राष्ट्रीय प्रौद्योगिकी संस्थान रायपुर
NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR
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Department of Information Technology

Updated Schemes of B.Tech. Programme as per 49th Senate

BTech (IT) 7th Semester

National Institute of Technology Raipur (Dept of Information Technology)													
Course of Study and Scheme of Examination							B. Tech. 7th Semester				Branch: IT	
S. No.	Subject Code	Subject Name	Periods per Week			TA	Examination Scheme				Total Marks	Credits
			L	T	P		MSE/MTR		ESE/ESVE			
							Theory	Prac.	Theory	Prac.		
1	IT107101IT	Internet of Things	3	1	0	20	30	-	50	-	100	4
2	IT107102IT	Distributed Systems	3	1	0	20	30	-	50	-	100	4
3	Program Elective (EXX4)		3	0	0	20	30	-	50	-	100	3
4	Program Elective (EXX5)		3	0	0	20	30	-	50	-	100	3
5	Open Elective (OXX3)		3	0	0	20	30	-	50	-	100	3
6	IT107501IT	Project-I	0	0	6	40		20		40	100	3
7	IT107401IT	Internet of Things Lab	0	0	2	40	-	20	-	40	100	1
8	IT107701IT	Summer Internship II	0	0	2	40	-	20	-	40	100	2
									Total Credits =			23

Subject Code	Program Elective (EXX4)
IT107201IT	Text Mining
IT107202IT	Adhoc and Sensor Network
IT107203IT	Software Testing
IT107204IT	Cyber Forensics and Audits
Subject Code	**Program Elective (EXX5)**
IT107205IT	Quantum Machine Learning
IT107206IT	Information Retrieval
IT107207IT	Bioinformatics
IT107208IT	Secure Software Engineering
Subject Code	**Open Elective (0XX3)**
IT107301IT	Neural Network and Fuzzy Logic
IT107302IT	Human Computer Interaction & Design
IT107303IT	Computer Vision

Internet of Things

[7thSemester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-1-0, (4)	Core	IT107101IT

[Pre-requisites: Computer Networks]

Course Objectives

1. To understand the definition and significance of the Internet of Things.
2. To learn the architecture, operation, and business benefits of an IoT solution.
3. To examine the potential Security issues in IoT and explore the relationship between IoT, cloud computing, and big data.
4. Design and program IoT devices, use real IoT protocols for communication, Secure the elements of an IoT device.

Course Content

Unit 1: Introduction to The Internet of Things

IoT Definition, Elements of an IoT ecosystem, IoT applications, trends and implications, sensing components and devices, Wearable sensors and their Applications, operating System for IoT, **Industrial IoT: case study: Agriculture, Healthcare, Process Automation & monitoring etc.**

Unit 2: Internet of Things– Architecture and Communication Protocol

Layered Architecture for IoT, Protocol Architecture of IoT, Infrastructure Protocols: MAC protocols for sensor network, S-MAC, IEEE 802.15.4, Near Field Communication **(**NFC), RFID, ZigBee, Bluetooth Low Energy (BLE),IPv6 over Low-Power Wireless Personal Area Networks (6LoWPAN), Long Term Evolution-Advanced, Z-Wave, Components of Z-Wave Network, Protocols for IoT Service Discovery: DNS service discovery, multicast domain name system.

Unit 3:Internet of Things – Networking Protocol

Constrained Application Protocol (CoAP), Message Queue Telemetry Transport (MQTT), Extensible Messaging and Presence Protocol (XMPP), Advanced Message Queuing Protocol (AMQP), Data Distribution Service (DDS), Service Discovery Protocols, Routing Protocol for Low Power and Lossy Networks (RPL), sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, sensor network architecture, data dissemination and gathering protocol.

Unit 4: Platforms for IOT Applications and Analytics

Role of the cloud and fog resources in the delivery of IoT services**,** The IoT Building Blocks, Connected Devices, IoT or Sensor Data Gateway, The IoT Data Analytics Platforms: IBM Watson IoT Platform, Splunk Software for IoT Data, Amazon Web Service IoT Platform, Azure IoT Hub, The IoT Data Virtualization Platforms, IoT Data Visualization Platform, Security and Privacy in IoT

Course Materials

Required Text: Text books

1. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri, “Internet of Things: Architectures, Protocols and Standards,” Wiley, 2018.
3. Fei Hu, “Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations,” CRC Press, 2016.

Optional Materials: Reference Books

1. R. Buyya and A.K. Dastjerdi (eds.), “Internet of Things: Principles and Paradigms,” Cambridge, MA, USA: Morgan Kaufmann (Elsevier), 2016.

Distributed Systems

[7thSemester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-1-0, (4)	Core	IT107102IT

[Pre-requisites: Operating Systems]

Course Objectives

1. To understand the working principle and various models of Distributed Systems.
2. To understand the clock synchronization schemes of Distributed Systems.
3. To understand the various algorithms of Distributed Mutual Exclusion, election, and consensus.
4. To understand the concepts of Distributed detection, storage, transaction, replication, and recovery.

Course Content

Unit 1: Introduction & Models of Distributed Systems

Concept of Distributed system,Characteristics and Challenges of Distributed Systems, Examples of Distributed Systems. Physical Model, Fundamental model and Architectural model of Distributed Systems.

Unit 2: Clocks in Distributed Systems

Concept of clock in Distributed System, Limitation of Distributed System, Clock synchronization,Lamport's Logical Clock, Vector Clocks, Causal ordering of messages, Chandy-Lamport's Global State Recording Algorithm.

Unit 3: Distributed Mutual Exclusion, Election & Consensus

Distributed Mutual Exclusion: Concept ofCritical Section, Central Server Algorithm, Ring-based Algorithm,Ricart-AgrawalaAlgorithm.Election Algorithms: Ring-based election algorithm, Bully's algorithm. Consensus Algorithms: Floodset algorithm, Byzantine General Agreement Problem.

Unit 4: Distributed Deadlock Detection, Storage, Transactions, Replication & Recovery

The Ho-Ramamoorthy'stwo-phase algorithm and one-phase algorithm.Distributed Storage, Distributed Transaction, Replication, Recovery inDistributed System, Commit protocol- The Two-Phase commit protocol.

Course Materials

Required Text: Text books

1. G. Couloris, "Distributed System, Concept & Design," Addison Wesley 1994.
2. Tanenbaum, "Distributed Systems," PHI.
3. P. K. Sinha, "Distributed Operating Systems," PHI.
4. Michel J. Quinn, " Parallel Computing: Theory and Practice," McGraw-Hill.

Optional Materials: Reference Books

1. MukeshSinghal, Niranjan G. Shivaratri, "Advanced concepts in operating systems: distributed, database, and multiprocessor operating systems", MGH, 1/E, 1994.
2. J.A.Shar,. "An introduction to distributed and parallel processing",1986.

Text Mining

[7thSemester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-0-0, (3)	Program Elective	IT107201IT

[Pre-requisites: Data Mining & Analysis]

Course Objectives

1. To understand the basic concepts of text mining and analysis for pattern recognition.
2. To understand various text categorization and clustering techniques.
3. To understand various information retrieval and extraction techniques.
4. To understand various topic modeling techniques and its application.

Course Content

Unit 1: Introduction

Overview of text mining, Definition, General Architecture, Algorithms, Core Operations, Pre-processing, Types of Problems, basics of document classification, information retrieval, clustering and organizing documents, information extraction, prediction and evaluation, Textual information to numerical vectors, Collecting documents, document standardization, tokenization, lemmatization, vector generation for prediction, sentence boundary determination, evaluation performance.

Unit 2:Text Categorization and Clustering

Text Categorization – Definition, Document Representation, Feature Selection, Decision Tree Classifiers, Rule-based Classifiers, Probabilistic and Naive Bayes Classifiers, Linear Classifiers, Classification of Linked and Web Data, Meta-Algorithms, Clustering - Definition, Vector Space Models, Distance-based Algorithms, Word and Phrase-based Clustering, Semi-Supervised Clustering, Transfer Learning.

Unit 3:Information Retrieval and Information Extraction

Information retrieval and text mining - keyword search, nearest-neighbor methods, similarity, web-based document search, matching, inverted lists, evaluation. Information extraction – Architecture, Term Frequency, TF-IDF, Co-reference, Named Entity and Relation Extraction, Template filling and database construction, Applications, Unsupervised Algorithms for Information Extraction, Text Summarization Techniques, Topic Representation, Influence of Context, Indicator Representations, Pattern Extraction, Apriori Algorithm, FP Tree algorithm.

Unit 4: Probabilistic Models& Recent Trends

Probabilistic Models for Text Mining, Mixture Models, Stochastic Processes in Bayesian Nonparametric Models, Graphical Models, Relationship Between Clustering, Dimension Reduction and Topic Modeling, Latent Semantic Indexing, Probabilistic Latent Semantic Indexing, Latent Dirichlet Allocation, Interpretation and Evaluation, Probabilistic Document Clustering and Topic Models, Probabilistic Models for Information Extraction, Hidden Markov Models, Stochastic Context Free Grammars, Maximal Entropy Modeling, Maximal Entropy Markov Models, Conditional Random Fields. Recent Trends: Visualization Techniques in Link Analysis - Example, Text Mining in Multimedia, Text Analytics in Social Media, Opinion Mining and Sentiment Analysis, Opinion Lexicon Expansion, Text Mining Applications and Case studies.

Course Materials

Required Text: Text books

1. Sholom Weiss, Nitin Indurkhya, Tong Zhang, Fred Damerau “The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”, Springer, paperback 2010.
2. Ronen Feldman, James Sanger -“The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data”-Cambridge University press, 2006.
3. Charu C. Aggarwal ,Cheng Xiang Zhai, Mining Text Data, Springer; 2012

Optional Materials: Reference Books

1. Introduction to Information Retrieval. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, Cambridge University Press, 2007.

Adhoc & Sensor Network

[7thSemester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-0-0, (3)	Program Elective	IT107202IT

[Pre-requisites: Computer Networks]

Course Objectives

1. To understand the fundamentals of wireless networks, sensor networks and its application to critical real time scenarios.
2. To study the various protocols at various layers and its differences with traditional protocols.
3. To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.
4. To analyze various critical parameters in deploying a WSN.

Course Content

Unit1: Mobile Adhoc Networks

Introductory concepts. Different models of operation. Various applications of MANET, Destination Sequenced Distance Vector protocol - overview, route advertisement, extending base station coverage, Dynamic Source Routing protocol - overview and properties, Support for heterogeneous networks and mobile IP, Multicast routing with DSR.

Unit2: Routing protocols in MANET

Ad Hoc On-Demand Distance-Vector protocol - properties, unicast route Establishment, multicast route establishment, Link Reversal Routing - Gafni-Bertsekas algorithm, lightweight mobile routing algorithm, Temporally ordered routing algorithm,Preserving battery life of mobile nodes - Associativity based routing, Recent trends in MANET.

Unit3: Wireless Sensor Networks

Introduction and Overview of Wireless Sensor Networks, Background of Sensor Network Technology, Applications of Wireless Sensor Networks, Sensor Network Architecture, QoS and Energy Management.

Unit 4: MAC and routing protocols in WSN

Medium Access Control Protocols for Wireless Sensor Networks, Schedule-Based Protocols, Random Access-Based Protocols, Coordination, Schedule Synchronization, Adaptive Listening, Access Control and Data Exchange, Routing Protocols for Wireless Sensor Networks, Routing Challenges and Design Issues, 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, Directed Diffusion.

Course Materials

Required Text: Text books

1. Charles E. Perkins, “Ad Hoc Networking” Addison-Wesley Professional.
2. Prasant Mohapatra, Srikanth Krishnamurthy, “AD HOC NETWORKS: Technologies and Protocols” Springer.
3. Kazem Sohraby, Daniel Minoli, and TaiebZnati, "Wireless sensor networks: technology, protocols, and applications" Johnwiley& sons, 2007.

Optional Materials: Reference Books

1. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. Cory Beard, and William Stallings. Wireless communication networks and systems. Pearson, 2015.

Software Testing

[7thSemester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-0-0, (3)	Program Elective	IT107203IT

[Pre-requisites: Software Engineering]

Course Objectives

1. To study fundamental concepts in software testing.
2. To discuss various software testing issues and solutions in software unit test, integration and system testing.
3. To expose the advanced software testing topics, such as object-oriented software testing methods

Course Content

Unit 1: Introduction to Testing

Testing as an Engineering Activity, Testing as a Process, Testing axioms, Basic definitions, Software Testing Principles, The Tester's Role in a Software Development Organization, Origins of Defects, Cost of defects, Defect Classes, The Defect Repository and Test Design, Defect Examples, Developer/Tester Support of Developing a Defect Repository, Defect Prevention strategies.

Unit 2:Test Case Design

Test case Design Strategies, Using Black Bod Approach to Test Case Design, Random Testing Requirements based testing, Boundary Value Analysis, Equivalence Class Partitioning, State based testing, Cause-effect graphing, Compatibility testing, user documentation testing, domain testing, Using White Box Approach to Test design, Test Adequacy Criteria, static testing vs. structural testing, code functional testing, Coverage and Control Flow Graphs.

Unit 3:Levels of Testing

The need for Levers of Testing, Unit Test, Unit Test Planning, Designing the Unit Tests, The Test Harness, Running the Unit tests and Recording results, Integration tests, Designing Integration Tests, Integration Test Planning, Scenario testing, Defect bash elimination System Testing, Acceptance testing, Performance testing, Regression Testing, Internationalization testing, Ad-hoc test, Alpha, Beta Tests, Testing OO systems, Usability and Accessibility testing.

Unit 4: Test Management

People and organizational issues in testing, Organization structures for testing teams, testing services, Test Planning, Test Plan Components, Test Plan Attachments, Locating Test Items, test management, test process, Reporting Test Results, The role of three groups in Test Planning and Policy Development, Introducing the test specialist, Skills needed by a test specialist, Building a Testing Group.Software test automation, skill needed for automation, scope of automation, design and architecture for automation, requirements for a test tool, challenges in automation, Test metrics and measurements, project, progress and productivity metrics.

Course Materials

Required Text: Text books

1. SrinivasanDesikan and Gopalaswamy Ramesh, Software Testing – Principles and Practices,Pearson Education, 2006.
2. Ron Patton, Software Testing, Second Edition, Sams Publishing, Pearson Education, 2007.
3. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.

Optional Materials: Reference Books

1. Edward Kit," Software Testing in the Real World – Improving the Process", PearsonEducation, 1995.
2. Boris Beizer," Software Testing Techniques" – 2nd Edition, Van Nostrand Reinhold, NewYork, 1990.

Cyber Forensics and Audit

[7th Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-0-0, (3)	Program Elective	IT107204IT

[Pre-requisites: Data Structures, Software Engineering]

Course Objectives:

1. To study the basic concepts of the Cyber Forensics and Audit
2. To understand and study the Windows Forensic Analysis
3. To study the fundamental of the Mobile Forensics analysis

Course Content

Unit-1 File system: CHS, LBA, HPA, write blockers, Extracting & recovering partitions, MBR, DOS partition table, Extended partition table, RAID; FAT file system: Architecture, File creation, File deletion; NTFS file system: Architecture, File creation, File deletion, Compression, encryption and indexing, Extended file systems: EXT2, EXT3 and EXT4, Architecture, File creation, File deletion and Journaling; Apple File System (APFS); Other Disk structures; Windows and Linux boot process; Filesystem acquisition and recovery

Unit-2 Windows Forensic Analysis: Window artifacts, Evidence volatility, System time, Logged on user(s), Open files, MRUs, Network information, Process information, Service information, Windows Registry, Startup tasks, Memory dumping; Document Forensics: PDF structure, PDF analysis, MSOffice Document structure and analysis, Macros, Windows thumbnails, Android Thumbnails

Unit-3

Mobile Forensics: SIM Card, Android architecture, Android File System, Android application, Android SDK,Android Debug Bridge, Memory & SIM acquisition; Virtual Machines, Network Forensics; Cybercrime investigation: Pre investigation, SOP for Investigation; Case scenarios: social media crime, Online defacement crime, Email investigation; CDR Analysis

Unit-4 Auditing: Internal Audit and IT Audit Function, IT Governance, Frameworks, Standards, and Regulations, Identifying information assets, Risk assessment, Risk management, Types of Auditing, ISO 27001, PCIDSS

Required Text: Text/Reference books:

1. Brown, Christopher LT., "*Computer evidence: Collection and preservation",* Charles River Media, Inc., 2009.
2. Enfinger, Frank, Amelia Phillips, Bill Nelson, and Christopher Steuart. "Guide to computer forensics and investigations." *Boston: Thomson Course Technology* (2005).
3. Vacca, John R. *Computer forensics: computer crime scene investigation*. Charles River Media, Inc., 2002.
4. Bunting, Steve and William Wei. EnCase Computer Forensics: The Official EnCE: EnCaseCertifed Examiner Study Guide. Sybex,
5. Prosise, Chris, Kevin Mandia, and Matt Pepe. *Incident response & computer forensics*. McGraw-Hill, Inc., 2003.
6. Carrier, Brian. *File system forensic analysis*. Addison-Wesley Professional, 2005.

Quantum Machine Learning

[7th Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-0-0, (3)	Program Elective	IT107205IT

[Pre-requisites: Data Structures, Discrete Structures, Data Mining]

Course Objectives:

1. To understand the basic concepts and terminology related to Quantum Computational Models
2. To understand the basic concepts of Quantum Algorithm design
3. To study the fundamental of the Quantum Machine learning Algorithms

Course Content

Unit-1: Quantum Computational Models

Introduction to Quantum computing, **Q**uantum Computer Architecture, the basics of the quantum circuit model, Qubit and Quantum State, working with one qubit and the Bloch sphere, working with two qubits and entanglement, Working with multiple qubits and universality.

Unit-2 Essential Quantum Encoding and Algorithms

Encodings of Data, *Quantum Encoding,* Basis Encoding, Amplitude Encoding, Qsample Encoding, *Essential Quantum Routines for QML,* Harrow–Hassidim–Lloyd algorithm, Grover's Algorithm, Quantum phase estimation, Variational quantum circuit

Unit-3

QML toolkit, Hamiltonian simulation, SWAP test, Qdist routine, ML vs. QML, Quantum principal component analysis, Quantum Linear Regression, **Quantum classification:** Distance-based quantum classification, Quantum *k*-nearest neighbours, Quantum support vector machine, SVM training with a quantum annealer, Quantum-inspired classification

Unit-4

Quantum clustering: Quantum K-Means Clustering, Quantum *K*-medians, Quantum divisive clustering, Clustering with a quantum annealer,

Quantum neural networks: Quantum Perceptron, Quantum feedforward neural networks, Quantum Convolutional Neural Network (QCNN), CNN vs. QCNN, Quantum AutoEncoder (QAE), Quantum generative adversarial networks

Required Text: Text/Reference books:

1. Pastorello, Davide. "***Concise Guide to Quantum Machine Learning***", Springer Nature, 2022.
2. Kaiser, Sarah C., and Christopher Granade. "***Learn quantum computing with python and Q#: A hands-on approach***", Simon and Schuster, 2021
3. Wittek, Peter. **"*Quantum machine learning: what quantum computing means to data mining*"**, Academic Press, 2014.
4. Combaro, E. F., and Samuel González-Castillo, "A Practical Guide to Quantum Machine Learning and Quantum Optimization: Hands-on Approach to Modern Quantum Algorithms" (2023).

Information Retrieval

[7th Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-0-0, (3)	Program Elective	IT107206IT

[Pre-requisites: Computational Mathematics]

Course Objectives

1. Understand the basic concepts of the information retrieval.
2. Understand data pre-processing, indexing, retrieval methods and concepts.
3. Understand how to evaluate the effectiveness and efficiency of different information retrieval.

Course Content

Unit 1: Introduction:

History of IR, Components of IR, Issues, Open source Search engine Frameworks. The impact of the web on IR, role of artificial intelligence (AI) in IR, IR Versus Web Search, Components of a Search engine.

Unit 2: Information Retrieval:

Boolean and vector-space retrieval models, Term weighting, TF-IDF weighting- cosine similarity, Preprocessing, Inverted indices - efficient processing with sparse vectors , Language Model based IR - Probabilistic IR–Latent Semantic Indexing, Relevance feedback and query expansion.

Unit 3: Web Search Engine:

Introduction and Crawling,Web search overview, web structure, the user, paid placement, search engine optimization/ spam. Web size measurement, search engine optimization/spam, Web Search Architectures, crawling, meta-crawlers- Focused Crawling, web indexes, Near-duplicate detection, Index Compression, XMLretrieval.

Unit 4: Web Search - Link Analysis and Specialized Search:

Link Analysis, hubs and authorities, Page Rank and HITS algorithms, Searching and Ranking, Relevance Scoring and ranking for Web, Similarity, Hadoop & Map Reduce - Evaluation, Personalized search , Collaborative filtering and content-based recommendation of documents and products, handling “invisible” Web Snippet generation, Summarization, Question Answering, Cross- Lingual Retrieval.

Course Materials

Required Text: Text books

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval , Cambridge University Press, 2008.
2. Ricardo Baeza -Yates and Berthier Ribeiro – Neto, Modern Information Retrieval: The Concepts and Technology behind Search, 2nd Edition, ACM Press Books 2011.
3. W. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley, 2009.
4. Mark Levene, An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley, 2010.

Optional Materials: Reference Books

1. Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
2. David A. Grossman and OphirFrieder “Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series”, 2nd Edition, Springer, 2004.

Bio- Informatics

[7th Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-0-0, (3)	Program Elective	IT107207IT

[Pre-requisites: Computational Mathematics, Data Mining, Artificial Intelligence, Data Science & Machine Learning]

Course Objectives

1. To study data mining for biological data
2. To study bioinformatics software
3. To study different databases and search techniques for biological data
4. To Learn Different Gene Analysis tools and machine learning models for gene identification

Course Content

Unit 1: Introduction to Bio-Informatics

Definition and History of Bioinformatics, Internet and Bioinformatics, Data generation: Generation of large scale molecular biology data through Genomesequencing, Protein sequencing, Gel electrophoresis, NMR Spectroscopy, X-Ray Diffraction,and microarray, Introduction to data types and Source. Biological Databases;Nucleic acid databases (NCBI, DDBJ, and EMBL), Protein databases (Primary, Composite, and Secondary), Specialized Genome databases: (SGD, TIGR, and ACeDB), Structure databases (CATH, SCOP, and PDBsum), Applications of Bioinformatics.

Unit 2: Bio-Computing

Introduction to String Matching Algorithms, Database Search Techniques, Sequence Comparison and Alignment Techniques, Use of Biochemical Scoring Matrices, Introduction to Graph Matching Algorithms, Automated Genome Comparison and its Implication, Automated Gene Prediction, Automated Identification of Bacterial Operons and Pathways.

Unit 3: Genome Analysis and Gene Mapping

Introduction to Signaling Pathways and Pathway Regulation. Gene Arrays, Analysis of Gene Arrays using programming paradigms: Greedy Algorithms, Dynamic Programming Algorithms, Dot Plots. Analysis tools for sequence and data bank, sequence homology using BLAST and FASTA, FASTA and BLAST Algorithm comparison.

Unit 4: Machine Learning

Machine-Learning Foundations: The Probabilistic Framework, Machine Learning Algorithms, Applications of Neural Networks in Bioinformatics,Ontologies, interchange languages and, standardization efforts, General Introduction to XML, UMLS, CORBA, PYTHON and OMG/LIFESCIENCE.

Course Materials

Required Text: Text books

1. Claverie , J.M. and Notredame C. 2003 Bioinformatics for Dummies. Wiley Editor.
2. Letovsky, S.I. 1999 Bioinformatics. Kluwer Academic Publishers.
3. Baldi, P. and Brunak, S. 1998 Bioinformatics. The MIT Press.

Optional Materials: Reference Books

1. Setubal, J. and Meidanis, J. 1996 Introduction to Computational Molecular Biology. PWS Publishing Co., Boston.
2. Lesk, A.M. 2002 Introduction to Bioinformatics. Oxford University Press.

Secure Software Engineering

[7th Semester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-0-0, (3)	Program Elective	IT107208IT

[Pre-requisites: Data Structures, Software Engineering]

Course Objectives:

4. To study the basic concepts of the secure software design concept
5. To understand the basic concepts of Secure Programming
6. To study the fundamental of the Software security knowledge for Architecture and Design

Course Content

Unit-1:

Software assurance and software security, threats to software security, sources of software insecurity, benefits of detecting software security, managing secure software development.

Unit-2:

Defining properties of secure software, how to influence the security properties of software, how to assert and specify desired security properties, Secure software Architecture and Design: Software security practices for architecture and design: Architectural risk analysis.

Unit-3:

Software security knowledge for Architecture and Design: security principles, security guidelines, and attack patterns, secure design through threat modelling, Writing secure software code: Secure coding techniques, Secure Programming: Data validation.

Unit-4:

Secure Programming: Using Cryptography Securely, Creating a Software Security Programs. Secure Coding and Testing: code analysis- source code review, coding practices, static analysis, software security testing, security testing consideration through SDLC.

Required Text: Text/Reference books:

1. Julia H Allen, Sean J Barnum, Robert J Ellison, Gary McGraw, Nancy R Mead, "**Software Security Engineering: A Guide for Project Managers"**, Addison Wesley,
2. Ross J Anderson, "**Security Engineering: A Guide to Building Dependable Distributed Systems"**, 2nd Edition, Wiley, 2008.
3. Howard, M. and LeBlanc, D., "**Writing Secure Code"**, 2nd Edition, Microsoft Press, 2003.

Neural Networks and Fuzzy Logic

[7thSemester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-0-0, (3)	Open Elective	IT107301IT

[Pre-requisites: Mathematics, Discrete Structures, Fundamental of Computing]

Course Objectives

1. To understand different soft computing tools to solve real life problems.
2. To enable students to solve problems that is appropriately solved by neural networks, fuzzy logic, and genetic algorithms.
3. To provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
4. To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic.

Course Content

Unit1: Introduction to Artificial Neural Networks

Elementary Neurophysiology, Biological Neuron, Biological and Artificial Neuron Models,characteristics of ANN, Historical developments, Neural Networks viewed as directed graphs,Feedback from neurons to ANN, Artificial Intelligence and Neural Networks, McCulloch-PittsModel, Network Architectures, Recurrent Networks, Topologies, overview of Single-layered Feedforward Networks and Multi-layered Feed- forward Networks. Classification Taxonomy of ANN, Different Learning Strategy-Supervised and Unsupervisedlearning, Reinforcement, Learning rules, Memory models, Stability and Convergence, Activation andSynaptic Dynamics, Competitive, Error-Correction Learning

Unit2: Associated Memories and Supervised network

Associative Memory, HebbianLearning, General concept of associated memory, Bidirectional Associated memory (BAM)architecture, BAM Training algorithm, Hopfield Network Architecture, Discrete and continuousversions, Storage and recall algorithm, stability analysis. Perceptron model, least mean square algorithm(Rosenblat Algorithm), ADALINEalgorithm and applications, MADALINE, Algorithm and applications, Multilayered Feed Forward NeuralNetworksmodel, BackpropagationAlgorithm, XOR – Problem, The generalized Deltarule, BPN Applications.

Unit3: Unsupervised network and applications of network model

Self-organizing Feature mapalgorithm, Learning Vector Quantization, Counter Propagation Network. Architecture, Algorithm and applications of Complex Pattern Recognition: ART/ART-1, ART-2, Cognitron, Structure & training, Neo-cognitron architecture, Data processing-performance, addition of lateralinhibition& feedback to the neo-cognitron, Character Recognition and Handwritten Digit recognition,Simulated Annealing, Support Vector machines.

Unit 4: Neural Fuzzy Systems

Introduction to classical sets-properties, Operations, and relations: Introduction to Fuzzy sets,membership, uncertainty, operations, relations, cardinalities, Examples of Fuzzy logic, defuzzification to crisps sets and its methods, Fuzzy Associative memories, Fuzziness in neural networks and examples, Fuzzy logic control and fuzzy classification.

Course Materials

Required Text: Text books

1. Artificial Neural Networks by B. Yagna Narayan, PHI
2. Neural Networks Fuzzy Logic & Genetic Alogrithms by Rajshekaran&Pai, Prentice Hall
3. Principles of Soft Computing by S. N. Sivanandam, S. N. Deepa, Wiley-India.
4. Introduction to Neural Networks using Matlab 6.0 by S.N. Sivanandam, S Sumathi, S.N.Deepa, TMH.

Optional Materials: Reference Books

1. Neural Networks by James A. Freeman and David M. Strapetuns, Prentice Hall.
2. Neural Network & Fuzzy System by Bart Kosko, PHI.
3. Neural Network Design by Hagan Demuth Deale Vikas Publication House.

Human Computer Interaction Design

[7thSemester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-0-0, (3)	Open Elective	IT107302IT

[Pre-requisites: Computer Programming, Digital Logic Analysis and Design]

Course Objectives

1. To understand the basics of Human Computer Interaction.
2. To understand the Cognitive Models and UI Design for HCI.
3. To evaluate techniques for HCI models.
4. Case study based in-depth analysis.

Course Content

Unit 1: Introduction to HCI:

A brief history of HCI, Applications of HCI. Interactive system design (theory and practice): Concept of usability – definition and Elaboration, HCI and Software Engineering, GUI design and aesthetics, Prototyping techniques.

Unit 2: Models in HCI:

Introduction to different types of models, GOMS family of models (KLM and CMN-GOMS), Fitts' law and Hick-Hyman's law, Model-based design case studies.

Unit 3: Cognitive Framework, HCI Interfaces and Evaluation:

Cognitive Framework of HCI, Perception & Representation. Attention and Interface Design, Memory in Interface Design. Knowledge Representation, User Modeling. Interaction with Natural Languages, Next Generation Interface.UI Evaluation, Cognitive Walkthrough, Heuristic Evaluation, Evaluation with Cognitive Models, Evaluation with Users, Model-based Evaluation.

Unit 4: Case Studies:

Case Study 1 – Multi-Key press Hindi Text Input Method on a Mobile Phone. Case Study 2 – GUI design for a mobile phone based Matrimonial Application. Case Study 3 – Employment Information System for unorganized construction workers on a Mobile Phone.

Course Materials

Required Text: Text books

1. Dix A., Finlay J., Abowd G. D. and Beale R. Human Computer Interaction, 3rd edition, Pearson Education, 2005.
2. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994.
3. Smith AtakanSerengal, "Human-Computer Interaction", Cengage Learning.
4. B. Shneiderman; Designing the User Interface, Addison Wesley 2000 (Indian Reprint).

Optional Materials: Reference Books

1. Brian Fling, "Mobile Design and Development", First Edition ,O"Reilly Media Inc., 2009
2. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O"Reilly, 2009.

Computer Vision

[7thSemester, Fourth Year]

Course Description

Offered by Department	Credits	Status	Code
Information Technology	3-0-0, (3)	Open Elective	IT107303IT

[Pre-requisites: Mathematics,Data Mining, Digital Image Processing]

Course Objectives

1. To introduce students to the fundamentals of image formation.
2. To introduce students to the methods and techniques of computer vision.
3. To develop an appreciation for various issues in the design of computer vision and object recognition systems.
4. To provide the student with programming experience from implementing computer vision and object recognition applications

Course Content

Unit-1: Introduction

Image Processing, Computer Vision and Computer, Graphics, Computer Vision - Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality

Unit 2: Depth estimation and Multi-camera views

Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.

Unit 3: Feature Extraction

Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Unit 4: Motion Estimation & Pattern Analysis

Motion parameter estimation, Regularization theory, Optical computation,Stereo Vision , Motion estimation , Structure from motion, Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

Textbooks:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall
3. Robot Vision, by B. K. P. Horn, McGraw-Hill.
4. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: PrenticeHall

Reference Books:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
3. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.
4. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006

Project-I

[7thSemester, Fourth Year]

Course Description			
Offered by Department	Credits	Status	Code
Information Technology	0-0-6, (3)	Project	IT107501IT

Internet of Things Lab

[7thSemester, Fourth Year]

Course Description			
Offered by Department	Credits	Status	Code
Information Technology	0-0-2, (1)	Lab	IT107401IT

Summer Internship -II

[7thSemester, Fourth Year]

Course Description			
Offered by Department	Credits	Status	Code
Information Technology	0-0-2, (1)	Internship	IT107701IT