AC –
Item No. –

As Per NEP 2020

Tolani College of Commerce (Autonomous)

Title of the Course: The Dynamic Evolution of Indian Science and Technology: A Journey through Time (IKS)

Programme: B.Sc. (Information Technology)
Semester V

Syllabus for 2 Credits

From the Academic Year: 2025-2026

Name of the Course: The Dynamic Evolution of Indian Science and Technology: A Journey through Time (IKS).

Sr. No.	Heading	Particulars
1	**Description of the course :**	This course explores into the historical contributions of ancient Indian mathematics and logic, highlighting key innovations like the concept of zero and algorithms. By connecting ancient principles to contemporary technologies, the course emphasizes the lasting impact of Indian thought on future innovations.
2	**Vertical :**	Major
3	**Type :**	Theory
4	**Credit**:	2 credits
5	**Hours Allotted :**	30 Hours
6	**Marks Allotted**:	50 Marks
7	**Course Objectives:** 1) To understand the historical perspective in Indian Mathematics. 2) To examine influence of Indian Knowledge Systems in Modern Computing.	
8	**Course Outcomes**: Learner will be able to : 1) understand how ancient Indian mathematical and logical systems have influenced the development of modern computing and computational theory. 2) apply insights from Indian Knowledge Systems (IKS) to contemporary fields like quantum computing, artificial intelligence, and big data.	

9	**Modules**:-
	Module 1: Ancient Contributions in Mathematics (15 Hours)
	• Foundations of Indian mathematics, Aryabhata's innovations in algorithms, Historical engineering marvels and mathematical systems in ancient India. • Development of binary systems and zero in ancient India, and their significance in modern digital computing. • Indian logic and its role in shaping modern computational theory: From Nyaya philosophy to the development of formal systems and programming languages.
	Module 2: Evolution of Indian Logic in Modern Computing (15 Hours)
	• Introduction of computers in India, IT outsourcing in the 1990s, role of Indian engineers in the global IT workforce, rise of India's IT sector: Key drivers of growth (1990s liberalization, Y2K crisis, outsourcing boom). • Turing Machines and Computability Theory: Connections between ancient Indian notions of computation and algorithmic logic. • How Indian Knowledge Systems (IKS) can influence future technologies like quantum computing, big data, and biotechnology.
10	**Text Books:** **Not Applicable**

11	**Reference Books:** **1.** Mathematics in India by Kim Plofker, First Edition, 2009. **2.** India and the IT Revolution: Networks of Global Culture Hardcover by A.Greenspan, October 2004.	
12	**Internal Continuous Assessment: 40%**	**Semester End Examination : 60%**
13	**Continuous Evaluation through:**	

Sub-components	Maximum Marks	Conditions for passing
1) Assignment	10	A learner must be present for each of the sub- components
2) MCQ	10	
Total	20	

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Question Paper Pattern for Semester End Examination

Maximum Marks: 30 **Duration: 1 Hr.**

Note: All questions are compulsory. Each question has an internal choice.

[Refer to Next Page]

Question Number		Nature of Questions	Maximum Marks
1)		**Attempt any 3**	
	a)		15
	b)		
	c)		
	d)		
	e)		
2)		**Attempt any 3**	
	a)		15
	b)		
	c)		
	d)		
	e)		

Signatures of Team Members

Sr.No	Name	Signature
1.	Mr. Deepak Sharma	
2.		
3.		
4.		
5.		

AC–11-3-2025
Item No. –03

Approved by the Bos in Bachelor of Science (Information of Technology) on 13-11-2024 Item No.03

As Per NEP 2020

Tolani College of Commerce (Autonomous)

Knowledge is Supreme

Title of the Course: Software Project Management

Programme: B.Sc(Information Technology) Semester V

Syllabus for 4 credits

From the academic year- 2025-2026

Name of the Course: Software Project Management

Sr. No.	Heading	Particulars
1	**Description of the course :**	A software development project is a complex undertaking by two or more persons within the boundaries of time, budget, and staff resources that produces new or enhanced computer code that adds significant business value to a new or existing business process.
2	**Vertical:**	Major
3	**Type:**	Theory and Project
4	**Credit**:	4 credits
5	**Hours Allotted:**	60 Hours
6	**Marks Allotted**:	100 Marks Practical Evaluation: 40 Marks Semester-End: 60 Marks
7	**Course Objectives**: 1. To describe the differences between project management and software project management. 2. To use multiple techniques to estimate software tasks, projects and products. 3. To define, implement, analyze and use the metrics required to manage a software project. 4. To define historical data to be captured at project closure.	
8	**Course Outcomes**: 1. Learners will be able to Identify the different project contexts and suggest an appropriate management strategy. 2. Learners will practice the role of professional ethics in successful software development 3. Learners will be able to Identify and describe the key phases of project management. 4. Learners will determine an appropriate project management approach through an evaluation of the business context and scope of the project.	

9	**Module1: Introduction to Software Project Management and An Overview of Project Planning(15 hours)**
	• 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 LifeCycle, Traditional versus Modern Project Management Practices. • Introduction to Step Wise Project Planning, Step 0: Select Project, Step 1: Identify Project Scope and Objectives, Step 2: Identify Project Infrastructure, Step 3: Analyses 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
	Module2: Selection of an Appropriate Project Approach and Software Effort Estimation(15 hours)
	• 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. • 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 Analysis, Function Points Mark II, COSMIC Full Function Points, COCOMO II: A Parametric Productivity Model, Cost Estimation, Staffing Pattern, Effect of Schedule Compression, Capers Jones Estimating Rules of Thumb.
	Module3: Risk Management, Resource Allocation and Working in Teams (15 hours)
	. • 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. • 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. • Introduction, becoming a Team, Decision Making, Organization and Team Structures, Coordination Dependencies, Dispersed and Virtual Teams, Communication Genres, Communication Plans, Leadership

Module4: Managing Contracts and Managing People in Software Environments and Project Closeout (15 hours)

- Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance.
- Introduction, Understanding Behavior, Organizational Behavior: 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.
- Introduction, Reasons for Project Closure, Project Closure Process, Performing a Financial Closure, Project Closeout Report.

10 **Reference Books:**

1) **Author/s**Bob Hughes, Mike Cotterell, Rajib Mall, **Title** : Software Project Management, **Publisher** : TMH , **Edition** : $_6$th, **Year** :2018.
2) **Author/s**Shailesh Mehta, **Title** : Project Management and Tools & Technologies – An overview, **Publisher** : SPD , **Edition** :1st, **Year** :2017.

11	**Project Assessment: 40%**	**Semester End Examination: 60%**

12 **Format of Question Paper:**

Scheme of Evaluation Pattern
Table 1A: Scheme of Continuous Evaluation (CE)
Scheme of Evaluation Patter

Sub-components	Maximum Marks	Conditions for passing
Project Documentation and Viva Voce	40	A learner must be presentfor each of the sub- components
Total	40	

Table 1B: Scheme of Semester End Examination (SEE) Evaluation
Question Paper Pattern for Semester End Examination (SEE)
Maximum Marks: 60 **Duration: 2 Hrs.**

Note: All questions are compulsory. Each question has an internal choice.

Question Number		Nature of Questions	Maximum Marks
1)		**Attempt any three**	15
	a)		
	b)		
	c)		
	d)		
	e)		
2)		**Attempt any three**	15
	a)		
	b)		
	c)		
	d)		
	e)		
3)		**Attempt any three**	15
	a)		
	b)		
	c)		
	d)		
	e)		

		4)		**Attempt any three**	15	
			a)			
			b)			
			c)			
			d)			
			e)			

AC–11-03-2025
ItemNo. – 03

Approved by the Bos in Bachelor of Science (Information of Technology) on 13-11-2024 Item No.03

As Per NEP 2020

Tolani College of Commerce (Autonomous)

Title of the Course: Enterprise Java

Programme :Bachelor of Science (Information Technology)Semester V

Syllabus for 4 credits Course

From the academic year-2025-2026

Name of the Course: Enterprise Java

Sr. No.	Heading	Particulars
1	**Description the course :**	Enterprise Edition (Java EE) is the standard in community-driven enterprise software. Java EE is developed using the Java Community Process, with contributions from industry experts, commercial and open source organizations, Java User Groups, and countless individuals.
2	**Vertical:**	Major Elective
3	**Type:**	Theory and Practical
4	**Credit**:	4 credits
5	**Hours Allotted:**	60 Hours
6	**Marks Allotted**:	Total : 100 Marks Practical Evaluation: 40 Marks Semester-End: 60 Marks
7	**Course Objectives:** 1) To learn why Java is useful for the design of desktop and web applications. 2) To learn how to implement object-oriented designs with Java. 3) To identify Java language components and how they work together in applications. 4) To design and program stand-alone Java applications.	
8	**Course Outcomes:** 1) Learners will understand the concepts related to Java Technology 2) Learners will explore and understand use of Java Server Programming 3) Learners will create dynamic web pages, using Servlets and JSP 4) Learners learn to access database through Java programs, using Java Database Connectivity (JDBC)	

9	**Modules**:-
	Module 1: Understanding Java EE, Java EE Architecture, Server and Containers, Introduction to Java Servlets, Servlet API and Lifecycle, Working with Servlets, Working with Databases: (15 hours)
	• What is an Enterprise Application? What is java enterprise edition? Java EE Technologies, Java EE evolution, Glassfish server • Types of System Architecture, Java EE Server, Java EE Containers. • The Need for Dynamic Content, Java Servlet Technology, Why Servlets? What can Servlets do? • Java Servlet API, The Servlet Skeleton, The Servlet Life Cycle, A Simple Welcome Servlet • Getting Started, Using Annotations Instead of Deployment Descriptor. • What Is JDBC? JDBC Architecture ,Accessing Database, The Servlet GUI and Database Example.
	Module2: Request Dispatcher, COOKIES, SESSION,Working with Files, Working with Non-Blocking I/O (15 hours)
	• Resquestdispatcher Interface, Methods of Requestdispatcher, Requestdispatcher Application. • Kinds of Cookies, Where Cookies Are Used? Creating Cookies Using Servlet, Dynamically Changing the Colors of A Page • What Are Sessions? Lifecycle of Http Session, Session Tracking With Servlet API, A Servlet Session Example • Uploading Files, Creating an Upload File Application, Downloading Files, Creating a Download File Application. • Creating a Non-Blocking Read Application, Creating The Web Application, Creating Java Class, Creating Servlets, Retrieving The File, Creating index.jsp
	Module3: Introduction To Java Server Pages, Getting Started With Java Server Pages, Action Elements Implicit Objects, Scope and El Expressions and Java Server Pages Standard Tag Libraries(15 hours)
	• Why use Java Server Pages? Disadvantages Of JSP, JSP v\s Servlets, Life Cycle of a JSP Page, How does a JSP function? How does JSP execute? About Java Server Pages • Comments, JSP Document, JSP Elements, JSP GUI Example. • Including other Files, Forwarding JSP Page to Another Page, Passing Parameters for other Actions, Loading a Javabean. • Implicit Objects, Character Quoting Conventions, Unified Expression Language [UnifiedEl], Expression Language. • What is wrong in using JSP Scriptlet Tags? How JSTL Fixes JSP Scriptlet's Shortcomings?Disadvantages Of JSTL, Tag Libraries.
	Module4: Introduction To Enterprise Javabeans, Working with Session Beans, Working with Message Driven Beans, Interceptors and Java Naming and Directory Interface(15 hours)
	• Enterprise Bean Architecture, Benefits of Enterprise Bean, Types of Enterprise Bean, Accessing Enterprise Beans, Enterprise Bean Application, Packaging Enterprise 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. • Lifecycle of a Message Driven Bean, Uses of Message Driven Beans, The Message Driven Beans Example. • Request and Interceptor, Defining An Interceptor, AroundInvoke Method, Applying Interceptor,

	Adding An Interceptor To An Enterprise Bean, Build and Run the Web Application. • 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
10	**Reference Books:** 1) **Author/s:** Elder Moraes **Title** :Java EE 8 Cookbook: Build reliable applications with the most robust and mature technology forenterprise development, **Publisher** :Packt , **Edition** :First, **Year**:2018. 2) **Author/s:** Sharanam Shah, Vaishali Shah **Title** Java EE 7 For Beginners, **Publisher** : SPD , **Edition** :First, **Year**:2017.

11	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
12	**Continuous Evaluation through:**	Practical Assessment

13 Format of Question Paper:

Scheme of Evaluation Pattern

Table 1A: Scheme of Continuous Evaluation (CE/Practical)

Scheme of Evaluation Pattern

Sub-components	Maximum Marks	Conditions for passing
1) Practical exam	30	A learner must be present for each of the sub-components
2) Journal and Viva	10	
Total	40	

Table 1B: Scheme of Semester End Examination (SEE) Evaluation

Question Paper Pattern for Semester End Examination (SEE)

Maximum Marks: 60 **Duration: 2 Hrs.**

Note: All questions are compulsory. Each question has an internal choice.

Question Number		Nature of Questions	Maximum Marks
1)		**Attempt any Three**	15
	a)		
	b)		
	c)		
	d)		
	e)		
2)		**Attempt any Three**	15
	a)		
	b)		
	c)		
	d)		
	e)		
3)		**Attempt any Three**	15
	a)		
	b)		
	c)		
	d)		
	e)		
4)		**Attempt any Three**	15
	a)		
	b)		
	c)		

			d)		
			e)		

Course Name: Enterprise Java Practical			
Periods per week (1 Period is 60 minutes)		**4**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**40**

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.
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.	Develop Simple Servlet Question Answer Application using Database.
b.	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.
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.
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.

1	Q.1	15
2	Q.2	15
3	Viva	5
4	Journal	5
5	**Total**	**40**

AC–11-03-2025
Item No. – 03

Approved by the Bos in Bachelor of Science (Information of Technology) on 13-11-2024 Item No.03

As Per NEP 2020

Tolani College of Commerce (Autonomous)

Title of the Course: Next Generation Technology

Programme: B.Sc(Information Technology) Semester V

Syllabus for 4 Credit Course

From the academic year- 2025-2026

Name of the Course: Next Generation Technology

Sr. No.	Heading	Particulars
1	**Description of the course :**	Writing MongoDB queries to create, drop, insert, query, update, and delete databases. Connecting Java, PHP, and Python with MongoDB to insert, retrieve, update, and delete. Exporting MongoDB to JSON.
2	**Vertical:**	Major Elective
3	**Type:**	Theory and Practical
4	**Credit**:	4 credits
5	**Hours Allotted:**	60 Hours
6	**Marks Allotted**:	Total : 100 Marks Practical Evaluation: 40 Marks Semester-End: 60 Marks
7	**Course Objectives:** 1. Need of understanding big data 2. Concept of unstructured or NoSQL data 3. Handling unstructured data with MongoDB 4. Understand the architecture of MongoDB	
8	**Course Outcomes:** 1. Explain the term big data and its use in current world 2. Identify the difference between structured and unstructured data 3. Create unstructured data using MongoDB 4. Compare and contrast in-memory databases	

9	**Module1: (15 hours)**
	• **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 • **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 • **Introducing MongoDB:** History, MongoDB Design Philosophy, Speed, Scalability,and Agility, Non-Relational Approach, JSON-Based Document Store,Performance vs. Features, Running the Database Anywhere, SQLComparison
	Module2: (15 hours)
	• **The MongoDB Data Model:** The Data Model, JSON and BSON, The Identifier (_id), Capped Collection, Polymorphic Schemas, Object-Oriented Programming, Schema Evolution • **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 • **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).
	Module3: (15 hours)
	• **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,GridFSunder the Hood, Using GridFS, Indexing, Types of Indexes,Behaviors and Limitations. • **MongoDB Use Cases:** Use Case 1 -Performance Monitoring, Schema Design, Operations, Sharding, Managing the Data, Use Case 2 – Social Networking, Schema Design, Operations, Sharding • **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.
	Module4: (15 hours)
	• **jQuery:** Introduction, Traversing the DOM, DOM Manipulation with jQuery, Events, Ajax with jQuery, jQuery Plug-ins, jQuery Image Slider. • **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.

10	**Reference Books:** 1) **Author/s:** Jack Franklin Russ Ferguson**, Title** : Beginning jQuery, **Publisher** : Apress, **Edition** : 2nd, **Year** :2018. 2) **https://e-next.in/bsc-it-ngt-notes-1/**	
11	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
12	**Continuous Evaluation through:**	Practical Assessment
13	**Format of Question Paper:**	

Scheme of Evaluation Pattern
Table 1A: Scheme of Continuous Evaluation (CE/Practical)
Scheme of Evaluation Pattern

Sub-components	Maximum Marks	Conditions for passing
1) Practical exam	30	A learner must be present for each of the sub-components
2) Journal and Viva	10	
Total	40	

Table 1B: Scheme of Semester End Examination (SEE) Evaluation
Question Paper Pattern for Semester End Examination (SEE)
Maximum Marks: 60 **Duration: 2 Hrs.**

Note: All questions are compulsory. Each question has an internal choice.

Question Number		Nature of Questions	Maximum Marks
1)		**Attempt any Three**	15
	a)		
	b)		
	c)		
	d)		
	e)		
2)		**Attempt any Three**	15
	a)		
	b)		
	c)		
	d)		
	e)		
3)		**Attempt any Three**	15
	a)		
	b)		

			c)		
			d)		
			e)		
		4)		**Attempt any Three**	15
			a)		
			b)		
			c)		
			d)		
			e)		

Course Name: Next Generation Technology Practical			
Periods per week (1 Period is 60 minutes)		**4**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**40**

Practical No	**Details**
1	**MongoDB Basics:** a) Write a MongoDB query to create and drop database. b) Write a MongoDB query to create, display and drop collection
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.
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.
5	**Java and MongoDB** a) Connecting Java with MongoDB and inserting, retrieving, updating and deleting.
6	**Programs on Basic jQuery** a) jQuery Basic, jQuery Events b) jQuery Selectors, jQuery Hide and Show effects
7	**jQuery Advanced** a)jQuery Animation effects, jQuery Chaining b) jQuery Callback, jQuery Get and Set Contents

8	**JSON** a)Creating JSON b)Parsing JSON

1	Q.1	15
2	Q.2	15
3	Viva	5
4	Journal	5
5	**Total**	**40**

AC–11-03-25
Item No. –03
Approved by the Bos in Bachelor of Science (Information of Technology) on 13-11-2024 Item No.03

As Per NEP 2020

Tolani College of Commerce (Autonomous)

Title of the Course: Linux Administration

Programme: B.Sc(Information Technology) Semester V

Syllabus for 4 credits

From the academic year- 2025-2026

Name of the Course: Linux Administration

Sr. No.	Heading	Particulars
1	**Description of the course :**	A Linux administrator is a back-end IT specialist who installs, configures and maintains Linux operating systems in the following ways: Installs and configures Linux systems including back-end databases and scripts. Performs system maintenance by reviewing error logs
2	**Vertical:**	Major Electives
3	**Type:**	Theory and Practical
4	**Credit**:	4 credits
5	**Hours Allotted:**	60 Hours
6	**Marks Allotted**:	100 Marks Practical Evaluation: 40 Marks Semester-End: 60 Marks
7	**Course Objectives**: 1. To familiarize with the Linux operating system working environment. 2. To enable the accomplishment of several Linux system administration tasks. 3. To comprehend the configuration of Linux systems from an administration point of view. 4. To highlight the network and server configuration with Linux.	
8	**Course Outcomes**: 1. Explain the working environment of the Linux operating system. 2. Discuss role of an Linux System administrator in an organization. 3. Perform administrative operations in the Linux operating system using CLI and GUI. 4. Configure various servers on Linux operating systems like DHCP server, DNS server, Mail server.	

9	**Module1: Introduction to Red Hat Enterprise Linux, Command Line, System Administration Tasks (15 hours)**
	• Linux, Open Source and Red Hat, Origins of Linux, Distributions, Duties of Linux System Administrator. • Working with the Bash Shell, Getting the Best of Bash, Useful Bash Key Sequences, Working with Bash History, Performing Basic File System Management Tasks, Working with Directories, Piping and Redirection, Finding Files • Performing Job Management Tasks, System and Process Monitoring and Management, Managing Processes with ps, Sending Signals to Processes with the kill Command, Using top to Show Current System Activity, Managing Process Niceness, Scheduling Jobs, Mounting Devices, Working with Links, Creating Backups, Managing Printers, Setting Up System Logging, Setting Up Rsyslog, Common Log Files, Setting Up Logrotate
	Module2: Configuring and Managing Storage , Connecting to the Network , Working with Users, Groups, and Permissions (15 hours)
	• 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 • Understanding Network Manager, Working with Services and Runlevels, Configuring the Network with Network Manager, Working with system-config-network, Network Manager Configuration Files, Network Service Scripts, Networking from the Command Line, Troubleshooting Networking, Setting Up IPv6, Configuring SSH, Enabling the SSH Server, Using the SSH Client, Using PuTTY on Windows Machines, Configuring Key-Based SSH Authentication, Using Graphical Applications with SSH, Using SSH Port Forwarding, Configuring VNC Server Access • 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, 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.

Module3: Securing Server with iptables, Setting Up Cryptographic Services, Configuring Server for File Sharing (15 hours)

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- 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
- 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
- What is NFS? Advantages and Disadvantages of NFS, Configuring NFS4, Setting Up NFSv4, Mounting an NFS Share, Making NFS Mounts Persistent, Configuring Automount, Configuring Samba, Setting Up a Samba File Server, Samba Advanced Authentication Options, Accessing Samba Shares,

Module4: Configuring DNS and DHCP, Set Introducing Bash Shell Scripting, Configuring Apache on Red Hat Enterprise Linux (15 hours)

- 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 DHCP, Setting Up a DHCP Server
- 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.
- Configuring the Apache Web Server, Creating a Basic Website, Understanding the Apache Configuration Files, Apache Log Files, Working with Virtual Hosts, Securing the Web Server with TLS Certificates, Configuring Authentication, Setting Up Authentication with .htpasswd,

10 **Reference Books:**

1) **Author:** Sander van Vugt **Title** : Red Hat Enterprise Linux6 Administration, **Publisher** : John Wiley and Sons, **Edition** : 3rd , **Year** :2013.
2) **Author/**Wale Soyinka, **Title** : Linux Administration: A Beginner's Guide, **Publisher** : TMH , **Edition** :5th.

11	**Practical Assessment: 40%**	**Semester End Examination: 60%**

12 **Format of Question Paper:**

Scheme of Evaluation Pattern
Table 1A: Scheme of Continuous Evaluation (CE)
Scheme of Evaluation Patter

Sub-components	Maximum Marks	Conditions for passing
1) Practical exam	30	A learner must be presentfor each of the sub- components
2) Journal and Viva	10	
Total	40	

Table 1B: Scheme of Semester End Examination (SEE) Evaluation
Question Paper Pattern for Semester End Examination (SEE)
Maximum Marks: 60 **Duration: 2 Hrs.**

Note: All questions are compulsory. Each question has an internal choice.

Question Number		Nature of Questions	Maximum Marks
1)		**Attempt any three**	15
	a)		
	b)		
	c)		
	d)		
	e)		
2)		**Attempt any three**	15
	a)		
	b)		
	c)		
	d)		
	e)		
3)		**Attempt any three**	15
	a)		
	b)		
	c)		
	d)		
	e)		

4)		**Attempt any three**	15	
	a)			
	b)			
	c)			
	d)			
	e)			

Course Name: Linux Administration Practical			
Periods per week (1 Period is 60 minutes)		**4**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**40**

Practical No	**Details**
0	**Installation of RHEL 6.X**
1	**Graphical User Interface and Command Line Interface and Processes**
a	Exploring the Graphical Desktop
b	The Command Line Interface
2	**Storage Devices and Links, Backup and Repository**
a	Working with Storage Devices and Links
b	Making a Backup
c	Creating a Repository
3	**Working with RPMsm Storage and Networking**
a	Using Query Options
b	Extracting Files From RPMs
c	Configuring and Managing Storage
d	Connecting to the Network
4	**Working with Users, Groups, and Permissions**
5	**Firewall and Cryptographic services**
a	Securing Server with iptables
b	Setting Up Cryptographic Services
6	**Configuring Server for File Sharing**
a	Configuring NFS Server and Client
b	Configuring Samba
c	Configuring FTP

7	**DNS, DHCP**
a	Configuring DNS

b	Configuring DHCP
8	**Web Server and Shell Scripts**
a	Configuring Apache on Red Hat Enterprise Linux
b	Writing Shell Scripts
c	Configuring Booting with GRUB

1	Q.1	15
2	Q.2	15
3	Viva	5
4	Journal	5
5	**Total**	**40**

7	**DNS, DHCP**
a	Configuring DNS

b	Configuring DHCP
8	**Web Server and Shell Scripts**
a	Configuring Apache on Red Hat Enterprise Linux
b	Writing Shell Scripts
c	Configuring Booting with GRUB

1	Q.1	15
2	Q.2	15
3	Viva	5
4	Journal	5
5	**Total**	**40**

AC–11-03-25
Item No. –03

Approved by the Bos in Bachelor of Science (Information of Technology) on 13-11-2024 Item No.03

As Per NEP 2020

Tolani College of Commerce (Autonomous)

Knowledge is Supreme

Title of the Course: Advanced Web Programming

Programme: Bachelor of Science (Information Technology) Semester V

Syllabus for 4 credits Course

From the academic year-2025-2026

Name of the Course: Advanced Web Programming

Sr. No.	Heading	Particulars
1	**Description the course :**	This course covers topics ranging from programming a basic, web-based shopping cart to integrating the application to a back-end database.
2	**Vertical:**	Major
3	**Type:**	Theory and Practical
4	**Credit**:	4 credits
5	**Hours Allotted:**	60 Hours
6	**Marks Allotted**:	Total 100 Marks Practical Evaluation: 40 Marks Semester End Examination: 60 Marks
7	**Course Objectives**: 1. Create and Console Application with basics code. 2. Create the Application using different types of statements and loops. 3. Know about namespaces and assemblies and how to create the same. 4. Create console application using delegates and methods.	
8	**Course Outcomes:** 1. Able to gain the knowledge for designing and developing web applications. 2. Apply PHP7 to improve accessibility of a web document. 3. Develop a static, interactive and well formed webpage using JavaScript, CSS3. and HTML5.	

9	**Modules**:-
	Module 1: Introducing .NET & C# Language (15 hours)
	• NET Framework 4.8, The Common Language Runtime,.NET Class Library • C# 11 Language Basics, Variables and Data Types, Variable Operations, Conditional Logic, Loops, Methods. • The Basics About Classes, Building a Basic Class, Value Types and Reference Types. • Understanding Namespaces and Assemblies, Advanced Class Programming.
	Module 2: Web Form Fundamentals and Form Controls (15 hours)
	• 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. • 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, Blazor, AdRotator, Pages with Multiple Views, User Controls and Graphics, User Controls. • Website Navigation: Site Maps, URL Mapping and Routing, SiteMapPath Control, TreeView Control, Menu Control.
	Module 3: Error Handling, Logging, and Tracing , State Management and Styles, Themes, and Master Pages (15 hours)
	• Avoiding Common Errors, Understanding Exception Handling, Handling Exceptions, Throwing Your Own Exceptions, Using Page Tracing • Understanding the Problem of State, Using View State, Transferring Information Between Pages, Using Cookies, Managing Session State, Configuring Session State, Using Application State, Comparing State Management Options. • Styles, Themes, Razor Layouts.
	Module 4: ADO.NET Fundamentals & ASP.NET AJAX (15 hours)
	• Understanding Databases, Configuring Your Database, Understanding SQL Basics, Understanding the Data Provider Model • Using Direct Data Access, Using Disconnected Data Access, Working with Data Source Controls, • The Grid View, Formatting the Grid View, selecting a Grid View Row, Editing with the Grid View, Sorting and Paging the Grid View, Understanding Ajax, Using Partial Refreshes, Using Progress Notification, Implementing Timed Refreshes, Working with the ASP.NET AJAX Control Toolkit.
10	**Reference Books:** 1) **Bohem, Anne, and Joel Murach.** *C# 2024*. Murach, 3rd ed., 2024. 2) **Delamater, Mary, and Anne Bohem.** *Murach's ASP.NET 4.6 Web Programming in C# 2024*. SPD, 6th ed., 2024

11	**Internal Continuous Assessment: 40%**	**Semester End Examination:60%**
12	**Continuous Evaluation through:**	Practical Assessment

13 **Format of Question Paper:**

Scheme of Evaluation Pattern

Table 1A: Scheme of Continuous Evaluation (CE/Practical)

Scheme of Evaluation Pattern

Sub-components	Maximum Marks	Conditions for passing
1) Practical exam	30	A learner must be present for each of the sub-components
2) Journal and Viva	10	
Total	40	

Table 1B: Scheme of Semester End Examination (SEE) Evaluation

Question Paper Pattern for Semester End Examination (SEE)

Maximum Marks: 60 **Duration: 2 Hrs.**

Note: All questions are compulsory. Each question has an internal choice.

Question Number		Nature of Questions	Maximum Marks
1)		**Attempt any Three**	15
	a)		
	b)		
	c)		
	d)		
	e)		
2)		**Attempt any Three**	15
	a)		
	b)		
	c)		
	d)		
	e)		
3)		**Attempt any Three**	15
	a)		
	b)		
	c)		
	d)		

	e)		
4)		**Attempt any Three**	15
	a)		
	b)		
	c)		
	d)		
	e)		

Course Name: Advanced Web Programming Practical			
Periods per week (1 Period is 60 minutes)		**4**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2**	**40**

List of Practical	
1.	**Working with basic C# and ASP .NET**
a.	Create an application that obtains four int values from the user and displays the product.
b.	Create an application to demonstrate string operations.
c.	Create an application that receives the (Student Id, Student Name, Course Name, Date of Birth) information from a set of students. The application should also display the information of all the students once the data entered.
d.	Create an application to demonstrate following operations i. Generate Fibonacci series. ii. Test for prime numbers. iii. Test for vowels. iv. Use of foreach loop with arrays v. Reverse a number and find sum of digits of a number.
2.	**Working with Object Oriented C# and ASP .NET**
a.	Create simple application to perform following operations i. Finding factorial Value ii. Money Conversion iii. Quadratic Equation iv. Temperature Conversion
b.	Create simple application to demonstrate use of following concepts i. Function Overloading ii. Inheritance (all types) iii. Constructor overloading iv. Interfaces
c.	Create simple application to demonstrate use of following concepts i. Using Delegates and events ii. Exception handling
3.	**Working with Web Forms and Controls**

a.	Create a simple web page with various sever controls to demonstrate setting and use of their properties. (Example : AutoPostBack)
b.	Demonstrate the use of Calendar control to perform following operations. a) Display messages in a calendar control b) Display vacation in a calendar control c) Selected day in a calendar control using style dates d) Difference between two calendar
c.	Demonstrate the use of Treeview control perform following operations. a) Treeview control and datalist b) Treeview operations
4.	**Working with Form Controls**
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.	**Working with Navigation, Beautification and Master page.**
a.	Create Web Form to demonstrate use of Website Navigation controls and Site Map.
b.	Create a web application to demonstrate use of Master Page with applying Styles and Themes for page beautification.
c.	Create a web application to demonstrate various states of ASP.NET Pages.
6.	**Working with Database**
a.	Create a web application bind data in a multiline textbox by querying in another textbox.
b.	Create a web application to display records by using database.
c.	Demonstrate the use of Datalist link control.
7.	**Working with Database**
a.	Create a web application to display Databinding using dropdownlist control.
b.	Create a web application for to display the phone no of an author using database.
c.	Create a web application for inserting and deleting record from a database. (Using Execute-Non Query).
8.	**Working with data controls**
a.	Create a web application to demonstrate various uses and properties of SqlDataSource.
b.	Create a web application to demonstrate data binding using DetailsView and FormView Control.
c.	Create a web application to display Using Disconnected Data Access and Databinding using GridView.
9.	**Working with GridView control**
a.	Create a web application to demonstrate use of GridView control template and GridView hyperlink.
b.	Create a web application to demonstrate use of GridView button column and GridView events.
c.	Create a web application to demonstrate GridView paging and Creating own table format using GridView.
10.	**Working with AJAX and XML**
a.	Create a web application to demonstrate reading and writing operation with XML.
b.	Create a web application to demonstrate Form Security and Windows Security with proper Authentication and Authorization properties.
c.	Create a web application to demonstrate use of various Ajax controls.
11.	**Programs to create and use DLL**

1	Q.1	15
2	Q.2	15
3	Viva	5
4	Journal	5
5	**Total**	**40**

AC
Item No.

As per NEP 2020

Tolani College of Commerce (Autonomous)

Title of the Course: Applied Mathematics - Differential Equations
Semester V

Programmes:

Bachelor of Commerce (Management Studies)
Bachelor of Commerce (Accounting & Finance)
Bachelor of Commerce (Banking & Insurance)
Bachelor of Commerce (Financial Markets)
Bachelor of Science (Information Technology)

Syllabus for Four Credit Course

From the academic year – 2026-2027

Sr. No.	Heading	Particulars
1	**Description the course:**	Differential equations are mathematical equations that describe how quantities change continuously in relation to one another. A differential equations course introduces students to the theory and techniques for solving these equations. Differential equations provide a challenging yet rewarding subject for students interested in applied mathematics and mathematical modeling. Differential equations have connections with calculus, linear algebra
2	**Vertical:**	Minor
3	**Type:**	Theory / Practical
4	**Credit**:	4 credits (2 credit = 30 Hours for Theory and 30 Hours of Practical work in a semester)
5	**Hours Allotted:**	60 Hours
6	**Marks Allotted**:	100 Marks (60 (SE) + 40 (CE))
7	**Course Objectives**: **1.** Develop proficiency in solving various types of differential equations using analytical techniques, such as separation of variables 2.To find the integrating factors, substitution, and undetermined coefficients. **3.** Interpret the solutions of differential equations in the context of the real-world phenomena being modeled. 4. To apply the differential equations in various fields	
8	**Course Outcomes**: **1.** Students can classify differential equations according to their type, order, linearity, and homogeneity **2.** Students can apply differential equations to model 3. Students can solve problems from various disciplines, including physics, engineering, biology, chemistry, economics, and environmental science. 4. Students can correlates the differential equations with the real world problems	
9	**Modules**:-	
	Module 1: Formation of a differential Equation (15 Hours) ● Definition of a differential equation, ● Formation of a differential equation ● Find Order, and degree of a differential equation ● Homogeneous differential equations of first order and first degreeSolution of homogeneous equations	
	Module 2. **Methods to solve a differential equation (15 Hours)** ● Solving of a differential equation by Variable Separable method ● Solution of homogeneous equations ● Solution of Non homogeneous equations	

	● Solution of Variable separable method	
	Module 3: Methods to solve a differential equation (15 Hours)	
	● General Solution and Particular Solution of a differential Equation ● Exact differential equation, ● Necessary and sufficient condition to be exact ● Integrating Factor,	
	Module 4: Methods to solve a differential equation (15 Hours) ● Linear Equations ● Methods to solve the linear differential equations ● Non- linear Equations ● Methods to solve the non - linear differential equations	
10	**Reference Books** ● Bali, N.P. Differential Equations. New Age International Publisher. ● Raisinghania, M.D. Advanced Differential Equations. S. Chand. ● Iyengar, T.K.V. Differential Equations & Vector Calculus. S. Chand. ● O'Regan, Donal. An Introduction to Ordinary Differential Equations. Springer.	
11	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**
12	**Continuous Evaluation through:**	
13	**Format of Question Paper:** Q. 1 Attempt any Three (15 marks) a. b. c. d. Q. 2 Attempt any Three (15 marks) a. b. c. d. Q. 3 Attempt any Three (15 marks) a. b. c. d. Q. 4 Attempt any Three (15 marks) a. b. c. d.	

Signatures of Team Members

Sr.No	Name	Signature
1.	Ms. Shubha Chaubal	
2.	Ms. Priyanka Malvankar	

AC
Item No.

As per NEP 2020

Tolani College of Commerce (Autonomous)

Knowledge is Supreme

Title of the Course: Design of Experiments
Semester V

Programmes:

Bachelor of Commerce (Management Studies)
Bachelor of Commerce (Accounting & Finance)
Bachelor of Commerce (Banking & Insurance)
Bachelor of Commerce (Financial Markets)
Bachelor of Science (Information Technology)

Syllabus for Four Credit Course

From the academic year – 2026-2027

Sr. No.	Heading	Particulars
1	**Description the course:**	Design of Experiments (DOE) is a statistical methodology used to plan, conduct, analyze, and interpret controlled experiments to optimize processes, improve product quality, and reduce variability. DOE is closely connected with other courses in statistics, quality control, process improvement, and industrial engineering
2	**Vertical :**	Minor
3	**Type :**	Theory / Practical
4	**Credit**:	4 credits (2 credit = 30 Hours for Theory and 30 Hours of Practical work in a semester)
5	**Hours Allotted :**	60 Hours
6	**Marks Allotted**:	100 Marks (60 (SE) + 40 (CE))
7	**Course Objectives**: **1.** Introduce students to the fundamental principles of experimental design, including randomization 2. Students will be familiar of replication, blocking and control **3.** Familiarize students with various experimental layouts, such as completely randomized designs, randomized complete block designs 4. To clarify between the Latin squares, and split-plot designs.	
8	**Course Outcomes**: **1.** Students will demonstrate a clear understanding of fundamental principles of experimental design, 2. Expertizing students in randomization, replication, blocking, and control **3.** Students will be proficient in selecting and implementing appropriate experimental layouts 4. Drawing of randomized designs, randomized complete block designs, Latin squares, and split-plot designs, based on experimental objectives and constraints.	
9	**Modules**:-	
	Module 1: Analysis of Variance(15 Hours) 1. Introduction, Uses, One way classification with equal and unequal observations per class 2. Two way classification with one observation per cell 3. Mathematical model, Assumptions, Expectation of variance, 4. Sum of squares, F test, ANOVA table	
	Module 2: Variance of Estimator(15 Hours) **1.** Least square estimators of parameters **2.** Variance of estimators 3. Standard error 4. Confidence limits	
	Module 3: Design of Experiments(15 Hours) **1.** Concept of Experiments, Experimental units 2. Yield, Block, Replicate, Experimental Error	

	3. Principle of design of experiments, Randomization and local control 4. Efficiency of design D1 with respect to design D2	
	Module 4: Design of Experiments(RBD) (15 Hours) 1. Mathematical model, Assumptions 2. Expectation of various sum of squares, F Test, ANOVA table **3.** Efficiency of Randomized Block Design (RBD) relative to Completely Randomized Design (CRD) 4. Missing plot techniques for one missing observation in case of CRD, RBD, LSD	
10	**Reference Books**	
	Das, M.N., and N.C. Giri. *Design and Analysis of Experiments*. New Age International Pvt. Ltd, 1986. Kempthorne, Oscar. *Design and Analysis of Experiments*. John Wiley & Sons, 2000. Gupta, S.C., and V.K. Kapoor. *Fundamentals of Applied Statistics*. S. Chand & Co., 2001.	
11	**Internal Continuous Assessment: 40%**	**Semester End Examination : 60%**
12	**Continuous Evaluation through:**	**Assignments and Practical**
13	**Format of Question Paper:** Q. 1 Attempt any Three (15 marks) a. b. c. d. Q. 2 Attempt any Three (15 marks) a. b. c. d. Q. 3 Attempt any Three (15 marks) a. b. c. d. Q. 4 Attempt any Three (15 marks) a. b. c. d.	

Signatures of Team Members

Sr. No.	Name	Signature
1	Ms. Shubha Chaubal	
2	Ms. Priyanka Malvankar	

A
C

As Per NEP 2020

Tolani College of Commerce (Autonomous)

Knowledge is Supreme

Programme: Bachelor of Science (Information Technology)
Semester V

Title of the Course: Advance Embedded System

Syllabus for 4 credits
From the Academic Year 2026-2027

Name of the Course: Advance Embedded System

Sr. No.	Heading	Particulars
1	**Description the course:**	This course provides an in-depth exploration of advanced concepts, design methodologies, and implementation techniques used in modern embedded systems. Building on fundamental embedded system principles, the course emphasizes real-time processing, hardware–software co-design, embedded operating systems, and system optimization for performance, power, and reliability. The course bridges theory and practice through laboratory projects and case studies drawn from automotive, industrial, and consumer electronics domains.
2	**Vertical:**	Minor Elective Basket
3	**Type:**	Theory
4	**Credit**:	04
5	**Hours Allotted:**	60 Hours
6	**Marks Allotted**:	100 Marks Continuous Evaluation 40 Semester End Examination 60
7	**Course Objectives**: 1. To understand the fundamentals of embedded systems, their components, and applications in real-time control and automation. 2. To explain and analyze the architecture, memory organization, and instruction set of PIC and ARM microcontrollers. 3. To develop and debug embedded programs in Assembly and C for interfacing peripherals and handling interrupts. 4. To apply data handling and communication protocols (I^2C, SPI, UART, Bluetooth, Wi-Fi, GSM, etc.) for efficient embedded data transfer.	
8	**Course Outcomes**: Learners will be able to : 1. describe the structure and components of embedded systems and distinguish microcontrollers from microprocessors. 2. analyze the architecture, memory, and instruction set of PIC and ARM microcontrollers. 3. develop and execute Assembly and Embedded C programs for I/O control, data conversion, timers, and interrupts. 4. design simple embedded projects considering ethics, safety, and sustainability.	

9	**Module 1: PIC Microcontroller Architecture and Programming (15 Hours)**
	• **Introduction to Embedded Systems:** Overview of Embedded Systems, Components of an Embedded System, Microcontrollers vs Microprocessors, Embedded Hardware and Software Concepts, Applications of Embedded Systems • **PIC Microcontroller Architecture:** Introduction to PIC Microcontrollers, Architecture and Functional Blocks, Memory Organization (Program & Data Memory),Addressing Modes, Instruction Set and Instruction Classification • **PIC Programming and Peripherals:** Programming PIC in Assembly and C,I/O Port Configuration and Control, Data Conversion Techniques (ADC/DAC),RAM and ROM Allocation Methods, Timer Programming and Interrupt Handling
	Module 2: ARM Architecture and Communication Protocols (15 Hours)
	• **ARM Controllers and Architecture:** Introduction to ARM Processors and Features, ARM Family Overview and Core Concepts, ARM Architecture and Memory Organization, Addressing Modes and ARM Programmer's Model, Registers, Pipeline, and Execution Stages. • **ARM Programming and Advanced Features:** ARM Instruction Set Overview, Interrupts, Exception Handling, and Coprocessors, ARM Interrupt Structure and Priorities, Applications of ARM in Advanced Embedded Systems. • **Communication Protocols in Embedded Systems:** Introduction to Communication Interfaces, Serial Communication Basics, I2C Protocol: Concept, Operation, Bit-Banging Method,I2C Device Interfacing: RTC, EEPROM, ADC/DAC, Port Expander,SPI Protocol and Interfacing Techniques
	Module 3: Wireless Communication and Arduino Programming (15 Hours)
	• **Wireless and Network Communication Protocols:** Bluetooth Communication, WI-Fi Communication and IoT Integration, ZigBee and Infrared Interfaces, RFID Communication Principles, GSM and GPS Communication in Embedded Systems,PDH/SDH and Ethernet Overview • **Getting Started with Arduino:** Introduction to Arduino Boards and Variants, Installing Drivers and Arduino IDE, Programming Environment Overview, Basic Arduino Structure and Syntax • **Arduino Programming Functions:** Digital I/O and Analog I/O Functions, Timer Functions and Interrupt Handling, Communication Functions (Serial, SPI, I2C),Math and Logical Functions, Advanced I/O Functions
	Module 4: Advanced Arduino Interfacing and Wireless Control Applications (15 Hours)
	• **Sensor Interfacing with Arduino:** Light and Temperature Sensors,Humidity and Line-Tracking Sensors, Ultrasonic and Infrared Motion Sensors, Gas, Hall, and Color Sensors, Joystick, Tilt, and Vibration Sensors, Sound, Voice Recognition, and Capacitive Touch Sensors, Triple Axis Acceleration Sensor • **Electromechanical Control Systems:** DC Motor Control, Stepper Motor Control, Servo Motor Control,PWM Concepts and Speed Control Applications

	• **Wireless Control Using Arduino:** Infrared Transmitter and Receiver Modules, Wireless RF Communication, Bluetooth and Wi-Fi Based Control, GSM/GPRS Interfacing and Applications **Embedded System Case Studies:** Air Quality Monitoring System using Arduino, Fire-Fighting Robot using Arduino, Intelligent Lock System using Arduino

10	**Reference Books:**
	1. *Mazidi, Muhammad Ali, Rolin D. McKinlay, and Danny Causey,* PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18, *Pearson Education, 1st Edition, 2008.* 2. *Bates, Martin P.,* Programming 8-bit PIC Microcontrollers in C: With Interactive Hardware Simulation, *Newnes (Elsevier), 2nd Edition, 2009.* 3. *Sloss, Andrew N., Dominic Symes, and Chris Wright,* ARM System Developer's Guide: Designing and Optimizing System Software, *Elsevier, 1st Edition, 2004.* 4. *Furber, Steve,* ARM System-on-Chip Architecture, *Addison Wesley, 2nd Edition, 2000.* 5. *Han-Way Huang,* The ARM Cortex-M Microcontroller and Embedded Systems: Using Assembly and C, *Pearson Education, 2nd Edition, 2019.* 6. *Dogan Ibrahim,* Advanced PIC Microcontroller Projects in C: From USB to RTOS with the PIC18F Series, *Newnes, 2nd Edition, 2008.*
11	**Websites:** 1. ControllersTech® 2. EmbeddedTutorials 3. https://www.ctrlaihub.com/embedded.html?utm_source=chatgpt.com **YouTube & Video Resources:** 1. The miro samek course on YouTube 2. PIC microcontroller tutorial

13	**Internal Continuous Assessment: 40%**	**Semester End Examination: 60%**	
14	**Continuous Evaluation through:**	Practical Examination	40 Marks

15 **Format of Question Paper:**

Question Number		Nature of Questions	Maximum Marks
1)		Attempt any THREE of the following: (From Module I)	15
	A.		
	B.		
	C.		
	D.		
	E.		
2)		Attempt any THREE of the following: (From Module II)	15
	A.		
	B.		
	C.		
	D.		
	E.		
3)		Attempt any THREE of the following: (From Module III)	15
	A.		
	B.		
	C.		
	D.		
	E		
4)		Attempt any THREE of the following: (From Module IV)	15
	A.		
	B.		
	C.		
	D.		
	E		

Signatures of Team Members

Sr.No	Name	Signature
1.	Mr. Deepak Sharma	
2.	Ms.Sabiha Malik	

Practical No	Details
1	Write and execute a simple LED blinking program using Assembly and then in Embedded C.
2	Display “Hello World” message using Internal UART.
3	To write and execute an Assembly language program to transfer data between registers and memory.
4	Interface an analog temperature sensor (e.g., LM35) with the PIC microcontroller and write a program to display the digital temperature value using ADC.
5	Write a program to convert an 8-bit digital value to an analog output using a DAC.
6	Demonstrate RAM and ROM allocation by writing a program that stores data in different memory sections and verify using MPLAB memory view.
7	Implement a timer-based delay program using Timer0 and measure the delay accuracy.
8	Write a program to generate an interrupt when a button is pressed and toggle an LED upon interrupt.
9	Configure I/O ports of a PIC16F877A to control multiple LEDs and read input from push buttons.
10	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.

AC–11-03-2025
Item No. – 03

Approved by the Bos in Bachelor of Science (Information of Technology) on 13-11-2024 Item No.03

As Per NEP 2020

Tolani College of Commerce (Autonomous)

Title of the Course: Artificial Intelligence

Programme: Bachelor of Science (Information Technology)Semester V

Syllabus for 2 credits Course

From the academic year-2025-2026

Name of the Course: Artificial Intelligence

Sr. No.	Heading	Particulars
1	**Description the course :**	The goals of artificial intelligence include computer-enhanced learning, reasoning, and perception. AI is being used today across different industries from finance to healthcare.
2	**Vertical:**	Vocational Skill Course
3	**Type:**	Theory and Practical
4	**Credit**:	2 credits
5	**Hours Allotted:**	30 Hours
6	**Marks Allotted**:	Total : 50 Marks Practical Evaluation: 20 Marks Semester-End: 30 Marks
7	**Course Objectives**: 1. Apply selected basic AI techniques 2. Artificial intelligence (AI) refers to the simulation or approximation of human intelligence in machines.	
8	**Course Outcomes**: 1. AI system accepts data input in the form of speech, text, image, etc. 2. The system then processes data by applying various rules and algorithms, interpreting, predicting, and acting on the input data.	

9	**Modules**:-
	Module 1: Introduction and Intelligent Agents (15 hours)
	• What is Artificial Intelligence? Foundations of AI, history, the state of art AI today. • agents and environment, good behavior, nature of environment, the structure of agents.
	Module2: Solving Problems by Searching and **Beyond Classical Search (15 hours)**
	• Problem solving agents, examples problems, searching for solutions, uninformed search, informed search strategies, heuristic functions. • local search algorithms, searching with non-deterministic action, searching with partial observations, online search agents and unknown environments.
10	**Reference Books:** 1) **Author/s:** Rahul Deva **Title** :Artificial Intelligence: A Rational Approach, **Publisher** :Shroff publishers , **Edition** :$_1$st, **Year**:2018. 2) **Author/s:** Deepak Khemani **Title** A First Course in Artificial Intelligence, **Publisher** :TMH , **Edition** :First, **Year**:2017.

11	**Internal Continuous Assessment: 20%**	**Semester End Examination: 30%**
12	**Continuous Evaluation through:**	Practical Assessment

13 **Format of Question Paper:**

Scheme of Evaluation Pattern

Table 1A: Scheme of Continuous Evaluation (CE/Practical)

Scheme of Evaluation Pattern

Sub-components	Maximum Marks	Conditions for passing
1) Practical exam	16	A learner must be present for each of the sub-components
2) Journal and Viva	04	
Total	20	

Table 1B: Scheme of Semester End Examination (SEE) Evaluation

Question Paper Pattern for Semester End Examination (SEE)

Maximum Marks: 30 **Duration: I Hrs.**

Note: All questions are compulsory. Each question has an internal choice.

Question Number		Nature of Questions	Maximum Marks
1)		**Attempt any Three**	15
	a)		
	b)		
	c)		
	d)		
	e)		
2)		**Attempt any Three**	15
	a)		
	b)		
	c)		
	d)		
	e)		

Course Name: Artificial Intelligence Practical			
Periods per week (1 Period is 60 minutes)		**2**	
Credits		**1**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**1**	**20**

Practical No		**Details**
1	a	Write a program to implement depth first search algorithm.
	b	Write a program to implement breadth first search algorithm.
2	a	Write a program to simulate 4-Queen / N-Queen problem.
	b	Write a program to solve tower of Hanoi problem.
3	a	Write a program to implement alpha beta search.
	b	Write a program for Hill climbing problem.
4	a	Write a program to implement A* algorithm.
	b	Write a program to implement AO* algorithm.
5	a	Write a program to solve water jug problem.
	b	Design the simulation of tic – tac – toe game using min-max algorithm.
6	a	Write a program to solve Missionaries and Cannibals problem.
	b	Design an application to simulate number puzzle problem.
7	a	Write a program to shuffle Deck of cards.
	b	Solve traveling salesman problem using artificial intelligence technique.
8	a	Solve the block of World problem.
	b	Solve constraint satisfaction problem
9	a	Derive the expressions based on Associative law
	b	Derive the expressions based on Distributive law
10	a	Write a program to derive the predicate. (for e.g.: Sachin is batsman , batsman is cricketer) - > Sachin is Cricketer.
	b	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

1	Q.1	08
2	Q.2	08
3	Viva	02
4	Journal	02
5	**Total**	**20**