JHARKAHAND UNIVERSITY OF TECHNOLOGY, RANCHI

Syllabus for B. Tech course in Computer Science & Engineering and Information Technology

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6th Semester, CSE

S. No	Course Code	Category	Subject	L	T	P	Credit
1	CS601	Professional Core-I	Computer Networks	4	1	0	4
2	CS602	Professional Core-II	Data Science	3	1	0	3
3	CS603	Professional Core-III	Image Processing	3	1	0	3
4		Professional Electives-II	List of Professional Electives-II	3	1	0	3
5		Open Elective-II	List of Open Elective-II	3	1	0	3
Laboratory/Sessional							
1	CS601P	Laboratory-I	Computer Networks Lab.	0	0	3	1
2	CS602P	Laboratory-II	Data Science Lab.	0	0	3	1
3	CS603P	Laboratory-III	Image Processing Lab.	0	0	3	1
4		Laboratory-IV	Professional Electives-II Lab.	0	0	3	1
5		Laboratory-V	Internship/Tour & Training /Industrial Training	0	0	2	2
Total Credits (Theory + Sessional)							22

List of Electives 6th Semester, CSE

Professional Elective-II	
Course No.	Subject Name
CS604	Soft Computing
CS605	System Software
CS606	Distributed System
CS607	Natural Language Processing
CS608	Software Engineering
Open Elective-II	
Course No.	Subject Name
IT601	Information Retrieval
CS609	AI and Machine Learning*
CS601	Computer Network*
IT602	Internet Of Things (IOT)

*These subjects are open for all the branches other than CSE and IT.

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Semester – VI

Computer Science & Engineering					
Code: CS601	**Computer Networks**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

Course Objective:

This course includes learning about computer network organization and implementation. Students are introduced to computer network design and its operations, and discuss the topics of OSI communication model; error detection and recovery; LANs; network naming and addressing; and basics of cryptography and network security.

Course Outcome:

CO1	Describe and analyze the importance of data communications and the layered protocol model
CO2	Describe, analyze and evaluate a number of data link, network, and transport layer protocols and network devices.
CO3	Have a basic knowledge of the use of cryptography and network security;
CO4	Explain concepts and theories of networking and apply them to various situations, classifying networks, analyzing performance and implementing new technologies

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CO1	1	1	-	2	-	-	-	1	1	-	-	2
CO2	2	2	1	1	3	-	-	-	1	-	1	2
CO3	-	1	3	2	-	2	2	3	-	-	-	3
CO4	3	2	2	2	2	-	-	2	1	1	2	2

Course Description:

MODULE 1:

Data communication Components**:** Representation of data and its flow in Networks, Various Connection Topology, Protocols and Standards, OSI model.Physical Layer: LAN technologies (Ethernet), Multiplexing, Transmission Media, Switching Techniques.

MODULE 2:

Data Link Layer: Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, and Sliding Window. Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA. Error Detection and Error Correction - Fundamentals, Block coding, CRC, Hamming Code.

MODULE 3:

Network Layer: Internetworking Devices. IP Addressing and Subnetting, Network Layer Protocols: IPV4, IPV6 and ICMP. Address Mapping: ARP, RARP and DHCP. Routing algorithms (link state and distance vector).

MODULE 4:

Transport Layer: Process to Process Delivery: UDP and TCP, Congestion Control and Quality of Services.

MODULE 5:

Application Layer: Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi.

MODULE 6:

Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.

Text Books:

1. "Data Communication and Networking", Behrouz Forouzan, McGraw Hill Education.

Reference Books:

1. "Computer Networks", Andrew S Tanenbaum, Pearson Edition
2. "Data and Computer Communications " , W. Stallings, PHI/ Pearson Education

Computer Science & Engineering					
Code: CS602	**Data Science**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

Course Objective:

The main objective of this course is to train the student to do theoretical with practical data science work, Career-wise, we expect our students to be able to develop into skilled data science researchers or software developers.

Course Outcome:

1. To enable students with data analytics skill
2. To develop knowledge of fundamentals of data science
3. To empower students with hands-on for data science
4. To make students experience with theoretical data science and programming

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO5**	**PO9**	**P11**	**P12**
CO1	-	3	2	-	1	3	3
CO2	3	2	-	-	2	2	2
CO3	-	2	3	3	3	3	-
CO4	2	-	2	3	3	2	2

MODULE-I

INTRODUCTION: -

Introduction to data science, Different sectors of using data science, Purpose and components of Python, Data Analytics processes, Exploratory data analytics, Quantitative technique and graphical technique, Data types for plotting.

MODULE-II

STATISTICAL ANALYSIS: -

Introduction to statistics, statistical and non-statistical analysis, major categories of statistics, population and sample, Measure of central tendency and dispersion, Moments, Skewness and kurtosis, Correlation and regression, Theoretical distributions – Binomial, Poisson, Normal

MODULE-III

INTRODUCTION TO MACHINE LEARNING: -

Machine learning, Types of learning, Properties of learning algorithms, Linear regression and regularization, model selection and evaluation, classification: SVM, kNN and decision tree, Ensemble methods: random forest, Naive Bayes and logistic regression, Clustering: k-means, feature engineering and selection, Dimensionality reduction: PCA

MODULE-IV

PYTHON SETUP FOR MATHEMATICAL AND SCIENTIFIC COMPUTING: -

Anaconda installation process, data types with python, basic operators and setup, introduction to numpy, mathematical functions of numpy, introduction to scipy, scipy packages, data frame and data operations, data visualisation using matplotlib

Text Books:

1. N.G.Das , Statistical Methods (combined edition Vol.I and Vol.II) – Mc Graw Hill
2. Roger D. Peng, Elizabeth Matusi, The Art of Data Science: A Guide for Anyone who work with data - Leanpub
3. AurelienGeron, Hands-On Machine Learning with Scikit – Learn &TensorFlow – O'reilly

Reference Books:

1. AndriyBurkov, The Hundred Page Machine Learning Book – Xpress Publishing
2. James, G., Witten, D., Hastie, T., Tibshirani, R. An introduction to statistical learning with applications in R. Springer.
3. Murphy, K. Machine Learning: A Probabilistic Perspective. - MIT Press
4. Jan Erik Solem, Programming Computer Vision with Python – O' Reilly

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Pre-	**Computer Science & Engineering**					
	Code: CS603	**Image Processing**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

requisite(s)

Knowledge of Data Structures, Computer Graphics required for this course.

Objectives of the course

Course Outcomes:

After completing this course, students will be able to:

CO1	To study the image fundamentals and image transforms necessary for image processing
CO2	To study the image enhancement techniques.
CO3	To study the image restoration procedures and segmentation tools.
CO4	To study the wavelet tools and the image compression procedures.

Mapping of course outcomes with program outcomes :

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	2	-	-	-	-	-	-	-	-	
CO2	3	2	2	3	-	-	-	-	-	-	-	-
CO3	2	-	3	2	-	-	-	-	-	-	-	-
CO4	1	2	3	-	-	-	-	-	-	-	-	-

MODULE-I:

INTRODUCTION AND DIGITAL IMAGE FUNDAMENTALS

Introduction: Origin, Steps in Digital Image Processing, Components. Digital Image Fundamentals: Elements of Visual Perception, Image Sampling and Quantization, Some Basic Relationships between pixels, Color Models.

MODULE-II:

IMAGE TRANSFORM

Introduction to the Fourier Transform, The Discrete Fourier Transform, Discrete Cosine Transform, Singular Value Decomposition and Principal Component Analysis.

MODULE-III:

IMAGE ENHANCEMENT

Spatial Domain: Some Simple Intensity Transformations, Histogram processing, Basics of Spatial Filtering, Smoothing and Sharpening Spatial Filtering. Frequency Domain: Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

MODULE-IV:

IMAGE RESTORATION AND SEGMENTATION

Image Restoration: Noise models, Mean Filters, Order Statistics, Adaptive filters, Band reject Filters, Band pass Filters, Notch Filters, Optimum Notch Filtering, Inverse Filtering, Wiener filtering. Segmentation: Thresholding.

MODULE-V:

WAVELETS AND IMAGE COMPRESSION

Wavelets: Background, Sub-band Coding, Multi-resolution Expansions. Compression: Fundamentals, Image Compression Models, Error Free compression- Variable Length Coding, Bit-Plane Coding, Lossless Predictive Coding, Lossy Compression, Lossy Predictive Coding, Transform Coding and Wavelet Coding.

TEXT BOOK:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.

REFERENCES:

1. S. Jayaraman, S Essakirajan, “Digital Image Processing”, Second Edition, Tata McGraw Hill, 2009
2. Khalid Sayood, “Introduction to Data Compression”, Third Edition, Elsevier, 2006.
3. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
4. https://cse19-iiith.vlabs.ac.in/index.html

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Computer Science & Engineering					
Code: CS605	**System Software**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Objectives of the course

To introduce the student to key concepts in Phase transformations and enable an understanding of the steps involved in several important phase transformations.

Course Outcomes

After completing this course, the student should be able to:

CO1	Explain the organization of basic computer, its design and the design of control unit.
CO2	Understand the organization of memory and memory management hardware.
CO3	Distinguish between Operating Systems software and Application Systems software.
CO4	Identify the primary functions of an Operating System.
CO5	Master attributes and assessment of quality, reliability and security of software.

Detailed Syllabus:

MODULE-I

INTRODUCTION: System Software, Application Software, components of a programming system: Assembler, Loader, Linker, Macros, Compiler, Program Development Cycle, Evolution of Operating Systems, Functions of Operating System, Machine Structure: General Machine Structure, Approach to a new machine, Memory Registers, Data, Instructions, Evolution of Machine Language: Long Way, No looping, Address Modification, Looping, Introduction to Assembly LanguageProgram.

MODULE –II

ASSEMBLERS: Review of Computer Architecture – Machine Instructions and Programs – Assemblers –Basic Assembler Functions – Assembler Features – Assembler Design Options. LOADERS AND LINKERS: Loaders and Linkers – Basic Loader Functions – Machine-Dependent Loader Features – Machine-Independent Loader Features– Loader Design Options-Dynamic Linking and Loading- Object files- Contents of an object file – designing an object format – Null object formats- Code sections- Relocation – Symbols and Relocation – Relocatable a.out-ELF.

MODULE-III

MACROPROCESSORS AND EMULATORS: Microprocessors – Basic Macro Processor Functions – Machine-Independent Macro Processor Features – Macro Processor Design Options - Introduction to Virtual Machines (VM) - Emulation - basic Interpretation – Threaded Interpretation – Interpreting a complex instruction set – binary translation.

MODULE-IV

VIRTUAL MACHINES: Pascal P-Code VM – Object-Oriented VMs – Java VM Architecture – Common Language Infrastructure – Dynamic Class Loading. ADVANCED FEATURES: Instruction Set Issues – Profiling – Migration – Grids – Code optimizations- Garbage Collection - Examples of real-world implementations of system software.

TEXT BOOKS:

1. Leland L. Beck, “System Software”, 3rd ed., PearsonEducation.
2. John R. Levine, “Linkers & Loaders”, MorganKauffman.
3. James E Smith and Ravi Nair, “Virtual Machines”,Elsevier.

REFERENCES:

1. Srimanta Pal, “ Systems Programming “ , Oxford UniversityPress.
2. John J.Donovan, “ “Systems Programming”, Tata McGraw-Hill.
3. Systems Programming by John J Donovan (McGraw-HillEducation)
4. Operating System and System Programming – Dhamdhere (McGraw-HillEducation)

Computer Science & Engineering					
Code: CS606	**Distributed System**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objective:

This course covers the basic understanding of distributed computing system. The course aims to provide an understanding of the principles on which the Internet and other distributed systems are based; their architecture, algorithms and how they meet the demands of contemporary distributed applications. The course covers the building blocks for a study of distributed systems, and addressing thecharacteristicsandthechallengesthatmustbeaddressedintheirdesign:scalability,heterogeneity, securityandfailurehandlingbeingthemostsignificant.Distributedcomputingisafieldofcomputerscience that studies distributed systems. A distributed system is a system whose components are located on different networked computers, which communicate and coordinate their actions bypassingmessagestooneanother.Thecomponentsinteractwithoneanotherinordertoachieve a common goal. Three significant characteristics of distributed systems are: concurrency of components, lack of a global clock, and independent failure ofcomponents.

Course Outcomes:

At the end of this course the students will be able to:

CO1	Demonstrate knowledge of the basic elements and concepts related to distributedsystem technologies.
CO2	Demonstrate knowledge of the core architectural aspects of distributed systems
CO3	Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);
CO4	Use and apply important methods in distributed systems to support scalability and fault tolerance;
CO5	Demonstrate experience in building large-scale distributed applications.

Detailed Syllabus:

MODULE-I.

Introduction to distributed computing system, evolution different models, gaining popularity, definition, issues in design, DCE, message passing –introduction, desirable features of a good message passing system, issues in IPC,

synchronization, buffering, multigram messages, encoding and decoding of message data, process addressing, failure handling, group communication.

MODULE-II.

Introduction, model, transparency, implementation mechanism,stubgeneration, RPC messages, marshalling arguments and results, server management, parameter - passing semantics, call semantics, communication protocols for RPCs, client – server binding, exception handling, security, mini project using Java RMI.

MODULE-III.

General architecture of DSM systems, design and implementation issues of DSM systems, granularity, structure of shared memory space, consistency model, replacement strategy, thrashing, advantages of DSM, clock synchronization DFS and security- Desirable features of good DFS, file models, file accessing Models, file sharing semantics, file catching schemes, file replication, fault Tolerance, atomic transaction, potential attacks to computer system, cryptography, authentication, access control.Digital signatures, DCE securityservice.

MODULE-IV.

Operating Systems, Client-Server Model, Distributed Database Systems, Parallel Programming Languages and Algorithms. Distributed Network Architectures- Managing Distributed Systems. Design Considerations.

MODULE-V.

For development, implementation & evaluation of distributed information systems, workflow, software processes, transaction management, and data modeling, infrastructure e.g. middle-ware to glue heterogeneous, autonomous, and partly mobile/distributed data systems, such as e.g. client/server-, CORBA-, and Internet-technologies. Methods for building distributed applications.

Text / Reference

1. Pradeep K. Sinha, "Distributed Operating Systems: Concepts Design", 2007
2. Crichlow Joel M, "An Introduction to Distributed and Parallel Computing", PHI, 1997
3. Black Uyless, "Data Communications and Distributed Networks", PHI, 5thEdition,1997

Computer Science & Engineering					
Code: CS608	**Software Engineering**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives –

1. To develop basic Knowledge in Software Engineering and its applications.

2. To understand software Engineering layered architecture and the process frame work.

3. To analyze software process models such as the waterfall, spiral, evolutionary models and agile method for software development.

4. To design software requirements and specifications of documents.

5. To understand project planning, scheduling, cost estimation, risk management.

6. To describe data models, object models, context models and behavioral models.

7. To learn coding style and testing issues.

8. To know about the quality checking mechanism for software process and product.

Course outcomes –

CO.1 Identifythe principles of large scale software systems, and the processes that are used to build them.

CO.2 Ableto use tools and techniques for producing application software solutions from informal and semi-formal problem specifications.

CO.3 Develop an appreciation of the cost, quality, and management issues involved in software construction.

CO.4 Implement design and communicate ideas about software system solutions at different levels.

CO.5 Establish the relation with other people in a team, communicating computing ideas effectively in speech and in writing.

Mapping of course outcomes with program outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CO.1	2	2	-	3	-	-	-	-	-	-	-	1
CO.2	-	3	-	2	1	-	-	-	-	-	-	-
CO.3	-	3	3	-	-	-	-	-	-	-	-	-
CO.4	1	2	-	1	-	-	-	-	-	1	-	-
CO.5	-	-	-	-	-	1	-	1	1	1	2	3

MODULE-I:

INTRODUCTION TO SOFTWARE PROCESS

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming (XP) Process.

MODULE-II:

REQUIREMENTS ANALYSIS AND SPECIFICATION

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

MODULE-III:

SOFTWARE DESIGN

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

MODULE-IV:

TESTING AND MAINTENANCE

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

MODULE-V:

PROJECT MANAGEMENT

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

TEXT BOOKS:

1. Roger S. Pressman, ―Software Engineering – A Practitioner's Approach‖, Seventh Edition, Mc Graw-Hill International Edition, 2010.

2. Rajib Mall, ―Fundamentals of Software Engineering‖, Third Edition, PHI Learning PrivateLimited, 2009.

REFERENCE BOOKS:

1. Ian Sommerville, ―Software Engineering‖, 9th Edition, Pearson Education Asia, 2011.

2. Pankaj Jalote, ―Software Engineering, A Precise Approach‖, Wiley India, 2010.

3. Kelkar S.A., ―Software Engineering‖, Prentice Hall of India Pvt Ltd, 2007.

4. Stephen R.Schach, ―Software Engineering‖, Tata McGraw-Hill Publishing Company Limited,2007.

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Computer Science & Engineering					
Code: CS609	**Artificial Intelligence & Machine Learning**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives -

The aim of Artificial Intelligence & Machine Learning course is to prepare students for career in computer science & engineering where knowledge of AI & ML techniques leading to the advancement of research and technology. Artificial Intelligence and Machine Learning are the terms of computer science. Machine Learning is the learning in which machine can learn by its ownwithoutbeingexplicitlyprogrammed.ItisanapplicationofAIthatprovidesystemtheability to automatically learn and improve fromexperience.

Course Outcomes: After completing this course the student will be able to:

CO1	Demonstrate fundamental understanding of artificial intelligence (AI) and expert systems.
CO2	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
CO3	Demonstrate proficiency in applying scientific method to models of machine learning.
CO4	Discuss the basics of ANN and different optimizations techniques.

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	2	-	-	-	-	-	-	-
CO2	2	-	3	2	-	-	-	-	-	-	-	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-
CO4	2	-	1	-	3	-	2	-	-	-	-	-

Course Detail -

MODULE-I:

Overview and Search Techniques: Introduction to AI, Problem Solving, State space search, Blind search: Depth first search, Breadth first search, Informed search: Heuristic function, Hill climbing search, Best first search, A* & AO* Search, Constraint satisfaction problem; Game tree, Evaluation function, Mini-Max search, Alpha-beta pruning, Games of chance.

MODULE-II:

Knowledge Representation (KR): Introduction to KR, Knowledge agent, Predicate logic, Inference rule & theorem proving forward chaining, backward chaining, resolution;Propositionalknowledge,Booleancircuitagents;RuleBasedSystems,Forward reasoning: Conflict resolution, backward reasoning: Structured KR: Semantic Net - slots, inheritance, Conceptual Dependency.

MODULE-III:

Handling uncertainty and Learning: Source of uncertainty, Probabilistic inference,Bayes'theorem,LimitationofnaïveBayesiansystem,BayesianBeliefNetwork (BBN); Machine learning, Basic principal, Utility of ML Well defined learning system, Challenges in ML, Application of ML.

MODULE-IV:

Learning and Classifier: Linear Regression (with one variable and multiple variables), Decision Trees and issue in decision tree, Clustering (K-means, Hierarchical, etc), Dimensionality reduction, Principal Component Analysis, Anomaly detection, Feasibility of learning, Reinforcement learning.

MODULE-V:

Artificial Neural Networks: Introduction, Artificial Perceptron's, Gradient Descent and The Delta Rule, Adaline, Multilayer Networks, Back-propagation Rule back-propagation Algorithm- Convergence; Evolutionary algorithm, Genetic Algorithms – An Illustrative Example, Hypothesis Space Search, Swarm intelligence algorithm.

Text Book:

1. Artificial Intelligence by Elaine Rich and Kevin Knight, Tata MeGrawHill
2. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David.Cambridge UniversityPress.
3. Artificial Neural Network, B. Yegnanarayana, PHI,2005

Reference Book:

1. Christopher M. Bishop. Pattern Recognition and Machine Learning(Springer)
2. IntroductiontoArtificialIntelligenceandExpertSystemsbyDanW.Patterson,Prentice Hall ofIndia

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Computer Science & Engineering					
Code: CS604	**Soft Computing**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objective:

This course will cover fundamental concepts used in Soft computing. Soft Computing refers to a partnership of computational techniques in computer science, artificial intelligence, machine learning and some engineering disciplines, which attempt to study, model, and analyze complex phenomena.TheconceptsofArtificialNeuralNetworks(ANNs)willbecoveredfirst,followedby Fuzzylogic(FL)andoptimizationtechniquesusingGeneticAlgorithm(GA).ApplicationsofSoft Computing techniques to solve a number of real-life problems will be covered to have hands on practices.Insummary,thiscoursewillprovideexposuretotheoryaswellaspracticalsystemsand software used in soft computing.

Course outcomes:

At the end of the course students will be able to:

CO1	**Present** the feasibility of applying a soft computing methodology for specific problem.
CO2	**Identify** and describe soft computing techniques and their roles in building intelligent machines.
CO3	**Apply** neural networks to pattern classification and regression problems.
CO4	**Apply** fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
CO5	**Apply** genetic algorithms to combinatorial optimization problems.

Mapping of course outcomes with program outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CO 1	3	3	3	2	3	-	-	-	-	1	-	2
CO 2	3	3	2	2	-	-	-	-	2	-	-	-
CO 3	3	2	2	2	2	-	-	-	-	-	-	2
CO 4	3	3	2	2	2	-	-	-	-	-	-	-
CO 5	3	2	2	2	2	-	-	-	-	-	-	2
Avg	3	2.6	2.2	2	2.25				2	1		2

Detailed Syllabus

MODULE-I:

INTRODUCTION TO SOFT COMPUTING: Soft computing: Soft computing concepts, soft computing versus hard computing, various types of soft computing techniques, applications of soft computing.

MODULE-II:

ARTIFICIAL NEURAL NETWORKS: Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, learning rules, Learning Paradigms- Supervised, Unsupervised and reinforcement Learning, ANN training, Algorithms-perceptions; Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model.

MODULE-III:

SPECIAL LEARNING NETWORK: Competitive learning networks, Kohonen Self-organizing networks, Hebbian learning, Hopfield Networks, Associative memories, The Boltzman machine**,** Applications of Artificial Neural Networks.

MODULE-IV:

FUZZY LOGIC: Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic: Classical Logic, Multi valued Logics, Fuzzy Qualifiers, Linguistic Hedges, Introduction & features of membership functions.

MODULE-V:

FUZZY RULE BASED SYSTEM: Fuzzy rule base system: Fuzzy Propositions, implications and inferences, Fuzzy reasoning, Defuzzification techniques, Fuzzy logic controller design, Fuzzy decision making & Applications of fuzzy logic.

MODULE-VI:

GENETIC ALGORITHMS: Genetic Algorithms: An Overview of Genetic algorithm (GA), Evolution strategies (ES), Evolutionary programming (EP), Genetic programming (GP); GA operators: Encoding, Selection, Crossover, Mutation, schemaanalysis,analysisofselectionalgorithms;convergence;optimization,oftravelling salesman problem using genetic algorithm approach; Markov & other stochastic models. Other Soft Computing Techniques: Simulated annealing, Tabu search, Ant colony-based optimization (ACO),etc.

Text Book:

1. P. R. Beeley, Foundry Technology, Newnes- Buttterworths,2001.
2. P. D. Webster, Fundamentals of Foundry Technology, Portwillis press, Red hill,1980.

Supplementary Reading:

1. P. C. Mukherjee, Fundamentals of Metal casting Technology, Oxford IBH,1980.
2.R. W. Hein, C. R. Loper and P. C. Rosenthal, Principles of Metal casting, Mc Graw Hill,1976.

Computer Science & Engineering					
Code: IT601	**Information Retrieval**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To provide an overview of Information Retrieval systems. Expose them to various retrieval models with emphasis on pros and cons of these models. Discuss mechanisms of web search along with the details of ranking algorithms. Introduce basic concepts of text categorization and recommender systems.

MODULE-I

Introduction to Information Retrieval: The nature of unstructured and semi-structured text. Inverted index and Boolean queries. Text Indexing, Storage and Compression Text encoding: tokenization; stemming; stop words; phrases; index optimization. Index compression: lexicon compression and postings lists compression. Gap encoding, gamma codes, Zipf's Law. Index construction. Postings size estimation, dynamic indexing, positional indexes, n-gram indexes, real-world issues.

MODULE -II

Information Retrieval Models: Boolean; vector space; TFIDF; Okapi; probabilistic; language modeling; latent semantic indexing. Vector space scoring. The cosine measure. Efficiency considerations. Document length normalization. Relevance feedback and query expansion. Rocchio algorithm.

MODULE -III

Web Information Retrieval: Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS. Retrieving Structured Documents: XML retrieval, semantic web.

Performance Evaluation of IR systems: Evaluating search engines. User happiness, precision, recall, F-measure. Creating test collections: kappa measure, inter judge agreement.

MODULE -IV

Text Categorization and Filtering: Introduction to text classification. Naive Bayes models. Spam filtering. Vector space classification using hyperplanes; centroids; k Nearest Neighbors. Support vector machine classifiers. Kernel functions. Boosting.

MODULE -V

Advanced Topics: Summarization, Topic detection and tracking, Personalization, Question answering, Cross language information retrieval (CLIR). Recommender System.

COURSE OUTCOMES:

Students will get:

CO1: The understanding of different Information retrieval models

CO2: To know about evaluation methods of the information retrieval model

CO3: Exposures of implementing retrieval models on text data

CO4: To know about text categorization and its implementation

CO5: To know the challenges associated with each topics on new domain of retrieval and classification

CO-PO mapping table

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2			
CO2		1	2	3	
CO3			3	2	2
CO4	3	2	3		
CO5			2	3	

TEXT BOOKS:

1. Manning, Raghavan and Schutze, "Introduction to Information Retrieval", Cambridge University Press, 2009.
2. Baeza-Yates and Ribeiro-Neto, "Modern Information Retrieval", Addison Wesley.

REFERENCES:

1. Charles L. A. Clarke, Gordon Cormack, and Stefan Büttcher, "Information Retrieval: Implementing and Evaluating Search Engines", MIT Press Cambridge, 2010.
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Computer Science & Engineering					
Code: CS607	**Natural Language Processing**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: To provide an overview of Information Retrieval systems. Expose them to various retrieval models with emphasis on pros and cons of these models. Discuss mechanisms of web search along with the details of ranking algorithms. Introduce basic concepts of text categorization and recommender systems.

MODULE-I

Introduction to Information Retrieval: The nature of unstructured and semi-structured text. Inverted index and Boolean queries. Text Indexing, Storage and Compression Text encoding: tokenization; stemming; stop words; phrases; index optimization. Index compression: lexicon compression and postings lists compression. Gap encoding, gamma codes, Zipf's Law. Index construction. Postings size estimation, dynamic indexing, positional indexes, n-gram indexes, real-world issues.

MODULE -II

Information Retrieval Models: Boolean; vector space; TFIDF; Okapi; probabilistic; language modeling; latent semantic indexing. Vector space scoring. The cosine measure. Efficiency considerations. Document length normalization. Relevance feedback and query expansion. Rocchio algorithm.

MODULE -III

Web Information Retrieval: Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS. Retrieving Structured Documents: XML retrieval, semantic web.

Performance Evaluation of IR systems: Evaluating search engines. User happiness, precision, recall, F-measure. Creating test collections: kappa measure, interjudge agreement.

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CO-PO mapping table

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	-	-	-
CO2	-	1	2	3	-
CO3	-	-	3	2	2
CO4	3	2	3	-	-
CO5	-	-	2	3	-

TEXT BOOKS:

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Computer Science & Engineering					
Code: IT602	**Internet of Things**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Module I

Introduction

Overview and Motivations, IPv6 Role, IoT Definitions, IoT Frameworks. .

Module II

Prototyping Embedded Devices

Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, BeagleBone Black, Electric Imp, Other Notable Platforms

Module III

IPv6 Technologies for the IoT

Overview and Motivations, Address Capabilities, IPv6 Protocol Overview, IPv6 Tunnelling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6,Migration Strategies to IPv6

Module IV

Evolving IoT Standards

Overview and Approaches, IETF IPv6 Routing Protocol for RPL Roll, Constrained Application Protocol (CoAP) , Representational State Transfer (REST) , ETSI M2M , Third-Generation Partnership Project Service

Requirements for Machine-Type Communications , CENELEC, IETF IPv6 Over Lowpower WPAN (6LoWPAN) , ZigBee IP (ZIP), IP in Smart Objects (IPSO)

Module V

Prototyping Online Components

Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols: MQTT, Extensible Messaging and Presence Protocol

Module VI

IoT Application Examples

Overview, Smart Metering/Advanced Metering Infrastructure, e-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking (Following and Monitoring Mobile Objects),Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications

Textbooks:

1. Building the Internet of Things with IPv6 AND MIPv6 by DANIEL MINOLI Published by John Wiley & Sons, Inc., Hoboken, New Jersey.(UNIT-I, III, V, VI)
2. Designing the Internet of Things by Adrian McEwen and Hakim Cassimally Published by John Wiley & Sons (UNIT-II, IV)

References:

1. Getting Started with the Internet of Things by CunoPfister Published by O'Reilly Media, Inc.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things" Key

Course Outcomes:

After completion of course students will be able to

COs	**COs in detail**
CO1	Explain the concept of IoT
CO2	Illustrate key technology, protocols and standard of IoT
CO3	Analyse trade-off in interconnected wireless embedded device networks
CO4	Understand application of IoT in automation of commercial and real world example
CO5	Design a simple IoT System comprising sensors, edge devices and wireless network involving prototyping, programming and data analytics

CO-PO mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**
CO2	**3**	**_**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**
CO3	**2**	**_**	**1**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**

CO4	**3**	**_**	**2**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**
CO5	**3**	**_**	**2**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**	**_**

Computer Science & Engineering					
Code: CS601P	**Computer Networks Lab**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1**

List of Experiments:

1. Study of Network Devices in detail and to connect the computers in Local Area Network.
2. Study of IP and to Configure Host IP, Subnet Mask and Default Gateway in a system in LAN (TCP/IP Configuration).
3. Study of different types of Network cables and to implement the cross-wired cable and straight through cable in a network.
4. Implementation of basic network command and Network configuration commands.
5. Performing an Initial Switch Configuration.
6. Performing an Initial Router Configuration.
7. Configuring and Examining Network Address Translation (NAT).
8. Configuring Ethernet and Serial Interfaces.
9. Configuring Routing Information Protocol (RIP).
10. Configuring a Cisco Router as a DHCP Server.

JHARKAHAND UNIVERSITY OF TECHNOLOGY, RANCHI

Syllabus for B. Tech course in Computer Science & Engineering and Information Technology

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Computer Science & Engineering					
Code: CS602P	**Data Science Lab**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1**

List of Experiments:

1. Basic Python or R programming
   a. Program to add two numbers
   b. Maximum of two numbers
   c. Program for factorial of a number
   d. Program to check Armstrong number
2. Array Programming
   a. Program to find sum of array
   b. Program to reverse an array
   c. Program to find largest element of an array
3. List programming
   a. Program to swap two elements in a list
   b. Program to find sum of numbers in a list
   c. Program to find even numbers in a list
   d. Program to do cumulative sum of a list
4. Matrix program
   a. Program to add two matrices
   b. Program to multiply two matrices
   c. Program to find transpose of matrix
   d. Program to subtract matrices
5. Dictionary program
   a. Program to find sum of all items in a dictionary
   b. Program to merge two dictionary
   c. Program to remove all duplicate words in a sentence
6. Tuple program
   a. Program to find the size of tuple
   b. Program to find Maximum and minimum element in tuple
   c. Program to extract digits from a tuple list
   d. Program to remove tuple of K-length
7. Searching and sorting program
   a. Program for insertion sort
   b. Program Merge sort
   c. Program for Bubble sort
   d. Program for Quick sort
8. File handling program
   a. Program to read file one by one
   b. Program to remove lines starting with any prefix
   c. Program to merge two file to a third file
9. Use Data sets for analysis
   a. Use Iris Data set to perform PCA and do your analysis on different flowers with different sepal and petal length & width.

b. Use Titanic Data set to find any analysis on death rate with gender and age
c. Use House price data set to do house price prediction

10. Use Image/text data set for analysis
    a. Use Lungs image data for segmentation
    b. Use any image data set you want to go for feature extraction and dimensionality reduction.
    c. Document classification on any available dataset

Computer Science & Engineering					
Code: CS603P	**Image Processing Lab**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1**

List of Experiments

1. Distance and Connectivity
2. Image Arithmetic
3. Affine Transformation
4. Point Operations
5. Neighborhood Operations
6. Image Histogram
7. Fourier Transform
8. Color Image Processing
9. Morphological Operations
10. Image Segmentation
11. Image Processing Test Bench

Computer Science & Engineering					
Code: CS604P	**Soft Computing Lab**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1**

List of Experiments:

1. To perform Union, Intersection and Complement operations in Fuzzy Logic.
2. To implement De-Morgan's Law.
3. To plot various Membership Functions in Fuzzy Logic.
4. Implementation of Fuzzy Relations using Max-Min Composition method.
5. Implementation of Fuzzy Controller using FIS (Washing Machine).
6. To generate Activation Functions that are being used in Neural Networks.
7. To generate the output of ANDNOT function using McCulloch-Pitts Neural Network.
8. To generate the output of XOR function using McCulloch-Pitts Neural Network.
9. To classify two-dimensional input patterns inbipolar with given targets using Hebb Net.