Academic Council Meeting No. and Date : 09 / July 02, 2024

Agenda Number : 03 Resolution Number : 41, 42 / 3.13 & 3.33

Vidya Prasarak Mandal's
B. N. Bandodkar College of Science (Autonomous), Thane

Syllabus for

Programme Code: BUIT

Programme: Bachelor of Science

Specific Programme: Information Technology

[S.Y.B.Sc. (Information Technology)]

Level 5.0

CHOICE BASED GRADING SYSTEM

Revised under NEP

From academic year 2024 - 2025

Preamble

The B.Sc. Information Technology programme is having an aim to make the students employable and impart industry oriented training. The main objectives of the course are:

- to think analytically, creatively and critically in developing robust, extensible and highly maintainable technological solutions to simple and complex problems.
- to apply their knowledge and skills to be employed and excel in IT professional careers and/or to continue their education in IT and/or related post graduate programmes.
- to work effectively as a part of a team to achieve a common stated goal.
- to adhere to the highest standards of ethics, including relevant industry and organizational codes of conduct.
- to communicate effectively with a range of audiences both technical and non-technical.
- to develop an aptitude to engage in continuing professional development.

The students will be ready for the jobs available in different fields like:

- Software Development (Programming)
- Website Development
- Mobile app development
- Embedded Systems Programming
- Embedded Systems Development
- Software Testing
- Networking
- Database Administration
- System Administration
- Cyber Law Consultant
- GIS (Geographic Information Systems)
- IT Service Desk
- Security

Abhijeet A. Kale
Chairman
Board of Studies in Computer Science

PROGRAMME OUTCOMES (PO)

The Undergraduate Programmes of Science are intended to cater quality education and attain holistic development of learners through the following programme outcomes:

- **BACHELOR OF SCIENCE (B.Sc.)**

PO1 - Disciplinary Knowledge
Lay strong foundation of conceptual learning in science. Instil ability to apply science in professional, social and personal life.

PO2 - Inculcation of Research Aptitude
Ignite spirit of inquiry, critical thinking, analytical skills and problem-solving approach which will help learner to grasp concepts related to research methodology and execute budding research ideas.

PO3 - Digital Literacy
Enhance ability to access, select and use a variety of relevant information e-resources for curricular, co-curricular and extracurricular learning process.

PO4 - Sensitization towards Environment
Build cohesive bond with nature by respecting natural resources, encouraging eco-friendly practices and creating awareness about sustainable development.

PO5 - Individuality and Team work
Encourage learner to work independently or in collaboration for achieving effective results through practical experiments, project work and research activities.

PO6 - Social and Ethical Awareness
Foster ethical principles which will help in developing rational thinking and becoming socially aware citizens. Build attitude of unbiased, truthful actions and avoid unethical behaviour in all aspects of life.

Program Specific Outcome:

On completion of the B.Sc. (Information Technology) degree the graduates will be able to

- Develop Problem Solving and Programming Skills. (Level 6)
- Design, develop, and manage computer-based systems involving databases, operating systems, computer networks, and web technologies. (Level 6)
- Analyze statistical methods, data analytics, and modern tools to extract insights from data and demonstrate adaptability to emerging technologies. (Level 4)
- Enhance skills and adapt new computing technologies for attaining professional excellence and carrying research. (Level 6)
- Demonstrate professional ethics, teamwork, communication skills, and project management abilities required for successful careers in the IT industry. (Level 3)
- Apply self-directed learning and research skills to adopt emerging technologies and entrepreneurial practices. (Level 3)

VPM's B.N.Bandodkar College of Science (Autonomous), Thane

S.Y.B.Sc. (Information Technology) Revised under NEP

Structure of Programme

Semester III

	Course Code	Course Title		No. of lectures	Credits
Major	24BUIT3T01	Data Structures using Python		**30**	**2**
	24BUIT3T02	Computer Network		**30**	**2**
	24BUIT3T03	Introduction to PL/SQL		**30**	**2**
	24BUIT3P01	Practical Based on 24BUIT3T01		**60**	**2**
	24BUIT3P02	Practical Based on 24BUIT3T03		**60**	**2**
Minor	24BUIT3T04	Applied Mathematics		**30**	**2**
OE	24BUIT3T05	Introduction to Linux Operating System		**30**	**2**
AEC	24BU3AEC05	Software Engineering – I		**30**	**2**
VSC	24BU3VSC04	Management for I.T.		**30**	**2**
SEC	24BU3SEC08	Public Administration		**30**	**2**
CC*	23BU3CESC6	23BU3CC601	N.S.S.		**2**
		23BU3CC602	N.C.C.		
		23BU3CC603	D.L.L.E.		
		23BU3CC604	Sports		
		23BU3CC605	Cultural Activities		
		23BU3CC607	Yoga for Total Health		
		23BU3CC608	Cyber Security		

* For Syllabus of CC course, check the website / contact to concern authority.

Semester IV

	Course Code	Course Title		No. of lectures	Credits
Major	24BUIT4T01	Core Java		**30**	**2**
	24BUIT4T02	Computer Graphics		**30**	**2**
	24BUIT4T03	Introduction to Embedded Systems		**30**	**2**
	24BUIT4P01	Practical Based on 24BUIT4T01		**60**	**2**
	24BUIT4P02	Practical Based on 24BUIT4T02		**60**	**2**
Minor	24BUIT4T04	Computer Oriented Statistical Techniques		**30**	**2**
OE	24BUIT4T05	Introduction to Intellectual Property Rights		**30**	**2**
AEC	24BU4AEC05	Software Engineering – II		**30**	**2**
VSC	24BU4VSC03	Retailing Management		**30**	**2**
Field Proj	24BUIT4P03	Mini Project and Documentation		**30**	**2**
CC*		23BU3CC601	N.S.S.		**2**
		23BU3CC602	N.C.C.		
		23BU3CC603	D.L.L.E.		
		23BU3CC604	Sports		
		23BU3CC605	Cultural Activities		
		23BU3CC607	Yoga for Total Health		
		23BU3CC608	Cyber Crime Awareness		

***** For Syllabus of CC course, check the website / contact to concern authority.

Semester III

Course Code	Course Title	Credits	No. of lectures
24BUIT3T01	**Major: Data Structures using Python**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Identify the basic types for data structure, implementation and application.	L1
CO2	Explain the strength and weakness of various data structures.	L2
CO3	Demonstrate the use of appropriate data structure and programming skills which require to solve given problem	L3
CO4	Apply core data structures such as arrays and lists to write Python Programs	L3

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	-	-
CO2	3	3	2	-	-	-
CO3	3	3	3	-	2	-
CO4	3	2	3	-	2	-

Unit I	**Abstract Data Types:** Introduction, The Date Abstract Data Type, Bags, Iterators. Application **Arrays:** Array Structure, Python List, Two Dimensional Arrays, Matrix Abstract Data Type, Application **Sets and Maps:** Sets-Set ADT, Selecting Data Structure, List based Implementation, Maps-Map ADT, List Based Implementation, Multi-Dimensional Arrays-Multi-Array ADT, Multi-arrays, Application **Algorithm Analysis:** Complexity Analysis-Big-O Notation, Evaluating Python Code, Evaluating Python List, Amortized Cost, Evaluating Set ADT, Application **Searching and Sorting**: Searching-Linear Search, Binary Search, Sorting-Bubble, Selection and Insertion Sort, Working with Sorted Lists-Maintaining Sorted List, Maintaining sorted Lists. **Linked Structures**: Introduction, Singly Linked List-Traversing, Searching,Prepending and Removing Nodes, Bag ADT-Linked List Implementation. Comparing Implementations, Linked List Iterators, More Ways to Build Kinked Lists, Applications-Polynomials	**15** [CO1, CO2, CO4]
Unit II	**Stacks:** Stack ADT, Implementing Stacks-Using Python List, Using Linked List, Stack Applications-Balanced Delimiters, Evaluating Postfix Expressions **Queues:** Queue ADT, Implementing Queue-Using Python List, Circular Array, Using List, Priority Queues- Priority Queue ADT, Bounded and unbounded Priority Queues **Advanced Linked List:** Doubly Linked Lists-Organization and Operation, Circular Linked List-Organization and Operation, Multi Lists **Recursion:** Recursive Functions, Properties of Recursion, Its working, Recursive Applications **Hash Table:** Introduction, Hashing-Linear Probing, Clustering, Rehashing, Separate Chaining, Hash Functions	15 [CO3, CO4]

References:

1. Data Structure and algorithm Using Python, Rance D. Necaise, 2016 Wiley India Edition
2. Data Structure and Algorithm in Python, Michael T. Goodrich, RobertomTamassia, M. H. Goldwasser,2016 Wiley India Edition

Course Code	Course Title	Credits	No. of lectures
24BUIT3T02	**Major: Computer Network**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Recognize basic elements of computer network and Transmission Media.	L1
CO2	Explain the Working of Data Link Layer, Network Layer and Transport Layer.	L2
CO3	Use protocols used in Data Link Layer, Network Layer and Transport Layer to configure network operations.	L3
CO4	Use fundamental underlying principles of computer networking	L3

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	-	-	-
CO2	3	2	2	-	-	-
CO3	3	3	3	-	2	-
CO4	3	2	2	-	1	-

Unit I	**Introduction to Data-Link Layer:** Introduction to Data-Link Layer, Nodes and Links, Services, Two Sub-layers, Three Types of addresses, Address Resolution Protocol (ARP). Error Detection and Correction, introduction, Types of Errors, Redundancy, Detection versus Correction,	**15** **[CO1, CO2, CO3]**
Unit II	**Network layer, Transport Layer** Media Access Control (MAC), random access, CSMA, CSMA/CD, CSMA/CA, controlled access, Reservation, Polling, Token Passing, channelization, FDMA, TDMA, CDMA. Connecting Devices and Virtual LANs, connecting devices, Hubs, Link-Layer, Switches, Routers, Introduction to Network Layer, network layer services, Packetizing, Routing and Forwarding, Other Services, IPv4 addresses, Address Space, Classful Addressing. Unicast Routing, General Idea, Least-Cost Routing, Routing Algorithms, Distance-Vector Routing, Link-State Routing, Path-Vector Routing, Introduction to Transport Layer, Transport-Layer Services, Connectionless and Connection-Oriented Protocols. Transport-Layer Protocols, Service, Port Numbers, User Datagram Protocol, User Datagram, UDP Services, UDP Applications, Transmission Control Protocol, TCP Services, TCP Features, Segment.	**15** **[CO2, CO3, CO4]**

References:
1) Data Communications and Networking, Behrouz A. Forouzan, Fifth Edition, TMH, 2013.
2) Computer Network, Andrew S. Tanenbaum, David J. Wetherall, 5th Ed, Pearson Education,2011.
3) Computer Network, Bhushan Trivedi, Oxford University Press
4) Data and Computer Communication, William Stallings, PHI

Course Code	Course Title	Credits	No. of lectures
24BUIT3T03	**Major: Introduction to PL/SQL**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Explain the basic components of PL/SQL.	L2
CO2	Use SQL and PL/SQL to create and modify database applications.	L3
CO3	Implement PL/SQL Control structures and command functions in writing practical code.	L3
CO4	Explain the importance of procedures, triggers, functions in database	L2

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	-	-	-
CO2	3	3	3	-	2	1
CO3	3	3	3	-	2	1
CO4	3	2	2	-	1	2

Unit I	Understanding the differences and integration between SQL and PL/SQL, Fundamentals of PL/SQL, Advantages of PL/SQL, Datatypes in PL/SQL, Program structure of PL/SQL, Using Variables in PL/SQL, Writing PL/SQL Executable Statements, Handling Exceptions, SQL in PL/SQL, implementing control structures, such as IF-THEN-ELSE and FOR loops, to control program flow	15 [CO1, CO2, CO3]
Unit II	Creating and Using Cursors, Creation Of Stored Procedures, Creating and Using Functions, Packages, Triggers	15 [CO4]

References:

1. Database System and Concepts, A Silberschatz, H Korth, S Sudarshan, McGraw-Hill, 5th Ed.
2. Database Systems, RobCoronelm, Cengage Learning, Twelfth Edition
3. Programming with PL/SQL for Beginners, H.Dand, R.Patil, T. Sambare, X –Team, 1st Ed, 2011
4. Introduction to Database System, C.J.Date, Pearson, First Edition, 2003

Course Code	Course Title	Credits	No. of lectures
24BUIT3P01	**Practical Based on 24BUIT3T01 and 24BUIT3T02**	**02**	**60**

Upon Completing the Course, Students will able to		
CO1	Identity the appropriate data structure for given problem	
CO2	Analyze the applications of data structures	
CO3	Analyze the performance of various network protocols using simulation tools.	
CO4	Compare the performance of different transport layer protocols	

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	-	-	-
CO2	3	3	3	-	2	1
CO3	3	3	3	-	2	1
CO4	3	2	2	-	1	2

Practical 1	Implement Linear Search to find an item in a list
Practical 2	Implement binary search to find an itemin an ordered list.
Practical 3	Implement Sorting Algorithms - Insertion sort
Practical 4	Implement Sorting Algorithms - A Bubble sort
Practical 5	Implement Sorting Algorithms- Quick sort
Practical 6	Implement Sorting Algorithms- Merge Sort
Practical 7	Implement use of Sets and various operations on Sets.
Practical 8	Implement an Array and perform insertion, deletion, traversal in the array
Practical 9	Implement Queue and perform insertion, deletion, traversal in the array
Practical 10	Implement stack and perform insertion, deletion, traversal in the array
Practical 11	Write a program that uses functions to perform the following operations on singly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.
Practical 12	Write a program that uses functions to perform the following operations on doubly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.
Practical 13	Write a program that uses functions to perform the following operations on circular linked List i) Creation ii) Insertion iii) Deletion iv) Traversal
Practical 14	Implement stack using Linked list
Practical 15	Implement Queue using Linked list
Practical 16	Write Python code to perform the following operations: a) Insert an element into a binary search tree. b) Delete an element from a binary search tree. c) Search for a key element in a binary search tree
Practical 17	Write Python Code to implement the tree traversal methods
Practical 18	Write a Code to implement graph traversal method: Breadth First Search
Practical 19	Write Code to implement the graph traversal method: Depth First Search
Practical 20	Study of Network devices in detail & connect computers in LAN
Practical 21	Use of ping, tracert / trace route, ipconfig / ifconfig, route and arp utilities.
Practical 22	Configure IP static routing.
Practical 23	Configure IP routing using RIP.
Practical 24	Configuring Simple OSPF.

Practical 25	Configuring DHCP server and client.
Practical 26	Configuring DNS Server and client.
Practical 27	Configuring OSPF with multiple areas.
Practical 28	To write a client-server application for chat using TCP
Practical 29	To Perform File Transfer in Client & Server Using TCP/IP
Practical 30	**IPv4AddressingandSubnetting** a) Given an IP address and network mask, determine other information about the IP address such as: • Network address • Network broad cast address • Total number of host bits • Number of hosts b) Given an IP address and network mask, determine other information about the IP address such as: • The subnet address of this subnet • The broadcast address of this subnet • The range of host addresses for this subnet • The maximum number of subnets for this subnet mask • The number of hosts for each subnet • The number of subnet bits • The number of this subnet

Course Code	Course Title	Credits	No. of lectures
24BUIT3P02	**Practical Based on 24BUIT3T03**	**02**	**60**

Upon Completing the Course, Students will able to		
CO1	Understand importance of PL/SQL basics	L2
CO2	Analyze the working of PL/SQL blocks.	L4
CO3	Illustrate functions and procedures using PL/SQL	L4
CO4	Understand the importance of triggers in database	L2

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	-	1	1
CO2	3	2	2	-	1	1
CO3	3	2	3	-	2	1
CO4	3	3	2	-	2	2

Practical 1	Understand the PL/SQL blocks and its use.
Practical 2	Write a PL/SQL code to enter any two numbers and find out their sum, difference, product, quotient and remainder
Practical 3	Write a PL/SQL code to find out the greatest of any three numbers
Practical 4	Write a PL/SQL code to enter any number, find out whether it's positive or negative or zero
Practical 5	Write a PL/SQL code to input any number and check whether it's even or odd.
Practical 6	Write a PL/SQL code to find the factorial of any number
Practical 7	Write a PL/SQL code to insert a new row in EMP table.
Practical 8	Write a PL/SQL code to demonstrate %ROWCOUNT
Practical 9	Write a PL/SQL code to accept the monthly salary of employee & find bonus of 12% on annual salary if experience is more than 3 years & otherwise bonus is Rs. 1000. Calculate the total salary received by the employ on that month along with the bonus amount
Practical 10	Write a PL/SQL code to increase the sal of employees by 1000 rs of deptno=10.
Practical 11	Write a PL/SQL code to insert the datas of the clerks from emp table to another table
Practical 12	Take the salary of an employee into a variable and check if his or her salary is less than 3000. If it is less than 3000 then update the EMP table with 3000
Practical 13	Write a Procedure debit_account that accepts a account number and amount to update the account.
Practical 14	Write a Procedure to raise salary of an employee. The procedure accepts two parameters employee code, amount increased.
Practical 15	Write a procedure that accepts two parameters employeeno, designation. Call it from a procedure that accepts only employee code.
Practical 16	Write a function that returns the balance of an account. The function accepts only one account no. Call it from procedure that accepts only one account no.
Practical 17	Write a PL/SQL code to demonstrate Exception Handling
Practical 18	Write a PL/SQL block of code using parameterized Cursor that will merge data availablein the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table then that data should be skipped.
Practical 19	Write a database trigger on Library table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added in Library_Audit table.
Practical 20	Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scoredby students in examination is <=1500 and marks>=990 then student will be placed in distinction category if marks scored are between 989 and 900 category is first class, if marks 899 and 825 category is Higher Second Class.

Course Code	Course Title	Credits	No. of lectures
24BUIT3T04	**Minor: Applied Mathematics**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Identify problems with mathematical solutions from across disciplines	L1
CO2	Describe how different mathematical methods could be applied to a given situation.	L2
CO3	Explain how matrices can be used to solve problems.	L2
CO4	Apply techniques to interpret given mathematical results.	L3

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	1	1
CO2	3	2	1	-	1	1
CO3	3	2	2	-	1	1
CO4	3	3	2	-	2	1

Unit I	**Matrices:** Inverse of a matrix, Properties of matrices, Elementary Transformation, Rank of Matrix, Echelon or Normal Matrix, Inverse of matrix, Linear equations, Linear dependence and linear independence of vectors, Linear transformation, Characteristics roots and characteristics vectors, Properties of characteristic vectors, Caley-Hamilton Theorem, Similarity of matrices, Reduction of matrix to a diagonal matrix which has elements as characteristics values. **Complex Numbers:** Complex number, Equality of complex numbers, Graphical representation of complex number(Argand's Diagram), Polar form of complex numbers, Polar form of x+iy for different signs of x,y, Exponential form of complex numbers, Mathematical operation with complex numbers and their representation on Argand's Diagram, Circular functions of complex angles, Definition of hyperbolic function, Relations between circular and hyperbolic functions, Inverse hyperbolic functions, Differentiation and Integration, Graphs of the hyperbolic functions, Logarithms of complex quality, j(=i)as an operator(Electrical circuits)	**15** [CO1, CO2, CO4]
Unit II	**Equation of the first order and of the first degree:** Separation of variables, Equations homogeneous in x and y, Non-homogeneous linear equations, Exact differential Equation, Integrating Factor, Linear Equation and equation reducible to this form, Method of substitution. **Differential equation of the first order of a degree higher than the first:** Introduction, Solvable for p (or the method of factors), Solve for y, Solve for x, Clairaut's form of the equation, Methods of Substitution, Method of Substitution.	**15** [CO3, CO4]

References:

1. A text book of Applied Mathematics Vol I, P. N. Wartikar, J. N. Wartikar, PuneVidyathiGraha
2. Applied Mathematics II, P. N. Wartikar and J. N. Wartikar, Pune VidyathiGraha
3. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publications

Course Code	Course Title	Credits	No. of lectures
24BUIT3T05	**OE: Introduction to Linux Operating System**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Understand the history and origins of the Linux operating system	L2
CO2	Implement Linux design principles in operating system tasks	L3
CO3	Analyze Linux tools and workflows to improve productivity in a Linux environment	L4
CO4	Understand basic Linux System Administration and configuration	L2

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	-	1	2
CO2	3	2	3	-	2	1
CO3	3	3	3	-	2	1
CO4	3	2	3	-	2	2

Unit I	**Introduction to Linux**: Open Source and Red Hat, Origins of Linux, GNU & Linux Distributions, Versions of Linux, Architecture of Linux. **Duties of the System Administrator:** The Linux System Administrator, Installing and Configuring Servers, Installing and Configuring Application Software, Creating and Maintaining User Accounts, Backing Up and Restoring Files, Monitoring and Tuning Performance, Configuring a Secure System, Using Tools to Monitor Security. Installation of Redhat Linux on Virtual Machine, Understanding Partitions of Linux, Booting and shutting down Linux, Understanding Boot loaders: GRUB & LILO, Bootstrapping, Init process, rc scripts, Enabling and disabling services. Different Run levels in Linux, Understanding Linux file system **Command Line:** Working with the Bash Shell, Working with basic linux command, Working with advanced linux commands, Working with Directories, Piping and Redirection, Finding Files, Using Vi Editor **Managing Software:** Understanding RPM, Understanding Meta Package Handlers, Creating Your Own Repositories, Managing Repositories, Installing Software with Yum, Querying Software, Extracting Files from RPM Packages.	**15** [CO1, CO2, CO3]
Unit II	Managing Users and Groups, Commands for User Management, Passwords, Modifying, Deleting User Accounts, Configuration Files, Creating Groups, Using Graphical Tools for User, and Group Management, Using External Authentication Sources, the Authentication Process, sssd, nsswitch, Pluggable Authentication Modules, Managing Permissions, the Role of Ownership, Basic Permissions: Read, Write, and Execute, Advanced Permissions, Working with Access Control Lists, Setting Default Permissions with umask, Working with Attributes **TCP/IP Networking:** Understanding Network Classes, Setting Up a Network Interface Card (NIC), Understanding Subnetting, Working with Gateways and Routers, Configuring Dynamic Host Configuration Protocol, Configuring Network **The Network File System:** NFS Overview, Planning an NFS Installation, Configuring an NFS Server, Configuring an NFS Client, Using Automount Services, Examining NFS Security Introduction to DNS, The DNS Hierarchy, DNS Server Types, The DNS Lookup Process, DNS Zone Types, Setting Up a DNS Server, Setting Up a Cache-Only Name Server, Setting Up a Primary Name Server, Setting Up a Secondary Name Server, Understanding and setting up DHCP	**15** [CO3, CO4]

Text Book: 1. Redhat Linux Networking & System Administration, Terry Collings, Kurt Wall, Wiley

- Red Hat Enterprise Linux 6 Administration, Sander van Vugt, John Wiley and Sons
- Linus kernel Unix the ultimate guide, Sumitabha das, McGraw-Hill
- Advanced programming in the Unix environments, W.R. Stevens, O'Reilly Media, Inc

Course Code	Course Title	Credits	No. of lectures
24BU3AEC05	**AEC: Software Engineering – I**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Explain the fundamentals of software engineering, including software development life cycle (SDLC), software processes, and critical socio-technical systems	L5
CO2	Describe software requirements, including functional, non-functional, user, system, and interface requirements	L1
CO3	Apply and analyze different software development process models, including Waterfall, Prototyping, Iterative, RAD, RUP, Agile, and Extreme Programming, to select suitable models for real-world projects.	L3
CO4	Apply system modeling and architectural design principles, including context, behavioral, data, object models, modular decomposition, control styles, and reference architectures, to design structured and maintainable software systems.	L3

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	1	2
CO2	3	2	2	-	2	2
CO3	3	3	2	-	2	2
CO4	3	3	2	-	2	2

Unit I	**Introduction:** What is software engineering? Software Development Life Cycle, Requirements Analysis, Software Design, Coding, Testing, Maintenance etc. **Software Requirements:** Functional and Non-functional requirements, User Requirements, System Requirements, Interface Specification, Documentation of the software requirements. **Software Processes:** Process and Project, Component Software Processes. **Software Development Process Models.** • Waterfall Model. • Prototyping. • Iterative Development. • Rational Unified Process. • The RAD Model • Time boxing Model. **Agile software development**: Agile methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods.	**15** [CO1, CO2, CO3]
Unit II	**Socio-technical system:** Essential characteristics of socio technical systems, Emergent System Properties, Systems Engineering, Components of system such as organization, people and computers, Dealing Legacy Systems. **Critical system:** Types of critical system, A simple safety critical system, Dependability of a system, Availability and Reliability, Safety and Security of Software systems. **Requirements Engineering Processes:** Feasibility study, Requirement selicitation and analysis, Requirements Validations, Requirements Management. **System Models:** Models and its types, Context Models, Behavioural Models, Data Models, Object Models, Structured Methods. **Architectural Design:** Architectural Design Decisions, System Organisation, Modular Decomposition Styles, Control Styles, Reference Architectures. **User Interface Design:** Need of UI design, Design issues, The UI design Process, User analysis, User Interface Prototyping, Interface Evaluation.	**15** [OC3, CO4]

Text book:

1.Software Engineering, edition, Ian Somerville, Pearson Education, Ninth Edition
2.Software Engineering, Pankaj Jalote, Narosa Publication
3.Software engineering, a practitioner's approach, Roger Pressman, Tata Mcgraw-hill, 7th Edition

Course Code	Course Title	Credits	No. of lectures
24BU3VSC04	**VSC: Management for I.T.**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Explain the definition, nature, scope, functions, and levels of management, and analyze the challenges faced by managers in modern organizations	L5
CO2	Describe the evolution of management theories, including classical, behavioral, contingency, and IT approaches, and evaluate their relevance to contemporary management practices.	L1
CO3	Apply the principles of scientific management and analyze its techniques, advantages, disadvantages, and issues in practical organizational settings	L3
CO4	Apply and analyze core management functions and practices (POSDCORB, staffing, directing, coordinating, controlling, budgeting, motivation, time management), and evaluate their impact on organizational performance.	L3

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	1	2
CO2	3	2	1	-	1	2
CO3	3	2	1	-	2	2
CO4	3	3	1	-	2	2

Unit I	Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Contingency Approach, IT Approach Planning and Decision Making: General Framework for Planning - Planning Process, Types of Plans	**15** [CO1, CO2]
Unit II	Introduction to Management: Scientific Management, Meaning and scope, History of Scientific Management, Features of Scientific Management, Principles of Scientific Management, Scientific Management Techniques, Issues with Scientific Management, Advantages and disadvantages of Scientific Management Principles and Practices of Management: Core Areas • POSDCORB • Planning • Organization • Staffing • Directing • Coordinating & Controlling • Reporting • Budgeting • Motivation • Time Management	**15** [CO3, CO4]

References:

1. Jagdish Kumar. 2003. Ancient Wisdom & Modern Management. English Edition Publishers and Distributors (India) Pvt. Ltd. Mumbai
2. Koontz, Harold and Weihrich, Heinz. 2012. Essentials of Management: An International and Leadership Perspective. Tata Mc Graw-Hill Publishing Company Limited, New Delhi
3. Prasad, L.M. 2019. Principles and Practice of Management. Sultan Chand & Sons Pvt. Ltd. New Delhi
4. Taylor, Frederick, W. 2016. The Principles of Scientific Management. Cosimo Inc. Delaware (US)

Course Code	Course Title	Credits	No. of lectures
24BU3SEC08	**SEC: Public Administration**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Explain the evolution and constitutional context of Indian administration and analyze the changing role of the District Collector since independence.	L5
CO2	Explain the role of Public Service Commissions at Union and State levels and analyze their functions in recruitment, examinations, and maintaining administrative efficiency.	L5
CO3	Analyze the financial administration process, including budgetary procedures, role of Parliamentary Committees, Comptroller and Auditor General to evaluate financial accountability mechanisms	L4
CO4	Examine contemporary issues in Indian administration, Citizens' Charter, citizen-administration interaction and evaluate their effectiveness in promoting transparent governance	L4

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	1	3
CO2	3	2	1	-	1	3
CO3	3	3	1	-	1	3
CO4	3	3	2	-	2	3

Unit I	**Introduction to Indian Administration :** Evolution and Constitutional Context, Salient features, District Administration since Independence: Changing role of District Collector **Personnel Administration :** Recruitment: All India Services, Central Services, State Services Public Service Commission: Union Public Service Commission and Maharashtra Public Service Commission Training: All- India Services, Central Services, State Services (Maharashtra)	**15** [CO1, CO2]
Unit II	**Financial Administration:** Budgetary Process, Parliamentary Committees: Public Accounts Committee, Estimates Committee, Committee on Public Undertakings, Comptroller and Auditor General **Contemporary Issues in Indian Administration:** Integrity in Administration: Lokpal, Lokyukta, CVC, Citizen and Administration, Citizens' Charter	**15** [CO3, CO4]

References:

1. Bava,.Noorjahan.Public Administration in the 21stCentury, Kanishka Publishers New Delhi, 2010.
2. Avasthi, Maheshwari, Public Administration, Laxmi Narayan Agarwal Publications, Agra, 2006
3. onlinelibrary.wiley.com
4. Patil, B. B., Lokaprashasan,PhadkePrakashan, Kolhapur, 2009.
5. Bora, Shirsat, Lokaprashasanshastra,Vidya Books Publishers, Aurangabad, 2013

Semester IV

Course Code	Course Title	Credits	No. of lectures
24BUIT4T01	**Major: Core Java**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Explain the fundamentals of Java programming, including Java features, syntax, data types, typecasting, arrays, and program structure, and apply these concepts to write basic Java programs.	L5
CO2	Apply Object-Oriented Programming concepts such as classes, objects, inheritance, polymorphism, encapsulation, constructors, and keywords (this, super, static) to design and implement modular Java programs.	L3
CO3	Apply exception handling and multithreading techniques, including try-catch, throw, throws, synchronization, wait/notify methods, to develop robust and concurrent Java applications.	L3
CO4	Implement networking and wrapper classes in Java, client-server communication using sockets and using wrapper classes for data type conversions to solve real-world programming problems.	L3

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	-	1	1
CO2	3	2	2	-	2	1
CO3	3	3	2	-	2	1
CO4	3	3	3	-	2	1

Unit I	**The Java Language:** Features of Java, Java programming format, Java Tokens, Java Statements, Java Data Types, Typecasting, Arrays **OOPS**: Introduction, Class, Object, Static Keywords, Constructors, this Key Word, Inheritance, super Key Word, Polymorphism (overloading and overriding), Encapsulation **String Manipulations**: String, String Buffer, String Tokenizer **Packages:** Introduction to predefined packages (java.lang, java.util, java.io, java.sql, java.swing), User Defined Packages, Access specifiers	15 [CO1, CO2, CO3]
Unit II	**Exception Handling:** Introduction, Pre-Defined Exceptions, Try-Catch-Finally, Throws, throw, User Defined Exception examples **Multithreading:** Thread Creations, Thread Life Cycle, Life Cycle Methods, Synchronization, Wait() notify() notify all() methods **Networking:** Introduction, Socket, Server socket, Client –Server Communication **Wrapper Classes:** Introduction, Byte, Short, Integer, Long, Float, Double, Character, Boolean classes	15 [CO2, CO3, CO4]

References:

1) Herbert Schildt, Java The Complete Reference, Ninth Edition, McGraw-Hill Education, 2014
2) E. Balagurusamy, Programming with Java, Tata McGraw-Hill Education India, 2014
3) Programming in JAVA, 2nd Ed, Sachin Malhotra & Saurabh Choudhary, Oxford Press
4) The Java Tutorials: http://docs.oracle.com/javase/tutorial/

Course Code	Course Title	Credits	No. of lectures
24BUIT4T02	**Major: Computer Graphics**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Explain the fundamentals of computer graphics, including graphics devices, display technologies, raster and random-scan display, and color concepts.	L5
CO2	Apply and analyze line, circle, midpoint algorithms for circle and ellipse drawing, and implement clipping algorithms like Cohen-Sutherland for graphics applications.	L3
CO3	Describe and apply 2D transformation techniques, including translation, rotation, scaling, reflection, homogeneous coordinates, and window-to-viewport transformations for graphical objects	L1
CO4	Apply 3D transformation techniques such as translation, rotation, scaling, reflection, and shearing, and analyze combined or multiple transformations for 3D graphical modeling.	L3

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	-	1	1
CO2	3	3	2	-	2	1
CO3	3	3	2	-	2	1
CO4	3	3	2	-	2	1

Unit I	**Introduction to Computer Graphics:** Overview of Computer Graphics, Computer Graphics Application and Software, Input Devices, Active and Passive Graphics Devices, Display Technologies, Raster Refresh (Raster-Scan) Graphics Displays, Cathode Ray Tube Basics, Color CRT Raster Scan Basics, Video Basics, The Video Controller, Random-Scan Display Processor, LCD displays. **Scan conversion** – Digital Differential Analyzer (DDA) algorithm, Bresenhams' Line drawing algorithm. Bresenhams' method of Circle drawing, Midpoint Circle Algorithm, Midpoint Ellipse Algorithm, Clipping Lines algorithms– Cohen-Sutherland **Color:** Color models, Colorimetry, Color Spaces, Chromatic Adaptation, Color Appearance	**15** [CO1, CO2, CO3]
Unit II	**Two-Dimensional Transformations:** Transformations and Matrices, Transformation Conventions, 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformations, Translations and Homogeneous Coordinates, Rotation, Reflection, Scaling, Combined Transformation, Transformation of Points, The Window-to- Viewport Transformations **Three-Dimensional Transformations:** Three-Dimensional Scaling, Three-Dimensional Shearing, ThreeDimensionalRotation, Three-Dimensional Reflection, Three- Dimensional Translation, Multiple Transformation	**15** [CO3, CO4]

References:

1. Computer Graphics -Principles and Practice, J. D. Foley, A., Van Dam, S. K., Feiner and J. F., Hughes, Pearson Education, Second Edition
2. Steve Marschner, Peter Shirley, Fundamentals of Computer Graphics, CRC press Fourth Edition, 2016
3. Computer Graphics Hearn, Baker Pearson Education Second Edition
4. Principles of Interactive Computer Graphics, William M., Newman and Robert F. Sproull, Tata McGraw Hill, Second Edition

Course Code	Course Title	Credits	No. of lectures
24BUIT4T03	**Major: Introduction to Embedded Systems**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Explain the fundamentals, history, classifications, and applications of embedded systems, and analyze the differences between embedded and general-purpose computer systems	L5
CO2	Describe the core components of embedded systems and apply the knowledge to select appropriate hardware and firmware for specific applications.	L1
CO3	Understand functioning of Microcontrollers and their importance in Embedded platform.	L2
CO4	Apply embedded system development tools to design, develop, and evaluate embedded systems	L3

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	1	1
CO2	3	2	2	-	2	1
CO3	3	2	2	-	1	1
CO4	3	3	3	-	2	1

Unit I	**Introduction:** Embedded Systems and general purpose computer systems, history, classifications, applications and purpose of embedded systems **Core of embedded systems:** microprocessors and micro controllers, RISC and CISC controllers, Big endian and Little endian processors, Application specific ICs, Programmable logic devices, COTS, sensors and actuators, communication interface, embedded firmware, other system components. **Characteristics and quality attributes of embedded systems:** Characteristics, operational and non-operational quality attributes. **Embedded Systems – Application and Domain Specific:** Application specific – washing machine, domain specific – automotive **Embedded Hardware:** Memory map, i/o map, interrupt map, processor family, external peripherals, memory – RAM , ROM, types of RAM and ROM, memory testing, CRC ,Flash memory.	15 [CO1, CO2]
Unit II	**8051 Programming in C:** Data Types and time delay in 8051 C, I/O Programming, Logic operations, Data conversion Programs. Designing **Embedded System with 8051 Microcontroller:** Factors to be considered in selecting a controller, why 8051 Microcontroller, Designing with 8051 **Programming embedded systems:** structure of embedded program, infinite loop, compiling, linking and debugging. **Design and Development:** Embedded system development Environment IDE, types of file generated on cross compilation, disassembler/ de-compiler, simulator, emulator and debugging, embedded product development life-cycle, trends in embedded industry.	15 [CO3, CO4]

References:

1. Programming Embedded Systems in C and C++, Michael Barr, O'Reilly, Edition First, 1999
2. Introduction to embedded systems, Shibu K V, TataMcgraw-Hill, First Edition 2012
3. The 8051 Microcontroller and Embedded Systems, Muhammad Ali Mazidi, Pearson, Second Edition, 2011
4. Embedded Systems Rajkamal Tata Mcgraw-Hill

Course Code	Course Title	Credits	No. of lectures
24BUIT4P01	Practical Based on 24BUIT4T01	02	60

Upon Completing the Course, Students will able to		
CO1	Analyze Java programs involving control structures, arrays, strings, and mathematical computations to determine program logic, data flow, and correctness.	L4
CO2	Analyze and evaluate object-oriented design concepts such as classes, constructors, inheritance, method overloading, method overriding, and exception handling for solving programming problems efficiently.	L4
CO3	Evaluate Java applications involving multithreading, thread life cycle, and user-defined exceptions, ensuring proper synchronization, execution flow, and error handling.	L5
CO4	Design complete Java applications by combining control structures, data structures, object oriented principles, and multithreading to solve real-world computational problems.	L6

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	1	1
CO2	3	3	2	-	2	1
CO3	3	3	2	-	2	1
CO4	3	3	3	-	2	1

Practical 1	i) Write a Java program that takes a number as input and prints its multiplication table upto 10. ii) find the average and sum of the N numbers iii) test the Prime number. iv) calculate the Simple Interest and Input by the user. v)find the factorial of a given number
Practical 2	i) Accept integer values for a, b and c which are coefficients of quadratic equation. Find the solution of quadratic equation ii) calculate the Simple Interest
Practical 3	Write a JAVA code to create a Simple class to find out the Area and perimeter of rectangle and box using super and this keyword
Practical 4	Write a JAVA code to add two binary numbers.
Practical 5	Write a JAVA code to reverse a string
Practical 6	Write a JAVA code to accept two n x m matrices. Write a Java program to find addition of these matrices
Practical 7	Write a JAVA code to convert a decimal number to binary number & vice versa
Practical 8	Write a JAVA code to find the smallest and largest element from the array
Practical 9	Write JAVA code to accept n strings & sort them in ascending/descending order
Practical 10	Write a JAVA code to count the letters, spaces, numbers and other characters of an input string
Practical 11	Write a JAVA code to demonstrate the use of constructor and destructor.
Practical 12	Write a JAVA code to demonstrate Java inheritance using extends keyword.
Practical 13	Write a JAVA code to implement single level inheritance.
Practical 14	Write a JAVA code to implement multiple inheritance
Practical 15	Write a JAVA code to method overloading and method overriding
Practical 16	Write a JAVA code to demonstrate your own exception in Java
Practical 17	Write a JAVA code to print the factorial for an input value.
Practical 18	Write a JAVA code to implement thread life cycle
Practical 19	Write a JAVA code to implement multithreading

Course Code	Course Title	Credits	No. of lectures
24BUIT4P02	Practical Based on 24BUIT4T02	02	60

Upon Completing the Course, Students will able to		
CO1	Identifyand explain basic computer graphics concepts, coordinate systems, and built-in graphics functions available in C / C++ / Python for drawing basic primitives such as lines, circles, rectangles, and ellipses.	L1
CO2	Apply standard computer graphics algorithms such as DDA line drawing, Bresenham's line and circle algorithms, and Midpoint circle algorithm to generate geometric shapes accurately on the screen.	L3
CO3	Implement and analyze 2D and 3D geometric transformations including translation, scaling, rotation, shearing, and reflection, and apply line clipping algorithms (Cohen–Sutherland) to graphical objects.	L3
CO4	Develop complete graphical applications by integrating multiple graphics concepts to draw complex objects (Car, Hut, Fish), perform animations, and implement filling algorithms such as flood fill.	L6

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	-	1	1
CO2	3	3	2	-	2	1
CO3	3	3	2	-	2	1
CO4	3	3	3	-	2	1

Practical 1	Study and enlist the basic functions used for graphics in C / C++ / Python language. Give an example for each of them.
Practical 2	Draw a co-ordinate axis at the center of the screen.
Practical 3	Divide your screen into four region, draw circle, rectangle, ellipse and half ellipsein each region with appropriate message.
Practical 4	Draw i. Circle ii. Rectangle iii. Square iv. Concentric Circles v. Ellipse vi. Line using available functions in C / C++ / Python
Practical 5	Develop the program for DDA Line drawing algorithm.
Practical 6	Develop the program for Bresenham's Line drawing algorithm.
Practical 7	Write a program to draw a circle using Bresenhams' method.
Practical 8	Write a program to draw a circle using Midpoint Circle Algorithm
Practical 9	Implementation of 2D transformation: Translation
Practical 10	Write a program to implement 2D transformation: Scaling.
Practical 11	Write a program to implement 2D transformation: Rotation
Practical 12	Write a program to implement 2D transformation: Shearing
Practical 13	Write a program to implement 2D transformation: Reflection
Practical 14	Implement Line Clipping using Cohen-Sutherland algorithm
Practical 15	Implementation of 3D geometric transformations: Translation
Practical 16	Implementation of 3D geometric transformations: Scaling
Practical 17	Implementation of 3D geometric transformations: Rotation
Practical 18	Draw a Car on the screen
Practical 19	Draw a simple Hut on the screen
Practical 20	Draw a simple Fish on the screen
Practical 21	To implement flood fill algorithm for filling a rectangle with given color.
Practical 22	Write a program for a Circle moving from left to right and vice versa

Course Code	Course Title	Credits	No. of lectures
24BUIT4T04	**Minor: Computer Oriented Statistical Techniques**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Explain and compute measures of central tendency and dispersion	L5
CO2	Calculate moments, correlation coefficients, and analyze relationships between variables using Karl Pearson's method, rank correlation, and concurrent deviation method, including assessment of probable error	L3
CO3	Explain elementary probability concepts and probability distributions (Binomial, Poisson, Normal), and apply these concepts to determine means, variances, and probabilities for real-life problems.	L5
CO4	Apply sampling methods and statistical inference techniques to analyze data, evaluate results, and make informed decisions while understanding Type I and Type II errors.	L3

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	1	1
CO2	3	3	1	-	1	1
CO3	3	3	1	-	1	1
CO4	3	3	2	-	2	2

Unit I	**Measure of Central Tendency**, Types: Arithmetic mean, Geometric Mean, Harmonic Mean, Median, Mode. **Measure of Dispersion**: Range, Quartile Deviation, mean deviation, Coefficient of mean Deviation, Standard Deviation **Moments:** raw moments, central moments **Correlation**: Introduction, Types, Properties, Methods of Correlation: Karl Pearson's Coefficient of Correlation, Rank Correlation and Concurrent Deviation method, Probable error	15 [CO1, CO2]
Unit II	**Elementary Probability Theory:** Definitions of Probability, Conditional Probability; Independent and Dependent Events, Mutually Exclusive Events **Probability Distribution**: Random Variable, Types: Binomial, Poisson, Normal Distribution, Mean and Variance of Binomial, Poisson, and Normal Distribution **Sample introduction**, Sampling: Meaning, methods of Sampling, Statistical Inference: Test of Hypothesis, Types of hypothesis, Procedure of hypothesis Testing, Type I and Type II error, t test, F test, Chi square Test, ANOVA	15 [CO3, CO4]

References:

- Statistics, Murray R. Spiegel, Larry J. Stephens., Mcgraw –Hill Iternational, Fourth Edition
- Fundamental Of Mathematical Statistics, S.C. Gupta And V.K. Kapoor, Sultan Chand And Sons, Edition Eleventh, Revised, 2011
- Mathematical Statistics, J.N. Kapur And H.C.Saxena
- S. Chand Twentieth, Revised 2005

Course Code	Course Title	Credits	No. of lectures
24BUIT4T05	**OE: Introduction to Intellectual Property Rights**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Identify different types of Intellectual Property Rights (IPRs).	L1
CO2	Explain the criteria for determining which form of Intellectual Property Rights (IPRs) is suitable for one's own work.	L2
CO3	Analyze rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial Design	L4
CO4	Analyze issues concerning the protection of traditional knowledge, including bio-prospecting and bio-piracy	L4

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	-	1	2
CO2	3	2	1	-	1	2
CO3	3	2	1	-	1	3
CO4	3	3	1	2	1	3

Unit I	**Introduction to Intellectual Property Rights (IPR) :** Concept and kinds, Economic importance, IPR in India and world, IPR and WTO. **Patents :** Objectives, Rights, Patent Acts 1970 and its amendments. Procedure of obtaining patents, working of patent, Infringement, Industrial Application: Non-Patentable Subject Matter, Registration Procedure, Rights and duties of Patentees. **Copyrights :** Introduction, works protected under copyright law, Rights, Transfer of Copyrights, Infringement, Remedies and Penalties.	15 [CO1, CO2]
Unit II	**Trademarks :** Objectives, Types, Rights, Protection of goodwill, Infringement, Passing off, Defenses, Domain name. **Protection of traditional knowledge :** Objectives, Concept of traditional knowledge, Holders, Issues concerning, Bio-Prospecting and Bio-Piracy, Alternative ways, Protectability, Traditional Knowledge Digital Library.	15 [CO3, CO4]

Text Book:

1. Nithyananda, K.V. 2019. Intellectual Property Rights: Protection and Management. India, In: Cengage Learning India Private Limited.
2. Neeraj, P. and Khusdeep, D. 2014. Intellectual Property Rights. India, In: PHI learning Private Limited.
3. Ahuja, V.K. 2017. Law relating to Intellectual Property Rights. India, In: Lexis Nexis.

Course Code	Course Title	Credits	No. of lectures
24BU4AEC05	**AEC: Software Engineering – II**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Apply software development principles, concepts, and techniques to develop software	L3
CO2	Interpret the process of using theoretical and technical knowledge to develop systems	L2
CO3	Differentiate software development practices that contribute to maintainability across the lifecycle.	L4
CO4	Evaluate and justify project management strategies, including task sequencing, responsibility assignment, and schedule adaptation in response to project risks.	L5

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	2	1
CO2	3	2	2	-	2	1
CO3	3	3	2	-	1	2
CO4	3	3	2	-	2	2

Unit I	**Project Management** Software Project Management, Management activities, Project Planning, Project Scheduling, Risk Management. **Quality Management:** Process and Product Quality, Quality assurance and Standards, Quality Planning, Quality Control, Software Measurement and Metrics. **Verification and Validation:** Planning Verification and Validation, Software Inspections, Automated Static Analysis, Verification and Formal Methods. **Software Testing:** System Testing, Component Testing, Test Case Design, Test Automation. **Software Measurement**: Size-Oriented Metrics, Function-Oriented Metrics, Extended Function Point Metrics	15 [CO1, CO2, CO3]
Unit II	**Software Cost Estimation:**Software Productivity, Estimation Techniques, Algorithmic Cost Modelling, Project Duration and Staffing **Process Improvement:** Process and product quality, Process Classification, Process Measurement, Process Analysis and Modeling, Process Change, The CMMI Process Improvement Framework. **Service Oriented Software Engineering:** Services as reusable components, Service Engineering, Software Development with Services. **Software reuse:** The reuse landscape, Application frameworks, Software product lines, COTS product reuse. **Distributed software engineering**: Distributed systems issues, Client–server computing, Architectural patterns for distributed systems, Software as a service	15 [CO3, CO4]

References:

1.Software Engineering, edition, Ian Somerville, Pearson Education, Ninth Edition
2.Software Engineering, Pankaj Jalote, Narosa Publication
3.Software engineering, a practitioner's approach, Roger Pressman, Tata Mcgraw-hill, 7th Edition

Course Code	Course Title	Credits	No. of lectures
24BU4VSC03	**VSC: Retailing Management**	**02**	**30**

Upon Completing the Course, Students will able to		
CO1	Understand the organized retail sector and its operations.	L2
CO2	Understand the various strategies involved with the retail sector	L2
CO3	Identify how to deal with customers and understand their needs to sustain in the market	L1
CO4	Clarify the concept and related terms in retailing	L2

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	-	1	2
CO2	3	2	1	-	1	2
CO3	3	2	1	-	2	3
CO4	3	1	1	-	1	1

Unit I	**THE WORLD OF RETAILING:** Introduction to the World of Retailing, Types of Retailers, Multichannel and Omni channel Retailing, Customer Buying Behavior. **RETAILING STRATEGY:** Retail Market Strategy, Financial Strategy, Retail Locations.	**15** **[CO1, CO2, CO4]**
Unit II	**RETAILING STRATEGY:** Retail Site Location, Information Systems and Supply Chain Management, Customer Relationship Management. **MERCHANDISE MANAGEMENT:** Managing the Merchandise Planning Process, Buying Merchandise, Retail Pricing, Retail Communication Mix.	**15** **[CO3, CO4]**

References:

1. Retailing Management, 10th Edition, By Michael Levy, Barton A. Weitz, Dhruv Grewal, 2023

Course Code	Course Title	Credits	No. of lectures
24BUIT4P03	**FP: Mini Project and Documentation**	**02**	**60**

Upon Completing the Course, Students will able to		
CO1	Identify the problem to solve and meet its requirements	L2
CO2	Understand concepts of Project and Project Management	L2
CO3	Examine project planning techniques applied in Industrial In-Plant training	L4
CO4	Develop interest towards research-oriented field with ability to search the literature and brief report preparation.	L6

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	-	2	1
CO2	3	2	1	-	2	1
CO3	3	3	1	-	3	1
CO4	2	3	2	-	1	2

Annexure 1 : Project Guidelines
Annexure 2 : Research Paper/ Article Guidelines

Annexure 1 : Project Guidelines

Guidelines to Prepare-Mini-Project

This document provides guide lines for writing and evaluating the technical specifications for a B.Sc. IT Mini project.

Writing the specification

The purpose of the technical specification is to provide specific information about how the project will be carried out with details about the products that will be delivered. The technical specification should include the following sections.

FrontPage

Page1 Title page
Page2 Certificate from External Guide / Organization
Page3 Acknowledgement
Page4 Contents
Page5 Abstract

1. Introduction

Define the "Problem"
Objectives
Purpose
Scope
Advantages
Applicability

2. Survey of Technology

3. Gantt Chart, Hardware and Software Requirements

4. **System Design**

Basic Modules

Data Design (if applicable)

Logic Diagrams

- Class Diagram
- Use case Diagram
- ER Diagram

5. **Implementation and Testing**

Coding

Testing

6. **Results**
7. **Conclusion**
8. **REFERENCES/BIBLIOGRAPHY**

1. Author Name, Title of Paper/Book, Publisher's Name, Year of publication
2. Full URL Address

Typing and Binding of Research Project Report Font

1. Chapter Names - 16TIMESNEWROMAN(Bold)All Caps
2. Headings - 14TIMESNEWROMAN(Bold)All Caps
3. Subheadings - 14TIMESNEWROMAN(Bold)Title Case
4. Sub–Sub Headings- 12TIMESNEWROMAN(Bold)Title Case
5. Body of Project - 12TIMESNEWROMAN
6. Text in Diagrams - 12TIMESNEWROMAN(All Lower Case)
7. Diagrams/Table Headings/Fig.Headings-12'TIMESNEWROMANTitleCase
8. If Any Text 12'TIMESNEWROMAN(Title Case)

Spacing

1. Two(2)Line Spacing between Heading and Body Text.
2. LineSpacingInBodyTextshouldbe1.5
3. New Paragraphs Start With Single Tab.

Margins

Left1.5' Right1.0'

Top1.0' Bottom1.0'

Page Numbers

Position Bottom, Middle

1. FrontPages Small Roman Numbers

(Excluding Title Page, Certificate Page, Acknowledgement Page)

2. Body Pages 1,2,3…….

3.Annexure 1,2,3……..

(Separate For Each Annexure)

Size:A4 Paper **Color:** White

Documentation: Spiral Binding

Project Report Should Not Exceed More Than 25-to-30 Pages

Annexure 2 :
Research Paper/ Article Guidelines

Article title

Author Name[1], Author Name[2], Author Name[3]
[1]University/College Name, Department, Street Address, City, Country, Postal Code
Company Name, Street Address, City, Country, Postal Code
Email:xxx@xxx.xxx[1]xxx@xxx.xxx[2]xxx@xxx.xxx[2]

Abstract

Sample text inserted for illustration. Replace with abstract text. Your abstract should give readers a brief summary of your article. It should concisely describe the contents of your article, and include key terms. It should be informative, accessible and not only indicate the general scope of the article but also state the main results obtained and conclusions drawn. The abstract should be complete in itself; it should not contain undefined abbreviations and no table numbers, figure numbers, references or equations should be referred to. It should be suitable for direct inclusion in abstracting services and should not normally be more than 300 words.

Keywords: optics, photonics, light, lasers, templates, journals.

1. Introduction

2. Litreature Review

3. Statement of Problem (Optional)

4. Experimental Techniques / Research Methodology

5. Figures and Tables (Data analysis Or Interpretation of Data)

5.1 Figures

Figures are numbered in the order in which they are called out in the text. Figures should be embedded in the manuscript for the initial submission; individual figure files will be requested for the first revision in .tif, .eps, .png, or PDF format. We cannot accept application files (e.g., Corel Draw, Microsoft PowerPoint, etc.). All figure parts must be labeled (a), (b), etc. Each figure file should contain all parts of the figure.

6. Results and Discussions

7. Recommendation

8. Conclusion

References

1. M. Gómez and M. Lazzari, *Materials Today* **17**, 358 (2014).
2. J. S. Huang, V. Callegari, P. Geisler, and B. Hecht, *Nature Communications***1**, 150, (2010)
3. S. D. George, U. Ladiwala, J. Thomas, A. Bankapur, S. Chidangil, and D. Mathur, *Appl. Surface Sci.***305**, 375 (2014).

Evaluation and Examination Scheme

Evaluation Scheme 30:20
Internals Based on Unit 1 / Unit 2 / Unit 3/ Unit 4

Assignments/ Tutorials/Class Test	Seminar or any other activities	Active Participation & Leadership qualities	Total
10	05	05	20

Suggested Format for Mandatory Question paper

Duration: 1.30Hours **Total Marks: 30**

N. B.: 1. All the questions are compulsory
2. Figures to the right indicate full marks.
3. Answer to the same question must be written together.
4.Use of non-programmable calculator is allowed.

Q.1 **Attempt any Two** **8**
(A)
(B)
(C)
(D)

Q.2 **(A)** **Attempt any One** **4**
i)
ii)
(B) **Attempt any One** **3**
i)
ii)

Q.3 **Attempt any Two** **8**
(A)
(B)
(C)
(D)

Q.4 **(A)** **Attempt any One** **4**
i)
ii)
(B) **Attempt any One** **3**
i)
ii)

Semester End Practical Examination:
Practical examination of each paper for 50 marks will be held for 2 or 3 hours.

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VPM's B. N. Bandodkar College of Science (Autonomous), Thane

Curriculum Structure for the Undergraduate Degree Programme S.Y.B.Sc. Information Technology

	Course Code	SEMESTER–III	Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)			Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)			
		Course Title	EM	EN	SD	PE	GE	HV	ES
Major	24BUIT3T01	Data Structures using Python	√		√				
	24BUIT3T02	Computer Network	√	√	√				
	24BUIT3T03	Advanced Database Management System	√	√	√				
	24BUIT3P01	Practical Based on 24BUIT3T01	√	√	√				
	24BUIT3P02	Practical Based on 24BUIT3T03	√	√	√				
MN	24BUIT3T04	Applied Mathematics			√				
OE	24BUIT3T05	Introduction to Linux Operating System	√	√	√				
AEC	24BU3AEC05	Management for I.T.	√	√	√	√			
VSC	24BU3VSC04	Software Engineering – I	√	√	√				
SEC	24BU3SEC08	Public Administration				√	√		
CC	-	Co-curricular Course		√	√			√	

VPM's B. N. Bandodkar College of Science (Autonomous), Thane

Curriculum Structure for the Undergraduate Degree Programme S.Y.B.Sc. Information Technology

	Course Code	SEMESTER–IV	Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)			Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)			
		Course Title	EM	EN	SD	PE	GE	HV	ES
Major	24BUIT4T01	Core Java	√		√				
	24BUIT4T02	Computer Graphics	√	√	√				
	24BUIT4T03	Introduction to Embedded Systems	√	√	√				
	24BUIT4P01	Practical Based on 24BUIT4T01	√	√	√				
	24BUIT4P02	Practical Based on 24BUIT4T02	√	√	√				
MN	24BUIT4T04	Computer Oriented Statistical Techniques	√		√				
OE	24BUIT4T05	Introduction to Intellectual Property Rights	√	√	√	√			
AEC	24BU4AEC05	Retailing Management	√	√	√				
VSC	24BU4VSC03	Software Engineering – II	√	√	√				
FP	24BUIT4P03	Mini Project and Documentation	√	√	√				
CC		Co-curricular Course		√	√			√	

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