



**Bharati Vidyapeeth's**  
**College of Engineering Lavale, Pune-412115**  
**Department of Computer Engineering**

**Course Outcomes (BE 2019 Pattern)**

**Semester VII**

**410241: Design and Analysis of Algorithms**

- CO1: Formulate the problem
- CO2: Analyze the asymptotic performance of algorithms
- CO3: Decide and apply algorithmic strategies to solve given problem
- CO4: Find optimal solution by applying various methods
- CO5: Analyze and Apply Scheduling and Sorting Algorithms.
- CO6: Solve problems for multi-core or distributed or concurrent environments

**410242: Machine Learning**

- CO1: Identify the needs and challenges of machine learning for real time applications.
- CO2: Apply various data pre-processing techniques to simplify and speed up machine learning algorithms.
- CO3: Select and apply appropriately supervised machine learning algorithms for real time applications.
- CO4: Implement variants of multi-class classifier and measure its performance.
- CO5 :Compare and contrast different clustering algorithms.
- CO6: Design a neural network for solving engineering problems.

**410243: Blockchain Technology**

- CO1: Interpret the fundamentals and basic concepts in Blockchain
- CO2: Compare the working of different blockchain platforms
- CO3: Use Crypto wallet for cryptocurrency based transactions
- CO4: Analyze the importance of blockchain in finding the solution to the real-world problems.
- CO5: Illustrate the Ethereum public block chain platform
- CO6: Identify relative application where block chain technology can be effectively used and implemented.

**Elective III 410244(A): Pervasive Computing**

- CO1. Demonstrate fundamental concepts in pervasive computing.
- CO2. Explain pervasive devices and decide appropriate one as per the need of real time applications.
- CO3. Classify and analyze context aware systems for their efficiency in different ICT systems.
- CO4. Illustrate intelligent systems and generic intelligent interactive applications.
- CO5. Design HCI systems in pervasive computing environment.
- CO6. Explore the security challenges and know the role of ethics in the context of pervasive computing.

**Elective III 410244(B): Multimedia Techniques**

- CO1: Describe the media and supporting devices commonly associated with multimedia information and systems.
- CO2: Demonstrate the use of content-based information analysis in a multimedia information system.
- CO3: Critique multimedia presentations in terms of their appropriate use of audio, video, graphics, color, and other information presentation concepts.
- CO4: Implement a multimedia application using an authoring system.

CO5: Understanding of technologies for tracking, navigation and gestural control.

CO6: Implement Multimedia Internet of Things Architectures.

### **Elective III 410244(C): Cyber Security and Digital Forensics**

CO1: Analyze threats in order to protect or defend it in cyberspace from cyber-attacks.

CO2: Build appropriate security solutions against cyber-attacks.

CO3: Underline the need of digital forensic and role of digital evidences.

CO4: Explain rules and types of evidence collection

CO5: Analyze, validate and process crime scenes

CO6: Identify the methods to generate legal evidence and supporting investigation reports.

### **Elective III 410244(D): Object oriented Modeling and Design**

CO1: Describe the concepts of object-oriented and basic class modelling.

CO2: Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.

CO3: Choose and apply a befitting design pattern for the given problem

CO4: To Analyze applications, architectural Styles & software control strategies

CO5: To develop Class design Models & choose Legacy Systems.

CO6: To Understand Design Patterns

### **Elective III 410244(E): Digital Signal Processing**

CO1: Understand the mathematical models and representations of DT Signals and Systems

CO2: Apply different transforms like Fourier and Z-Transform from applications point of view.

CO3: Understand the design and implementation of DT systems as DT filters with filter structures and different transforms.

CO4: Demonstrate the knowledge of signals and systems for design and analysis of systems

CO5: Apply knowledge and use the signal transforms for digital processing applications

CO6: To understand Filtering and Different Filter Structures

### **Elective IV 410245(A): Information Retrieval**

CO1: Implement the concept of Information Retrieval

CO2: Generate quality information out of retrieved information

CO3: Apply techniques such as classification, clustering, and filtering over multimedia to analyze the information

CO4: Evaluate and analyze retrieved information

CO5: Understand the data in various Application and Extensions of information retrieval

CO6: Understand Parallel information retrieving and web structure.

### **Elective IV 410245(B): GPU Programming and Architecture**

CO1: Describe GPU architecture

CO2: Write programs using CUDA, identify issues and debug them.

CO3: Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication

CO4: Write simple programs using OpenCL

CO5: Identify efficient parallel programming patterns to solve problems

CO6: Explore the modern GPUs architecture and it's Applications.

### **Elective IV 410245(C): Mobile Computing**

CO1: Develop a strong grounding in the fundamentals of mobile Networks  
CO2: Apply knowledge in MAC, Network, and Transport Layer protocols of Wireless Network  
CO3: Illustrate Global System for Mobile Communications  
CO4: Use the 3G/4G technology based network with bandwidth capacity planning, VLR and HLR identification algorithms  
CO5: Classify network and transport layer of mobile communication  
CO6: Design & development of various wireless network protocols using simulation tools

#### **Elective IV 410245 (D): Software Testing and Quality Assurance**

CO1: Describe fundamental concepts in software testing such as manual testing, automation testing and software quality assurance.  
CO2: Design and Develop project test plan, design test cases, test data, and conduct test operations.  
CO3: Apply recent automation tool for various software testing for testing software.  
CO4: Apply different approaches of quality management, assurance, and quality standard to software system.  
CO5: Apply and analyze effectiveness Software Quality Tools.  
CO6: Apply tools necessary for efficient testing framework.

#### **Elective IV 410245(E): Compilers**

CO1: Design and implement a lexical analyzer using LEX tools  
CO2: Design and implement a syntax analyzer using YACC tools  
CO3: Understand syntax-directed translation and run-time environment  
CO4 : Generate intermediate codes for high-level statements.  
CO5 :Construct algorithms to produce computer code.  
CO6: Analyze and transform programs to improve their time and memory efficiency.

#### **410246: Laboratory Practice III**

CO1: Apply preprocessing techniques on datasets.  
CO2: Implement and evaluate linear regression and random forest regression models.  
CO3: Apply and evaluate classification and clustering techniques.  
CO4: Analyze performance of an algorithm.  
CO5: Implement an algorithm that follows one of the following algorithm design strategies: divide and conquer, greedy, dynamic programming, backtracking, branch and bound.  
CO6: Interpret the basic concepts in Blockchain technology and its applications

#### **410247: Laboratory Practice IV**

CO1: Apply android application development for solving real life problems  
CO2: Design and develop system using various multimedia components.  
CO3: Identify various vulnerabilities and demonstrate using various tools.  
CO4: Apply information retrieval tools for natural language processing  
CO5: Develop an application using open source GPU programming languages  
CO6: Apply software testing tools to perform automated testing

#### **410248: Project Work Stage I**

CO1: Solve real life problems by applying knowledge.  
CO2: Analyze alternative approaches, apply and use most appropriate one for feasible solution.

CO3: Write precise reports and technical documents in a nutshell.

CO4: Participate effectively in multi-disciplinary and heterogeneous teams exhibiting team work

CO5: Inter-personal relationships, conflict management and leadership quality.

#### **410249: Audit Course 7**

##### **410249: Audit Course 7 AC7 – I: MOOC-learn New Skill**

CO1: To acquire additional knowledge and skill.

##### **410249: Audit Course 7 AC7 – II: Entrepreneurship Development**

CO1: Understand the legalities in product development

CO2: Undertake the process of IPR, Trademarks, Copyright and patenting

CO3: Understand and apply functional plans

CO4: Manage Entrepreneurial Finance

CO5: Inculcate managerial skill as an entrepreneur

##### **410249: Audit Course 7 AC7 – III: Botnet of Things**

CO1: Implement security as a culture and show mistakes that make applications vulnerable to attacks.

CO2: Understand various attacks like DoS, buffer overflow, web specific, database specific, web - spoofing attacks.

CO3: Demonstrate skills needed to deal with common programming errors that lead to most security problems and to learn how to develop secure applications

##### **410249: Audit Course 7 AC7 – IV: 3D Printing**

CO1: Understand the basic knowledge of Shop Floor Safety rules and regulations basics of Machine tools and 3D printing machines

CO2: Understand the concept of concept of technical sketching, multi-view drawings, Lettering, tolerance, and metric construction

CO3: Identify and Distinguish drafting terminologies and construction of geometrical figures using drawing instruments, procedure to prepare a drawing sheet as per SP-46:2003

CO4: Describe and Explain practical aspects to generate detailed and assembly views with dimensions, annotations, in 3D Modeling software.

CO5: Apply concepts and Fabricate the simple mechanical parts, prototype/ end use product for 3D Printing

##### **410249: Audit Course 7 AC7 – V: Industrial Safety and Environment Consciousness**

CO1: Develop the plan for Safety performance

CO2: Demonstrate the action plan for accidents and hazards

CO3: Apply the safety and security norms in the industry

CO4: Evaluate the environmental issues of Industrialization

### **Semester VIII**

#### **410250: High Performance Computing**

CO1: Understand various Parallel Paradigm

CO2: Design and Develop an efficient parallel algorithm to solve given problem

CO3: Illustrate data communication operations on various parallel architecture

CO4: Analyze and measure performance of modern parallel computing systems

CO5: Apply CUDA architecture for parallel programming

CO6: Analyze the performance of HPC applications

#### **410251: Deep Learning**

CO1: Understand the basics of Deep Learning and apply the tools to implement deep learning applications  
CO2: Evaluate the performance of deep learning models (e.g., with respect to the bias-variance trade-off, overfitting and underfitting, estimation of test error).  
CO3: To apply the technique of Convolution (CNN) and Recurrent Neural Network (RNN) for implementing Deep Learning models  
CO4: To implement and apply deep generative models.  
CO5: Construct and apply on-policy reinforcement learning algorithms  
CO6: To Understand Reinforcement Learning Process

#### **Elective V 410252(A): Natural Language Processing**

CO1: Describe the fundamental concepts of NLP, challenges and issues in NLP  
CO2: Analyze Natural languages morphologically, syntactical and semantically OR Describe the concepts of morphology, syntax, semantics of natural language  
CO3: Illustrate various language modelling techniques  
CO4: Integrate the NLP techniques for the information retrieval task  
CO5: Demonstrate the use of NLP tools and techniques for text-based processing of natural languages  
CO6: Develop real world NLP applications

#### **Elective V 410252 (B): Image Processing**

CO1: Apply Relevant Mathematics Required for Digital Image Processing.  
CO2: Apply Special and Frequency Domain Method for Image Enhancement.  
CO3: Apply algorithmic approaches for Image segmentation.  
CO4: Summarize the Concept of Image Compression and Object Recognition.  
CO5: Explore the Image Restoration Techniques.  
CO6: Explore the Medical and Satellite Image Processing Applications.

#### **Elective V 410252(C): Software Defined Networks**

CO1: Interpret the need of Software Defined networking solutions.  
CO2: Analyze different methodologies for sustainable Software Defined Networking solutions.  
CO3: Select best practices for design, deploy and troubleshoot of next generation networks.  
CO4: Develop programmability of network elements.  
CO5: Demonstrate virtualization and SDN Controllers using Open Flow protocol  
CO6: Design and develop various applications of SDN

#### **Elective V 410252(D): Advanced Digital Signal Processing**

CO1: Understand and apply different transforms for the design of DT/Digital systems  
CO2: Explore the knowledge of adaptive filtering and Multi-rate DSP  
CO3: Design DT systems in the field/area of adaptive filtering, spectral estimation and multi-rate DSP  
CO4: Explore use of DCT and WT in speech and image processing  
CO5: Develop algorithms in the field of speech , image processing and other DSP applications  
CO6: Identify Image Processing Techniques

#### **Elective V 410252(E): Open Elective I**

The open elective included, so as to give the student a wide choice of subjects from other Engineering Programs. To inculcate the out of box thinking and to feed the inquisitive minds of the learners the idea of open elective is need of the time. Flexibility is extended with the choice of open elective allows the learner to choose interdisciplinary/exotic/future technology related courses to expand the knowledge horizons. With this idea learner opts for the course without any boundaries to choose the approved by academic council and Board of Studies

#### **Elective VI 410253(A): Pattern Recognition**

CO1: Analyze various type of pattern recognition techniques  
CO2: Identify and apply various pattern recognition and classification approaches to solve the problems  
CO3: Evaluate statistical and structural pattern recognition  
CO4: Percept recent advances in pattern recognition confined to various applications  
CO5: Implement Bellman's optimality principle and dynamic programming  
CO6: Analyze Patterns using Genetic Algorithms & Pattern recognition applications.

#### **Elective VI 410253(B): Soft Computing**

CO1: Understand requirement of soft computing and be aware of various soft computing techniques.  
CO2: Understand Artificial Neural Network and its characteristics and implement ANN algorithms.  
CO3: Understand and Implement Evolutionary Computing Techniques.  
CO4: Understand the Fuzzy logic and Implement fuzzy algorithms for solving real life problems.  
CO5: Apply knowledge of Genetic algorithms for problem solving.  
CO6: Develop hybrid systems for problem solving.

#### **Elective VI 410253(C): Business Intelligence**

CO1: Differentiate the concepts of Decision Support System & Business Intelligence  
CO2: Use Data Warehouse & Business Architecture to design a BI system.  
CO3: Build graphical reports  
CO4: Apply different data preprocessing techniques on dataset  
CO5: Implement machine learning algorithms as per business needs  
CO6: Identify role of BI in marketing, logistics, and finance and telecommunication sector

#### **Elective VI 410253(D): Quantum Computing**

CO1: To understand the concepts of Quantum Computing  
CO2: To understand and get exposure to mathematical foundation and quantum mechanics  
CO3: To understand and implement building blocks of Quantum circuits  
CO4: To understand quantum information, its processing and Simulation tools  
CO5: To understand basic signal processing algorithms FT, DFT and FFT  
CO6 : To study and solve examples of Quantum Fourier Transforms and their applications

#### **Elective IV 410253(E): Open Elective II**

The open elective included, so as to give the student a wide choice of subjects from other Engineering Programs. To inculcate the out of box thinking and to feed the inquisitive minds of the learners the idea of open elective is need of the time.

Flexibility is extended with the choice of open elective allows the learner to choose interdisciplinary/exotic/future technology related courses to expand the knowledge horizons.

With this idea learner opts for the course without any boundaries to choose the approved by academic council and Board of Studies.

#### **410254: Laboratory Practice V**

CO1: Analyze and measure performance of sequential and parallel algorithms.

CO2: Design and Implement solutions for multicore/Distributed/parallel environment.

CO3: Identify and apply the suitable algorithms to solve AI/ML problems.

CO4: Apply the technique of Deep Neural network for implementing Linear regression and classification.

CO5: Apply the technique of Convolution (CNN) for implementing Deep Learning models.

CO6: Design and develop Recurrent Neural Network (RNN) for prediction.

#### **410255: Laboratory Practice VI**

CO1: Apply basic principles of elective subjects to problem solving and modeling.

CO2: Use tools and techniques in the area of software development to build mini projects

CO3: Design and develop applications on subjects of their choice.

CO4: Generate and manage deployment, administration & security.

#### **410256: Project Work Stage II**

CO1: Show evidence of independent investigation

CO2: Critically analyze the results and their interpretation.

CO3: Report and present the original results in an orderly way and placing the open questions in the right perspective.

CO4: Link techniques and results from literature as well as actual research and future research lines with the research.

CO5: Appreciate practical implications and constraints of the specialist subject

#### **410257: Audit Course 8**

##### **410257: Audit Course 8 AC8 – I: Usability Engineering**

CO1: Describe the human centered design process and usability engineering process and their roles in system design and development.

CO2: Discuss usability design guidelines, their foundations, assumptions, advantages, and weaknesses.

CO3: Design a user interface based on analysis of human needs and prepare a prototype system.

CO4: Assess user interfaces using different usability engineering techniques.

CO5: Present the design decisions

##### **410257: Audit Course 8 AC8 – II: Conversational Interfaces**

CO1: Develop an effective interface for conversation

CO2: Explore advanced concepts in user interface

##### **410257: Audit Course 8 AC8–III: Social Media And Analytics**

CO1: Develop a far deeper understanding of the changing digital land scape.

CO2: Identify some of the latest digital marketing trends and skill sets needed for today's marketer.

CO3: Successful planning, prediction, and management of digital marketing campaigns  
CO4: Assess user interfaces using different usability engineering techniques.  
CO5: Implement smart management of different digital assets for marketing needs.

**410257: Audit Course 8 AC8 – IV: MOOC-learn New Skill**

CO1: Have the ability to communicate confidently and clearly in the Japanese language.  
CO2: Understand the nature of Japanese script.  
CO3: Get introduced to reading, writing and listening skills.  
CO4: Develop interest to pursue further study, work and leisure.

**410257: Audit Course 8 AC8 – V: Emotional Intelligence**

CO1: To acquire additional knowledge and skill.