

University of Mumbai



No. AAMS_UGS/ICC/2024-25/20

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology is invited to this office circular No.UG/76 of 2018-19 dated 6th July, 2018 relating to the revised syllabus as per (CBCS) for the T.Y.B.Sc in Information Technology (Sem – V & VI).

They are hereby informed that the recommendations made by the Ad-hoc **Board of Studies in Information Technology** at its meeting held on 03rd June, 2024 and subsequently passed by the Board of Deans at its meeting held on 27th June, 2024 **vide** item No. 6.6 (R) have been accepted by the Academic Council at its meeting held on 28th June, 2024 **vide** item No.6.6 (R) and that in accordance therewith, the **revised syllabus** as per the (CBCS) for the **T.Y.B.Sc. in Information Technology (Sem.-V & VI)**, has been brought into force with effect from the academic year 2024-25.

(The circular is available on the University's website www.mu.ac.in).

MUMBAI – 400 032

24th July, 2024

Baliram
(Prof.(Dr) Baliram Gaikwad)
I/c Registrar

To

The Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology.

A.C/6.6(R)/28/06/2024

Copy forwarded with Compliments for information to:-

- 1) The Dean, Faculty of Science & Technology,
- 2) The Chairman, Ad-hoc Board of Studies in Information Technology,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Director, Department of Information & Communication Technology.
- 6) The Co-ordinator, MKCL.
- 7) The Deputy Registrar, Admissions, Enrolment, Eligibility & Migration Department (AEM),
- 8) The Deputy Registrar, Result Unit,
- 9) The Deputy Registrar, College Affiliations Development Department (CAD)

Copy to :-

- 1. The Deputy Registrar, Academic Authorities Meetings and Services (AAMS),**
- 2. The Deputy Registrar, College Affiliations & Development Department (CAD),**
- 3. The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),**
- 4. The Deputy Registrar, Research Administration & Promotion Cell (RAPC),**
- 5. The Deputy Registrar, Executive Authorities Section (EA),**
- 6. The Deputy Registrar, PRO, Fort, (Publication Section),**
- 7. The Deputy Registrar, (Special Cell),**
- 8. The Deputy Registrar, Fort/ Vidyanagari Administration Department (FAD) (VAD), Record Section,**
- 9. The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,**

They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.

- 1. P.A to Hon'ble Vice-Chancellor,**
- 2. P.A Pro-Vice-Chancellor,**
- 3. P.A to Registrar,**
- 4. All Deans of all Faculties,**
- 5. P.A to Finance & Account Officers, (F.& A.O),**
- 6. P.A to Director, Board of Examinations and Evaluation,**
- 7. P.A to Director, Innovation, Incubation and Linkages,**
- 8. P.A to Director, Board of Lifelong Learning and Extension (BLLE),**
- 9. The Director, Dept. of Information and Communication Technology (DICT) (CCF & UCC), Vidyanagari,**
- 10. The Director of Board of Student Development,**
- 11. The Director, Department of Students Welfare (DSD),**
- 12. All Deputy Registrar, Examination House,**
- 13. The Deputy Registrars, Finance & Accounts Section,**
- 14. The Assistant Registrar, Administrative sub-Campus Thane,**
- 15. The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,**
- 16. The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,**
- 17. The Assistant Registrar, Constituent Colleges Unit,**
- 18. BUCTU,**
- 19. The Receptionist,**
- 20. The Telephone Operator,**
- 21. The Secretary MUASA**

for information.

University of Mumbai



Revised Syllabus for
T.Y.B.Sc. (Information Technology)
Semester – (Sem V and VI)
(Choice Based Credit System)

(With effect from the academic year 2024-25)

University of Mumbai



Syllabus for Approval

O: _____	Title of Course	T.Y.B.Sc. (Information Technology)
O: _____	Eligibility	As per University Ordinance
R: _____	Passing Marks	40%
No. of years/Semesters:		Sem. V & VI
Level:		U.G.
Pattern:		Semester
Status:		Revised
To be implemented from Academic Year :		From Academic Year: 2024-25

Sign of Chairperson
Dr. Mrs. R.
Srivaramangai
Ad-hoc BoS (IT)

Sign of the
Offg. Associate Dean
Dr. Madhav R. Rajwade
Faculty of Science &
Technology

Sign of Offg. Dean,
Prof. Shivram S. Garje
Faculty of Science &
Technology

Semester – 5			
Course Code	Course Type	Course Title	Credits
USIT501	Skill Enhancement Course	Software Project Development	2
USIT502	Skill Enhancement Course	Internet of Things: Theory and Practice	2
USIT503	Skill Enhancement Course	Advanced Web Development	2
USIT504	Discipline Specific Elective (Any One)	Artificial Intelligence and Applications	2
USIT505		Linux Server Administration	
USIT506	Discipline Specific Elective (Any One)	Advanced Java Technologies	2
USIT507		Emerging Technologies	
USIT5P1	Skill Enhancement Course Practical	Project Dissertation	2
USIT5P2	Skill Enhancement Course Practical	Internet of Things: Theory and Practice Practical	2
USIT5P3	Skill Enhancement Course Practical	Advanced Web Development Practical	2
USIT5P4	Discipline Specific Elective Practical (Any One)*	Artificial Intelligence and Applications Practical	2
USIT5P5		Linux Server Administration Practical	
USIT5P6	Discipline Specific Elective Practical (Any One)*	Advanced Java Technologies Practical	2
USIT5P7		Emerging Technologies Practical	
Total Credits			20

(All the practical mentioned in the syllabi are compulsory as per the courses chosen)

Semester – 6			
Course Code	Course Type	Course Title	Credits
USIT601	Skill Enhancement Course	Software Testing and Quality Assurance	2
USIT602	Skill Enhancement Course	Information Security	2
USIT603	Skill Enhancement Course	Business Intelligence and Data Analytics	2
USIT604	Discipline Specific Elective (Any One)	Fundamentals of GIS	2
USIT605		Enterprise Network Design	
USIT606	Discipline Specific Elective (Any One)	IT Infrastructure Management	2
USIT607		IT Act and Cyber Laws	
USIT6P1	Skill Enhancement Course Practical	Project Implementation	2
USIT6P2	Skill Enhancement Course Practical	Information Security Practical	2
USIT6P3	Skill Enhancement Course Practical	Business Intelligence and Data Analytics Practical	2
USIT6P4	Discipline Specific Elective Practical (Any One)*	Fundamentals of GIS Practical	2
USIT6P5		Enterprise Network Design Practical	
USIT6P6	Skill Enhancement Course Practical	Android Programming Practical	2
Total Credits			20

***The choice of Practical course is based on the theory Course. For Semester V, USIT504, USIT505, USIT506 and USIT507, the practical courses are USIT5P4, USIT5P5 USIT5P6, USIT5P7. For Semester VI, USIT604, USIT605 the practical courses are USIT6P4, USIT6P5 respectively. Practical Course USIT6P6 is compulsory.**

Semester-V

Software Project Development

B. Sc. (Information Technology)		Semester – V	
Course Name: Software Project Development		Course Code: USIT501	
Periods per week (1 Period is 50 minutes)		5	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2½	75
	Internal	--	25

Course Objective:

- Understanding on the need for Software Project Management.
- Understanding the basic steps of project evaluation, planning.
- Understanding the basic steps of activity planning, risk management.
- Understanding the basic steps of controlling cost, managing contracts, managing people.
- Understanding how to work in team, maintaining quality and successfully closing the project.

Unit	Details	Lectures
I	<p>Introduction to Software Project Management: Introduction, Why is Software Project Management Important? What is a Project? Software Projects versus Other Types of Project, Contract Management and Technical Project Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some Ways of Categorizing Software Projects, Project Charter, Stakeholders, Setting Objectives, The Business Case, Project Success and Failure, What is Management? Management Control, Project Management Life Cycle, Traditional versus Modern Project Management Practices.</p> <p>Project Evaluation and Programme Management: Introduction, Business Case, Project Portfolio Management, Evaluation of Individual Projects, Cost–benefit Evaluation Techniques, Risk Evaluation, Programme Management, Managing the Allocation of Resources within Programmes, Strategic Programme Management, Creating a Programme, Aids to Programme Management, Some Reservations about Programme Management, Benefits Management.</p> <p>An Overview of Project Planning: Introduction to Step Wise Project Planning, Step 0: Select Project, Step 1: Identify Project Scope and Objectives, Step 2: Identify Project Infrastructure, Step 3: Analyse Project Characteristics, Step 4: Identify Project Products and Activities, Step 5: Estimate Effort for Each Activity, Step 6: Identify Activity Risks, Step 7: Allocate Resources, Step 8: Review/Publicize Plan, Steps 9 and 10: Execute Plan/Lower Levels of Planning</p>	12

<p>II</p>	<p>Selection of an Appropriate Project Approach: Introduction, Build or Buy? Choosing Methodologies and Technologies, Software Processes and Process Models, Choice of Process Models, Structure versus Speed of Delivery, The Waterfall Model, The Spiral Model, Software Prototyping, Other Ways of Categorizing Prototypes, Incremental Delivery, Atern/Dynamic Systems Development Method, Rapid Application Development, Agile Methods, Extreme Programming (XP), Scrum, Lean Software Development, Managing Iterative Processes, Selecting the Most Appropriate Process Model.</p> <p>Software Effort Estimation: Introduction, Where are the Estimates Done? Problems with Over- and Under-Estimates, The Basis for Software Estimating, Software Effort Estimation Techniques, Bottom-up Estimating, The Top-down Approach and Parametric Models, Expert Judgement, Estimating by Analogy, Albrecht Function Point</p> <p>Analysis, Function Points Mark II, COSMIC Full Function Points, COCOMO II: A Parametric Productivity Model, Cost Estimation,</p> <p>Staffing Pattern, Effect of Schedule Compression, Capers Jones Estimating Rules of Thumb.</p>	<p>12</p>
<p>III</p>	<p>Activity Planning: Introduction, Objectives of Activity Planning, When to Plan, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Model, Adding the Time Dimension, The Forward Pass, Backward Pass, Identifying the Critical Path, Activity Float, Shortening the Project Duration, Identifying Critical Activities, Activity-on-Arrow Networks.</p> <p>Risk Management: Introduction, Risk, Categories of Risk, Risk Management Approaches, A Framework for Dealing with Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Evaluating Risks to the Schedule, Boehm’s Top 10 Risks and Counter Measures, Applying the PERT Technique, Monte Carlo Simulation, Critical Chain Concepts.</p> <p>Resource Allocation: Introduction, Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Creating Critical Paths, Counting the Cost, Being Specific, Publishing the Resource Schedule, Cost Schedules, Scheduling Sequence.</p>	<p>12</p>
<p>IV</p>	<p>Monitoring and Control: Introduction, Creating the Framework, Collecting the Data, Review, Visualizing Progress, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting the Project Back to Target, Change Control, Software Configuration Management (SCM).</p> <p>Managing Contracts: Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance.</p> <p>Managing People in Software Environments: Introduction, Understanding Behaviour, Organizational Behaviour: A Background, Selecting the Right Person for the Job, Instruction in the Best Methods, Motivation, The Oldham–Hackman Job Characteristics Model, Stress, Stress Management, Health and Safety, Some Ethical and Professional Concerns.</p>	<p>12</p>

V	<p>Working in Teams: Introduction, becoming a Team, Decision Making, Organization and Team Structures, Coordination Dependencies, Dispersed and Virtual Teams, Communication Genres, Communication Plans, Leadership.</p> <p>Software Quality: Introduction, The Place of Software Quality in Project Planning, Importance of Software Quality, Defining Software Quality, Software Quality Models, ISO 9126, Product and Process Metrics, Product versus Process Quality Management, Quality Management Systems, Process Capability Models, Techniques to Help Enhance Software Quality, Testing, Software Reliability, Quality Plans.</p> <p>Project Closeout: Introduction, Reasons for Project Closure, Project Closure Process, Performing a Financial Closure, Project Closeout Report.</p>	12
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Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Software Project Management	Bob Hughes, Mike Cotterell, Rajib Mall	TMH	6th	2018
2.	Project Management and Tools & Technologies – An overview	Shailesh Mehta	SPD	1st	2017
3.	Software Project Management	Walker Royce	Pearson		2005

Course Outcome:

After completing the course, the learner will be able to:

CO1: Describe the basic concepts of software project management with its life cycle

CO2: Apply project estimation and evaluation techniques to real world problem

CO3: Apply Key project management system techniques like PERT, CRM

CO4: Identify project risk, monitor and track project deadlines

CO5: Work in teams to evaluate the different modes of communication among people.

Internet of Things: Theory and Practice

B. Sc. (Information Technology)		Semester – V	
Course Name: Internet of Things: Theory and Practice		Course Code: USIT502	
Periods per week (1 Period is 50 minutes)		5	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2½	75
	Internal	--	25

Course Objectives:

- To understand the concept of the Internet of Things and its impact on technology
- To learn about the design principles of connected devices for a seamless user experience
- To delve into the workings of the internet and its communication protocols
- To explore different techniques of prototyping embedded devices and their physical design
- To gain knowledge about various business models and funding options for Internet of Things startups.

Unit	Details	Lectures
I	<p>The Internet of Things: An Overview : The Flavour of the Internet of Things, The “Internet” of “Things”, The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?</p> <p>Design Principles for Connected Devices: Calm and Ambient Technology, Magic as Metaphor, Privacy, Keeping Secrets, Whose Data Is It Anyway? Web Thinking for Connected Devices, Small Pieces, Loosely Joined, First-Class Citizens On The Internet, Graceful Degradation, Affordances.</p> <p>Internet Principles: Internet Communications: An Overview, IP, TCP, The IP Protocol Suite (TCP/IP), UDP, IP Addresses, DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6, MAC Addresses, TCP and UDP Ports, An Example: HTTP Ports, Other Common Ports, Application Layer Protocols, HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols.</p>	12
II	<p>Thinking About Prototyping: Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Changing Embedded Platform, Physical Prototypes and Mass Personalisation, Climbing into the Cloud, Open Source versus Closed Source, Why Closed? Why Open? Mixing Open and Closed Source, Closed Source for Mass Market Projects, Tapping into the Community.</p> <p>Prototyping Embedded Devices: Electronics, Sensors, Actuators, Scaling Up the Electronics, Embedded Computing Basics, Microcontrollers, System-on-Chips, Choosing Your Platform, Arduino, Developing on the Arduino, Some Notes on the Hardware, Openness, Raspberry Pi, Cases and Extension Boards, Developing on the Raspberry Pi, Some Notes on the Hardware, Openness.</p>	12
III	<p>Prototyping the Physical Design: Preparation, Sketch, Iterate, and Explore, Nondigital Methods, Laser Cutting, Choosing a Laser Cutter, Software, Hinges and Joints, 3D Printing, Types of 3D Printing, Software, CNC Milling, Repurposing/Recycling.</p> <p>Prototyping Online Components: Getting Started with an API, Mashing Up APIs, Scraping, Legalities, Writing a New API, Clockodillo, Security,</p>	12

	Implementing the API, Using Curl to Test, Going Further, Real-Time Reactions, Polling, Comet, Other Protocols, MQ Telemetry Transport, Extensible Messaging and Presence Protocol, Constrained Application Protocol.	
IV	<p>Techniques for Writing Embedded Code: Memory Management, Types of Memory, Making the Most of Your RAM, Performance and Battery Life, Libraries, Debugging,</p> <p>Business Models: A Short History of Business Models, Space and Time, From Craft to Mass Production, The Long Tail of the Internet, Learning from History, The Business Model Canvas, Who Is the Business Model For? Models, Make Thing, Sell Thing, Subscriptions, Customisation, Be a Key Resource, Provide Infrastructure: Sensor Networks, Take a Percentage, Funding an Internet of Things Startup, Hobby Projects and Open Source, Venture Capital, Government Funding, Crowdfunding, Lean Startups.</p>	12
V	<p>Moving to Manufacture: What Are You Producing? Designing Kits, Designing Printed circuit boards, Software Choices, The Design Process, Manufacturing Printed Circuit Boards, Etching Boards, Milling Boards. Assembly, Testing, Mass-Producing the Case and Other Fixtures, Certification, Costs, Scaling Up Software, Deployment, Correctness and Maintainability, Security, Performance, User Community.</p> <p>Ethics: Characterizing the Internet of Things, Privacy, Control, Disrupting Control, Crowdsourcing, Environment, Physical Thing, Electronics, Internet Service, Solutions, The Internet of Things as Part of the Solution, Cautious Optimism, The Open Internet of Things Definition.</p>	12

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Designing the Internet of Things	Adrian McEwen, Hakim Cassimally	WILEY	First	2014
2.	Internet of Things – Architecture and Design	Raj Kamal	McGraw Hill	First	2017
3.	Getting Started with the Internet of Things	Cuno Pfister	O'Reilly	Sixth	2018
4.	Getting Started with Raspberry Pi	Matt Richardson and Shawn Wallace	SPD	Third	2016

Course Outcomes:

Upon completion of the course, students will be able to:

- CO1. Explain the concept of the Internet of Things and its applications in real-life scenarios.
- CO2. Apply design principles to create user-friendly and connected devices.
- CO3. Understand the communication protocols of the internet and design efficient web-connected devices.
- CO4. Prototype embedded devices and create their physical design using various tools and techniques.
- CO5. Understand the business models and funding options available for startups in the Internet of Things domain and apply them to real-life scenarios.

Advanced Web Development

B. Sc. (Information Technology)		Semester – V	
Course Name: Advanced Web Development		Course Code: USIT503	
Periods per week (1 Period is 50 minutes)		5	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2½	75
	Internal	--	25

Course Objective:

- Understand .NET Fundamentals: Gain a comprehensive understanding of the .NET framework, including its languages (C#), the Common Language Runtime, and the .NET Class Library.
- Learn the fundamentals of the C# language, covering variables, data types, conditional logic, loops, methods, and advanced topics like object-based manipulation.
- Develop skills in writing code for ASP.NET applications, utilizing server controls, handling events, and configuring applications. Understand various form controls, validation techniques, and navigation concepts. Handling error handling, debugging, and exception handling techniques in ASP.NET.
- Learn about state management on both client and server sides, including view state, transferring information between pages, and working with cookies.
- Gain expertise in ADO.NET components, data providers, SQL commands, and queries.
- Understand the data provider model, direct data access, and disconnected data access.
- Learn to work with data source controls and integrate with Microsoft Azure Database.

Unit	Details	Lectures
I	.NET Technology and Framework, C#, VB, and the .NET Languages, The Common Language Runtime, The .NET Class Library. The C# Language: C# Language Basics, Variables and Data Types, Variable Operations, Object-Based Manipulation, Conditional Logic, Loops, Methods. Types, Objects, and Namespaces: The Basics About Classes, Building a Basic Class, Value Types and Reference Types, Understanding Namespaces and Assemblies, Advanced Class Programming.	12
II	ASP.NET Web Forms, Writing Code, Using the Code-Behind Class, Adding Event Handlers, Understanding the Anatomy of an ASP.NET Application, Introducing Server Controls, Using the Page Class, Using Application Events, Configuring an ASP.NET Application. Form Controls: Stepping Up to Web Controls, Web Control Classes, List Controls, Table Controls, Web Control Events and AutoPostBack, Validation, Understanding Validation, Using the Validation Controls, Rich Controls, The Calendar, The AdRotator, Pages with Multiple Views, User Controls and Graphics, User Controls, Dynamic Graphics, The Chart Control, Website Navigation: Site Maps, URL Mapping and Routing, The SiteMapPath Control, The TreeView Control, The Menu Control.	12
III	Tracing, Error Handling, Debugging, Exception Handling, User defined Exceptions, Page Tracing, Client and Server side state management, View State, Transferring Information Between Pages, Cookies- creation, retrieval, reading, Types of Cookies, Using Master Pages and Content Pages	12

IV	ADO.NET Components, Data Providers, SQL Basic command and queries, Understanding the Data Provider Model, Using Direct Data Access, Using Disconnected Data Access. Working with Data Source Controls, Data Controls: GridView, DetailsView and FormView.	12
V	Understanding Security Requirements, Introduction to Authentication and Authorization NuGet package manager for .NET and Visual Studio- Installation, Basics, framework, Bootstrap basics, Structure of the Page, Typography, Forms Ajax- Using Partial Refreshes, Using Progress Notification, Implementing Timed Refreshes, Working with the ASP.NET AJAX Control Toolkit.	12

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Beginning Visual C# 2010	K. Watson, C. Nagel, J.H Padderson	Wrox (Wiley)		2010
2.	Murach's ASP.NET 4.6 Web Programming in C#2015	Mary Delamater and Anne Bohem	SPD	Sixth	2016
3.	ASP.NET 4.0 programming	J. Kanjilal	Tata McGraw Hill		2011
4.	Programming ML.NET	Dino Esposito, Francesco Esposito	Paperback		
5.	Ajax : A Beginner's Guide	Steven Holzner	Paperback		2017
6	Introducing Bootstrap 4	Jörg Krause	Apress		2016

Web reference:

NuGet package :- <https://learn.microsoft.com/en-us/nuget/quickstart/install-and-use-a-package-in-visual-studio>

Course Outcome:

After completing the course, the learner will be able to:

- CO1: Learner will explore the foundations of .NET Development, .NET Ecosystem, C# and Fundamental Concepts
- CO2: Comprehensive Understanding and Practical Application using controls.
- CO3: ASP.NET Web Development Essentials: Tracing, Debugging, and State Management Techniques
- CO4: Mastering Data Access in ASP.NET: ADO.NET Essentials and Azure Integration
- CO5: Securing ASP.NET Applications: Authentication, Authorization, and Advanced Techniques with Ajax and Bootstrap

Artificial Intelligence and Applications

B. Sc. (Information Technology)		Semester – V	
Course Name: Artificial Intelligence and Applications		Course Code: USIT504 (Elective 1)	
Periods per week (1 Period is 50 minutes)		5	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2½	75
	Internal	--	25

Pre-requisites:

1. Proficiency in at least one programming language such as C++, Python or Java.
2. Knowledge of fundamental data structures (arrays, linked lists, stacks, queues, trees, graphs) and their algorithms.
3. Understanding of discrete mathematics, linear algebra, probability and statistics.
4. Familiarity with logical reasoning.

Course Objectives:

- To understand the fundamental concepts and history of Artificial Intelligence, including the current state of the field and its foundational principles.
- To develop proficiency in problem-solving techniques using various search algorithms, both uninformed and informed, and apply heuristic functions effectively.
- To gain knowledge and skills in adversarial search, including strategies for games, optimal decision-making, and dealing with uncertainty in partially observable environments.
- To master logical reasoning and inference methods, including propositional and first-order logic, and apply them to knowledge representation and problem-solving tasks.
- To explore advanced topics such as planning algorithms, including classical planning and multi-agent planning, as well as generative AI techniques and their applications.

Unit	Details	Lectures
I	Introduction: What is Artificial Intelligence? Foundations of AI, History, the state of art AI today. Intelligent Agents: Agents and Environment, Good Behaviour, Nature of Environment, Structure of Agents.	12
II	Solving Problems by Searching: Problem Solving Agents, Searching for Solutions, Uninformed Search, Informed Search Strategies, Heuristic Functions. Beyond Classical Search: Local Search Algorithms, Searching with Non-Deterministic Action, Searching with Partial Observations, Online Search Agents and Unknown Environments.	12
III	Adversarial Search: Games, Optimal Decisions in Games, Alpha-Beta Pruning, Stochastic Games, Partially Observable Games. Logical Agents: Knowledge Base Agents, The Wumpus World, Propositional Logic, Propositional Theorem Proving. Probabilistic Reasoning: Uncertainty, Conditional Probability, Bayes Theorem.	12
IV	First Order Logic: Need For First Order Logic, Difference between Propositional and First Order Logic, Knowledge Engineering in First Order Logic. Inference in First Order Logic: Unification and Lifting, Forward and Backward Chaining, Resolution. Artificial Neural Network: Architecture of ANN, Merits and Demerits of ANN, Types of ANN.	12
V	Planning: Definition of Classical Planning, Algorithms for Planning as State	12

Space Search, Planning Graphs, Other Classical Planning Approaches, Analysis of Planning Approaches, Time, Schedules and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multiagent Planning.
Generative AI: What is Generative AI? Types of Generative AI

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Artificial Intelligence: A Modern Approach	Stuart Russel and Peter Norvig	Pearson	Third	2015
2.	A First Course in Artificial Intelligence	Deepak Khemani	TMH	First	2017
3.	Artificial Intelligence: A Rational Approach	Rahul Deva	Shroff Publisher	First	2018
4.	Artificial Intelligence	Elaine Rich, Kevin Knight and Shivashankar Nair	TMH	Third	2009
5.	Artificial Intelligence & Soft Computing for Beginners	Anandita Das Bhattacharjee	SPD	First	2013
6.	Artificial Intelligence & Generative AI for Beginners: The Complete Guide	David M. Patel	GD Publishing	First	2023

Course Outcomes:

After completing the course, the learner will be able to:

- CO1:** Articulate the historical development and current trends in Artificial Intelligence, demonstrating a comprehensive understanding of its foundations and principles.
- CO2:** Demonstrate proficiency in implementing and analyzing various search algorithms, utilizing both uninformed and informed strategies to solve complex problems efficiently.
- CO3:** Apply adversarial search techniques to decision-making in competitive environments, including games, and effectively manage uncertainty and partial observability.
- CO4:** Demonstrate competency in logical reasoning and inference, utilizing propositional and first-order logic to represent and solve real-world problems in AI applications.
- CO5:** Gain practical experience in planning algorithms and generative AI techniques, enabling them to design and implement AI systems capable of planning actions and generating novel content autonomously.

Linux Server Administration

B. Sc. (Information Technology)		Semester – V	
Course Name: Linux Server Administration		Course Code: USIT505 (Elective-I)	
Periods per week (1 Period is 50 minutes)		5	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2½	75
	Internal	--	25

Course Objective:

- To gain a deep understanding of various Linux distributions.
- To be able to install, configure, and optimize for specific server roles.
- To develop expertise in securing Linux servers from unauthorized access, attacks, and vulnerabilities.
- To acquire the skills to monitor server performance, identify bottlenecks, and optimize resource utilization.
- To understand Bash scripting language to automate repetitive tasks and server management processes.

Unit	Details	Lectures
I	<p>Getting Started Starting with Linux , Duties of the System Administrator, Installing Red Hat Enterprise Linux Server</p> <p>Working with Users, Groups, and Permissions: Managing Users and Groups, Commands for User Management, Managing Passwords, Modifying and Deleting User Accounts, Configuration Files, Creating Groups, Using Graphical Tools for User, and Group Management, 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.</p> <p>Gaining Privileges, Console Access, Installing and Managing Software YUM: Checking for and updating Packages, Packages and Package Groups, Configuring Yum and Yum Repositories, Yum Plug-ins, Additional resources Packagekit: Updating packages with software update, Using Add/Remove Software, Packagekit Architecture, Additional Resources</p>	12
II	<p>Configuring and Managing Storage: Understanding Partitions and Logical Volumes, Creating Partitions, Creating File Systems, File Systems Overview, Creating File Systems, Changing File System Properties, Checking the File System Integrity, Mounting File Systems Automatically Through fstab, Working with Logical Volumes, Creating Logical Volumes, Resizing Logical Volumes, Working with Snapshots, Replacing Failing Storage Devices, Creating Swap Space, Working with Encrypted Volumes</p> <p>Networking, Network Manager: The Network Manager Daemon, Interacting with Network Manager, Establishing Connections</p> <p>Network Interfaces: Network Configuration Files, Interface Configuration files, Interface Control Scripts, Static routes and the default gateway, Configuring static routes in ifcfg files, Network function files, ETHTool.</p>	12

	<p>Infrastructure Services: Services and Daemons- Configuring the default runlevel, Configuring the Services, Running Services, Additional Resources.</p> <p>Configuring Authentication- Configuring System Authentication, Using and Caching credentials with SSSD.</p> <p>OpenSSH- The SSH Protocol, Configuring OpenSSH, Using OpenSSH certificate authentication, OpenSSH clients, More than a Secure Shell, Additional Resources</p>	
III	<p>TigerVNC- VNC servers, sharing an existing Desktop, Using a VNC Viewer, Additional Resources</p> <p>Servers:</p> <p>DHCP Servers: Why Use DHCP? Configuring DHCPv4 server, Configuring DHCPv4 Client.</p> <p>DNS Servers – Introduction to DNS, BIND</p> <p>Web Servers – The Apache HTTP server</p> <p>Mail Servers – Email Protocols, Email Program Classification, Mail Transport Agents, Mail Delivery Agents, Mail User Agents, Additional Resources</p> <p>File Servers – Samba, FTP</p>	12
IV	<p>Monitoring and Automation</p> <p>System Monitoring Tools – Viewing System Processes, Viewing Memory Usage, Viewing CPU Usage, Viewing Block Devices and Filesystems, Viewing Hardware Information, Monitoring Performance with NET-SNMP, Additional Resources</p> <p>Viewing and Managing Log Files – Installing rsyslog, Locating Log files, Basic Configuration of rsyslog, working with queues in rsyslog, configuring rsyslog on a logging server, using rsyslog modules, debugging rsyslog, Managing Log files in graphical environment</p> <p>Automating System Tasks – Cron and Anacron, At and Batch</p>	12
V	<p>Securing Server with iptables: Understanding Firewalls, Setting Up a Firewall with system-config-firewall, Allowing Services, Trusted Interfaces, Masquerading, Configuration Files, Setting Up a Firewall with iptables, Tables, Chains, and Rules, Composition of Rule, Configuration Example, Advanced iptables Configuration, Configuring Logging, The Limit Module, Configuring NAT</p> <p>Setting Up Cryptographic Services: Introducing SSL, Proof of Authenticity: The Certificate Authority, Managing Certificates with OpenSSL, creating a Signing Request, Working with GNU Privacy Guard, Creating GPG Keys, Key Transfer, Managing GPG Keys, Encrypting Files with GPG, GPG Signing, Signing RPM Files</p> <p>Introducing Bash Shell Scripting</p> <p>Introduction, Elements of a Good Shell Script, Executing the Script, Working with Variables and Input, Understanding Variables, Variables, Subshells, and Sourcing, Working with Script Arguments, Asking for Input, Using Command Substitution, Substitution Operators, Changing Variable Content with Pattern Matching, Performing Calculations, Using Control Structures, Using if...then...else, Using case, Using while, Using until, Using for, Configuring booting with GRUB</p>	12

Books and References:						
Sr. No.	Title	Author/s	Publisher	Edition	Year	
1	Red Hat Enterprise Linux 6 Deployment Guide	Red Hat	Red Hat Content Services	First	2021	
2.	Linux Bible	Christopher Negus	Wiley	Tenth	2020	
3.	Red hat Linux Networking and System Administration	Terry Collings and Kurt Wall	Wiley	Third	2005	
4.	Red Hat Enterprise Linux6 Administration	Sander van Vugt	Sybex	First	2013	
5.	Linux Administration: A Beginner's Guide	Wale Soyinka	TMH	Eighth	2020	

Course Outcome:

After completing the course, the learner will be able to:

CO1: Demonstrate a comprehensive understanding of various Linux distributions, packages and proficiency in developing effective access control lists to manage users and group accounts.

CO2: Acquire the ability to manage storage and partitions, and develop efficiency in configuring network and infrastructure services.

CO3: Implement different servers with their server configuration roles and parameters.

CO4: Analyze system logs to identify potential problems and security incidents.

CO5: Develop expertise in implementing security measures like firewalls, access controls, password policies, and encryption to protect the system and ability to write scripts to automate tasks

Advanced Java Technologies

B. Sc. (Information Technology)		Semester – V	
Course Name: Advanced Java Technologies		Course Code: USIT506 (Elective-II)	
Periods per week (1 Period is 50 minutes)		5	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2½	75
	Internal	--	25

Course Objective:

- To understand the concept of and develop applications using servlets and database connectivity.
- To develop applications that can handle cookies, sessions and file operations.
- To understand the concept of and design applications using Java server pages.
- To understand the concept of and design applications using Enterprise Java Beans.
- To understand the concepts of persistence, Hibernate and develop JPA applications, Hibernate applications.

Unit	Details	Lectures
I	<p>Understanding Java EE: What is an Enterprise Application? What is java enterprise edition? Java EE Technologies, Java EE evolution, Glassfish server</p> <p>Java EE Architecture, Server and Containers: Types of System Architecture, Java EE Server, Java EE Containers.</p> <p>Introduction to Java Servlets: The Need for Dynamic Content, Java Servlet Technology, Why Servlets? What can Servlets do?</p> <p>Servlet API and Lifecycle: Java Servlet API, The Servlet Skeleton, The Servlet Life Cycle, A Simple Welcome Servlet</p> <p>Working with Servlets: Getting Started, Using Annotations Instead of Deployment Descriptor.</p> <p>Working with Databases: What Is JDBC? JDBC Architecture, Accessing Database, The Servlet GUI and Database Example.</p>	12
II	<p>Request Dispatcher: Requestdispatcher Interface, Methods of Requestdispatcher, Requestdispatcher Application.</p> <p>COOKIES: Kinds of Cookies, Where Cookies Are Used? Creating Cookies, Using Servlet, Dynamically Changing the Colors of A Page</p> <p>SESSION: What Are Sessions? Lifecycle of HttpSession, Session Tracking With Servlet API, A Servlet Session Example</p> <p>Working with Files: Uploading Files, Creating an Upload File Application, Downloading Files, Creating a Download File Application.</p> <p>Working with Non-Blocking I/O: Creating a Non-Blocking Read Application, Creating The Web Application, Creating Java Class, Creating Servlets, Retrieving The File, Creating index.jsp</p>	12
III	<p>Introduction To Java Server Pages: Why use Java Server Pages? Disadvantages Of JSP, JSP v\vs Servlets, Life Cycle of a JSP Page, How does a</p>	12

	<p>JSP function? How does JSP execute? About Java Server Pages Getting Started With Java Server Pages: Comments, JSPDocument, JSPElements, JSP GUI Example.</p> <p>Action Elements: Including other Files, Forwarding JSP Page to Another Page, Passing Parameters for other Actions, Loading a Java bean.</p> <p>Implicit Objects, Scope and El Expressions: Implicit Objects, Character Quoting Conventions, Unified Expression Language [UnifiedEl], Expression Language.</p> <p>Java Server Pages Standard Tag Libraries: What is wrong in using JSP Scriptlet Tags? How JSTL Fixes JSP Scriptlet's Short comings? Disadvantages Of JSTL, Tag Libraries.</p>	
IV	<p>Introduction To Enterprise Javabeans: Enterprise Bean Architecture, Benefits of Enterprise Bean, Types of Enterprise Bean, Accessing Enterprise Beans, Enterprise Bean Application, Packaging Enterprise Beans</p> <p>Working with Session Beans: When to use Session Beans? Types of Session Beans, Remote and Local Interfaces, Accessing Interfaces, Lifecycle of Enterprise Beans, Packaging Enterprise Beans, Example of Stateful Session Bean, Example of Stateless Session Bean, Example of Singleton Session Beans.</p> <p>Working with Message Driven Beans: Lifecycle of a Message Driven Bean, Uses of Message Driven Beans, The Message Driven Beans Example.</p> <p>Interceptors: Request and Interceptor, Defining An Interceptor, AroundInvoke Method, Applying Interceptor, Adding An Interceptor To An Enterprise Bean, Build and Run the Web Application.</p> <p>Java Naming and Directory Interface: What is Naming Service? What is Directory Service? What is Java Naming and Directory interface? Basic Lookup, JNDI Namespace in Java EE, Resources and JNDI, Datasource Resource Definition in Java EE.</p>	12
V	<p>Persistence, Object/Relational Mapping And JPA: What is Persistence? Persistence in Java, Current Persistence Standards in Java, Why another Persistence Standards? Object/Relational Mapping.</p> <p>Introduction to Java Persistence API: The Java Persistence API, JPA, ORM, Database and the Application, Architecture of JPA, How JPA Works? JPA Specifications.</p> <p>Writing JPA Application: Application Requirement Specifications, Software Requirements, The Application Development Approach, Creating Database and Tables in Mysql, creating a Web Application, Adding the Required Library Files, creating a Javabean Class, Creating Persistence Unit [Persistence.Xml], Creating JSP's, The JPA Application Structure, Running the JPA Application.</p> <p>Introduction to Hibernate: What is Hibernate? Why Hibernate? Hibernate, Database and The Application, Components of Hibernate, Architecture of Hibernate, How Hibernate Works?</p> <p>Writing Hibernate Application: Application Requirement Specifications, Software Requirements, The Application Development Approach, Creating Database and Tables in Mysql, Creating a Web Application, Adding the Required Library Files, Creating a Java bean Class, Creating Hibernate Configuration File, Adding a Mapping Class, Creating JSP's, Running The Hibernate Application.</p>	12

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Java EE 7 For Beginners	Sharanam Shah, Vaishali Shah	SPD	First	2017
2.	Java EE 8 Cookbook	Elder Moraes	Packt	First	2018
3.	Advanced Java Programming	Uttam Kumar Roy	Oxford Press	First	2015
4.	Java EE 8 Application Development	David R. Heffelfinger	Packt	First	2017
5.	Java EE 7 Essentials	Arun Gupta	O'Reilly	First	2013

Course Outcome:

After completing the course, the learner will be able to:

CO1: Proficiently understand and apply servlets and database connectivity concepts to develop dynamic web applications.

CO2: Demonstrate the ability to develop applications capable of managing cookies, sessions, and performing file operations effectively.

CO3: Proficient in understanding and designing applications using Java Server Pages (JSP), enabling dynamic and interactive web content creation.

CO4: Adept at comprehending and designing applications utilizing Enterprise Java Beans (EJB), facilitating the development of scalable and distributed enterprise-level applications.

CO5: Possess a thorough understanding of persistence concepts, Hibernate framework, and the ability to develop Java Persistence API (JPA) and Hibernate applications proficiently.

Emerging Technologies

B. Sc. (Information Technology)		Semester – V	
Course Name: Emerging Technologies		Course Code: USIT507 (Elective-II)	
Periods per week (1 Period is 50 minutes)		5	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2½	75
	Internal	--	25

Course Objective:

- To gain a comprehensive understanding of Big Data, develop insights into NoSQL databases, their history, advantages, and differences from SQL databases.
- To have an in-depth understanding of MongoDB's data modeling techniques, and to be proficient in using the MongoDB shell.
- To have a comprehensive understanding of MongoDB's storage engine and indexing mechanisms, be able to identify and address limitations in MongoDB deployments.
- To gain a comprehensive understanding of the evolution and advantages of SSD, exploring technologies such as TimesTen, Redis etc, while also mastering jQuery for efficient DOM traversal and manipulation.
- To understand and apply JSON grammar, syntax, and data types; create, parse, and persist JSON objects and arrays; compare JSON with XML for data interchange.

Unit	Details	Lectures
I	<p>Big Data: Getting Started, Big Data, Facts About Big Data, Big Data Sources, Three Vs of Big Data, Volume, Variety, Velocity, Usage of Big Data, Visibility, Discover and Analyze Information, Segmentation and Customizations, Aiding Decision Making, Innovation, Big Data Challenges, Policies and Procedures, Access to Data, Technology and Techniques, Legacy Systems and Big Data, Structure of Big Data, Data Storage, Data Processing, Big Data Technologies</p> <p>NoSQL: SQL, NoSQL, Definition, A Brief History of NoSQL, ACID vs. BASE, CAP Theorem (Brewer's Theorem), The BASE, NoSQL Advantages and Disadvantages, Advantages of NoSQL, Disadvantages of NoSQL, SQL vs. NoSQL Databases, Categories of NoSQL Databases</p> <p>Introducing MongoDB: History, MongoDB Design Philosophy, Speed, Scalability, and Agility, Non-Relational Approach, JSON-Based Document Store, Performance vs. Features, Running the Database Anywhere, SQL Comparison</p>	12
II	<p>The MongoDB Data Model: The Data Model, JSON and BSON, The Identifier (_id), Capped Collection, Polymorphic Schemas, Object- Oriented Programming, Schema Evolution</p> <p>Using MongoDB Shell: Basic Querying, Create and Insert, Explicitly Creating Collections, Inserting Documents Using Loop, Inserting by Explicitly Specifying _id, Update, Delete, Read, Using Indexes, Stepping Beyond the Basics, Using Conditional Operators, Regular Expressions, MapReduce, aggregate(), Designing an Application's Data Model, Relational Data Modeling and Normalization, MongoDB Document Data Model Approach</p>	12

	<p>MongoDB Architecture: Core Processes, mongod, mongo, mongos, MongoDB Tools, Standalone Deployment, Replication, Master/Slave Replication, Replica Set, Implementing Advanced Clustering with Replica Sets, Sharding, Sharding Components, Data Distribution Process, Data Balancing Process, Operations, Implementing Sharding, Controlling Collection Distribution (Tag-Based Sharding), Points to Remember When Importing Data in a Sharded Environment, Monitoring for Sharding, Monitoring the Config Servers, Production Cluster Architecture, Scenario 1, Scenario 2, Scenario 3, Scenario 4</p>	
III	<p>MongoDB Storage Engine: Data Storage Engine, Data File (Relevant for MMAPv1), Namespace (.ns File), Data File (Relevant for WiredTiger), Reads and Writes, How Data Is Written Using Journaling, GridFS – The MongoDB File System, The Rationale of GridFS, GridFS under the Hood, Using GridFS, Indexing, Types of Indexes, Behaviors and Limitations</p> <p>MongoDB Use Cases: Use Case 1 -Performance Monitoring, Schema Design, Operations, Sharding, Managing the Data, Use Case 2 – Social Networking, Schema Design, Operations, Sharding</p> <p>MongoDB Limitations: MongoDB Space Is Too Large (Applicable for MMAPv1), Memory Issues (Applicable for Storage Engine MMAPv1), 32-bit vs. 64-bit, BSON Documents, Namespaces Limits, Indexes Limit, Capped Collections Limit - Maximum Number of Documents in a Capped Collection, Sharding Limitations, Shard Early to Avoid Any Issues, Shard Key Can't Be Updated, Shard Collection Limit, Select the Correct Shard Key, Security Limitations, No Authentication by Default, Traffic to and from MongoDB Isn't Encrypted, Write and Read Limitations, Case-Sensitive Queries, Type-Sensitive Fields, No JOIN, Transactions, MongoDB Not Applicable Range</p> <p>MongoDB Best Practices: Deployment, Hardware Suggestions from the MongoDB Site, Few Points to be Noted, Coding, Application Response Time Optimization, Data Safety, Administration, Replication Lag, Sharding, Monitoring</p>	12
IV	<p>The End of Disk? SSD and In-Memory Databases: The End of Disk?, Solid State Disk, The Economics of Disk, SSD-Enabled Databases, In-Memory Databases, TimesTen, Redis, SAP HANA, VoltDB, Oracle 12c “in-Memory Database, Berkeley Analytics Data Stack and Spark, Spark Architecture</p> <p>jQuery: Introduction, Traversing the DOM, DOM Manipulation with jQuery, Events, Ajax with jQuery, jQuery Plug-ins, jQuery Image Slider</p>	12
V	<p>JSON: Introduction, JSON Grammar, JSON Values, JSON Tokens, Syntax, JSON vs XML, Data Types, Objects, Arrays, Creating JSON, JSON Object, Parsing JSON, Persisting JSON, Data Interchange, JSON PHP, JSON HTML, JSONP</p>	12

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Practical MongoDB	Shakuntala Gupta dward NavinSabharwal	Apress	First	2015
2.	Beginning jQuery	Jack Franklin Russ Ferguson	Apress	Second	2017

3.	Next Generation Databases	Guy Harrison	Apress	First	2015
4.	Beginning JSON	Ben Smith	Apress	First	2015
5.	Mastering MongoDB	Marko Aleksendric, Arek Borucki, Leandro Domingues	Packt	First	2015

Course Outcome:

After completing the course, the learner will be able to:

CO1: Understand and articulate the foundational concepts and practical applications of Big Data, and compare and contrast SQL and NoSQL databases.

CO2: Design and implement effective MongoDB data models utilizing JSON, BSON, and various schema strategies; efficiently perform data operations using the MongoDB shell.

CO3: Understand and utilize MongoDB's storage engine, journaling, and GridFS file system; effectively design and implement MongoDB use cases.

CO4: Evaluate the benefits and implications of transitioning from traditional disk storage to SSD and in-memory databases, proficiently use technologies like TimesTen, Redis, etc., and effectively utilize jQuery for DOM manipulation.

CO5: Understanding of JSON, including its grammar, syntax, and data types, and be able to create, parse, and persist JSON objects and arrays. They will also learn to compare JSON with XML for data interchange and effectively use JSON in various web development contexts.

Internet of Things: Theory and Practice Practical

B. Sc. (Information Technology)		Semester – V	
Course Name: Internet of Things: Theory and Practice Practical		Course Code: USIT5P2	
Periods per week (1 Period is 50 minutes)		3	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2	50
	Internal	--	--

Practical No	Details
0	Starting Raspbian OS, Familiarizing with Raspberry Pi Components and interface, Connecting to ethernet, Monitor, USB.
1	Displaying different LED patterns with Raspberry Pi.
2	Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi
3	Interfacing 16X2 LCD with Raspberry Pi to display different messages.
4	Raspberry Pi Based Oscilloscope
5	Controlling Raspberry Pi with WhatsApp.
6	Fingerprint Sensor interfacing with Raspberry Pi
7	Raspberry Pi GPS Module Interfacing
8	IoT based Web Controlled Home Automation using Raspberry Pi
9	Interfacing Pi Camera with Raspberry Pi
10	Interfacing Raspberry Pi with RFID.
11	Installing Windows 10 IoT Core on Raspberry Pi (Demo Practical)

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Designing the Internet of Things	Adrian McEwen, Hakim Cassimally	WILEY	First	2014
2.	Official Raspberry Pi Beginner's Guide	Gareth Halfacre	Raspberry Pi Press	First	2018
3.	Programming the Raspberry Pi	by Simon Monk	McGraw Hill	Third	2021
4.	Getting Started with Raspberry Pi	Matt Richardson and Shawn Wallace	SPD	Third	2016

Advanced Web Development Practical

B. Sc. (Information Technology)		Semester – V	
Course Name: Advanced Web Development Practical		Course Code: USIT5P3	
Periods per week (1 Period is 50 minutes)		3	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2½	50
	Internal	--	--

List of Practical

1.	Write the program for the following:
a.	Create an application to print on screen the output of adding, subtracting, multiplying and dividing two numbers entered by the user in C#.
b.	Create an application to print Floyd's triangle till n rows in C#.
c.	Create an application to demonstrate following operations i. Generate Fibonacci series. ii. Test for prime numbers.
2.	Write the program for the following:
a.	Create a simple application to demonstrate the concepts boxing and unboxing.
b.	Create a simple application to perform addition and subtraction using delegate.
c.	Create a simple application to demonstrate use of the concepts of interfaces.
3.	Write the program for the following:
a.	Create a simple web page with various server controls to demonstrate setting and use of their properties. (Example : AutoPostBack)
b.	Create a simple application to demonstrate your vacation using calendar control.
c.	Demonstrate the use of Treeview operations on the web form.
4.	Write the program for the following:
a.	Create a Registration form to demonstrate use of various Validation controls.
b.	Create Web Form to demonstrate use of Adrotator Control.
c.	Create Web Form to demonstrate use User Controls
5.	Write the program for the following:
a.	Create Web Form to demonstrate use of Website Navigation controls.
b.	Create a web application to demonstrate use of Master Page and content page.
c.	Create a web application to demonstrate various states of ASP.NET Pages.
6.	Write the program for the following:
a.	Create a web application for inserting and deleting records from a database.
b.	Create a web application to display Using Disconnected Data Access and Databinding using GridView.

7.	Write the program for the following:
a.	Create a web application to demonstrate the use of different types of Cookies.
b.	Create a web application to demonstrate Form Security and Windows Security with proper Authentication and Authorization properties.
8.	Write the program for the following:
a.	Create a web application for inserting and deleting records from a database. (Using ExecuteNonQuery).
b.	Create a web application for user defined exception handling.
9.	Write the program for the following:
a.	Create a web application to demonstrate use of GridView button column and GridView events along with paging and sorting.
b.	Create a web application to demonstrate data binding using DetailsView and FormView Control.
10.	Write the program for the following:
a.	Create a web application to demonstrate JS Bootstrap Button.
b.	Create a web application to demonstrate use of various Ajax controls.
c.	Create a web application to demonstrate Installation and use of NuGet package.

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Beginning Visual C# 2010	K. Watson, C. Nagel, J.H Padderson, J.D. Reid, M.Skinner	Wrox (Wiley)		2010
2.	Murach's ASP.NET 4.6 Web Programming in C#2015	Mary Delamater and Anne Bohem	SPD	Sixth	2016
3.	ASP.NET 4.0 programming	J. Kanjilal	Tata McGrawHill		2011
4.	Programming ML.NET	Dino Esposito (Author), Francesco Esposito (Author)	Paperback		
5.	Ajax : A Beginner's Guide	Steven Holzner	Paperback		2017
6	Introducing Bootstrap 4	By Jörg Krause	Apress		2016

Artificial Intelligence and Applications Practical

B. Sc. (Information Technology)		Semester – V	
Course Name: Artificial Intelligence and Applications Practical		Course Code: USIT5P4 (Elective I)	
Periods per week (1 Period is 50 minutes)		3	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2½	50
	Internal	--	--

List of Practical	
1.	Write programs for the following:
a.	Implement depth first search algorithm.
b.	Implement breadth first search algorithm.
2.	Write programs for the following:
a.	Simulate 4-Queen / N-Queen problem.
b.	Solve tower of Hanoi problem.
3.	Write programs for the following:
a.	Implement alpha beta search.
b.	Implement hill climbing problem.
4.	Write programs for the following:
a.	Implement A* algorithm.
b.	Solve water jug problem.
5.	Write programs for the following:
a.	Simulate tic – tac – toe game using min-max algorithm.
b.	Shuffle deck of cards.
6.	Write program for the following:
a.	Design an application to simulate number puzzle problem.
7.	Write program for the following:
a.	Solve constraint satisfaction problem.
8.	Write programs for the following:
a.	Derive the expressions based on Associative Law.
b.	Derive the expressions based on Distributive Law.
9.	Write program for the following:
a.	Derive the predicate. (for e.g.: Sachin is batsman, batsman is cricketer) - > Sachin is Cricketer

10.	Write program for the following:
a.	Write a program which contains three predicates: male, female, parent. Make rules for following family relations: father, mother, grandfather, grandmother, brother, sister, uncle, aunt, nephew and niece, cousin. Question: i. Draw Family Tree. ii. Define: Clauses, Facts, Predicates and Rules with conjunction and disjunction

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Artificial Intelligence: A Modern Approach	Stuart Russel and Peter Norvig	Pearson	Third	2015
2.	A First Course in Artificial Intelligence	Deepak Khemani	TMH	First	2017
3.	Artificial Intelligence: A Rational Approach	Rahul Deva	Shroff Publisher	First	2018
4.	Artificial Intelligence	Elaine Rich, Kevin Knight and Shivashankar Nair	TMH	Third	2009
5.	Artificial Intelligence & Soft Computing for Beginners	Anandita Das Bhattacharjee	SPD	First	2013

Essentials of Linux Server Administration Practical

B. Sc. (Information Technology)		Semester – V	
Course Name: Essentials of Linux Server Administration Practical		Course Code: USIT5P5 (Elective-I)	
Periods per week (1 Period is 50 minutes)		3	
Credits		2	
		Hours	Mark s
Evaluation System	Practical Examination	2½	50
	Internal	--	--

List of Practical	
0.	Installation of RHEL6.x
1.	Working with Users, Groups, and Permissions
a.	Creating and Managing Users
b.	Creating and Managing Groups
c.	Using Permissions and Advanced Permissions
2.	Working with Console, RPM, and Yum
a.	Managing Console and Gaining Privileges
b.	Working with RPM
c.	Working with Yum
3.	Working with Storage, Network and Infrastructure services
a.	Configuring and Managing Storage
b.	Connecting to the Network
c.	Configuring and enabling Infrastructure services
d.	Configuring OpenSSH
4.	Configuring Server for File Sharing
a.	Configuring NFS Server and Client
b.	Configuring Samba
c.	Configuring FTP
5.	Configuring DHCP, DNS, Web and Mail Servers
a.	Configuring DHCP server
b.	Configuring DNS server
c.	Configuring Web server
d.	Configuring Mail server
6.	Configuring Monitoring and Automation tools
a.	Configuring System Monitoring tools
b.	Configuring rsyslog
c.	Configuring cron, anacron, At and Batch Utility

7.	Firewall and Cryptographic services
a.	Securing Server with iptables
b.	Setting Up Cryptographic Services
8.	Write the program for the following:
a.	Programs on Shell scripting
b.	Shell scripts to automate or monitor tasks/processes
9.	Perform Daily System Administration tasks
a.	Managing Processes
b.	Working with Storage Devices and Links
c.	Working with repository
10.	Configuring selinux
a.	Working with selinux

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1	Red Hat Enterprise Linux6 Administration	Sander van Vugt	Sybex	First	2013
2	Red Hat Enterprise Linux 6 Deployment Guide	Red Hat	Red Hat Content Services	First	2021
3	Red hat Linux Networking and System Administration	Terry Collings and Kurt Wall	Wiley	Third	2005
4	Linux Administration: A Beginner's Guide	Wale Soyinka	TMH	Eighth	2020
5	RedHat certified System Administrator	William Maning	Emero Publishing	Second	2012

Advanced Java Technologies Practical

B. Sc. (Information Technology)		Semester – V	
Course Name: Advanced Java Technologies Practical		Course Code: USIT5P6 (Elective-II)	
Periods per week (1 Period is 50 minutes)		3	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2½	50
	Internal	--	--

List of Practical	
1.	Implement the following Simple Servlet applications.
a.	Create a simple calculator application using servlet.
b.	Create a servlet for a login page. If the username and password are correct then it says message “Hello <username>” else a message “login failed”
c.	Create a registration servlet in Java using JDBC. Accept the details such as Username, Password, Email, and Country from the user using HTML Form and store the registration details in the database.
2.	Implement the following Servlet applications with Cookies and Sessions.
a.	Using Request Dispatcher Interface create a Servlet which will validate the password entered by the user, if the user has entered "Servlet" as password, then he will be forwarded to Welcome Servlet else the user will stay on the index.html page and an error message will be displayed.
b.	Create a servlet that uses Cookies to store the number of times a user has visited servlet.
c.	Create a servlet demonstrating the use of session creation and destruction. Also check whether the user has visited this page first time or has visited earlier also using sessions.
3.	Implement the Servlet IO and File applications.
a.	Create a Servlet application to upload and download a file.
b.	Develop Simple Servlet Question Answer Application using Database.
c.	Create simple Servlet application to demonstrate Non-Blocking Read Operation.
4.	Implement the following JSP applications.
a.	Develop a simple JSP application to display values obtained from the use of intrinsic objects of various types.
b.	Develop a simple JSP application to pass values from one page to another with validations. (Name-txt, age-txt, hobbies-checkbox, email-txt, gender-radio button).
c.	Create a registration and login JSP application to register and authenticate the user based on username and password using JDBC.
5.	Implement the following JSP JSTL and EL Applications.
a.	Create an html page with fields, eno, name, age, desg, salary. Now on submit this data to a JSP page which will update the employee table of database with matching eno.

b.	Create a JSP page to demonstrate the use of Expression language.
c.	Create a JSP application to demonstrate the use of JSTL.
6.	Implement the following EJB Applications.
a.	Create a Currency Converter application using EJB.
b.	Develop a Simple Room Reservation System Application Using EJB.
c.	Develop simple shopping cart application using EJB [Stateful Session Bean].
7.	Implement the following EJB applications with different types of Beans.
a.	Develop simple EJB application to demonstrate Servlet Hit count using Singleton Session Beans.
b.	Develop simple visitor Statistics application using Message Driven Bean [Stateless Session Bean].
c.	Develop simple Marks Entry Application to demonstrate accessing Database using EJB.
8.	Implement the following JPA applications.
a.	Develop a simple Inventory Application Using JPA.
b.	Develop a Guestbook Application Using JPA.
c.	Create simple JPA application to store and retrieve Book details.
9.	Implement the following JPA applications with ORM and Hibernate.
a.	Develop a JPA Application to demonstrate use of ORM associations.
b.	Develop a Hibernate application to store Feedback of Website Visitor in MySQL Database.
c.	Develop a Hibernate application to store and retrieve employee details in MySQL Database.
10.	Implement the following Hibernate applications.
a.	Develop an application to demonstrate Hibernate One- To -One Mapping Using Annotation.
b.	Develop Hibernate application to enter and retrieve course details with ORM Mapping.
c.	Develop a five page web application site using any two or three Java EE Technologies.

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Java EE 7 For Beginners	Sharanam Shah, Vaishali Shah	SPD	First	2017
2.	Java EE 8 Cookbook	Elder Moraes	Packt	First	2018
3.	Advanced Java Programming	Uttam Kumar Roy	Oxford Press	First	2015
4.	Java EE 8 Application Development	David R. Heffelfinger	Packt	First	2017
5.	Java EE 7 Essentials	Arun Gupta	O'Reilly	First	2013

Emerging Technologies Practical

B. Sc. (Information Technology)		Semester – V	
Course Name: Emerging Technologies Practical		Course Code: USIT5P7 (Elective-II)	
Periods per week (1 Period is 50 minutes)		3	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2½	50
	Internal	--	--

List of Practical	
1.	MongoDB Basics
a.	Write a MongoDB query to create and drop database.
b.	Write a MongoDB query to create, display and drop collection
c.	Write a MongoDB query to insert, query, update and delete a document.
2.	Simple Queries with MongoDB
3.	Implementing Aggregation
a.	Write a MongoDB query to use sum, avg, min and max expression.
b.	Write a MongoDB query to use push and addToSet expression.
c.	Write a MongoDB query to use first and last expression.
4.	Replication, Backup and Restore
a.	Write a MongoDB query to create Replica of existing database.
b.	Write a MongoDB query to create a backup of existing database.
c.	Write a MongoDB query to restore database from the backup.
5.	Java and MongoDB
a.	Connecting Java with MongoDB and inserting, retrieving, updating and deleting.
6.	PHP and MongoDB
a.	Connecting PHP with MongoDB and inserting, retrieving, updating and deleting.
7.	Python and MongoDB
a.	Connecting Python with MongoDB and inserting, retrieving, updating and deleting.

8.	Programs on Basic jQuery
a.	jQuery Basic, jQuery Events
b.	jQuery Selectors, jQuery Hide and Show effects
c.	jQuery fading effects, jQuery Sliding effects
9.	jQuery Advanced
a.	jQuery Animation effects, jQuery Chaining
b.	jQuery Callback, jQuery Get and Set Contents
c.	jQuery Insert Content, jQuery Remove Elements and Attribute
10.	JSON & Mongo DB
a.	Creating JSON
b.	Parsing JSON
c.	Persisting JSON
d.	Export MongoDB to JSON.
e.	Write a MongoDB query to delete JSON object from MongoDB.

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Practical MongoDB	Shakuntala Gupta Edward Navin Sabharwal	Apress	First	2015
2.	Beginning jQuery	Jack Franklin			
3.	Russ Ferguson	Apress	Second	2017	
4.	Next Generation Databases	Guy Harrison	Apress	First	2015
5.	Beginning JSON	Ben Smith	Apress	First	2015