RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF ENGINEERING (B.TECH) DEGREE
COURSE SEMESTER VI(C.B.C.S)
BRANCH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject : Language Processor **Subject Code:BTAI&ML601T**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
[36+0] hrs	3	30	70	100

Aim: To bridge the gap between Application Domain and Execution Domain , to understand the translation from one language to another and to detect error in source during translation.

Prerequisite(S): Theory of Computation, System Programming

Course Objectives:

- To introduce the various techniques involved in the translation of source programs into object programs by a compiler.
- To provide various types of parsers.
- To introduce the concept of intermediate code generation and code optimization
- To Explore the use of tools available in compiler construction.

Course Outcomes:

At the end of course students are able to,

CO1	**Describe** various phases of compiler, **construct** state machine for Regular languages using finite automata, regular expressions, and **use** compiler writing tools like LEX and Flex.
CO2	**List, apply** and **compare the** parsers and **use** the parser design tools likeYacc& bison.
CO3	**Explain** & **apply** SDTS to transform source code to intermediate code.
CO4	**Explain** storage allocation strategies, **list choose** data structure for symbol table management and understand error recovery in different parsers.

CO5	**Explain** and **apply various** code optimization techniques , analyze control flow & data flow and**compute** reaching definitions using data flow equations, loop optimization,. **list** basic issues in code generation, **explain** register allocation, assignment and code generation by code generator algorithm.

Syllabus:

Unit I:

Introduction to compilers, compilers and translators, Cross Compiler. Phases of compilation and overview. Regular languages, finite automata, regular expressions scanner generator (lex, flex). scanner generator (lex, flex).

Unit II:

Syntax Analysis: Syntax specification of programming languages, Design of top-down, bottom-up parsing technique, Design of LL(1) parser, LR parsing: Design of SLR, LALR, CLR parsers. Dealing with ambiguity of the grammar, Parser generator (yacc, bison).

Unit III:

Semantic Analysis: Syntax directed definitions, inherited and synthesized attributes, dependency graph, evaluation order, bottom up and top down evaluation of attributes, L- and S-attributed definitions, implementation of SDTS, Evaluation of expressions using semantic actions, Intermediate code representations (postfix, syntax tree, TAC).

Unit IV:

Intermediate code generation using SDTS of controls structures, Intermediate code generation using SDTS of controls structures, Intermediate code generation using SDTS of controls structures, declarations, procedure calls, Array reference. Error detection and recovery: Error recovery in LR parsing, Error recovery in LL parsing, Automatic error recovery in YACC.

Unit V:

Table Management: Storage allocation and run time storage administration, Symbol table management. Code optimization: Sources of optimization, Loop optimization, control flow analysis, data flow analysis, setting up data flow equations to compute reaching definitions, available expressions,setting up data flow equations to compute reaching definitions, Code generation: Problems in code generation, Simple code generator, Register allocation and assignment, Code generation from DAG, Peephole optimization.

TEXT BOOKS:

- Aho, Sethi, and Ullman; Compilers – Principles, Techniques and Tools; Second Edition, Pearson Education, 2008.
- Theory of Computation O.G.Kakde.Laxmi Publications
- Vinu V. Das; Compiler Design using Flex and Yacc; PHI Publication, 2008.

REFERENCE BOOKS:

- Alfred V. Aho and Jeffery D. Ullman; Principles of Compiler Design; Narosa Publishing House, 1977.
- Principles of Compiler Design, V. Raghavan, Tata McGraw Hill, 2009.
- Compiler Design, O. G. Kakde, Laxmi Publications, 2008

Subject : Language Processor **Subject Code:BTAI&ML601P**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
2Hrs(Per Practical)	1	25	25	50

Practical List:- Practicals Based on above Syllabus

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COURSE SEMESTER VI(C.B.C.S)
BRANCH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject : Introduction to Cryptography & Blockchain **Subject Code:BTAI&ML602T**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
[36+0] hrs	3	30	70	100

Aim: To understand the concept of network security and secure exchange of data between two transacting nodes

Prerequisite(S): TCP/IP

Course Objectives:

- Understanding of Information Security,OSI & basic Encryption
- Complete knowledge on what Cryptography is .
- Understanding of various algorithms for eg. RSA,DES,AES etc.
- This course is intended to study the basics of Blockchain technology
- By implementing, learners will have idea about private and public Blockchain

Course Outcomes:

At the end of course students are able to,

CO1	**Explain** the need of Information Security , **list** and **summarize** OSI security architecture, attacks, services ,mechanisms and conventional encryption.(Bloom's 1,2)
CO2	**Illustrate** secret key and cryptography , **list** encryption & decryption techniques ,**solve** problems on basic cryptography.(Bloom's 1,2,4)
CO3	**Acquire** public key concepts in details, **key management** encryption techniques using ECC ,**analyze** cryptography algorithms. (Bloom's 1,2,3,4)
CO4	Understand and explore the working of Blockchain technology

CO5	Analyze the working of public and private blockchains.

Syllabus:

Unit I:

Need of Information Security: Legal, Ethical and Professional IssuesAttributes of security-authentication, access control, confidentiality, authorization, integrity, non-reproduction.OSI Security Architecture: attacks, services and mechanisms. Security Attacks, Security services, A model of Internetwork Security.Conventional Encryption: Classical Encryption Techniques and Problems on classical ciphers, Security architecture.

Unit II:

Introduction to Secret key and cryptography, Encrypt given messages using DES, AES, IDEA, Problems on cryptography algorithms, Principles, finite fields, stream cipher, block cipher modes of operation, DES, Triple DES, AES, IDEA, RC5, key distribution.

Unit III:

Introduction to Public key and Cryptography, Encrypt given message susing ECC, Problems on key generation, cryptography algorithms Principles, Introduction to number theory, RSA-algorithm, security of RSA, Key management- Diffie-Hellman key exchange, man-in-the-middle attack, Elliptical curve cryptography.

Unit IV:

What is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions and Blocks, P2P Systems.

Unit V:

What is Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double- Spend Problem, Blockchain and Digital Currency, Transactional Blocks, Impact of Blockchain Technology on Cryptocurrency.

TEXT BOOKS:

- Cryptography and network security - principles and practices, William Stallings, Pearson Education, 2002.

REFERENCE BOOKS:

- Network Security and Cryptography, Bernard Menezes, Cengage Learning.

Subject: Introduction to Cryptography & Blockchain **Subject Code:BTAI&ML602P**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
2Hrs(Per Practical)	1	25	25	50

Practical List:- Practicals Based on above Syllabus

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COURSE SEMESTER VI (C.B.C.S)
BRANCH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject : Digital System Design using Verilog **Subject Code:BTAI&ML603T**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
[36+0] hrs	3	30	70	100

Aim: To understand the concepts of Verilog and its applications in digital systems.

Prerequisite(S): Digital Circuits

Course Objectives:

- To acquire the basic concepts of Verilog and application to understand digital systems.
- To determine the output and performance of given combinational and sequential circuits.
- To understand Hardware Implementation of design circuits using Verilog.
- To acquire knowledge of various logic families of Digital circuits.

Course Outcomes:

At the end of course students are able to,

CO1	Study Boolean expressions of digital logic circuits
CO2	Understand fundamentals of Hardware Description Language
CO3	Illustrate the performance parameters of logic families.
CO4	Design combinational and sequential circuits using Hardware Description Language.
CO5	Design digital functions using Programmable Logic Devices and FPGAs.

Syllabus:

UNIT I:

Introduction to Verilog:

Verilog as HDL, Levels of design Description, Concurrency, Simulation and Synthesis, Functional Verification , System Tasks, Programming Language Interface(PLI), Module, Simulation and Synthesis Tools, Test Benches.

Language Constructs and Conventions: Introduction, Keywords, Identifiers, White space characters, Comments, Numbers , Strings, Logic Values, Strengths, DAta Types, Scalars and Vectors, Parameters, Operators.

Unit II:

Gate Level Modeling and Gate Primitive, Module structure, other GATE primitives, Illustrative Examples, Tri-State Gates,Arrays of Instances of Primitives , Design of Flip-flops with Gate Primitives, DElays, Strength and Contention Resolution, Net Types, Design of Basic Circuits. Modeling at Data Flow Level Introduction, Continous assignment structures, DElays and continuous, Assignments ,Assignment to vectors, Operators.

Unit III:

Behavioral Modeling

Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Behavioral modeling of Flip Flops and latches, Assignments with Delays, Wait construct, Multiple Always Blocks, Blocking and Non blocking Assignments, The case statement, if and if-else constructs, Assign-de-assign construct, repeat construct, for loop, The disable construct, while loop, forever loop, Parallel blocks, Force-release, construct, Event.

UNIT IV

Synthesis of Digital Sub-systems:

Synthesis of Combinational Sub-systems: Introduction to Synthesis, Synthesis of Combinational Logic, Synthesis of Sequential Logic with latches, Synthesis of Three-state Devices and Bus Interfaces.Synthesis of Sequential Sub-systems:

Synthesis of Seqeuntial Logic with Flip-Flops, Syntheisis of Explicit State Machines, Registered Logic, State Encoding, Synthesis of Implicit State Machines, Registers and Counters.

UNIT V

System Implementation and User-Defined Primitives:

Introduction of Programmable Logic Array (PLA), Programmable Array Logic(PAL), Programmability of PLDs, Complex PLDs (CPLDs), Field Programmable GAte Arrays, The role of FPGAs in the ASIC Market, FPGA Technologies, Verilog-Based Design Flows for FPGAs and ASICs. Comparison of design implementation using CPLDs, FPGA and ASIC.

TEXT BOOKS:

- Verilog HDL- A guide to design Digital design and synthesis by Samir Palnitkar (Pearson).
- Design Through Verilog HDL by T.R. Padmanabhan, WILEY INDIA.
- Verilog HDL Primer 3rd Edition by Bhasker. J., Bsp.
- Digital Design: with an Introduction to the Verilog HDL by Moris Meno.

REFERENCE BOOKS:

- Advanced Digital Design with the Verilog HDL by Michael D. Ciletti.

Subject : Digital System Design using Verilog **Subject Code:BTAI&ML603P**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
2Hrs(Per Practical)	1	25	25	50

Practical List:- Practicals Based on above Syllabus

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BRANCH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(OPEN ELECTIVE -I)

Subject:Bioinformatics **SubjectCode:BTAI&ML-604T**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
[36+0] hrs	3	30	70	100

Aim: To study and extract knowledge from biological data through the development of algorithms and software

Prerequisite(S): NIL

Course Objectives:

- To get Knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics
- To understand Existing software effectively to extract information from large databases and to use this information in computer modeling
- To learn Problem-solving skills, including the ability to develop new algorithms and analysis methods

Course Outcomes:

At the end of course students are able to,

CO1	DescribeAutomatic analysis
CO2	Apply experimental methods used in determining the structurE
CO3	Description of biological networks
CO4	Design quantitative modeling
CO5	Design Information system

UNIT-1

Genome Bioinformatics: Automatic analysis, alignment, comparison and annotation of biological sequences; analysis of genome evolution and variation; molecular biology databases.

UNIT-2

Structural Bioinformatics: An introduction to experimental methods used in determining the structure of biomolecules, protein structure prediction and biomolecular systems simulation.

UNIT-3

Systems Biology: The description of biological networks and protein and metabolic gene network modelling. Emphasis in both topological aspects of networks and their dynamical behavior.

UNIT-4

Pharmacoinformatics: Molecular library management and virtual screening, computer assisted drug design and quantitative modelling of structure-activity relationships (QSAR and 3D-QSAR).

UNIT-5

Biomedical Computing: Clinical and healthcare information systems, biomedical imaging analysis, studying genotype-phenotype relationships and IT support systems for healthcare decision making.

TEXT BOOKS

- M.M Ranga, "Bioinformatics" , AgrobiosPublications
- P.G.Higgs& T.K. Attwood-Bioinfomatics and Molecular Evalution-Blavkwell publishing-2005

REFERENCE BOOKS

- R.Durbin, S.Eddy, A.Krugh,G.Mitchinor-Biological srquence analysis-CUP-1998.
- David Mount-Bioinfomatics:sequence and genome analysis-CBS publishers-2003

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BRANCH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(OPEN ELECTIVE -I)

Subject: Bioinspired Computing **SubjectCode:BTAI&ML-604T**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
[36+0] hrs	3	30	70	100

Aim: To understand the fundamentals of nature inspired techniques which influence computing, study the Swarm Intelligence and Immuno computing techniques and familiarize the DNA Computing

Prerequisite(S): NIL

Course Objectives:

- To understand the philosophy of Natural systems to computation.
- To learn the concepts of Computing Inspired by Nature
- To get the knowledge of bio inspired algorithms
- To learn about the basics of IMMUNOCOMPUTING
- To get the idea of DNA Computing

Course Outcomes:

At the end of course students are able to,

CO1	The basics Natural systems
CO2	The concepts of Natural systems and its applications
CO3	Basic Natural systems functions(operations)
CO4	Natural design considerations
CO5	Integration of Hardware and software in Natural applications

UNIT-1

INTRODUCTION: From Nature to Nature Computing , Philosophy , Three Branches: A Brief Overview, Individuals, Entities and agents - Parallelism and Distributivity Interactivity ,AdaptationFeedback-Self-Organization-Complexity, Emergence and, Bottom-up Vs Top-Down-Determination, Chaos and Fractals.

UNIT-2

Computing Inspired by Nature: Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm - Genetic Algorithms , Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming.

UNIT-3

SWARM INTELLIGENCE: Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge , Particle Swarm Optimization.

UNIT-4

IMMUNOCOMPUTING: Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding , Immune Network Theory- Danger Theory, Evaluation InteractionImmune Algorithms , Introduction – Genetic algorithms , Bone Marrow Models , Forest's Algorithm, Artificial Immune Networks

UNIT-5

COMPUTING WITH NEW NATURAL MATERIALS: DNA Computing: Motivation, DNA Molecule , Adleman's experiment , Test tube programming language, Universal DNA Computers, PAM Model , Splicing Systems , Lipton's Solution to SAT Problem , Scope of DNA Computing, From Classical to DNA Computing.

TEXT BOOKS

- Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007

REFERENCE BOOKS

- Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
- Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
- Marco Dorrigo, Thomas Stutzle," Ant Colony Optimization", PHI,2005.

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COURSE SEMESTER VI(C.B.C.S)
BRANCH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(ELECTIVE-II)

Subject : Data Visualization **Subject Code:BTAI&ML605T**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
[36+0] hrs	3	30	70	100

Aim: To understand the importance and use of Data Analysis.

Prerequisite(S): Programming Concepts

Course Objectives:

- Understand the various types of data, apply and evaluate the principles of data visualization.
- Acquire skills to apply visualization techniques to a problem and its associated dataset.
- Apply structured approach to create effective visualizations.
- Learn how to bring valuable insight from the massive dataset using visualization.
- Learn how to build visualization dashboard to support decision making.
- Create interactive visualization for better insight using various visualization tools

Course Outcomes:

At the end of course students are able to,

CO1	Identify the different data types, visualization types to bring out the insight and relate the visualization towards the problem based on the dataset to analyze and bring out valuable insight on large dataset.
CO2	Design visualization dashboard to support the decision making on large scale data
CO3	Demonstrate the analysis of large dataset using various visualization techniques and tools.

CO4	Identify the different attributes and showcasing them in plots. Identify and create various visualizations for geospatial and table data
CO5	Ability to create and interpret plots using R/Python

Syllabus:

Unit I:

Introduction to Data Visualization: Overview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation.

Visualization Techniques: Scalar and Point techniques – Color maps – Contouring – Height Plots - Vector visualization techniques – Vector properties – Vector Glyphs – Vector Color Coding – Matrix visualization techniques

Unit II:

Visual Analytics: Visual Variables- Networks and Trees - Map Color and Other Channels- Manipulate View- Heat Map

Unit III:

Visualization Tools & Techniques: Introduction to various data visualization tools: R –basics, Data preprocessing, Statistical analysis, Plotly and ggplot library, Tableau, D3.js, Gephi.

Diverse Types of Visual Analysis: Time- Series data visualization – Text data visualization – Multivariate data visualization and case studies

Unit IV:

Visualization of Streaming Data: Best practices of Data Streaming, processing streaming data for visualization, presenting streaming data, streaming visualization techniques, streaming analysis.

Unit V:

Geo Spatial Visualization: Chloropleth map, Hexagonal Binning, Dot map, Cluster map, cartogram map Visualization Dashboard Creations - Dashboard creation using visualization tools for the use cases: Finance-marketing-insurance-healthcare etc.,

TEXT BOOKS:

- Tamara Munzer, Visualization Analysis and Design, CRC Press 2014.
- Aragues, Anthony. Visualizing Streaming Data: Interactive Analysis Beyond Static Limits. O'Reilly Media, Inc., 2018

REFERENCE BOOKS:

- Dr. Chun-hauh Chen, W.K.Hardle, A.Unwin, Handbook of Data Visualization, Springer publication, 2016.
- Christian Toninski, Heidrun Schumann, Interactive Visual Data Analysis, CRC press publication,2020
- Alexandru C. Telea, Data Visualization: Principles and Practice, AK Peters, 2014

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COURSE SEMESTER VI(C.B.C.S)
BRANCH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(ELECTIVE-II)

Subject: Intelligent and Sensor Instrumentation **SubjectCode:BTAI&ML-605T**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
[36+0] hrs	3	30	70	100

Aim: To understand the concepts of Intelligent Sensors used in real life applications.
Prerequisite(S): NIL

Course Objectives:

- To learn the basic knowledge about sensors and instrumentation.
- To understand the different sensors used to measure various physical parameters.
- To understand the concepts of measurement technology.
- To learn the construction and working principles of different types of sensors.
- To analyze the sensor, instrument and measurement situation.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

Course Outcomes:
At the end of course students are able to,

CO1	Identify the different types of sensors used in real-life applications.
CO2	Evaluate the performance characteristics of different types of sensors.
CO3	Use the sensors for converting a physical parameter into an electrical quantity.
CO4	Comprehend intelligent instrumentation in industrial automation.
CO5	Apply the various sensors for measurement of pressure, force and displacement

Unit- I: Sensors & Transducer: Definition, Classification &selection of sensors, Measurement of displacement usingPotentiometer, LVDT & Optical Encoder, Measurement of force usingstrain gauge, Measurement of pressure using LVDT based diaphragm& piezoelectric sensor.

Unit-II: Measurement of temperature using Thermistor,
Thermocouple & RTD, Concept of thermal imaging, Measurement ofposition using Hall effect sensors, Proximity sensors: Inductive &Capacitive, Use of proximity sensor as accelerometer and vibration
sensor, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic& Capacitive.

Unit -III: Virtual Instrumentation:
Graphical programmingtechniques, Data types, Advantage of Virtual Instrumentationtechniques, Concept of WHILE & FOR loops, Arrays, Clusters &graphs, Structures: Case, Sequence & Formula nodes, Need ofsoftware based instruments for industrial automation.

Unit-IV: Data Acquisition Methods:
Basic block diagram, Analogand Digital IO, Counters, Timers, Types of ADC: successiveapproximation and sigma-delta, Types of DAC: Weighted Resistor andR-2R Ladder type, Use of Data Sockets for NetworkedCommunication.

Unit V: Intelligent Sensors:
General Structure of smart sensors &its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors:Automatic robot control & automobile engine control.

TEXT BOOKS

- DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition2013
- D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
- S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & ProcessControl, 2nd ED / Instrument Society of America, 1994.
- Gary Johnson / Lab VIEW Graphical Programing II Edition /McGraw Hill 1997.

REFERENCE BOOKS

- Arun K. Ghosh, Introduction to measurements andInstrumentation, PHI, 4th Edition 2012.
- A.D. Helfrick and W.D. cooper,Modern Electronic Instrumentation& Measurement Techniques, PHI – 2001
- Hermann K.P. Neubert, "Instrument Transducers" 2nd Edition2012, Oxford University Press.

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BRANCH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(ELECTIVE-II)

Subject: Human Computer Interface **SubjectCode:BTAI&ML-605T**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
[36+0] hrs	3	30	70	100

Aim: The study of human-computer interaction aims to create a conversation between people and machines that seems natural and intuitive.

Prerequisite(S): NIL

Course Objectives:

- To understand how a system/device interacts with its users
- To learn HCI intersection of many disciplines including cognitive psychology, linguistics, design and engineering.
- To understand HCI considerations in product design.
- To explore the science behind HCI.

Course Outcomes:

At the end of course students are able to,

CO1	Describe typical human -computer interaction (HCI) models, styles, and various historic HCl paradigms.
CO2	Understand capabilities of both humans and computers from th e viewpoint of human information processing.
CO3	Examine HCI design principles, standards and guidelines.
CO4	Design and analyze HCI systems for real world problems.

CO5	Illustrate HCI issues in groupware, ubiquitous computing, virtual reality, multimedia, and Word Wide Web-related environments

UNIT-1

The Human: input-output channels , Human memory, thinking, emotions, individual differences, psychology and the design of interactive systems. The computer: Text entry devices with focus on the design of key boards, positioning, pointing and drawing, display devices. The Interaction: Models of interaction, ergonomics, in teraction styles, elements of WIMP interfaces, interactivity, experience, engagement and fun. Paradigms for Interaction.

UNIT-2

Design Process: The process of design, user focus, scenarios, navigation design screen design and layout, Iteration & prototyping. Usability Engineering. Design rules: Principles to support usability, standards, guidelines, rules and heuristics, HCI patterns.

UNIT-3

Evaluation Techniques: Definition and goals of evaluation, evaluation through expert analysis and user participation, choosing an evaluation method. User support, requirement, approaches, adaptive help systems, designing user support systems.

UNIT-4

Cognitive methods: Goals and task hierarchies, linguistic models, challenges of display-based systems, physical and device models, cognitive architectures.

UNIT-5

Communications and collaborations model:Face to Face communication, conversations, Text based communication, group working. Task Analysis: Differences between task analysis and other techniques, task decomposition, knowledge-based analysis, ER based analysis, sources of infom1ation and data collection, use of task analysis

TEXT BOOKS

- "Human-Computer Interaction 3/E",Dix, Prentice Hall.
- "Design of Everyday Things", Donald Norman.

REFERENCE BOOKS

- S. Sahni "SmartThings: Ubiquitous Computing User Experience Design, Mike Kuniavsky".
- "The UX Book: Process and Guidelines for Ensuring a Quality User Experience", Rex Harston and Pardha Pyla.
- "Designing for the Digital Age: How to Create Human-Centered Products and Services", Kim Goodwin and Alan Cooper.
- "Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Appl ications" , Third Edition, Julie Jacko

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COURSE SEMESTER VI(C.B.C.S)
BRANCH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(ELECTIVE -II)

Subject: Software Engineering **SubjectCode:BTAI&ML-605T**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
[36+0] hrs	3	30	70	100

Aim: The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.

Prerequisite(S): NIL

Course Objectives:

- To learn about process models and software requirements.
- To understand software design and software testing.
- To get the knowledge of software process/product metrics and risk management.
- To understand quality management and UML diagrams.

Course Outcomes:

At the end of course students are able to,

CO1	Ability to translate end-user requirements into system and software requirements
CO2	Identify and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.
CO3	Understand the design process and design quality

CO4	Experience and/or awareness of testing problems
CO5	Able to develop a simple testing report

UNIT-1

UNIT-1

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. Process models: The waterfall model, incremental process models, evolutionary process models, the unified process

UNIT-2

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document. Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. System models: Context models, behavioral models, data models, object models, structured methods.

UNIT-3

Design Engineering: Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

UNIT-4

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging. Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

UNIT-5

Metrics for Process and Products: Software measurement, metrics for software quality. Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.

Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

UNIT 1:

Overview of Intellectual Property:Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967,the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994**TEXT BOOKS**

- Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
- Software Engineering- Sommerville, 7th edition, Pearson Education.
- The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.

REFERENCE BOOKS

- Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
- Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
- Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF ENGINEERING (B.TECH) DEGREE
COURSE SEMESTER VI(C.B.C.S)
BRANCH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject : Mini Project **Subject Code:BTAI&ML606P**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
2Hrs(Per Practical)	3	25	25	50

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BRANCH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Subject : Intellectual Property Rights(Audit) **Subject Code: BTAI&ML607T**

Load (Th+Tu)	Credits (Th+Tu)	College Assessment Marks	University Evaluation	Total Marks
2 hrs / week	2	In grades O,A,B,C	-	-

Aim: To introduce the basics of Intellectual Property Rights, Copyright laws, trade marks and issues related to patents. The overall idea of the course is to help and encourage the students for startups and innovation.

Prerequisite(S): NIL

Course Objectives:

- To introduce fundamental aspects of Intellectual Property Rights
- To disseminate knowledge on patents, patent regime in india and abroad and registration aspects
- To disseminate knowledge on copyright and its related rights and registration aspects
- To disseminate knowledge on trademarks and registration aspects
- To disseminate knowledge on Design, Geographical Indication (GI) Plant Variety and Layout Design Protection and their registration aspect

Course Outcomes:

At the end of course students are able to,

CO1	Understand fundamental aspects of Intellectual property Rights
CO2	To Apply knowledge on patents, patent regime in india and abroad and registration aspects
CO3	Be capable of getting copyright and its related rights and registration aspects
CO4	Be capable of getting trademarks and registration aspects

CO5	Apply knowledge on Design, Geographical Indication (GI) Plant Variety and Layout Design Protection and their registration aspect

Syllabus:

Unit I:

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR) – Kinds of Intellectual Property Rights: Patent, Copyright, Trade Marks, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret – IPR in India : Genesis and development – IPR in abroad- Major International Instruments concerning Intellectual Property Right: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967, the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994

Unit II:

Patents- Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application – Non- Patentable Subject Matter- Registration Procedure, Rights and Duties of Patentable Subject Matter Registration Procedure, Rights and Duties of Patentee, Assignment and license, Restoration of Lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties- Patent office and Appellate Board

Unit III:

Copyright – Nature of Copyright – Subject matter of copyright: original literary, dramatic, musical, artistic works; cinema to graph films and sound recordings- Registration Procedure, Team of protection, Ownership of copyright, Assignment and license of copyright- infringement, Remedies & Penalties- Related Rights- Distinction between related rights and copyrights

Unit IV:

Trademarks- Concept of Trademarks- Different kinds of marks (brand names, logos, signatures, symbols, well know marks certification marks and service marks) – Non Registrable Trademarks- Registration of Trademarks- Rights of holder and assignment and licensing of marks- Infringement, Remedies & Penalties – Trademarks registry and appellate board

Unit V:

Other forms of IP-

Design: Design meaning and concept of novel and original- Procedure for registration, effect of registration and term of protection Geographical Indication (GI): Geographical indication meaning, and difference between GI and trademarks – Procedure for registration, effect of registration and term of protection

Plant Variety Protection: Plant variety protection meaning and benefit sharing and farmers' rights- procedure for registration, effect of registration and term of protection

Layout Design Protection Layout Design protection meaning – Procedure for registration, effect of registration and term of protection

TEXT BOOKS:

- Nithyananda, K.V. (2019). Intellectual Property Rights: Protection and Management,

India, IN: Cengage Learning India Private Limited.

REFERENCE BOOKS:

- Neeraj, P., & Khusdeep, D (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited
- Ahuja, V.K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis