



Hirachand Nemchand College of Commerce, Solapur

(Autonomous College)



(Affiliated to P.A.H Solapur University, Solapur)

Name of Faculty: Computer Science & Information technology

Choice Based Credit System

Syllabus for Bachelor of Computer Application (B.C.A)

**Third Year
Semester V & VI**

**With
(NEP 2023)
(w. e. from June 2025-26)**

Internal Assessment:

The medium of instruction & examination will be only in English.

Details of Internal examination:

Particulars	Marks (2 credit paper)	Marks (4 credit Paper)
Attendance	05 Marks	05 Marks
Mid Test	05 Marks	10 Marks
Home Assignments	--	05 Marks
Group Exercise / Seminars / Projects	--	--
Total	10	20

HIRACHAND NEMCHAND COLLEGE OF COMMERCE, SOLAPUR

(AUTONOMOUS COLLEGE)

PART-III, SEMESTER – V & VI

BCA PART - III, SEMESER – V					
Level	Category	SubjectCode	Subject Name	Credit	Marks (ESE+ISE)
5.5	Major- Mandatory -13	23BCAMM351	Advance Java	4	100=(60+40)
	Major- Mandatory -14	23BCAMM352	Basic Python	4	100=(60+40)
	Major- Mandatory -15	23BCAMM353	Data Warehouse & Data Mining	2	50=(30+20)
	Elective-1	23BCAEL351/ 23BCAEL352	Angular / Knowledge Management System	4	100=(60+40)
	Minor-6	23BCAMN351	Visual Programming	4	100=(60+40)
	VSC-4	23BCAVS351	Cyber Security	2	50=(30+20)
	FP-2	23BCAFP351	Mini Project	2	50=(30+20)
Total Credits				22	Total = 550
BCA PART - III, SEMESER – VI					
Level	Category	Subject Code	Subject Name	Credit	Marks (ESE+ISE)
5.5	Major- Mandatory -16	23BCAMM361	Dot Net Technology	4	100=(60+40)
	Major- Mandatory -17	23BCAMM362	Adv. Python	4	100=(60+40)
	Major- Mandatory -18	23BCAMM363	Computer Graphics	2	50=(30+20)
	Elective-2	23BCAEL361	R-Language / Big Data & Hadoop	4	100=(60+40)
	Minor – 8	23BCAMN361	Linux	4	100=(60+40)
	OJT-1	23BCAOJ361	Major subjects	4	100=(60+40)
Total Credits				22	Total = 550
OE- Open Electives, VSC-Vocational Skill Courses, SEC- Skill Enhancement Courses, AEC-Ability Enhancement Courses, VEC- Value Education Courses, IKS- Indian Knowledge System, OJT- On Job Training, FP- Field Projects, CEP- Community Engagement Projects, CC- Co curricular Courses, RM-Research Methodology, RP-Research Project					

NEP Curriculum : w.e.f June 2023

Programme: BCA III (Level 5.5)

Semester:	V	Assessment & Evaluation			L/W*	Credits
	Paper Category:	Major Mandatory 13	Pattern			
Paper Name:	Advance Java	ESE*	ISE*	Total	4	4
Paper Code:	23BCAMM351	60	40	100		

C01: Understand JDBC fundamentals, analyze driver types, implement JDBC statements and methods, work with ResultSet and metadata, and develop JDBC-based applications efficiently. (Understanding)

C02: Students will be able to develop basic Servlet applications that handle HTTP requests and generate dynamic web content. (Apply)

C03: Students will be able to compare and contrast the use of JSP with other web development technologies (e.g., Servlets, HTML, JavaScript). (Analyze)

C04: Students will be able to evaluate the effectiveness of Hibernate in solving real-world data persistence problems. (Evaluate)

C05: Students will be able to design and develop a complete Spring-based application, including data access, business logic, and presentation layers. (Create)

Module 1: JDBC (C01)

- Introduction to JDBC
- Feature & Architecture of JDBC
- Types of drivers, its advantage & disadvantage
- JDBC Statements & Methods : statement, Prepared Statement, Callable Statement, execute(), executeQuery(), executeUpdate(), Working with Resultset interface, Working with Resultset Metadata

Module 2: Servlet (C01, C02, C03, C04)

- Introducing CGI & Servlet
- Advantages of Servlet over CGI , Features of Servlet
- Introducing Servlet API , javax.servlet package, javax.servlet.http package
- Servlet life Cycle
 - Init()
 - Service()
 - Destroy()
- Working with GenericServlet and HttpServlet
- RequestDispatcher interface - Include() and forward()
- Introducing session, Implementation of Session, Session tracking mechanism
- Cookies, use of cookies, Advantages & disadvantages
- Hidden form field, use of Hidden form field, Advantages & disadvantages
- URL rewritten, Use of URL rewriting, advantages & disadvantages
- HttpSession, use of URL HttpSession, Advantages & disadvantages

Module 3: JSP (C01, C02, C03, C04)

- Introduction to JSP
- Advantages of JSP over Servlet
- JSP architecture, JSP life cycle
- Implicit objects in JSP- request, response, out, page, pageContext, application, session, config, exception
- JSP tag elements- Declarative, Declaration, scriplet, expression, action.
- Java Bean- Advantages & Disadvantages
- useBean tag- setProperty and getProperty
- Bean In Jsp
- JSTL core tag: General purpose tag, conditional tag, networking tag, SQL tags, formatting tags, xml tags
- Custom tag: empty tag, body content tag, iteration tag, simple tag
- Introducing internationalization & Java: local class, ResourceBundle class

Module 4: Hibernate (C01, C02, C03, C04)

- Introduction Hibernate
- Application of HB: HB with annotation, HB web application
- Inheritance mapping: Table per Hierarchy, TPH using annotation, Table Per Concrete, TPC using annotation, Table Per Subclass, TPS using annotation.
- Collection mapping: Mapping list, Mapping bag, Mapping Set, Mapping Map (One to One, One to Many, Many to One)

Recommended Books	<ol style="list-style-type: none">1. "JDBC, Servlet and JSP Black Book"- Santosh Kumar K.2. "Java EE Server programming"- Sharanam Shah and Vaishali Shah.3. "Java Server Programming Black book"4. "Hibernate"- Sharanam Shah &Vaishali Shah5. "Spring Persistence with Hibernate"- Paul Tepper Fisher, Brian D Murphy
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NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	V	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	Major Mandatory 14	Assessment & Evaluation Pattern			L/W*	Credits
Paper Name:	Basic Python	ESE*	ISE*	Total	4	4
Paper Code:	23BCAMM352	60	40	100		

C01: Students will be able to use operators effectively to perform various operations on data. (Applying)

C02: Students will be able to compare and contrast the performance and suitability of different data structures for a given problem. (Analyzing)

C03: Students will be able to assess the suitability of object-oriented programming for a given problem domain. (Evaluating)

C04: Students will be able to create Python scripts to interact with a MySQL database and perform data manipulation tasks. (Create)

Module 1: Introduction to Python (C01, C02)

- **Introduction to Python:** Features/Characteristics of Python, Installation and Working with Python, Structure of a Python Program, Writing simple python program, Executing python program using command line window and IDLE graphics window, Python Virtual Machine, Identifiers and Keywords
- **Python Data Types:** Python Variables, Data types, Sequences, Sets, Literals, Constants, Type conversion, I/O Statements, Command line arguments.
- **Operators-**Arithmetic, Relational, Logical, Boolean, Assignment, Bit wise, Membership, Identity, Operator Precedence and Associativity
- **Conditional Statements**-if, if-else, nested if-else, Looping-for, while, nested loops, Loop manipulation using pass, continue, break, assert and else suite

Module 2: Array, String, Collection, List, Tuples, Dictionaries (C01, C02, C03)

- **Array:** Introduction, importing and slicing on array, types of array, compare and aliasing.
- **Strings:** Introduction to String, String Manipulation.
- **Collection List:** Introduction to List, Manipulating list.
- **Tuples:** Introduction to Tuples, Manipulating Tuples.
- **Dictionaries:** Concept of Dictionary, Techniques to create, update & delete dictionary items.

Module 3: Functions, Object Oriented Programming (C01, C02, C03)

- **Functions:** Difference between a Function and a Method, Defining a function, Calling a function, Advantages of functions, Types of functions, Function parameters:-Formal parameters, Actual parameters, Anonymous functions, Global and Local variables
- **Modules:** Importing module, Creating & exploring modules, Math module, Random module, Time module
- **Object Oriented Programming:** Features, Concept of Class & Objects, Constructor, Types of Variables, Namespaces, Types of Methods, Inner Classes, Constructors in Inheritance, Overriding Super Class Constructors and Methods, Types of Inheritance, Abstract Classes and Interfaces, The Super() Method, Operator Overloading, Method Overloading, Method Overriding.

Module 4: Regular Expression, Exception Handling & File Operation (C01, C02, C03, C04)

- **Regular Expressions:** Introduction to Regular Expression, Advantages & Operations, Sequence characters in Regular Expression, Powerful pattern matching and searching, Password, email, url validation using regular expression, Pattern finding programs using regular expression
- **Exception Handling:** Errors in a Program, Exceptions, Exception handling, Types of

Exceptions, User-defined Exceptions

- **Python File Operation:** Types of File, Opening and Closing a File, Reading and writing to files, Manipulating directories
- **Graphical user interface-** root window, fonts and colors, working with containers, canvas, frame, widgets and its types. Database connectivity- Installing MySQL db module, working with MySQL, Retrieving, inserting, Deleting and Updating rows into table, creating database tables

NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	V	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	Major Mandatory 15					
Paper Name:	Data Warehouse & Data Mining	ESE*	ISE*	Total	3	2
Paper Code:	23BCAMM353	30	20	50		

C01: Students will be able to define key terms related to data warehousing, such as data warehouse, data mart, ETL, OLAP, dimension, fact, and schema. (Remembering)

C02: Students will be able to comprehend the importance of data preprocessing in the data mining process. (Understanding)

C03: Use association rule mining techniques to analyze real-world datasets. (Applying)

C04: Students will be able to compare and contrast the strengths and weaknesses of different classification algorithms. (Analyzing)

C05: Students will be able to evaluate the quality of clustering results using appropriate metrics. (Evaluating)

C06: Students will be able to develop simple applications that utilize data mining techniques. (Create)

Module 1: Introduction to Data Warehouse (C01, C02)

- Difference between operational database systems and data warehouses.
- Data warehouse Characteristics, Data warehouse Architecture and its Components
- Extraction – Transformation – Loading, Logical (Multi – Dimensional)
- Data Modeling - Schema Design, Star and Snow – Flake Schema, Fact Constellation, Fact Table, Fully Addictive, Semi – Addictive, Non Addictive Measures; Fact – Less – Facts
- Dimension Table Characteristics; OLAP Cube, OLAP Operations, OLAP Server Architecture – ROLAP, MOLAP and HOLAP.

Module 2: Introduction to Data Mining (C01, C02)

- What is Data Mining, Difference between Database Management System, Data Warehouse and Data Mining
- KDD, Challenges, Data Mining Tasks
- Need for Pre-processing the Data
- Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction
- Discretization and Concept Hierarchy
- Generation, Binaryzation
- Data Transformation: Measures of Similarity and Dissimilarity – Basics.

Module 3: Association Rule (C01, C02, C03)

- Problems Definition
- Frequent Item Set Generation
- The APRIORI Principle, Support and Confidence Measures
- Association Rule Generation; APRIORI Algorithm
- The Partition Algorithms, FP- Growth Algorithms
- Compact Representation of Frequent Item set- Maximal Frequent Item Set
- Closed Frequent Item Sets.

Module 4: Classification (C01, C02, C03, C04)

- Problem Definition
- General Approaches to solving a classification problem
- Evaluation of classifiers, Classification Techniques

- Decision Tree – Decision tree Construction, Methods for
- Expressing attribute test conditions
- Measures for Selecting the Best Split
- Algorithm for Decision tree Induction; Naive Bayes Classifier, Rule base classification
- Bayesian Belief Networks; K – Nearest neighbor classification – Algorithm and Characteristics.

Module 5: Clustering (C01, C02, C03, C04, C05)

- Problem Definition, Clustering Overview
- Evaluation of Clustering Algorithms, Partitioning Clustering -K-Means Algorithm, K-Means Additional issues, PAM Algorithm
- Hierarchical Clustering – Agglomerative Methods and divisive methods
- Basic Agglomerative Hierarchical Clustering, Strengths and Weakness Outlier Detection.

Module 6: Application & Trends in Data Mining (C01, C02, C03, C04, C05, C06)

- Spatial Data Mining
- Text Data Mining
- Multimedia Data Mining
- Web Data Mining Application of data mining

Recommended Books	<ol style="list-style-type: none"> 1) Data Mining – Concepts and Techniques – Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006. 2) Introduction to Data Mining, Pang – Ning Tan, Vipin Kumar, Michael Steinbach, Pearson Education. 3) Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press. 4) Data Warehouse Fundamentals, Pualraj Ponnaiah, Wiley Student Edition. 5) Data Mining, Vikram Pudi, P Radha Krishna, Oxford University Press
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NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	V	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	Elective – 1					
Paper Name:	Angular	ESE*	ISE*	Total	4	4
Paper Code:	23BCAEL351	60	40	100		

C01: Students will be able to recall the basic syntax for declaring variables and defining functions in TypeScript. (Remembering)

C02: Explain the advantages of using TypeScript over JavaScript in terms of code maintainability, scalability, and error prevention. (Understanding)

C03: Use JavaScript to add basic interactivity to web pages (e.g., handle user events, manipulate the DOM). (Applying)

C04: Evaluate the effectiveness of different routing strategies in an Angular application. (Analyzing)

C05: Assess the performance and scalability of a Node.js application. (Evaluating)

C06: Develop a Node.js application that interacts with a MongoDB database to perform complex data operations.(Create)

Module 1: Basics of Typescript Programming language (C01, C02)

- Introduction to JavaScript
- Features of JavaScript
- Components of JavaScript as a language
- Introduction to TypeScript
- Features of JavaScript
- Components of JavaScript
- Transpile Typescript to JavaScript procedure
- TypeScript – Overview, Environment Setup, Basic Syntax, Types, Variables, Operators, Decision Making, Loops, Functions, Numbers, Strings, Arrays, Tuples, Union

Module 2: Advanced Typescript Programming language (C01, C02, C03)

- TypeScript - Interfaces
- Classes & Objects
- Namespaces
- Modules
- Typescript VS JavaScript
- Comparative study of language and its usage in Web development

Module 3: Introduction to web development (C01, C02, C03)

- Introduction to Web Development
- Web development types and required skill set
- Client-Server Architecture in web development
- Basic overview of Client-Server architecture and its responsibilities
- Client-side and Server-side technologies used for web development
- Introduction to Document Object Model (DOM)
- Internals of Logical structure of Web page
- Use of HTML and CSS to design web pages
- Components of MEAN stack Development
- MongoDB as Document-based NoSQL database
- Express as a backend
- Angular as Client-side framework
- Node as Server Side framework

Module 4: ANGULAR client side web development (CO1, CO2, CO3, CO4, CO5)

- Introduction to Angular 15 framework
- Architecture of Angular Framework
- Installations steps for Angular
- Installing Node Package Manager
- Installing Angular CLI
- Installing Angular
- CLI commands to create and maintain Angular project
- ng new - To create a new project
- ng generate - To add component, directive, pipe, service, module, Enumeration
- ng serve - To run the Angular app locally
- Use of Visual Studio Code as IDE
- Creating Angular project using Visual Studio Code
- Project structure of Angular
- Overview and contents of each folder and file of Angular Project
- e2e, node_module, editorconfig
- Karma.conf.js, package.json, src, assets folder
- environment folder, index.html , main.ts ,pollyfills.ts
- style.css ,test.ts ,angular-cli.json
- Creating First Angular project
- Angular applications lifecycle hooks
- Module in Angular
- Creating a new module, Contents of Module,
- Component in Angular, Contents of Components, Creating a custom component
- Binding concept, Property Binding, Event Binding, Class Binding, Style Binding, Two Way Binding
- Template reference variables
- Inter Component Communication
- @Input and @Output decorators
- Angular Structural Directives
- NgIf, NgFor, NgSwitch
- Angular Custom Directives
- Frontend development using Bootstrap, Installation of Bootstrap library
- Designing strategy using bootstrap
- Frontend development using Material Design
- Philosophy behind Material Design
- Use of different GUI components
- Use of material.angular.io site
- Changing pages with Angular routing
- Routing paths, Routing navigation, Routing Wildcards
- Angular Services, Service creation with dependency injection
- Angular Dependency Injection
- Angular Observables
- Server communication using HTTP
- Angular Forms
- Template-driven forms
- Reactive forms
- Angular forms validation techniques
- Lazy Loading in Angular
- Pipe in Angular, Inbuilt pipe - String-based, number, Custom pipes
- Introduction to Cloud
- Deploying Angular Application using Amazon Web Services
- Introduction to Amazon Web Services
- Services comes under AWS
- Amazon S3
- Unit testing of Angular Application

Module 5: Introduction to Server side web development using NODE.JS and Express.js (C01, C02, C03, C04, C05, C06)

- Introduction to NodeJS
- Installation required for the node
- Application development in Node
- API writing in Node
- Express Server Setup
- Server structure and callback mechanism
- Server side Node Setup
- Service and method writing in Node
- Connection of Angular and Node application

Module 6: Introduction to MONGODB (C01, C02, C03, C04, C05, C06)

- Introduction to NOsql
- concept of database and data manipulation
- MongoDB architecture and its use
- Installation of mongodb and use if mongodb compass
- Accessing database through mongodb atlas
- CRUD operations
- Connection of node application and mongodb

NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	V	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	Elective – 1					
Paper Name:	Knowledge Management System	ESE*	ISE*	Total	4	4
Paper Code:	23BCAEL352	60	40	100		

CO 1: To analyse various concepts in knowledge

CO2 : To analyse knowledge in infrastructure

CO3: To Discuss the various levels in knowledge sharing

CO4: To examine the knowledge management Metrics

CO5: To analyse the recent trends in Knowledge Management

Module I: Introduction

Introducing KM: Concept, Principles and processes of KM, Industrial Economy to Knowledge Economy - KM system life cycle - aligning KM and business strategy - KM Cycle: Knowledge creation - capturing tacit knowledge - Types of knowledge and its implications for KM

Module II: Knowledge Creation

Knowledge creation – Knowledge toolbox – Communities of Practice (COP) – knowledge centres - the role of culture and structure - Analysis design and development - Knowledge infrastructure - Knowledge audit and knowledge team

Module III: Knowledge Exchange

Knowledge exchange: Definition, Developing the knowledge environment - Role & importance of stakeholders - protecting knowledge & research–Social Nature of Knowledge - Social Network Analysis - Obstacles to knowledge sharing - Organizational learning & Social Capital. Knowledge Application – Individual level, Group level & Organization Level Collaboration

Module IV: Knowledge Management Metrics

KM tools and Portals: inferences from data - data mining and knowledge portals - Evaluation of KM effectiveness: Tools and metrics KM Strategy, KM Tools – Knowledge Capture & Creation tools, Knowledge sharing & Dissemination Tools, Knowledge Acquisition & Application tools.

Module V: Trends In Knowledge Management

KM experiences from Indian companies - KM innovation and Learning organization Knowledge audit - GAP Analysis, Road Map - KM Metrics - Balance Score Card - Ethical, legal and managerial issues

References:

General Knowledge Management Concepts & Principles (Madanmohan Rao – *Leading with Knowledge: Knowledge Management Practices in Global Infotech Companies* (McGraw-Hill, 2004))

Knowledge Creation & Exchange (Ashok Jashapara – *Knowledge Management: An Integrated Approach* (Pearson, 2010))

NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	V	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	Minor - 6					
Paper Name:	Visual Programming	ESE*	ISE*	Total	4	4
Paper Code:	23BCAMN351	60	40	100		

C01: Define the .NET Framework and its key components (CLR, BCL). (Remember)

C02: Interpret the role of indexers and properties in object-oriented design. (Understanding)

C03: Perform file and directory operations (e.g., create, delete, copy, move) using File, FileInfo, Directory, and DirectoryInfo classes. (Applying)

C04: Identify suitable use cases for delegates in different scenarios. (Analyzing)

C05: Evaluate the suitability of different collection classes for specific data storage requirements. (Evaluating)

C06: Design and implement a data access layer for a Windows Forms application. (Create)

Module 1: Introduction to Dot Net Framework (C01, C02)

- DOT NET class framework
- Common Language Runtime
- Elements of .NET application
- Memory Management
- Garbage Collector : Faster Memory allocation, Optimizations
- Common Language Integration
- Common type system
- User and Program Interface
- **Introduction to C#**
- C# Language elements
- Data types -Reference Type and Value Type
- Boxing and Unboxing
- Enum and Constant
- Operators, Control Statements
- Working with Arrays and Strings
- Parameter passing technique: Pass by value and by reference, out parameters, Variable length parameter

Module 2: Object Oriented Concepts (C01, C02, C03)

- Working with Indexer and Properties
- Constructor & Destructor
- Working with "static" Members
- Inheritance & Polymorphism - Types of Inheritance - Constructor in Inheritance - Interface Implementation - Operator and method Overloading and overriding - Static and Dynamic Binding and Virtual Methods, Abstract Class, sealed keyword
- **Exception Handling**
- What is Exception, Rules for Handling Exception
- Exception classes and its important properties
- Understanding & using try, catch keywords
- Throwing exceptions & Importance of finally block

Module 3: Using I/O Class (C01, C02, C03)

- Streams Class
- Text Stream and Binary Stream
- System.IO and Base classes of Stream
- Console I/O Streams
- Working with File System -File , FileInfo, Directory ,Directory Info classes

Module 4: Delegates (C01, C02, C03, C04)

- Introduction of Delegation
- Types of delegate
- Anonymous Methods

Module 5: Collections & Generics (C01, C02, C03, C04, C05)

- Collection classes:
- ArrayList, Hashtable, stack, queue.
- Writing custom generic classes. Working with Generic Collection Classes

Module 6: Windows Form (C01, C02, C03, C04, C05, C06)

- Controls: Common control Group,
- Data control Group, Dialog control Group, Container control Group
- Menus and Context Menus: Menu Strip, Toolbar Strip.
- SDI and MDI Applications
- Introduction to crystal reports, Features of crystal reports, Crystal report creation wizard
- **Data Access Using ADO.Net**
 - Evolution of ADO.NET
 - Connected and Disconnect Classes
 - Establishing Connection with Database
 - Executing simple Insert, Update and Delete Statements
 - DataReader and DataAdapter
 - What is Dataset? Advantages of DataSet
 - Stored Procedures

Recommended Books	<ol style="list-style-type: none">1. "Programming C#" - Jesse Liberty , O'Reilly Press.2. "Professional C#" -Robinson et al, Wrox Press, 2002.3. "The Complete Reference: C#" -Herbert Schildt, Tata McGraw Hill.4. "The Complete Reference: Ado.Net" - Jerke, Tata McGraw Hill.5."C# for programmer"-Deilte-Pearson
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NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	V	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	VSC – 4	ESE*	ISE*	Total	3	2
Paper Name:	Cyber Security					
Paper Code:	23BCAVS351	30	20	50		

CO1: Analyze a security incident report to identify the root cause of the breach.
(Analyze)

CO2: Assess the security posture of a network based on vulnerability scan results.
(Evaluating)

CO3: Develop scripts to automate network scanning and vulnerability assessment tasks.
(Create)

Module 1: Introduction to Cyber Security

- Introduction, Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control and Cryptography.
- Web attack: Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks.
- Network Vulnerabilities: Overview of vulnerability scanning, Open Port / Service Identification, Banner /Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit.
- Networks Vulnerability Scanning (Ncat, Socat), Network Sniffers and Injection tools.

Module 2: Network Defense Tools

- Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding.
- VPN: the basic of Virtual Private Networks.
- Firewall: Introduction, Linux Firewall, Windows Firewall.
- Snort: Introduction Detection System.
- **Web Application Tool:**
 - Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel.
 - Application Inspection tools – Zed Attack Proxy, Sqlmap (Component & Working)
 - Password Cracking and Brute-Force Tools: John the Ripper, L0htcrack, Pwdump, HTC-Hydra.

Module 3: Introduction to Cyber Crime, law & investigation

- Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world.
- Internet crime and Act: A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.
- Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks.

NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	V	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	FP – 2					
Paper Name:	Mini Project	ESE*	ISE*	Total	3	2
Paper Code:	23BCAFP351	30	20	50		

Guidelines:

Module 1: Project Topic Selection and Allocation:

- Project topic selection Process to be defined and followed:
- Project orientation can be given on start of semester
- Students can certainly take ideas from anywhere, but be sure that they should evolve them in the unique way to suit their project requirements.
- Topics can be finalized with respect to following criterion:
- **Topic Selection:** The topics selected should be on current requirement of society/industries (Product based, Application based or Research based) or should work towards removing currently existing systems.
- **Technology Used:** Use of latest technology or modern tools can be encouraged.
- Project work must be carried out by the group of at least 2 students
- Guide allocation should be done and students have to submit weekly progress report to the internal guide
- Internal guide has to keep track of the progress of the project and also has to maintain attendance report. This progress report can be used for awarding term work marks.

Module 2: Project Report Format:

A project report should preferably contain at least following details:

- Abstract
- Introduction o Literature Survey/ Existing system
- Limitation Existing system or research gap
- Problem Statement and Objective
- Proposed System
 - Analysis/Framework/ Algorithm
 - Design details
 - Methodology (your approach to solve the problem) Proposed System
- Experimental Set up
 - Details of Database or details about input to systems or selected data
 - Performance Evaluation Parameters (for Validation)
 - Software and Hardware Set up

NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	VI	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	Major Mandatory - 16	Pattern				
Paper Name:	Dot Net Technology	ESE*	ISE*	Total	4	4
Paper Code:	23BCAMM361	60	40	100		

C01: Explain the ASP.NET architecture, the page lifecycle, and the role of the CLR. (Understanding)

C02: Create ASP.NET pages using various web controls to build user interfaces. (Create)

C03: Implement validation controls in ASP.NET pages to ensure data integrity. (Applying)

C04: Explain the benefits of using master pages and themes for consistent website design. (Understanding)

C05: Implement site navigation in an ASP.NET application using appropriate controls. (Applying)

C06: Choose and implement appropriate state management techniques for specific scenarios. (Applying)

C07: Implement basic AJAX functionality using JavaScript and ASP.NET AJAX controls. (Applying)

C08: Create and consume simple web services in ASP.NET applications. (Applying)

C09: Write C# code to connect to a database, execute SQL commands, and retrieve data using ADO.NET. (Apply)

C010: Design and develop a complete ASP.NET web application with multiple pages, user controls, and data access. (Create)

Module 1: Introduction of ASP.Net

- Evaluation & fundamentals of Asp.Net
- Architecture of ASP.NET
- Compilation Technique of ASP.Net
- Application Location, Web Page and Web Site life cycle
- ASP.Net Page Structure, Page Directives, Self-page and Cross page posting
- Postback and ViewState concepts
- Application Folder

Module 2: Web Server Control

- Creating ASP.NET Pages – Web Forms
- Working with web controls – Standard, control group, Rich Controls, Different type of List controls, FileUpload, AdRotator, MultiView, Calendar, Create Web User Control

Module 3: Validation Control

- Introduction of validation , Types of validation
- Validation Controls
- Validation Groups

Module 4: Master Pages & Themes

- Need of Master Pages
- Basics of master pages, Creating Master and Content pages
- Programmatically assign master pages
- Nested Master pages
- Event ordering of master pages
- Basic Themes and Skins, Creating and Using Themes
- Defining multiple skins, Programmatically working with themes

Module 5: Site Navigation

- Site Navigation technique- SiteMapPath, TreeView and Menu Control, Nesting sitemap file

- Attach XML file to treeview and menu

Module 6: State Management

- Introduction of state management technique
- Types of State Management technique
- Client side and server side State Management

Module 7: AJAX

- What is AJAX and need for AJAX, Client side and server side AJAX
- Implementing AJAX with JavaScript
- Using ASP.NET Ajax Control toolkit
- Working with AJAX's Server side controls.
- ScriptManager, ScriptMangerProxy, Updatepanel, UpdateProgress, Timer

Module 8: Web Services

- What is Web Service?
- Understanding SOAP, WSDL, Proxy etc.
- Creating Web services
- How to consume web services to build an WebService application and Client

Module 9: Storing & Retrieving Data with ADO.Net

- Accessing Data with ADO.NET
- Using Data Sets on Web Forms
- Processing Transactions
- Working with DML commands

Module 10: Deploying Application

- What is web hosting?
- About FTP
- How to deploy ASP.Net application?

<p>Recommended Books</p>	<ol style="list-style-type: none"> 1. "Unlished Asp.Net " - Walther , SAMS Pearson. 2. "Professional ASP.Net"-Evjen, Sivkumar, Wrox Press. 3. "The Complete Reference: Asp.Net"-MacDonald, Tata McGraw Hill. 4. "The Complete Reference: Ajex"- Powell, Tata McGraw Hill. 5. "Pro Asp.Net in C#" -MacDonald, Szpuszta-APress 6. "Asp.Net Step by step"- George Shephera-Microsoft Press 7. "Professional Ajex"-Zakas, NxPeak, fawcett, Wrox Press 8. complete reference crystal reports-Geogre Pea
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NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	VI	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	Major Mandatory - 17	Assessment & Evaluation Pattern			L/W*	Credits
Paper Name:	Advanced Python	ESE*	ISE*	Total	4	4
Paper Code:	23BCAMM362	60	40	100		

CO1: Design and conduct experiments to evaluate the performance of different image processing methods. (Create)

CO2: Determine the most appropriate Django features and techniques for a given project. (Evaluate)

CO3: Critically examine the security implications of using XML in different contexts. (Evaluate)

CO4: Develop a network application that utilizes a specific network protocol (e.g., UDP for real-time communication).

Module 1: Windows Application

Windows applications using tkinter :

- Advantages of GUI , basic operations using tkinter
- Root window
- Working with containers – Canvas and Frame
- Introducing different widgets
- Layout management
- Events and bindings
- Mysql database connectivity with python

Basic numerical processing

- Introduction to numpy
- Creation of vectors and matrices
- Matrix manipulation
- Basic image processing

Introduction to digital image processing

- Basic operations on an image
- Crop
- Scale
- Rotate
- Flip
- Changing contrast, brightness and color
- Edge detection, blur, sharpening

Module 2: Web Application using Django

- What Is a Web Framework?
- The MVC Design Pattern
- Django's History, Advantages of Django
- Understanding Django environment
- Installing Django, Setting Up a Database Django architecture
- The Development Server
- Django Commands Overview
- Starting a Project
- Django apps, Difference between app and project
- The Project Structure
- Create an Application Migration
- Admin Panel
- Views in Django
- URL Routing

- Template in Django, Models in Django, Forms in Django

Module 3: XML

- Introduction to XML
- XML Parser Architecture and API's
- Parsing XML with SAX API's and DOM API's

Module 4: Network Programming

- Introduction to Sockets Programming
- Server and Client Socket Methods
- IP Address
- URL
- TCP/IP Server and TCP/IP Client
- Sending E-mail Application

Recommended Books	<ol style="list-style-type: none">1. Beginning Django: Web Application Development and Deployment with Python-Daniel RubioApress2. Django Unleashed- Andrew Pinkham-SAMS3. Practical Django Projects- James Bennett-Apress4. Python GUI Programming with Tkinter- Alan D. Moore-Packt5. Tkinter GUI Application Development H TSHOT - BhaskarChaudhary -Packt
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NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	VI	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	Major Mandatory - 18	Assessment & Evaluation Pattern			L/W*	Credits
Paper Name:	Computer Graphics	ESE*	ISE*	Total	3	2
Paper Code:	23BCAMM363	30	20	50		

C01: Evaluate the suitability of different graphics software packages for specific tasks. (Evaluate)

C02: Design and develop new algorithms/applications. (Create)

C03: Critically assess the efficiency and accuracy of different transformation methods. (Evaluate)

C04: Design and implement a simple 3D graphics application that utilizes 3D transformations to manipulate objects in space. (Create)

C05: Compare and contrast different projection methods, considering their advantages and limitations. (Analyze)

C06: Apply the Cohen-Sutherland and Sutherland-Hodgman algorithms to clip lines and polygons, respectively. (Applying)

Module 1: Introduction

- Applications of computer graphics
- operations of computer graphics
- graphics software packages
- Graphical input – output devices: graphical input devices, output devices, raster scan video principles- raster scan monitors, color raster scan systems, plasma panel display
- LCD panels, hard copy raster devices.
- Random scan devices- monitor tube displays
- Plotters

Module 2: Scan conversion

- Scan conversion methods
- polynomial method for line, polynomial method for circle
- DDA algorithm for line and circle
- Bresenham algorithm for line and circle drawing
- Midpoint methods for line and circle, problems of scan conversion

SCAN CONVERSION FOR SOLIDS:-

- Solid areas or polygons
- inside-outside test – odd even method
- winding number method
- Solid area filling algorithms- boundary fill algorithm
- scan line fill algorithm, scan line seed fill algorithm

Module 3: 2D geometrical transformations

- Basic transformations- translation, Rotation, Scaling
- homogeneous co-ordinate system – transformations in homogeneous notation
- inverse of basic transformations
- scaling about a reference point
- rotation about an arbitrary point
- Other transformations – reflection about any arbitrary line
- Shearing, combined transformation- computational efficiency, visual reality
- inverse of combines transformations

Module 4: 3D geometrical transformations

- Basic 3D transformation- 3D translation, 3D scaling, 3D rotation
- rotation about an arbitrary axis in space
- other 3D transformations- 3D reflection, reflection about any arbitrary plane
- 3D shearing

Module 5: Projection

- Introduction, parallel projection- orthographic projection, axonometric projection
- oblique projection, perspective projection – standard perspective projection
- vanishing points
- Image formation inside a camera

Module 6: 2D viewing and clipping

- windows and viewports
- viewing transformation
- clipping of lines in 2D- cohen-sutherland clipping algorithm
- polygon clipping – Sutherland – hogman polygon clipping

Recommended Books	<ol style="list-style-type: none">1) Computer Graphics, Multimedia and Animation by Malay K Pakhira2) Computer Graphics, Donald Hearn, M. Pauline Baker, Prentice-Hall3) Computer Graphics, Roy A. Plastock, Gordon Kalley, Schaum's Outlines, McGraw Hill
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NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	VI	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	Elective - 2					
Paper Name:	R-Language	ESE*	ISE*	Total	4	4
Paper Code:	23BCAEL361	60	40	100		

C01: Create and manipulate R objects (vectors, matrices, data frames) using basic commands. (Applying)

C02: Develop R scripts that effectively utilize vectors and control structures to solve real-world problems. (Creating)

C03: Evaluate the efficiency and readability of different function implementations. (Evaluating)

C04: Evaluate the efficiency and appropriateness of different matrix operations for solving specific problems. (Evaluating)

C05: Develop R scripts that effectively utilize lists to solve real-world problems involving complex data structures. (Create)

C06: Analyze the structure of arrays and identify appropriate use cases for arrays compared to other data structures. (Analyze)

C07: Evaluate the efficiency of different data frame operations and the appropriateness of using data frames for specific data. (Evaluate)

C08: Develop custom visualizations using R graphics functions to effectively communicate complex data relationships. (Create)

C09: Evaluate the efficiency and readability of code that utilizes the stringr package and regular expressions. (Evaluate)

C010: Develop R scripts that effectively utilize the dplyr package to perform complex data manipulation tasks such as data cleaning, transformation, and aggregation. (Create)

Module 1: FUNDAMENTALS OF R

- Installation of R & R Studio
- Features and Variables, Constants, Operators in R
- Datatypes and R Objects
- Accepting Input from keyboard
- Important Built-in functions

Module 2: VECTORS

- Creating Vectors
- Accessing elements of a Vector
- Operations on Vectors
- Vector Arithmetic
- Control Structures in R

Module 3: FUNCTIONS IN R

- Formal and Actual arguments
- Named arguments
- Global and local variables
- Argument and lazy evaluation of functions
- Recursive functions

Module 4: MATRICES

- Creating matrices
- Accessing elements of a Matrix
- Operations on Matrices
- Matrix transpose

Module 5: LISTS

- Creating lists
- Manipulating list elements
- Merging lists
- Converting lists to vectors

Module 6: ARRAYS IN R

- Creating arrays
- Accessing array elements
- Calculations across array elements

Module 7: DATA FRAMES IN R

- Creating data frame
- Operations on data frames
- Accessing data frames
- Creating data frames from various sources

Module 8: DATA VISUALIZATION IN R

- Need for data visualization
- Bar plot
- Plotting categorical data
- Stacked bar plot
- Histogram
- plot() function and line plot
- pie chart / 3D pie chart
- Scatter plot
- Box plot

Module 9: STRINGR PACKAGE

- Important functions in stringr
- Regular expressions

Module 10: DPLYR PACKAGE

- Load data into dataframe
- Viewing the data
- Selecting columns
- Selecting rows
- Reordering the rows
- Pipe operator
- Group operations

NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	VI	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	Elective - 2					
Paper Name:	Big Data & Hadoop	ESE*	ISE*	Total	4	4
Paper Code:	23BCAEL362	60	40	100		

C01: Evaluate the suitability of different storage and processing technologies for specific Big Data use cases. (Evaluate)

C02: Analyze the requirements for setting up a Hadoop environment in different scenarios. (Analyze)

C03: Develop scripts or commands to interact with the HDFS, including creating directories, uploading/downloading files, and managing data. (Create)

C04: Evaluate the suitability of MapReduce for specific data processing challenges. (Evaluating)

C05: Design and implement a basic Flume data pipeline to collect and transfer real-time data from a specified source to a target destination.

C06: Create and manage Hive tables, load data into Hive tables, and execute HiveQL queries to analyze data. (Apply)

C07: Design and implement complex Pig scripts to solve real-world data analysis challenges, such as data cleaning, feature engineering, and machine learning model training. (Create)

Module 1: INTRODUCTION OF BIG DATA

- Big Data Introduction
- Big Data Architecture
- Understand various data formats and data units
- Big data With Industry Requirements
- Big Data Complexity
- Big Data Storage
- Big Data performance optimization

Module 2: HADOOP ENVIRONMENT

- Understand Hadoop Environment
- Requirement of Setting Hadoop Environment
- Importance of Data Analytics
- Setting up Hadoop Environment

Module 3: HADOOP CLUSTER & FILE SYSTEM

- Explaining Various file systems
- Hdfs GFS, POSIX, GPFS
- explain clustering methodology
- Advantages of IBM BIGINSIGHTS over other tools
- IBM BIGINSIGHTS Approach
- RACK Awareness
- Understanding Name Node System
- Working Methodology of Data Node
- Understand Demon process
- Master Nodes and slave nodes
- HADOOP FILE SYSTEM(HDFS) & HADOOP ARCHITECTURE
- Working on hdfs File System
- Accessing Hadoop File System
- Hadoop file system Architecture
- Creating lib and accessing lib from HDFS
- hadoop commands make dir, deletediretc
- working with web console

Module 4: HADOOP MAPREDUCE

- Introduction of Map Reduce
- mapreduce programming and word count
- mapreduce nodes job tracker and task tracker running
- Mapreduce program through web console
- Mapreduce Programming approach

Module 5: HADOOP FLUME

- Introduction of FLUME Approach
- Understand information stream
- Understand Information ocean
- Working with FLUME Language

Module 6: HADOOP HIVE

- Understand Data Ware Housing
- Requirement of Data Ware housing
- Data Ware housing with Hive
- Understand Hive environment
- working with Hive Query Language
- Perform DDL approach Through Hive
- Perform DML approach through Hive

Module 7: HADOOP PIG

- Introduction of PIG
- Requirement of Pig
- Working with pig Script
- Running and managing Pig Script
- Perform Streaming Data Analytics through PIG
- Pig Advantages and Disadvantages

NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	VI	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	Minor - 8					
Paper Name:	Linux	ESE*	ISE*	Total	4	4
Paper Code:	23BCAMN361	60	40	100		

C01: Understand the core concepts of various Linux desktop environments (KDE, GNOME, Xfce). (Understanding)

C02: Analyze the impact of different partitioning schemes on system performance and storage utilization. (Analysing)

C03: Evaluate the suitability of different file systems for specific workloads and applications. (Evaluating)

C04: Create and manage user accounts with appropriate permissions and settings. (Applying)

C05: Create and maintain a well-organized file system structure. (Creating)

C06: Analyze the performance and efficiency of different shell scripting techniques. (Analyzing)

C07: Understand the significance of administrative files and their impact on system behavior. (Understanding)

Module 1: Introduction to Linux

- History
- Distributions
- Features
- Linux Architecture
- Kernel
- Types of Shells
- Difference between Windows and Linux
- Working environments –KDE, GNOME , Xface4 etc

Module 2: Installation of Linux

- Hardware requirement
- Software requirements
- Create partitions
- Configuration of X system
- Start-up configuration

Module 3: Linux File System

- File System
- Hierarchy of File system
- Devices and Drives in Linux
- Mounting Devices File System parts-
- Boot Block, Super Block, Inode Block, Data Block

Module 4: Users, Groups and Permissions

- Create Users
- Create groups
- Special groups
- Assigning permissions to users and groups

Module 5: Commands, Utilities and File Management

- Managing file and directories: mkdir, cd and pwd, ls, cat, more, less
- Nested directories
- File and Directory Operations:
- find, cp, mv, rm, ln etc.

- Filters: head, tail ,pr, cut, paste , sort, uniq, grep, egrep, fgrep.
- Text Editors- vi, vim File and Directory permissions- chmod, chown, chgrp.
- Printing the files - lpr, lpq, lprm etc. Archive and File compression, Windows integration tools.

Module 6: Shell Programming and Process Management

- Shell Variables, Shell Scripts –
- Control and Loop structure,
- User defined commands,
- I/O and Redirection, Piping, Metacharacters
- Process Management: Shell process, Parent and children, Process status, System process, Multiple jobs in background and foreground, Changing process priority with nice.
- Listing processes, ps, kill, Premature termination of process.

Module 7: Disk management and System Administration

- Boot Loaders-GRUB, LILO,
- Custom Loaders System administration –
- Common administrative tasks, Identifying administrative files, Configuration and log files, Chkconfig, Role of system administrator, Security Enhanced Linux.
- Configuration Apache and MySql, X Window, Communication.

Recommended Books	<ol style="list-style-type: none"> 1) Operating Systems by William Stallings(PHI) 2) Operating System by AchyutGodbole (TMH) 3) Linux the complete refrence by Richard Mathews(TMh) 4) Red Hat Linux :The Complete Reference by Peterson (TMH) 5) Unix Systems V 4 Concepts & Applications by Sumitabha Das 6) Using Linux by Bill Ball
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NEP Curriculum : w.e.f June 2023						
Programme: BCA III (Level 5.5)						
Semester:	VI	Assessment & Evaluation Pattern			L/W*	Credits
Paper Category:	OJT - 1					
Paper Name:	Major Subject	ESE*	ISE*	Total	4	4
Paper Code:	23BCA0J361	60	40	100		

It is mandatory for the students to seek written approval from the Faculty Guide about the Topic & the Organization before commencing the Internship. During the Internship students are expected to take necessary guidance from the faculty guide allotted by the Institute. To do it effectively they should be in touch with their guide through e-mail or telecom. Internship Project should be a Computer Application to Real life business activity. The learning outcomes and the utility to the organization must be highlighted in Internship Project Report.

General chapterization of the report shall be as under:

- | | |
|----------------------------|-----------------------------|
| 1) Introduction | 5) System Requirements |
| 2) Theoretical background | 6) System Analysis & Design |
| 3) Company profile | 7) Implementation & Testing |
| 4) Objectives of the study | 8) Conclusion & Suggestions |

Project (community Based/Software based)

The project work would expose students to the socio-economic issues in society so that the theoretical learning's can be supplemented by actual life experiences to generate solutions to real-life problems.

As a part of Semester-VI, each student shall undertake Community based project related the areas of community engagement and service, environmental education, and value-based education.

It is mandatory for the students to seek written approval from the Faculty Guide about the Topic before commencing the project work. The topic may relate survey based or software based problem.

The learning outcomes and the utility to the society must be highlighted in Project Report.

Credits and Duration of On-the-Job Training (OJT):

- On-the-job training (OJT) will carry a weightage of Four Credits.
- Each student is required to complete one hundred & twenty clock hours of On Job Training.(OJT)
- The OJT program is to be completed during Semester VI. According to the guidelines outlined in the National Education Policy (NEP), postgraduate students are expected to fulfil this requirement either within the second semester of their PG program or during the semester break following the Sixth semester

Evaluation of OJT: Evaluation during the OJT program involves two key components: External Evaluation (50%) and Internal Evaluation (50%). The following is a suggested two-fold pattern of evaluation.

1. Host Organization Evaluation: The host organization will assess students based on criteria such as punctuality, completion of hours, and proficiency in required skill sets. They will also provide feedback on the student's overall performance.

2. Department Mentor Evaluation: Additionally, students will be evaluated by their department mentor based on their weekly reporting, written report, and viva voce/presentations.

External (OJT Supervisor, for instance)	<i>Completion of Hours</i>	<i>Quality/ Performance</i>	<i>Punctuality/ Regularity</i>	Total
	20	20	10	50
Department Mentor	<i>Weekly Reporting</i>	<i>Written Report</i>	<i>Viva-Voce /Presentation</i>	
	15	20	15	50