DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY
UTTAR PRADESH, LUCKNOW

EVALUATION SCHEME & SYLLABUS
First Year
FOR

MASTER OF COMPUTER APPLICATIONS (MCA)
(Two Year Course)

Based On
NEP2020
(Effective from the Session: 2024-25)

MCA (MASTER OF COMPUTER APPLICATIONS)
MCA FIRST YEAR, 2024-25

SEMESTER-I

S.No.	Subject Code	Subject Name	Periods			Sessional			ESE	Total	Credit
			L	T	P	CT	TA	Total			
1.	BMC101	Fundamental of Computers & Emerging Technologies	3	0	0	20	10	30	70	100	3
2.	BMC102	Problem Solving using C	3	1	0	20	10	30	70	100	4
3.	BMC103	Principles of Management & Communication	3	0	0	20	10	30	70	100	3
4.	BMC104	Discrete Mathematics	3	0	0	20	10	30	70	100	3
5.	BMC105	Computer Organization & Architecture	3	1	0	20	10	30	70	100	4
6.	BMC151	Problem Solving using C **Lab**	0	0	4	30	20	50	50	100	2
7.	BMC152	Computer Organization & Architecture **Lab**	0	0	3	30	20	50	50	100	2
8.	BMC153	Professional Communication **Lab**	0	0	2	30	20	50	50	100	2
9.	BMC106	Cyber Security*	2	0	0	20	10	30	70	100	0
		Total						**330**	**570**	**900**	**23**

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

*** Qualifying Non-credit Course**

SEMESTER-II

S.No.	Subject Code	Subject Name	Periods			Sessional			ESE	Total	Credit
			L	T	P	CT	TA	Total			
1.	BMC201	Web Technology	3	0	0	20	10	30	70	100	3
2.	BMC202	Object Oriented Programming	3	0	0	20	10	30	70	100	3
3.	BMC203	Operating Systems	3	0	0	20	10	30	70	100	3
4.	BMC204	Database Management Systems	3	0	0	20	10	30	70	100	3
5.	BMC205	Data Structures & Analysis of Algorithms	4	0	0	20	10	30	70	100	4
6.	BMC251	Web Technology **Lab**	0	0	3	30	20	50	50	100	2
7.	BMC252	Object Oriented Programming **Lab**	0	0	3	30	20	50	50	100	2
8.	BMC253	DBMS **Lab**	0	0	2	30	20	50	50	100	1
9.	BMC254	Data Structures & Analysis of Algorithms **Lab**	0	0	3	30	20	50	50	100	2
10.	BVA251	Sports and Yoga******	0	0	3	-	100	-	-	-	0
		Total						**350**	**550**	**900**	**23**

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

****Non-credit Course**

Syllabus

MCA 1st Year
Ist Semester

MCA (MASTER OF COMPUTER APPLICATIONS)
FIRST YEAR SYLLABUS
SEMESTER-I

BMC101 : FUNDAMENTAL OF COMPUTERS & EMERGING TECHNOLOGIES		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Demonstrate the knowledge of the basic structure, components, features and generations of computers.	K_1, K_2
CO 2	Describe the concept of computer languages, language translators and construct algorithms to solve problems using programming concepts.	K_2, K_3
CO 3	Compare and contrast features, functioning & types of operating system and computer networks.	K_4
CO 4	Demonstrate architecture, functioning & services of the Internet and basics of multimedia.	K_2
CO 5	Illustrate the emerging trends and technologies in the field of Information Technology.	K_1, K_2
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to Computer:** Definition, Computer Hardware & Computer Software **Components:** Hardware – Introduction, Input devices, Output devices, Central Processing Unit, Memory- Primary and Secondary. Software - Introduction, Types – System and Application. **Computer Languages:** Introduction, Concept of Compiler, Interpreter & Assembler **Problem solving concept:** Algorithms – Introduction, Definition, Characteristics, Limitations, Conditions in pseudo-code, Loops in pseudo code.	**08**
II	**Operating system:** Definition, Functions, Types, Classification, Elements of command based and GUI based operating system. **Computer Network:** Overview, Types (LAN, WAN and MAN), Data communication, topologies.	**08**
III	**Internet:** Overview, Architecture, Functioning, Basic services like WWW, FTP, Telnet, Gopher etc., Search engines, E-mail, Web Browsers. **Internet of Things (IoT):** Definition, Sensors, their types and features, Smart Cities, Industrial Internet of Things.	**08**
IV	**Block chain:** Introduction, overview, features, limitations and application areas fundamentals of Block Chain. **Crypto currencies:** Introduction, Applications and use cases **Cloud Computing**: nature and benefits, AWS, Google, Microsoft & IBM Services	**08**
V	**Emerging Technologies:** Introduction, overview, features, limitations and application areas of Augmented Reality, Virtual Reality, Grid computing, Green computing, Big data analytics, Quantum Computing and Brain Computer Interface	**08**

Suggested Readings:

1. Rajaraman V., "Fundamentals of Computers", Prentice-Hall of India.
2. Norton P., "Introduction to Computers", McGraw Hill Education.
3. Goel A., "Computer Fundamentals", Pearson.
4. Balagurusamy E., "Fundamentals of Computers", McGraw Hill.
5. Thareja R., "Fundamentals of Computers", Oxford University Press.
6. Bindra J., "The Tech Whisperer- on Digital Transformation and the Technologies that Enable it", Penguin Books.

BMC102 : PROBLEM SOLVING USING C		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Describe the functional components and fundamental concepts of a digital computer system including number systems.	K_1, K_2
CO 2	Construct flowchart and write algorithms for solving basic problems.	K_2, K_3
CO 3	Write 'C' programs that incorporate use of variables, operators and expressions along with data types.	K_2, K_3
CO 4	Write simple programs using the basic elements like control statements, functions, arrays and strings.	K_2, K_3
CO 5	Write advanced programs using the concepts of pointers, structures, unions and enumerated data types.	K_2, K_3
CO 6	Apply pre-processor directives and basic file handling and graphics operations in advanced programming.	K_2, K_3
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Basics of programming:** Approaches to problem solving, Use of high-level programming language for systematic development of programs, Concept of algorithm and flowchart, Concept and role of structured programming. **Basics of C**: History of C, Salient features of C, Structure of C Program, Compiling C Program, Link and Run C Program, Character set, Tokens, Keywords, Identifiers, Constants, Variables, Instructions, Data types, Standard Input/Output, Operators and expressions.	**08**
II	**Conditional Program Execution:** if, if-else, and nested if-else statements, Switch statements, Restrictions on switch values, Use of break and default with switch, Comparison of switch and if-else. **Loops and Iteration:** for, while and do-while loops, Multiple loop variables, Nested loops, Assignment operators, break and continue statement. **Functions:** Introduction, Types, Declaration of a Function, Function calls, Defining functions, Function Prototypes, Passing arguments to a function Return values and their types, Writing multifunction program, Calling function by value, Recursive functions.	**08**
III	**Arrays:** Array notation and representation, Declaring one-dimensional array, Initializing arrays, Accessing array elements, Manipulating array elements, Arrays of unknown or varying size, Two-dimensional arrays, Multidimensional arrays. **Pointers:** Introduction, Characteristics, * and & operators, Pointer type declaration and assignment, Pointer arithmetic, Call by reference, Passing pointers to functions, array of pointers, Pointers to functions, Pointer to pointer, Array of pointers. **Strings:** Introduction, Initializing strings, Accessing string elements, Array of strings, Passing strings to functions, String functions.	**08**

IV	**Structure:** Introduction, Initializing, defining and declaring structure, Accessing members, Operations on individual members, Operations on structures, Structure within structure, Array of structure, Pointers to structure. **Union:** Introduction, Declaring union, Usage of unions, Operations on union. Enumerated data types **Storage classes**: Introduction, Types- automatic, register, static and external.	**08**
V	**Dynamic Memory Allocation**: Introduction, Library functions – malloc, calloc, realloc and free. **File Handling:** Basics, File types, File operations, File pointer, File opening modes, File handling functions, File handling through command line argument, Record I/O in files. **Graphics:** Introduction, Constant, Data types and global variables used in graphics, Library functions used in drawing, Drawing and filling images, GUI interaction within the program.	**08**

Suggested Readings:

1. Kanetkar Y., "Let Us C", BPB Publications.
2. Hanly J. R. and Koffman E. B., "Problem Solving and Program Design in C", Pearson Education.
3. Schildt H., "C- The Complete Reference", Tata McGraw-Hill.
4. Goyal K. K. and Pandey H.M., "Trouble Free C", University Science Press
5. Gottfried B., "Schaum's Outlines- Programming in C", Tata McGraw-Hill Publications.
6. Kochan S.G., "Programming in C", Addison-Wesley.
7. Dey P. and Ghosh M., "Computer Fundamentals and Programming in C", Oxford University Press.
8. Goyal K. K., Sharma M. K. and Thapliyal M. P. "Concept of Computer and C Programming", University Science Press.

BMC103 : PRINCIPLES OF MANAGEMENT & COMMUNICATION		
Course Outcome (CO**)**		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Describe primary features, processes and principles of management.	K_1, K_2
CO 2	Explain functions of management in terms of planning, decision making and organizing.	K_3, K_4
CO 3	Illustrate key factors of leadership skill in directing and controlling business resources and processes.	K_5, K_6
CO 4	Exhibit adequate verbal and non-verbal communication skills	K_1, K_3
CO 5	Demonstrate effective discussion, presentation and writing skills.	K_3, K_5
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Management**: Need, Scope, Meaning and Definition. The process of Management, Development of Management thought F.W. Taylor and Henry Fayol, Harthorne Studies, Qualities of an Efficient Management.	**08**
II	**Planning & Organizing:** Need, Scope and Importance of Planning, Steps in planning, Decision making model. Organizing need and Importance, Organizational Design, Organizational structure, centralization and Decentralization, Delegation.	**08**
III	**Directing & Controlling:** Motivation—Meaning, Importance, need. Theories of Motivation, Leadership—meaning, need and importance, leadership style, Qualities of effective leader, principles of directing, Basic control process, Different control Techniques.	**08**
IV	**Introduction to Communication:** What is Communication, Levels of communication, Barriers to communication, Process of Communication, Non-verbal Communication, The flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group) Communication, Technology Enabled communication, Impact of Technology, Selection of appropriate communication Technology, Importance of Technical communication.	**08**
V	**Business letters:** Sales & Credit letters; Claim and Adjustment Letters; Job application and Resumes. **Reports:** Types; Structure, Style & Writing of Reports. **Technical Proposal:** Parts; Types; Writing of Proposal; Significance. Nuances of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Communication skills, Presentation strategies, Group Discussion; Interview skills; Workshop; Conference; Seminars.	**08**

Suggested Readings:

1. Tripathi P.C. and Reddy P.N., "Principles of Management", McGraw Hill Education.
2. Gupta C. B., "Management Principles and Practice", Sultan Chand & Sons.
3. Chhabra T.N., "Business Communication", Sun India Publication.
4. Arora V.N. and Chandra L., "Improve Your Writing", Oxford University Press.
5. Rani M. and Verma S., "Technical Communication: A Practical Approach", Acme Learning.
6. Raman M. and Sharma S., "Technical Communication- Principles and Practices", Oxford University Press.
7. Harold K. and Heinz W., "Essentials of Management", Tata McGraw Hill.
8. Robbins S. P. and Coulter M. K., "Management", Pearson Prentice Hall.
9. Stoner J. A F, Freeman R. E. and Gilbert D.R., "Management", Pearson Education.
10. Chaturvedi P.D., "Business Communication", Pearson Education.

BMC104 : DISCRETE MATHEMATICS		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations and Functions	K_1, K_2
CO 2	Apply mathematical arguments using logical connectives and quantifiers to check the validity of an argument through truth tables and propositional and predicate logic	K_2, K_3
CO 3	Identify and prove properties of Algebraic Structures like Groups, Rings and Fields	K_3, K_4
CO 4	Formulate and solve recurrences and recursive functions	K_3, K_4
CO 5	Apply the concept of combinatorics to solve basic problems in discrete mathematics	K_1, K_3
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Set Theory:** Introduction, Size of sets and Cardinals, Venn diagrams, Combination of sets, Multisets, Ordered pairs and Set Identities. **Relation:** Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation. **Functions:** Definition, Classification of functions, Operations on functions, Recursively defined functions.	**08**
II	**Posets, Hasse Diagram and Lattices:** Introduction, Partial ordered sets, Combination of Partial ordered sets, Hasse diagram, Introduction of lattices, Properties of lattices – Bounded, Complemented, Modular and Complete lattice. **Boolean Algebra:** Introduction, Axioms and Theorems of Boolean algebra, Boolean functions. Simplification of Boolean functions, Karnaugh maps, Logic gates.	**08**
III	**Propositional:** Propositions, Truth tables, Tautology, Contradiction, Algebra of Propositions, Theory of Inference and Natural Detection. **Predicate Logic:** Theory of Predicates, First order predicate, Predicate formulas, Quantifiers, Inference theory of predicate logic.	**08**
IV	**Algebraic Structures:** Introduction to algebraic Structures and properties. Types of algebraic structures: Semi group, Monoid, Group, Abelian group and Properties of group. Subgroup, Cyclic group, Cosets, Permutation groups, Homomorphism and Isomorphism of groups. **Rings and Fields:** Definition and elementary properties of Rings and Fields.	**08**
V	**Natural Numbers:** Introduction, Piano's axioms, Mathematical Induction, Strong Induction and Induction with Nonzero Base cases. **Recurrence Relation & Generating functions:** Introduction and properties of Generating Functions. Simple Recurrence relation with constant coefficients and Linear recurrence relation without constant coefficients. Methods of solving recurrences. **Combinatorics:** Introduction, Counting techniques and Pigeonhole principle, Polya's Counting theorem.	**08**

Suggested Readings:

1. Rosen K. H., "Discrete Mathematics and Its Applications", McGraw Hill.
2. Kolman B., Busby R.C and Ross S.C., "Discrete Mathematics Structures", Prentice Hall.
3. Girimaldi R.P, "Discrete and Combinatorial Mathematics", Addison Wesley.
4. Singh Y.N., "Discrete Mathematical Structures", Wiley- India.
5. Sarkar S., "A Textbook of Discrete Mathematics", S. Chand & Company PVT. LTD.
6. Krishnamurthy V., "Combinatorics Theory & Application", East-West Press Pvt. Ltd.
7. Liptschutz S. and Lipson M.C., "Discrete Mathematics", McGraw Hill.
8. Trembely J.P. and Manohar R., "Discrete Mathematical Structure with application to Computer Science", McGraw Hill.

BMC105 : COMPUTER ORGANIZATION & ARCHITECTURE		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
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 using various addressing modes.	K_2, K_4
CO 3	Design various types of memory and its organization.	K_3
CO 4	Describe the various modes in which IO devices communicate with CPU and memory.	K_2, K_3
CO 5	List the criteria for classification of parallel computer and describe various architectural schemes.	K_1, K_2
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. **Processor organization:** general registers organization, stack organization and addressing modes.	**08**
II	**Arithmetic and logic unit:** Look ahead carries adders. Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Arithmetic & logic unit design. IEEE Standard for Floating Point Numbers.	**08**
III	**Control Unit:** Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc.), micro-operations, execution of a complete instruction. Program Control, Reduced Instruction Set Computer, Pipelining. Hardwire and micro programmed control: micro-program sequencing, concept of horizontal and vertical microprogramming.	**08**
IV	**Memory:** Basic concept and hierarchy, semiconductor RAM memories, 2D & 2 1/2D memory organization. ROM memories. Cache memories: concept and design issues & performance, address mapping and replacement Auxiliary memories: magnetic disk, magnetic tape and optical disks Virtual memory: concept implementation.	**08**
V	**Input / Output:** Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.	**08**

Suggested Readings:

1. Mano M. M., "Computer System Architecture", PHI.
2. Hamacher C., Vranesic Z. and Zaky S., "Computer Organization", McGraw-Hill.
3. Hayes J. P., "Computer Architecture and Organization", Tata McGraw Hill.
4. Stallings W., "Computer Organization and Architecture-Designing for Performance", Pearson Education.
5. Parahami B., “Computer Architecture”, Oxford University Press.
6. Patterson D. A. and Hennessy J. L., “Computer Architecture-A Quantitative Approach”, Elsevier Pub.
7. Tannenbaum A.S., "Structured Computer Organization", PHI.

BMC151 : PROBLEM SOLVING USING C LAB		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO1	Write, compile, debug and execute programs in a C programming environment.	K_3
CO2	Write programs that incorporate use of variables, operators and expressions along with data types.	K_3
CO3	Write programs for solving problems involving use of decision control structures and loops.	K_3
CO4	Write programs that involve the use of arrays, structures and user defined functions.	K_3
CO5	Write programs using graphics and file handling operations.	K_3

1. Program to implement conditional statements in C language.
2. Program to implement switch-case statement in C language
3. Program to implement looping constructs in C language.
4. Program to perform basic input-output operations in C language.
5. Program to implement user defined functions in C language.
6. Program to implement recursive functions in C language.
7. Program to implement one-dimensional arrays in C language.
8. Program to implement two-dimensional arrays in C language.
9. Program to perform various operations on two-dimensional arrays in C language.
10. Program to implement multi-dimensional arrays in C language.
11. Program to implement string manipulation functions in C language.
12. Program to implement structure in C language.
13. Program to implement union in C language.
14. Program to perform file handling operations in C language.
15. Program to perform graphical operations in C language.

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

BMC152 : COMPUTER ORGANIZATION & ARCHITECTURE LAB		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO1	Design and verify combinational circuits (adder, code converter, decoder, multiplexer) using basic gates.	K_6
CO2	Design and verify various flip-flops.	K_3
CO3	Design I/O system and ALU.	K_3
CO4	Demonstrate combinational circuit using simulator	K_2

1. Implement HALF ADDER, FULL ADDER using basic logic gates.
2. Implement Binary -to -Gray, Gray -to -Binary code conversions.
3. Implement 3-8 line DECODER. Implementing 4x1 and 8x1 MULTIPLEXERS.
4. Verify the excitation tables of various FLIP-FLOPS.
5. Design of an 8-bit Input/ Output system with four 8-bit Internal Registers.
6. Design of an 8-bit ARITHMETIC LOGIC UNIT.
7. Design the data path of a computer from its register transfer language description.
8. Design the control unit of a computer using either hardwiring or microprogramming based on its register transfer language description.
9. Implement a simple instruction set computer with a control unit and a data path.

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

BMC153 : PROFESSIONAL COMMUNICATION LAB		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO1	Develop the ability to work as a team member as an integral activity in the workplace.	K_3
CO2	Increase confidence in their ability to read, comprehend, organize, and retain written information. Improve reading fluency.	K_4
CO3	Write coherent speech outlines that demonstrate their ability to use organizational formats with a specific purpose; Deliver effective speeches that are consistent with and appropriate for the audience and purpose.	K_5,K_6
CO4	Develop proper listening skills; articulate and enunciate words and sentences clearly and efficiently.	K_3
CO5	Show confidence and clarity in public speaking projects; be schooled in preparation and research skills for oral presentations.	K_5

1. Group Discussion: participating in group discussions- understanding group dynamics.
2. GD strategies-activities to improve GD skills. Practical based on Accurate and Current Grammatical Patterns.
3. Interview Etiquette-dress code, body language attending job interview – Telephone/Skype interview one to one interview &Panel interview.
4. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistic/ Kinesics, practicing word stress, rhythm in sentences, weak forms, intonation.
5. Oral Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics voice modulation, Audience Awareness, Presentation plan visual aids.
6. Speaking: Fluency & Accuracy in speech- positive thinking, Improving Self-expression Developing persuasive speaking skills, pronunciation practice (for accept neutralization) particularly of problem sounds, in isolated words as well as sentences.
7. Individual Speech Delivery/Conferences with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehension Skills based on Reading and Listening Practical's on a model Audio-Visual Usage.

BMC106 : CYBER SECURITY		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Identify and analyze nature & inherent difficulties in the security of the Information System.	K_3
CO 2	Analyze various threats and attacks, corresponding counter measures and various vulnerability assessment and security techniques in an organization.	K_3
CO 3	Applications of cyber based policies and use of IPR and patent law for software-based design. Define E-commerce types and threats to E-commerce.	K_1, K_2
CO 4	Explain concepts and theories of networking and apply them to various situations, classifying networks, analyzing performance.	K_2
DETAILED SYLLABUS		**2-0-0**
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, Bombs, 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, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets - Access Control, CCTV, Backup Security Measures.	**08**
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. and Pfleeger S. L., “Analyzing 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.

Syllabus

MCA 1st Year
IInd Semester

MCA (MASTER OF COMPUTER APPLICATIONS)
FIRST YEAR SYLLABUS
SEMESTER-II

BMC201 : 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 CSS to develop web application and analyze the insights of internet programming to implement complete application over the web.	K3, K6
CO 2	Understand, analyze and apply the role of JavaScript in the workings of the web and web applications.	K2, K3
CO 3	Understand, analyze and build dynamic web applications using servlet and JSP.	K_2, K_3
CO 4	Develop Spring-based Java applications using Java configuration, XML configuration, annotation-based configuration, beans and their scopes, and properties.	K_2, K_4, K_6
CO 5	Develop web application using Spring Boot and RESTful Web Services	K_3, 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, Introduction of CSS, CSS Syntax, External Style Sheet using < link >, Multiple Style Sheets, Value Lengths and Percentages, CSS-Selectors, CSS-Box Model, Floats, Clear, Introduction to Bootstrap.	**08**
II	**Scripting:** 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	**08**
III	**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): Introduction, Java Server Pages Overview, A First Java Server Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries.	**08**

IV	**Spring:** 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, WebSocket, Auto wiring, Annotations, Life Cycle Call backs, Bean Configuration styles	**08**
V	**Spring Boot:** Spring Boot- Spring Boot Configuration, Spring Boot Annotations, Spring Boot Actuator, Spring Boot Build Systems, Spring Boot Code Structure, Spring Boot Runners, Logger, BUILDING RESTFUL WEB SERVICES, Rest Controller, Request Mapping, Request Body, Path Variable, Request Parameter, GET, POST, PUT, DELETE APIs, Build Web Applications	**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.

BMC202 : OBJECT ORIENTED 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 and key features of object-oriented programming and modeling using UML	K_4
CO 2	Construct basic structural, behavioral and architectural models using object oriented software engineering approach.	K_6
CO 3	Integrate object-oriented modeling techniques for analysis and design of a system.	K_4, K_5
CO 4	Use the basic features of data abstraction and encapsulation in C++ programs.	K_4
CO 5	Use the advanced features such as Inheritance, polymorphism and virtual function in C++ programs.	K_3, K_4
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Object Oriented Programming: objects, classes, Abstraction, Encapsulation, Inheritance, Polymorphism, OOP in Java, Characteristics of Java, The Java Environment, Java Source File Structure, and Compilation. Fundamental Programming Structures in Java: Defining classes in Java, constructors, methods, access specifies, static members, Comments, Data Types, Variables, Operators, Control Flow, Arrays.	**08**
II	**Inheritance, Interfaces, and Packages:** Inheritance: Super classes, sub classes, Protected members, constructors in sub classes, Object class, abstract classes and methods. Interfaces: defining an interface, implementing interface, differences between classes and interfaces and extending interfaces, Object cloning, inner classes. Packages: Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages, Import and Static Import Naming Convention For Packages, Networking java.net package.	**08**
III	**Exception Handling, I/O**: Exceptions: exception hierarchy, throwing and catching exceptions, built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics: Byte streams and Character streams, Reading and Writing, Console Reading and Writing Files.	**08**
IV	**Multithreading and Generic Programming:** Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming: Generic classes, generic methods, Bounded Types: Restrictions and Limitations.	**08**
V	**Event Driven Programming:** Graphics programming: Frame, Components, working with 2D shapes, Using colors, fonts, and images. Basics of event handling: event handlers, adapter classes, actions, mouse events, AWT event hierarchy. Introduction to Swing: layout management, Swing Components: Text Fields, Text Areas, Buttons, Check Boxes, Radio Buttons, Lists, choices, Scrollbars, Windows Menus and Dialog Boxes.	**08**

Suggested Readings:

1. Schildt H., "Java - The complete Reference", McGraw Hill Education.
2. Horstmann C. S. and Cornell G., "Core Java Volume I Fundamentals", Prentice Hall.
3. Holzner S., “Java - Black Book”, Dreamtech.
4. Balagurusamy E., “Programming in Java”, Tata McGraw Hill.
5. Mughal K., “A Programmer’s Guide to Java SE 8 Oracle Certified Associate (OCA)”, Addison-Wesley.

BMC203 : 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, Disk storage 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 Pub.
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.

BMC204 : DATABASE MANAGEMENT SYSTEMS		
Course Outcome (CO**)**		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Describe the features of a database system and its application and compare various types of data models.	K_2
CO 2	Construct an ER Model for a given problem and transform it into a relation database schema.	K_5, K_6
CO 3	Formulate solution to a query problem using SQL Commands, relational algebra, tuple calculus and domain calculus.	K_5, K_6
CO 4	Explain the need of normalization and normalize a given relation to the desired normal form.	K_2, K_3
CO 5	Explain different approaches of transaction processing and concurrency control.	K_2
DETAILED SYLLABUS		**3-0-0**
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	**08**

	Transaction, Case Study of Oracle.	

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. 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.

BMC205 : DATA STRUCTURES & ANALYSIS OF ALGORITHMS		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO 1	Explain the concept of data structure, abstract data types, algorithms, analysis of algorithms and basic data organization schemes such as arrays and linked lists.	K_2
CO 2	Describe the applications of stacks and queues and implement various operations on them using arrays and linked lists.	K_3
CO 3	Describe the properties of graphs and trees and implement various operations such as searching and traversal on them.	K_3
CO 4	Compare incremental and divide-and-conquer approaches of designing algorithms for problems such as sorting and searching.	K_4
CO 5	Apply and analyze various design approaches such as Divide-and-Conquer, greedy and dynamic for problem solving.	K_4
DETAILED SYLLABUS		**4-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction to data structure:** Data, Entity, Information, Difference between Data and Information, Data type , Build in data type, Abstract data type, Definition of data structures, Types of Data Structures: Linear and Non-Linear Data Structure, Introduction to Algorithms: Definition of Algorithms, Difference between algorithm and programs, properties of algorithm, Algorithm Design Techniques, Performance Analysis of Algorithms, Complexity of various code structures, Order of Growth, Asymptotic Notations. **Arrays:** Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D Array Application of arrays, Sparse Matrices and their representations. **Linked lists:** Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable.	**08**
II	**Stacks**: Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion- Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. **Queues:** Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue. **Searching:** Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing &	**08**

	Collision resolution Techniques used in Hashing.	
III	**Sorting:** Insertion Sort, Selection Sort, Bubble Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time: Counting Sort and Bucket Sort. **Graphs:** Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component.	**08**
IV	**Trees:** Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer (Linked List) Representation, Binary Search Tree, Complete Binary Tree, A Extended Binary Trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Constructing Binary Tree from given Tree Traversal, Operation of Insertion, Deletion, Searching & Modification of data in Binary Search Tree. Threaded Binary trees, Huffman coding using Binary Tree, AVL Tree and B Tree.	**08**
V	Divide and Conquer with Examples Such as Merge Sort, Quick Sort, Matrix Multiplication: Strassen's Algorithm Dynamic Programming: Dijikstra Algorithm, Bellman Ford Algorithm, All- pair Shortest Path: Warshal Algorithm, Longest Common Sub-sequence Greedy Programming: Prims and Kruskal algorithm.	**08**

Suggested Readings:

1. Cormen T. H., Leiserson C. E., Rivest R. L. and Stein C., "Introduction to Algorithms", PHI.
2. Horowitz E., Sahni S. and Rajasekharan S., "Fundamentals of Computer Algorithms", Universities Press.
3. Dave P. H. and Dave H. B, "Design and Analysis of Algorithms", Pearson Education.
4. Lipschuts S., "Theory and Problems of Data Structures Schaum's Series)", Tata McGraw-Hill.
5. Goyal K. K., Sharma S. and Gupta A., "Data Structures and Analysis of Algorithms", HP Hamilton.
6. Samanta D., "Classic Data Structures", Prentice Hall India.
7. Goodrich M. T. and Tomassia R., "Algorithm Design: Foundations, Analysis and Internet Examples", John Wiley and sons.
8. Sridhar S., "Design and Analysis of Algorithms", Oxford Univ. Press.
9. Aho A., Ullman J. and Hopcroft J., "Design and Analysis of algorithms", Pearson Education.
10. Neapolitan R. and K. Naimipour, "Foundations of Algorithms", Jones and Bartlett Student Edition.

BMC251 : WEB TECHNOLOGY LAB		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO1	Design web pages using HTML, DHTML and Cascading Styles sheets.	K_2
CO2	Develop a dynamic web pages using JavaScript.	K_3
CO3	Develop an interactive web applications using JSP.	K_3
CO4	Create web applications using Spring Boot.	K_2

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. Add a Cascading Style sheet for designing the web page.
6. Design a dynamic web page with validation using JavaScript.
7. Write a program using JavaScript to demonstrate the concept of built-in array methods.
8. Write a program using JavaScript to demonstrate the concept of nested functions.
9. Write programs using JavaScript for Web Page to display browsers information.
10. Write a program using JavaScript to merge property of two objects.
11. Write a program using JavaScript to include a JS file into another JS file.
12. Develop a Servlet to validate user name and password stored in database. Display authorized user is she/he is authorized else display unauthorized user.
13. Write JSP & Servlet program to store student details sent from registration form in to database table.
14. 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.
15. Write a java program/servlet application to connect to a database and extract data from the table containing employee's information and display them.
16. Write program to demonstrate the concept of spring and spring boot.
17. Create REST Service for an Education Site.
18. Use the Spring Boot Starter Web to Create a Web Application.

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

BMC252 : OBJECT ORIENTED PROGRAMMING LAB		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO1	Use the Concept of Data Abstraction and Encapsulation in C++ programs.	K_3
CO2	Design and Develop C++ program using the concept such as polymorphism, virtual function, exception handling and template.	K_3
CO3	Apply object-oriented techniques to analyze, design and develop a complete solution for a given problem.	K_3

1. Use Java compiler and eclipse platform to write and execute java program.
2. Write programs to implement conditional statements and looping constructs.
3. Write programs to implement basic input / output operations.
4. Write programs using inheritance and polymorphism.
5. Write programs to implement error-handling techniques using exception handling and multithreading.
6. Write programs to demonstrate the use of java packages.
7. Write programs to demonstrate the concept of file handling and establishment of database connection.
8. Write program to develop a calculator application in Java.
9. Write program to develop a Client Server Application.
10. Write program to develop GUI applications using Swing components.

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

BMC253 : DATABASE MANAGEMENT SYSTEMS LAB		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO1	Use the Concept of Data Abstraction and Encapsulation in C++ programs.	K_6
CO2	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_6

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. Normalization.
5. Create cursor.
6. Create procedure and functions.
7. Create packages and triggers.
8. Design and implement payroll processing system.
9. Design and implement Library Information System.
10. Design and implement Student Information System.
11. Automatic Backup of Files and Recovery of Files

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

BMC254 : DATA STRUCTURES & ANALYSIS OF ALGORITHMS LAB		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course, the student will be able to		
CO1	Write and execute programs to implement various searching and sorting algorithms.	K_3
CO2	Write and execute programs to implement various operations on two-dimensional arrays.	K_3
CO3	Implement various operations of Stacks and Queues using both arrays and linked lists data structures.	K_3
CO4	Implement graph algorithm to solve the problem of minimum spanning tree	K_3

Program in C or C++ for following:

1. To implement addition and multiplication of two 2D arrays.
2. To transpose a 2D array.
3. To implement stack using array.
4. To implement queue using array.
5. To implement circular queue using array.
6. To implement stack using linked list.
7. To implement queue using linked list.
8. To implement BFS using linked list.
9. To implement DFS using linked list.
10. To implement Linear Search.
11. To implement Binary Search.
12. To implement Bubble Sorting.
13. To implement Selection Sorting.
14. To implement Insertion Sorting.
15. To implement Merge Sorting.
16. To implement Heap Sorting.
17. To implement Matrix Multiplication by Strassen's algorithm.
18. Find Minimum Spanning Tree using Kruskal's Algorithm.

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

BVA251 : SPORTS AND YOGA

Objective of the Course:

- To maintain mental and physical wellness upright and develop ability in the students 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 introduce a practice oriented introductory course on the subject. More involved / advanced course may come up in subsequent years of study

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, student has to opt for at least one game out of the remaining mentioned below.

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

a. Introduction of Yoga

Introduction of Yoga, Origin of Yoga, Aims and Objective of Yoga, Patanjali Yoga darshan, Hath yoga, Gheranda Samhita, Karm yoga, Gyan yoga.

b. Asanas, Pranayam and Meditation Practices

Meaning of Asanas, Objective of Asanas, rules and regulations of Asanas and Pranayams, Types of Yogasana

Yogic postures: Standing Posture, Sitting posture, Supine posture, Prone posture, balancing Postures, Pranayam according to Patanjali and Hath Yoga, Meditaion Mudras

c. Science of Yoga

Physiological effects of Asanas- Paranayama and meditation, stress management and yoga, Mental health and yoga practice, Health and Personality Development.

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 a minimum of five choices of the 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 the award of the sessional marks based upon following components.

I.	Level of understanding and general awareness	(20 %)
II.	Involvements in the Practice Sessions	(50 %)
III.	Regularity, Sincerity and Discipline	(20 %)
IV.	Participation in University level / District level / State level / National Level events	(10 %)