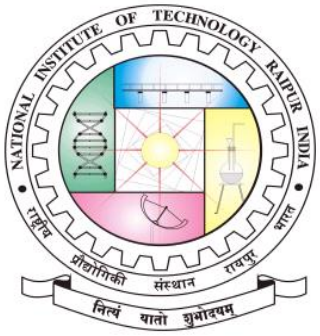
SCHEME AND DETAILED SYLLABUS

FOR

M.TECH TWO YEAR DEGREE COURSE

IN

INFORMATION TECHNOLOGY



DEPARTMENT OF INFORMATION TECHNOLOGY

National Institute of Technology Raipur

Chhattisgarh – 492010

SCHEME AND DETAILED SYLLABUS

FOR

M.TECH TWO YEAR DEGREE COURSE

IN

INFORMATION TECHNOLOGY

(To be applicable for batches admitted from July, 2015 onwards)

(Dr. Sudhakar Pandey) Chairman, DAC Deptt. of IT	(Dr. N K Nagwani) Chairman, DAC Deptt. of CSE	(Dr. Shrish Verma) Chairman, DAC Deptt. of ET& T

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Scheme of Study

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

DEPARTMENT OF INFORMATION TECHNOLOGY

SEMESTER: I

S.No.	Board of Studies	Sub. Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/ 2
				L	T	P	TA	FE	SE	ESE	Pract. ESE		
1	Information Technology	IT MC101	Distributed Operating System	4	0	-	20	15	15	100		150	4
2	Information Technology	IT MC102	Object Oriented Software Engineering	4	0	-	20	15	15	100		150	4
3	Information Technology	IT MC103	Computer Network Design	4	0	-	20	15	15	100		150	4
4	Information Technology	IT ME11X	Elective 1	4	0	-	20	15	15	100		150	4
5	Information Technology	IT ME12X	Elective 2	4	0	-	20	15	15	100		150	4
6	Information Technology	IT ML101	Lab 1	-	-	3	75	-	-	-	50	125	2
7	Information Technology	IT ML102	Lab 2	-	-	3	75	-	-	-	50	125	2
			Total	20	0	6	250	75	75	500	100	1000	24

Note : For attendance of a student in every theory and practical class, the teachers are supposed to keep records ultimately in the following format which will be included in the semester mark-sheet.

List of Subjects for Elective-1 (1st Semester)		
Sr.No.	**Sub. Code**	**Subject Name**
1	IT ME111	Sensor Networks
2	IT ME112	Cyber Crime & Laws and Intellectual Property Rights
3	IT ME113	Image Processing
4	IT ME114	Advance Data Modelling

List of Subjects for Elective-2 (1st Semester)		
Sr.No.	**Sub. Code**	**Subject Name**
1	IT ME121	Next Generation Network: Application & Protocol
2	IT ME122	Distributed Database Management System
3	IT ME123	Software Design Pattern
4	IT ME124	Cellular and Mobile Computing
5	IT ME125	Secure Communication

T.C.A. = Total of Continuous Assessment.

Format for Attendance				
Attendance				Category
> 85			----->	High "H"
> 70 & < 85			----->	Medium "M"
> 60 & < 70			----->	Low "L"
< 60			----->	Poor "P"

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

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SEMESTER: II

S.No.	Board of Studies	Sub. Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/2
				L	T	P	TA	FE	SE	ESE	Pract. ESE		
1	Information Technology	IT MC201	Parallel System Architecture	4	0	-	20	15	15	100		150	4
2	Information Technology	IT MC202	Advance Data Structures and Algorithms	4	0	-	20	15	15	100		150	4
3	Information Technology	IT ME23X	Elective 3	4	0	-	20	15	15	100		150	4
4	Information Technology	IT ME24X	Elective 4	4	0	-	20	15	15	100		150	4
5	Information Technology	IT ME25X	Elective 5	4	0	-	20	15	15	100		150	4
6	Information Technology	IT ML201	Lab 3	-	-	3	75	-	-	-	50	125	2
7	Information Technology	IT ML202	Lab 4	-	-	3	75	-	-	-	50	125	2
			Total	20	0	6	250	75	75	500	100	1000	24

Note : For attendance of a student in every theory and practical class, the teachers are supposed to keep records ultimately in the following format which will be included in the semester mark-sheet.

List of Subjects for Elective-3 (2nd Semester)		
Sr.No.	**Sub. Code**	**Subject Name**
1	IT ME231	Grid and Cloud Computing
2	IT ME232	Optical Networks
3	IT ME233	Pattern Recognition
4	IT ME234	Big Data Analysis
5	IT ME235	Information Theory & Coding

List of Subjects for Elective-4 (2nd Semester)		
Sr.No.	**Sub. Code**	**Subject Name**
1	IT ME241	Soft Computing techniques
2	IT ME242	Next Generation Computing
3	IT ME243	Information Retrieval System
4	IT ME244	Modeling and Simulation
5	IT ME245	Agile Software Development

List of Subjects for Elective-5 (2nd Semester)		
Sr.No.	**Sub. Code**	**Subject Name**
1	IT ME251	Software Testing Techniques
2	IT ME252	Network Security
3	IT ME253	Medical Imaging
4	IT ME254	Real Time Embedded System

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SEMESTER: III

S.No.	Board of Studies	Sub. Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/2
				L	T	P	TA	FE	SE	ESE	Pract. ESE		
1	Information Technology	IT MT301	Preliminary work on Dissertation	-	-	24	100	-	-	-	200	300	12
2	Information Technology	IT MT302	Comprehensive Viva Voice & Seminar	-	-	-	-	-	-	-	200	200	4
			Total	-	-	24	100	-	-	-	400	500	16

Note : For attendance of a student in every theory and practical class, the teachers are supposed to keep records ltimately in the following format which will be included in the semester mark-sheet.

T.C.A. = Total of Continuous Assessment.

Format for Attendance				
Attendance				Category
> 85			----->	High "H"
> 70 & < 85			----->	Medium "M"
> 60 & < 70			----->	Low "L"
< 60			----->	Poor "P"

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

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SEMESTER: IV

S.No.	Board of Studies	Sub. Code	Subject Name	Periods/week			Examination Scheme					Total Marks	Credits L+(T+P)/2
				L	T	P	TA	FE	SE	ESE	Pract. ESE		
1	Information Technology	IT MT401	Dissertation	-	-	32	200	-	-	-	300	500	16
			Total	0	0	32	200	0	0	0	300	500	16

Note : For attendance of a student in every theory and practical class, the teachers are supposed to keep records ltimately in the following format which will be included in the semester mark-sheets.

T.C.A. = Total of Continuous Assessment.

Format for Attendance				
Attendance				Category
> 85			----->	High "H"
> 70 & < 85			----->	Medium "M"
> 60 & < 70			----->	Low "L"
< 60			----->	Poor "P"

Detailed Syllabus

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Distributed Operating System

Theory Periods: 40
Credits: 4 Code: IT MC101

UNIT 1: Architectures of Distributed Systems - System Architecture types - issues in distributed operating systems - communication networks - communication primitives. Theoretical Foundations - inherent limitations of a distributed system - lamp ports logical clocks - vector clocks - casual ordering of messages - global state - cuts of a distributed computation - termination detection. Distributed Mutual Exclusion - introduction - the classification of mutual exclusion and associated algorithms - a comparative performance analysis.

UNIT 2: Distributed Deadlock Detection -Introduction - deadlock handling strategies in distributed systems - issues in deadlock detection and resolution - control organizations for distributed deadlock detection - centralized and distributed deadlock detection algorithms -hierarchical deadlock detection algorithms. Agreement protocols - introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, applications of agreement algorithms. Distributed resource management: introduction-architecture - mechanism for building distributed file systems - design issues - log structured file systems**.**

UNIT 3: Distributed Shared Memory-Architecture- algorithms for implementing DSM - memory coherence and protocols - design issues. Distributed Scheduling - introduction - issues in load distributing - components of a load distributing algorithm - stability - load distributing algorithm - performance comparison - selecting a suitable load sharing algorithm - requirements for load distributing -task migration and associated issues. Failure Recovery and Fault tolerance: introduction-basic concepts - classification of failures - backward and forward error recovery, backward error recovery- recovery in concurrent systems - consistent set of check points - synchronous and asynchronous check pointing and recovery - check pointing for distributed database systems- recovery in replicated distributed databases.

UNIT 4: Protection and Security -preliminaries, the access matrix model and its implementations.- safety in matrix model- advanced models of protection. Data security - cryptography: Model of cryptography, conventional cryptography- modern cryptography, private key cryptography, data encryption standard- public key cryptography - multiple encryption - authentication in distributed systems.

UNIT 5: Multiprocessor Operating Systems - basic multiprocessor system architectures - inter connection networks for multiprocessor systems - caching - hypercube architecture. Multiprocessor Operating System - structures of multiprocessor operating system, operating system design issues-threads- process synchronization and scheduling. Database Operating systems :Introduction-requirements of a database operating system Concurrency control : theoretical aspects - introduction, database systems - a concurrency control model of database systems- the problem of concurrency control - serializability theory- distributed database systems, concurrency control algorithms - introduction, basic synchronization primitives, lock based algorithms-timestamp based algorithms, optimistic algorithms - concurrency control algorithms, data replication.

Text books:

[1] Andrew Tanenbaum and Maarten van Steen, *Distributed Systems Principles and Paradigms*
[2] Mukesh Singhal and Niranjan Shivaratri, *Advanced Concepts in Operating Systems*
[3] Tanenbaum, *Modern Operating Systems* (background)
[4] Silberschatz, Galvin, Gagne, *Operating System Concepts* (background)

References:

[1] Gary Nutt, *Operating Systems: A Modern Perspective* (background)
[2] Gary Nutt, *Kernel Projects for Linux* (background)
[3] Kernighan, Ritchie, *The C Programming Language* (background)
[4] Maxwell, *Linux Core Kernel Commentary* (background)
[5] Corbet, Rubini, and Kroah-Hartman, *Linux Device Drivers*, 3rd edition (background)

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Object Oriented Software Engineering

Theory Periods: 40
Credits: 4 Code: IT MC102

Unit 1: Software Life Cycle Models: Waterfall Model, Incremental Process Models, The unified Process, An Agile View of Process, Agile Process Models ï Extreme Programming, Adaptive Software Development ï Scrum, Object oriented software life cycle.

Unit 2: Object Oriented Analysis and Design: OO Analysis an introduction, Techniques for information Gathering for RA, Use case - Driven OO Analysis. OO Design Introduction, System Design Concepts and the Object-Oriented Approach Conventional Vs OO approaches, Design issues, the generic components of the OO design model, the system design process, and the object design process.

Unit 3: Object Modeling with UML: Introduction to the Unified Modeling Language (UML), the unified Approach, Unified Modeling Language, Class diagram, Object diagram, interaction diagram, Collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram.

Unit 4: Object Oriented Testing and Metrics: Testing OOA and OOD models, Object oriented testing strategies, Test case design for OO software, testing methods applicable at the class level, Interclass test case design. Technical metrics for object oriented systems: The intent of OO metrics, the distinguishing characteristics, metrics for the OO design model, class oriented metrics, operation oriented metrics, metrics for object oriented testing, metrics for object oriented projects.

Unit 5: Object Oriented Software Maintenance and Configuration: Maintenance- Types of maintenance, Maintenance Log and defect reports, Reverse and re-engineering Software Configuration Management -Managing and controlling Changes, Managing and controlling versions.

Text Book:

[1] Bernd Bruegge, ñObject oriented software engineeringò, Second Edition, Pearson Education
[2] Stephan R. Schach, ñObject oriented software engineeringò, Tata McGraw Hill.
[3] Jacobson, M. Christerson, P. Jousson, G. Overgaard: ñObject-Oriented Software Engineeringò A Use Case Driven Approach, Addison-Wesley, 1992.
[4] Grady Booch, James Runbaugh, Ivar Jacobson, ñThe UML User Guideò, Pearson, 2004.
[5] Roger Pressman, ñSoftware Engineeringò, sixth edition, Tata McGraw Hill.

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Computer Network Design

Theory Periods: 40
Credits: 4 Code: IT MC103

UNIT 1: Introduction to Computer Network Design , The Network Development Life Cycle, Network Analysis and Design Methodology, The Art of Network Design Structured Enterprise Network Design, Hierarchical Network Design Model LAN and WAN Network Design ,Backbone Design: Centralized vs. Distributed Node Placement ,Technology Choices ,Structured Cabling Systems

UNIT 2: Web , CDNs & Caching , Multimedia Networking, Peer to Peer Network, QoS and Queuing, Fair Queuing, Intserv, Diffserv, Equation-based congestion control, TCP Performance and TCP mechanics.

UNIT 3: Introduction, Virtual Circuit and Datagram Networks, Whatôs Inside a Router?, The Internet Protocol (IP): Forwarding and Addressing in the Internet, Routing Algorithms Routing in the Internet, Broadcast and Multicast Routing.

UNIT 4: Introduction to the Link Layer, Queuing Models ï Littleôs Theorem, The M/M/1 Queuing System, The M/M/m, M/M/infinity, M/M/m/m, and other Markov systems, The M/G/1 System, Networks of Transmission Lines, Time Reversibility ï Burkeôs Theorem, Networks of Queues ï Jacksonôs Theorem, Traffic Engineering, Network Reliability.

UNIT 5: Peer to Peer Network, Data center Network, Software Defined Network & Open Flow.

Text Books:

[1] James F. Kurose, Keith W. Ross: Computer Networking: A Top-Down Approach, 6e
[2] Dimitri Bertsekas, Robert Gallager: Data Networks, 2e
[3] Larry Peterson, Bruce Davie: Computer Networks: A Systems Approach, 5e
[4] P. Oppenheimer, ñTop-Down Network Design,ò Cisco Press, 3Rd edition, 2010.

References:

[1] J. McCabe, ñNetwork Analysis, Architecture, and Designò Morgan Kaufmann Publishers, Inc., 3rdedition, 2007.
[2] M. Pióro and D. Medhi, ñRouting, Flow, and Capacity Design in Communication and Computer Networksò, Morgan Kaufmann Publishers, Inc., 2004.
[3] Kershenbaum, ñTelecommunications Network Design Algorithmsò, McGraw-Hill,1993.
[4] R. Cahn, ñWide Area Network Design: Concepts and Tools for Optimizationò, Morgan Kaufmann Publishers, Inc., 1998.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
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Sensor Networks

Theory Periods: 40
Credits: 4 Code: IT ME111

UNIT 1: Introduction and Overview of Wireless Sensor Networks, Brief Historical Survey of Sensor Networks, and Background of Sensor Network Technology, Applications of Wireless Sensor Networks.

UNIT 2: Data Retrieval in Sensor Networks, Classification of WSNs, MAC Layer, Routing Layer, High-Level Application Layer Support, Adapting to the Inherent Dynamic Nature of WSNs, Issues in design of sensor network, sensor network architecture.

Unit 3: Medium Access Control Protocols for Wireless Sensor Networks, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs: Schedule-Based Protocols, Random Access-Based Protocols, Coordination, Schedule Synchronization, Adaptive Listening, Access Control and Data Exchange.

Unit 4: Routing Protocols for Wireless Sensor Networks, Data Dissemination and Gathering, Routing Challenges and Design Issues, Network Scale and Time-Varying Characteristics, Resource Constraints, Sensor Applications Data Models, Routing Strategies: WSN Routing Techniques, Flooding and Its Variants, Sensor Protocols for Information via Negotiation, Low-Energy Adaptive Clustering Hierarchy, Power-Efficient Gathering in Sensor Information Systems, Geographical Routing, Directed Diffusion.

Unit 5: QoS and Energy Management : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

Text Books:

[1] Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.
[2] Feng Zhao & Leonidas J. Guibas, ñWireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

References:

[1] Kazem Sohraby, Daniel Minoli, & Taieb Znati, ñWireless Sensor Networks- Technology, Protocols, And Applicationsò, John Wiley, 2007.
[2] Anna Hac, ñWireless Sensor Network Designsò, John Wiley, 2003.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
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Cyber Crime & Laws and Intellectual Property Rights

Theory Periods: 40
Credits: 4 Code: IT ME112

Unit 1: Introduction to Cyber Law: Emergence of Cyber space, Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace -Web space, Web hosting and Web Development agreement, Legal and Technological Significance of domain Names, Evolution of Computer Technology, Internet as a tool for global access. **Information technology Act:** Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication, The Design Act 2000.

UNIT 2: Introduction to Computer Security: Definition, Threats to security, Government requirements, Information Protection and Access Controls, Computer security efforts, Standards, Computer Security mandates and legislation, Privacy considerations, International security activity.
Information security policies and procedures: Corporate policies-Tier 1, Tier 2 and Tier 3 policies, process management-planning and preparation, developing policies, asset classification policy, developing standards.

UNIT 3: Cyber Law and Related Legislation: Patent Law, Trademark Law, Copyright, Software ï Copyright or Patented, Trademark Issues in Cyber Space, Domain Names and Copyright disputes, The ICANN Uniform Domain Name Dispute Resolution Policy, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

Unit 4: Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India - Genesis and Development, IPR in abroad, some important examples of IPR**. Patents:** Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions, Granting of patent, Rights of a patent, How extensive is patent protection? Why protect inventions by patents? Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options)

Unit 5: Utility Models: Differences between a utility model and a patent, Trade secrets and know-how agreements**, Copyright:** What is copyright?, What is covered by copyright? How long does copyright last? Why protect copyright? RELATED RIGHTS, What are related rights? Distinction between related rights and copyright, Rights covered by copyright? **Trademarks:** What is a trademark? Rights of trademark, what kind of signs can be used as trademarks? Types of trademark, function does a trademark perform, How is a trademark protected? , How is a trademark registered?

How long is a registered trademark protected for? How extensive is trademark protection? What are well-known marks and how are they protected? Domain name and how does it relate to trademarks?

Text Books:

[1] K. Kumar, ñCyber Laws: Intellectual property & E Commerce, Securityò,1st Edition, Dominant Publisher, 2011.
[2] Kenneth J. Knapp, ñCyber Security and Global Information Assurance: Threat Analysis and Response Solutionsò, IGI Global, 2009.
[3] Jonathan Rosenoer, ñCyber law: the Law of the Internetò, Springer -verlag, 1997.
[4] James Graham, ñCyber Security Essentialsò Averbach Publication T & F Group.
[5] Rodney D. Ryder, ñGuide To Cyber Lawsò, Second Edition, Wadhwa and Company, New Delhi, 2007.
[6] T. M Murray and M.J. Mehlman, Encyclopedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley & Sons 2000.

References:

[1] Vakul Sharma, "Handbook Of Cyber Laws" Macmillan India Ltd, 2nd Edition,PHI,2003.
[2] Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, 1st Edition,New Delhi, 2003.
[3] S.R. Sharma, ñDimensions Of Cyber Crimeò, Annual Publications Pvt. Ltd., 1st Edition, 2004.
[4] Augastine, T. Paul, ñCyber Crimes And Legal Issuesò, Crecent Publishing Corporation, 2007.
[5] Ajit Parulekar and Sarita Dô Souza, Indian Patents Law - Legal & Business Implications; Macmillan India ltd, 2006

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Image Processing

Theory Periods: 40
Credits: 4 Code: IT ME113

UNIT 1: Image Representation: Gray scale and colour Images, image sampling and quantization. Two dimensional orthogonal transforms: DFT, WHT, Haar transform, KLT, DCT. Image enhancement - filters in spatial and frequency domains, histogram-based processing, homomorphic filtering. Edge detection - non parametric and model based approaches, LOG filters, localization problem.

UNIT 2: Image Restoration: Degradation Models, PSF, circulant and block - circulant matrices, deconvolution, restoration using inverse filtering, Wiener filtering and maximum entropy-based methods. Image Segmentation: Pixel classification, Bi-level thresholding, Multi-level thresholding, P-tile method, Adaptive thresholding, Spectral & spatial classification, Edge detection, Hough transform, Region growing.

UNIT 3: Fundamental Concepts of Image Compression: Compression models - Information theoretic perspective. Fundamental coding theorem - Lossless Compression: Huffman Coding-Arithmetic coding - Bit plane coding - Run length coding - Lossy compression: Transform coding - Image compression standards.

UNIT 4: Mathematical Morphology - binary morphology, dilation, erosion, opening and closing, duality relations, gray scale morphology, applications such as hit-and-miss transform, thinning and shape decomposition.

UNIT 5: Image Texture Analysis - co-occurence matrix, measures of textures, statistical models for textures. Misc. topics such as - Hough Transform, boundary detection, chain coding, and segmentation, thresholding methods.

Text Books:

[1] Digital Image Processing By Gonzalez and Woods.
[2] A. K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.

References:

[1] R.M. Haralick, and L.G. Shapiro, Computer and Robot Vision, Vol-1, Addison Wesley, Reading, MA, 1992.
[2] R. Jain, R. Kasturi and B.G. Schunck, Machine Vision, McGraw-Hill International Edition, 1995.
[3] W. K. Pratt, Digital image processing, Prentice Hall, 1989.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Advanced Data Modelling

Theory Periods: 40
Credits: 4 Code: IT ME114

Unit 1: Introduction to Data Modelling: Data model, data model components: Entities, Data elements, Relationship, Keys, Subject Area, Logical and Physical Data, Data model Quality, Information Levels, Classification of Information levels, Data Centred Perspective.

Unit 2: Data Modelling Conventions and Its Aspects: Conventions: Syntactic, Positional, Semantics, Aspects of Data modelling: Logical Modelling, Conceptual Modelling, Dimensional Modelling, Physical Data modelling, Generic Data modelling, ER data modelling, UML data modelling, Enterprise data modelling, Normalization, De-normalization.

Unit 3: UML and Architectural Data Models: Architectural Data Model in UML, Architecture vs. Object Oriented Design: Behavior, Relationship and association, Specifying roles in UML, Object Oriented Design vs Relational Database Design: Persistence, Inheritance, Security.

Unit 4: Data Modelling Issues: Complex Data Model Issues: Normalizing data beyond 3NF, Mastering time based data and rules, Super-type and Sub-type structures, Generalization and patterns, Meta data, 3 Dimensional data models, Advanced Data models: Semi-structured, Object-oriented, Semantic data models.

Unit 5: Model Development: Understanding the business model, Developing the model, Creating and maintaining keys, Modelling the Calendar, Modelling Hierarchies, Modelling Transactions, Modelling Business Rules, Modelling for Data Warehouses and Data Marts.

Text Books:

[1] Data Modelling Fundamentals by Paulraj Pooniah - Wiley Interscience
[2] UML and Data Modeling: A Reconciliation by David C. Hay - Technics Publications LLC; First edition.

References:

[1] Data Modeler's Workbench: Tools and Technique by Steve Hoberman- Wiley Publication.
[2] Data Modeling Made Simple: A Practical Guide by S. Hoberman, C. Lehn - Technics Publications, LLC.
[3] Data Model Patterns: Conventions of Thought by David C. Hay- Dorset House Publishing
[4] Mastering Data Warehouse Design: Relational and Dimensional Techniques by C. Imhoff, N. Galemmo, J. G. Geiger, - Wiley Publication.

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Next Generation Network: Application & Protocol

Theory Periods: 40
Credits: 4 Code: IT ME121

UNIT1 Next Generation Networks: Principles and definition of an NGN, The NGN architecture, Outline of technology choices, Network and implementation issues with NGN, Numbering & Addressing

UNIT 2 Broadband Access, Next Generation Core Network: Review of broadband access systems for , Relative merits of the various systems and their enabling role in NGNs, The role of the core network, Enabling Control and Reconfigurability

UNIT 3 Packet Switching IP Multi -Media System : ATM, IP, MPLS, Ethernet, Principles of control for IP networks Concept of IMS, The architectural principles and the key components, Service aspects

UNIT 4 UMTS Terrestrial Radio Access Network: 2G, 2G Transition, IMT 2000, 3G transition, IMT Advance, 5G

UNIT 5 Mobile IP & Mobile Systems: The concept of mobile IP, Mobile IP application and limitations, Brief review of the principles of mobile networks, Relationship of mobile developments to NGN

Text Books:

[1] VALDAR, A R: ôUnderstanding Telecommunications Networks ö, IET Telecommunications Series 52, 2006.
[2] Convergence Technologies for 3G Networks: IP, UMTS, EGPRS and ATM Authors: Jeffrey Bannister, Paul Mather, and Sebastian Coope. . John Wiley & Sons, Ltd. ISBN 0470-86091-X (HB). Copyright 2004. Reprinted with corrections January 2005, February 2005.
[3] CDMA2000 Evolution: System Concepts and Design Principles Author: Kamran Etemad. Wiley-Interscience. ISBN 0-471-46125-3. Copyright 2004.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
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Distributed Database Management System

Theory Periods: 40
Credits: 4 Code: IT ME122

UNIT 1: Overview of Distributed Database: Distributed Databases: What and Why? Distributed Database Management Systems - Promises of distributed database, design issues of distributed databases, distributed database architecture, data fragmentation, Distributed Database Access Primitives, Integrity Constraints in Distributed Databases.

UNIT 2: Distributed Database Design: Framework for Distributed Database Design, Database Fragmentation Design, horizontal fragmentation, vertical fragmentation, Allocation of Fragments, allocation problem, allocation model, Translation of Global Queries to Fragment Queries, The Equivalence Transformation for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping - Aggregate Function Evaluation, Parametric Queries, Database Integration, Schema Matching, Schema Integration, Schema Mapping.

UNIT 3: Query Decomposition and Data Localization: Overview of Query Processing-objectives, Characterization of Query Processors, Layers of Query Processing, Query Decomposition and Data Localization- Localization of Distributed Data, Optimization of Distributed Queries, Centralized Query Optimization, Join Ordering in Distributed Queries, Distributed Query Optimization.

UNIT 4: Distributed Transaction Management and Concurrency Control: Introduction to Transaction Management, Properties of Transactions, Types of Transactions, Distributed Concurrency Control, Taxonomy of Concurrency Control Mechanisms, Locking Based Concurrency Control Algorithms, Timestamp Based Concurrency Control Algorithms, Optimistic Concurrency Control Algorithms, Deadlock Management - The System R* ,The Architecture of System R*, Compilation - Execution and Recompilation of Queries, Protocols for Data Definition and Authorization in R*, Transaction and Terminal Management.

UNIT 5: Reliability and Replication: Distributed DBMS Reliability, Reliability Concepts and Measures, Failures in Distributed DBMS, Local Reliability Protocols, Distributed Reliability Protocols, Data Replication, Consistency of Replicated Databases, Update Management Strategies, Replication Protocols.

Text Books:

[1] Stefano Ceri, Guiseppe Pelagatti, ñ*Distributed Databases - Principles and Systems*ò, Tata McGraw Hill, 2008.
[2] Ozsu M.T., Sridhar S., ñ*Principles of Distributed database systems*ò, Pearson education, 2011.

References:

[1] Raghu RamaKrishnan, Johnaas Gehrke, ñ*Database Management Systems*ò,Tata McGrawHill, 2000.
[2] Elmasri, Navathe, ñ*Fundamentals of Database Systems*ò, Addison-Wesley, Fifth Edition 2008.
[3] Peter Rob, Carlos Coronnel, ñ*Database Systems- Design, Implementation and Management*ò, Course Technology, 2000.

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Software Design Pattern

Theory Periods: 40
Credits: 4 Code: IT ME123

Unit 1: The Nature of Design Process: What is design, role of the design activity, Design as a problem solving process, design as a wicked problem, what is software, building models, transferring design knowledge, constraints upon the design process and product.

Unit 2: Design in the Software Development Process: A context for design, linear development process, Incremental development processes, Economic factors, the longer term, Design Qualities: The qualities concept, assessing design quality, assessing the design process.

Unit 3: Transferring Design Knowledge: Describe a design solution, representing abstract ideas, Design viewpoint for software, forms of notation, Transferring design knowledge, the need to share knowledge, the architecture, Design method, The rotational for methods.

Unit 4: Design practices: Stepwise refinement, architectural consequence, black box to white box in stage, prototyping, structures system analysis and structured design, origins, development and philosophy, representation forms for SSA/SD, Jackson System Development. The JSD Model, JSD representation forms, JSD heuristics

Unit 5: Design with Objects: The object concept, design practices for the object oriented paradigm, Object oriented frameworks, object based design, object oriented design, component based design, the comportment concept, Designing with components.

Text Books:

[1] Software Design, By David Budgen, Second edition Pearson education, 2003
[2] Design Patterns: Elements of Reusable Object-Oriented Software (Hardcover) **by** Erich Gamma.

References:

[1] Framework Design Guidelines: Conventions, Idioms, and Patterns for Reusable .NET Libraries by Krzysztof Cwalina, Brad Abrams.
[2] Implementing Domain-Driven Design by Vaughn Vernon.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Cellular and Mobile Computing

Theory Periods: 40
Credits: 4 Code: IT ME124

Unit 1: Overview Of Wireless Communications, Cellular Wireless Networks, Fast Fading Wireless Channel Modeling, Rayleigh/Ricean Fading Channels, BER Performance In Fading Channels, Diversity Modeling For Wireless Communications, BER Performance Improvement With Diversity, Types Of Diversity ï Frequency, Time, Space

Unit 2: Wireless Local Area Networks (Wi-Fi),Wireless Wireline Interworking, Mobile IP, Wireless Personal Area Networks (Bluetooth, UWB, Zigbee).

Unit 3: Introduction To Cellular Communications, Frequency Reuse, Multiple Access Technologies, Cellular Processes - Call Setup, Handover Etc., Teletraffic Theory, Mobility Management And Radio Resource Management, Traffic Models And Mobility Models, Multiple Access Techniques

Unit 4: Introduction To OFDM, Multicarrier Modulation And Cyclic Prefix, Channel Model And SNR Performance, OFDM Issues ï PAPR, Frequency And Timing Offset Issues, Introduction To MIMO, MIMO Channel Capacity, SVD And Eigenmodes Of The MIMO Channel, MIMO Spatial Multiplexing ï BLAST, MIMO Diversity ï Alamouti, OSTBC, MRT, MIMO, OFDM.

Unit 5: 3G And 4G Wireless Standards: GSM, GPRS, WCDMA, LTE, WiMax, Simulations of Wireless Networks (OPNET, NS2)

Text Books:

[1] J. Schiller, Mobile Communications, Addison Wesley.
[2] A. Mehrotra , GSM System Engineering.

References:

[1] M. V. D. Heijden, M. Taylor, Understanding WAP, Artech House.
[2] Charles Perkins, Mobile IP, Addison Wesley.
[3] Charles Perkins, Ad hoc Networks, Addison Wesley.
[4] Wireless and Mobile Network Architecture By Yi-bang lin

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Secure Communication

Theory Periods: 40
Credits: 4 Code: IT ME125

Unit 1:**Introduction:** Rings and fields- Homomorphism- Euclidean domains - Principal Ideal Domains -Unique Factorization Domains -- Field extensions- Splitting fields - Divisibility- Euler theorem - Chinese Remainder Theorem ï Primarily.

Unit 2: Basic Encryption Techniques: Concept of cryptanalysis - Shannon's theory ï Perfect secrecy - Block ciphers -Cryptographic algorithms - Features of DES - Stream ciphers - Pseudo random sequence generators ï linear complexity - Non-linear combination of LFSRs - Boolean functions.

Unit 3: Private Key and Public Key Crypto Systems: One way functions - Discrete log problem ï Factorization problem - RSA encryption - Diffie Hellmann key exchange ï Message authentication and hash functions -Digital signatures - Secret sharing - features of visual cryptography - other applications of cryptography.

Unit 4: Elliptic Curves: Basic theory - Weirstrass equation - Group law - Point at Infinity -Elliptic curves over finite fields - Discrete logarithm problem on EC - Elliptic curve cryptography - Diffie Hellmann key exchange over EC - Elgamal encryption over EC ï ECDSA.

Unit 5: Security: IP Security- overview, IP security architecture, authentication, header, security payload, security associations, key management, web security requirement, secure sockets layer, transport layer security, secure electronic transaction, dual signature, intruders, viruses, worms, firewall design, trusted systems, antivirus techniques, digital immune systems.

Text Books

[1] Douglas A. Stinson, ñCryptography, Theory and Practiceò, 2nd edition, Chapman & Hall, CRC Press Company, Washington
[2] William Stallings, ñCryptography and Network Securityò, 3rd edition, Pearson Education.

References

[1] Lawrence C. Washington, ñElliptic Curvesò, Chapman & Hall, CRC Press Company,Washington.
[2] David S. Dummit, Richard M. Foote, ñ Abstract Algebraò, John Wiley & Sons
[3] Evangelos Kranakis, ñ Primality and Cryptographyò, John Wiley & Sons
[4] Rainer A. Ruppel, ñAnalysis and Design of Stream Ciphersò, Springer Verlag.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Parallel System Architecture

Theory Periods: 40
Credits: 4 Code: IT MC201

Unit 1: Theory Of Parallelism: Parallel computer models- the state of computing, Multiprocessors and multi computers and multivectors and SIMD computers, PRAM and VLSI models, Architecture development tracks Program and network properties.

Unit 2: Parallel Processing Applications: Conditions of parallelism, Program portioning and scheduling, Program flow mechanisms, system interconnect architectures. Principles of scalable performance, performance matrices and measures, Parallel Processing applications, speedup performance laws, scalability analysis and approaches.

Unit 3: Hardware Technologies: Processor and memory hierarchy advanced processor technology, superscalar and vector processors, memory hierarchy technology, virtual memory technology, bus cache and shared memory, backplane bus systems, cache memory organizations, shared memory Organizations, sequential and weak consistency models.

Unit 4: Pipelining And Superscalar Architectures: Parallel and scalable architectures, multiprocessor and multicomputers, multivector and SIMD computers scalable, multithreaded and data flow architectures.

Unit 5: Parallel Programming: OpenMP Implementation in óCô Execution Model, Memory Model; Directives: Conditional Compilation, Internal Control Variables, Parallel Construct, Work Sharing Constructs, Combined Parallel Work-Sharing Constructs, Master and Synchronization Constructs; Run-Time Library Routines: Execution Environment Routines, Lock Routines, Timing Routines; Simple Examples in óCô Basics of MPI.

Text Book:

[1] Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing", Tata McGraw-Hill, New Delhi.
[2] Quinn, ñParallel Programming in C with MPI and Open MPò, TMH Open MP Specification and Usage.

References:

[1] D.Sima, T.Fountain and P.Kacsuk, "Advanced Computer Architectures: A Design Space Approach", Addison Wesley.
[2] John L. Hennessey and David A. Patterson, "Computer Architecture: A Quantitative Approach", Morgan Kaufmann.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Advance Data Structures and Algorithms

Theory Periods: 40
Credits: 4 Code: IT MC202

UNIT 1: Complexity Analysis and Elementary Data Structures: Asymptotic notations, properties of big oh notation, asymptotic notation with several Parameters, conditional asymptotic notation, amortized analysis, NP completeness, NP Hard, recurrence equations, solving recurrence equations, arrays, linked lists, trees.

UNIT 2: Issues Managing Equal Sized Blocks: Garbage Collection, Algorithms for Equal Sized Blocks, Storage Allocation for the objects with mixed Sizes, Buddy Systems Storage and Compactions.

UNIT 3: Heap Structures: Min-max heaps, deeps, leftist heaps , binomial heaps, Fibonacci heaps, skew heaps, lazy, binomial heaps, Search structures, Binary search trees, avl trees, 2,3 trees, 2,3,4 trees, red, black trees, b trees, splay trees, Hashing techniques.

UNIT 4: Programming Paradigms: Greedy & divide and conquer, Quick sort, Strassenôs matrix multiplication, convex hull tree, vertex splitting, job Sequencing with deadlines, optimal storage on tapes, Dynamic programming and backtracking, Multistage graphs ï 0/1 knapsack using dynamic programming, flow shop scheduling, 8-Queens problem, graph colouring, knapsack using backtracking.

UNIT 5: Searching, Sorting and File Structure: Spanning trees, graph traversal algorithms, hash table representation, hash function, collision, sorting, heap sort, bin sort, radix sort, external sorting, multiway merge sort, poly-phase sorting, file structures, sequential and direct access, relative files, indexed files, multi indexed files, inverted files, hashed files.

Text Books:

[1] E. Horowitz, s. Sahni and dinesh mehta, fundamentals of data structures in c++, Galgotia, 1999.
[2] E. Horowitz, s.sahni and s. Rajasekaran, computer algorithms / c++, galgotia, 1999.
[3] Adam drozdex, data structures and algorithms in c++, second edition, thomson Learning ï vikas publishing house, 2001.

References:

[1] G. Brassard and p. Bratley, algorithmics: theory and practice, printice ï hall, 1988.
[2] Thomas h.corman, charles e. leiserson, ronald . Rivest, òintroduction to algorithmsò, 2nd edition, 2003.
[3] Mark Allen Weiss- Data Structure and Algorithms Analysis in C++, Pearson education 2002.
[4] Aho Ullman-- Data Structure and Algorithms Analysis in C++, Pearson education 2002.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Grid & Cloud Computing

Theory Periods: 40
Credits: 4 Code: IT ME231

Unit 1: Concepts and Architecture: Introduction-Parallel and Distributed Computing-Cluster Computing-Grid Computing- Anatomy and Physiology of Grid-Review of Web Services-OGSA-WSRF, Grid Monitoring Architecture (GMA) - An Overview of Grid Monitoring Systems- GridICE ï JAMM -MDS-Network Weather Service-R-GMA-

Unit 2: Data Management and Grid Portals: Data Management-Categories and Origins of Structured Data-Data Management Challenges-Architectural Approaches-Collective Data Management Services-Federation Services-Grid Portals-First-Generation Grid Portals-Second-Generation Grid Portals

Unit 3: Cloud Computing Fundamentals, Concept & Technology: Definition of cloud Computing, Grids versus Clouds, Benefits and Challenges of Cloud Computing, Virtualization, Load Balancing, scalability & Elasticity, Deployment, Replication and Monitoring.

Unit 4: Infrastructure Model & Virtualization: Public, Private and Hybrid cloud model. Cloud System Model: Software as a Service, Platform as a Service and Infrastructure as a Service mode. Virtual Machine, Virtual Infrastructure Management, Virtual Machine Migration Strategies, Dynamic Resource Allocation using Virtual Machine, Server Virtualization.

Unit 5: Understanding Services and Applications: Understanding Service Oriented Architecture, Moving Applications to the Cloud, Cloud Strategy, Cloud-Based Storage, Cloud Design and Implementation Using SOA.

Text Books:

[1] Borko Furht, Armando Escalante, ñHandbook of Cloud Computingò Publisher: Springer 2010-09-29, 2010, ISBN 10: 1441965238 / ISBN 13: 9781441965233.
[2] Rajkumar Buyya, Andrzej Goscinski, James Broberg, ñCloud Computing: Principles and Paradigmsò Publisher: Wiley (2013).
[3] Kai Hwang, Geffrey C. Fox, Jack J. Dongarra, ñDistributed and Cloud Computingò Publisher:Morgan Kaufmann (2012).
[4] Maozhen Li, Mark Baker, The Grid Core Technologies, John Wiley & Sons ,2005.

References:

[1] Barrie Sosinsky ñCloud Computing Bibleò Publisher: Wiley India Pvt Ltd (2011).
[2] Tiberiu Tajts ñCloud-Computing-Securityò Publisher: Createspace (2011).
[3] Rajkumar Buyya, S. Thamarai Selvi, Christian Vecchiola ñMastering Cloud Computing: Foundations and Applications Programmingò, Morgan Kaufmann (2013).
[4] Ian Foster & Carl Kesselman, The Grid 2 ï Blueprint for a New Computing Infrastructure , Morgan Kaufman ï 2004.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Optical Networks

Theory Periods: 40
Credits: 4 Code: IT ME232

Unit 1: Introduction: Light wave generation systems, system components, optical fibers, SI, GI, fibers, modes, Dispersion in fibers, limitations due to dispersion, Fiber loss, non linear effects. Dispersion shifted and Dispersion flattened fibers. Optical transmitters, receivers and amplifiers. First- and second-generation optical networks, Components: couplers, isolators, circulators, multiplexers, filters, switches, and wavelength converters.

Unit 2: Optical Network Architectures: Introduction to Optical Networks**;** SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks- Topologies for Broadcast Networks, Media-Access Control Protocols, Testbeds for Broadcast & Select WDM; Wavelength Routing Architecture. Integration of TDM signals, Layers, Framing, Transport overhead, Alarms, Multiplexing, Network elements, Topologies, Protection architectures, Ring architectures, Network Management.

Unit 3: Broadcast And Select Networks: Topologies, Single-hop, Multihop, and Shufflenet multihop networks, Media-Access control protocols, Test beds. WAVELENGTH-ROUTING NETWORKS: The Optical layer, Node Designs, Optical layer cost tradeoff, Routing and Wavelength Assignment, Virtual Topology design, Wavelength Routing Test beds, Architectural variations.

Unit 4: Packet Switching And Access Networks: Photonic Packet Switching ï OTDM , Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch based networks; Access Networks- Network Architecture overview ,Future Access Networks, Optical Access Network Architectures; and OTDM networks.

Unit 5: High Capacity Networks, Network Design and Management: SDM, TDM, and WDM approaches, Application areas, Optical TDM Networks: Multiplexing and demultiplexing, Synchronization, Broadcast networks, Switch-based networks, OTDM test bed. Transmission system Engineering-system model, Power penality-transmitter, receiver, Optical amplifiers, crosstalk, dispersion, wavelength stabilization; overall design consideration; Control and Management-Network manage functions, Configuration management, Performance management, Fault management. Optical safety, Service interface.

Text Books:

[1] Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A practical perspective, Morgan Kaufmann, 2nd edition, 2001.
[2] Vivek Alwayn, Optical Network Design and Implementation, Pearson Education, 2004.

References:

[1] Hussein T.Mouftab and Pin-Han Ho, Optical Networks: Architecture and Survivability, Kluwer Academic Publishers, 2002.

[2] Biswanath Mukherjee, Optical Communication Networks, McGraw Hill, 1997.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Pattern Recognition

Theory Periods: 40
Credits: 4 Code: IT ME233

UNIT 1: Review of probability theory: conditional probability, Bayes theorem, random variables, distribution function, expectation and variance, joint distribution function of multiple random variables, normal distribution.

UNIT 2: Introduction to pattern recognition system, design cycle, introduction to feature extraction and classification, types of learning. Bayesian decision theory, Bayes Classifier, Discriminant functions, Minimum-error-rate classification.

UNIT 3: Parameter estimation methods, Maximum-Likelihood estimation, Gaussian mixture models, Bayesian estimation, Expectation maximization method, Hidden Markov models, Dimension reduction methods, Fisher discriminant analysis, Principal component analysis.

UNIT 4: Non-parametric techniques for density estimation and pattern classification, Parzen-window method, K-Nearest Neighbour method, linear discriminant analysis, Support vector machines.

UNIT 5: Unsupervised learning and clustering, linear least square regression, Criterion functions for clustering, Algorithms for clustering: Hierarchical and other methods, Cluster validation.

Text Books:

[1] S. M. Ross, Introduction to Probability models, Academic Press, 2010.
[2] R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001.

References:

[1] C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Big Data Analysis

Theory Periods: 40
Credits: 4 Code: IT ME234

Unit 1: Introduction to Hadoop and Big Data: Introduction, challenges for processing big data, technologies support big data, basic concepts of Hadoop, history of Hadoop, Installation of Hadoop, use cases of Hadoop, RDBMS vs Hadoop, hardware recommendations & statistics.

Unit 2:- HDFS: Hadoop Distributed File System: significance of HDFS in Hadoop, features of HDFS, Data Storage in HDFS, Accessing HDFS, Fault tolerance.
Learning Data Analytics with R and Hadoop : Understanding the data analytics project life cycle, Understanding data analytics problems.

Unit 3 : Importing and Exporting Data from various DBs: Learning about data files as database, understanding MySQL, Excel, MongoDB, SQLite, PostgreSQL, Hive, HBase.

Unit 4: Map Reduce & Apache: Map reduce story, architecture, working principle, map reduce programming model, creating input and output formats in Map Reduce Jobs. **PIG:** Introduction to Apache Pig, Map Reduce Vs. Apache Pig, Modes of Executing in Pig. **Hive:** Hive architecture, Partitions and buckets, **HBASE:** architecture, column families and regions, write pipeline, read pipeline, HBASE Commands.

Unit 5: Understanding Big Data Analysis with Machine Learning: Introduction to machine learning: types of machine-learning algorithms, supervised machine-learning algorithms: Linear regressing, Logistic regression, unsupervised machine learning algorithm: clustering: clustering with R, performing clustering with R and Hadoop, recommendation algorithms.

Text Books:

[1] Big Data Analysis with R and Hadoop, by Vignesh Prajapati.

[2] Big Data: A Revolution That Will Transform How We Live, Work, and Think By Viktor Mayer-Schönberger, Kenneth Cukier.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Information Theory and Coding

Theory Periods: 40
Credits: 4 Code: IT ME235

UNIT 1: Probability And Entropy: Communication channel and noise, Simple error correcting codes for binary symmetric channels, Probabilities and ensembles, Forward and inverse probabilities, Gibbsô inequality, Jensenôs inequality. Information content of a random variable, Lossy and lossless compression, Typicality, Shannonôs source coding theorem.

UNIT 2: Symbol And Stream Codes: Symbol codes, Unique decodeability, Optimal source coding, Huffman codes, Advantages and disadvantages. Arithmetic codes, Lempel-Ziv coding, Codes for integers.

UNIT 3: Noisy Channel Coding: Entropy of dependent random variables, Data processing theorem, Different noisy channels, Information conveyed by a channel, Noisy-channel coding theorem, Jointly-typical sequences, Communication above capacity, Computing capacity. Capacity of Gaussian channel.

UNIT 4: Information-retrieval problem, Hash codes, Collision resolution. Binary codes, Distance properties, Perfect binary codes, Weight enumerator function, Dual codes, Simultaneous proof of source coding and noisy-channel coding theorem, Data compression by linear Hash codes.

UNIT 5: Communication over constrained noiseless channels, constrained binary channel, Capacity of constrained noiseless channel, Number of possible messages, Practical communication over constrained channels. **Message Passing And Decoding:** Counting, Path-counting, Lowest cost path, Exact marginalization, marginalization on trellis and graphs, Convolutional and Turbo codes.

Text Books:

[1] Communication Systems 4ed, Simon Haykin, John Wiley and Sons, 2001.

References:

[3] Information Theory, Inference, and Learning Algorithms, David J. C. MacKay, Cambridge University Press, 2003.
[4] Elements of Information Theory, T. M. Cover and J. A. Thomas, John Wiley and Sons, 1999.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Soft Computing Techniques

Theory Periods: 40
Credits: 4 Code: IT ME241

UNIT 1: Introduction To Soft Computing: Introduction, Importance of Soft Computing, Main Components of Soft Computing: Fuzzy Logic, Artificial Neural Networks, Introduction to Evolutionary Algorithms, Hybrid Intelligent Systems,

UNIT 2: Artificial Neural Network: overview of biological Neuro-system, mathematical models of Neurons, ANN architecture, learning rules, learning Paradigms-Supervised, Unsupervised and reinforcement Learning, Pattern Recognition and Data Classification, various learning techniques, Kohonen Self-Organizing Feature Maps, Perception and convergence rule, associative memory, McCulloch-Pitts neuron, Hop-field network, Bayesô Theorem, implementing classification decision with BayesôTheorem, Adaptive Resonance Theory.

UNIT 3: Fuzzy Logic: Basic concept of fuzzy logic, fuzzy sets and crisp sets, fuzzy set theory and operations, fuzzy to crisp conversion, fuzzy membership function, fuzzy rules, fuzzy inference, fuzzifier and defuzzifier, Defizzification methods, Fuzzy relation, different fuzzy systems, fuzzy expert system, fuzzy decision making.

UNIT 4: Genetic Algorithm: Basic concepts, building block hypothesis, working principle, procedures of GA, Genetic representations (encoding), initialization and selection, genetic operators, reproduction, mutation, crossover, GA optimization problems, JSPP (Job Shop Scheduling Problem), TSP (Traveling Salesman Problem), Differences & similarities between GA and other Traditional methods, Applications of GA.

UNIT 5: Hybrid Soft Computing Techniques & Applications: Neuro-fuzzy hybrid systems ï genetic neuro hybrid systems ï genetic fuzzy hybrid and fuzzy genetic hybrid systems ï simplified fuzzy ARTMAP ï Applications: A fusion approach of multi-spectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

TEXT BOOKS:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, ñNeuro-Fuzzy and Soft Computingò, PHI /Pearson Education.2004.
2. S.N.Sivanandam and S.N.Deepa, ñPrinciples of Soft Computingò, Wiley India Pvt Ltd, 2011.

References:

[1] Freeman J.A. , D.M. Skapura, ñNeural Networks: Algorithms, Applications and Programming Techniquesò, Addison wesley, Reading, Mass, (1992).

[2] George J. Klir and Bo Yuan, ñFuzzy Sets and Fuzzy Logic ï Theory and Applicationsò, Prentice Hall, 1995.

[3] NEURAL NETWORKS, FUZZY LOGIC AND GENETIC ALGORITHM: SYNTHESIS AND By S. RAJASEKARAN, G. A. VIJAYALAKSHMI PAI.

[4] David E. Goldberg, ñGenetic Algorithms in Search, Optimization and Machine Learningò, Addison Wesley, 2007.

[5] Introduction to fuzzy sets and fuzzy logic, by M.Ganesh.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Next Generation Computing

Theory Periods: 40
Credits: 4 Code: IT ME242

UNIT I: **Cloud Computing:** Introduction to Cloud Computing including benefits, challenges, and risks, Cloud Computing Models including Infrastructure/Platform/Software ï as-a-service, Cloud OS Cloud Architectures including Federated Clouds

Unit II: Grid Computing: Introduction to Parallel and Distributed Computing, Cluster Computing, Grid Computing, Anatomy and Physiology of Grid, Review of Web Services, OGS, WSRF.

Unit III: **Open Grid Services Architecture (OGSA):** Some Sample Use cases that drive the OGSA, CDC, NFS, Online Media and Entertainment. OGSA Platform Components.**Open Grid Services Infrastructure (OGSI):** Introduction, Grid Services, High-Level Introduction to OGSI, Technical Details of OGSI specification, Introduction to Service Data Concepts, Grid Service : Naming and Change Management Recommendations.

Unit IV: Evolutionary Computing: The basics (and I mean basics!) of biological evolution and genetics. Genetic Algorithms (GA): fitness, reproduction, mutation, etc. The Schema Theorem in GA. Genetic programming and how it differs from GA.

Unit V: Agent Based Systems: Foundations of Intelligent Agents, Problem Solving, Searching, Heuristics, Constraint Satisfaction Problems, Game playing. Logical Agents, First order logic, First Order Inference, Knowledge Representation of Objects,Actions, Events. Acting under uncertainty,Probability Notation, Bayes Rule and use, Bayesian Networks, Time and Uncertainty, Temporal Models, Decision Network ï Complex Decisions.

Text Books:

[1] John W.Rittinghouse and James F. Ransome Clod computing: Implementation, Management, Security, CRC Press. 2009.
[2] Joshy Joseph and Craig Fellenstein, "Grid Computing", Pearson Education.
[3] Riccardo Poli , William B Langdon and Nicholas Freitag McPhee, A Field Guide to Genetic Programming.
[4] Stuart Russell and Peter Norvig, ñArtificial Intelligence - A Modern Approachò,2nd Edition, Prentice Hall, 2002

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Information Retrieval System

Theory Periods: 40
Credits: 4 Code: IT ME243

Unit 1: Introduction: Introduction to ad-hoc search: Boolean retrieval, Text representation, Search engine indexes, Evaluation, Information needs and queries, Principle Component Analysis and Singular Value Decomposition, Large-scale structured learning for classification.

Unit 2: Basic IR Models: Boolean and vector-space retrieval models; ranked retrieval; text-similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity, Retrieval models: Vector space, Retrieval models: Probabilistic models, Retrieval models: Statistical language models, Retrieval models: Inference networks, Index construction, Federated and vertical search, Experimental Evaluation of IR - Performance metrics: recall, precision, and F-measure; Evaluations on benchmark text collections.

Unit 3: Document Clustering, Collaborative Filtering: Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Applications to web search and information organization, Collaborative filtering and content-based recommendation of documents and products.

Unit 4: Text Categorization: Categorization algorithms: Rocchio, nearest neighbor, and naive Bayes. Applications to information filtering and organization, Categorization (overview), Categorization (logistic regression algorithms, convexity, regularization), Categorization (SVM), Learning to rank (pairwise constrained optimization), Learning to rank (list-wise constrained optimization)

Unit 5: Information Extraction and Integration: Extracting data from text; semantic web; collecting and integrating specialized information on the web, Link Analysis: HITS, PageRank, Link Analysis: Personalized and Topic Sensitive PageRank.

Text Books:

[5] Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Introduction to Information Retrieval, Cambridge University Press. 2008.

References:

[1] Cheng Xiang Zhai, Statistical Language Models for Information Retrieval (Synthesis Lectures Series on Human Language Technologies), Morgan & Claypool Publishers, 2008.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Modelling and Simulation

Theory Periods: 40
Credits: 4 Code: IT ME244

UNIT 1: Introduction: Basic Simulation Modelling, Systems, Models and Simulation, Discrete Event Simulation, Simulation of single server queuing system, Simulation of Inventory System, Alternative approaches to modelling and simulation.

UNIT 2: Simulation Software: Comparison of simulation packages with Programming languages, Classification of Software, Desirable Software features, General purpose simulation packages ï Arena, Extend and others, Object Oriented Simulation, Examples of application oriented simulation packages.

UNIT 3: Building Simulation Models: Guidelines for determining levels of model detail, Techniques for increasing model validity and credibility.

UNIT 4: Modelling Time Driven Systems: Modelling input signals, delays, System integration, Linear Systems, Motion control models, Numerical Experimentation.

UNIT 5: Exogenous Signals and Events: Disturbance signals, State Machines, Petri Nets & Analysis, System encapsulation. Markov Process Probabilistic systems, Discrete Time Markov processes, Random walks, Poisson processes, the exponential distribution, simulating a poison process, Continuous-Time Markov processes.

Text Books:

[1] Frank L. Severance, ñSystem Modeling & Simulation, An Introductionò, ï John Wiley & Sons, Reprint 2009.
[2] Averill M. Law, W. David Kelton, ñSimulation Modelling and Analysisò, TMH, 3rd Edition, 2003.

References:

[1] Geoffery Gordon, ñSystems Simulationò, PHI, 1978, 2nd Edition.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Agile Software Development

Theory Periods: 40
Credits: 4 Code: IT ME245

Unit 1: Introduction: The XP Lifecycle, The XP Team, XP Concepts. Thinking - Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives.

Unit 2: Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting.

Unit 3: Releasing: ñDone Doneò, No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation

Unit 4: Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating

Unit 5: Developing: Incremental Requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

Text Books:

[1] Alistair Cockburn, "Agile Software Development: The Cooperative Game", Pearson Education, ISBN: 0-321-48275-1
[2] James Shore, Shane Warden, "The Art of Agile Development", OReilly, ISBN: 978-0-596-52767-9

References:

[1] Robert C. Martin, "Agile Software Development: Principles, Patterns, and Practices", Prentice Hall/Pearson Education,ISBN- 9780135974445

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Software Testing Techniques

Theory Periods: 40
Credits: 4 Code: IT ME251

Unit 1: Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of Bugs. **Flow graphs and Path testing:** Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

Unit 2: Transaction Flow Testing: Transaction flows, transaction flow testing techniques. **Data flow testing:** Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

Unit 3: Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability. **Paths, Path products and Regular expressions:** Path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Unit 4: Logic Based Testing: Overview, decision tables, path expressions, kv charts, specifications. **State, State Graphs and Transition testing:** State graphs, good & bad state graphs, state testing, Testability tips.

Unit 5: Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Winrunner)

Text Books:

[1] Software Testing techniques - Baris Beizer, Dreamtech, second edition.
[2] Software Testing Tools ï Dr.K.V.K.K.Prasad, Dreamtech.

References:

[1] The craft of software testing - Brian Marick, Pearson Education.
[2] Software Testing Techniques ï SPD(Oreille).
[3] Software Testing in the Real World ï Edward Kit, Pearson.
[4] Effective methods of Software Testing, Perry, John Wiley.
[5] Art of Software Testing ï Meyers, John Wiley.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Network Security

Theory Periods: 40
Credits: 4 Code: IT ME252

UNIT 1: Services and mechanism, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stream and block ciphers, modern block cipher; block ciphers principles, shannonôs theory of confusion and diffusion, fiestal structure, data encryption standard, strength of DES, block cipher modes of operations, triple DES.

UNIT 2: Field, finite field of the form GF(p), modular arithmetic, prime and relative prime numbers, extended euclidean algorithm, advanced encryption standard, encryption and decryption fermatôs and eulerôs theorem, primality testing, chinese remainder theorem, discrete logarithmic problem, principles of public key crypto systems, RSA algorithm.

UNIT 3: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions, secure hash algorithm digital signatures; digital signatures, elgamal digital signature techniques, digital signature standards proof of digital signature algorithm.

UNIT 4: Symmetric key distribution, diffie-hellman key exchange, public key distribution, X.509 certificates, public key infrastructure, authentication application, kerberos electronic mail security; pretty good privacy.

UNIT 5: Architecture, authentication header, encapsulating security payloads, combining security associations, key management, introduction to secure socket layer, secure electronic, transaction (set) system security: idea of intrusion, intrusion detection, viruses and related threats, firewalls, web security.

Text Books:

[1] Bernard Menezes, Network Security and Cryptography, Cengage Learning, fifth edition, 2010.
[2] Behrouz A. Frouzan, Cryptography and Network Security, TMH Publication, third edition, 2004.

References:

[1] Wade Trappe, Lawrence C Washington, ñ Introduction to Cryptography with coding theoryò, 2nd ed, Pearson, 2007.
[2] William Stallings, ñCrpyptography and Network security Principles and Practicesò, Pearson/PHI, 4th ed, 2006.
[3] Atul Kahate, Cryptography and Network Security, TMH, third edition, 2008.

NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

Medical Imaging

Theory Periods: 40
Credits: 4 Code: IT ME253

UNIT 1: Introduction to Medical Imaging Technology: Introduction to medical imaging technology, systems and modalities, Brief history, importance; applications; trends; challenges.

UNIT 2: Medical Image Formation Principles: X-Ray and CT imaging X-Ray physics; X-Ray generation, Basic principles of CT; reconstruction methods; artifacts; CT hardware, Medical Image Storage, Archiving and Communication Systems and Formats ,Picture archiving and communication system (PACS); Formats: DICOM ,Radiology Information Systems (RIS) and Hospital Information Systems (HIS)

UNIT 3: Magnetic Resonance Imaging (MRI): Principles of NMR, MR imaging, MR pulse programming, MRS & fMRI, Applications of MR Ultrasound Imaging: Principles of US, Practice of US MR

UNIT 4: Medical Image Processing, Enhancement, Filtering: Basic image processing algorithms : Thresholding; contrast enhancement; SNR characteristics; filtering; histogram modeling Medical Image Visualization Fundamentals of visualization; surface and volume rendering/visualization; animation

UNIT 5: Medical Image Segmentation I: Histogram-based methods; Region growing and watersheds; Markov Random Field models; active contours; model-based segmentation.
Medical Image Segmentation - II Multi-scale segmentation; semi-automated methods; clustering-based methods; classification-based methods; atlas-guided approaches; multi-model segmentation.

TEXTBOOKS:

[1] Fundamentals of Medical Imaging Paul Suetens
[2] Medical Image Processing and Analysis-J. Michael Fitzpatrickand Milan Sonka

REFERENCE BOOKS:

[1] Biomedical Signal and Image Processing -Kayvan Najarian and Robert Splinter
[2] Digital Image Processing for Medical Applications-Geoff Dougherty
[3] Medical Imaging Signals and Systems Jerry L. Prince and Jonathan Links
[4] Biosignal and Medical Image Processing John L. Semmlow

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Real Time Embedded System

Theory Periods: 40
Credits: 4 Code: IT ME254

Unit 1: Hardware Software Co-design and Programme Modelling: Characteristics of an Embedded System, Quality Attributes of Embedded Systems, Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modelling Language (UML), Hardware Software Tradeoffs.

Unit 2: Real-Time Operating Systems (RTOS) Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling :Putting them Altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS.

Unit 3: Program Modeling Concepts: Program Models, DFG Models, state Machine Programming Models for Event controlled Program Flow, Modeling of Multiprocessor Systems, UML Modeling.

Unit 4: Real Time Operating Systems: OS Services, Process Management, Timer junctions, Event Functions, Memory Management, Device, File and IO Subsystems Management, Interrupt Routines in RTOS Environment and Handling of Interrupt, Source Calls, Real time Operating Systems, Basic Design an RTOS, RTOS Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Matrices, OS Security Issues.

Unit 5: Design Examples and Case Studies of Program Modeling and Programming With RTOS: Case study of Communication between Orchestra Robots, Embedded Systems in Automobile, Case study of an Embedded System for an Adaptive Cruise Control(ACC) System in a Car, Case study of an Embedded System for a Smart Card, Case study of a Mobile Phone Software for Key Inputs.

Text Books:

[1] Introduction to Embedded System, Shibu K V, McGraw Hill Higher Edition.
[2] Embedded Systems Architecture, Programming and Design, Raj Kamal, Second Edition, McGraw Hill Companies.
[3] Embedded System Design by Peter Marwedel, Springer.

References:

[1] Embedded System Design - A Unified Hardware/Software Introduction, Frank Vahid, Tony D. Givargis, John Wiley, 2002.
[2] Embedded/ Real Time Systems, KVKK Prasad, Dreamtech Press, 2005.