VEER BAHADUR SINGH PURVANCHAL UNIVERSITY,

JAUNPUR 222003 (UP)

EVALUATION SCHEME & SYLLABUS
(II[nd] & III[rd] Year)

for

BACHELOR OF COMPUTER APPLICATIONS (BCA)

(Three Year Course)

As per
National Education Policy 2020
(Effective from the Session: 2026-27)

BCA Second Year Evaluation Scheme, 2026-2027

SEMESTER-III

S. No.	Subject Code	Subject Name	Periods			Sessional			ESE	Total	Credit
			L	T	P	CT	TA	Total			
1.	NBC301	Object Oriented Programming in C++	3	1	0	20	10	30	70	100	4
2.	NBC302	Web Technology	3	1	0	20	10	30	70	100	4
3.	NBC303	Business Communication	3	1	0	20	10	30	70	100	4
4.	NBC304	Computer Organization	3	0	0	20	10	30	70	100	3
5.	NBC305	Universal Human Values and Professional Ethics	3	0	0	20	10	30	70	100	3
6.	NBC351	Object Oriented Programming in C++ Lab	0	0	3	30	20	50	50	100	2
7.	NBC352	Web Technology Lab	0	0	3	30	20	50	50	100	2
		Total	15	3	6			250	450	700	22

CT: Class Test **TA**: Teacher Assessment **L/T/P**: Lecture/ Tutorial/ Practical

SEMESTER-IV

S. No.	Subject Code	Subject Name	Periods			Sessional			ESE	Total	Credit
			L	T	P	CT	TA	Total			
1.	NBC401	Java Programming	3	1	0	20	10	30	70	100	4
2.	NBC402	DBMS	3	1	0	20	10	30	70	100	4
3.	NBC403	Operating Systems	3	1	0	20	10	30	70	100	4
4.	NBC404	Technical Communication	3	0	0	20	10	30	70	100	3
5.	NBC405	Indian Tradition, Culture And Society	3	0	0	20	10	30	70	100	3
6.	NBC451	Java Programming Lab	0	0	3	30	20	50	50	100	2
7.	NBC452	DBMS Lab	0	0	3	30	20	50	50	100	2
8.	NVA451	Sports and Yoga*	0	0	3		100				0
		Total	15	3	9					700	22

CT: Class Test **TA**: Teacher Assessment **L/T/P**: Lecture/ Tutorial/ Practical ***Non-credit Course***

Note: *The Startup and Entrepreneurial Activity Assessment will be done in the VI semester, under which a student will have to undergo a startup / entrepreneurship activity of at least 60 hours till the V semester.*

BCA (Three Year Course) IInd Year

BCA Third Year Evaluation Scheme, 2026-27

SEMESTER-V

S. No.	Subject Code	Subject Name	Periods			Sessional			ESE	Total	Credit
			L	T	P	CT	TA	Total			
1.	NBC501	Artificial Intelligence & Machine Learning	3	0	0	20	10	30	70	100	3
2.	NBC502	Python Programming	2	1	0	20	10	30	70	100	3
3.	NBC503	Computer Networks	3	0	0	20	10	30	70	100	3
4.	NBC504	Software Project Management	2	0	0	20	10	30	70	100	2
5.		Elective-I	2	0	0	20	10	30	70	100	2
6.	NBC551	Artificial Intelligence & Machine Learning Lab	0	0	2	30	20	50	50	100	1
7.	NBC552	Mini Project Lab	0	0	3	30	20	50	50	100	2
		Total	12	1	5					700	16

CT: Class Test TA: Teacher Assessment L/T/P: Lecture/Tutorial/Practical

SEMESTER-VI

S. No.	Subject Code	Subject Name	Periods			Sessional			ESE	Total	Credit
			L	T	P	CT	TA	Total			
1.	NBC601	Cyber Security	2	0	0	20	10	30	70	100	2
2.	NBC602	Digital Marketing	2	0	0	20	10	30	70	100	2
3.	NBC603	Software Testing & Quality Assurance	3	0	0	20	10	30	70	100	3
4.	NBC651	Startup and Entrepreneurial Activity Assessment	0	0	4		100	100		100	2
5.	NBC652	Project	0	0	14		100	100	200	300	7
		Total	7 18	0						700	16

CT: Class Test TA: Teacher Assessment L/T/P: Lecture/Tutorial/Practical

Elective-1

NBC011 Cryptography & Network Security NBC012 Internet of Things

NBC013 Theory of Computation NBC014 Cloud Computing

NBC015 Distributed DBMS

BCA

SECOND YEAR SYLLABUS

SEMESTER-III

NBC301: OBJECT ORIENTED PROGRAMMING IN C++		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	List the significance, key features and principles of object-oriented programming.	K_1, K_2
CO 2	Analyze basic structural, behavioral and architectural models using object-oriented software engineering approach.	K_4
CO 3	Illustrate object-oriented modeling techniques for analysis.	K_3
CO 4	Use the basic features of data abstraction and encapsulation, constructors, destructors in C++ programs.	K_3, K_4
CO 5	Utilize templates and file handling mechanisms effectively.	K_3
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Introducing Object – Oriented Approach, Relating to other paradigms (functional and data decomposition). Basic concepts: Class, Object, Abstraction, Encapsulation, Inheritance, Polymorphism, Review of C, Difference between C and C++, cin, cout, new, delete, operators.	**08**
II	**Classes and Objects:** Encapsulation, Information hiding, Abstract data types, Object & classes, Attributes, Methods, C++ class declaration, State identity and behavior of an object, Constructors and destructors, Instantiation of objects, Default parameter value, object types, C++ garbage collection, Dynamic memory allocation, Meta class / Abstract classes.	**08**
III	**Inheritance and Polymorphism:** Inheritance, Class hierarchy, Derivation – public, private & protected, Aggregation, composition vs classification hierarchies, Polymorphism, Categorization of polymorphism techniques, Method polymorphism, Polymorphism by parameter, Operator overloading, Parametric Polymorphism.	**08**
IV	**Generic Programming:** Introduction to Generic Programming, Class Templates, Class templates with multiple parameters, Template function, Function template with multiple parameters, Overloading of Template functions, Standard Template Library.	**08**
V	**Streams, Files and Exception Handling:** Overview of Stream Class Hierarchy, Streams classes, Stream Errors, Disk File I/O with streams, file pointers, Exception handling mechanism, Error handling in file I/O with member function, Multiple catch statements.	**08**

Suggested Readings:

1. Venugopal A.R., Rajkumar, Ravishanker T., "Mastering C++", TMH.
2. Lippman S.B. and Lajoie J., "C++ Primer", Addison Wesley.
3. Lafore R., "Object Oriented Programming using C++", Galgotia Publications.
4. Balagurusamy E., "Object Oriented Programming with C++", TMH
5. Salaria R.S., "Mastering Object-Oriented Programming with C++", Khanna Publishing

House
6. Sehlidt H., "The Complete Reference C++", TMH.
7. Gottfried B. S., "Schaum's Outline of Programming with C++", TMH.
8. Stanley B. Lippman and Lajoie J., "C++ Primer", Pearson Education.
9. Stroustrup B., "The C++ Programming Language", Pearson Education.

BCA (Three Year Course) IInd Year

NBC302: WEB TECHNOLOGY		
Course Outcome(CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Apply the knowledge of HTML and DHTML to develop web application and analyze the insights of internet programming to implement complete application over the web.	K_3, K_6
CO 2	Recognize and apply the elements of Creating Style Sheet (CSS) , Understand Bootstrap	K_2, K_4
CO 3	Understand, analyze and apply the role of JavaScript in the workings of the web and web applications, Understand XML.	K_2, K_3
CO 4	Understand, analyze and build dynamic web applications using servlet and JSP.	K_2, K_3
CO 5	Develop Spring-based Java applications using Java configuration, annotation-based configuration, beans and their scopes, and properties., Develop web application using Spring Boot.	K_2, K_4, K_6
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Web Page Designing:** Introduction and Web Development Strategies, History of Web and Internet, Protocols Governing Web, HTML-Introduction, HTML Tags, HTML-Grouping Using Div & Span, HTML-Lists, HTML-Images, HTML-Hyperlink, HTML Table, HTML- Iframe, HTML-Form, Dynamic HTML, Document Object Model, Features of DHTML, DHTML Events	**08**
II	**CSS:** Creating Style Sheet, CSS Properties , CSS Styling ,Working with block elements and objects, Working with Lists and Tables , CSS Id and Class, Box Model (Introduction, Border properties, Padding Properties, Margin properties), CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector), Introduction to Bootstrap	**08**
III	**Java Script and XML:** Introduction to JavaScript, Creating Variables in JavaScript, Creating Functions in JavaScript, UI Events, Returning Data from Functions, Working with Conditions, looping in JavaScript, Block Scope Variables, Working with Objects, Creating Object using Object Literals, Manipulating DOM Elements with JavaScript , Introduction to XML, Defining XML tags	**08**
IV	**Web Application development using JSP & Servlets:** Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with Http Session. Java Server Pages (JSP) , Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries	**08**

V	**Spring & Spring Boot:** Spring Core Basics-Spring Dependency Injection concepts, Introduction to Design patterns, Factory Design Pattern, Strategy Design pattern, Spring Inversion of Control, AOP, Bean Scopes Singleton, Prototype, Request, Session, Application, Spring Boot Configuration, Spring Boot Annotations, Spring Boot Actuator, Spring Boot Build Systems, Spring Boot Code Structures	08

Suggested Readings:

1. Burdman J., "Collaborative Web Development – Strategies and Best practices for Web Teams", Addison-Wesley.
2. Xavier C, "Web Technology & Design", New Age International Publishers.
3. Bayross I., "Web Technologies", BPB Publications.
4. Schieldth H., "The Complete Reference – HTML & CSS", McGraw Hill.
5. Bergsten H., "Java Server Pages", SPD O' Reilly.
6. Walls C., "Spring Boot in Action", Manning Publications.
7. Bakliwal S., "Hands-on Application Development using Spring Boot", BPB Publications

BCA (Three Year Course) IInd Year

NBC303: BUSINESS COMMUNICATION		
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
	At the end of course, the student will be able to understand	
CO 1	To understand business communication strategies and principles for effective communication in domestic and international business situations.	K_3, K_5
CO 2	To understand and appropriately apply modes of expression, i.e., descriptive, expositive, narrative, scientific, and self-expressive, in written, visual, and oral communication.	K_3, K_4
CO 3	To develop the ability to research and write a documented paper and/or to give an oral presentation.	K_3
CO 4	To develop the ability to communicate via electronic mail, Internet, and other technologies for presenting business messages.	K_3, K_4
CO 5	To understand and apply basic principles of critical thinking, problem solving, and technical proficiency in the development of exposition and argument.	K_2, K_6
	DETAILED SYLLABUS	**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Basic Principles of Communication:** Introduction, Role of communication, defining and classifying communication, process of communication, importance of communication in management, communication in the workplace, barriers to communication.	**08**
II	**Oral Communication:** What is oral Communication, principles of successful oral communication, non – verbal communication, Written communication: –characteristics of verbal & non-verbal communication.	**08**
III	**Business Correspondence:** Business letter writing, reports, Parts of a report, Business Letter Layout-Full Block, Modified Block, Semi-Block Principles of Effective Letter Writing. Statement of purpose Job Application Letter and Resume, Paragraph writing.	**08**
IV	**Presentation Skill and Group Communication:** Principles of effective presentation; Making effective presentation; Listening skills; Group discussion, Interview preparation, conducting meeting, Drafting Notice, Agenda and resolution, Public Relations.	**08**
V	**Language and Writing Skills:** Letter of Complaints, Sales Letters, Adjustments letter, Consumer Grievance Letters. **Reports:** Layout, Types and parts of a report: Feasibility reports, Investigative reports,	**08**

Suggested Readings:

1. Chaturvedi P.D., "The Art and Science of Business Communication", Pearson.
2. Chhabra T. N., "Business Communication", Sun India Publications.
3. Bovee & Thill, "Business Communication Essentials A Skill–Based Approach to Vital Business", English Pearson.
4. Kumar K. & Salaria R.S., "Effective Communication Skills", Khanna Publishing House.
5. Bisen & Priya, "Business Communication", New Age International Publication.
6. Kalkar S. and Gupta S., "Business Communication" Orient Blackswan.
7. Bhatia V., "Business Communications", Khanna Publishing House.

BCA (Three Year Course) IInd Year

NBC304: COMPUTER ORGANIZATION		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO 1	Describe functional units of digital system and explain how arithmetic and logical operations are performed by computers.	K_2, K_3
CO 2	Describe the operations of control unit and write sequence of instructions for carrying out simple operation.	K_2, K_4
CO 3	Describe various types of processor organization and addressing modes.	K_2, K_3
CO 4	Describe the various modes in which IO devices communicate with CPU and memory.	K_2, K_3
CO 5	Design various types of memory and its organization.	K_3
	DETAILED SYLLABUS	**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	Register Transfer Language, Bus and Memory Transfers, Bus Architecture, Arithmetic Logic, Shift Microoperation, Arithmetic Logic Shift Unit, Design of Fast adders, Arithmetic Algorithms (addition, subtraction, Booth Multiplication).	**08**
II	**Control Design:** Hardwired & Micro Programmed (Control UNIT)-Fundamental Concepts (Register Transfers, performing of arithmetic or logical operations, fetching a word from memory, storing a word in memory), Execution of a complete instruction, Multiple-Bus organization, Hardwired Control, Micro programmed control(Microinstruction, Microprogram sequencing, Wide-Branch addressing, Microinstruction with Next-address field, Prefetching Microinstruction).	**08**
III	**Processor Design:** Processor Organization- General register organization, Stack organization, Addressing mode, Instruction format, Data transfer & manipulations, Program Control, Reduced Instruction Set Computer.	**08**
IV	**Input-Output Organization:** I/O Interface, Modes of transfer, Interrupts & Interrupt handling, Direct Memory access, Input-Output processor, Serial Communication.	**08**
V	**Memory Organization:** Memory Hierarchy, Main Memory (RAM and ROM Chips), Auxiliary memory, Cache memory, Virtual Memory, Memory management hardware.	**08**

Suggested Readings:

1. Mano M., "Computer System Architecture", Pearson.
2. Hamacher C., Vranesic Z. and Zaky S., "Computer Organization", Tata McGraw Hill.
3. Tanenbaum A. S., "Structured Computer Organization", Pearson Education.
4. Stallings W., "Computer Organization and Architecture", Pearson Education.
5. Hayes J. P., "Computer Architecture and Organization", McGraw Hill.

BCA (Three Year Course) IInd Year

NBC305: UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS		
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
	At the end of course, the student will be able to understand	
CO 1	To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.	K_2, K_4
CO 2	To help students initiate a process of dialog with in themselves to know what they 'really want to be' in their life and profession	K_1, K_2
CO 3	To help students understand the meaning of happiness and prosperity for a human being.	K_2
CO 4	To facilitate the students to understand harmony at all the levels of human living, and live accordingly.	K_2
CO 5	To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.	K_2, K_4
	DETAILED SYLLABUS	**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Understanding the need, content and process for Value Education, Classification of Value Education: understanding personal values, social values, and moral values & spiritual values; Understanding the difference between ideology and values, Self-Exploration–content and process; Natural Acceptance; Understanding Harmony with self, Society and Nature, Meaning and nature of human values; Significance of human values in life; Relation between values and ethics.	**08**
II	**Understanding Harmony in the Human Being:** Understanding the relationship among: Self, Identity and Personality; Understanding human being as a co-existence of the 'I' and the 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.	**08**
III	**Understanding Harmony in the Family and Society:** Understanding Happiness and Prosperity - basic Human Aspirations, Right understanding, Relationship and Physical Facilities, Understanding harmony in the Family, Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; foundational values of relationship, Understanding the meaning of *Vishwas*; Difference between intention and competence, Understanding the meaning of *Samman*, Difference between respect and differentiation; Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj*), Universal Order (*Sarvabhaum Vyawastha*)- from family to world family.	**08**
IV	**Understanding Harmony in the Nature and Existence:** Nature; Characteristics and scope of professional ethics; Types of professional ethics; Understanding the harmony in the nature, and scope	

	of professional ethics Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.	**08**
V	**Implications of Holistic Understanding of Harmony on Professional Ethics:** Value based Life and Profession; Issues in Professional Ethics – The Current Scenario; Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models – Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.	**08**

Suggested Readings:

1. Gaur R. R., Sangal R and Bagaria G.P., "A Foundation Course in Human Values and Professional Ethics", Excel Books.
2. Naarazan R.S., "A text book on Professional Ethics & Human Values", New Age.
3. Tripathi A. N., "Human Values", New Age.
4. Govindarajan, M., Natarajan, S. and Kumar S. V. S., "Professional Ethics and Human Values", PHI.
5. Kiran D. R.,"Professional Ethics and Human Values", McGraw Hill Education (India).
6. Dhar P. L., Gaur R.R., "Science and Humanism", Commonwealth Publishers.
7. Banerjee B. P., "Foundations of Ethics and Management", Excel Books.

BCA (Three Year Course) IInd Year

NBC351: OBJECT ORIENTED PROGRAMMING IN C++ LAB		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Use the Concept of Data Abstraction and Encapsulation in C++ programs.	K_3
CO 2	Interpret C++ program using the concept such as polymorphism, virtual function, exception handling and template.	K_3
CO 3	Apply object-oriented techniques to analyze, design and develop a complete solution for a given problem.	K_3, K_4

1. Write a program using functions.
2. Write a program using functions with default arguments.
3. Write a program to implement call by value, call by address, and call by reference.
4. Write a program to understand objects, member functions, and constructors.
5. Write a program using classes with primitive data members.
6. Write a program using classes with arrays as data members.
7. Write a program using classes with pointers as data members.
8. Write a program using classes with constant data members.
9. Write a program using classes with static member functions.
10. Write a program to demonstrate compile-time polymorphism.
11. Write a program to demonstrate operator overloading.
12. Write a program to demonstrate function overloading.
13. Write a program to demonstrate run-time polymorphism.
14. Write a program to implement inheritance.
15. Write a program to demonstrate virtual functions.
16. Write a program using virtual base classes.
17. Write a program using templates.
18. Write a program for file handling.
19. Write a program to perform sequential file access.
20. Write a program to perform random file access.

Note: The instructor may add/delete/modify experiments, wherever he/she feels in a justified manner.

NBC352: WEB TECHNOLOGY LAB		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Design web pages using HTML, DHTML.	K_2
CO 2	Design web pages using Cascading Styles sheets.	K_2
CO 3	Develop dynamic web pages using JavaScript.	K_3
CO 4	Develop an interactive web applications using JSP.	K_3
CO 5	Create web applications using Spring & Spring Boot.	K_2

DETAILED SYLLABUS

1. Create a simple webpage using HTML
2. Create a HTML page, which has properly aligned paragraphs with image along with it.
3. Write a program to display list of items in different styles.
4. Use frames to Include Images and Videos.
5. Design a website with different methods of embedding CSS in a web page.
6. Add a Cascading Style sheet for designing the web page.
7. Write programs using Java script for Web Page to display browsers information.
8. Design a dynamic web page with validation using JavaScript.
9. Write a program using JavaScript to demonstrate the concept of built-in array methods.
10. Write a program using JavaScript to demonstrate the concept of nested functions.
11. Write programs using JavaScript for Web Page to display browsers information.
12. Write a program using JavaScript to merge property of two objects.
13. Write a program using JavaScript to include a JS file into another JS file.
14. Develop a Servlet to validate user name and password stored in database. Display authorized user is she/he is Authorized else display unauthorized user.
15. Write JSP & Servlet program to store student details sent from registration form in to database table.
16. Write appropriate JSP pages to insert, update and delete data in student table in a single application with proper Linking of JSP pages and session management.
17. Write a java program/servlet application to connect to a database and extract data from the table containing Employee's information and display them.
18. Write program to demonstrate the concept of spring and spring boot.

Note: The instructor may add/delete/modify experiments, wherever he/she feels in a justified manner.

BCA (Three Year Course) IInd Year

BCA SECOND YEAR SYLLABUS

SEMESTER-IV

NBC401: JAVA PROGRAMMING		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	List the significance, key features, and principles of Object-Oriented Programming in Java.	K_1
CO 2	Analyze basic structural, behavioral, and architectural models using object-oriented software engineering in Java.	K_4
CO 3	Illustrate object-oriented modeling techniques and build GUI/web-based applications using Java APIs.	K_2, K_3
CO 4	Use the core Java features like abstraction, encapsulation, constructors, and garbage collection in Java programs.	K_3, K_4
CO 5	Utilize Java generics and file handling mechanisms effectively for modular programming.	K_3
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** History of Java, Characteristics of Java, The Java Environment, Java Source File Structure and Compilation. Fundamental Programming Structures in Java: Data type, Variables, Comments, Operators, Methods & Classes, Constructors, Arrays, Control Statements, Access specifies.	**08**
II	**Inheritance, Interfaces, and Packages:** OOP in Java, Inheritance and its types, super and this keyword, final and static keyword, method overloading and overriding, abstract classes and methods. Defining an interface, implement interfaces, accessing implementations through interface references, extending interface. **Packages-** Defining, creating and accessing a package, importing packages.	**08**
III	**Exception handling & File I/O:** Define Exception, advantages of exception handling, Exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, creating own exception. Introduction to file I/O(Input/Output).	**08**
IV	**Java Awt & Swing**: Differences Swing and AWT, Creating a Swing Applet and Application, Programming using Panes, Labels, Text fields, Buttons, Scroll Bars, Lists, Combo box, Progress Bar, Menus and Toolbars, Layouts, Windows, Dialog Boxes, Inner frame. JDBC: Introduction to JDBC, Java.sql package, Introduction to MySQL Database, Server and connectivity to remote database.	**08**
V	**Java Servlets:** Servlet basics, Servlet API basic, Life cycle of a Servlet, Running Servlet, Debugging Servlets, Thread-safe Servlets, HTTP Redirects, Cookies, Introduction to Java Server pages (JSP).	**08**

Suggested Readings:

1. Radha Krishna P., "Object Oriented Programming through Java", Universities Press.
2. Eckel B., "Thinking in Java", Prentice Hall.
3. Malhotra S. and Choudhary S., "Programming in Java", Oxford University Press.
4. Schildt H., "Java: The Complete Reference", McGraw Hill.
5. Horstmann C.S., "Core Java Volume I – Fundamentals", Pearson Education.
6. Basham B., Sierra K. and Bates B., "Head First Servlets and JSP", O'Reilly Media.
7. Balagurusamy E., "Programming with Java: A Primer", McGraw-Hill Education.

BCA (Three Year Course) IInd Year

NBC402: DATABASE MANAGEMENT SYSTEMS		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand:		
CO 1	The features of a database system and its representation through data models.	K_1
CO 2	Understanding of ER Model and basis of database constraints.	K_5
CO 3	Formulate solution to a query problem using SQL Commands, relational algebra, tuple calculus and domain calculus.	K_5, K_6
CO 4	Understanding of normalization, a given relation to the desired normal form.	K_2, K_3
CO 5	Understanding of transaction processing and concurrency control process.	K_2
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Overview, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.	**08**
II	**Relational data Model and Language:** Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction to SQL: Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands. SQL Operators and their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL	**08**
III	**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.	**08**
IV	**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System	**08**
V	**Concurrency Control Techniques:** Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.	**08**

Suggested Readings:

1. Silbertschatz A., Korth H. and Sudarshan S., "Database Concepts", McGraw Hill.
2. Date C. J., "An Introduction to Database Systems", Addision Wesley.
3. Elmasri R. and Navathe S., "Fundamentals of Database Systems", Pearson Education.
4. O'Neil P., "Databases", Elsevier Publications.
5. Ramakrishnan R. and Gehrke J., "Database Management Systems", McGraw Hill.
6. Leon A. and Leon M., "Database Management Systems", Vikas Publishing House.
7. Desai B.C., "An Introduction to Database Systems", Galgotia Publications.
8. Majumdar A. K. and Bhattacharya P., "Database Management System", Tata McGraw Hill.

BCA (Three Year Course) IInd Year

NBC403: OPERATING SYSTEMS		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Explain main components, services, types and structure of operating systems.	K_2
CO 2	Apply the various algorithms and techniques to handle the various concurrency control issues.	K_3
CO 3	Compare and apply various CPU scheduling algorithms for process execution.	K_2
CO 4	Identify occurrence of deadlock and describe ways to handle it.	K_3
CO 5	Explain and apply various memory, I/O and disk management techniques.	K_5
DETAILED SYLLABUS		**3-0-0**

Unit	Topic	Proposed Lecture
I	**Introduction**: Operating System Structure- Layered structure, System Components, Operating system functions, Classification of Operating systems- Batch, Interactive, Time-sharing, Real-Time System, Multiprocessor Systems, Multiuser Systems, Multi process Systems, Multithreaded Systems, Operating System services, Reentrant Kernels, Monolithic and Microkernel Systems.	08
II	**Concurrent Processes**: Process Concept, Principle of Concurrency, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Test and Set operation, Classical Problem in Concurrency- Dining Philosopher Problem, Sleeping Barber Problem, Inter Process Communication models and Schemes, Process generation.	08
III	**CPU Scheduling:** Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling. Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock.	08
IV	**Memory Management:** Basic bare machine, Resident monitor, Multiprogramming with fixed partitions, Multiprogramming with variable partitions, Protection schemes, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.	08
V	**I/O Management and Disk Scheduling**: I/O devices, and I/O subsystems, I/O buffering, Disks to rage and disk scheduling, RAID. File System: File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File System protection and security.	08

Suggested Readings:

1. Silberschatz A., Galvin P.B. and Gagne G., "Operating Systems Concepts", Wiley Publication
2. Halder S. and Arvind A. A "Operating Systems", Pearson Education.
3. Dietel H.M, "An Introduction to Operating System", Pearson Education.
4. Stallings W., "Operating Systems: Internals and Design Principles", Pearson Education.

5. Harris J.A., "Operating Systems (Schaum's Outlines)", McGraw Hill Education.

NBC404: TECHNICAL COMMUNICATION		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Understand the nature and remember the objectives of Technical Communication relevant for the work place as a software Engineers.	K_1, K_2
CO 2	Analyze and understand the key concepts of writing, designing and speaking.	K_2, K_4
CO 3	Utilize the technical writing skills for the purposes of Technical Communication and its exposure in various dimensions.	K_3
CO 4	Buildup interpersonal communication traits that will make the transition from institution to workplace smoother and help them to excel in their jobs.	K_4, K_6
CO 5	Evaluate and apply technical communication to build their personal brand and handle crisis communication.	K_3, K_5
DETAILED SYLLABUS		**3-0-0**

Unit	Topic	Proposed Lecture
I	**Fundamentals of Communication and Voice Dynamics:** Role and Purpose of Technical Communication, Types & Flow of Communication, Barriers to Effective Communication, 7 C's of Communication, Code and Content; Stimulus & Response, Vowel Sounds, Consonant Sounds, Tone: Rising and Falling Tone.	08
II	**Communication Skills for Career Building:** CV and Résumé Writing, Interview Skills, Group Discussion, Effective Profiling, Communication and Networking: Building relationships, Writing the Statement of Purpose (SOP) for admission in Higher Studies, Seminar & Conference Paper Writing, Expert Technical Lecture: Writing and Presenting.	08
III	**Communication Skills for Presentation: Writing, Designing, and Speaking:** Thesis and Project Report Writing, Technical Proposal Writing, How to Pitch an Idea: Process, Preparation and Structure, Elements of Speech Delivery: Passion, Poise & Illustrations.	08
IV	**Communication and Leadership Development:** Leadership Communication, Communication and Social competence: context, feelings, intentions, behaviors, Providing and Receiving feedback, Difference between Tact and Intelligence, Emotional Intelligence: Trust through Communication, Thinking Skills: Meaning and Types.	08
V	**Digital Communication and Personality Making:** Content Creation for Social Media: Emails, Webinars, podcasts, Blogs. Effective and Ethical use of Social Media by Text and Technique, Speech and Personality, Personality Analysis: Types of Personality; Concept of Personality: Maslow, Freud, Vivekananda, Jung Typology &Personality Assessment.	08

Suggested Readings:

1. Raman M. & Sharma S., "Technical Communication – Principles and Practices", Oxford Univ. Press.
2. Mitra B. K., "Personality Development and Soft Skills", Oxford Univ. Press.
3. Pfeiffer, "Technical Communication", Pearson.
4. Pillai S. and Fernandez A., "Soft Skills & Employability", Cambridge University Press.

5. Pandey L. U. B., "Practical Communication: Process and Practice", A.I.T.B.S. Publications India Ltd.
6. M. Ashraf Rizvi, "Effective Technical Communication", McGraw Hill Education India Pvt. Ltd.

NBC405: INDIAN TRADITION, CULTURE AND SOCIETY		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO 1	Students will be able explain society, state and polity in India in traditional and modern context.	K_2, K_3
CO 2	Students will be acquaint with essence of Indian Literature, Culture, Tradition and Practices.	K_2
CO 3	Students will be able to visualize the root of Indian Religion, Philosophy and Practices.	K_3, K_4
CO 4	Students will be able to understand Science, Management and Indian Knowledge System.	K_1, K_2
CO 5	Students will connect up and explain Cultural Heritage of India and root of Performing Arts.	K_2, K_3
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Module 1- Society State and Polity in India** State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions' of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women. Four-class Classification, Slavery.	**08**
II	**Module 2- Indian Literature, Culture, Tradition, and Practices** Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali, Prakrit And Sanskrit, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature, Malayalam Literature, Sangama Literature Northern Indian Languages & Literature, Persian and Urdu , Hindi Literature.	**08**
III	**Module 3- Indian Religion, Philosophy, and Practices** Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines, Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.	**08**
IV	**Module 4- Science, Management and Indian Knowledge System** Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India, Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India, Writing Technology in India, Pyrotechnics in India Trade in Ancient India/, India's Dominance up to Pre-colonial Times.	**08**

V	**Module 5- Cultural Heritage and Performing Arts Indian Architect** Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World. Indian Cinema.	**08**

Suggested Readings:

1. Sivaramakrishna V., "Cultural Heritage of India-Course Material", Bharatiya Vidya Bhavan, Mumbai.
2. Baliyan S., "Indian Art and Culture", Oxford University Press, India.
3. Jitatmanand S., "Modern Physics and Vedant", Bharatiya Vidya Bhavan.
4. Thapar R., "Readings In Early Indian History", Oxford University Press, India.
5. Fritz of Capra, Tao of Physics.
6. Fritz of Capra, The wave of Life.
7. Jha V. N., "Tarkasangraha of Annam Bhatta", International Chinmay Foundation, Velliarnad, Amakuam (English Translation).
8. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
9. Jha G. N. and Jha R. N., "Yoga-darshanam with Vyasa Bhashya", Vidyanidhi Prakasham.
10. Jha R. N., "Science of Consciousness Psychotherapy and Yoga Practices", Vidyanidhi Prakasham, Delhi.
11. Sharma P. R., Shodashang Hridayam (English Translation).
12. Basham A. L., "The Wonder that was India", Rupa & Co., New Delhi.
13. Sharma R. S., "Aspects of Political Ideas and Institutions in Ancient India", Motilal Banarsidass.

NBC451: JAVA PROGRAMMING LAB		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Understand basic syntax and core Java concepts like input/output, strings, and command-line arguments.	K_2
CO 2	Apply Object-Oriented Programming concepts like inheritance, encapsulation, file handling.	K_3, K_4
CO 3	Illustrate GUI applications and use Java APIs like AWT/Swing with JDBC.	K_3

LIST OF PROGRAMS:

1. Write a program to find the number of arguments provided at runtime.
2. Write a program to calculate the simple interest by entering input by the user.
3. Write a program to create a simple class to find out the area and perimeter of rectangle and box using super and this keyword.
4. Write a program to design a class account using the inheritance and static that show all function of bank (withdrawal, deposit).
5. Write a program to design a string class that performs String method (equal, reverse the string, change case).
6. Write a program that import the user define package and access the member variable of classes that contained by package.
7. Write a program to create a class component that shows controls and event handling on controls (Math calc)
8. Write a program to draw a line, rectangle, oval using the graphics method.
9. Write a program to create a Menu using the frame.
10. Write a program to implement the Grid Layout and Card Layout.
11. Write a program to create Frame to display the student information.
12. Write a program to process student information and marks sheet using method overloading.
13. Write a program to create an employee class and calculate the Gross salary of employee using inheritance.
14. Write a program to illustrate the inheritance and use of the Super key word.
15. Write a program to create a new txt file in the disk.
16. Write a program to read string data from the File.
17. Write a program to read data from the File.
18. Write a program to create a Notepad using Swing.
19. Write a program to create a calculator.
20. Write a program to maintain student database using JDBC.

Note: The instructor may add/delete/modify experiments, wherever he/she feels in a justified manner.

NBC452: DATABASE MANAGEMENT SYSTEMS LAB		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Write SQL commands for DDL, DML and DCL.	K_5
CO 2	Write SQL commands to query a database.	K_3
CO3	Write PL/SQL programs for implementing stored procedures, stored functions, cursors, trigger and packages.	K_4

LIST OF PRACTICALS

1. Install oracle/ MYSQL.
2. Create Entity-Relationship Diagram using case tools.
3. Write SQL statements Using ORACLE /MYSQL:
   a) Write basic SQL SELECT statements.
   b) Restrict and sort data.
   c) Display data from multiple tables.
   d) Aggregate data using group function.
   e) Manipulate data.
   f) Create and manage tables.
4. Create cursor.
5. Create procedure and functions.
6. Create packages and triggers.
7. Design and implement any one:
   a) Payroll Processing System.
   b) Library Information System.
   c) Student Information System.

Note: The instructor may add/delete/modify experiments, wherever he/she feels in a justified manner.

NVA451: Sports and Yoga-II

Objective of the Course:

- To maintain their mental and physical wellness upright and develop ability in them to cope up with the stress arising in the life.
- To create space in the curriculum to nurture the potential of the students in sports/games/yoga etc.
- To take forward the previous course on the topic to next advance level in terms of practice and specialization.

Syllabus/ Guidelines

Part A: Sports/Games

Some form of Athletics would be compulsory for all students, unless restricted due to medical / physical reasons.

In addition to this, a student has to opt for **at least one Sport/Game** out of the remaining mentioned below. The chosen game may be same which was taken up by the students in previous year of study or may change the option.

A fair theoretical knowledge and a reasonable amount of field / site practice of the chosen games will be essential.

1. Athletics **Compulsory**
2. Volleyball
3. Basketball
4. Handball
5. Football
6. Badminton
7. Kabaddi
8. Kho-kho
9. Table tennis
10. Cricket

Part B: Yoga

- **Yogic postures**: Prone and Balancing
- **Pranayama:** Breath awareness, Sectional breathing, Nadishuddhi, Bhastrika, Ujjai, Cooling pranayama (Shitali, Shitkari), Bhramari, Udgit Pranayama (with Antar & Bahya Kumbhaka)
- **Practices leading to Meditation:** Pranav and SohamJapa, Yoga Nidra (1,2,3), Antarmauna, AjapaDharana (Stage 1,2,3), Practices leading to Breath Meditation, Practices leading to Om Meditation, Practices leading to Vipassana Meditation, Transcedental Meditation

General Guidelines

1. Institutes must assign minimum of three periods in the Time Table for the activities of Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.
4. Student must be made familiar with the terminologies, rules/regulations, dimension/ marking of the play field/area and general knowledge of national/ international level facts/figures related to the chosen game.

Assessment:

The Institute must assign coordinator/ subject teacher for the subject for every batch/group of the students who would be responsible for coordinating the required activities and keep watch on the level of student's participation in the chosen game.

Coordinator/mentor would be responsible for award of the sessional marks based upon following components.

1. Level of understanding and general awareness (20 %)
2. Involvements in the Practice Sessions (50 %)
3. Regularity, Sincerity and Discipline (20 %)
4. Participation in University level / District level / State level / National Level events (10 %)

BCA
THIRD YEAR
SYLLABUS
SEMESTER-V

NBC501: Artificial Intelligence & Machine Learning		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO1	Explain basic concepts, foundation areas, historical development, applications of Artificial intelligence and intelligent agents.	K_2
CO2	Apply uniformed, informed and local search techniques for solving AI problems	K_3
CO3	Understand, apply and analyze knowledge representation and reasoning techniques to create knowledge base of an intelligent machine.	K_2
CO4	Identify fundamental concepts, types, issues and application areas of machine learning and data preprocessing.	K_1
CO5	Apply and evaluate machine learning algorithms to solving real-world problems Introduction, types, components of learning process, issues, application areas and performance measurement criteria of learning algorithm.	K_3

DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Artificial Intelligence:** Introduction, historical development, foundation areas, tasks and application areas. **Intelligent Agents:** Introduction, types and structure of intelligent agents. Computer Vision, Natural language processing.	**08**
II	**Searching Techniques:** Introduction, Problem solving by searching, Searching for solutions, Uniformed and Informed searching techniques. Local search algorithms, Adversarial search methods, Search techniques used in games, Alpha-Beta pruning.	**08**
III	**Knowledge Representation and Reasoning:** Propositional logic, Predicate logic, First order logic, Inference in first order logic, Clause form conversion, Resolution. **Chaining:** Concept, forward chaining and backward chaining, Utility theory and Probabilistic reasoning.	**08**
IV	**Machine Learning:** Introduction, types, components of learning process, issues, application areas and performance measurement criteria of learning algorithm, Data preprocessing, Data transformation, Scaling training and test data. **Supervised Learning:** Introduction, operations, types of learning algorithms, Regression, Classification algorithms – Decision tree, Support vector machine, K-Nearest Neighbors, Naïve Bayes.	**08**

V	**Unsupervised learning:** Introduction, types, working, issues, application areas, clustering algorithms (K-means, Hierarchical), Association rule learning and dimensionality reduction. **Reinforcement learning:** Introduction, components, types, working, issues and application areas.	08

Suggested Readings:

1. Russell S. and Norvig P., "Artificial Intelligence – A Modern Approach", Pearson Education. 2. Rich E. and Knight K., "Artificial Intelligence", McGraw Hill Publications.
3. Charnik E. and McDermott D., "Introduction to Artificial Intelligence", Pearson Education. 4. Patterson D. W., "Artificial Intelligence and Expert Systems", PHI Publications.
5. Khemani D., "A First Course in Artificial Intelligence", McGraw Hill.
6. Winston P. H., "Artificial Intelligence", Pearson Education.
7. Mitchell T.M., "Machine Learning", McGraw Hill.
8. Alpaydin E. "Introduction to Machine Learning", MIT Press.

NBC502: Python Programming		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO1	Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.	K1
CO2	Express proficiency in the handling of strings and functions	K2
CO3	Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.	K3
CO4	Use OO concepts while programming in Python	K3
CO5	Work with Python using GUI.	K2

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction to Python:** Introduction and Basics; Setting up path Python Data Variables & Operators: Data Variables and its types, id() and type() functions, Coding Standards; **Control Structures:** if-else, elif, Nested if, Iteration Control structures, Break, Continue & Pass, Loops, **Python** Classes and Objects.	**08**
II	**String Manipulation:** Accessing Strings, Basic Operations, String slices, Function and Methods. **Lists:** Introduction, Accessing list, Operations, Working with lists, Function and Methods. **Tuple:** Introduction, accessing tuples, Operations, Working, Functions and Methods.	**08**
III	**Dictionaries:** Introduction, accessing values in dictionaries, Working with dictionaries, Properties, Functions. **Functions:** Defining & Calling a function, Passing arguments to functions – Mutable & Immutable Data Types, Different types of arguments, Recursion, Scope of variables;	**08**
IV	**Modules and Packages:** User-defined modules and Standard Library: random, numpy, scipy, sys, Math Module, String Module, List Module, Date & Time Module, Regular Expressions: match, search, replace; **Input-Output:** Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions.	**08**
V	**Exception Handling:** Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions. Basics of Python for Data Analysis, Introduction to series and data frames & Python	**08**

Suggested Readings:

1. Basin Harsh, "Python For Beginners", New Age International Publishers.
2. Ramalho Luciano, "Fluent Python", SPD.
3. Severance Charles, "Python For Everybody",SPD.
4. Brown Martin C., "The Complete Reference", Mc Graw Hill.
5. Kanetkar Yashavant, Kanetkar Aditya, "Let Us Python", Bpb.
6. Lutz Mark, "Learning Python", SPD.

NBC503: Computer Networks		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO1	Explain basic concepts, OSI reference model, services and role of each layer of OSI model and TCP/IP, networks devices and transmission media, Analog and digital data transmission.	K_2
CO2	Apply channel allocation, framing, error and flow control techniques.	K_2
CO3	Describe the functions of Network Layer i.e. Logical addressing, sub netting & Routing Mechanism.	K_2
CO4	Explain the different Transport Layer function i.e. Port addressing, Connection Management, Error control and Flow control mechanism.	K_3
CO5	Explain the functions offered by session and presentation layer and their Implementation. Explain the different protocols used at application layer i.e. HTTP, SNMP, SMTP, FTP, TELNET and VPN.	K_3
DETAILED SYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introductory Concepts**: Goals and applications of networks, Categories of networks, Organization of the Internet, ISP, Network structure and architecture (layering principles, services, protocols and standards), The OSI reference model, TCP/IP protocol suite, Network devices and components. Physical Layer: Network topology design, Types of connections, Transmission media, Signal transmission and encoding, Network performance and transmission impairments, Switching techniques and multiplexing.	**08**
II	**Data Link layer:** Framing, Error Detection and Correction, Flow control (Elementary Data Link Protocols, Sliding Window protocols). Medium Access Control and Local Area Networks: Channel allocation, Multiple access protocols, LAN standards, Link layer switches & bridges (learning bridge and spanning tree algorithms).	**08**
III	**Network Layer:** Point-to-point networks, Logical addressing, Basic internetworking (IP, CIDR, ARP, RARP, DHCP, ICMP), Routing, forwarding and delivery, Static and dynamic routing, Routing algorithms and protocols, Congestion control algorithms, IPv6	**08**
IV	**Transport Layer**: Process-to-process delivery, Transport layer protocols (UDP and TCP), Multiplexing, Connection management, Flow control and retransmission, Window management, TCP Congestion control, Quality of service.	**08**
V	**Application Layer:** Domain Name System, World Wide Web and Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol, Remote login, Network management, Data compression, Cryptography – Basic concepts.	**08**

Suggested Readings:

1. Behrouz Forouzan, "Data Communication and Networking", McGraw Hill
2. Andrew Tanenbaum "Computer Networks", Prentice Hall.
3. William Stallings, "Data and Computer Communication", Pearson.
4. Kurose and Ross, "Computer Networking- A Top-Down Approach", Pearson.
5. Peterson and Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann
6. W. A. Shay, "Understanding Communications and Networks", Cengage Learning. 7. D. Comer, "Computer Networks and Internets", Pearson.
8. Behrouz Forouzan, "TCP/IP Protocol Suite", McGraw Hill

NBC504: Software Project Management		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO 1	Identify project planning objectives, along with various cost/effort estimation models.	K1
CO 2	Organize & schedule project activities to compute critical path for risk analysis	K3
CO 3	Monitor and control project activities.	K3
CO 4	Formulate testing objectives and test plan to ensure good software quality under SEI-CMM	K2
CO 5	Configure changes and manage risks using project management tools.	K2

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Project Evaluation and Project Planning:** Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.	08
II	**Project Life Cycle and Effort Estimation:** Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model.	08
III	**Activity Planning and Risk Management:** Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of Critical paths – Cost schedules.	08
IV	**Project Management and Control:** Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control Software Configuration Management – Managing contracts – Contract Management.	08
V	**Staffing in Software Projects:** Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model - Stress – Health and Safety – Ethical and Professional concerns - Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.	08

Suggested Readings:

1. Bob Hughes, Mike Cotterell and Rajib Mall: "Software Project Management" – Fifth Edition, McGraw Hill,New Delhi, 2012.
2. Robert K. Wysocki — "Effective Software Project Management" – Wiley Publication, 2011.
3. Walker Royce: — "Software Project Management" - Addison-Wesley, 1998.
4. Gopalaswamy Ramesh, — "Managing Global Software Projects" – McGraw Hill Education (India), Fourteenth Reprint 2013.
5. Koontz Harold & Weihrich Heinz, "Essentials of Management", McGraw Hill 5thEdition 2008.
6. Robbins and Coulter, "Management", Prentice Hall of India, 9th edition.
7. James A. F., Stoner, "Management", Pearson Education Delhi.
8. P. D. Chaturvedi, "Business Communication", Pearson Education.

BACHELOR OF COMPUTER APPLICATION (Three Year Course) BCA IIIrd Year

Elective-1

NBC011: Cryptography & Network Security		
Course Outcome (CO)	**Bloom's Knowledge Level (KL)**	
At the end of course, the student will be able to understand		
CO 1	Understand various security attacks and their protection mechanism.	K_2
CO 2	Apply and analyze various encryption algorithms.	K_3
CO 3	Understand functions and algorithms to authenticate messages and study and apply different digital signature techniques.	K_2
CO 4	Analyze different types of key distributions.	K_3
CO 5	Study and appraise different IP and system security mechanism.	K_1

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	Introduction to security attacks, Services and mechanism, Classical encryption techniques substitution ciphers and transposition ciphers, Cryptanalysis, Steganography, Stream and block ciphers. **Modern Block Ciphers:** Block ciphers principles, Shannon's theory of confusion and diffusion, Feistel structure, Data encryption standard(DES), Strength of DES, Idea of differential cryptanalysis, Block cipher modes of operations, Triple DES	08
II	Introduction to group, field, finite field of the form GF(p), Modular arithmetic, Prime and relative prime numbers, Extended Euclidean Algorithm, Advanced Encryption Standard (AES). Fermat's and Euler's theorem, Primality testing, Chinese Remainder theorem, Discrete Logarithmic Problem, Principals of public key crypto systems, RSA algorithm, Security of RSA	08
III	**Message Authentication Codes:** Authentication requirements, Authentication functions, Message authentication code, Hash functions, Birthday attacks, Security of hash functions, Secure hash algorithm (SHA). **Digital Signatures:** Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), Proof of digital signature algorithm.	08
IV	**Key Management and distribution:** Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure. **Authentication Applications:** Kerberos Electronic mail security: pretty good privacy (PGP), S/MIME.	08
V	**IP Security:** Architecture, Authentication header, Encapsulating security payloads, Combining security associations, Key management. Introduction to Secure Socket Layer, Secure electronic transaction (SET). **System Security:** Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls and Network Security Tools.	08

Suggested Readings:

1. Stallings W., "Cryptography and Network Security: Principals and Practice", Pearson Education.
2. Frouzan B. A., "Cryptography and Network Security", McGraw Hill.
3. Kahate A., "Cryptography and Network Security", Tata McGraw Hill.

NBC012: Internet of Things		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO 1	Demonstrate basic concepts, principles and challenges in IoT.	K_1
CO 2	Illustrate functioning of hardware devices and sensors used for IoT.	K_2
CO 3	Analyze network communication aspects and protocols used in IoT.	K_3
CO 4	Apply IoT for developing real life applications using Ardunio programming.	K_3
CP 5	To develop IoT infrastructure for popular applications	K_3

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability	08
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	08
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	08
IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.	08
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	08

Suggested Readings:

1. Olivier Hersent,David Boswarthick, Omar Elloumi"The Internet of Things key applications and protocols", willey
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
5. ArshdeepBahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications,2014
6. Adrian McEwen,Hakin Cassimally "Designing the Internet of Things" Wiley India

NBC013: Theory of Computation		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO1	Explain the fundamentals of automata theory and construct DFA, NFA, and regular expressions for regular languages	K_2
CO2	Analyze regular languages using pumping lemma and design context-free grammars for context-free languages.	K_4
CO3	Design pushdown automata and relate them with context-free grammars for solving language recognition problems.	K_3
CO4	Explain Turing machines and evaluate computability and decidability of problems.	K_2
CO5	Analyze computational complexity of algorithms and distinguish between tractable and intractable problems.	K_4

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction to Automata and Regular Language:** Mathematical preliminaries, Alphabets, Strings, Languages, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata.	08
II	**Regular Expression Languages and Context-Free Grammars:** Regular expression (RE), Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.	08
III	**Context free grammar (CFG) and Context Free Languages (CFL):** Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Pumping lemma for CFLs.	08
IV	**Pushdown Automata and Context-Free Languages:** Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.	08
V	**Turing Machines and Computability:** Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability,	08

	Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory	

Suggested Readings:

1. Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education.
2. KLP Mishra and N. Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", PHI Learning Private Limited, Delhi India.
3. Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.
4. YN Singh "Mathematical Foundation of Computer Science", New Age International.
5. Malviya, AK "Theory of Computation and Application", BPaperback Publications .
6. Papadimitrou, C. and Lewis, CL, "Elements of the Theory of Computation", Pearson Publication.
7. K. Krithivasan and R. Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education.
8. Harry R. Lewis and Christos H. Papadimitriou, Elements of the theory of Computation, Second Edition, Prentice-Hall of India Pvt. Ltd.
9. Micheal Sipser, "Introduction of the Theory and Computation", Thomson Learning.
10. Katuri Viswanath, "Introduction to Mathematical Computer Science, An" Universities Press.

NBC014: Cloud Computing		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO 1	Understand the concepts of Cloud Computing, key technologies, strengths and limitations of cloud computing.	K_2
CO 2	Develop the ability to understand and use the architecture to compute and storage cloud, service and models.	K_2
CO 3	Understand the application in cloud computing.	K_2
CO 4	Learn the key and enabling technologies that help in the development of cloud.	K_3
CO 5	Explain the core issues of cloud computing such as resource management and security.	K_2

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction:** Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed, History of Cloud Computing - Cloud Architecture - Types of Clouds - Business models around Clouds – Major Players in Cloud Computing-issues in Clouds - Eucalyptus - Nimbus - Open Nebula, CloudSim.	08
II	**Cloud Services:** Types of Cloud services: Software as a Service-Platform as a Service –Infrastructure as a Service - Database as a Service - Monitoring as a Service –Communication as services. Service providers-Google, Amazon, Microsoft Azure, IBM, Sales force.	08
III	**Collaborating Using Cloud Services:** Email Communication over the Cloud - CRM Management – Project Management- Event Management - Task Management – Calendar - Schedules - Word Processing – Presentation – Spreadsheet - Databases – Desktop - Social Networks and Groupware.	08
IV	**Virtualization for Cloud:** Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization –System VM, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - supervisors – Xen, KVM, VMware, Virtual Box, Hyper-V.	08
V	**Security, Standards and Applications:** Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud. Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine	08

Suggested Readings:

1. David E.Y. Sarna, "Implementing and Developing Cloud Application", CRC press 2011.
2. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May 2011.
3. Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing : A Practical Approach", Tata McGraw-Hill 2010.
4. Haley Beard, "Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, July 2008.
5. G. J. Popek, R.P. Goldberg, "Formal requirements for virtualizable third generation Architectures, Communications of the ACM", No.7 Vol.17, July 1974.

NBC015: Distributed DBMS		
	Course Outcome (CO)	**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to:		
CO 1	Understand theoretical and practical aspects of distributed database systems.	K_2
CO 2	Study and identify various issues related to the development of distributed database system	K_3
CO 3	Understand the design aspects of object-oriented database system and related development	K_2
CO 4	Equip students with principles and knowledge of distributed reliability.	K_3
CO 5	Equip students with principles and knowledge of parallel and object-oriented databases.	K_3

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction:** Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas. Distributed DBMS Architecture: Architectural Models for Distributed DBMS, DDMBS Architecture. Distributed Database Design: Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.	08
II	**Query processing and decomposition:** Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data. Distributed query Optimization: Query optimization, centralized query optimization, distributed query optimization algorithms.	08
III	Transaction Management: Definition, properties of transaction, types of transactions, distributed concurrency control: Serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic concurrency control Algorithms, deadlock Management.	08
IV	**Distributed DBMS Reliability:** Reliability concepts and measures, fault- tolerance in distributed systems, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning. Parallel Database Systems: Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters.	08
V	**Distributed object Database Management Systems:** Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing. **Object Oriented Data Model:** Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS	08

Suggested Readings:

1. M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.

2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill.

3. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: TheComplete Book", Second Edition, Pearson International Edition

NBC551: Artificial Intelligence & Machine Learning Lab		
Course Outcome(CO)		**Bloom's Knowledge Level(KL)**
At the end of course, the student will be able to		
CO1	Demonstrate the working of different types of intelligent agents and apply AI problem solving techniques to solve problems	K_2
CO2	Implement and analyze uninformed, informed and local search techniques for AI problem solving.	K_3
CO3	Develop programs for knowledge representation and reasoning.	K_3
CO4	Implement and analyze various supervised, unsupervised and reinforcement machine learning algorithms.	K_3
CO5	Implement and evaluate data preprocessing and data transformation techniques	K_3

Detailed Syllabus:

1. Program to demonstrate different types of intelligent agents.
2. Program to solve AI problems (4-3 water jug, 8 -puzzle, 4 queens, 8 queens).
3. Program to implement uninformed search algorithm (Breadth-first search, Depth-first search, Bidirectional, Uniform Cost).
4. Program to implement heuristic search algorithm (Hill climbing, Best-first search, A*, AO*).
5. Program to implement different game playing techniques.
6. Program to implement various knowledge representation techniques.
7. Program to implement chaining algorithm (forward, backward).
8. Program to implement Regression (linear, multi-linear, logistic).
9. Program to implement Classification algorithm (Decision tree, support vector machine, K-nearest neighbor, Naïve Bayes)
10. Program to implement clustering algorithm (k-means, Hierarchical)
11. Program to implement Association rule learning techniques.
12. Program to implement algorithm for Reinforcement learning.
13. Program to pre-process a real-world data set.
14. Program to import and explore a dataset and identify the missing / duplicate values.
15. Program to split a dataset into training and testing datasets.

Note: The Instructor may add/delete/modify experiments, wherever he/she feels in a justified manner.

BCA
THIRD YEAR
SYLLABUS
SEMESTER-VI

NBC601: Cyber Security		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO1	Understand the fundamentals of information systems, information security, the CIA triad, cyber security concepts, information assurance, security risk analysis, and the various threats affecting information systems.	K_1
CO2	Understand application security, data security practices, access control mechanisms, security technologies, and the identification and mitigation of common cyber security threats and network attacks.	K_2
CO3	Understand the principles of secure e-commerce, electronic payment systems, digital signatures, cryptography, secure information system development, information security governance, risk management, security architecture, and the protection of hardware, data storage, and physical IT assets.	K_2
CO4	Understand the importance of information security policies, the policy development and review process, different types of organizational security policies, and their application in corporate security through case studies.	K_3
CO5	Understand information security standards, cyber laws, the provisions of the IT Act 2000, intellectual property rights, copyright, patents, software licensing, and legal issues related to cyber crimes and software piracy.	K_2

DETAILEDSYLLABUS		
Unit	**Topic**	**Proposed Lecture**
I	**Introduction-** Introduction to Information Systems, Types of Information Systems, Development of Information Systems, Introduction to Information Security and CIA triad, Need for Information Security, Threats to Information Systems, Information Assurance and Security Risk Analysis, Cyber Security.	**08**
II	**Application Security-** (Database, E-mail and Internet), Data Security Considerations (Backups, Archival Storage and Disposal of Data), Security Technology(Firewall , VPNs, Intrusion Detection System), Access Control. Security Threats -Viruses, Worms, Trojan Horse, Trapdoors, Spoofs, E-mail Viruses, Macro Viruses, Malicious Software, Network and Denial of Services Attack.	**08**
III	Introduction to E-Commerce, Threats to E-Commerce, Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, Cryptography Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management,	**08**

	Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets - Access Control, CCTV, Backup Security Measures.	
IV	**Security Policies-** Why policies should be developed, Policy Review Process, Publication and Notification Requirement of policies, Types of policies – WWW policies, Email Security policies, Corporate Policies, Sample Security Policies. **Case Study** – Corporate Security	**08**
V	**Information Security Standards-**ISO, IT Act, Copyright Act, IPR. Cyber Crimes, Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law, Copy Right Law, Semiconductor Law and Patent Law, Software Piracy and Software License.	**08**

Suggested Readings:

1. Pfleeger C. P., PfleegerS. L., "Analysing Computer Security", Pearson Education India.
2. Pachghare V.K., "Cryptography and information Security", PHI Learning Private Limited.
3. Goyal K. K. and Garg A. "Cyber Security", University Science Press.
4. Whitman M. E.and Mattord H. J, "Principle of Information Security" Cengage.
5. Chapple M. and Seidl D., "Cyberwarfare: Information operations in a connected world" Jones & Bartlett Learning.
6. Goyal K. K., Garg A. and Singhal S., "Cyber Security & Data Privacy", HP Hamilton.
7. Schou C.D. and Shoemaker D. P., "Information Assurance for the Enterprise", Tata McGraw Hill.

NBC602: Digital Marketing		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO1	Understanding the digital marketing concepts and its usefulness in business.	K_1
CO2	Planning steps for digital marketing strategy and successfully executing it.	K_2
CO3	Understand the importance of Social Media Platforms and Social Media Marketing for online communication.	K_2
CO4	Applying Search Engine Optimization techniques (SEO) and Search Engine Marketing (SEM) to maximize reach and enhance engagement of users.	K_3
CO5	Analyzing web using analytics tools and gaining insights to various tools for Social Media Marketing.	K_4

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Digital Marketing Basics:** Digital Marketing meaning and its importance, Traditional vs Digital Marketing, Benefits of Digital Marketing, Internet Marketing basics, Digital Marketing channels, Types of Business models, Digital Marketing strategies (P.O.E.M framework),Inbound and Outbound marketing, Digital Transformation model, 4Cs of Digital Marketing.	08
II	**Social Media Marketing** : Introduction to Social Media Marketing, Social Media marketing strategies, Overview of Social Media platforms — Instagram, Snapchat, Facebook, Mobile, Twitter, Content Planning and Strategy, Influential marketing, Content marketing, Digital Marketing campaign.	08
III	**Search Engine Optimization (SEO):** Introduction to SEO, On-Page and Off-Page Optimization, Role of Keywords in SEO, Organic vs Non-Organic SEO, Blogging as marketing strategy, Types of Blogs.	08
IV	**Web Analytics**: Meaning, Purpose and process, Types and Tools for analytics — Google analytics, Audience analytics, Acquisition analytics, Behavior analytics Conversion analytics.	08

V	**E-Commerce & Digital Trends** E-Commerce: Introduction, fundamental concepts, and online payment gateways. Digital Innovation: Virtual reality, geo-location targeting, programmatic advertising, and privacy/security issues in digital marketing.	08

Suggested Readings:

1. Rajan Gupta, Supriya Madan, "Digital Marketing", BPB Publication, 1st dition, 2022.

2. Seema Gupta, "Digital Marketing", McGraw Hill, 2nd Edition, 2018.

3. Puneet Singh Bhatia, "Fundamentals of Digital Marketing", Pearson, 2nd dition, 2020.

4. Vandana Ahuja, "Digital Marketing", Oxford University Press, 8th Edition, 2019.

NBC603: Software Testing & Quality Assurance		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to understand		
CO1	Test the software by applying testing techniques to deliver a product free from bugs.	K_3
CO2	Investigate the scenario and select the proper testing technique.	K_1
CO3	Explore the test automation concepts and tools and estimation of cost, schedule based on standard metrics.	K_2
CO4	Understand how to detect, classify, prevent and remove defects.	K_2
CO5	Choose appropriate quality assurance models and develop quality. Ability to conduct formal inspections, record and evaluate results of inspections.	K_3

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Software Testing Basics:** Testing as an engineering activity, Role of process in software quality, Testing as a process, Basic definitions, Software testing principles, The tester's role in a software development organization, Origins of defects, Defect classes, The defect repository and test design, Defect examples, Developer / Tester support for developing a defect repository.	08
II	**Testing Techniques and Levels of Testing:** Using White Box Approach to Test design– Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing, Defect Bash Elimination. System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing.	08
III	**Software Test Automation And Quality Metrics:** Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug, Debugging. Testing Software System Security - Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness, FMEA, Quality Function Deployment, Taguchi Quality Loss Function, Cost of Quality.	08
IV	**Fundamentals of Software Quality Assurance:** SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools and Modern Tools.	08

V	**Software Assurance Models:** Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P- CMM. **Software Quality Assurance Trends:** Software Process- PSP and TSP, OO Methodology, Clean room software engineering, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs, Case Tools and their affect on Software Quality.	**08**

Suggested Readings:

1. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing: Principles and Practices", Pearson.
2. Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Pearson
3. Aditya P. Mathur, "Foundations of Software Testing", Pearson.
4. Paul Ammann, Jeff Offutt, "Introduction to Software Testing", Cambridge University Press.
5. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", Auerbach Publications.
6. William Perry, "Effective Methods of Software Testing", Wiley Publishing, Third Edition.
7. Renu Rajani, Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Tata McGraw Hill.
8. Stephen Kan, "Metrics and Models in Software Quality", Addison – Wesley, Second Edition.
9. S. A. Kelkar, "Software quality and Testing", PHI Learning Pvt, Ltd.
10. Watts S Humphrey, "Managing the Software Process", Pearson Education Inc.