Faculty of Engineering and Technology
Board of Studies in Computer Science and Engineering
Curriculum structure of BE (Computer Science and Engineering)
PART-I

Sub Code	Part-I	Contact Hrs/Week				Examination Scheme						Duration of The Theory Examination
		L	T	P	Total	CT	TH	TW	PR	Total	credits	
CSE401	Data Warehousing and Data Mining	4	--	--	4	20	80	--	--	100	**4**	**3 Hrs**
CSE402	Principles of Compiler Design	4	--	--	4	20	80	--	--	100	**4**	**3 Hrs**
CSE403	Object Oriented Software Modeling & Design	4	--	--	4	20	80	--	--	100	**4**	**3 Hrs**
CSE404	Cloud Computing	4	--	--	4	20	80	--	--	100	**4**	**3 Hrs**
CSE441 CSE442 CSE443	Elective – IV	4	--	--	4	20	80	--	--	100	**4**	**3 Hrs**
CSE421	Lab 1: Data Warehousing and Data Mining	--	--	2	2	--	--	--	50	50	**1**	
CSE422	Lab 2: Principles of Compiler Design	--	--	2	2	--	--	--	50	50	**1**	
CSE423	Lab 3: Cloud Computing	--	--	2	2	--	--	--	50	50	**1**	
CSE424 CSE425 CSE426	Lab 4: Elective – IV	--	--	2	2	--	--	50	--	50	**1**	
CSE427	Project Part-I	--	--	4	4	--	--	25	--	25	**2**	
CSE428	Seminar	--	--	4	4	--	--	25	--	25	**2**	
	Total	**20**	**--**	**16**	**36**	**100**	**400**	**100**	**150**	**750**	**28**	

Elective –IV:

Code	Subject (Elective – IV)
CSE441	Agile Methodology
CSE442	Remote Sensing & Geographical Information Systems
CSE443	Internet of Things

L: Lecture hours per week **T**: Tutorial hours per week **P**: Practical hours per week
CT: Class Test **TH**: University Theory Examination, **TW**: Term Work, **PR**: Practical/Oral Examination

PART - II

Sub Code	Part-II	Contact Hrs/Week				Examination Scheme						Duration of The Theory Examination
	Subject	**L**	**T**	**P**	**Total**	**CT**	**TH**	**TW**	**PR**	**Total**	**Credits**	
CSE451	Big Data Computing	4	--	--	4	20	80	--	--	100	**4**	**3 Hrs**
CSE452	Soft Computing	4	--	--	4	20	80	--	--	100	**4**	**3 Hrs**
CSE453	Machine Learning	4	--	--	4	20	80	--	--	100	**4**	**3 Hrs**
CSE491 CSE492 CSE493 CSE494	Elective-V	4	--	--	4	20	80	--	--	100	**4**	**3 Hrs**
CSE471	Lab 5: Big Data Computing	--	--	2	2	--	--	--	50	50	**1**	
CSE472	Lab 6: Soft Computing	--	--	2	2	--	--	--	50	50	**1**	
CSE473	Lab 7: Machine Learning	--	--	2	2	--	--		50	50	**1**	
CSE474 CSE475 CSE476 CSE477	Lab 8 (Elective-V)	--	--	2	2	--	--	50	--	50	**1**	
CSE478	Project Part – II	--	--	8	8	--	--	50	100	150	**4**	
	Total	**16**	**--**	**16**	**32**	**80**	**320**	**100**	**250**	**750**	**24**	
	Total of Semester I & II	**36**	**--**	**32**	**68**	**180**	**720**	**200**	**400**	**1500**	**52**	

Elective - V:

Code	Subject (Elective – V)
CSE491	Information & Cyber Security
CSE492	ERP
CSE493	Game Architecture & Design
CSE494	Human Computer Interface

L: Lecture hours per week **T**: Tutorial hours per week **P**: Practical hours per week
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Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
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Final Year Engineering (CSE)
Part-I

Course Code: CSE401 **Title: Data Ware Housing and Data Mining**

Teaching Scheme
Theory: 04Hours/Week

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:
1. Database Management Systems

Objectives:
1. To introduce basic principles, concepts and applications of data warehousing.
2. To introduce students to the basic concept of Data Mining & preprocessing.
3. To introduce a wide range of Association, classification, clustering, classification algorithms.
4. To introduce basic concept of BI.

CONTENTS
SECTION-A

Unit 1: Data Warehousing: **[6Hrs]**
Data Warehouse: Basic Concepts, A Multitiered Architecture, Enterprise Warehouse, Data Mart, Extraction, Transformation, and Loading, Metadata Repository.

Unit 2: Data Warehouse Modeling and Implementation: **[8Hrs]**
Data Cube: A Multidimensional Data Model, Stars, Snowflakes, and Fact Constellations: Schemas for Multidimensional Data Models, Dimensions: The Role of Concept Hierarchies ,Measures: Their Categorization and Computation, Typical OLAP Operations, A Starnet Query Model for Querying Multidimensional Databases, Indexing OLAP Data: Bitmap Index and Join Index, OLAP Server Architectures: ROLAP versus MOLAP versus HOLAP.

Unit 3: Data Mining: **[6Hrs]**
Introduction: Data, Types of Data, Data Mining Functionalities, Interestingness of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Data Warehouse, Issues, Data Preprocessing.

SECTION-B

Unit 4: Association Rule Mining and Classification: **[8 hrs]**
Mining Frequent Patterns, Associations and Correlations, Mining Methods, Mining various Kinds of Association Rules, Correlation Analysis, Constraint Based Association Mining, Classification and Prediction, Basic Concepts, Decision Tree Induction, Bayesian Classification, Rule Based Classification, Support Vector Machines, Regression Models.

Unit 5: Clustering: **[6Hrs]**
Introduction, Clustering, Cluster Analysis, Clustering Methods- K means, Hierarchical clustering, Agglomerative clustering, Divisive clustering Introduction to Web Mining: Web Content Mining, Web Structure Mining, Web Usage Mining.

Unit 6: Business Intelligence: [6Hrs]

Introduction, Business Intelligence, Business Intelligence tools, Business Intelligence Infrastructure, Business Intelligence Applications, BI versus Data Warehouse, BI versus Data Mining, Future of BI.

Text Books:

1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Third Edition, Elsevier Publication.
2. Paulraj Ponniah, Data Warehousing: Fundamentals for IT Professionals, Wiley Publication.

Reference Books

1. Business Intelligence: A Managerial Approach (2nd Ed.) Turban, Sharda, Delen, King, Wiley Publication
2. C. S. R. Prabhu: Data Warehousing Concepts, Techniques, Products and Applications, Prentice Hall of India.
3. Alex Berson, Stephan J. Smith: Data Warehousing, Data Mining and OLAP, Tata McGraw Hill Edition.

Pattern of Question Paper:

Six units in the syllabus shall be divided in two equal parts i.e. 3 units in each part. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
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4. From the remaining questions in section A and B students are supposed to solve any two questions,15 marks each.

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Part-I

Course Code: CSE402 **Title: Principals of Compiler Design**

Teaching Scheme:
Theory: 04 Hours/Week

Examination Scheme:
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:
1. Understanding of Data structure, Discrete Mathematics and Algorithms.
2. Basic Knowledge of subject 'Theory of Computation'.
3. Programming skills in basic programming language like C.

Objectives:
1. To get working knowledge of the major phases of compilation, like lexical analysis, parsing, semantic analysis and code generation.
2. To use the formal attributed grammars for specifying the syntax and semantics of programming languages.
3. To learn and use tools for compiler construction.
4. To understand the structure of a compiler, and how the source and target languages influence various choices in the design.

SECTION A

Unit 1: Introduction to compilers: **[6 Hrs]**
Compilers & translators, structure of compilers, bootstrapping, compiler construction tools. Programming language basics.

Unit 2: Lexical analysis: **[6 Hrs]**
Role of LA, Input buffering, Specification of tokens, Recognition of tokens, Finite automata, Design of a lexical analyzer generator.

Unit 3: Syntax Analysis: **[8 Hrs]**
Role of Parser, shift reduce parsing, top down parsing, Predictive parsing – Computation of FIRST & FOLLOW functions and construction of parsing table, LR parsers, the canonical collection of LR (0) items, LALR parser, Automatic parser Generator YACC, YACC programs, Error detection and correction with YACC.

SECTION B

Unit 4: Syntax Directed Translation (SDT): **[8 Hrs]**
Syntax-Directed Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S-Attributed Definitions, L-Attributed Definitions, Top Down Translation, Bottom-Up Evaluation of Inherited Attributes, Type Checking: Type Systems, Specification of a Simple Type Checker, Equivalence of Type Expressions, Type conversions.

Unit 5: Intermediate Code Generation, Symbol Table, Error detection and Recovery: **[6 Hrs]**
Intermediate Code: Postfix notation, parser trees and syntax trees, three address codes – Quadruples and triples, indirect triples, Contents of Symbol table, data structures for symbol tables, representation scope information, Errors, Lexical-phase errors, syntactic-phase errors, semantic errors.

Unit 6: Code Optimization: **[6 Hrs]**

Principal sources of optimization, loop optimization - Basic blocks, flow graphs, loops, code motion, induction variables, DAG representation of basic blocks, Application of DAGs, Global Data Flow Analysis, Data Flow equations. Loop unrolling, loop jamming, constant folding, Object programs: the environment of code, generator, run-time addresses for names, Problems in code generation, A machine model, working of a simple code generator in brief, Register allocation and assignments, Peephole optimization.

Text Books:

1. A V Aho, R. Sethi, J D Ullman, "Compilers: Principles, Techniques, and Tools", Pearson Education
2. D. M. Dhamdhere, "Compiler Construction – Principles & practices".

Reference Books:

1. A.V. Aho, J.D. Ullman , "Principles of Compiler Design" – (NAROSA)
2. V Raghavan ,"Principles of Compiler Design"-TMH Publications.

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Final Year Engineering (CSE)
Part-I

Course Code: CSE403 **Title: - Object Oriented Software Modeling and Design**

Teaching Scheme:
Theory: 4 Hours/Week

Examination Scheme:
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hour

Prerequisite:
1. Students should have prior knowledge of software engineering.
2. Students should have idea of software development life cycle.
3. Students should have knowledge of object oriented concepts.

Objectives: Students will be able to:
1. Design a software project using Object Oriented Modeling
2. Design a software project using Design Patterns
3. Design an Object- Oriented Software

CONTENTS
SECTION-A: SOFTWARE MODELLING

Unit 1: Introduction: **[6 hrs]**
- Complexity of Software, Algorithmic and Object-Oriented Decomposition
- Software Modeling : Object-Oriented Methods and the Unified Modeling Language
- Software Architectural Design : Method and Notation
- UML as a Standard
- Multiple Views of Software Architecture
- Evolution of Software Modeling and Design Methods
- Evolution of Object-Oriented Analysis and Design Methods
- Survey of Concurrent, Distributed, and Real-Time Design Methods

Unit 2: UML Modeling: **[8 hrs]**
1. **Functional Modeling:** Basics of Use Cases System, Actors: Finding actors, actors in UML, Relationship between actors
   Use case: Finding use cases, use cases in UML, Relationship between use cases.
   Use Case Description: Types of use cases, elements of use case Description, Guidelines for Creating Use cases descriptions, organizing use cases, describing use cases, realizing use cases and Use case Diagrams.
2. **Structural Modeling**: Structural Models: Classes, attributes, operations, Relationship Class Responsibility Collaboration (CRC Cards), Class Diagram: Elements of Class Diagram.

Unit 3: Behavioral Modeling: **[6 hrs]**
Behavioral Models, Interaction Diagrams: Objects, operations and messages, Sequence diagram, Communication diagram. State machine diagram.
Activity Diagram: elements of activity diagram, guidelines for creating Activity diagram
Component diagram, deployment diagram.

NOTE: Proposed Case Study for Unit 2 & 3:
- Online banking, Institute Management System, Library Management System

SECTION-B: DESIGN PATTERNS

Unit 4: User Interface Design: **[6 hrs]**

- The Golden Rules
- User Interface Design
- Task Analysis and Modeling
- Interface Design Activities
- Implementation Tools
- Design Evaluation

Unit 5: Introduction to Design Patterns **[8 hrs]**

- What is a Design Pattern?
- The Catalog of Design Patterns
- Organizing the Catalog
- Creational Design Pattern
  Intent, applicability, structure, collaborations, consequence, implementations
  - Abstract Factory
  - Prototype
  - Singleton

Unit 6: Structural and Behavioral Design Patterns **[6 hrs]**

- Intent, applicability, structure, collaborations, consequence, implementations
- Structural Patterns: Adapter, Bridge, Composite,
- Behavioral Patterns: Chain of responsibility, Command, Iterator

NOTE: Case Study for Unit 5 and 6: Document Editor.

Text Books:

1. Object-Oriented Analysis and Design by Grady Booch, 2nd Edition , Addison Wesley
2. Alan Dennis, Barbara Haley Wixom,David Tegarden ,"System Analysis and Design with UML 2.0 " Wiley India Edition.
3. Software Modeling and Design UML, Use Cases, Patterns, and Software Architectures by Hassan Gomaa.
4. Design Patterns (ISBN: 81-7808-135-0) by Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides (Pearson Education Inc.) (Gang-of Four)
5. Software Engineering: A Practitioner's Approach by Roger S. Pressman, 5th Ed., McGraw Hill.

Reference Books:

1. Software Architecture Design − Methodology and Styles ISBN: 1-58874-621-6 Stipes Publishing L.L.C. by Lixin Tao, Xiang Fu and Kai Qian
2. Pattern Oriented Software Architecture (ISBN: 9971-51-421-4) by Frank Bushmann
3. Hank-Erik Eriksson, Magnus Penkar,Brian Lyons, David Fado," UML 2 Tool Kit" OMG Press

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Final Year Engineering (CSE)
Part-I

Course Code: CSE404 **Title: Cloud Computing**
Teaching Scheme: **Examination Scheme:**
Theory: 4 Hours/Week Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03Hours

Prerequisite:
1. Computer Network
2. Parallel & Distributed Computing

Objectives:
1. To learn and understand basic concepts of Cloud Computing & its Models.
2. To learn and understand Cloud Technologies
3. To design, develop and deploy Cloud applications
4. To get acquainted with the challenges and security aspects of Cloud Computing.
5. To study Mobile Cloud Applications

CONTENTS
SECTION-A

Unit 1: Introduction to Cloud Computing [6 Hrs]

- Introduction to Mainframe architecture & Client-server architecture,
- Parallel & Distributed Computing, Cluster & Grid Computing
- Definition and Evolution of Cloud Computing, the Vision of Cloud Computing,
- Cloud Deployment Models, Cloud Service Models, Key Characteristics, Benefits, Risks & Challenges in Cloud Computing,
- Service oriented architecture (SOA) and Cloud Computing Reference Architecture by IBM.

Unit 2: Cloud Services & Infrastructure [8 Hrs]

Cloud Services: Model architecture, Benefits and Drawbacks:

- Infrastructure-as-a-Service (IaaS),
- Platform-as-a-Service (PaaS),
- Software-as-a-Service (SaaS),
- Identity-as-a-service (IDaaS),
- Storage-as-a-service.
- Case Study: Platform as a Service: Google App Engine

Cloud Infrastructure:

- Historical Perspective of Data Centers
- **Datacenter Components:** IT Equipment and Facilities
- **Design Considerations:** Requirements, Power, Efficiency, & Redundancy, Power and Challenges in Cloud Data Centers

Unit 3: Enabling Cloud Technologies [6 Hrs]

- **Web services:** XML, SOAP, REST

- **Virtualization:** Introduction to virtualization, Hypervisor: Type-I & Type II, Types of Virtualization, Pros and cons of virtualization,
- **Virtualization applications in enterprises:** Server virtualization, Desktop and Application Virtualization, Storage and Network Virtualization. Case Study: Amazon EC2

SECTION-B

Unit 4: Basics of Hadoop **[6 Hrs]**

- **Big Data**, Concept of Big Data, Challenges in Big Data,
- **Hadoop:** Definition, Architecture,
- **Introduction to Storage Systems**: Cloud Storage Concepts Distributed File Systems (GFS, HDFS), Cloud Databases (Hbase, Big Table), Cloud Object Storage (Amazon S3), MapReduce and extensions: Parallel computing, The MapReduce model: Parallel efficiency of MapReduce
- **Projects in Hadoop:** Hive, Spark, Pig, Oozie, Flume.

Unit 5: Security in the Cloud **[8 Hrs]**

Cloud Security, cloud Security Challenges, **Infrastructure security:** Network, Host and Application, VM Security Issues, Data security and storage, Security Management in the cloud, Secure Software Development Life Cycle (SecSDLC), Security Monitoring and Incident Response, Security Architecture Design, Data Privacy, Life cycle of Data, Key Privacy Concerns in cloud and Disaster Recovery.

Unit 6: Mobile Cloud & Latest Cloud Technology Services **[6 Hrs]**

Mobile Cloud: Adopting mobile cloud applications, Using Smartphones with the cloud: Android, Apple
Working with Mobile Web Services: Mobile Interoperability.
Performing Service Discovery: Context-aware services, MEMS, Location awareness & its Strategies, Push Services, Defining WAP and Other Protocols.
Immerging Cloud Technologies: Impact of AWS in Cloud Computing, Types of AWS Services.

Text Books:

1. Enterprise Cloud Computing: Technology, Architecture, Applications by Gautam Shroff, Cambridge University Press.
2. Cloud Computing Implementation, Management, and Security By John W. Rittinghouse, James F. Ransome , CRC Press.
3. IBM smart storage cloud Red paper by Larry Coyne Mark Bagley Gaurav Chhaunker
4. Cloud Security and Privacy Tim Mather, Subra Kumaraswamy, Shahed Latif.

Reference Books:

1. Cloud computing Bible by Barrie Sosinsky, Wiley India Pvt Ltd (2011)
2. Mastering Cloud Computing Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi
3. Harnessing Green IT Principles & Practices by San Murugesan, G. R. Gangadharan

PATTERN OF QUESTION PAPER:

Six units in the syllabus shall be divided in two equal parts i.e. 3 units in each part. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions

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3. Question no. 1 from section A and Question no. 6 from section B, 10 marks each, will be compulsory.
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Final Year Engineering (CSE)
Part-I

Course Code: CSE441 **Title: Elective-IV: Agile Methodology**

Teaching Scheme:
Theory: 04 Hours/Week

Examination Scheme:
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisites:
1. Awareness of basics of software engineering concepts and waterfall methodology.
2. Exposure to any object-oriented programming language such as Java, C#.

Objectives:
1. To understand the background and driving forces for taking an Agile approach to software development.
2. To understand the business value of adopting agile approaches.
3. To understand the Agile development practices.
4. To drive development with unit tests using Test Driven Development.
5. To Apply design principles and refactoring to achieve Agility.
6. To deploy automated build tools, version control and continuous integration.

CONTENTS
SECTION-A

Unit 1: Fundamentals of Agile **[6 Hrs]**
The Genesis of Agile, Challenges of conventional SDLC, Introduction and background, Agile Manifesto and Principles, Traditional Model vs. Agile Model, classification of agile methods, ethics in agile teams.

Unit 2: Agile Scrum Framework **[8 Hrs]**
Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint Backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and Retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management, Case study using SCRUM.

Unit 3: Agile Processes **[6 Hrs]**
Extreme Programming, Lean software development, Test Driven Development, Feature Driven Development, Kanban, Requirements in Agile Context, Attributes of Agile Requirements, Requirements Engineering in Agile Software Development

SECTION-B

Unit 4: Agile Software Design Principles **[6 Hrs]**
Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles. Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control.

Unit 5: Agile Testing **[8 Hrs]**

The Agile lifecycle and its impact on testing, The Differences between Testing in Traditional and Agile Approaches, Role and Skills of a Tester in an Agile Team ,Test-Driven Development (TDD), x Unit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester.

Unit 6: Industry Trends **[6 Hrs]**

Market scenario and adoption of Agile, Agile maturity model, Introduction to DevOps, Agile ALM, Roles in an Agile project, agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies.

Text Books:

1. Agile Software Development with Scrum by Ken Schawber, Mike Beedle Publisher: Pearson
2. Published: 21 Mar 2008.
3. Agile Testing: A Practical Guide for Testers and Agile Teams by Lisa Crispin, Janet Gregory
4. Publisher: Addison Wesley Published: 30 Dec 2008.

Reference Books:

1. Agile Software Development, Principles, Patterns and Practices by Robert C. Martin Publisher: Prentice Hall Published: 25 Oct 2002.

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Final Year Engineering (CSE)
Part-I

Course Code: CSE442 **Title: Elective-IV: Remote Sensing & Geographical Information Systems**

Teaching Scheme:
Theory: 4 Hours/Week

Examination Scheme:
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:
1. Image processing
2. Computer Graphics

Objectives:
1. To get acquainted with the concepts of Earth observation and remote data acquisition techniques.
2. To understand the concepts of remotely sensed data processing and visualization.
3. To apply data processing and visualization methods
4. To perform data processing and visualization methods for number of earth science applications, including Geographical Information System.

CONTENTS
SECTION-A

Unit 1: Fundamental of Remote Sensing **[7 Hrs]**
Principles of Remote sensing, History of Remote sensing, Remote sensing in India, Electromagnetic radiation, Electromagnetic Spectrum, EMR quantities, Nomenclature and Units, Thermal Emission and Radiation, Principles, Interaction of EMR with Earth Surface, Spectral signature, Reflectance Characteristics of earth cover type, Remote sensing systems, Human vision colors, Spectral signatures and their interpretation.

Unit 2: Remote Sensing Platforms and Sensors **[6 Hrs]**
Platforms, Types of sensors, Sensor resolutions, Passive and Active sensors, Optical sensors, Classification of RS, Selection of sensor parameter, Spatial resolution, Spectral resolution, Radiometric resolution, Temporal resolution, Band combinations and optimum index factor, False and pseudo colour composites, Errors in imaging process.

Unit 3: Visual Image Interpretation **[7 Hrs]**
Elements of image interpretation, Interpretation key, Hardware and software aspects of digital image processing, Concept of data editing, Properties of digital remote sensing data, concept of geo-referencing, Errors due to geo-referencing, Physical and mathematical models, Hybrid models, Rectification of Images, Interpolation methods in the rectification of images, nearest neighbor, bilinear and bi-cubic methods, Concepts of world file and embedding of projection information in the images.

SECTION-B

Unit 4: Remote Sensing Image Processing **[7 Hrs]**

Image Registration, Image Enhancement techniques, The Classification Process, Image Classification techniques, supervised and unsupervised techniques.

Unit 5: Geographic Information System **[6 Hrs]**

Definition of GIS, Elements of GIS, Coordinate system, Need for GIS, Data models, Raster and vector, GIS data acquisition, Data input for GIS, Integration of satellite images, Aerial photographs and GIS, Concept of web GIS.

Unit 6: Data Exploration & Analysis **[7 Hrs]**

Data display and Cartography, Data exploration, Vector data analysis, Raster data analysis, Terrain Mapping and analysis.

Text Books:

1. Lillesand Kiefer, Chipman, Remote Sensing and Image Interpretation, Wiley Publications.
2. Robert A. Schowengerdt, Remote Sensing Models & methods for Image Processing, 3rd Edition, Academic Press.
3. Kang- tsung Chang, Introduction to Geographic Information Systems, Tata McGraw Hill, 4th Edition.

Reference Books:

1. Fundamental of Remote Sensing, George Joseph, Universities Press (India) Pvt. Ltd.
2. Remote Sensing- Principles & Applications, Dr, B C Panda. Viva Books Pvt. Ltd.
3. J. B. Campbell and R. H. Wyne, Introduction to Remote Sensing, Guilford Press, 2011.

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Final Year Engineering (CSE)
Part-I

Course Code: CSE443 **Title: Elective-IV: Internet of Things**

Teaching Scheme:
Theory: 4 Hours/Week

Examination Scheme:
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:
1. Introductory course on Computer Networks
2. Sensors Technology

Objective:
1. An Understanding of the IoT value chain structure(device, cloud, data), application area and technologies involved
2. IoT applications and example overview
3. An Understanding of various sensor technologies

CONTENTS
SECTION-A

UNIT I: FUNDAMENTALS OF IoT: **[6 Hrs]**
Internet of Things Definitions, Uses and Applications of IoT, IoT Architectures: one M2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Functional blocks of an IoT, IoT implementation, platforms and integration tools.

UNIT II: IoT PROTOCOLS and Sensors: **[8 Hrs]**
Light weight Machine to Machine communication protocols, JSON format, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Application Layer Protocols: CoAP and MQTT, XMPP, SOAP and Web Socket.
IoT Sensors: Temperature sensors, Humidity sensors, light sensors, Proximity sensors, Pressure sensors, Water quality sensors, pH sensors, Gas sensors, Smoke sensors, IR sensors, Level sensors, Image sensors, Motion detector sensors, Accelerometer sensors, Gyroscope sensors.

UNIT III: Design and Developments: **[6 Hrs]**
Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

SECTION- B

UNIT IV: Data Acquisition and Supporting Services: **[6 Hrs]**
Criteria for sensors selection, designing of sampling time of data acquisition, selection criteria for actuators, exchanging messages using TCP and UDP, serving web pages with dynamic data, Serving Web pages that respond to user input.

Unit V: Cloud and IoT: **[6 Hrs]**

Introduction to cloud storage models and communication API's, WAMP-AutoBahn for IoT, Python web application framework, AMAZON web services for IoT, SkyNet IoT messaging platform

UNIT VI Case Studies: **[8 Hrs]**

1.Home automation 2. Traffic light system 3. Home security

In each case study, it is expected to elaborate: Problem identification, functional and non functional requirements, System design, Sensor and Actuators selection, Deployment architectures and pseudo code for all modules.

Text Books:

1. Internet of Things: A Hands-On Approach Arshdeep Bahga, Vijay Madisetti VPT – Paperback 2015 978- 0996025515 628/- 2.
2. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things David Hanes, Gonzalo Salgueiro, Patrick Grossetete Cisco Press – Paperback – 16 Aug 2017 978-1- 58714-456- 1 599.
3. Internet of Things, Architecture and Design Principles, Rajkamal, McGrawHill publication
4. Embedded Ethernet and Internet complete, Jan Axelolson, Penram International Publishing Pvt Ltd.

Pattern of Question Paper:

Six units in the syllabus shall be divided in two equal parts i.e. 3 units in each part. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no. 1 from section A and Question no. 6 from section B, 10 marks each, will be compulsory.
4. From the remaining questions in section A and B students are supposed to solve any two questions, 15 marks each.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF SCIENCE AND TECHNOLOGY
Final Year Engineering (CSE)
Part-I

Course Code: CSE421 **Title: LAB-I Data Warehousing and Data Mining**

Teaching Scheme:
Practical: 02 Hours/Week

Examination Scheme:
Practical /Oral Examination: 50 Marks
Practical /Oral Examination (Duration): 03 Hours

Suggestive List of Practicals/Assignments: (Min. 8 experiments to be conducted)
Design, develop and implement the following Assignments by

1. To Study Different Types of data warehousing
2. Experiments on Summarization/generalization Techniques
3. Implementation of Star Data Warehouse Schema
4. Implementation of Snowflake Data Warehouse Schema
5. Implementation of Fact Constellation Warehouse Schema
6. Experiments on Associations Techniques
7. Classification Using Decision Trees
8. Classification Using *Bayesian*
9. Experiments on Clustering Techniques using k means
10. Case study

Practical Examination:

Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

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Final Year Engineering (CSE)
Part-I

Course Code: CSE422 **Title: LAB-II Principles of Compiler Design**

Teaching Scheme:
Practical: 02 Hours/Week

Examination Scheme:
Practical /Oral Examination: 50 Marks
Practical /Oral Examination (Duration): 03 Hours

Suggestive List of Practical Assignments: (Min. 8 experiments to be conducted)
Design, develop and implement the following Assignments …...

1. Program to convert Non-deterministic finite automaton (NFA) to Deterministic finite automaton (DFA).
2. Program to generate lexical tokens.
3. Study of LEX/FLEX and write LEX program to identify tokens: integer, decimal numbers, identifiers, keywords, arithmetic operators, relational operators.
4. Program to implement LR parser.
5. YACC program for desktop calculator.
6. Program to implement any one code optimization technique.
7. Implementation of any one method of Intermediate Code Generator.
8. Implementation of code generator.

Assignment No.: 1 Case Study: GCC, G++ compiler
Assignment No.: 2 Case Study: Parallel Compilation (NVCC), LLVM compiler

Practical Examination:

Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

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Final Year Engineering (CSE)
Part-I

Course Code: CSE423 **Title: LAB-III Cloud Computing**

Teaching Scheme:
Practical: 2 Hours/Week

Examination Scheme:
Practical /Oral Examination: 50 Marks
Practical /Oral Examination (Duration): 03 Hours

Suggestive List of Practical Assignments:
Design, develop and implement the following Assignments …....

1. Study of Basic Concepts in Cloud Computing
2. Creating a Warehouse Application in SalesForce.com.
3. Implementation of SOAP Web services in C#/JAVA Applications.
4. Implementation of Full-Virtualization by the use of a Hypervisor.
5. Implementation of Para-Virtualization by the use of a Hypervisor.
6. Installation and Configuration of Single-Node Setup in Hadoop.
7. To study Cloud security challenges.
8. Case Study: PAAS (Facebook, Google App Engine)
9. Case Study: Amazon Web Services.
10. To study the Basics of Hadoop Eco-system

Practical Examination:

Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF SCIENCE AND TECHNOLOGY
Final Year Engineering (CSE)
Part-I

Course Code: CSE424 **Title: LAB-IV-(Elective-IV) Agile Methodology**
Teaching Scheme: **Examination Scheme:**
Practical: 02 Hours/Week **Term Work**: 50Marks

Suggestive List of Practical Assignments:
Design, develop and implement the following Assignments

1. Understand the background and driving forces for taking an Agile approach to software development.
2. Understand the business value of adopting Agile approaches.
3. Understand the Agile development practices.
4. Apply design principles and refactoring to achieve Agility.
5. Drive development with unit tests using Test Driven Development.
6. Deploy automated build tools, version control and continuous integration.
7. Agile projects on Cloud
8. Perform testing activities within an agile project.

Term Work:

The term work shall consist of at least 8 experiments/ assignments based on the syllabus above.

Assessment of term work should be done as follows

- Continuous lab assessment
- Actual practical performance in Laboratory

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Final Year Engineering (CSE)
Part-I

Course Code: CSE425 **Title: LAB-IV: Elective-IV: Remote Sensing & Geographical Information Systems**

Teaching Scheme:
Practical: 2 Hours/Week

Examination Scheme:
Term Work: 50 Marks

Suggestive List of Practical Assignments:
Minimum 8 assignments should be conducted.

(Software: ILWIS / GRASS/ QGIS/ ArcGIS)

1. Reading and importing a raster dataset into RS/ GIS software and creating a subset.
2. Image Processing filters: smoothing and edge detection filtering
3. Image Classification: Unsupervised Classification
4. Image Classification: Supervised Classification
5. Image Classification: Accuracy Assessment
6. Image geo- referencing and understanding projections
7. Image fusion with images of two different resolutions
8. Digitization of point, line and polygon features
9. Composition of maps
10. Connecting with map, google map or bing map for mapping

Term Work:

Term Work shall consist of at least 8 experiments / assignments based on the syllabus above. Assessment of term work should be done as follows

- Continuous lab assessment
- Actual practical performance in laboratory

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Final Year Engineering (CSE)
Part-I

Course Code: CSE426 **Title: LAB-IV- (Elective-IV) Internet of Things**
Teaching Scheme: **Examination Scheme**
Practical: 2 Hours/Week Term Work: 50 Marks

Suggested list of Assignments:

1. Study of Raspberry-Pi, Arduino, verify practically pin functions of each board.
2. Installation of OS on Raspberry-Pi, verify board's functionality after OS installation
3. Study of functionality of various sensors and its data sheets, it is expected to study Range of parameters, range of environmental parameters in which it can work, precision and how to calibrate it.
4. Implement interfacing of LEDS. Understanding GPIO and its use in program.
5. Design and implement an application which will monitor temperature and it will be indicated by either buzzer or LED if crossed its threshold value.
6. Design and implement an application with IR sensor to detect water level of a tank & display the message if tank is empty or full, after crossing its threshold value.
7. Write a program of connectivity of Raspberry-Pi board with any Internet Module/Cloud. Write a network application for communication between two devices.
8. Design and implement traffic light system considering following aspects
    - Consider one cross road
    - Study density of traffic on that cross road
    - Classify the traffic in heavy, medium and light weight
    - Design duty cycle of Green, Yellow and Red light
    - Write a program and simulate the scenario
9. Design an application for home security considering following aspects:
   Consider an isolated bungalow located near slum area and crowdie place where there is Compound but no security guard:
    - Aanalyze the scenario
    - Write security policy
    - Identify IoT mechanisms
    - How will you deploy the same
10. Design an application for home security considering following aspects:
    Consider a bungalow located in a society where there is complete compound and 24X7 security guard is available
    - 1.Analyze the scenario
    - 2.Write security policy
    - 3.Identify IoT mechanisms
    - 4.How will you deploy the same.

Term Work:
Term Work shall consist of at least 8 experiments/assignments based on the syllabus above. Assessment of term work should be done as follows

- Continuous lab assessment
- Actual practical performance in laboratory

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Final Year Engineering (CSE)
Part-I

Course Code: CSE427 **Title: Project Part-I**
Teaching Scheme: **Examination Scheme:**
Practical: 04 Hours/Week Term Work: 25 Marks

1. Project Group size should be of maximum 4 students.
2. The project is to be taken up at the start of the semester I and the project must be completed by the end of semester II.
3. While submitting project proposal care is to be taken that project will be completed within the available time of two terms.
4. Project title should be precise and clear. Selection and approval of topic: Topic should be related to real life or commercial application in the field of Information Technology.

OR

Investigation of the latest development in a specific field of Information Technology.

OR

Commercial and Interdisciplinary projects should be encouraged. The examination will be conducted independently in respective departments.

5. The group should maintain a logbook of activities. It should have entries related to the work done, problems faced, solution evolved etc., duly signed by guide. This data should be used for finding the total man hours and estimating the cost of the project.
6. The group is expected to complete details Literature Survey, system/problem definition, analysis, design, etc. in (B.E. first Term) seventh term, as a part of term work in the form of a joint report. Project report must be submitted in the prescribed format only. No variation in the format will be accepted.
7. The guides should regularly monitor the progress of the project work.
8. Assessment of the project for award of term work marks shall be done by the guide and a departmental committee as per the guidelines given in the following table.
9. The suggestive format of the report is as follows:

(Only one report should be submitted per group as a part of term work submission.)

Title of the Project:
Names & Roll Numbers of the students:
Name of the guide:
Chapter 1: Introduction
Chapter 2: Literature Survey
Chapter 3: System Development

A) Assessment of project –I Term Work B.E. First Term

Name of the Project:_____

Name of the Guide:_____

Sr. No.	Exam Seat No.	Name of the Student	Assessment by Guide (70 %)					Assessment by Departmental Committee (30 %)			
			Literature Survey	Topic Selection	Documentation	Attendance	Total	Evaluation (10%)	Presentation (20%)	Total	Grand Total
		Marks	05	2.5	7.5	2.5	17.5	2.5	5	7.5	25

Sign of Guide Sign of Committee Members Sign of HOD

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Part-I

Course Code: CSE428 **Title: Seminar**

Practical: 04 Hours/Week **Examination Scheme:**

Term Work: 25 Marks

All the final year students are informed to present a seminar on a topic related to current trends and technologies. Seminar should be evaluated on the following basis:

- PPT prepared and Presentation skills
- Understanding of subject
- Report preparation

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
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Final Year Engineering (CSE)
Part-II

Course Code: CSE451 **Title: Big Data Computing**

Teaching Scheme:
Theory: 4 Hours/Week

Examination Scheme:
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:

1. Students should have the knowledge of programming language (Python, Java), Database Management Systems, Linux Operating Systems and Data warehousing & Data Mining.

Objectives:

1. To know the fundamental concepts of big data and analytics.
2. To understand technical and business professionals who need to understand the different types of big data components and the underlying technology concepts that support big data.
3. To understand concepts of Hadoop, Map Reduce, Hadoop file systems (HDFS).
4. To explore tools and practices for working with big data.
5. To know about the research that requires the integration of large amounts of data

CONTENTS
SECTION-A

Unit 1: Statistics Essential for Analytics **[06 Hrs]**

Statistical Analysis: Inferential Statistics, Descriptive Statistics. **Measures of Central Tendency:** Mean, Median, Mode. **Measures of Spread:** Range, Inter-quartile Range, Standard Deviation, Variance, Skewness & Kurtosis. **Probability:** Introduction to Probability, Probability Distributions, Conditional Probability, Bayesian Inference, Normal Distribution, Poisson distribution.

Unit 2: Data Extraction, Wrangling and Exploration **[08 Hrs]**

What is Data? Types of Data: Quantitative & Qualitative Data, What is a Variable? Sampling Methods, Point Estimation, Hypothesis Testing, Parametric Testing, Non-Parametric Testing, Experimental designing, Data Analysis Pipeline, What is Data Extraction, Raw and Processed Data, Data Wrangling, Exploratory Data Analysis, Visualization of Data: Strip Charts, Histogram, Box Plots, Scatter Plots, Case Study- Stock Market predictions.

Unit 3: Fundamentals of Big Data **[06 Hrs]**

What is Big data? Characteristics of big data and its role in current world, Types of Big Data: Defining Unstructured, Semi-Structure and Structured Data, Technologies being Used to handle and process Big data, Five V's of big data, Drivers for big data, Big data challenges, Fallbacks of traditional RDBMS in handling and processing Big data, Some Real-world Examples to adopt in major industries, NoSQL Databases, CAP Theorem Categories of NoSQL: Key Value Stores, Document Stores, Column Oriented Stores, Graph Databases.

SECTION-B

Unit 4: Introduction to Hadoop (Understanding Hadoop Ecosystem) [06 Hrs]

What is Hadoop? Hadoop Key Characteristics, Differences between RDBMS & Hadoop, Brief History of Hadoop, Hadoop Ecosystem (Version 1.x & 2.x), Hadoop commands, Components of Hadoop (Version 2.x): HDFS & MapReduce, Architecture of HDFS & Map Reduce, Basic Operations to store and access from HDFS via Command Line, Phases in MapReduce Algorithm, YARN architecture, YARN advantages.

Unit 5: Pig & Hive Hadoop Projects [08 Hrs]

Apache Pig: Pig Architecture, Modes of Pig Execution, Operations in Pig: Intro to Pig Latin, Pig Latin Data types, Basic Pig Latin Statements: Loading and Storing Data, Relational and Arithmetic Operators, Debugging Techniques (Dump, Describe, Explain etc.),

Apache Hive: Hive architecture, Modes of Hive Execution, Operations in Hive: Intro to HiveQL, Basic HiveQL commands: DDL Operations (creating, browsing, updating and deleting tables), DML Operations (Load, Update, Insert and delete data into Hive tables).

Unit 6: HBase & Sqoop Hadoop Projects [06 Hrs]

Apache HBase: HBase Architecture, HBase Vs RDBMS, HBase Shell Commands.

Apache Sqoop: Sqoop Architecture, importing data: Transferring an entire table, specifying a target directory, importing only a subset of data, Incremental Uploads: Importing only new data.

Text Books:

1. S M Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Academic Foundation, 2011.
2. Tom White, Hadoop: The Definitive Guide. O’reilly, Fourth Edition, 2011.
3. "Hadoop in Action" Third Edition, Chuck Lam.
4. Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packt Publications.

Reference Books:

1. "Programming Hive", Jason Rutherglen, Dean Wampler & Edward Capriolo, O’Reilly Publication.
2. "Programming in Pig", Alan Gates, O’Reilly Publication.
3. "HBase: The Definite Guide", Lars George, O’Reilly Publication.
4. “Apache Sqoop Cookbook” Kathleen Ting, Jarek Jarcec Cecho, O’Reilly Publication.
5. Statistics Unplugged, Sally Cladwell, 3rd Edition, WADSWORTH cengage Learning.

PATTERN OF QUESTION PAPER:

Six units in the syllabus shall be divided in two equal parts i.e. 3 units in each part. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no.1 from section A and Question no. 6 from section B, 10 marks each, will be compulsory.
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Final Year Engineering (CSE)
Part-II

Course Code: CSE452 **Title: Soft Computing**

Teaching Scheme: **Examination Scheme:**

Theory: 4 Hours/Week Class Test: 20 Marks

Theory Examination (Marks):80 Marks

Theory Examination (Duration):03 Hours

Prerequisite:

1. Programming Languages (C, C++, Java, MatLab)
2. Basic Mathematics

Objectives:

1. To understand the scope of soft computing and pattern recognition tasks that can be performed by some of the basic structures of artificial neural networks.
2. Analyze feed forward networks and understand the significance of nonlinear output functions of processing unit in feedback network for pattern storage.
3. To understand basics of deep learning
4. To describe and explain Core concepts and techniques of fuzzy logic.
5. To understand the working of Genetic Algorithm and synthesize applications of soft computing using Genetic Algorithm.

CONTENTS
SECTION-A

Unit 1: Soft Computing: **[7 Hrs]**

Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Characteristics of Neural Networks, Structure and Working of a biological neural network, Artificial Neural Network Terminology, models of neurons: MP model, Perceptron model, Adaline model, Topology, Basic Learning laws, what is learning, supervised and unsupervised learning, Functional Units of ANN for pattern recognition task: Pattern Recognition Problem, Basic functional units.

Unit 2: Perceptron learning **[7 Hrs]**

Single layer and multilayer perceptron, linear and non-linear separability problems, supervised learning algorithms**,** Error correction and Gradient Decent Rules, FFNN, Architecture of FFNN, Backpropagation learning algorithm, pattern classification, pattern association by FFNN.

Unit 3: Pattern association **[6 Hrs]**

Auto association and hetero association, feedback NN, architecture of FBNN, energy function, associative memory, bidirectional associative memory, Hopfield network.

SECTION-B

Unit 4: Deep Learning **[7 Hrs]**

Introduction to deep learning, why deep learning? Building blocks of deep neural network, Introduction to RNN, CNN with an example.

Unit 5: Fuzzy Logic **[6 Hrs]**

Classical sets, Fuzzy sets, Crisp relations, Fuzzy relations, Examples, Properties of membership functions, fuzzification and Defuzzification to crisp sets, Application of fuzzy control.

Unit 6: Genetic Algorithms and its applications **[7 Hrs]**

Fundamentals, basic concepts, working principle, Inheritance Operators, Cross over types, inversion and Deletion, Mutation Operator, Bit-wise Operators, Convergence of GA, Applications of GA.

Text Books:

1. S. N. Sivanandam & S. N. Deepa, “Principles of Soft Computing”, Wiley Publications.
2. B. Yegnanarayana, “Artificial Neural Networks”, PHI Publications.
3. John Yen, Reza Langari, “Fuzzy Logic”, Pearson Education.
4. S. Rajasekaran, VijaylakshmiPai, “Neural Networks, Fuzzy Logic and Genetic algorithms-Synthesis and Applications”, PHI Publications.
5. Davis E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
6. Deep Learning, An MIT Press book, Ian Goodfellow and Yoshua Bengio and Aaron Courville http://www.deeplearningbook.org.

Reference Books:

1. Timothy J Ross, “Fuzzy Logic with Engg. Applications”, Wiley Publications.
2. B. Satish Kumar, “Neural Networks - A Classroom Approach”, McGrawHill Publications

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Final Year Engineering (CSE)
Part-II

Course Code: CSE453 **Title: Machine Learning**

Teaching Scheme:
Theory: 04 Hours/Week

Examination Scheme:
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:
1. Probability
2. Linear Algebra
3. Basics of Programming

Objectives:
1. To understand the possibilities and limitations of ML, and know how to formulate your own ML problem.
2. To understand the main ideas behind the most widely used machine learning algorithms
3. To know how to build predictive models from data and analyze their performance.

CONTENTS

SECTION-A

UNIT 1: Introduction **[6 Hrs]**
What Is Machine Learning? Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Unsupervised Learning, Reinforcement Learning

Unit 2: Supervised Learning **[08 Hrs]**
Learning a Class from Examples, Vapnik-Chervonenkis (VC) Dimension, Probably Approximately Correct (PAC) Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm

Unit 3: Dimensionality Reduction **[06 Hrs]**
Introduction, Subset Selection, Principal Components Analysis, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis, Isomap, Locally Linear Embedding

SECTION-B

Unit 4: Decision Tree Learning **[06 Hrs]**
Introduction, Decision tree presentation, Appropriate problems for Decision tree learning, The Basic decision tree learning algorithm, Which attribute is the best classifier?, An Illustrative example.

Unit 5: Clustering **[08 Hrs]**
Introduction, mixture Densities, *k*-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Hierarchical Clustering, Choosing the Number of Clusters

Unit 6: Bayesian Decision Theory **[06 Hrs]**
Introduction, Classification, Losses and Risks, Discriminant Functions, Utility Theory, Association Rules

Text Books:

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2. Introduction to Machine Learning Edition 2, by Ethem Alpaydin

Reference Books:

1.Christopher Bishop. Pattern Recognition and Machine Learning. 2e.

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Final Year Engineering (CSE)
Part-II

Course Code: CSE491 **Title: (Elective – V) Information & Cyber Security**

Teaching Scheme:
Theory: 04 Hours/Week

Examination Scheme:
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:
1. Data Communication
2. Computer Network
3. Network Security

Objectives:
1. Understand information and network security.
2. To study assessment types for information security
3. To study cyber security fundamentals.
4. To study different cybercrimes.
5. To learn forensics and investigation tools and techniques.

CONTENTS
SECTION-A

Unit 1: Introduction to Information Security **[08 Hrs]**

What Is Security, CNSS Security Model, Components of an Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, The Systems Development Life Cycle, The Security Systems Development Life Cycle, Security Professionals and the Organization, Communities of Interest, The Need for Security: Business Needs First, Threats, Attacks, Secure Software Development.

Unit 2: Implementing Information Security **[06 Hrs]**

Information Security Project Management, Technical Aspects of Implementation, Nontechnical Aspects of Implementation, Information Systems Security Certification and Accreditation.

Unit 3: Information Security Maintenance **[06 Hrs]**

Security Management Maintenance Models: The Security Maintenance Model, Monitoring the External Environment, Monitoring the Internal Environment, Planning and Risk Assessment, Vulnerability Assessment and Remediation, Readiness and Review.

Digital Forensics: The Digital Forensics Team, Affidavits and Search Warrants, Digital Forensics Methodology, Evidentiary Procedures.

SECTION-B

Unit 4: Introduction to Cyber Security **[06 Hrs]**

Introduction, Definition and origin, Cybercrime and Information security, Classification of cybercrimes, The legal perspectives- Indian perspective, Global perspective, Categories of Cybercrime, Types of Attacks, a Social Engineering, Cyber stalking, Cloud Computing and Cybercrime.

Unit 5: Cybercrime: Mobile and Wireless Devices [06 Hrs]

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card frauds, Security Challenges posed by Mobile Devices, Registry Setting for Mobile Devices, Authentication Security Services, Attacks on Mobile Phones, Organizational Measures for handling Mobiles.

Unit 6: Tools and Methods Used in Cybercrime [08 Hrs]

Introduction, Proxy servers and Anonymizers, Phishing, Password Cracking, Key-loggers and Spywares, Types of Virus, Worms, Dos and DDoS, SQL injection, Cybercrime and Legal perspectives, Cyber laws-Indian context, The Indian IT Act-Challenges, Amendments, Challenges to Indian Law and cybercrime Scenario in India, Indian IT Act and Digital Signatures. Study network security scanners: Nmap and Wireshark.

Text Books:

1. Michael E. Whitman and Herbert J. Mattord Principles of Information Security, Fourth Edition, Cengage Learning Publishing
2. Atul Kahate. "Cryptography and Network Security." Tata McGraw-Hill Education,
3. Nina Godbole, Sunit Belapure, "Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiely India Pvt.Ltd,

Reference Books:

2. Mark Merkow, Information Security-Principles and Practices, Pearson Ed.
3. William Stallings, "Cryptography and Network Security: Principles and Practices", Pearson Education
4. Bernard Menezes, "Network Security and Cryptography", Cengage Learning
5. Eric Cole, Dr. Ronald Kurtz and James W. Conley, "Network Security Bible", Wiley Publishers
6. Marjie T. Britz, "Computer Forensics and Cyber Crim: An Introduction, 3rd Edition, Prentice Hall, 2013.

NPTEL: Prof. D. Mukhopadhyay, Cryptography and Network Security.

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3. Question no. 1 from section A and Question no. 6 from section B, 10 marks each, will be compulsory.
4. From the remaining questions in section A and B students are supposed to solve any two questions, 15 marks each.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

FACULTY OF SCIENCE AND TECHNOLOGY
Final Year Engineering (CSE)
Part-II

Course Code: CSE492 **Title: (Elective – V) Enterprise Resource Planning**

Teaching Scheme
Theory: 04 Hours/Week

Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:

1. Fundamentals of Organization structure.
2. Fundamentals of Business Process, Software Project Management.

Objectives:

The learner will be familiar with ERP and related technologies like Business Processing Reengineering (BPR), Supply Chain Management (SCM), Customer Relationship Management (CRM), MIS - Management Information System, DSS - Decision Support System, EIS - Executive Information System etc. The learner should gain the knowledge on ERP tools and ERP benefits.

CONTENTS

SECTION-A

Unit 1: Introduction to ERP **[7 Hrs.]**

Enterprise – An Overview, integrated Management Information, Business Modeling, and Integrated Data Model

ERP and Related Technologies: Business Processing Reengineering (BPR), Data Warehousing, Data Mining, On-line Analytical Processing (OLAP), Supply Chain Management (SCM), Customer Relationship Management (CRM), MIS -Management Information System, DSS - Decision Support

Unit 2: ERP Manufacturing Perspective **[07 Hrs.]**

MRP-Material Requirement Planning, BOM - Bill of Material, MRP -Manufacturing Resource Planning, DRP – Distributed Requirement Planning, PDM - Product Data Management

ERP Modules: Finance, Plant Maintenance, Quality Management, Materials Management

Unit 3: ERP Implementation Lifecycle **[06 Hrs.]**

Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation Team Training, Testing, Going Live, End-user Training, Post-implementation (Maintenance mode)

SECTION-B

Unit 4: E-Business Architecture **[06 Hrs.]**

Enterprise resource planning the E-business Backbone Enterprise architecture, planning, ERP usage in Real world, ERP Implementation, E-Procurement, E-Governance, Developing the E-Business Design

Unit 5: Introduction to ERP tools **[07 Hrs.]**

JD Edwards-Enterprise One Microsoft Dynamics-CRM Module
Real-world case studies: Rolls Royce's ERP Implementation, WIPRO and MBH, HP SAP Implementation, NIKE ERP Implementation, Walt Disney CRM Strategy, Nestle ERP Implementation, Hershey's Enterprise 21 Project.

Unit 6: ERP Market, ERP Present and Future [07 Hrs.]

ERP Venders: - SAP, BAAN, Oracle, PeopleSoft, Microsoft dynamics, ERP and Total Quality Management, **ERP Subsystems**: Human Resource Management (HRM), Inventory Control System, Quality Management, Marketing

Text Books

1. Enterprise Resource Planning - Alexis Leon, Tata McGraw Hill.
2. Enterprise Resource Planning – Diversified by Alexis Leon, TMH.
3. Enterprise Resource Planning - Ravi Shankar & S. Jaiswal, Galgotia.

Reference Books:

1. Guide to Planning ERP Application, Annetta Clewwto and Dane Franklin, McGraw-Hill, 1997
2. The SAP R/3 Handbook, Jose Antonio, McGraw – Hill
3. E-Business Network Resource planning using SAP

PATTERN OF QUESTION PAPER:

Six units in the syllabus shall be divided in two equal parts i.e. 3 units in each part. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions

2. Five questions in each section

3. Question no. 1 from section A and Question no. 6 from section B, 10 marks each, will be compulsory.

4. from the remaining questions in section A and B students are supposed to solve any two questions, 15 marks each.

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FACULTY OF SCIENCE AND TECHNOLOGY
Final Year Engineering (CSE)
Part-II

Course Code: CSE493 **Title: Elective-V Game Architecture & Design**

Teaching Scheme:
Theory: 4 Hours/Week

Examination Scheme:
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:

1. Basic visual design and basic scripting or programming skills
2. Moderate fluency in 2D and 3D animation and graphics packages
3. Awareness of game platforms and the technology

Objectives:

1. To familiarize with the process of game design and development
2. To learn the processes, mechanics, issues in game design
3. To understand the architecture of game programming

CONTENTS
SECTION-A

Unit 1: Games and Video Games **[06 Hrs]**

Introduction, Conventional Games Versus Video Games, Games for Entertainment, Serious Games, Designing and Developing Games: Key Components of Video Games, The Structure of a Video Game, Stages of the Design Process, Game Design Team Roles, Game Design Documents, The Anatomy of a Game Designer, The Major Genres, Understanding Your Player, Understanding Your Machine, Game Balance.

Unit 2: Game Concepts **[6 Hrs]**

Getting an Idea, From Idea to Game Concept, Game Worlds, Creative and Expressive Play, Character Development, The Goals of Character Design: The Relationship Between Player and Avatar, Visual Appearances, Character Depth, Audio Design

Unit 3: Storytelling and Creating the User Experience **[8 Hrs]**

Key Concepts, The Story telling Engine, Linear and Nonlinear Stories, Granularity, Mechanisms for Advancing the Plot, Emotional Limits of Interactive Stories, Scripted Conversations and Dialogue Trees, When to Write the Story Player-Centric Interface Design, The Design Process, Managing Complexity, Interaction Models, Camera Models, Visual and Audio Elements, Input Devices, Navigation Mechanisms, Accessibility Issues, Allowing for Customization.

SECTION-B

Unit 4: Current Methods of Team Management [6 Hrs]

The Current Development Model - The Origins of the Industry, The Trouble with Game Developers, The Problem Developer, Excessive Long Hours Mean an Unsuccessful Project, Exceptions to the Rule Roles and Divisions - Assigning Personnel, Improving Morale and the Working Environment,
The Software Factory - What Is a Software Factory? Why Use a Software Factory? Solving Game Development Issues, organizing a Software Factory, Applying the Software Factory Structure and Methodology, The Suitability of a Software Factory, Milestones and Deadlines: Procedures and "Process", Procedures: Where to Use Them? What Should Source Control Be Used For? The Importance of Information Transmission, Troubleshooting, The Future of the Industry

Unit 5: Architecture Design [8 Hrs]

Initial Design, The Beginning , Hardware Abstraction , Sound Hardware Abstraction , Other Hardware, The Problem Domain, Thinking in Tokens, Use of Technology: he State of the Art,Blue-Sky Research, Reinventing the Wheel, Use of Object Technology , Building Blocks Initial Architecture Design: The Birth of an Architecture, Architectural Concepts, The Tier System, Architecture Design Development: The Development Process-Code Quality, Debugging and Module Completion, Types of Bugs, reusable Architecture , Documentation, Design First, Schedule, Catch Mistakes as You Go Along.

Unit 6: Game Analysis [6 Hrs]

Game Analysis: Abdicating Authorship, Familiar Subject Matter, Safe Experimentation, Depth and Focus, Interface, Controlled Versus Autonomous Behavior, A Lesson to Be Learned.
Designing Design Tools., Desired Functionality, Scripting Languages and Object Behaviors, Us Versus Them, The Best of Intentions, A Game Editor for All Seasons, Play testing.

Text Books:

1. Fundamentals of Game Design Third Edition by Ernest Adams, (New Riders Games)
2. Game Architecture and Design by Andrew Rollings Dave Morris

Reference Books:

1. Game Design: Theory & Practice by Richard Rouse III Illustrations by Steve Ogden, Foreword by Noah Falstein
2. The Art of Game Design by Jesse Schell, Morgan Kaufmann Publication
3. Game Programming Patterns by Robert Nystorm

Pattern of Question Paper:

Six units in the syllabus shall be divided in two equal parts i.e. 3 units in each part. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no. 1 from section A and Question no. 6 from section B, 10 marks each, will be compulsory.
4. From the remaining questions in section A and B students are supposed to solve any two questions, 15 marks each.

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Final Year Engineering (CSE)
Part-II

Course Code: CSE494 **Title: Elective-V Human Computer Interface**

Teaching Scheme:
Theory: 4 Hours/Week

Examination Scheme:
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:
1. GUI & basics
2. HTML & CSS
3. Basics of system design and programming

Objectives:
1. To learn capabilities of humans & computers from point of view of human information processing.
2. To learn HCI design principles, standards& guidelines.
3. To learn & analyze user models, socio-organizational issues & stakeholder requirements of HCI systems.
4. To analyze & discuss HCI issues in multimedia & World Wide Web related environment.

CONTENTS

SECTION-A

Unit 1: Introduction **[08 Hrs]**
The human, the computer, The interaction, Paradigms, Usability of Interactive Systems, Guidelines, Principles, and Theories.

Unit 2: Design Process **[06 Hrs]**
Interaction design basics, HCI in the software process, Design rules, managing design process

Unit 3: Implementation and Evaluation **[06 Hrs]**
Implementation support, Evaluation techniques, Universal design, User support, evaluating user interface design.

SECTION-B

Unit 4: Models **[08 Hrs]**
Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models.

Unit 5: Theories **[06 Hrs]**
Task analysis, Dialogue notations and design, Models of the system, modeling rich interaction.

Unit 6: Outside the Box **[06 Hrs]**
Group ware, Ubiquitous computing and augmented realities,

Hypertext, multimedia, and the World Wide Web, Direct Manipulation & Virtual environment.

Text Books:

1, “Human Computer Interaction” by Alan Dix, Janet Finlay, ISBN: 9788131717035, Pearson Education (2004) Third Edition.
2. “Designing the User Interface - Strategies for Effective Human Computer Interaction”, by Ben Shneiderman ISBN: 9788131732557, Pearson Education (2010) Fifth Edition

Pattern Of Question Paper:

Six units in the syllabus shall be divided in two equal parts i.e. 3 units in each part. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no. 1 from section A and Question no. 6 from section B, 10 marks each, will be compulsory.
4. From the remaining questions in section A and B students are supposed to solve any two questions, 15 marks each.

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Final Year Engineering (CSE)
Part-II

Course Code: CSE471 **Title: LAB-V Big Data Computing**

Teaching Scheme:
Practical: 2 Hours/Week

Examination Scheme:
Practical /Oral Examination: 50 Marks
Practical /Oral Examination (Duration): 03 Hours

Prerequisites:
Familiarity with intermediate Python or Java is advised. Most assignments could easily be done in Python, Scala, Java or R.

Instructions: Students need access to a computer with 64 bit operating system and at least 4 GB of RAM. Note: 8 GB or more RAM is strongly advised.

Suggestive List of Practical Assignments:
Design, develop and implement the following Assignments-

1. Import the following data into some statistical tool (R/SAS) and calculate the mean, median, mode and standard deviation

   The dataset looks like this:

	Rural Male	Rural Female	Urban Male	Urban Female
50-54	11.7	8.7	15.4	8.4
55-59	18.1	11.7	24.3	13.6
60-64	26.9	20.3	37.0	19.3
65-69	41.0	30.9	54.6	35.1
70-74	66.0	54.3	71.1	50.0

2. Perform Data wrangling, clean the data, Analyze and Visualize using appropriate type of graph on Some Dataset with some statistical tool (R/SAS).
3. Installation of Hadoop in Single Node, Pseudo Distributed Mode.
4. Hadoop: Installation of multi node cluster.
5. Write a Map Reduce program to count words from a given text file.
6. Perform a NOSQL analysis of a public data set using PIG Scripting.
7. Perform a NOSQL analysis of a public data set using HIVE Scripting.
8. Import data from a SQL database to HDFS using Sqoop.
9. Case study: Hadoop and Hive at Facebook.
10. Case study: Study & Installation of Cloudera CDH

Practical Examination: Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
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Final Year Engineering (CSE)
Part-II

Course Code: CSE472 **Title: LAB VI - Soft Computing**

Teaching Scheme:
Practical: 2 Hours/Week

Examination Scheme:
Practical /Oral Examination:50 Marks
Practical /Oral Examination (Duration): 03 Hours

Suggestive List of Practical Assignments:
Minimum 08 implementation assignments and two study assignments should be conducted.

1. Write a program to implement MP-model
2. Write a program for solving linearly separable and nonlinearly separable problems with single layer and multilayer perception.
3. Write a program to solve pattern recognition problem with FFNN using back Propagation algorithm.
4. Write a program to solve pattern storage problem with feedback NN
5. Write a program for deep learning (RNN/CNN).
6. Write a program to solve Face recognition problem using ANN as a classifier
7. Write a program to solve character recognition problem (or classification for medical database)
8. Write a program to implement Fuzzy set operation and properties.
9. Write a program to perform Max-Min composition of two matrices obtained from Cartesian Product.
10. Implementation of Simple Genetic Application

Practical Examination:
Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
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Final Year Engineering (CSE)
Part-II

Course Code: CSE473 **Title: LAB-VII Machine Learning**

Teaching Scheme:
Practical: 2 Hours/Week

Examination Scheme:
Practical /Oral Examination: 50 Marks
Practical /Oral Examination (Duration): 03 Hours

Design, develop and implement the following Assignments (Minimum 8)

Suggestive List of Practical Assignments:

1. Introduction to Python.
2. Implementation of Simple Linear Regression.
3. Implementation of Multivariate Linear Regression.
4. Implementation of Logistic Regression.
5. Implementation of Multivariate Logistic Regression.
6. Implementation of Support Vector Machines.
7. Implementation of K-Means Clustering.
8. Principal Components Analysis.
9. Study of Natural Language Toolkit (NLTK) a suite of libraries.
10. Study of basics of machine learning libraries Tensor Flow.

Practical Examination: Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF SCIENCE AND TECHNOLOGY
Final Year Engineering (CSE)
Part-II

Course Code: CSE474 **Title: LAB-VIII (Elective – V) Information & Cyber Security**

Teaching Scheme:
Practical: 02 Hours/Week

Examination Scheme:
Term Work: 50 Marks

Suggestive List of Practical Assignments:
Minimum 8 Assignments should be conducted

Design, develop and implement the following Assignments

1. Installation and demonstration of Nmap/Wireshark/any other security scanning tool.
2. Perform an experiment to demonstrate Nmap/ Wireshark/ any other security scanning tool.
3. Install & perform penetration testing using Metasploit tool.
4. Write a program in C++ or Java to implement RSA algorithm for key generation and cipher verification.
5. Install & perform an experiment using Samurai tool.
6. Write a java code to create antivirus & detect the virus.exe file.
7. Install & perform an experiment using MobSF (Mobile Security Framework) tool.
8. Install & perform Aircrack-ng for wireless password hacking.
9. Install & perform operations on Maltego tool.
10. Install & perform an experiment using HULK: DoS attack tool for the web server.
11. Visit Cyber Cell Forensic Lab & write a report of visit
12. Study of IT ACT 2000 & 2008 (Information Technology Amendment)
13. Case Study: Cyber Crime

Term Work:

The Term Work shall consist of at least 8 experiments / assignments based on the suggestive list of practical assignments. Assessment of term work should be done as follows:

- Continuous lab assessment
- Actual practical performance in laboratory

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
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Final Year Engineering (CSE)
Part-II

Course Code: CSE475 **Title: Lab VIII Elective-V-ERP**
Teaching Scheme **Examination Scheme:**
Practical: 2 Hours/Week Term Work: 50 Marks

List of Practical Assignments:
All Experiment are compulsory.

1. To study the basics of ERP system.
2. Study of ERP technologies and its ecosystem.
3. Study of different Management Information Systems (MIS).
4. Case study: Customer Relationship Management (CRM).
5. Study of different ERP modules.
6. Study of ERP implementation life cycle.
7. Study of open source ERP systems.
8. Case study on Integrated Enterprise applications.
9. Case study: SAP.
10. Case study: Microsoft Dynamics.

Note: Instructor may modify the list of assignments if required and can add more assignments if required

Term Work: The term work shall consist of at least 8 experiments/ assignments based on the syllabus above. Assessment of term work should be done as follows
1. Continuous lab assessment
2. Actual practical performance in Laboratory.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF SCIENCE AND TECHNOLOGY
Final Year Engineering (CSE)
Part-II

Course Code: CSE476 **Title: LAB VIII Elective-V- Game Architecture and Design**

Teaching Scheme: **Examination Scheme:**

Practical: 2 Hours/Week Term Work: 50 Marks

Suggestive List of Practical Assignments:

Design, develop and implement the following Assignments using Python programming

1. Introduction to python programming
2. Write an assignment on designing and developing games
3. Create your own story in graphics tool
4. Write an assignment on solving game development issues.
5. Write a program for sliding puzzle game
6. Write a program for nibbles game
7. Write a program for tic-tac-toe game
8. Write a program for connect four game
9. Write a program for abalone game
10. Write a program for Simon game
11. Write a program for memory puzzle game
12. Write an assignment on game analysis and play testing

Term Work: The term work shall consist of at least 8 experiments/ assignments based on the syllabus above. Assessment of term work should be done as follows
1. Continuous lab assessment
2. Actual practical performance in Laboratory.

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Final Year Engineering (CSE)
Part-II

Course Code: CSE477 **Title: LAB VIII Elective-V- Human Computer Interface**

Teaching Scheme: **Examination Scheme:**

Practical: 2 Hours/Week Term Work: 50Marks

Suggestive List of Practical Assignments:

Design, develop and implement the following Assignments.

1. Create a webpage with HTML describing your department. Use paragraph and list tags. Apply various colors to suitably distinguish key words. Also apply font styling like italics, underline and two other fonts to words you find appropriate. Also use header tags.
2. Create a webpage with HTML to illustrate the use of embedded multimedia.
3. Design a Signup form with validation using HTML.
4. Write a program to create menu using HTML & CSS. Apply CSS to change colors of certain text portion, bold, underline and italics certain words in your HTML web page. Also change background color of each paragraph using CSS.
5. Write a program to Show use of alert, confirm and prompt box as an interaction for user & computer.
6. Write a program to show the webpage layout with tags using HTML & CSS.
7. Create a responsive webpage for your college website using HTML, CSS & Bootstrap.
8. Case Study based on above syllabus.

Term Work:

The term work shall consist of at least 8 experiments/ assignments based on the syllabus above.
Assessment of term work should be done as follows:

1. Continuous lab assessment
2. Actual practical performance in Laboratory.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF ENGINEERING AND TECHNOLOGY
Final Year Engineering (CSE)
Part-II

Course Code: CSE478 **Title: Project Part II**
Teaching Scheme: **Examination Scheme:**
Practical: 08 Hours/Week **Term Wok: 50 Marks**
Practical /Oral Examination: 100 Marks
Practical /Oral Examination (Duration): 03 Hours

1. The guide should be internal examiner for oral examination.
2. The external examiner should be from the related area of the concerned project. He should have minimum of five years of experience at degree level / industry.
3. The evaluations at final oral examination should be done jointly by the internal and external examiner.
4. The same project group of Part I should continue the work in Part – II as well. The project group should complete the project work taken in Part I. It should complete the rest of the work from stage III onwards till the conclusion. The performance Analysis chapter should consist of various testing methods used along with sample test cases. It should also include how better the system is performing as compared to other similar systems. The final examination will consist of the demonstration of work which will be judged by two examiners (one internal and one external) and the marks will be given accordingly. The suggestive format of the report is as follows:

(Only one report should be submitted per group as a part of term work submission)

Title of the Project:

Names & Roll Numbers of the students:

Name of the guide:

Chapter 1: Introduction

Chapter 2: Literature Survey

Chapter 3: System Development
(This chapter will include the entire design process with necessary DFDs, other diagrams, design methodologies and other design and implementation details.)

Chapter 4: Performance Analysis

Chapter 5: Conclusions
(Detailed format of the project report is to be made available by the Dept.)