



Karmaveer Bhaurao Patil University, Satara

Syllabus for

B.Voc.-III (Software Development)

Under

Faculty of Science and Technology

With effect from Academic Year 2026-2027

Syllabus for Bachelor of Vocational Software Development:

PREAMBLE:

This syllabus is framed to give sound knowledge with an understanding of Software Development to undergraduate students in Third year of B.Voc. Degree course. It has been designed to meet the specific needs of B.Voc. Software Development students.

The University Grants Commission (UGC) has launched a scheme on skills development based higher education as part of college/university education, leading to Bachelor of Vocational (B.Voc.) Degree with multiple exits such as Diploma/Advanced Diploma under the NSQF.

The proposed vocational programme in Software Development will be a judicious mix of skills, professional education related to Software Development and also appropriate content of general education. It is designed with the objective of equipping the students to cope with the emerging trends and challenges in the Software Development environment.

General Objective of the Programme:

- 1) Provide students with strong programming foundations in languages like Python, Java, C++ and C#.
- 2) Learn to design, develop and maintain web applications, mobile apps and database-driven systems.
- 3) Gain knowledge of modern domains such as Cloud Computing, Big Data, Data Analytics, IoT and Machine Learning.
- 4) Maintain a curriculum split (typically ~60% skill development / practical labs and ~40% general education) to ensure practical proficiency alongside critical thinking.
- 5) Enhance professional communication, problem-solving, logical reasoning and team-based development practices.
- 6) Prepare students for agile workplace dynamics, client interactions and project management.
- 7) Prepare graduates for direct placement in IT companies through mandatory internships, live industry projects and hands-on lab work.

General Outcome of the Programme:

The student will be able to...

- 1) **GPO1:** Apply fundamental programming principles, data structures and algorithms to design and develop software solutions
- 2) **GPO2:** Build, deploy and maintain dynamic web, desktop and mobile applications using modern frameworks and database management systems.
- 3) **GPO3:** Analyze real-world problems and execute all phases of the Software Development Life Cycle (SDLC), including requirements gathering, architecture design, testing and debugging.
- 4) **GPO4:** Use industry-standard tools, environments, version control systems (e.g., Git) and modern deployment pipelines.
- 5) **GPO5:** Collaborate effectively in multidisciplinary project teams using modern methodologies like Agile or Scrum.
- 6) **GPO6:** Acquire technical concepts clearly through written documentation, client interaction and structured technical presentations.
- 7) **GPO7:** Demonstrate self-directed learning to adapt to rapidly evolving tech frameworks, languages and modern domains like Cloud, Data Analytics and AI.

Programme Specific Objective:

- 1) Learn the principles of information security, risk management and the governance of information systems to protect digital assets and organizational infrastructure.
- 2) Equip learners with comprehensive theoretical frameworks and hands-on laboratory techniques in software testing, mobile application development.
- 3) Introduce core managerial concepts in Human Resource Management and Entrepreneurship Development to bridge technical execution with business acumen.
- 4) Integrate advanced technologies in Digital Image Processing (DIP), Machine Learning, Big Data Analysis and Augmented/Virtual Reality (AR/VR) to build intelligent and immersive applications.

Programme Specific Outcome:

The student will be able to...

- 1) Write secure code and applications using modern frameworks and languages to build functional software systems, mobile applications and digital platforms across various domains.
- 2) Create structured information systems and databases to handle large volumes of data securely, leveraging advanced tools and data processing techniques.
- 3) Analyze complex system requirements, security protocols and business needs to design scalable software architectures and manage projects from conception to completion.
- 4) Write scripts and implement advanced technologies like Machine Learning, Big Data Analysis, Digital Image Processing and AR/VR to solve real-world technical problems.
- 5) Use management principles, human resource strategies and entrepreneurship development frameworks to make smart business decisions and promote tech solutions effectively.
- 6) Explore hands-on practice in specialized computer labs (Software Testing, Mobile App Dev, DIP).

1. TITLE: B.Voc. (Software Development) Part III

2. YEAR OF IMPLEMENTATION: From 2026-2027

3. DURATION: 01 year

4. PATTERN: Semester

5. MEDIUM OF INSTRUCTION: English

6. COURSE STRUCTURE:

B.Voc.-III Semester - V

General				Skill			
No.	Title	Credit	Hrs/ Week	No.	Title	Credit	Hrs/ Week
VS 351	Information Security	4	4	VS 354	Software Testing	4	4
VS 352	Management Information System	4	4	VS 355	Mobile Application Development	4	4
VS 353	IT and Society	4	4	VS 356	Digital Image Processing	4	4
				VS 357	Lab: Software Testing	2	4
				VS 358	Lab: Mobile Application Development	2	4
				VS 359	Lab: Digital Image Processing	2	4
	Total	12	12		Total	18	24

B.Voc.-III Semester – VI

General				Skill			
No.	Title	Credit	Hrs/ Week	No.	Title	Credit	Hrs/ Week
VS 361	Human Resource Management	4	4	VS 364	Big Data Analysis	4	4
VS 362	Free and Open-Source software	4	4	VS 365	Augmented and Virtual Reality	4	4
VS 363	Entrepreneurship Development	4	4	VS 366	Machine Learning	4	4
				VS 367	Lab: Big Data analysis and Machine Learning	2	4
				VS 368	Lab: AR-VR	2	4
				VS 369	Major Project	2	4
	Total	12	12		Total	18	24

7. EVALUATION STRUCTURE

B.Voc. – III

Sem	Paper Code	Subject	General/Skill	Credit	Cont. Hrs.	Marks ESE	Marks ISE	Total Marks
V	VS 351	Information Security	General	4	60	60	40	100
	VS 352	Management Information System	General	4	60	60	40	100
	VS 353	IT and Society	General	4	60	60	40	100
	VS 354	Software Testing	Skill	4	60	60	40	100
	VS 355	Mobile Application Development	Skill	4	60	60	40	100
	VS 356	Digital Image Processing	Skill	4	60	60	40	100
	VS 357	Lab : Software Testing	Skill	2	60	40	30	70
	VS 358	Lab : Mobile Application Development	Skill	2	60	40	30	70
	VS 359	Lab : Digital Image Processing	Skill	2	60	40	20	60
VI	VS 361	Human Resource Management	General	4	60	60	40	100
	VS 362	Free and Open Source Software	General	4	60	60	40	100
	VS 363	Entrepreneurship Development	General	4	60	60	40	100
	VS 364	Big Data Analysis	Skill	4	60	60	40	100
	VS 365	Augmented and virtual Reality	Skill	4	60	60	40	100
	VS 366	Machine Learning	Skill	2	60	60	40	100
	VS 367	Lab : Big data Analysis and Machine Learning	Skill	2	60	40	30	70
	VS 368	Lab : AR-VR	Skill	2	60	40	30	70
	VS 369	Major Project	Skill	2	60	60	-	60
		Total		60		980	620	1600



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(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science & Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computational Sciences

Programme: B.Voc. (Soft. Dev.)

Semester – V

Type: General

Marks: 100

Credits: 4

From: A.Y. 2026-27

Name of the Course and Code: Information Security (VS 351)

Course Objectives: Students should be able to...

- 1) Learn the fundamental concepts of information security.
- 2) Understand security principles and techniques to protect systems from threats and attacks.
- 3) Utilize various cryptographic methods and security tools for securing information and communication.
- 4) Interpret security policies, risk management strategies and ethical issues in information security.

Course Outcomes: Students will be able to...

- 1) Implement security policies, controls and access management systems.
- 2) Formulate risk mitigation strategies and incident response plans.
- 3) Develop secure systems and applications ensuring confidentiality, integrity and availability of information.
- 4) Execute security mechanisms and cryptographic techniques to protect data.

Module	Title and Contents	Hrs
Module -1:	Fundamentals of Information Security 1.1 Definition of Information Security, Importance, Goals, Terminology. 1.2 Types of Security, Security Services and mechanisms, Types of Threats and Attacks. 1.3 Cryptographic Techniques: Conventional substitution and transposition ciphers, One-time Pad, Block cipher and Stream Cipher. 1.4 Basic Security Mechanisms: Security Policies and Governance, Legal and Ethical Aspects, Security Challenges.	15
Module -2:	Cryptographic Techniques and Applications 2.1 DES, AES, RSA algorithms: Definition, Features, Working of algorithms, Advantages, Disadvantages, Applications. 2.2 Authentication: Objectives, Types, Authentication Process and Digital Signatures: Objectives, Types, Components, Working. 2.3 Cryptography for authentication: Need, Cryptographic Techniques. 2.4 Secure Hash function: Common Secure Hash Algorithms, Key management –Kerberos.	15
Module -3:	Program Security 3.1 Secure Programming Concepts. 3.2 Programming Vulnerabilities: Buffer overflow, incomplete mediation, Time-of-check to Time-of- useErrors. 3.3 Malware and Software Attacks: Viruses, Worms, Trapdoors, Salami attack. 3.4 Network and Communication Attacks: Man-in-the- middle attacks, Covert channels.	15

Module -4:	Security in Networks 4.1 Network Security Fundamentals, Threats and Controls: Network Security Threats, Types of Network Attacks, Network Security Controls. 4.2 Architecture, Encryption, Content Integrity, Strong Authentication. 4.3 Network Access Security and Wireless Protection: Access Control Mechanism, Wireless Network Security, Honeypots and Honeynets, Traffic Flow Security. 4.4 Firewalls: Types, Firewall Architecture, IDS, Email Security :PGP,S/MIME.	15
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Reference Books:-

- 1) Kennedy, David, Jim O'Gorman, Devon Kearns and Mati Aharoni. Metasploit: The Penetration Tester's Guide. San Francisco: No Starch Press, 2026.
- 2) Kim, Peter. The Hacker Playbook 3: Practical Guide to Penetration Testing. Independent, 2026.
- 3) Singh, Tarnveer and Sarah Y. Zheng. The Psychology of Cybersecurity: Hacking and the Human Mind. 1st ed. London: Routledge, 2025.
- 4) Loi, Michele. The Ethics of Cybersecurity. 1st ed. Cham: Springer, 2020.
- 5) Douglas, Ken. Cyber Security for Beginners: Understanding Cyber security and Ways to Protect Yourself. 1st ed., 2020.

Evaluation Pattern:

Total Marks: 100

Continuous and Comprehensive Evaluation (40 Marks): • CCE - I : 20 Marks: Activity • CCE - II: 20 Marks: Activity • CCE - III: 20 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (60 Marks): • Question-1: Solve the following questions (Six questions of 2 Marks) Compulsory • Attempt any four questions from Q. 2 to Q. 7 (each questions carry 12 marks)
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Faculty of Science & Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computational Sciences

Programme: B.Voc. (Soft. Dev.)

Semester - V

Type: General

Marks: 100

Credits: 4

From: A. Y. 2026-27

Name of the Course and Code: Management Information System (VS 352)

Course Objectives: Students should be able to...

- 1) Use information system tools and techniques to improve business processes.
- 2) Utilize various MIS technologies, databases and software for effective data management and reporting.
- 3) Interpret organizational data for better planning and control.
- 4) Learn the fundamental concepts of Management of Information Systems.

Course Outcomes: Students will be able to...

- 1) Analyze business information needs and processes.
- 2) Execute MIS tools for data handling and reporting.
- 3) Implement systems to improve business operations.
- 4) Formulate strategies for effective information management.

Module	Title and Contents	Hrs
Module -1:	Introduction to Information System 1.1 Definition, need, Characteristics of Information System. 1.2 Components of Information System. 1.3 Types of Information Systems. 1.4 Role of information System.	15
Module -2:	Decision Making 2.1 Decision Making Concepts, Types, Decision Making Process. 2.2 Role of MIS in Decision Making. 2.3 Techniques in Decision Making: Group Decision Making, Data-Driven Decision Making. 2.4 Different Management Levels: Top Level Management, Middle Level Management, Operational Level Management.	15
Module -3:	Introduction to Level Information Systems 3.1 Operational Level Information Systems. 3.2 Transaction Processing System (TPS): Need, Characteristics, Components. 3.3 Knowledge Work System (KWS). 3.4 KWS (Knowledge Work System). 3.5 DSS and ESS: Need, Characteristics, Components.	15
Module -4:	Introduction to Applications of MIS 4.1 Financial Information System: Need, Importance, Characteristics, Accounting Information System. 4.2 Human Resource Information System: Need, Importance, Characteristics, Employee Database Management. 4.3 Production Information System: Need, Importance, Manufacturing Resource Planning. 4.4 Marketing Information System: Need, Importance, Characteristics, Customer	15

	Relationship Management.	
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Reference Books:-

- 1) Laudon, Kenneth C. and Jane P. Laudon. Management Information Systems: Managing the Digital Firm. 17th ed. Noida: Pearson Education, 2022.
- 2) Laudon, Kenneth C. and Jane P. Laudon. Management Information Systems: Managing the Digital Firm. 17th ed. Pearson Education, 2021.
- 3) Laudon, Kenneth C. and Jane P. Laudon. Essentials of Management Information Systems. 14th global ed. Boston: Pearson, 2020.
- 4) Stair, Ralph and George Reynolds. Principles of Information Systems. 13th ed. Boston: Cengage Learning, 2019.
- 5) Effy Oz. Management Information Systems. 8th ed. Boston: Cengage Learning, 2018.

Evaluation Pattern:**Total Marks: 100****Continuous and Comprehensive Evaluation
(40 Marks):**

- CCE - I : 20 Marks: Activity
- CCE - II: 20 Marks: Activity
- CCE - III: 20 Marks: MCQ Test
(Best of 2 from CCE I, II & III Selected for final Score)

End Semester Examination (60 Marks):

- Question-1: Solve the following questions (Six questions of 2 Marks) Compulsory
- Attempt any four questions from Q. 2 to Q. 7 (each questions carry 12 marks)



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Board of Studies in Computational Sciences

Programme: B.Voc. (Soft. Dev.)

Semester – V

Type : General

Marks:100

Credits : 4

From: A. Y. 2026-27

Name of the Course and Code: IT and Society (VS 353)

Course Objectives: Students should be able to...

- 1) Learn the fundamental concepts of Information Technology and its impact on society, culture and economy.
- 2) Use IT tools and digital technologies in everyday life and professional settings.
- 3) Utilize modern communication systems for social and organizational development.
- 4) Interpret the social, legal and ethical issues related to Information Technology.

Course Outcomes: Students will be able to...

- 1) Execute the use of IT tools and digital platforms in real-life and professional scenarios.
- 2) Implement ethical, legal and responsible practices while using information systems.
- 3) Formulate solutions for social and organizational issues using Information Technology.
- 4) Develop awareness of digital citizenship, cyber laws and emerging IT trends affecting society.

Module	Title and Contents	Hrs
Module -1:	Introduction to IT and Society 1.1 Definition: Profession and Professional, Role and Responsibilities of IT Professionals, Core qualities of IT Professionals. 1.2 IT Environment and its Components, Impact of IT on Society, Complexity of IT Environment. 1.3 Social attitudes, beliefs and values, IT Governance. 1.4 IT Risk Management and Compliance: Introduction, Risk Identification and Assessment, Compliance and Regulatory Requirements.	15
Module -2:	Ethics 2.1 Importance of Ethics, Professional Ethics, Codes of ethics, solving ethical conflicts. 2.2 Moral reasoning, Ethical theories: Utilitarianism, Deontology, Virtue Ethics, Computer ethics. 2.3 Ethics and the internet, Hacking, Netiquette. 2.4 Privacy and Data Protection, Ethical Issues Related to Privacy, Emotional Intelligence, Concept of business ethics.	15
Module -3:	Quality Management 3.1 Introduction to Quality Management: Need and Importance, Total quality Management. 3.2 Quality Statements, Quality Policy, Quality Planning Process 3.3 Six Sigma Principles, ISO certifications. 3.4 Component maturity models, CMM Levels, Quality Control Tools.	15
Module -4:	Cyber Law 4.1 Introduction to Cyber Law, Need of Cyber Law. 4.2 Cyber Crimes and Legal Issues.	15

	4.3 Intellectual property rights: Types. 4.4 Copyrights applied for software. 4.5 Indian copyright law, provisions for software, various licensing models. 4.6 Software Patents, Patent Laws Related to Software, Free Software Concept, Open Source Software.	
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Reference Books:-

- 1) Heap, Nick, ed. Information Technology and Society. 2023 ed. London: SAGE Publications, 2023.
- 2) Macionis, John J. Society: The Basics. 16th ed. New York: Pearson, 2022.
- 3) Yates, Jon. Fractured: Why Our Societies Are Coming Apart and How We Put Them Back Together Again. Manchester: HarperNorth, 2021.
- 4) Boyd, Danah. It's Complicated: The Social Lives of Networked Teens. New Haven, CT: Yale University Press, 2014.
- 5) Dutton, William H., ed. The Oxford Handbook of Internet Studies. Oxford: Oxford University Press, 2013.

Evaluation Pattern:

Total Marks: 100

Continuous and Comprehensive Evaluation (40 Marks): • CCE - I : 20 Marks: Activity • CCE - II: 20 Marks: Activity • CCE - III: 20 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (60 Marks): • Question-1: Solve the following questions (Six questions of 2 Marks) Compulsory • Attempt any four questions from Q. 2 to Q. 7 (each questions carry 12 marks)
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Board of Studies in Computational Sciences

Programme: B.Voc. (Soft. Dev.)

Semester - V

Type: Skill

Marks: 100

Credits: 4

From: A. Y. 2026-27

Name of the Course and Code: Software Testing (VS 354)

Course Objectives: Students should be able to...

- 1) Utilize testing tools, frameworks and bug tracking systems to ensure software quality and reliability.
- 2) Interpret test results, defect reports and quality metrics to improve software performance and maintainability.
- 3) Understand manual and automated testing techniques in real-world software projects.
- 4) Learn the fundamental concepts of software testing, including testing principles, life cycle and different testing techniques.

Course Outcomes: Students will be able to...

- 1) Implement various testing techniques such as unit, integration, system and regression testing.
- 2) Formulate test plans, test scenarios and defect reporting methods for quality assurance.
- 3) Develop automated test scripts and frameworks to ensure software reliability and performance
- 4) Execute manual and automated test cases using appropriate testing tools.

Module	Title and Contents	Hrs
Module -1:	Introduction to Software Testing 1.1 Definition, Objectives, Importance of Software Testing. 1.2 Testing Principles, Roles and Responsibilities of Software Tester. 1.3 Software Testing Models: V-Model, Relationship between Development and Testing Phases, Test Case Generation. 1.4 Software Testing Life Cycle: Phases of STLC, Defect Life Cycle.	15
Module -2:	Types of Testing 2.1 Testing Strategies, Testing Levels: Unit Testing, Integration Testing, System Testing, Acceptance Testing. 2.2 Smoke and Regression Testing, Functional Testing vs Non-Functional Testing. 2.3 Categorization of testing methods, Testing Tools. 2.4 Non-Functional Testing: Performance Test, Memory Test, Scalability and Compatibility Test.	15
Module -3:	Software Testing Life Cycle 3.1 Requirements Analysis/Design, Traceability Matrix. 3.2 Test Case Design and Development: Test Case Design Process, Test Scenario Identification, Test Data Preparation. 3.3 Scope of Testing, Schedule, Quality Objectives, Entry & Exit Criteria. 3.4 Testing Assumptions, Testing Risks and Mitigation Strategies, Test Automation, Test Deliverables: Test Plan, Test Cases, Test Reports, Defect Reports.	15
Module -4:	Test Cases Design	

	4.1 Test Case Design Fundamentals: Introduction to Test Cases, Importance and Purpose of Test Cases, Writing Test Cases, Test Case Review Process, Test Case Template and Documentation. 4.2 Test Scenarios and Test Case Types: Types of Test Cases, Difference between Test Scenarios and Test Cases, Test Scenario Identification. 4.3 Test Environment: Setup, Configuration, Execution. 4.4 Data and Resource Requirements: Hardware and software requirements, Test Data.	15
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Reference Books: -

1. Ammann, Paul and Jeff Offutt. Introduction to Software Testing. 3rd ed. Cambridge: Cambridge University Press, 2026.
2. Homès, Bernard. Fundamentals of Software Testing. 2nd ed. Hoboken: Wiley-ISTE, 2024.
3. Aniche, Maurício. Effective Software Testing. Shelter Island: Manning Publications, 2022.
4. Khorikov, Vladimir. Unit Testing: Principles, Practices and Patterns. Shelter Island: Manning Publications, 2020.
5. Ammann, Paul and Jeff Offutt. Introduction to Software Testing. Cambridge: Cambridge University Press, 2017.

Evaluation Pattern:

Total Marks: 100

Continuous and Comprehensive Evaluation (40 Marks): • CCE - I : 20 Marks: Activity • CCE - II: 20 Marks: Activity • CCE - III: 20 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (60 Marks): • Question-1: Solve the following questions (Six questions of 2 Marks) Compulsory • Attempt any four questions from Q. 2 to Q. 7 (each questions carry 12 marks)
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Board of Studies in Computational Sciences

Programme: B.Voc. (Soft. Dev.)

Semester - V

Type : Skill

Marks: 100

Credits : 4

From: A. Y. 2026-27

Name of the Course and Code: Mobile Application Development (VS 355)

Course Objectives: Students should be able to...

- 1) Learn the fundamental concepts of mobile application development including mobile platforms, UI/UX design principles and application life cycle.
- 2) Understand programming skills and development frameworks to design mobile applications for Android and/or iOS platforms.
- 3) Utilize mobile development tools for creating interactive mobile applications.
- 4) Interpret user requirements, application performance to improve usability and reliability of mobile apps.

Course Outcomes: Students will be able to...

- 1) Execute mobile application development using appropriate tools, languages and frameworks.
- 2) Implement user interfaces, business logic and database connectivity in mobile apps.
- 3) Formulate strategies for testing and optimizing mobile application performance.
- 4) Develop fully functional mobile applications using SDKs, APIs and modern development practices.

Module	Title and Contents	Hrs
Module -1:	Introduction to Android Development 1.1 Android operating System: Introduction, History, Features, Advantages & Disadvantages. 1.2 Open Handset Alliance (OHA), Android as an Open Source Mobile Platform. 1.3 Categories of Android applications. 1.4 Android Architecture: Layers of Android Architecture.	15
Module -2:	Android Development Tools 2.1 Eclipse integrated development environment (IDE), application development tools (ADT) plugin. 2.2 Emulators and Devices: Android virtual devices (AVDs), Dalvik Virtual Devices, Difference between JVM and DVM. 2.3 Connecting Androids to the development platform, USB drivers for Android development. 2.4 Android Development Lifecycle: "Hello World!", Running on the emulator, running on a device.	15
Module -3:	XML Fundamentals 3.1 Introduction to XML in Android, Activity Lifecycles: Callbacks and activity pyramids, Components of a screen. 3.2 Linear Layout, Absolute Layout, Frame Layout, Table Layout, Relative Layout. 3.3 Fundamental UI design: View and View Group-Text view, Image and Scroll View ,Edit Text, Button, Image Button, Toggle Button, Radio Button and	15

	Radio Group, Checkbox. 3.4 Progress Bar, Grid, Custom Toast Alert. Time and Date Picker.	
Module -4:	Interaction with Other Apps and Data Storage 4.1 Interaction with Other Apps, Location-Aware Apps, Play Audio and Video, Photos and Video. 4.2 Intent, Intent Filter, SQLite Database, necessity of SQLite, Creation & Connection of database. 4.3 Application Deployment: Creating Small Application. 4.4 Signing of application, Deploying app on Google Play Store.	15
Reference Books:- 1) Darwin, Ian F. Android Cookbook: Problems and Solutions for Android Developers. 3rd ed. Sebastopol, CA: O'Reilly Media, 2026. 2) Williams, Trevor. .NET MAUI Mobile App Development. Birmingham: Packt Publishing, 2022. 3) Windmill, Eric. Flutter in Action. Shelter Island: Manning Publications, 2020. 4) Cornell, Scott. Flutter in Motion. Shelter Island: Manning Publications, 2019. 5) Bakshi, Tanmay. Hello Swift! Shelter Island: Manning Publications, 2019.		
Evaluation Pattern:		
Total Marks: 100		
Continuous and Comprehensive Evaluation (40 Marks): - CCE - I : 20 Marks: Activity - CCE - II: 20 Marks: Activity - CCE - III: 20 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)		End Semester Examination (60 Marks): - Question-1: Solve the following questions (Six questions of 2 Marks) Compulsory - Attempt any four questions from Q. 2 to Q. 7 (each questions carry 12 marks)



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Board of Studies in Computational Sciences

Programme: B.Voc.(Soft. Dev.)

Semester - V

Type : Skill

Marks: 100

Credits : 4

From: A. Y. 2026-27

Name of the Course and Code: Digital Image Processing (VS 356)

Course Objectives: Students should be able to...

- 1) Learn the fundamental concepts of digital image processing.
- 2) Use image processing algorithms.
- 3) Utilize image processing tools, libraries and software for developing applications.
- 4) Interpret processed image outputs, histograms and feature data to analyse image quality.

Course Outcomes: Students will be able to...

- 1) Analyze digital images to extract meaningful features and understand image characteristics.
- 2) Execute image processing techniques such as enhancement, restoration and transformation.
- 3) Implement algorithms for filtering, segmentation and feature extraction.
- 4) Formulate solutions for real-world image processing problems using appropriate methods.

Module	Title and Contents	Hrs
Module -1:	Fundamentals of Computer Graphics and Image processing: 1.1 Introduction of Coordinate representation, Pixel Raster Scan & Random Scan systems, Video controller. 1.2 Raster scan display processor& its applications, Image processing system Components, Image sensing and acquisition. 1.3 Sampling and quantization, Neighbors of pixel adjacency connectivity. 1.4 Regions and boundaries, Distance measures.	15
Module -2:	Fundamentals of Image Enhancement 2.1 Image Enhancement: Introduction, Need, Objectives, Applications, Enhancement Techniques. 2.2 Image Filtering: Mean Filtering, Median Filtering, Noise Reduction, Contrast Enhancement Techniques. 2.3 Image Enhancement Domains: Spatial Domain Processing, Frequency Domain Processing, Comparison of Spatial and Frequency Domain Techniques. 2.4 Contrast Enhancement Methods: Contrast Stretching, Histogram Processing, Histogram Equalization.	15
Module -3:	Image Restoration 3.1 Image Restoration: Introduction, Need, Objectives, Noise Models, Mean Filters, Order Statistics Filters. 3.2 Adaptive Filtering Techniques, Band Reject Filters, Image Restoration Methods. 3.3 Band Pass Filters, Notch Filters, Frequency Domain Restoration Techniques. 3.4 Image Restoration vs. Image Enhancement, Comparison, Applications	15

	of Image Restoration.	
Module -4:	Color Image Processing 4.1 Color Image Processing: Introduction, Fundamentals, Need, Objectives, Applications, Color Image Representation. 4.2 Color Models: RGB, CMY, CMYK, HSV, HSI, YCbCr Color Models. 4.3 Image Compression: Introduction, Need, Objectives, Error-Free (Lossless) Compression Techniques. 4.4 Lossy Compression Techniques, Compression Standards, Performance Measures and Evaluation Criteria.	15

Reference Books:-

- 1) Pandey, Jay Kumar, et al., eds. Computational Intelligence in Surveillance Systems Using Image Processing. 1st ed. New York: Elsevier, 2026.
- 2) Divan, Mario J., ed. Advances in Image Processing, Reliability and Artificial Intelligence: Data Centred-Techniques and Applications in Edge Computing. 1st ed. London: Elsevier, 2025.
- 3) Cuevas, Francisco, Pier Luigi Mazzeo and Alessandro Bruno, eds. Digital Image Processing: Latest Advances and Applications. London: IntechOpen, 2024.
- 4) Mahmood, Zahid. "Digital Image Processing: Advanced Technologies and Applications." Applied Sciences 14, no. 14 (2024): 6051.
- 5) Gonzalez, Rafael C. and Richard E. Woods. Digital Image Processing. 4th ed. New York: Pearson, 2018.

Evaluation Pattern:

Total Marks: 100

Continuous and Comprehensive Evaluation (40 Marks): • CCE - I : 20 Marks: Activity • CCE - II: 20 Marks: Activity • CCE - III: 20 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (60 Marks): • Question-1: Solve the following questions (Six questions of 2 Marks) Compulsory • Attempt any four questions from Q. 2 to Q. 7 (each questions carry 12 marks)
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Faculty of Science & Technology

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Board of Studies in Computational Sciences

Programme: B.Voc. (Soft. Dev.)

Semester - V

Type : Practical

Marks: 70

Credits : 2

From: A. Y. 2026-27

Name of the Course and Code: Lab: Software Testing (VS 357)
Practical Batch:12 Student/Batch

Course Objectives: Students should be able to...

- 1) Learn basic software testing concepts through practical experiments.
- 2) Understand different testing techniques on sample programs.
- 3) Utilize testing tools like Jira for test execution.
- 4) Interpret test results and defect reports to improve software quality.

Course Outcomes: Students will be able to...

- 1) Develop effective test scripts for software quality assurance.
- 2) Analyze software requirements to design appropriate test cases.
- 3) Execute manual test cases using testing tools.
- 4) Implement different testing techniques such as unit, integration and system testing.

Sr. No.	Practical List (Any 15 of the following)	Hrs
1)	Read and understand the software project documentation/guides. Also, study the Application under Test (AUT) if available.	60
2)	Draft Test cases that cover all the requirements mentioned in the documentation.	
3)	Review and baseline the test cases with Team Lead, Client (as applicable).	
4)	Execute the test cases on the AUT.	
5)	Report bugs.	
6)	Once bugs are fixed, again execute the failing test cases to verify they pass.	
7)	Write test cases for ATM Machine.	
8)	Write test cases for remote control.	
9)	Create User Stories and Test Cases for Registration and Login Functionality.	
10)	Raise Defect on JEERA tool.	
11)	Prepare Requirement Traceability Matrix (RTM).	
12)	Perform Smoke Testing on AUT.	
13)	Perform Regression Testing.	
14)	Perform Boundary Value Analysis (BVA).	
15)	Perform Equivalence Partitioning Testing.	
16)	Write Test Cases for E-commerce Website.	
17)	Create and Execute Test Plan Document.	
18)	Write Simple Test Cases for Calculator	
19)	Perform Login Page Testing.	

20)

Check UI Elements of a Web Page.

Reference Books:-

- 1) Kennedy, David, Jim O’Gorman, Devon Kearns and Mati Aharoni. Metasploit: The Penetration Tester’s Guide. San Francisco: No Starch Press, 2026.
- 2) Homès, Bernard. Fundamentals of Software Testing. 2nd ed. Hoboken: Wiley-ISTE, 2024.
- 3) Aniche, Maurício. Effective Software Testing. Shelter Island: Manning Publications, 2022.
- 4) Williams, Trevor. Test Driven Development in ASP.NET Core: The Handbook. Shelter Island: Manning Publications, 2022.
- 5) Khorikov, Vladimir. Unit Testing: Principles, Practices and Patterns. Shelter Island: Manning Publications, 2020.

Evaluation Pattern:**Total Marks: 70****Internal Continuous Evaluation:(30 Marks)**

- Journal – 10 Marks
- Case Study – 10 Marks
- Oral – 5 Marks
- Attendance – 5 Marks

End Semester Examination:(40 Marks)

Attempt any 4 Questions

- Question -1 (10 Marks = 1X 10=10 Marks)
- Question -2 (10 Marks = 1X 10=10 Marks)
- Question -3 (10 Marks = 1X 10=10 Marks)
- Question -4 (10 Marks = 1X 10=10 Marks)
- Question -5 (10 Marks = 1X 10=10 Marks)



Karmaveer Bhaurao Patil University, Satara

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Faculty of Science & Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computational Sciences

Programme: B.Voc. (Soft. Dev.)

Semester – V

Type : Practical

Marks: 70

Credits : 2

From: A. Y. 2026-27

Name of the Course and Code: Lab: Mobile Application development (VS 358)

Practical Batch: 12 Student/Batch

Course Objectives: Students should be able to...

- 1) Learn the basics of mobile app development through hands-on practice.
- 2) Understand coding skills to design and develop simple mobile applications.
- 3) Utilize development tools, SDKs and APIs for building functional mobile apps.
- 4) Interpret application performance and testing results to improve app quality and usability.

Course Outcomes: Students will be able to...

- 1) Analyze requirements for mobile application design.
- 2) Execute development using mobile programming tools.
- 3) Implement UI, logic and database features in apps
- 4) Functional mobile applications using SDKs and APIs.

Sr. No.	Practical List (Any 15 of the following)	Hrs.
1)	Install/configure java development kit (JDK) android studio and android SDK.	60
2)	Configure android development tools (ADT) plug-in and create android virtual device.	
3)	Develop a program to display Hello World on screen.	
4)	Develop a program to implement linear layout and absolute layout.	
5)	Develop a program to implement frame layout, table layout and relative layout.	
6)	Develop a program to implement Text view & Edit Text.	
7)	Develop a program to implement Arithmetic operations.	
8)	Develop a program to implement Checkbox.	
9)	Develop a program to implement Date and Time Picker.	
10)	Develop a program to implement Radio Button & Radio Group.	
11)	Develop a program to implement list view, Grid view and Image view and scroll view.	
12)	Develop a program to implement Custom Toast Alert.	
13)	Develop a program to implement new activity using explicit intent and implicit intent.	
14)	Create sample application with login module (check username and password) on successful login, change Text View "Login Successful". And on login fail, alert user using Toast "Login fail".	
15)	Develop a program: a) Send SMS b) Receive SMS	
16)	Develop a program to implement Spinner (Dropdown List).	
17)	Develop a program to implement Progress Bar.	
18)	Develop a program to implement Alert Dialog Box.	
19)	Develop a program to implement Shared Preferences.	

20)	Develop a program to implement Web View.	
Reference Books:-		
1) Darwin, Ian F. Android Cookbook: Problems and Solutions for Android Developers. 3rd ed. Sebastopol, CA: O'Reilly Media, 2026. 2) Sario, Azhar ul Haque. Mobile App Development. Software Development (2025 Edition). London: Academic Publishing, 2025. 3) Srinivasan, P. and T. Chandrasekar. Mobile Application Development: A Practitioner's Approach. New Delhi: Academic Guru Publishing House, 2024. 4) Singh, Jagannath, Debasish Das, Lov Kumar and Aneesh Krishna, eds. Mobile Application Development: Practice and Experience. Singapore: Springer, 2023. 5) Williams, Trevor. .NET MAUI Mobile App Development. Birmingham: Packt Publishing, 2022.		
Evaluation Pattern:		
Total Marks:70		
Internal Continuous Evaluation:(30 Marks)		End Semester Examination:(40 Marks)
- Journal – 10 Marks - Case Study – 10 Marks - Oral – 5 Marks - Attendance – 5 Marks		Attempt any 4 Questions - Question -1 (10 Marks = 1X 10=10 Marks) - Question -2 (10 Marks = 1X 10=10 Marks) - Question -3 (10 Marks = 1X 10=10 Marks) - Question -4 (10 Marks = 1X 10=10 Marks) - Question -5 (10 Marks = 1X 10=10 Marks)



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Faculty of Science & Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computational Sciences

Programme: B.Voc.(Soft. Dev.)

Semester – V

Type : Practical

Marks: 60

Credits : 2

From: A. Y. 2026-27

Name of the Course and Code: Lab: Digital Image Processing (VS 359)

Practical Batch: 12 Student/Batch

Course Objectives: Students should be able to...

- 1) Learn basic image processing operations through practical experiments.
- 2) Understand image processing algorithms such as filtering, enhancement and segmentation.
- 3) Utilize tools like MATLAB or OpenCV for implementing image processing tasks.
- 4) Interpret processed image outputs and results for analysis and evaluation.

Course Outcomes: Students will be able to...

- 1) Analyse digital images to understand their properties and characteristics.
- 2) Execute image processing operations using appropriate tools and software.
- 3) Implement algorithms for image enhancement, filtering and segmentation.
- 4) Formulate techniques to solve image-related processing problems.

Sr. No.	Practical List (Any 15 of the following)	Hrs
1)	Read and display an image using a programming tool (MATLAB / Python / OpenCV).	60
2)	Convert a color image into a grayscale image.	
3)	Perform pixel manipulation on an image.	
4)	Demonstrate image sampling and quantization.	
5)	Apply histogram equalization on a given image.	
6)	Perform contrast stretching on an image.	
7)	Apply low-pass filter (smoothing) on an image.	
8)	Apply high-pass filter (sharpening) on an image.	
9)	Perform mean filtering for noise reduction.	
10)	Perform median filtering to remove salt-and-pepper noise.	
11)	Add Gaussian noise to an image and apply filtering to remove it.	
12)	Convert RGB image to HSV/HSI color model.	
13)	Separate and display RGB channels of an image.	
14)	Perform image compression (lossy and lossless concept demonstration).	
15)	Apply band reject / notch filtering for noise removal.	
16)	Demonstrate image enhancement techniques on a given image.	
17)	Compare image enhancement and image restoration (practical demonstration or output-based).	
18)	Convert color image into different intensity representations.	
19)	Convert a color image into grayscale and display both images.	
20)	Apply histogram equalization on an image and analyze the image.	

Reference Books:-

- 1) Pandey, Jay Kumar, et al., eds. Computational Intelligence in Surveillance Systems Using Image Processing. 1st ed. New York: Elsevier, 2026.
- 2) Divan, Mario J., ed. Advances in Image Processing, Reliability and Artificial Intelligence: Data

Centred-Techniques and Applications in Edge Computing. 1st ed. London: Elsevier, 2025.

- 3) Cuevas, Francisco, Pier Luigi Mazzeo and Alessandro Bruno, eds. Digital Image Processing: Latest Advances and Applications. London: IntechOpen, 2024.
- 4) Mahmood, Zahid. "Digital Image Processing: Advanced Technologies and Applications." Applied Sciences 14, 2024.
- 5) Baskar, A., Muthaiah Rajappa, Shriram K. Vasudevan and T. S. Muruges. Digital Image Processing. 1st ed. Boca Raton: CRC Press, 2023.

Evaluation Pattern:

Total Marks: 60

Internal Continuous Evaluation:(30 Marks)

- Journal – 5 Marks
- Case Study – 5 Marks
- Oral – 5 Marks
- Attendance – 5 Marks

End Semester Examination:(40 Marks)

Attempt any 4 Questions

- Question -1 (10 Marks = 1X 10=10 Marks)
- Question -2 (10 Marks = 1X 10=10 Marks)
- Question -3 (10 Marks = 1X 10=10 Marks)
- Question -4 (10 Marks = 1X 10=10 Marks)
- Question -5 (10 Marks = 1X 10=10 Marks)



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Faculty of Science & Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computational Sciences

Programme: B.Voc. (Soft. Dev.)

Semester – VI

Type : General

Marks: 100

Credits : 4

From: A. Y. 2026-27

Name of the Course and Code: Human Resource Management (VS 361)

Course Objectives: Students should be able to...

- 1) Understand importance of HRM.
- 2) Study the process of Human Resource Planning and workforce management.
- 3) Implement the role of HR in maintaining employee relations and organizational culture.
- 4) Learn how to manage employee performance, motivation and compensation systems.

Course Outcomes: Students will be able to...

- 1) Develop skills to handle real-time HR problems and decision-making in organizations.
- 2) Apply knowledge about qualitative and quantitative research to an independently constructed piece of work.
- 3) Apply HR planning, recruitment, selection and onboarding techniques to meet workforce requirements effectively.
- 4) Analyze development processes in organizations.

Module	Title and Contents	Hrs
Module -1:	Introduction to HRM 1.1 B-PM & HRM: Difference between PM and HRM, Role of HR Professional/ Manager, HRM in India. 1.2 Computer Application in HRM, Quality of a good Human Resource Managers, HR Analytics: Data-driven decision-making Metrics like attrition rate, cost per hire HR, Technology (HR Tech)-HR software, Automation, Job Analysis. 1.3 Job description and Job Specification, Organization and Functions of the HR. 1.4 HR Structure and Strategy, Role of Government and Personnel Environment including MNCs.	15
Module -2:	Skills of HR 2.1 Recruitment and Selection, Human Resource Information System [HRIS], HRP: Meaning and significance. 2.2 Selection Process, Test Types, Modern HR Concepts- Strategic Human Resource Management (SHRM). 2.3 Planning, Induction & Orientation, Performance and Potential Appraisal of HR. 2.4 HRM issues and practices in the context of Outsourcing as a strategy.	15
Module -3:	Personality Development 3.1 Training and Development: Meaning, Need, Methods, Design and Evaluation of Training and Development Programmes. 3.2 Career Development: Concept, Career Planning, Career Growth, Promotions and Transfers. 3.3 Employee Empowerment: Meaning, Importance, Methods, Delegation of	15

	Authority, Employee Participation and Motivation. 3.4 Employee Separation Processes: Retirement, Resignation, Termination.	
Module -4:	Presentation skills 4.1 Financial Compensation, Productivity & Performance: Productivity measurement Techniques. 4.2 Principal Compensation Issues & Management of presentation skill, Job Evaluation. 4.3 Performance Improvement Plans (PIP), Quality of Work Life, Project-Based HR Management Staffing for projects. 4.4 Resource allocation Bench management, Causes for Industrial Disputes, Settlement of Industrial Disputes.	15
Reference Books:- 1) Dessler, Gary. Human Resource Management. Pearson Education, 2016. 2) Armstrong, Michael. Armstrong's Handbook of Human Resource Management Practice. Kogan Page, 2014. 3) Aswathappa, K. Human Resource Management: Text and Cases. Tata McGraw-Hill Education, 2013. 4) Decenzo, David A. and Stephen P. Robbins. Human Resource Management. Wiley, 2012. 5) Rao, V. S. P. Human Resource Management. Excel Books, 2010.		
Evaluation Pattern:		
Total Marks: 100		
Continuous and Comprehensive Evaluation (40 Marks): • CCE - I : 20 Marks: Activity • CCE - II: 20 Marks: Activity • CCE - III: 20 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)		End Semester Examination (60 Marks): • Question-1: Solve the following questions (Six questions of 2 Marks) Compulsory • Attempt any four questions from Q. 2 to Q. 7 (each questions carry 12 marks)



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Board of Studies in Computational Sciences

Programme: B.Voc.(Soft. Dev.)

Semester – VI

Type : General

Marks: 100

Credits : 4

From: A. Y. 2026-27

Name of the Course and Code: Free and Open Source Software (VS 362)

Course Objectives: Students should be able to...

- 1) Understand the fundamentals of Linux operating system, its history and open-source concepts System.
- 2) Learn process management, file systems and directory structures in Linux.
- 3) Understand the installation of various packages in open source operating systems
- 4) Gain knowledge of Linux shell environments and basic shell scripting concepts.

Course Outcomes: Students will be able to...

- 1) Identify and use Linux utilities to create and manage simple file processing operations.
- 2) Develop shell scripts to perform more complex tasks in shell programming environment.
- 3) Apply basic Linux shell commands and perform operations using the bash shell.
- 4) Identify and apply new ideas, methods and ways of thinking.

Module	Title and Contents	Hrs
Module -1:	Linux Basics 1.1 History of Linux (History, FOSS, current Linux Distributions examples), The Linux Shell (different kinds of shell). 1.2 Process: parent and child processes, Files and Directories (File Structure and directory structure). 1.3 Interaction with System, Basic Linux Commands. 1.4 File Permissions & Security.	15
Module -2:	Getting Started with Shell Programming 2.1 Introduction to Shell Programming: Shell Script Basics, Features of Shell, Shell Commands and Execution of Shell Scripts. 2.2 Variables in shell: Assign values to shell variables, Default shell variables 2.3 Rules and Conventions for Naming Variables: Variable Naming Guidelines, Shell Variable Management and Usage in Scripts. 2.4 Shell Script Control and I/O Operations: Control Structures (Conditional Statements and Loops), Input and Output Handling, Script Execution and Basic Error Handling.	15
Module -3:	Basic Administration 3.1 Basic System Administration: Introduction, Linux Run Levels, User Accounts, System Initialization, Systemd Services and Service Management. 3.2 User and File System Management: Managing Users and Groups, User Administration Commands, File System Structure, Disk and File System Management. 3.3 Linux File Permissions: File Ownership, Permission Types, Access Control, Changing Permissions and Ownership Using Linux Commands. 3.4 System Monitoring and Maintenance: System Monitoring Tools, Process Management, Resource Monitoring, Log Management and System	15

	Performance Analysis.	
Module -4:	Files Systems and Editing Files 4.1 File Systems, Linux Files, Directories and Archives, The vi editor, awk, sed, Advanced File Handling Commands. 4.2 Graphics Tools and Multimedia, Mail and News Clients, Web, FTP and Java Clients. 4.3 Security- Encryption, Integrity Checks and Signatures. 4.4 Secure Shell and Kerberos, Firewalls.	15
Reference Books:- 1) Ward, Brian. How Linux Works: What Every Superuser Should Know. No Starch Press, 3rd ed., 2021. 2) Nemeth, Evi, et al. UNIX and Linux System Administration Handbook. Addison-Wesley, 5th ed., 2017. 3) Shotts, William E. The Linux Command Line: A Complete Introduction. No Starch Press, 2nd ed., 2019. 4) Sobell, Mark G. A Practical Guide to Linux Commands, Editors and Shell Programming. Pearson Education, 4th ed., 2017. 5) Love, Robert. Linux Kernel Development. Addison-Wesley, 3rd ed., 2010.		
Evaluation Pattern:		
Total Marks: 100		
Continuous and Comprehensive Evaluation (40 Marks): - CCE - I : 20 Marks: Activity - CCE - II: 20 Marks: Activity - CCE - III: 20 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (60 Marks): - Question-1: Solve the following questions (Six questions of 2 Marks) Compulsory - Attempt any four questions from Q. 2 to Q. 7 (each questions carry 12 marks)	



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Board of Studies in Computational Sciences

Programme: B.Voc.(Soft. Dev.)

Semester – VI

Type : General

Marks: 100

Credits : 4

From: A. Y. 2026-27

Name of the Course and Code: Entrepreneurship Development (VS 363)

Course Objectives: Students should be able to...

- 1) Understand concepts, importance and scope of entrepreneurship development.
- 2) Gain awareness of financial, legal and managerial aspects of entrepreneurship.
- 3) Learn about project planning, feasibility analysis and business plan preparation.
- 4) Study various entrepreneurship models

Course Outcomes: Students will be able to...

- 1) Apply entrepreneurial skills in real-world business situations and startups.
- 2) Develop creativity, leadership and decision-making skills required for entrepreneurship.
- 3) Evaluate challenges faced by entrepreneurs and suggest solutions.
- 4) Apply various schemes supporting entrepreneurship

Module	Title and Contents	Hrs
Module -1:	Concepts of entrepreneur 1.1 Entrepreneur: Definitions, Characteristics of entrepreneur, Classification of entrepreneur. 1.2 Entrepreneurial traits, Entrepreneurial functions, Role of entrepreneurs in the economic development. 1.3 Factor effecting entrepreneurial growth, Entrepreneur Vs Intrapreneur, Women Entrepreneurs, Recent Development. 1.4 Entrepreneurial Development Programs, Objectives of EDP, Methods of training, Phases of EDP.	15
Module -2:	Institutional support and incentives to entrepreneurs 2.1 Functions of Department of Industries and Commerce (DIC), Activities of Small Industrial Development Corporation (SIDCO). 2.2 Functions of National Small Industries Corporation (NSIC), Functions of Small Industries Development Bank of India (SIDBI), Khadi Village Industry Commission (KVIC), Techno Park, Functions of techno park Incentives. 2.3 MSME Framework, Activities of Science and Technology Entrepreneurship Development, Project (STEDP), Strategies of National entrepreneurship 2.4 Development Board (NEDB), Objectives of National Institute for entrepreneurship and small business development (NIESBUD), Importance, Classification of incentives, Subsidy.	15
Module -3:	Micro Small and Medium Enterprises 3.1 Introduction to MSME: Definition, Features, Objectives, Importance, Role of MSMEs in Economic Development, Contribution to Employment and Industrial Growth. 3.2 MSME Act 2006: Salient Features, Classification of MSMEs, Challenges	15

	Faced by MSMEs, Digital MSMEs, Government Initiatives and Support Systems. 3.3 MSME Financial Support and Infrastructure: Credit Guarantee Fund Trust Scheme (CGTMSE), Industrial Estates, Benefits of MSMEs, Green Channel, Bridge Capital and Financial Assistance Schemes. 3.4 MSME Development and Problem Management: Seed Capital Assistance, Margin Money Schemes, Single Window System, Industrial Sickness, Causes, Effects and Remedies.	
Module -4:	Set up of Industrial unit 4.1 Entrepreneurship Environment: Introduction, Business Environment, Factors Affecting Entrepreneurship, Criteria for Selection of Industrial Project. 4.2 Project Identification and Market Analysis: Generation of Project Ideas, Project Selection, Market Survey, Demand Analysis and Market Feasibility Study. 4.3 Project Feasibility Analysis: Feasibility Study, Technical Feasibility, Financial Feasibility, Economic Feasibility and Project Evaluation. 4.4 Project Implementation and Legal Requirements: Social Cost Benefit Analysis, Government Regulations, Legal Formalities, Registration Procedures and Statutory Requirements.	15

Reference Books:-

- 1) Singal, R. K. and Sruti Singal. Entrepreneurship Development. S. K. Kataria & Sons, 4th Edition, 2021.
- 2) Gupta, C. B. and Srinivasan N. P. Entrepreneurial Development. Sultan Chand & Sons, Revised Edition, 2020.
- 3) Charantimath, P. M. Entrepreneurship Development and Small Business Enterprises. Pearson Education India, 2013.
- 4) Ajmeri, Sanjay R. Entrepreneurship Development. Lulu Publications, 2012.
- 5) Rane, D. P., Ujagare S. and Randhawa N. Entrepreneurship Development. San International Scientific Publication, 2010.

Evaluation Pattern:

Total Marks: 100

Continuous and Comprehensive Evaluation (40 Marks): • CCE - I : 20 Marks: Activity • CCE - II: 20 Marks: Activity • CCE - III: 20 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (60 Marks): • Question-1: Solve the following questions (Six questions of 2 Marks) Compulsory • Attempt any four questions from Q. 2 to Q. 7 (each questions carry 12 marks)
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Board of Studies in Computational Sciences

Programme: B.Voc.(Soft. Dev.)

Semester – VI

Type : Skill

Marks: 100

Credits : 4

From: A. Y. 2026-27

Name of the Course and Code: Big Data Analysis (VS 364)

Course Objectives: Students should be able to...

- 1) Understand the fundamentals, concepts and importance of Big Data Analytics in modern computing.
- 2) Study the Big Data ecosystem and frameworks such as Hadoop and MapReduce.
- 3) Learn the sources, characteristics and types of big data generated from various systems.
- 4) Study tools and technologies like Hadoop, Hive and NoSQL databases.

Course Outcomes: Students will be able to...

- 1) Develop the ability to solve real-world problems using Big Data analytics approaches
- 2) Execute Big Data processing using frameworks such as Hadoop and MapReduce
- 3) Implement data preprocessing techniques for effective data analysis.
- 4) Analyze the fundamental concepts, characteristics and importance of Big Data Analytics.

Module	Title and Contents	Hrs
Module -1:	Introduction to Big Data 1.1 Introduction to Big Data: Definition, Need, Importance, Evolution, Characteristics of Big Data (Volume, Velocity, Variety, Veracity and Value). 1.2 Types and Business Approach of Big Data: Structured, Semi-Structured and Unstructured Data, Traditional Data Processing vs. Big Data Approach, Big Data Business Applications. 1.3 Sources of Big Data: Internal and External Data Sources, Social Media Data, Sensor Data, Machine-Generated Data, Web Data and Transactional Data. 1.4 Big Data Solutions and Applications: Big Data Architecture Overview, Industry Applications, Case Studies of Big Data Solutions and Business Use Cases.	15
Module -2:	Hadoop 2.1 Introduction, Core Hadoop Components. 2.2 Hadoop Ecosystem, Hadoop Architecture. 2.3 Physical Architecture of Hadoop. 2.4 Hadoop limitations, HDFS (Hadoop Distributed File System).	15
Module -3:	NoSQL 3.1 Introduction, NoSQL business drivers, NoSQL case studies. 3.2 NoSQL data architecture patterns, Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores. 3.3 Using NoSQL to manage big data, Understanding the types of big data problems, Analyzing big data with a shared-nothing architecture. 3.4 Master-slave versus peer-to-peer, four ways that NoSQL systems handle	15

	big data problems.	
Module -4:	File System 4.1 Distributed File Systems, Physical Organization of Compute Nodes, Large-Scale File-System Organization. 4.2 MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution. 4.3 Coping With Node Failures, Algorithms Using MapReduce, Computing Selections by MapReduce. 4.4 Computing Projections by MapReduce, Intersection and Difference by MapReduce.	15

Reference Books:-

- 1) Leskovec, Jure, Anand Rajaraman and Jeffrey D. Ullman. Mining of Massive Datasets. 3rd ed. Cambridge: Cambridge University Press, 2020.
- 2) Marr, Bernard. Big Data in Practice. 1st ed. Wiley, 2016
- 3) Seema Acharya and Subhashini Chellappan. Big Data and Analytics. New Delhi: Wiley India, 2015.
- 4) White, Tom. Hadoop: The Definitive Guide. 4th ed. Sebastopol: O'Reilly Media, 2015.
- 5) Marz, Nathan and James Warren. Big Data: Principles and Best Practices of Scalable Real-Time Systems. Manning Publications, 2015.

Evaluation Pattern:

Total Marks: 100

Continuous and Comprehensive Evaluation (40 Marks):

- CCE - I : 20 Marks: Activity
- CCE - II: 20 Marks: Activity
- CCE - III: 20 Marks: MCQ Test
(Best of 2 from CCE I, II & III Selected for final Score)

End Semester Examination (60 Marks):

- Question-1: Solve the following questions (Six questions of 2 Marks) Compulsory
- Attempt any four questions from Q. 2 to Q. 7 (each questions carry 12 marks)



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Programme: B.Voc.(Soft. Dev.)

Semester - VI

Type : Skill

Marks: 100

Credits : 4

From: A. Y. 2026-27

Name of the Course and Code: Augmented and Virtual Reality (VS 365)

Course Objectives: Students should be able to...

- 1) Understand the basic concepts of Virtual and Augmented Reality.
- 2) Study the tools, software platforms and development environments used for AR/VR application development.
- 3) Gain concepts of AR/VR for designing interactive and immersive applications.
- 4) Learn techniques for 3D object creation, tracking and interaction in AR/VR environments.

Course Outcomes: Students will be able to...

- 1) Implement techniques for object tracking, interaction and rendering in AR/VR environments
- 2) Develop interactive and immersive AR/VR applications with user-friendly interfaces.
- 3) Analyze AR/VR application requirements and identify suitable tools and platforms.
- 4) Develop skills to evaluate and improve AR/VR applications for better performance and user experience.

Module	Title and Contents	Hrs
Module -1:	Introduction to Augmented Reality (AR And VR) Augmented Reality 1.1 A Brief History of Augmented Reality, Displays (Multimodal Displays, Spatial Display Model and Visual Displays). 1.2 Strong vs Weak AR, Components of AR and VR System, Applications of AR, Challenges in AR. 1.3 Virtual Reality (VR): Definition and Scope, Difference Between AR and VR, Types of VR, Characteristics of VR. 1.4 Basic VR environments, Limitations of VR environments, Immersion Vs Presence, Key hardware requirements for VR.	15
Module -2:	Interaction design for AR/VR environments 2.1 Interaction design process, Identifying user needs, AR/VR design considerations. 2.2 Typical AR/VR Interface Metaphors, Affordances in AR/VR, Human Information Processing. 2.3 Design for Perception and cognition, User experience (UX) guidelines for AR/VR, UX challenges for AR/VR. 2.4 Prototyping for AR/VR, Evaluation of the developed AR/VR prototype.	15
Module -3:	Introduction to UNITY 3.1 Unity Overview: Introduction to Unity, Features, Unity Windows, User Interface, Workspace Layout, Navigation and Scene Management. 3.2 Unity Terminology and Game Objects: Basic Terminology, Game Objects, Object Hierarchy, Parenting and Child Objects, Assets and Asset Store. 3.3 Unity Assets and Environment Design: Importing Assets and Plug-ins,	15

	Creating Terrain, Applying Materials, Colors, Textures, Transparency and Rendering Basics. 3.4 Unity Scripting and Components: MonoBehaviour Class, Lifecycle Methods (Awake, Start, Update), Inspector Window, Components, Adding and Managing Scripts in Unity.	
Module -4:	Introduction to Vuforia and Physics in UNITY 4.1 Vuforia: Overview, Interface, Navigation, Terminology, Image Targeting, Custom Images. 4.2 Overview of Physics in Unity, Scripting: Introduction, Terminology, Creating Objects. 4.3 Accessing Components, Debugging, Lists, Loops. 4.4 AR Camera vs Main Camera difference.	15

Reference Books:-

- 1) Doerner, Ralf, Wolfgang Broll, Paul Grimm and Bernhard Jung. Virtual and Augmented Reality (VR/AR): Foundations and Methods of Extended Realities (XR). Cham: Springer, 2022.
- 2) Verma, Jitendra Kumar and Sudip Paul. Advances in Augmented Reality and Virtual Reality. Singapore: Springer Nature, 2022.
- 3) Dieck, M. Claudia tom, Timothy H. Jung and Sandra M. C. Loureiro. Augmented Reality and Virtual Reality: New Trends in Immersive Technology. Cham: Springer, 2021
- 4) Jung, Timothy, M. Claudia tom Dieck and Philipp A. Rauschnabel. Augmented Reality and Virtual Reality: Changing Realities in a Dynamic World. Cham: Springer, 2020.
- 5) Jung, Timothy and M. Claudia tom Dieck. Augmented Reality and Virtual Reality: Empowering Human, Place and Business. Cham: Springer, 2018.

Evaluation Pattern:

Total Marks: 100

Continuous and Comprehensive Evaluation (40 Marks): • CCE - I : 20 Marks: Activity • CCE - II: 20 Marks: Activity • CCE - III: 20 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (60 Marks): • Question-1: Solve the following questions (Six questions of 2 Marks) Compulsory • Attempt any four questions from Q. 2 to Q. 7 (each questions carry 12 marks)
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Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science & Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Computational Sciences

Programme: B.Voc.(Soft. Dev.)

Semester – VI

Type : Skill

Marks: 100

Credits : 4

From: A. Y. 2026-27

Name of the Course and Code: Machine Learning (VS 366)

Course Objectives: Students should be able to...

- 1) Learn different types of Machine Learning techniques such as supervised, unsupervised and reinforcement learning.
- 2) Study various Machine Learning algorithms for classification, regression and clustering.
- 3) Understand data preprocessing, feature selection and model evaluation methods
- 4) Gain Machine Learning concepts in areas like prediction, pattern recognition and data analysis

Course Outcomes: Students will be able to...

- 1) Develop and evaluate Machine Learning models using performance metrics.
- 2) Analyze datasets and identify appropriate preprocessing and feature selection techniques.
- 3) Implement models for classification, regression and clustering problems.
- 4) Apply machine learning techniques to real-world problems.

Module	Title and Contents	Hrs
Module -1:	Introduction and python ecosystem 1.1 Introduction Machine Learning, Types of Machine Learning, Machine Learning Model. 1.2 Challenges in Machines Learning, An Introduction to Python, Strengths and Weaknesses of Python. 1.3 Installing Python, Python for Data Science, Components of Python ML Ecosystem. 1.4 Jupyter Notebook, Types of Cells in Jupyter Notebook.	15
Module -2:	Methods for Machine Learning and Data Loading 2.1 Tasks Suited for Machine Learning, Batch Learning, Online Learning. 2.2 Based on Generalization Approach, Instance based Learning, Model based Learning. 2.3 Consideration While Loading CSV data, Methods to Load CSV Data File 2.4 Load CSV with NumPy, Load CSV with Pandas.	15
Module -3:	Data with Visualization & Preparing Data: 3.1 Introduction, Univariate Plots: Understanding Attributes Independently. 3.2 Density Plots, Box and Whisker Plots, Multivariate Plots, Interaction Among Multiple Variables. 3.3 Correlation Matrix Plot, Scatter Matrix Plot, Data Pre-processing, Data Pre-processing Techniques. 3.4 Normalization, Binarization, Standardization, Data Labelling.	15
Module -4:	Classification Algorithm 4.1 Introduction to Classification: Definition, Need, Objectives, Types of Classifiers, Classification Process, Building a Classification Model using Python. 4.2 Classification Evaluation and Performance Metrics: Model Evaluation	15

	Techniques, Accuracy, Precision, Recall, F1-Score, ROC Curve, Confusion Matrix. 4.3 Machine Learning Classification Algorithms: Decision Tree, Naive Bayes, K-Nearest Neighbor (KNN), Support Vector Machine (SVM), Logistic Regression, Applications of Classification Algorithms. 4.4 Model Training and Testing: Training Data, Testing Data, Data Splitting Techniques, Model Validation, Overfitting and Underfitting Concepts.	
Reference Books:- 1) Géron, Aurélien. Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow. 2nd ed. Sebastopol: O'Reilly Media, 2019. 2) Burkov andriy. The Hundred-Page Machine Learning Book. 1st ed. Andriy Burkov, 2019. 3) Goodfellow, Ian, Yoshua Bengio and Aaron Courville. Deep Learning. Cambridge: MIT Press, 2016. 4) Müller andreas C. and Sarah Guido. Introduction to Machine Learning with Python: A Guide for Data Scientists. Sebastopol: O'Reilly Media, 2016. 5) Bishop, Christopher M. Pattern Recognition and Machine Learning. New York: Springer, 2006.		
Evaluation Pattern:		
Total Marks: 100		
Continuous and Comprehensive Evaluation (40 Marks): • CCE - I : 20 Marks: Activity • CCE - II: 20 Marks: Activity • CCE - III: 20 Marks: MCQ Test (Best of 2 from CCE I, II & III Selected for final Score)	End Semester Examination (60 Marks): • Question-1: Solve the following questions (Six questions of 2 Marks) Compulsory • Attempt any four questions from Q. 2 to Q. 7 (each questions carry 12 marks)	



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Board of Studies in Computational Sciences

Programme: B.Voc.(Soft. Dev.)

Semester – VI

Type: Practical

Marks: 70

Credits: 2

From: A. Y. 2026-27

Name of the Course and Code: Lab: Big Data Analysis and Machine Learning (VS 367)

Practical Batch: 12 Student/Batch

Course Objectives: Students should be able to...

- 1) Understand the fundamentals, concepts and importance of Big Data Analytics in modern computing.
- 2) Learn Big Data ecosystem and frameworks such as Hadoop and MapReduce.
- 3) Understand data preprocessing, feature selection and model evaluation methods
- 4) Study Machine Learning concepts in areas like prediction, pattern recognition and data analysis.

Course Outcomes: Students will be able to...

- 1) Execute Big Data processing using frameworks such as Hadoop and MapReduce.
- 2) Implement data preprocessing techniques for effective data analysis.
- 3) Develop and evaluate Machine Learning models using performance metrics.
- 4) Analyze datasets and identify appropriate preprocessing and feature selection techniques.

Sr. No.	Practical List (Any 15 of the following)	Hrs
1)	Study of Hadoop ecosystem.	60
2)	Two programming exercises on Hadoop.	
3)	Two programming exercises in No SQL.	
4)	Implementing simple algorithms in Map- Reduce – Matrix Multiplication, Aggregates, joins, sorting, searching etc.	
5)	Implementing any one Frequent Itemset algorithm using Map-Reduce.	
6)	Implementing any one Clustering algorithm using Map-Reduce.	
7)	Implementing any one data streaming algorithm using Map-Reduce.	
8)	Create a Students collection in MongoDB and perform the CRUD operations.	
9)	Implementing CRUD and query operations using a NoSQL database.	
10)	Write a Hadoop MapReduce program to count the frequency of each IP address from a web server log file.	
11)	Perform data cleaning and analysis using Pandas.	
12)	Visualize a dataset using Matplotlib.	
13)	Implement and compare different Machine Learning algorithms on the same dataset.	
14)	To predict the health report using Confusion matrix.	
15)	To see the Temperature plot of India using linear regression.	
16)	Implement KNN classification using Scikit-learn.	
17)	Perform basic file operations like upload, download, delete and view files in HDFS.	
18)	To implement a Word Count program using MapReduce framework.	

19)	Perform matrix multiplication using the MapReduce programming model in Hadoop.	
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Reference Books:-

- 1) Leskovec, Jure, Anand Rajaraman and Jeffrey D. Ullman. Mining of Massive Datasets. 3rd ed. Cambridge: Cambridge University Press, 2020.
- 2) Marr, Bernard. Big Data in Practice. 1st ed. Wiley, 2016
- 3) Goodfellow, Ian, Yoshua Bengio and Aaron Courville. Deep Learning. Cambridge: MIT Press, 2016.
- 4) Müller andreas C. and Sarah Guido. Introduction to Machine Learning with Python: A Guide for Data Scientists. Sebastopol: O'Reilly Media, 2016.
- 5) Bishop, Christopher M. Pattern Recognition and Machine Learning. New York: Springer, 2006.

Evaluation Pattern:

Total Marks: 70

Internal Continuous Evaluation:(30 Marks)

- Journal – 10 Marks
- Case Study – 10 Marks
- Oral – 5 Marks
- Attendance – 5 Marks

End Semester Examination:(40 Marks)

Attempt any 4 Questions

- Question -1 (10 Marks = 1X 10=10 Marks)
- Question -2 (10 Marks = 1X 10=10 Marks)
- Question -3 (10 Marks = 1X 10=10 Marks)
- Question -4 (10 Marks = 1X 10=10 Marks)
- Question -5 (10 Marks = 1X 10=10 Marks)



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Programme: B.Voc.(Soft. Dev.)

Semester – VI

Type : Practical

Marks: 70

Credits : 2

From: A. Y. 2026-27

Name of the Course and Code: Lab: Augmented and Virtual Reality (VS 368)
Practical Batch: 12 Student/Batch

Course Objectives: Students should be able to...

- 1) Understand the basic concepts of Virtual and Augmented Reality
- 2) Study the tools, software platforms and development environments used for AR/VR application development.
- 3) development.
- 4) Gain the concepts of AR/VR for designing interactive and immersive applications.
- 5) Learn techniques for 3D object creation, tracking and interaction in AR/VR environments.

Course Outcomes: Students will be able to...

- 1) Implement techniques for object tracking, interaction and rendering in AR/VR environments
- 2) Develop interactive and immersive AR/VR applications with user-friendly interfaces.
- 3) Analyze AR/VR application requirements and identify suitable tools and platforms.
- 4) Develop skills to evaluate and improve AR/VR applications for better performance and user experience.

Sr. No.	Practical List (Any 15 of the following)	Hrs
1)	Study of different game engines.	60
2)	Implementation on Video/ Feature Viewing.	
3)	Implementation on Virtual tour.	
4)	Implementation on material animation.	
5)	Implementation to show portal planets.	
6)	Place object in AR with mobile gesture.	
7)	Rotate and scale AR Objects using sliders.	
8)	Use touch gestures to scale, rotate and drag AR objects.	
9)	Use canvas and text to create a scoreboard.	
10)	Mini Project on Augmented Reality or Virtual Reality.	
11)	Implement collision detection using Rigid body and Colliders (falling objects, bouncing ball).	
12)	Create a start menu with buttons (Play, Pause, Exit) using Canvas UI system.	
13)	Add background music and sound effects triggered by object interaction.	
14)	Implement Object Instantiation at Runtime.	
15)	Save and Load System Implementation.	
16)	Animation Controller Setup (Animator).	
17)	Raycasting for Object Interaction.	
18)	Implement Scene Transition and Management.	
19)	Implementation of Object Detection in AR.	
20)	Implementation of Voice Control in VR Environment.	

Reference Books:-

- 1) Doerner, Ralf, Wolfgang Broll, Paul Grimm and Bernhard Jung. Virtual and Augmented Reality (VR/AR): Foundations and Methods of Extended Realities (XR). Cham: Springer, 2022.
- 2) Verma, Jitendra Kumar and Sudip Paul. Advances in Augmented Reality and Virtual Reality. Singapore: Springer Nature, 2022.
- 3) Jung, Timothy, M. Claudia tom Dieck and Philipp A. Rauschnabel. Augmented Reality and Virtual Reality: Changing Realities in a Dynamic World. Cham: Springer, 2020.
- 4) Dieck, M. Claudia tom, Timothy H. Jung and Sandra M. C. Loureiro. Augmented Reality and Virtual Reality: New Trends in Immersive Technology. Cham: Springer, 2021 .
- 5) Jung, Timothy and M. Claudia tom Dieck. Augmented Reality and Virtual Reality: Empowering Human, Place and Business. Cham: Springer, 2018.

Evaluation Pattern:**Total Marks:70****Internal Continuous Evaluation:(30 Marks)**

- Journal – 10 Marks
- Case Study – 10 Marks
- Oral – 5 Marks
- Attendance – 5 Marks

End Semester Examination:(40 Marks)

Attempt any 4 Questions

- Question -1 (10 Marks = 1X 10=10 Marks)
- Question -2 (10 Marks = 1X 10=10 Marks)
- Question -3 (10 Marks = 1X 10=10 Marks)
- Question -4 (10 Marks = 1X 10=10 Marks)
- Question -5 (10 Marks = 1X 10=10 Marks)



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Programme: B.Voc.(Soft. Dev.)

Semester – VI

Type : Practical

Marks: 60

Credits : 2

From: A. Y. 2026-27

Name of the Course and Code: Lab: Major Project (VS 369)

Practical Batch:12 Student/Batch

Course Objectives: Students should be able to...

- 1) Learn real-world problems and identify appropriate solutions using technical knowledge.
- 2) Understand testing, debugging and deployment of applications.
- 3) Study existing systems, technologies and methodologies relevant to the project domain.
- 4) Understand documentation, report writing and project presentation techniques.

Course Outcomes: Students will be able to...

- 1) Develop a complete working project with proper documentation and testing.
- 2) Execute project planning, development and implementation effectively.
- 3) Implement software/hardware solutions using appropriate tools and technologies
- 4) Develop skills in teamwork, communication and project presentation.

Sr. No.	Practical List	Hrs
	Student will perform Major project.	60

Reference Books:-

- 1) Pressman, Roger S. Software Engineering: A Practitioner's Approach. 8th ed. New York: McGraw-Hill Education, 2015.
- 2) Sommerville, Ian. Software Engineering. 10th ed. Boston: Pearson Education, 2015.
- 3) Hughes, Bob, Mike Cotterell and Rajib Mall. Software Project Management. 6th ed. New Delhi: Tata McGraw Hill, 2017.
- 4) Wazlawick, Raul Sidnei. Object-Oriented Analysis and Design for Information Systems: Modeling with UML, OCL and IFML. Amsterdam: Elsevier, 2014.
- 5) Jalote, Pankaj. An Integrated Approach to Software Engineering. 3rd ed. New Delhi: Springer India, 2005.

Evaluation Pattern:

Total Marks: 60

Internal Continuous Evaluation:

- Internal Work -1
- Internal Work -2
- Internal Work -3
- Nil

End Semester Examination:

- Project Report – 60 Marks
- Oral – 20 Marks
- Presentation – 10 Marks
- Attendance – 10 Marks
- Total 100 Marks converted into 60 Marks