1).

Fuzzy Neural Networks: Fuzzy set theory, Operations on fuzzy sets, Fuzzy neural networks, Fuzzy min-max neural networks, General fuzzy min-max neural network

Applications: Handwritten character recognition, Face recognition, Forecasting, Image compression

References:

1. *Jacek Zurada, "Introduction to ANN", Jaico Publishing House*
2. *Bose and Liang, "Neural network fundamentals with Graphs, Algorithms, and Applications", TMH edition*
3. *Ham and Kostanic, "Principles of Neurocomputing for Science and Engineerin", TMH edition*

CSN504F Advanced Compilers

Topics include control-flow and data-flow analysis, classical optimization, instruction scheduling, and register allocation. Advanced topics include memory hierarchy management, optimization for instruction-level parallelism, modulo scheduling, predicated and speculative execution, topics of current research.

References:

1. *Steven S. Muchnick, Advanced Compiler Design & Implementation, Morgan Kaufmann, 2004.*
2. *Robert Morgan, Building an Optimizing Compiler, Butterworth-Heinemann, 1998.*
3. *Andrew W. Appel, Modern Compiler Impementation in Java, Cambridge, 2005.*

CSN504G Information System Security for Professionals – Part I

Information Security Governance and Risk Management : Fundamental Principles of Security, Security Definitions, Security Frameworks, Security Management, Risk Management, Risk Assessment and Analysis, Policies, Standards, Baselines, Guidelines, Procedures, Information Classification, Layers of Responsibility, Security Steering Committee, Security Governance.

Access Control: Access Control Overview, Security Principles, Identification, Authentication, Authorization and Accountability, Access control Models, Access Control techniques and technologies, Access control Administration, Access control methods, Accountability, Access control practices, Access control monitoring, Threats to access control.

Security Architecture and Design: Computer security, system architecture, computer architecture, operating system architecture, system security architecture, security models, security modes of operation, system evaluation methods, The orange book and the Rainbow series, Information Technology security evaluation criteria, common criteria, Certification vs. Accreditation, open vs. closed system, A few threats to review.

Physical and Environmental Security: Introduction to physical security, the planning process, protecting Assets, Internal support system, Perimeter security.

Telecommunication and Network Security : Telecommunication, open system interconnection reference model, TCP/IP model, Types of transmission, Cabling, Networking foundations, Networking devices, Intranet and Extranets, Metropolitan Area Networks, Wide Area Networks, Remote Connectivity, Wireless Technologies.

Reference Books:

All in one CISSP Examination Guide for Security Professional by Shon Harris, McGraw Hill Publication.

CSN505 : Seminar-I

The seminar should be done on any topic in Computer Science and Engineering to be decided by the students and the supervisor concerned. Seminar work shall be in the form of report to be submitted by the student at the end of the semester. The candidate will deliver the talk on the topic for half an hour and assessment will be made accordingly by the supervisor.

Semester II

CSN506 Advanced Computer Algorithms

Algorithmic paradigms: Dynamic Programming, Greedy, Branch-and-bound; Asymptotic complexity, Amortized analysis; Graph Algorithms: Shortest paths, Flow networks; NP-completeness; Approximation algorithms; Randomized algorithms and advanced data-structures, topics of current research.

References:

1. *T.H. Cormen, C.E. Leiserson, R.L. Rivest, Introduction to Algorithms, McGraw Hill, 1994.*
2. *Jon Kleinberg, Eva Tardos, Algorithm Design, Pearson Addison-Wesley, 2006*
3. *Dan Gusfield, Algorithms on Strings, trees and Sequences, Cambridge, 2005.*
4. *Sara Baase, Computer Algorithms: Introduction to Design and Analysis, Addison Wesley, 1998.*
5. *Michael T Goodrich & Roberto Tamassia, Algorithm Design: Foundations, Analysis & Internet Examples, John Wiley, 2002.*

CSN507 Information Security

Basic concepts, Access control, Protection, Secure coding, Cryptography, Network security, Firewalls, Security on the Internet and the World Wide Web, Attack Techniques, IDS, Cryptographic Protocols, Recent Cryptographic Techniques and algorithms, Hash Functions, Digital Signature and Key Exchange algorithms, Identification Schemes and Special Algorithms for Protocols, Typical Implementation examples, Security in Windows, Linux, Social & Ethical issues of Information Security, Information Security management, Case studies, topics on security in OS, databases, current trends and any relevant topics discussed by the teacher.

References:

1. *Matt Bishop, Computer Security- Arts and Science, Pearson Education, 2003.*
2. *Bruce Schneier, Applied Cryptography, Wiley.*
3. *Pieprzyk et.al, Fundamentals of Computer Security, Allied Publishers, 2004.*

CSN508 Stochastic Processes

Overview of Probability, Random variables, Probability functions, Functions of Random variables some important probability distributions, sequence of random variables, limit theorem, Random Correlation function, power spectral densities, linear systems with random inputs, Gaussian and Poisson process, Markov chain with stationary transition probabilities, properties of transition functions, classification of states, stationary distribution of Markov chain, Methods based on Markov chains for simulation of random vectors, topics of current research.

References:

1. *Gray R.M. and Davisson L.D., "An Introduction to Signal Processing" (available on internet)*
2. *Papoulis A, Probability, "Random variables and Stochastic Processes". McGraw Hill, 1984.*
3. *Taylor H. M. and Karlin S., "An Introduction to stochastic modeling", 1984.*
4. *Bhat B. R., "Stochastic Models: Analysis and Applications", New age publications, 2000.*

Semester II Electives

CSN509A Mobile and Wireless Networks

Signals, Digital modulation, spread spectrum, wireless networks: 802.11, Bluetooth, Pervasive Computing, mobile operating system, Distributed & Mobile Systems architecture, Mobile and Internet Protocols, Standards, Mobile applications. Wired/wireless networks; Effect of mobility on networks & systems; impact on IP stack from MAC layers; wireless broadcast. Satellite broadcast; Issues of security in wireless; issues of 802.11 protocols cellular networks, GSM, GPRS, Mobile networking, Mobile IP, Wireless transport protocols, Wireless application protocol, WML and WML Scripts, Topics of current research and any relevant topic discussed by teacher.

References:

1. *Mobile Computing Principles*, Reza B' Far, Cambridge, 2005.
2. *Geoffrey Elliott & Nigel Phillips, Mobile Computing & Electronic business Technology & Applications*, Pearson Education, 2003.
3. *Wireless networks*, Pahelvan and Krishnamurthy
4. *Mobile Communications*, Jochen Schiller
5. *Mobile Web services*, Ariel Pashtan, Cambridge, 2005.
6. *Perrig, Adrian; Tygar J. D., Secure Broadcast Communication in Wired and Wireless Networks*, Allied Publishers, 2004.

CSN509B Security Threats and Vulnerabilities

Basic security principles, principle of least privilege trust, trusted computing basics, reference monitors, inline reference monitors and access control, Secure multi party computation, secure two party models. Mobile code security Digital Defense: Issues in Security, and Critical Infrastructure Protection: Threats of viruses, worms, malicious codes, etc.. models of propagation and their epidemic spread, dos attacks, defenses against hacking. DDoS, design of scalable testbeds for simulation of attacks against critical infrastructures, architectures for robust and flexible Internet, ubiquitous, dependable and indestructible storage, topics of current research.

References:

1. *Ross Anderson Security Engineering: A guide to Building dependable Distributed systems*, John Wiley, 2001.
2. *Corporate Computer and Network Security*, Raymond Panko

CSN509C Information Retrieval

Overview- Concepts of a document- data structures in the large- document surrogates- Vocabulary control- data compression- text documents- images and sound, Query structures- Boolean queries- vector queries- fuzzy queries- probabilistic queries- Relevance and similarity measures- Effects of Weighting- Effects of scaling- the Matching process, Indexing- Matrix representations- Term Association- Document Analysis- stemming- thesauri- user profiles and their use, Multiple Reference point systems- document clusters- Retrieval Effectiveness- Precision and Recall- Operating curves- Expected search Length- satisfaction and Frustration, Effectiveness Improvement Techniques, Relevance feedback, Genetic Algorithms- TREC Experiments- Alternative Retrieval Techniques- Citation Processing- Hypertext links- Information Filtering and passage Retrieval, topics of current research.

References:

1. Korfhage Robert R., *Information storage and retrieval*, John Wiley & Sons, Inc, 1997.
2. Richardo & Bertheir, *Modern Information Retrieval*, Pearson Education, 2000

CSN509B Knowledge Based Systems

Architecture of AI & KBCS Systems, Design Issues of KBCS, Introduction to Expert System, Introduction to fuzzy logic systems, Natural Language processing, Heuristic Search techniques, knowledge based systems AI for security systems, topics of current research.

References:

1. Nilson, *Artificial Intelligence: A new Synthesis*, 2001.
2. *Hands on AI with JAVA*, Edwin Wise, McGraw Hill, 2004.
3. Taghi M. Khosgoftaar, *Software Engineering with Computational Intelligence*, Allied Publishers, 2004.

CSN509E Software Project Management

Basic concepts of project management; Managing requirements; Software lifecycles; Software estimation; The project plan; Monitoring the project; Risk analysis; Managing quality and People problems, CMM & P-CMM Principles, topics of current research.

References:

1. Joel Henry, *Software Project Management*, Pearson Education, 2003.
2. Kenneth R. Baine, *Integrated IT Project Management: A Model-Centric Approach*, Allied Publishers, 2004.
3. Mario E. Moreira, *Software Configuration Management Hand Book*, Allied Publishers, 2004.

CSN509F Distributed System

Introduction to distributed computing models. Issues in distribution of data and control: Clock synchronization, agreement, deadlock detection, termination detection etc. Distributed file servers: Concurrency control and recovery, resiliency etc. Distributed programming environments: Communication primitives, selected case studies.

References:

1. G. F. Coulouris, J. Dollimore and T. Kindberg, *Distributed Systems: Concepts and Design*, 4th Ed, Addison-Wesley, 2005.
2. S. Mullender (Ed), *Distributed Systems*, 2nd Ed, Addison-Wesley, 1994.
3. M. Singhal and N. Shivratri, *Advanced Concepts in Operating Systems*, McGraw Hill, 1994.

CSN509G Information System Security for Professionals – Part II

Cryptography: The history of Cryptography, Cryptography Definitions and Concepts, Types of ciphers, Methods of encryption, Types of symmetric system, Types of Asymmetric system, Message Integrity, Public key infrastructure, Key management, Trusted platform module, Link encryption vs. End to End Encryption, Email Standards, Internet Security, Attacks.

Business Continuity and Disaster Recovery Planning: Business Continuity and Disaster Recovery, BCP Project Components, Preventive Measures, Recovery Strategies, Insurance, Recovery and Restoration, Testing and Revising the Plan.

Legal, Regulations, Investigations and Compliance: The many Facets of Cyber Law, The Crux of computer Crime Laws, Complexities in Cybercrime, Intellectual Property Laws, Privacy Liabilities and its Ramifications, Compliance, Investigations, Ethics.

Software Development Security: Software Importance, Where Do We Place Security? System Development Life Cycle, Software Development Life Cycle, Secure Software Development Best Practices, Software Development Models, Capabilities Maturity Model Integration, Change Control, Programming Languages and Concepts, Distributed Computing, Mobile Code, Web Security, Database Management, Expert System/Knowledge Based System, Artificial Neural Network, Malicious Software (Malware).

Security Operations: The Role of Operation Department, Administrative Management, Assurance Levels, Operation Responsibilities, Configuration Management, Media Controls, Data Leakage, Network and Resource Availability, Mainframes, Email Security, Vulnerability Testing.

Reference Books:

All in one CISSP Examination Guide for Security Professional by Shon Harris, McGraw Hill Publication.

CSN510 Seminar-II

The seminar should be delivered on any topic in Computer Networks and Information Security as per the specialization selected by a student and the teachers concerned. Seminar work shall be in the form of report to be submitted by the student at the end of the semester. The candidate will deliver the talk on the topic for half an hour and assessment will be made accordingly by the supervisor. Usually the seminar-II will be related to the dissertation topic.

Semester-III

CSN601: DISSERTATION PART-I

Dissertation shall consist of:

Research work done by the candidate in the areas related to the chosen specialization, or Comprehensive and critical review of any recent development in the chosen specialization, or Design and/or development of a product related to the programme done by the candidate.

Following shall be the guidelines for evaluation of dissertation part I

Dissertation Part I shall consist of the following components (whichever applicable)

Extensive literature survey,

Data collection from R&D organizations, Industries, etc,

Study of the viability, applicability and scope of the dissertation

Detailed Design

Partial implementation

A candidate should prepare the following documents for examination

A term paper in the format of any standard journal based on the work

A detailed report of the work done by the candidate related to dissertation

Every candidate should present himself (for about 30 min.) before the panel of examiners (which will evaluate the dissertation I for TW and Oral marks) consisting of Head of Department, M. Tech. Coordinator or his nominee, all supervisors.

Semester-IV

CSN602: DISSERTATION PART-II

The dissertation shall be assessed internally by a panel of examiners (similar to the one in dissertation part- I) before submission. The candidate shall submit the dissertation in triplicate to the Head of the institution, duly certified that the work has been satisfactorily completed. The Practical examination (viva-voce) shall consist of a defense presented by the candidate or his/her work in the presence of examiners appointed by the Institute one of whom will be the supervisor and the other an external examiner.