Ewing Christian College

(An Autonomous Constituent College of Allahabad University)

Centre for Computer Sciences

B. Sc. – Computer Application

Approved Syllabus

(Implemented from session 2020 – 21)

Semester – I		
Paper Code	**Paper Title**	**Marks**
CAB101	Introduction to Computing Systems	75
CAB102	Programming in 'C'	75
CAB103	Lab-1	50
	Total	**200**
Semester – II		
CAB201	Computer Architecture and Organization	75
CAB202	Data Structures	75
CAB203	Lab-2	50
	Total	**200**
Semester – III		
CAB301	OOP with C++	75
CAB302	Operating System Concepts	75
CAB303	Lab-3	50
	Total	**200**
Semester – IV		
CAB401	Data Science	75
CAB402	Database Management Systems	75
CAB403	Lab.-4	50
	Total	**200**
Semester – V		
CAB501	System Analysis & Design	75
CAB502	Computer Graphics	75
CAB503	Java Programming	75
CAB504	Lab-5	75
	Total	**300**
Semester – VI		
CAB601	Web Technology	75
CAB602	.NET with C#	75
CAB603	Data Communication & Networks	75
CAB604	Project	75
	Total	**300**
	Grand Total	**1400**

Semester – I / Paper-I

CAB101-Introduction to Computing Systems

1. **An Introduction to Computers** – Computing History, Characteristics and Capabilities, Hardware and software, Generations of computers, Computer language generations - Machine level, Assembly & High level Computer languages, Translators - Compiler/Assembler and Interpreter, Computer classification, Computer Application Areas, Computer- ware, **Block Diagram** - CPU, Control Unit, ALU, **Input / Output Devices**: Keyboard, Mouse, VDU, LCD, LED, Printers, **Types of printers**: Dot Matrix, Laser and Inkjet., character set - ASCII, BCD and EBCDIC.

2. **Computer Memory** – Primary and Secondary memory. Types of Read Only Memory and Read-Write memory. SRAM, DRAM, PROM, EPROM, EEROM, Flash Memory etc. Concept of cache memory, Memory hierarchy, Virtual memory.

3. **Storage Devices**: Storage mechanism in Magnetic and optical disks, concepts of tracks and sectors in magnetic and optical disks. Compact disc, DVD and Blue ray technology.

4. **Introduction to OS –** Operating system**,** Functions, Overview of MS-Windows, MS-DOS & Linux, Internal and External DOS Commands, Basic Linux Commands, **Advance computing concepts**: Grid Computing, Cloud Computing and Artificial Intelligence etc.

Suggested Readings:

1. Fundamental of Computers by Rajaraman
2. Computer Fundamentals by P K Sinha
3. Computer Fundamentals by B Ram
4. Learn DOS in a Day by Russell A. Stultz
5. UNIX Concepts & Applications by Sumitabaha Das

Semester – I / Paper-II

CAB102- Programming in 'C'

1. **Introductory Concepts of Programming** - Introduction, History, Program Development Stages – Analysis, Design, Coding, Testing, Debugging and Implementation, Design Tools – Algorithm, flowchart, Program Constructs – Sequence, Selection, Iteration, algorithms/ flowcharts for GCD, factorial, Fibonacci series, prime numbers generation and other simple problems, searching and sorting techniques

2. **'C' Fundamentals**- Introduction to 'C', History & Development, Character Set, Identifiers and keywords, Tokens, Data Types, constants, variables, operators, Separators, Declarations, expressions, statements, Symbolic constants, **Control Statements**- if, switch, break, continue, for, while, do while.

3. **Functions:** Definition, Declaring a function, making function call, passing arguments to a function, recursion, functions with default arguments, standard library functions - mathematical, string, **Arrays:** Declaration, Initialization, processing an array- traversal, searching, sorting, merging, insertion, deletion, passing arrays to functions, Multidimensional arrays, Arrays and strings, **Structures:** definition, declaring a structure, accessing structure elements, memory allocation, array of structures, nested structures.

4. **Pointers-** Pointer declarations, pointer arithmetic, Passing pointers to the functions, pointers and one dimensional array, Operations on pointers, arrays of pointers, dynamic memory allocation, related functions, **Preprocessor Declaratives**- file inclusion, macro definition, conditional, **Data Files-** Opening and closing a text/ data file, file access modes, creating and reading a data file, working with binary data files.

Suggested Readings:

1. Let Us 'C' by Yashwant Kanetkar
2. 'C' in Depth by Yashwant Kanetkar
3. Programming in ANSI C by Balagursamy
4. Programming in 'C' by Kanthane

CAB201- Computer Architecture and Organization

1. **Data Representation:** Signed numbers, Fixed and Floating point numbers. Normalized floating point numbers. Computer arithmetic: Complements, Radix and diminished radix arithmetic. **Basic Computer Organization**: Central Processing Unit, Registers, ALU, System bus-their functions and interconnection. Memory Organization and interleaving, Cache and its mapping, Memory hierarchy.

2. **Microprocessor**: 8085 microprocessor, architecture, pin diagrams, interrupts, instructions, addressing modes, machine language, assembly language, simple programs. Comparative study of CISC Intel 8-bit microprocessors and 16 bit microprocessors. Charateristics of RISC and comparison with CISC.

3. **I/O Organization:** Memory mapped and standard I/O mapped. Modes of data transfer, Programmed I/O, interrupt driven, Direct Memory Access, DMA controller. Polling, Priority interrupt Controller.

4. **Parallel Organization:** Methods for parallelism in uniprocessor system, Flynn's and Feng's classifications, Instruction level pipelining and Superscalar Processors, Array processors, Multiple Processor Organizations, Amdahl's law, performance of parallel computers. Vector Computations.

Suggested Readings:

1. W. Stallings, "Computer Organization and Architecture: Designing for performance", Prentice Hall of India.

2. M. Mano, "Computer System Architecture", 3rd Edition, Pearson Education, Inc., 2003.

3. R.S. Gaonkar, "Microprocessor Architecture, Programming and Application with the 8085", 5th Edition, Penram International Publishing (India) Pvt. Ltd., 2011.

4. Rafiquzzaman, "Microprocessor, Theory and Application: Intel and Motorla, Prentice Hall of India.. 5. J. Hays, "Computer Architecture and Organization", McGraw-Hill.

Semester – II / Paper-II

CAB202- Data Structures

1. **Introduction:** Basic Terminology, Elementary Data Organization, Data Structure operations, Algorithm Complexity and Time-Space trade-off. **Stacks:** Array Representation and Implementation of stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack.

2. **Queues:** Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty. Circular queue, Deque, and Priority Queue**.** **Linked list**: Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.

3. **Trees**: Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree. Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees. Traversing Threaded Binary trees, Huffman algorithm**. Binary Search Trees**: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees, B-trees. Hashing Comparisons.

4. **Searching and Hashing**: Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation. ***Sorting****:* Insertion Sort, Bubble Sorting, Quick Sort, Two Way Merge Sort, Heap Sort.

References

1. Y. Langsam, M. Augenstin and A. Tannenbaum, Data Structures using C and C++, Pearson Education Asia, 2nd Edition, 2002.
2. Ellis Horowitz, S. Sahni, D. Mehta Fundamentals of Data Structures in C++, Galgotia Book Source, New Delhi.
3. S. Lipschutz, Data Structures Mc-Graw Hill International Editions, 1986.
4. Jean-Paul Tremblay, Paul. G. Soresan, An introduction to data structures with Applications, Tata Mc-Graw Hill International Editions, 2nd edition 1984.

Semester – III / Paper-I

CAB301- OOP with C++

1. **Introduction**: Introduction to Programming Techniques – POP, OOP, OOP Concept, characteristics, Applications, Introduction to OOP languages, Introduction to C++, Features, Bridging C & C++ (Overview of C Concepts), C++ Data Types, Tokens, Keywords, Operators, **Decision Making & Branching**: If Statement, If-Else statement, Nesting of If-Else, Switch statement, **Looping**: While Statement, Do Statement, For Statement, Overview of functions & structures in C.

2. **Class & Objects**: Declaring Data Members, Member Functions, Types of class Members, Array within a class. **Class Function Definition**: Member Function definition inside the class and outside the class, Friend Function, Inline Function, Static Members & Functions, Scope Resolution Operator, Private and Public Member Functions, Nesting of Member Functions. Creating Objects, Accessing class data members, Accessing member functions, Arrays of Objects, Objects as function arguments: Pass by value, Pass by reference, Pointers to Objects.

3. **Constructors and Destructors**: Declaration and Definition, Default Constructors, Parameterized Constructors, Constructor Overloading, Copy Constructors. Destructors: Definition and use. **Inheritance** - Extending Classes Concept of inheritance, Base class, Derived class, Defining derived classes, Visibility modes: Private, public, protected; Types of Inheritance- Single, Multiple, Multilevel, Hybrid, Hierarchical, Nesting of classes.

4. **Function Overloading & Operator Overloading**: Binary & Unary Operators. **Polymorphism**: Definition, early Binding, Polymorphism with pointers, Virtual Functions, late binding, pure virtual functions. **Input/output files**: Streams, buffers & iostreams, header files, redirection, file input and output.

Suggested Readings / Books:

1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata Mc-Graw Hill

2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.

3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.

4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing

Semester – III / Paper-II

CAB302- **Operating System Concepts**

1. **Introduction:** Operating system and functions, Classification of Operating systems – Batch, interactive, Time sharing, Real time System, Multiprocess systems, Multithreaded Systems, Operating Systems Structure-Layered structure, System Components, Operating System service, Reentrant Kernels, Monolithic and Microkernel Systems.

2. **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.

3. **CPU Scheduling**: Scheduling Concepts, Performance Criteria, Process States, Process Transition diagram Schedulers, Process Control Bank (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.

4. **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, I/O Management and Disk Scheduling: I/O devices, and I/O subsyatems, I/O buffering, Disk storage and disk scheduling, RAID. File System: File concept, file organization and access mechanism, file directors, and File sharing, File system implementation issues, File system protection and security.

Suggested Readings:

1. Silberchatz, Galvin and Gagne, "Operating Systems Concept", Wiley.

2. Sibsankar Halder and Alex A Aravind, "Operating Systems", Pearson Education.

3. Harvey M.Dietel, "An Introduction to Operating System", Pearson Education.

4. D.M Dhamdhere, "Operating Systems: A Concept based Approved", Tata McGraw-Hill Education.

5. Douglas Comer, "Operating System Design- the XINU Approach" Prentice Hall.

Semester – IV / Paper-I

CAB401- Data Science

1. Introduction: What is Data Science, Big Data and Data Science hype, getting past the hype - Why now? – Datafication - Current landscape of perspectives,

2. Three Basic Machine Learning Algorithms - Linear Regression - k-Nearest Neighbors (k-NN) - k-means, Artificial Neural Network (ANN) and Genetic Algorithms

3. Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests, **Mining Social-Network Graphs** - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighborhood properties in graphs,

4. Data Visualization - Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset, **Data Science and Ethical Issues** - Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists

Suggested Readings:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.

2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)

3. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.

4. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.

5. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)

6. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

Semester – IV / Paper-II

CAB402- DATABASE MANAGEMENT SYSTEMS

1. **Database Systems**, View of Data Models, Database Languages, DBMS Architecture, Database Users and Data Independence. ER Modeling, relation types, role and Structural Constraints, Extended ER Modeling Features, Design of an ER Database Schema, Reduction of ER Schema to Tables. Relational Model: Relational Model Concepts, Relational Algebra.

2. **Introduction to SQL & PL/SQL**: SQL data types and literals, Types of SQL commands, SQL operators, Tables, views and indexes, Queries and sub queries, Aggregate functions, Cursors in SQL. **PL/SQL**: PL/SQL data types, character set, variables, literals, constants, commit, rollback, locking, exceptions, triggers.

3. **Relational Database Design**: Functional and multi-valued Dependencies, Desirable Properties of Decomposition, Normalization up to BCNF. Concept and Design of Object Oriented Database. **Selected Database Issues**: Security, Transaction Management, Basic Algorithms to Query Processing and Query Optimization, Concurrency Control, Recovery Techniques, locking.

4. **Introduction to advance Database Concepts:** Data warehousing, Data mining, Big data, **Case Studies**: Oracle/ MS-SQL/ PL/SQL.

Suggested Readings:

1. C.J.Date, An Introduction to Database Systems, Vol I & II, Addison Wesley.
2. Korth Silberschatz, Data Base System Concepts, 4th ed., McGraw Hill.
3. J.D.Ullman, Principles of Database Systems, Golgotha, New Delhi.
4. Wiederhold, Database Design, McGraw Hill.
5. R. Elmasri, and S.B. Navathe, Fundamentals of Database Systems, Pearson Education Asia.
6. Raghu Ramakrishnan, Database Management Systems, McGraw-Hill Education.

Semester – V / Paper-I

CAB501- SYSTEM ANALYSIS AND DESIGN

1. **Concept of System and Information System:** Definition, **Types of Information System**: TPS, MIS, DSS, Interpersonal Communication System. **System Development Life Cycle:** Recognition of needs for System Change, Analysis, Design, Implementation & maintenance. **Feasibility Study:** Types of Feasibility, Steps. **Role of System Analyst:** Academic & Personal Qualifications, the Multifaceted Role of Analyst, the Analyst-User Interface.

2. **System Planning and Initial Investigation:** Strategies for Determining Information Requirement, Problem Definition & Project Initiation, Back Ground Analysis, Fact Analysis, Review of written Documents, On-site Observations, Interviews & Questionnaires, Fact Analysis, Performance Analysis, Efficiency Analysis, Service Analysis. **Information Gathering:** Information about the firms, Tools – Interview, Questionnaires.

3. **The Tools of Structured Analysis:** The Dataflow Diagram (DFD), Data Dictionary, Decision Tree and Structured English. Fundamental Design Activities- Verification and Validation, Input/output & Form Design: Input / CRT/ design, output design, Requirements, **System Testing:** Types of Testing, Preparing a Test Plan

4. **Quality Assurance:** Implementation of Quality assurance, Inspection, walks through, follow up, documentation and report writing. **Project Management:** Measuring the process, planning, estimating, identifying and evaluating risk, organizing resources, defining a project schedule, monitoring, review.

Suggested Readings:

1. Elias M. Awad, ”System Analysis & Design”, Galgotia Publication.
2. Hoffer, “Modern System Analysis & Design”, Addision Wesley.
3. Kendall, “Introduction to System Analysis & Design”, McGraw Hill.

Semester – V / Paper-II

CAB502- Computer Graphics

1. **Basic Concepts:** Origin of Computer Graphics, new display devices, how the interactive graphics display works, general purpose graphics S/W, user interface. **Graphical Input Devices & Input Techniques:** Pointing and positioning devices, mousse, tablets, light-pen, 3 dimensional input devices, comparators, positioning techniques, pointing & selection, inking and painting.

2. **Point Plotting Techniques:** Coordinate System, Incremental Method, Line Drawing Algorithms, Circle Generators, Line Drawing Displays – Display Devices & Controllers, The CRT, Inherent Memory Devices, The Storage Tube Display, The Refresh Line Drawing Display.

3. **Two Dimensional Transformations:** Transformation Principles, Concatenation, Matrix Representation. **Clipping & Windowing:** Line Clipping Algo, Midpoint Subdivision, Polygon Clipping, Viewing Transformations, Windowing Transformations, segments, functions for segmenting, posting and unposting a segment, free storage allocation, display file.

4. **Geometric Models:** Geometric Modeling, symbols and instances, boxing, advantages and limitations of display procedures. **Event Handling & Input Functions:** Polling, Interrupts, Event Queue, Event Handling Function, Dragging & Fixing, Hit Detection, Basic & Raster Graphics. **Transformations & Shading Models:** 3-D Transformations, parallel and perspective projections, simple shading models, Introduction to image editing and video editing software.

Suggested Readings:

1. Graphics Under C by Yashwant Kanetakar
2. Computer Graphics by Baker and Hearn
3. Computer Graphics : Schaum Series

Semester – V / Paper-III

CAB503- Java Programming

1. **Introduction to Java**: Features of Java, JDK Environment, Object Oriented Programming Concept Overview of Programming, Paradigm, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C++ and JAVA

2. **Java Programming Fundamental** :Structure of java program, Data types, Variables, Operators, Keywords, Naming Convention, Decision Making (if, switch),Looping(for, while) ,Type Casting, Classes and Objects: Creating Classes and objects, Memory allocation for objects, Constructor, Implementation of Inheritance, Implementation of Polymorphism, Method Overloading, Method Overriding, Nested and Inner classes, **Arrays and Strings**: Arrays, Creating an array, Types of Arrays, String class Methods, String Buffer methods.

3. **Abstract Class, Interface and Packages**: Modifiers and Access Control, Abstract classes and methods, Interfaces, Packages Concept, Creating user defined packages, **Exception Handling**: Exception types, Using try catch and multiple catch, Nested try, throw, throws and finally, Creating User defined Exceptions.

4. **File Handling**: Byte Stream, Character Stream, File IO Basics, File Operations, Creating file, Reading file, Writing File, **Multithreaded Programming:** Creating Threads, extending the thread class, blocking and stopping a thread**, Applet Programming**: Introduction, Types Applet, Applet Life cycle, Creating Applet, Applet tag

Suggested Readings:

1. Ivan Bayross, Web Enabled Commercial Application Development Using Html, Dhtml, javascript, Perl Cgi , BPB Publications, 2009.

2. Cay Horstmann, BIG Java, Wiley Publication , 3rd Edition., 2009

3. Herbert Schildt , Java 7, The Complete Reference, , 8th Edition, 2009.

4. E Balagurusamy , Programming with JAVA, TMH, 2007

CAB601- WEB TECHNOLOGY

1. **Introduction**: History of Web, Growth Of the Web, Protocols governing the web, Introduction To Cyber Laws in India, Introduction to International Cyber Laws, Web Browser, Web Server, Web Development Tools.

2. **HTML:** Introduction, HTML Tags, Links, List, Tables, Frames, Forms, Checkboxes, Text fields and Text areas, Comments in HTML, Style Sheets

3. **JAVA SCRIPT:** Introduction, Documents, Forms, Statements, functions, objects, Events and Event Handling, Arrays, Working with browser objects, Creating browser-specific scripts & Cross-browser scripts, **PHP (Hypertext Preprocessor)**: Introduction, syntax, variables, strings, operators, if-else, loop, switch, array, function, form, mail, file upload, session, error, exception, filter, PHP-ODBC

4. **ASP:** Introduction, Objects, Methods, Establishing Database Connections, **Web Publishing**: Setting/ Hosting Website

Suggested Readings:

1. HTML 4.0 – E Stephen Mack & Janan Platt
2. The ABCs of JavaScript – Lee Purcell, Mary Jane Mava
3. Active Server Pages 2.0 – Stephen Walther
4. Active Server Pages 3 – A Russel Jones
5. Commercial Web Development Using HTML, DHTML, Java Script, CGI, Perl- Ivan Bayross.

Semester – VI / Paper-II

CAB602- .NET WITH C#

1. **Introduction to .NET:** Definition, Features of .NET, CLR, CTS, CLS, MSIL, Managed Code and Managed data, Assembly, Namespace, Introduction to C#, Features of C#, **Types and Variables:** value type, reference type, Boxing and Un Boxing, Instance variable, array elements, Parameters(value/ reference/ output), local variables.

2. **Control Statements:** if, switch, while, do, for, for-each, break, continue, goto, return statements. **Exception Handling:** Exception, causes of exception, checked and un checked statements, compiler setting and overflow checking, try/catch, try/finally, try/catch/finally, throwing exceptions. **Namespace:** Definition, Namespace declaration, using directives, alias.

3. **Classes:** Definition and declaration, class modifiers, Abstract class, sealed class, Constructors and Destructors, Methods, Methods Parameters (value/ reference/ output), parameter array, static and instance method, virtual method, override method, method overloading, method hiding, sealed method, Abstract method, **Properties, Array Indexes:** Definition, Accessors, Read-only and write-only properties, Definition and declaration of arrays, single dimension/ multi dimension array, rank of an array, jagged array, Indexes.

4. **Structure, Enums, Delegates and Events:** Definition of struct, difference between class and struct, Enums, Enum members, Definition of delegates, single cast and multi cast delegates, Events. **Inheritance and Interface:** Definition of Inheritance and Interface, working with interface, inheritance of interfaces, Interface implementation, multiple implementations. **ADO.NET:** Introduction, Difference between ADO and ADO.NET, primary objects of ADO.NET, Reading/ Writing/ Updating/ displaying data in a data grid.

Suggested Readings:

1. Programming in C# by E Balagurusamy
2. C#: Nuts & Bolts by Sonal Mukhi
3. C#: A Complete Reference by Herbert Schildt

CAB603- DATA COMMUNICATION & NETWORKS

1. **Introduction:** History & development of computer network, network topologies, **Transmission media**- UTP, STP, Coaxial Cable, Optical Fiber, analog & digital transmission, multiplexing, FDM, TDM, Classification of Network in various ways.

2. **Data Transmission Basics:** Synchronous/Asynchronous, Error detection and correction methods, Data Compression, Protocol basic, circuit, message, packet and cell switching, connection oriented and connectionless network, ISO-OSI model, TCP/IP model, Ethernet, CSMA/CD, CSMA/CA, Token passing ring, FDDI.

3. **Networking Devices:** Hubs, Repeaters, Internetworking: Routers, Bridges, Switches, Gateways, Routing Basics, Routing algorithms, Implementation of wired and wireless networks, IP addressing, Sub netting, CIDR, Designing a campus-wide network.

4. **Internet:** Connecting to Internet: Telephone, Cable, Satellite connection, Choosing an ISP, network applications: Client Server Concepts.

Suggested Readings:

1. A. S. Tennanbaum, ―Computer Network,‖ 2nd Edition, PHI
2. Data Communication and Computer Networking – Behrouz A. Forouzan.
3. Data and Computer communication- W. Stalling.
4. A top-down approach to computer Networking – Kurose, Ross.

Revised Syllabus

w.e.f. 2020 onwards

Bachelor of Computer Applications (BCA)

CREDIT STRUCTURE OF Bachelor of Computer Applications (BCA)

SEMESTER-I

S.No	Course Code	Course Title	L	T	P	C	Int.	Ext.
THEORY								
1	**BCA101**	Mathematics-I	2	1	0	3	40	60
2	**BCA102**	Statistics	2	1	0	3	40	60
3	**BCA103**	Basic Circuit Analysis	2	1	0	3	40	60
4	**BCA104**	Fundamentals of Programming	2	1	0	3	40	60
5	**BCA105**	Communication Skills	2	1	0	3	40	60
6	**BCA106**	Business Systems	2	1	0	3	40	60
7	**BCA171**	Lab in Analog Electronics	0	1	3	4	40	60
	BCA172	Lab in C Programming/ Communication Skills	0	1	3	4	40	60
		TOTAL	**12**	**08**	**06**	**26**	**320**	**480**

SEMESTER-II

S.No	Course Code	Course Title	L	T	P	C	Int.	Ext.
THEORY								
1	**BCA201**	Mathematics-II	2	1	0	3	40	60
2	**BCA202**	Basic Electronics	2	1	0	3	40	60
3	**BCA203**	Digital Electronics and Computer Organization	2	1	0	3	40	60
4	**BCA204**	Data Structures	2	1	0	3	40	60
5	**BCA205**	Linux and Shell Programming	2	1	0	3	40	60
6	**BCA206**	Principles of Programming Languages	2	1	0	3	40	60
7	**BCA271**	Lab in Digital Electronics	0	1	3	4	40	60
	BCA272	Lab in Linux and Shell Programming	0	1	3	4	40	60
		TOTAL	**12**	**08**	**06**	**26**	**320**	**480**

SEMESTER-III

S. No.	Course Code	Course Title	L	T	P	C	Int.	Ext.
THEORY								
1	**BCA301**	Discrete Structures and Graph Theory	2	1	0	3	40	60
2	**BCA302**	Design and Analysis of Algorithm	2	1	0	3	40	60
3	**BCA303**	Introduction to System Software	2	1	0	3	40	60
4	**BCA304**	Object Oriented Programming using C++	2	1	0	3	40	60
5	**BCA305**	Database Management System	2	1	0	3	40	60
6	**BCA306**	Computer Architecture and Microprocessors	2	1	0	3	40	60
7	**BCA371**	Lab in C++ Programming	0	1	3	4	40	60
	BCA372	Lab in DBMS	0	1	3	4	40	60
		TOTAL	**12**	**08**	**06**	**26**	**320**	**480**

SEMESTER-IV

S. No.	Course Code	Course Title	L	T	P	C	Int.	Ext.
THEORY								
1	**BCA401**	Operating Systems	2	1	0	3	40	60
2	**BCA402**	Operation Research	2	1	0	3	40	60
3	**BCA403**	Data Communications and Networks	2	1	0	3	40	60
4	**BCA404**	Software Engineering	2	1	0	3	40	60
5	**BCA405**	Web Programming using JAVA	2	1	0	3	40	60
6	**BCA406**	Numerical Methods	2	1	0	3	40	60
7	**BCA471**	Lab in Java Programming	0	1	4	5	60	90
	BCA472	Lab in Data Communications & Networks	0	1	4	5	60	90
		TOTAL	**12**	**08**	**08**	**28**	**360**	**540**

SEMESTER-V

S.No	Course Code	Course Title	L	T	P	C	Int.	Ext.
THEORY								
1	**BCA501**	.Net Framework & C#	2	1	0	3	40	60
2	**BCA502**	Embedded System	2	1	0	3	40	60
3	**BCA503**	Computer Graphics	2	1	0	3	40	60
4	**BCA504**	Secure Computing	2	1	0	3	40	60
5	**BCA505**	Advanced DBMS	2	1	0	3	40	60
6	**BCA571**	Lab in C#	0	1	3	4	40	60
7	**BCA572**	**Mini Project**	0	1	8	9	120	180
		TOTAL	**10**	**7**	**11**	**28**	**360**	**540**

SEMESTER-VI

S.No	Course Code	Course Title	L	T	P	C	Int.	Ext.
THEORY								
1	**BCA601**	Image Processing	4	2	0	6	80	120
2	**BCA602**	Multimedia Systems	4	2	0	6	80	120
3	**BCA671**	**Main Project**	0	2	10	12	160	240
		TOTAL	**8**	**6**	**10**	**24**	**320**	**480**

DETAILED STRUCTURE OF BCA CURRICULUM

SEMESTER-I:

Paper-1: Mathematics-I (BCA101)

8 Lectures

1. **Linear Algebra:** Basis and Dimension, Linear transformations and their matrix representations, Matrix algebra, Rank of matrix, Echelon and normal form, Linear systems of algebraic equations, Consistency, Gauss elimination method, Homogeneous and non-homogeneous systems of equations, Inverse of matrices, Determinants, Characteristics polynomial, Eigen values and eigenvectors, Cayley-Hamilton theorem, Eigenvalues of Hermitian unitary matrices, Solution of linear and non-linear systems.

8 Lectures

2. **Differential Calculus:** Limit, Continuity & differentiability of functions of one variable, Mean-value Theorems, Rolle's Theorem, Leibnitz formula for nth derivatives of products of functions, Taylor and Maclaurin Theorems, Maxima, Minima and Tangent plane, Tangent lines and normals,

8 Lectures

3. **Integral Calculus:** Theorems of integral calculus, Evaluation of definite & improper integrals, Introduction to Functions of several variables: Partial differentiation, Change of variables in partial differentiation.

8 Lectures

4. **Ordinary Differential Equations:** Ordinary differential equations of first order, Separable, exact & linear equations, Existence and uniqueness theorems (Statement only)

8 Lectures

5. **Ordinary Differential Equations: Higher Order:** Higher order linear equations, Wronskians Method of variation of parameters for particular solutions, Euler's and Cauchy's equations, Systems of first order equations with constant coefficients

References:

1. Advanced Engineering Mathematics, Erwin Kreyszig
2. Calculus: Volume I, Aposto
3. Calculus and Analytical Geometry, G.B. Thomas & Finney
4. A Course in Ordinary Differential Equations, Rai, Chaudhary & Friedman
5. Higher Engineering Mathematics, B S Grewal
6. Mathematical Methods, Potter and Goldberg
7. Matrix Theory, David Lewis

Paper-2: Statistics (BCA102)

8 Lectures

1. **Elementary Probability:** Random Experiments, Sample space, Events, Definitions of probability, Probability of union of events, Conditional Probability, Bayes' theorem, Independence of events,

8 Lectures

2. **Random Variables:** Random variables, Distribution functions, Probability Mass Function (PMF) of Discrete Random Variables, Probability Density Function (PDF) of continuous random variables, Mathematical expectation, Moments.

8 Lectures

3. **Probability Distribution:** Discrete uniform distributions, Bernoulli distribution, Poisson distribution, Binomial distribution, Continuous uniform distribution, Normal distribution, Exponential distribution, Reliability function and instantaneous failure rate for exponential distribution

8 Lectures

4. **Statistical Methods:** Measures of Central Tendency, Dispersion, Simple linear regression, Method of least squares, Correlation Coefficients, Point and interval estimation, Unbiased, sufficiency, likelihood function and maximum likelihood estimator, Confidence interval for the mean of normal distribution

8 Lectures

5. **Statistical Inferences:** Sampling distributions: $\chi 2$, t and F distributions, Basic concept of testing of hypothesis, Role of p-value, Standard tests based on $\chi 2$, t and F distributions

References:

1. Fourier series and Boundary Value Problems, Churchill R.V. (McGraw Hill)
2. Probability and Statistics for Engineers, Irvrin Miller & Friend (Prentice Hall of India)
3. Engineering Statistics, Bowker and Lieberman (Prentice Hall of India)
4. Introductory Statistics and Probability for Engineering Science and Technology, Kirk – Patrick (PHI)
5. Modern Probability Theory and its Applications, Parzen E. (Wiley Eastern)

Paper-3: Basic Circuit Analysis (BCA103)

8 Lectures

1. **Purpose and role of circuit and electronics in computer engineering:** Difference between analog and digital circuits; Properties of material that make them useful for constructing electronic devices; definition and representation of basic circuit elements: resistance, inductance and capacitance; basic electrical quantities and relation between them (charge, current, voltage, energy and power).

8 Lectures

2. **Basic DC and AC circuit design:** Introduction to solving problems using Ohm's law including its power representation, using ohm's law to analyze basic electrical circuits; difference between resistance and reactance; the meaning of phase and the effect of frequency on capacitance and inductance; role of inductance and capacitance as basic storage elements.

8 Lectures

3. **Analysis of Basic Electrical Circuit:** Analysis of basic electrical circuits using Mesh and Nodal analysis; Kirchoff's law; Superposition theorem; Thevenin Theorem and Norton Theorem; Analysis and design of simple RLC circuits; frequency domain characteristics of electrical circuits; impedance and admittance; characteristics and uses of transformers.

8 Lectures

4. **Introduction to logic families**: RTL, DTL, TTL, ECL, MOS and CMOS circuits and comparison of their performance; interfacing different logic families; mixed signal circuit design; design parameter and issues; circuit modeling and simulation methods; effects of device parameters and various design styles on circuit characteristics such as timing, power and performance.

8 Lectures

5. **Electrical Measurements and Measuring Instruments:** Principles of operation and construction of moving coil, Moving iron, Dynamometer and induction types of Ammeters & Voltmeters; Extension of their ranges; Measurements of power- Three-ammeters and three voltmeters methods of measuring power in Single phase circuits; Construction of Watt meters; Induction and dynamometers types.

References:

1. Electric Circuit Analysis, B. Subramanyam (IKBooks).
2. Fundamentals of Electric Circuits, Charles K. Alexander, Matthew N. O. Sadiku.
3. Schaum's Outline of Basic Circuit Analysis, John O'Malley.
4. Microeletronic Circuits: Theory and Applications, Sedra & Smith.

Paper-4: Fundamentals of Programming (BCA104)

8 Lectures

1. **Algorithm development and C language Programming:** Structure and properties of algorithm, Flow chart, Algorithms for g.c.d., Factorial, Fibonacci series, Prime number generation and other simple problems, searching & sorting techniques. Basics of C Language: History, Introduction to C, Structure of C programs, Compilation & execution of C programs, Debugging techniques, Data types & sizes, Declaration of variables, Modifiers, Identifiers & keywords, Symbolic constants, Operators: Unary operators, Arithmetic & Logical operators, Bit-wise operators, Assignment operators and expressions, Conditional expressions, Precedence & order of evaluation.

8 Lectures

2. **C Language Features:** Control statements: If-else, Switch, Break, Continue, Comma operator, Go-to statement; Loops: For, While, Do-while; Functions: Built-in & User-defined, Function declaration, Definition & function call, Parameter passing: Call by value, Call by reference, Recursive functions, Multi-file programs, Command line parameters.

8 Lectures

3. **Arrays:** Linear arrays, Multi-dimensional arrays, Passing arrays to functions, Arrays & Strings; Storage classes: Automatic, External, Register & Static, Enumerations.

8 Lectures

4. **C Directives:** Macros, C pre-processor;Structures & Union: Definition and differences, Self-referential structure; Pointers: Value at (*) and address of (&) operator, Pointer to pointer, Dynamic memory allocation, Calloc & Malloc functions, Array of pointers, Function of pointers, Structures and pointers.

8 Lectures

5. **File Handling in C:** Opening, Closing and creating a data file, Read and Write functions, Unformatted data files

References:

1. The C Programming Language, B.W. Kernighan and D.M. Ritchie (PHI)
2. Programming using the C language, R.C. Hutchinson and S.B. Just (McGraw Hill)
3. Outline of Theory and Problems of Programming with C, B.S. Gottfried (Schaum McGraw Hill)
4. C: The Complete Reference, H. Schildt (McGraw Hill)

Paper-5: Communication Skills (BCA105)

8 Lectures

1. **Introduction to Communication:** Importance of communication, Communication in primitive societies, Verbal and non-verbal, One way and two way communication, Objectives of communication: Information, Advice, Order, suggestion, Persuasion, Education, Warning, Raising morale, Motivation, Mass communication, Written and oral communication, Visual communication, Audio-visual communication, Role of news papers, Radio, Cinema and TV.

8 Lectures

2. **Principles of communication:** Clarity, Completeness, Conciseness, Consideration, Courtesy, Correctness, Choice of the right word, the art of listening- learning through listening- body language.

8 Lectures

3. **Types of Communication:** Official and business communication, Process of communication, Downward, Upward and horizontal communication, Essential of good communication, Level of communication- inter and intra personal, group to person, group to group, Methods of effective oral, Written and non-verbal communication, Horizons-tone, frequency, rate, volume, depth, Barrier to communication and over coming barriers, Listening skill, Use of audio visual aids for effective communication.

8 Lectures

4. **Comprehension:** Comprehension of ideas in a passage, Expansion of an idea for a particular purpose, Summarizing a passage for official usage, Communication a given idea to suit different contexts, Report writing- importance of reports, preparing a report, technical report writing.

8 Lectures

5. **Communication Aids:** Prose Text Book, Precis writing, Grammar, Words, Idioms, Antonyms and synonyms, Using Microsoft Office Suite, Antonyms change of words into different parts of speech, Correspondence: Drafting personal letters, CV, Application for jobs, Business letters, Official letters, Project preparation, Report writing, Power-point presentation. Professional practice and related ethical codes.

References:

1. Essentials of Business Communication, Rajendra Pal & J S Korlahalli
2. Business Communication, Gyani
3. Effective Communication, Ludlow and Panthon
4. A Practical English Grammar, Thomson and Marlinet
5. English Conversation Practice, Grount Taylor
6. Developing Communication Skills, Krishna Mohan and Meera Banerji
7. Business Correspondence and Report Writing, R C Sharma and Krishna Mohan
8. Communication Skill, R Datta Roy and K K Dhir

Paper-6: Business Systems (BCA106)

8 Lectures

1. **Introduction to Business Data Processing:** Overview of Business systems; Management Functions, Levels of Management; Sources of Information, Applications like Payroll, Accounting, Inventory, MIS, DSS

8 Lectures

2. **Concept of Files:** File organization and handling: Sequential, Direct and Index Sequential; Usage of Inverted Files, Master & Transaction files, Modes of Processing: Batch, Online & Real Time, Report Generation Techniques, Multiple file handling and updation.

8 Lectures

3. **Business Applications:** Design Analysis & Development of Computerized Financial Accounting, Payroll, and Inventory Control, ERP etc.

8 Lectures

4. **Introduction to fundamental design activities:** Fundamental design activities; Information & Information Systems; relation between knowledge and information; Characteristics of information; Information System Design; Modeling approaches; System development activities; System life cycle; System design methodology; Information system analysis approaches; Structured analysis & design.

8 Lectures

5. **Usage of Design Tools:** DFD, decision tables and trees; Completeness of decision tables; Resolution of data access conflicts; Software design for maintainability; Decision Table; Object oriented analysis & design; Creating systems with acceptable response times, Estimation of design parameters; workload analysis of system design specifications; Context diagram and Data Flow Diagram

References:

1. Business & Information systems by Nickerson, PHI
2. Business Data Communication by Stallings, PHI
3. Business Data Network & Telecommunications, by Panko, PHI

SEMESTER-II:

Paper-1: Mathematics-II (BCA201)

8 Lectures

1. **Infinite Series** : Convergence and divergence of infinite series, Integral test, Comparison test, Ratio test, Cauchy's root test, Series of positive and negative terms, Absolute convergence, Alternating series, Power series and their convergence, Taylor and Maclaurin series

8 Lectures

2. **Complex Variables:** Complex numbers, Complex plane, Modulus and argument representation of complex numbers, Roots of complex numbers, Complex functions and mappings, Complex analytical functions: curves and regions in the complex plane, complex functions, limit, derivative, analytic function, Cauchy-Riemann equations, elementary complex functions such as powers, exponential function, logarithmic, trigonometric and hyperbolic functions, Inverse functions, Harmonic functions.

8 Lectures

3. **Vector Calculus:** Scalar and vector fields, Directional derivative & Gradient operator, Conservative fields and potential functions, Divergence and Curl of vector fields, Applications to different coordinate systems

8 Lectures

4. **Fourier Series & Fourier Transform:** Introduction to Fourier Series , Convergence of Fourier Series and their integration and differentiation, Euler formulae for Fourier coefficients , Functions having arbitrary period, Even and Odd functions , Half range expansions, Sine , Cosine and Exponential Fourier Series, Frequency and Amplitude Spectra of a function ,Fourier integral , Linearity property, Transform of derivatives, Convolution theorem, Fourier Transform Fourier Cosine and Sine Transforms .

8 Lectures

5. **Laplace Transform:** Definitions, Fundamental Ideas, Operational Properties of the Laplace Transform, Linearity property, Transform of elementary functions, Laplace transforms of derivatives and integrals, Differentiation and Integration of transforms, Convolution theorem, Inversion Integral, Use of Laplace transforms in the solution of initial problem, Unit step function, Impulse function-transforms of step functions, Transforms of Periodic functions.

References:

1. Advanced Engineering Mathematics, Erwin Kreyszig
2. Higher Engineering Mathematics, B.S. Grewal
3. Mathematical Methods, Potter and Goldberg
4. Mathematics for Engineers and Physicists, L.A. Pipes
5. Applied Mathematics for Mathematician & Engineers: L A Pipes (TMH)
6. Engineering Mathematics: H K Das (S Chand & Co. Ltd.)
7. Engineering Mathematics: B.S. Grewal (Khanna Pub.)

Paper-2: Basic Electronics (BCA202)

8 Lectures

1. **Semiconductors and PN Junction Diode:** Properties of semiconductors, Intrinsic and extrinsic semiconductors, P and N type of impurities and doping, Charge densities and potential barrier, Draft and diffusion currents, PN junction working and characteristics, It's applications as – Rectifier: Half wave, Full wave, Bridge Rectifier and their calculation for ripple, Efficiency and PIV; Clipper, Clamper and voltage doublers, Zener and Avalanche breakdown diodes, Tunnel diode, Varactor diode, Thermister.

8 Lectures

2. **Bipolar Transistor:** Transistor action with simple bias conditions, Working and basic characteristics, CB, CE & CC configuration of transistor amplifiers, Analysis for CB and CE basic amplifiers- Determination of Q-point, dc load line and calculations for gains and impedances, Effect of load and ac load line

8 Lectures

3. **Transistor biasing:** Biasing circuits for CB and CE configurations, Leakage currents in CB & CE and it's effect, Thermal stabilization & Stability factor, Different biasing arrangements for CE- their advantages and drawbacks, Transistor thermal power dissipation and rating. Equivalent Circuits of Transistor: Transistor as four port device, Impedance, Z-parameters and circuits representation, Admittance Y parameters and circuit representation, h-parameters and circuit representation; Analysis of CB and CE circuits using h-parameters for gains and impedances

8 Lectures

4. **Field Effect Transistors**: Basic configuration of JFET, Biasing, Principle of operation and basic characteristics, Basics of MOSFET

8 Lectures

5. **Power supplies:** Block diagram of Power Supply (PS) and it's constituent circuits , Electronics voltage stabilizer, Zener and transistor circuits for stabilization, Constant current, and current limited PS, Basics of SMPS and UPS.

References:

1. Electronic Devices and Circuits, Allen Motersheid
2. Integrated Electronics, Jacob Millman
3. Electronic Devices and Circuit Theory, L. Boylestad and Nashelsky
4. Handbook of Electronics, Gupta and Kumar

Paper-3: Digital Electronics & Computer Organization (BCA203)

8 Lectures

1. **Introduction:** Generation of Computers, Functional block diagram of a computer, Hardware and Software, Generation of programming languages, CPU, Memory, I/O, Secondary storage, DOS and Windows environment. Digital Integrated Circuits: Characteristics of digital ICs.

8 Lectures

2. **Logic Gates:** Level minimization: realization of switching expressions by Karnaugh map and Quinne-Mclusky methods combinational circuits and their analysis. Realization of switching expressions by two level AND, OR, invert gates, NAND gates only, NOR gates only and Ex-OR and AND gates only.

8 Lectures

3. **Combinational logic circuits:** Binary adder and Subtractor circuits, Magnitude comparator, Decoders, Encoders, Multiplexer and demultiplexer, Realization of switching expressions by decoders, encoders, multiplexer and Demultiplexer, Programmable logic circuits, Tri-state logic, Memory Elements.

8 Lectures

4. **Sequential Logic Circuits:** Sequential circuits, latches and Flip Flops, Analysis of clocked sequential circuits. State reduction and assignment, design of synchronous circuits, shift registers, ripple counters, synchronous counters. Asynchronous Sequential Logic: Analysis procedure, circuits with latches, Design procedure, reduction of states and flow tables .Races and race Free State assignments, Hazards.

8 Lectures

5. **Computer Organization:** Basic building blocks of digital computer- Essential & non-essential components; Types of storage elements- Static memory, Dynamic Memory, EDORAM, SDRAM, NVRAM, DDRRAM etc. Basic model of stored program computer, Instruction sets: Reduced, Complex. Addressing schemes, Instruction execution mechanism, Organization of CPU, Memory organization, RAM, ROM, Cache Memory, addressing cells in the cache memory: Associative and Direct memory organization, I/O devices with special reference to modern peripheral devices.

References:

1. Digital Design: M.Morris Mano (PHI)
2. Digital circuits & logic design: S.C.Lee (PHI)
3. Digital electronics (circuits, systems & ICs): S.N.Ali (Galgotia pub.)
4. Digital electronics: W.H.Gothmann (PHI)
5. Switching theory: A.K Gautam (Katsons)

Paper-4: Data Structures (BCA204)

8 Lectures

1. **Introduction:** Data Abstraction and Algorithm, Analysis , Data types / objects / structures, Abstract definition of data structures , Representation and implementation, Time requirements of algorithms, Space requirements of algorithms. Array implementation and addressing with examples Array applications and representation, Polynomials, Sparse matrices, String-pattern Matching. Linked list: Singly linked lists, list heads, circular list, doubly liked lists, orthogonal lists, generalized (recursive) lists, applications.

8 Lectures

2. **Stacks and queues:** Basic ideas, array and linked representation. Prefix/ infix / postfix expressions and their inter-conversion for evaluation, Priority, queues and simulation, Recursion.

8 Lectures

3. **Graph and Trees:** Graphs: Definition, terminologies and properties, Graph representations, Minimum spanning trees, Depth-first search , Breadth-first search , Networks. Trees: Definition, terminologies and properties, Binary tree representation traversals and applications, Threaded binary trees, Binary Search trees, AVL Trees

8 Lectures

4. **Dynamic storage management and garbage collection:** The fragmentation problem, first fit, best fit, next fit boundary tags, buddy system. Garbage collection-free lists, reference counts, marking algorithms.

8 Lectures

5. **Sort and search Algorithms:** Internal and External Sorting algorithms, Heap sort, Merge sort, Quick-sort, General radix sort, Symbol tables, sequential search, Binary search, Interpolation search. Hashing: Hash functions, collision resolution techniques (chaining , linear offset, others).

References:

1. Data Structures and Program Design- Robert Kruse.
2. Data Structures- Horowitz and Sahni
3. Data Structures through C- A. Tennenbaum

Paper-5: Linux & Shell Programming (BCA205)

8 Lectures

1. **Introduction:** Linux introduction and file system - Basic Features, Advantages, Installing requirement, Basic Architecture of Unix/Linux system, Kernel, Shell. Linux File system-Boot block, super block, Inode table, data blocks, How Linux access files, storage files, Linux standard directories.

8 Lectures

2. **Commands for files and directories**: cd, ls, cp, md, rm, mkdir, rmdir, pwd, file, more, less, creating and viewing files using cat, file comparisons – cmp & comm, View files, disk related commands, checking disk free spaces. System startup and shut-down process, init and run levels.

8 Lectures

3. **Commands:** Essential linux commands, Understanding shells, Processes in linux-process fundamentals, connecting processes with pipes, tee, Redirecting input output, manual help, Background processing, managing multiple processes, changing process priority with nice, scheduling of processes at command, cron, batch commands, kill, ps, who, sleep, Printing commands, find, sort, touch, file, file related commands-ws, sat, cut, dd, etc. Mathematical commands- bc, expr, factor, units. Creating and editing files with vi, joe & vim editor

8 Lectures

4. **Shell Programming:** Shell programming- Basic of shell programming, Various types of shell available in Linux, comparisons between various shells, shell programming in bash, read command, conditional and looping statements, case statements, parameter passing and arguments, Shell variables, system shell variables, shell keywords, Creating Shell programs for automate system tasks.

8 Lectures

5. **Filtering:** Simple filter commands – pr, head, tail, cut, paste, sort, uniq, tr; Filter using regular expressions – grep, egrep, and sed; awk programming – report printing with awk.

References:

1. Linux & Shell Programming,
2. Beginning Shell Scripting by Erick Foster-Johnson, Wiley India
3. Beginning Linux Programming, Neil Mathew, Richard Stones, Wiley India

Paper-6: Principles of Programming Languages (BCA206)

8 Lectures

1. **Introduction and Language Processors:** Characteristics of programming Languages, Factors influencing the evolution of programming language, Development in programming methodologies, desirable features and design issues. Language processors: Structures and operations of translators, software simulated computer, syntax, semantics, structure, virtual computers, binding and binding time

8 Lectures

2. **Elementary and structured data type:** Data object variables, constants, data type, elementary data types, declaration, assignments and initialization, enumeration, characters, strings. Specification of data structured types, vectors and arrays, records, variable size data structure, pointers and programmer constructed data structure, Set files.

8 Lectures

3. **Imperative and Object Oriented Languages:** Block structure, Scope rules, Parameter Passing, Construct like co-routines, Tasks etc. Object Oriented concepts: The class notion- Information hiding and data abstraction using classes, derived classes and inheritance, Polymorphism, Parameterized types.

8 Lectures

4. **Functional languages:** Functional programming concepts – Referential transparency – Types – Type systems - Names, bindings, environment and scope – Recursive functions – Polymorphic functions – Type variables – High order functions – Curried functions – Lists and programming with lists – Definition of new user defined types in ML – Abstract data types – Evaluation methods.

8 Lectures

5. **GUI Programming:** GUI vs CUI; Event Driven Programming; Visual Programming; VB Environment: Steps in creating & using controls; Notion of Scripting; Scripting via Perl

References:

1. Terrance W Pratt, "Programming Languages: Design and Implementation", PHI.
2. Sethi, "Programming Language", Addison Wesley.
3. E Horowitz, "Fundamental of Programming Languages", Galgotia.
4. Pratt, Zolkowitz, "Programming Languages Design Implementation", Pearson Edition.
5. Tucker Noonan, "Programming languages: Principles and Paradigms", TMH
6. D. A. Watt, "Programming Languages and Paradigms", PHI
7. Julia Case Bradley & A.C.Millspaugh "Programming in VB 6.0"

SEMESTER-III:

Paper-1: Discrete Structures & Graph Theory (BCA113)

8 Lectures

1. **Propositional Logic:** Statements, Connectives, Statement formulas, Truth functional rules, Interpretation of formulas, Tautologies, Equivalence, Functionally complete set of connectives, Normal forms, Inference, Theory of statement calculus, Consistency of premises, Mechanical theorem proving,

   8 Lectures

2. **Predicate Logic:** Predicates, Statement functions, Quantification, Interpretation of predicate formulas, Inference theory for predicate calculus, Informal & formal proofs, Prenex normal form

   8 Lectures

3. **Set Theory:** Relations, Relation matrix, Transitive closures, Partitions and equivalence relations, Characteristic functions of a set, Principle of inclusion and exclusion, Its applications

   8 Lectures

4. **Directed Graphs:** Definition, Simple digraphs, Matrix representations, Paths, Distances, Connectedness of digraphs, Path and reachability matrices, Boolean sum and product of bit matrices, Warshall's algorithm for transitive closure of relations

   8 Lectures

5. **Lattices and Boolean Algebra:** Partially ordered sets, Hasse diagrams, Lattices, Distributive and Modular lattices, Complements, Boolean Algebra, Atoms and join irreducibility, Stone representation theorem, Boolean expressions, Free Boolean Algebra, Boolean functions, Normal forms representation and minimization of Boolean functions, Symmetric Boolean functions

References:

1. Discrete Mathematical Structures with Application to Computer Science- Tremblay & Manohar
2. Discrete Mathematical Structures – Preparata and Yeh

Paper-2: Design & Analysis of Algorithms (BCA114)

8 Lectures

1. **Algorithm Analysis Techniques:** Asymptotic notations, Recurrences: substitution, iteration and master methods; Divide-and-conquer: general approach, binary search, merge sort, quick sort, Strassen's matrix multiplication; Greedy algorithms: general approach, activity selection, knapsack problem, minimum-spanning tree, Dijkstra's algorithm, Huffman code.

   8 Lectures

2. **Dynamic Programming:** General approach, multi-stage graph, matrix-chain multiplication, all-pairs shortest paths, traveling salesperson, 0/1 knapsack problem, longest common subsequence

   8 Lectures

3. **Backtracking:** N-queen problem, sum of subsets, knapsack problem, generation of all cliques, traveling salesperson problem, Graph coloring. Branch-and-Bound: Assignment problem, 0/1 knapsack problem

   8 Lectures

4. **Randomizing Algorithms:** Numerical Integration, Primality testing, randomized min-cut, randomized algorithm for n-queens, quick-sort

   8 Lectures

5. **Approximation and Lower Bound Theory:** Job scheduling, Bin packing, Set cover, Max cut. Lower Bound Theory: Decision tree; Reduction method; NP-completeness

References:

1. Fundamental of Computer algorithms – Horowitz and Sahni
2. The art of Computer Programming – Donald Knuth
3. Design Methods and Analysis of Algorithms – S.K. Basu
4. The Design and Analysis of Computer Algorithms – Aho, Hopcraft and Ullaman
5. Genetic Algorithm in Search, Optimization and Machine Learning – David E. Goldberg

Paper-3: Introduction to System Software (BCA115)

8 Lectures

1. **General concepts**-Review of assembly and machine language programming, distinction between system software and application software, Language processors:-Introduction , Language processing activities. Assemblers:- Elements of Assembly language programming, A simple assembly scheme, Pass structure of assemblers, Design of two pass assemblers.

8 Lectures

2. **Macros and macro processors**:- Macro definition and call, Macro expansion, Nested macro calls, advanced macro facilities, design of macro pre processor Linker-Relocation and linking concepts-self relocating programs. Loader-Types of loaders Editor-Types of editors-Components of editor-Debug monitor

8 Lectures

3. **Introduction to compiling**:- Compilers, Analysis of a source program, the phases of a compiler, Lexical analysis:-The role of the lexical analyzer, Input buffering, specification of tokens Recognition of tokens, Finite automata, Conversion of an NFA to DFA, From a regular expression to an NFA

8 Lectures

4. **Syntax analysis**:- the role of the parser, Context free grammars, writing a grammer, Top dowm parsing Bottom up parsing, syntax directed translation-syntax directed definition, , Construction of Syntax Tree, L R parsers-LR parsing algorithm, Constructing SLR parsing tables, SLR parsing table

8 Lectures

5. **Intermediate code generation**-postfix notation, syntax tree, three-address code, basic blocks and flow graph, the DAG representation of basic blocks, Backpatching, Code optimization:- The principal sources of optimization, optimization of basic blocks, loops in flow graphs, Peephole optimization Code Generations:- Issues in the design of a code generator, simple code generator

References:

1. Systems Programming- Donovan
2. Introduction to Systems Software- Dhamdhere D.M.

Paper-4: Object Oriented Programming using C++ (BCA116)

8 Lectures

1. **Object Modeling:** Object & Classes, Links & Associations, Generalization and Inheritance, Aggregation, Abstract Classes, Multiple Inheritance, Metadata, Constraints, a sample object model.

8 Lectures

2. **Dynamic Modeling:** Events & States, Operations & methods, State diagrams, concurrency, a sample dynamic model.

8 Lectures

3. **Programming in C++:** Classes, objects, functions, constructors, destructors, inheritance, polymorphism, virtual functions, class templates, Function templates, Working with files.

8 Lectures

4. **Object Oriented Testing:** Difference between structured and OBJECT ORIENTED testing, Test case design model.

8 Lectures

5. **OMT Methodologies:** Comparison of SA/ SD & JSD, Translating OBJECT ORIENTED design into implementation, An example of OBJECT ORIENTED design.

References:

1. Object-Oriented Modeling and Design:Rumbaugh et al
2. Object Oriented Design :Booch
3. Object Oriented Programming in C++ :Lafore
4. Software Engineering: A practitioner's Approach Pressman

Paper-5: Database Management System (BCA117)

8 Lectures

1. **Introduction:** Data, information and knowledge, Characteristics of database approach, Data independence, Architecture of database system, Data dictionary, Types of database language, database system life cycle, Overview of hierarchical, network and relational model. Relations and Codd's rules, Concepts of keys.

8 Lectures

2. **Relation Algebra**: Select, Project, Joins, Set operations, Update operations – tuple relational calculus, Relational Calculus vs. relational algebra.Data definition, data manipulation, view definition, nested queries, updation, Embedded SQL, Handling of nulls and cursors.

8 Lectures

3. **Data Models:** Conceptual, Logical and Physical design, ER models, ER diagrams, Strong and weak entity sets, Generalization, Specialization and Aggregation, Conversion of ER model into relational schemas

8 Lectures

4. **Normalization:** Normalization concepts, Functional dependencies and dependency preservations, Normal forms – 1NF, 2NF, 3NF, BCNF, 4NF, 5NF, DKNF, Indexing, File organization, De-normalization, Clustering of tables and indexes.

8 Lectures

5. **Transaction Handling:** Transaction recovery, System recovery, two phase commit, concurrency problems, locking, deadlocks, security, discretionary and mandatory access control, data encryption

References:

1. Introduction to Database System – C.J. Date
2. Database Systems – Mcfadden et.al.
3. Database Concepts – Navathe et.al.
4. Database Structured Techniques for Design Performance – S. Atre

Paper-6 : Computer Architecture & Microprocessors (BCA118)

8 Lectures

1. **Computer Architecture:** Concept of scalar processors; concept of scalar pipelined processors; pipeline hazards; super pipelining; super scalar architecture.

8 Lectures

2. **Microprocessors:** Essential & non-essential components, functional block diagram of a microprocessor; Addressing modes, Comparative study of 8-bit microprocessors, Comparative study of 16-bit microprocessors.

8 Lectures

3. Detailed study of 8085 and 8086; introduction to peripheral chips: Serial and parallel interface; to design systems around 8085 and 8086

8 Lectures

4. **Memory and I/O management techniques:** memory management, Concept of virtual memory, memory interleaving, I/O methods- Polled I/O, Interrupt driven I/O and Direct I/O: I/O addressing and I/O interfacing.

8 Lectures

5. **Assembly Language:** Assembler, Machine language instruction processor, Completeness of instruction set, Assembly language programs for common application problems such as Maximum finding, Summation, Sorting, Searching, Multiple precision arithmetic, Delay routines, etc.

References:

1. Digital Computer Electronics : Malvino
2. Microprocessor Architecture Programming Applications with 8085/8080A: Brey
3. Digital System Design and Microprocessor: Hayes, John P.
4. Computer Architecture and Organization: Hayes, John P.
5. Computer System Architecture: Mano, M. M.

SEMESTER-IV:

Paper-1: Operating System (BCA401)

8 Lectures

1. **Overview:** Introduction to OS – its functional behavior and responsibilities, Need for some of monitor/command interpreter, Types of operating systems, System structure, Hierarchical and layered organization of OS, I/O methods and interrupt structure.

8 Lectures

2. **Process Concepts:** Process definition, Process states and state transitions, Parallel processes and constructs, Process interaction, Operating system kernel, Data structures for processes and resources, Context switching, Process control primitives, Process scheduling.

8 Lectures

3. **Process Synchronization and Deadlock:** The determinacy problem, Mutual exclusion, Semaphores, Process synchronization, Conditional critical regions and monitors, Inter-process communication, Deadlock problem and its solutions.

8 Lectures

4. **Memory Management:** Memory management concepts, Relocation, Linking,_Multiprogramming with fixed partitions, Swapping, Variables partitions, Overlays, Virtual memory, Segmentation, Paging, Storage allocation strategies, Load control and thrashing

8 Lectures

5. **File and I/O Management:** Organization of file and I/O subsystems, Directory management, Basic file system, file descriptors, File manipulation, File organization methods, Management of auxiliary storage space, Command language and file system utilities, I/O subsystems, Programmed I/O, DMA, Interrupt driven I/O, Recovery procedures. Protection and Security: Safeguards, Penetration, Access and Information flow control, Protection problems, Formal models of protection.

References:

1 Introduction to Operating Systems: Deitel
2 Operating System Concepts: Peterson and Silbershatz
3 Modern Operating Systems: Andrew S Tanenbaum

Paper-2: Operation Research (BCA402)

8 Lectures

1. **Network Analysis:** Terminology of network, Shortest route problem, minimal spanning tree problem, max-flow problem.

8 Lectures

2. **Project Scheduling by PERT/CPM:** Diagram, representation, critical path calculation, construction of time chart and resource labeling, probability and cost consideration in project scheduling, project control.

8 Lectures

3. **Linear and Non Linear Programming:** Simplex Method, Revised simplex method, Duality in Linear programming, Application of Linear Programming to Economic and Industrial Problems. Nonlinear Programming: The Kuhn-Tucker conditions, Quadratic programming, Convex programming.

8 Lectures

4. **Replacement Models:** Introduction, Replacement policies for items whose efficiency deteriorates with time, Replacement policies for items that fail completely

8 Lectures

5. **Sequencing Model:** Classification of self problems, processing of n jobs through two machines, three machines, processing of two jobs through m machines

References:

(1) Operations Research- Taha
(2) Introduction to Operations Research- B.E. Gillet
(3) Optimization Theory and Applications- S.S.Rao
(4) Linear programming- G.Hadley

Paper-3: Data Communication & Networks (BCA403)

8 Lectures

1. **Introduction:** History of data communication, Open system standard, Definition of communication link and its application in telephony and computer networks, Importance of channel bandwidth and system noise, Protocols in telephony and internet communication, Types of channel, Advantages and disadvantages of analog and digital transmissions, Digitizing Speech, Wave form coding and companding, Voice over IP.

8 Lectures

2. **Data Transmission Basics:** Synchronous/Asynchronous, Error detection and correction methods, Data compression, Protocol basic, Circuit, Message, Packet and Cell switching, Connection oriented and connectionless services, importance of modulation and multiplexing in communication: introduction to different modulation and multiplexing techniques; importance of Nyquist Criterion and Shannon's theorem in communication; delay, bandwidth, throughput and noise.

8 Lectures

3. **Computer Networks:** Advantages and disadvantages of computer networks; classification of computer networks; introduction to various physical media in connection oriented and connection less networks; network protocols and their role in computer network. Layered approach to network design- ISO/OSI and TCP/IP model.

8 Lectures

4. **Network Topology and Network Devices:** Network topology, LAN wired/wireless, Ethernet, CSMA/CD, CSMA/ CA, Token passing rings, FDDI, Introduction to networking devices- repeaters, hubs, Switches, Bridges, Routers and gateways, Switching techniques: Store and forward, Filter, Next-Hop forwarding, Introduction to routing techniques- Link state routing and distance Vector routing.

8 Lectures

5. **Internetworking:** IP addressing, Address binding with ARP, Datagram encapsulation and fragmentation, Sub-netting and implementation of CIDR, UDP and TCP, TCP segment format, Adaptive retransmission, ICMP and error handling. Network applications, Client-Server concepts and application, DNS, HTTP, Email and web browsing, Broadband Multi-Service networks, Cell based networks, ISDN.

References:

1. Computer Networks :Tanenbaum, A.S
2. Data and Computer communication :Stallings, William
3. Inter Networking With TCP/IP Vol I, II,III: Comer, D.E. and Stevens D.L.
4. Computer Network and Distributed Data Processing : Martin.J.
5. Local Networks : Stalling, William
6. Data Communication and Networking : Forouzan, B.A

Paper-4: Software Engineering (BCA404)

8 Lectures

1. **Introduction:** Introduction to Software Engineering: Software development process; Life Cycle models – Waterfall, Spiral, Evolutionary, Prototype. Software Production Process**:** Process Models - ; Methodologies; Standards

8 Lectures

2. **Software Project Management and Design:** 4 Ps; Project Planning; Cost estimation – Loc, Function point, COCOMO; Work estimation; Resource estimation; Risk Analysis; Project Scheduling; Quality Plans; Project control. **Software Design: Abstraction**; Modularity; Cohesion; Coupling

8 Lectures

3. **Software Testing:** Black box vs White Box; Testing in the large vs Testing in the small; System Testing; Debugging; Validation vs Verification

8 Lectures

4. **Software Quality Assurance:** Quality Models; Software Quality Assurance Activities, Software configuration management; Software Reliability; Introduction to SEI-CMM

8 Lectures

5. **Software Maintenance and Case Studies:** Maintenance concepts and tasks; Side effects; Reverse Engineering; Re-engineering. CASE concepts, Use and applications.

References:

1. Software Engineering: Ian Sommerville, Pearson Education
2. Software Engineering: R. S. Pressman, McGraw Hill
3. An Integrated Approach to Software Engineering: Pankaj Jalote

Paper-5: Web Programming Using JAVA (BCA405)

8 Lectures

1. **Introduction to object oriented programming:** Features of Java; constants, variables and data types, Operators and expressions; decision making, branching and looping; Classes, objects and Methods; arrays, strings and vectors.

8 Lectures

2. **Inheritance & File Handling:** Interfaces; Managing Input/Output Files in Java; Packages, Exception Handling, Multithreaded Programming; Utility Classes; String Handling; Generics, Generic Class, Generic methods.

8 Lectures

3. **Applet Programming**: Life cycle of an applet; Adding images to an applet; Adding sound to an applet; Passing parameters to an applet, Event Handling; Introducing AWT: Working with Windows Graphics and Text. Using AWT Controls, Layout Managers and Menus.

8 Lectures

4. **JDBC Overview:** JDBC implementation; Connection class; Statements; Catching Database Results, handling database Queries; Networking: InetAddress class – URL class- TCP sockets - UDP sockets.

8 Lectures

5. **Web Page Design:** Web page Designing using HTML, Scripting basics-Client side and server side scripting. Java Script-Object, names, literals, operators and expressions- statements and features- events- windows- documents- frames- data types- built-in functions- Browser object model- Verifying forms; Servlet – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, using Cookies, Session Tracking. Introduction to JSP.

References:

1. Burdman, "Collaborative Web Development", Addison Wesley.
2. Sharma &Sharma, "Developing E-Commerce Sites", Addison Wesley
3. Ivan Bayross, "Web Technologies Part II", BPB Publications.
4. Margaret Levine Young, "The Complete Reference Internet", TMH
5. Naughton, Schildt, "The Complete Reference JAVA2", TMH
6. Balagurusamy E, "Programming in JAVA", TMH

Paper-6: Numerical Methods (BCA406)

8 Lectures

1. **Linear and Non-Linear Equations:** Numerical Analysis: Floating point representation of numbers, Errors in numerical computations, sources of errors, significant digits. Numerical solution of system of linear equation, LU decomposition, Gauss elimination method, Gauss-Siedel method , Rate of convergence, Matrix Inversion. Roots of Non-linear Algebraic and Transcendental Functions , Bisection, and Newton-Raphson Methods; Regula Falsi, Secant method; Method of iteration , fixed points in iteration.

8 Lectures

2. **Differentiation and Integration**: Polynomial interpolation: Finite differences, Newton's forward and backward differences interpolation polynomials, Numerical differentiation and integration, Formulae for derivatives in the case of equally spaced points, Trapezoidal and Simpson rules, Errors of interpolation and integration formulae

8 Lectures

3. **Differentials Equations:** Numerical solution of ordinary differential equations: Taylor series method, Euler's method, Modified Euler's method, Runge-kutta methods, Solution of linear difference equations with constant coefficients, Numerical solution of boundary value problems, Methods of finite differences, Finite differences methods for solving Laplace's equation in a rectangular region

8 Lectures

4. **Curve Fitting :** Curve fitting, Method of least squares, Correlation and regression, Lines of regression.

8 Lectures

5. **Monte-Carlo Method:** Basic principles, Random sampling, Integration of one dimensional and multi-dimensional integrals by random sampling, Error estimate in Monte-Carlo methods, Metropolis Algorithm, simple applications.

References:

1. Rajaraman V., "Computer Oriented Numerical Methods", PHI
2. Gerald & Wheatley, "Applied Numerical Analyses", AW
3. Jain, Iyengar and Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Int.
4. Grewal B. S., "Numerical methods in Engineering and Science", Khanna Publishers, Delhi
5. T. Veerarajan, T Ramachandran, "Theory and Problems in Numerical Methods", TMH
6. Pradip Niyogi, "Numerical Analysis and Algorithms", TMH
7. Francis Scheld, "Numerical Analysis", TMH

SEMESTER-V:

Paper-1: .Net Framework & C# (BCA125)

8 Lectures

1. **The .Net Framework and OOPS in .Net:** Introduction, DLL Hell, CLR, CTS, MSIL, Base Class Library , Namespace and its importance , System Namespace & Other Important Namespaces , Class / Object , Inheritance , Polymorphism , Abstract Class , Interfaces , Events & Delegates

8 Lectures

2. **Basic C# and Win Forms Programming:** Introduction , Data Types , Identifiers , Arrays , Error Handling, Introduction , Window Controls – TextBox , Radio , CheckBox , Combo , PictureBox , Menu , Tab , Progress Bar , ListView , Report Viewer.

8 Lectures

3. **Process And Threads:** Threads , Creation/Stopping Of Threads , Thread Pool Concept , Monitoring a thread, Synchronizing Multiple Threads

8 Lectures

4. **Assemblies & Their Importance:** Assemblies , Private Assembly , Signing an Assembly , Shared Assemblies, Reflection

8 Lectures

5. **ADO.NET:** ADO.NET classes hierarchy , Connection , Command , Dataset , Datareader , DataAdapter , SqlDataSource

References:

1. C# Black Book by Matt Telles
2. Complete Reference ASP. Net by MacDonand, TMH
3. C# Programming Bible by Jeff Ferguson, Brian-Patterson, Wiley
4. Wrox's Visual C# 2005 Express Edition, by F. Scott-Barker, Wiley

Paper-2: Embedded Systems (BCA126)

8 Lectures

1. **Introduction to Embedded System**: Definition; Real-Time vs Non-Real-Time System; Overview of Embedded System Architecture; Specialities of Embedded System – Reliability, Performance, Power Consumption, Cost, Size, Limited User Interface, Software upgradation facility; Recent trends in Embedded System- Processor Power, Memory, Operating System, Communication Interfaceand Network capability, Programming Languages, Development tools, Programmable Hardware, Microprocessor vs Microcontroller.

8 Lectures

2. **Architecture of Embedded Systems**: **Hardware architecture**: CPU, Memory, Clock circuits, Watchdog Timer/Reset Circuitry, Chip Select, I/O methods, Debug port, Communication Interface, Power Supply,

A/D Converters; Software architecture: Services provided by OS, Architecture of Embedded OS, Categories of Embedded OS, Application software, Communication software.

8 Lectures

3. **Process of Embedded System Development**: Programming of Embedded Systems: GNU development tools, Bit manipulation using C, Memory Management, Device Drivers,, Productivity Tools, Programming in C++, Programming in Java, J2ME, Server side programming, Java Development tools.

8 Lectures

4. **Development of Embedded Systems**: Hardware platforms: Single Board Computers, PC add-on cards, Custom built hardware platforms, Microcontroller development board: Communication interfaces: Serial/Parallel, UART/USART, PPI, USB, Infra Red, IEEE 1394 Firewire, Bluetooth, Ethernet; RFID and its applications; Managing Embedded System Development Projects.

8 Lectures

5. **Embedded/Real-Time OS concepts**: Architecture of kernel, Task and Task Scheduler, Context Switching, Scheduling algorithms: EDF and Rate Monotonic, Interrupt Service Routine, Memory Management, Priority Inversion Problem, Priority Inheritance, Embedded Os, Handheld OS

References:

1. Automatic Control Systems: Kuo, B.C.
2. Real-time Computer Control: Linkens & Bennett
3. Real-time software for small systems: Leigh, A.W.
4. Programming embedded microprocessors: Fowler, R.J.
5. Real-time systems Design & Analysis: Laplante P.A.

Paper-3: Computer Graphics (BCA127)

8 Lectures

1. **Introduction**: Introduction to Graphic Display Devices; Video Basics; LED & LCD Display; Physical Interactive Devices; Output Devices; Data Generation devices; Graphical User Interface.

8 Lectures

2. **Raster Scan Graphics**: Line, Circle & Ellipse Generation Techniques; Scan Conversion; Frame Buffer; Filling algorithms.

8 Lectures

3. **Geometrical Transformations**: Two dimensional transformations; Clipping & Windowing methods for 2D images; Three Dimensional transformations; Parallel and Perspective Projections; Viewing Transformations and Viewing Systems.

8 Lectures

4. **Plane Curves and Surfaces**: Parametric and Non-parametric curves and their representations; Cubic Splines; Bezier and B Splines.

8 Lectures

5. **Space Curves and Surfaces**: Parametric surfaces; Surfaces of revolution; Sweep surfaces; Quadric surfaces; Bilear surfaces; B Spline and Bezier Surfaces; Generalized cylinders and cones; Polygon mesh and wire frames.

References:

1. Computer Graphics: Principles and Practice: Foley et al.
2. Computer Graphics: Hern and Baker
3. Procedural elements in Computer Graphics: David F. Rogers
4. Computer Graphics: A. Plastock and Gordon Kelley
5. Computer Graphics for IBM PC: J. Mcgregger and Alan Watt
6. Mathematical Elements for Computer Graphics: David F. Rogers and J.A.Adams

Paper-4: Secure Computing (BCA128)

8 Lectures

1. **Introduction:** History of Computer Crime; Data Communications & information security; Mathematical models of computer security, CIA Triad

8 Lectures

2. **Types of Ciphers:** Terminology; Mono-alphabetic ciphers; Poly-alphabetic substitution ciphers; Transpositions; Stream & block ciphers; Secure encryption systems; Public key encryption systems; RSA encryption; Hash algorithms; Secure secret key systems; DES algorithm.

8 Lectures

3. **System Threats:** Information warfare; Viruses & other Malicious code; Mobile code; Denial-of-service attacks; Social Engineering & low-tech attacks; Spam, Phishing & Trojans; Web based vulnerabilities; Controls against program threats.

8 Lectures

4. **System security mechanism:** Protecting the information infrastructure; Operating system security; Protecting memory & addressing; File protection mechanisms; Database security; Security in networks & distributed systems; LAN & Gateway security devices; Intrusion detection & Intrusion prevention devices; Identification & authentication.

8 Lectures

5. **E-commerce & web server safeguards:** Web monitoring & content filtering; Securing VoIP; Managing software patches & vulnerabilities; Legal & ethical issues in computer security.

References:

1. Bharat Bhaskar, Electronic Commerce: Framework Technologies and Applications, TMH
2. Ravi Kalakota & A.B. Whinston, Frontiers of Electronic Commerce, Pearson Education.
3. Ravi Kalakota & A.B. Whinston, Electronic Commerce – A Manager's Guide, Pearson Education.
4. Agarwala Kamlesh, N and Agarwala Deeksha, Business on the Net_Introduction to the E-Com., Macmillan India.
5. P. T. Joseph, E-Commerce: A Managerial Perspective, PHI, 2002.

Paper-5: Advanced Database Management System (BCA129)

8 Lectures

1. **Query Processing:** Optimization & Database Tuning; Algorithms For Executing Query Operations. Heuristics For Query Optimizations, Estimations Of Query Processing Cost, Join Strategies For Parallel Processors, Database Workloads, Tuning Decisions, DBMS Benchmarks, Clustering & Indexing, Multiple Attribute Search Keys, Query Evaluation Plans, Pipelined Evaluations, System Catalogue In RDBMS.

8 Lectures

2. **Database Models:** Extended Relational Model & Object Oriented Database System; New Data Types, User Defined Abstract Data Types, Structured Types, Object Identity, Containment, Class Hierarchy, Logic Based Data Model, Data Log, Nested Relational Model And Expert Database System.

8 Lectures

3. **Distributed Database System:** Structure Of Distributed Database, Data Fragmentation, Data Model, Query Processing, Semi Join, Parallel & Pipeline Join, Concurrency Control In Distributed Database System, Recovery In Distributed Database System, Distributed Deadlock Detection And Resolution, Commit Protocols.

8 Lectures

4. **Enhanced Data Model For Advanced Applications:** Database Operating System, Introduction To Temporal Database Concepts, Spatial And Multimedia Databases, Data Mining, Active Database System, Deductive Databases, Database Machines, Web Databases, Advanced Transaction Models, Issues In Real Time Database Design.

8 Lectures

5. **Specialized Databases:** Expert Database And Fuzzy Database System: Introduction and overview

References

1. Majumdar & Bhattacharya, "Database Management System", TMH.
2. Korth, Silbertz, Sudarshan, " Database Concepts", McGraw Hill.
3. Elmasri, Navathe, "Fundamentals Of Database Systems", Addison Wesley.
4. Data C J," An Introduction To Database System", Addison Wesley.
5. Ramakrishnan, Gehrke, "Database Management System", McGraw Hill.
6. Bernstein, Hadzilacous, Goodman, " Concurrency Control & Recovery", Addison Wesley.
7. Ceri & Palgatti, "Distributed Databases", McGraw Hill.

SEMESTER-VI:

Paper -1: Image Processing (BCA130)

8 Lectures

1. **Introduction:** Image representation and modeling, 2-D linear system, Luminance, Contrast and Brightness, Color representation, Visibility functions, Monochrome and color vision model.

8 Lectures

2. **Image Quantization and Image Transforms:** Sampling theorem, Anti-aliasing, image quantization, Orthogonal and unitary transforms, DFT, Cosine transform, Hadamard transform, Haar transform, KL transform.

8 Lectures

3. **Image Enhancement:** Point operation, Histogram modeling, Filtering and spatial operations, Transform operations, Multi-spectral Image Enhancement

8 Lectures

4. **Image Restoration:** Image formation models, Noise models, Inverse and Wiener filtering, Least square filters,Recursive filters, Maximum entropy method, Blind de-convolution, Bayesian method of noise removal, Image reconstruction,

8 Lectures

5. **Data Compression:** Data compression vs. Bandwidth, Pixel coding, Predictive coding, Transform coding, Coding of two-tone images.

References:

1. Fundamentals of Digital Image Processing: Anil K. Jain
2. Digital Image Processing: R. Chellappa
3. Image Processing for Scientific Applications: Bernd Jahne
4. Digital Image Processing: R.C. Gonzalez & R.E. Woods
5. The Image Processing Handbook: J.C. Russ
6. Digital Image Processing: W.K. Pratt
7. Digital Image Restoration: Andrews & Hunt

Paper-2: Multimedia Systems (BCA131)

8 Lectures

1. **Multimedia Technology:** Meaning & scope of Multimedia; Elements of Multimedia; Creating multimedia applications; Multimedia file & I/O functions; Multimedia data structures; Multimedia file formats; Multimedia Protocols

8 Lectures

2. **Multimedia Audio:** Digital sound; True Speech; Special effects and Digital Signal Processing; Audio synthesis; FM synthesis; Sound blaster card; Special effect processors on sound cards; Wave table synthesis; MIDI functions; Speech synthesis & Recognition

8 Lectures

3. **Multimedia Video:** Representation of Digital video; Video capture; Frame grabbing; Full motion video; Live video in a window; Video processor; Playback acceleration methods; Video Conferencing

8 Lectures

4. **Audio Video Compression:** Audio compression & decompression; Companding; ADPCM compression; MPEG audio compression; Video compression & decompression; Standards for video compression & decompression.

8 Lectures

5. **Multimedia Authoring Tools:** Project editor; Topic editor; Hot-spot editor; Developing a multimedia title; Multimedia text authoring systems; Usage of authoring tools

References:

1. Multimedia: Computing, Communications & Applications – Nahrstedt & Steinmetz
2. Computer Speech Processing – Fallside F.
3. Speech Analysis, Synthesis & Perception – Flanagan,J.L.
4. Hypertext & Hypermedia- Nielsen J.

CENTRE FOR BIOTECHNOLOGY

EWING CHRISTIAN COLLEGE, ALLAHABAD
(An Autonomous Constituent College of University of Allahabad)

Curriculum for Semester System of Three-Year B.Sc. Program in BIOTECHNOLOGY

(w.e.f. AcademicSession 2020-21)

CURRICULUM STRUCTURE OF BIOTECHNOLOGY (W.E.F SESSION 2020-21)
THREE-YEAR UNDERGRADUATE DEGREE COURSE (06 SEMESTERS)

Academic Year	Semester No	Paper No.	Course Code	Title of the Paper	Mark Allotted	Credits
B.ScI	I	Core 1	1BIOT1	PRINCIPLES OF ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY -1 (BIOCHEMICAL)	75	02
		Core 2	1BIOT2	PRINCIPLES OF ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY -2 (BIOCHEMICAL)	75	02
		Core 3	1BIOTP	PRACTICALS BASED ON PAPER 1 AND 2	50	02
	II	Core 1	2BIOT1	HUMAN BIOLOGY	75	02
		Core 2	2BIOT2	CELL AND INHERITENCE BIOLOGY	75	02
		Core 3	2BIOTP	PRACTICALS BASED ON PAPER 1 AND 2	50	02
B.ScII	III	Core 1	3BIOT1	MICROBIOLOGY	75	02
		Core 2	3BIOT2	BIOMATHEMATICS AND BIOSTATISTICS	75	02
		Core 3	3BIOTP	PRACTICALS BASED ON PAPER 1 AND 2	50	02
	IV	Core 1	4BIOT1	MOLECULAR BIOLOGY	75	02
		Core 2	4BIOT2	BIOCHEMISTRY AND BIOENERGETICS	75	02
		Core 3	4BIOTP	PRACTICALS BASED ON PAPER 1 AND 2	50	02
B.Sc III	V	Core 1	5BIOT1	ANIMAL BIOTECHNOLOGY	75	02
		Core 2	5BIOT2	ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY	75	02
		Core 3	5BIOT3	IMMUNOLOGY AND MEDICAL BIOTECHNOLOGY	75	02
		Core 4	5BIOTP	PRACTICALS AND PROJECT WORK BASED ON PARER 1, 2, AND 3	75 (50+25)	03
	VI	Core 1	6BIOT1	PLANT BIOTECHNOLOGY	75	02
		Core 2	6BIOT2	RECOMBINANT DNA TECHNOLOGY AND GENETIC ENGINEERING	75	02
		Elective paper 3 (Select any one)	6BIOT3A	BIOINFORMATICS AND NANOBIOTECHNOLOGY	75	02
			6BIOT3B	DESSERTATION	75	02
		Core 4	6BIOTP	PRACTICALS AND PROJECT WORK BASED ON PAPER 1,2 AND 3	75 (50+25)	03
		SEC	6BIOTSE	SKILL ENHANCEMENT COURSE IN BIOTECHNOLOGY	GRADE	02

SEMESTER I

PAPER 1

TITLE: PRINCIPLES OF ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY – 1 (BIOCHEMICAL)

UNIT 1

Solutions: Definition of solution, solute, solvent, molarity, molality, normality, weight-percent, ppm/ppb, calculation of molecular weight, inter-conversion between percent, molar and normal solutions, methods of dilution and source of error.
Water: Water structure, Properties, interaction, water as solvent and reactant, water distillation, ion exchange and ion free water.
Colloidal solution: Types of Colloidal System, Properties of Colloidal Solution, Preparation of Colloidal Solution.DonnanEquilibrium,Gold number, Importance and application of Colloids.

UNIT 2

Chemical bonding: Concept of Ionic bonding, covalent bonding, Hydrogen bonding, and Vander-Waal forces of interaction.
Ionic Equilibrium in solution: Electrolytes (strong and weak) and Non-electrolytes, Ionizationof weak electrolytes (Ostwald dilution law), Concept of Acids and Bases (Arrhenius concept, Bronsted- Lowry concept. Lewis concept), Strength of Acids and Bases, Dissociation of Weak Acids, Bases and Water.
Indicators: Hydrogen ion indicator and their ranges. Theories of Indicator (Ostwald, Chromophore / Benzenoid Theory) with special reference to Phenolphthalein and Methyl Orange indicator, Limitation of indicators, Titration curves (Acid-base titration using indicators).

UNIT 3

pH and pH scale: pH value and determination of pH, pH scale, Common ion effect, Hydrogen ion selective electrode and pH meter, its operation and limitations.
Buffer solutions: Concept of Buffer, Types of buffer(acidic and basic standard buffers) and their buffer actions, Henderson Hasselbach equation for determination of pH of buffer solutions.
Biological buffers: Amino acid buffer(glycine),(Zwitterionic effect and determination of isoelectric pH), Phosphate buffer, Bicarbonate buffer, Hemoglobin buffer, TRIS buffer.

SUGGESTED READINGS

- Practical Biochemistry, Principles and Techniques: **Wilson and Walker**
- Bioinstrumentation:**Webster**
- Biophysical Chemistry (Principles and Techniques): **Upadhyay, Upadhyay and Nath**
- Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes: **J.F. Van Impe, Kluwer Academic.**
- Physical Chemistry:**Puri and Sharma.**
- Physical Chemistry:**R.C.Mukherjee.**
- Principles of Physical Biochemistry: **K.E. Van Holde, Prentice Hall.**
- Principles and Practice of Bioanalysis : **Richard F. Venn.**

PAPER 2

TITLE: PRINCIPLES OF ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY – 2 (BIOPHYSICAL)

UNIT 1

Thermometry: Law of thermodynamics, Enthalpy, free energy, heat dissipation and heat conservation, concept of temperature, Thermometers, Incubators, Oven, Water Bath. (Principle, working & precaution).

Photometry: Properties of light and sources of radiations. Basic principles of light absorption, Fluorescence and Phosphorescence, Raman effect. Beer lambert law.

Spectrophotometry: Basic principles of light absorption, Fluorescence and Phosphorescence, Raman effect. Beer lambert law, basic concepts and types of spectrophotometer (UV-Visible and Infrared Spectrophotometry), instrumentation and applications. Colorimeter.

UNIT 2

Microscopy: Microscope**,** principle, working and application of light and Electron microscopes.

Imaging Technique: MassSpectrometry, X-ray crystallography, Principle, working and applications of NMR and ESR. Circular Dichroism and its application in Biotechnology

Tracer techniques: Concept of Radioactivity, sources of radioisotopes, radioisotopes and their uses in biological science, techniques for detection of isotopes e.g.,Auto-Radiography, Geiger Counting Techniques, Liquid Scintillation, Gamma Counter. Isotope Dilution Technique. Safety in use of radiation.

UNIT 3

Centrifugation: Relative Centrifugal Force (RCF) and other factors effecting centrifugation, Sedimentation coefficient,Principles, instrumentation and application of centrifugation. Differential and Density Gradient Centrifuge, Ultracentrifugation.

Electrophoretic techniques: Electrophoresis, basic concept, principle, types(Gel Electrophoresis-Agarose gel, PAGE, SDS-PAGE)instrumentation techniques and application of electrophoresis.

Chromatographic techniques: Principle and types(Paper Chromatography, Thin-Layer Chromatography,Adsorption Chromatography, HPLC)

SUGGESTED READINGSs

- Modem Spectroscopy: J**.M. Hollas, John Wiley and Son Ltd.**
- NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry: **H. Gunther, John Wiley and Sons Ltd.**
- Microscopic Techniques in Biotechnology: **Michael Hoppert**
- Biochemistry :**J L. Jain**
- Practical Biochemistry, Principles and Techniques: **Wilson and Walker**
- Biophysical Chemistry (Principles and Techniques): **Upadhyay, Upadhyay and Nath**

PAPER 3

Practical based on theory Paper 1 and 2

SEMESTER II

PAPER 1

TITLE: HUMAN BIOLOGY

UNIT1

Classification of Animals: General classification of Animal kingdom. Salient feature of each phylum under Invertebrates and Vertebrates.

Human evolution: General characteristics and classification of Mammalia with special reference to *Homo sapiens*, Human evolution.

Human reproduction : Male and Female reproductive organ, Female reproductive cycle. The human sexual response, Fertilization and implantation of embryo. Embryonic Development.

UNIT2

Digestive System- different components, digestion and absorption of Carbohydrates, Lipids and Proteins.

Circulatory System: Structure and function of human heart and blood vessels,cellular and chemical composition of blood, Hemoglobin structure and role blood clotting, Blood Transfusion,

Respiratory system: Respiratory organ structure and function, breathing in human, transport and diffusion of oxygen and carbon dioxide,dissociation curve of oxyhemoglobin and its significance, Bohr's effect, Chloride Shift.

UNIT 3

Excretory system – Kidney - Its structure, organization and function. Structural and functional characteristics of tubules, ultra-filtration, selective reabsorption and secretion, role of aldosterone and antidiuretic hormones and mechanism of urine formation. Metabolic breakdown of amino acids, Transamination, Deamination, Urea Cycle.

Endocrine system - brief outline of various endocrine glands and their physiological roles, storage and secretion of hormones.

Nervous System- Nerve cells, nerve fibers, nerve impulse and neuro-transmission, chemical and electrical synapses, functional properties of nerve fibers, action potential, the reflex action and reflex.

SUGGESTED READINGSs

- Medical Physiology- **Bhanu Prakash**
- BIOS Instant Notes in Human Physiology- **Daniel McLaughlin, ,Jonathan Stamford David White**
- Medical Physiology – **Guyton and Hall**
- BRS Medical Physiology - **Linda Costanzo**
- Medical physiology- **Gillian Pocock, Christopher D. Richards, and David A. Richards**

PAPER 2

TITLE - CELL AND INHERITANCE BIOLOGY

UNIT 1

Cell organization: Structure and organization of prokaryotic and eukaryotic cells, Cell organelles- structure, function and integration, micro bodies.

Cell membrane structure and functions: Chemical composition and ultra-structure of cell membrane, Dynamic nature of plasma-membrane, Thermodynamics of transport through cell membrane, mechanism of transport passive transport (diffusion and facilitated diffusion,Ion gradient driven transport), ATP-driven active transport

Nucleus: Nuclear membrane and nuclear pore complex, nucleoplasm, nucleolus) chromatin and chromosome organization (Euchromatin and heterochromatin, Nucleosome organization, Centromere and telomere), banding patterns in human chromosome.

UNIT 2

Chromosomal Mutation: Structural and numerical changes in chromosomes, associated hereditary defects.

Cell Mechanics: Cell cycle and cell division (Mitosis and Meiosis), Karyotype and Idiogram, Feulgen staining technique. Chemicals used for arresting cell divisions.

Cancer: Characteristic of cancer cells. Cause of cancer, genetics of cancer cell senescence and programmed cell death.

UNIT 3

Principles of Inheritance: Mendel's law of inheritance, epistasis, Sex determination in animals, sex linked and sex influenced inheritance in human, Linkage and crossing over, recombination and gene mapping.

Gene Mutation: Concept, types, cause and mechanism ofgene mutation, mutagens typeand mutagenesis

Population genetics: Gene frequencies in population, Hardy-Weinberg law.

SUGGESTED READINGS

- Cell and Molecular Biology: Concepts and Experiments. **Karp**
- Cell and Molecular Biology. **De Robertis, and De Robertis**,
- The Cell: A Molecular Approach. **Cooper, G.M. and Hausman, R.E.**
- Molecular Biology of Cell- **Bruce Alberts**
- Molecular Cell Biology- **Lodhish**
- Genetics: **Gardner** and **Snustard**
- iGenetics- **PeterRussell**
- Principles of Genetics- **Tamarin**
- Concepts of Genetics- **RobertBrooker**
- Genetics: **Strickberger**
- Concepts of Genetics- **Klug** et al
- Genetics: **P. K. Gupta**
- Cell Biology, Genetics, molecular Biology, evolution and Ecology- **Verma and Agarwal**
- Cell Biology- **P.K.Gupta**

PAPER 3

Practicals based on Theory Paper 1 and 2

SEMESTER III

PAPER 1

TITLE - MICROBIOLOGY

UNIT 1

Introduction to Microbiology: History, scope and development of Microbiology; Applications of Microbiology in human welfare. Contribution of scientists in the field of microbiology: Antony von Leeuwenhoek. Alexander Fleming, Edward Jenner, Louis Pasteur, Robert Koch, Selman Waksman, Joseph Lister.

Diversity of Microbial World A: Classification, general characteristics and structure of Bacteria - (eubacteria & archaebacteria), Cyanobacteria, Actinomycetes, Mycoplasma ,Rickettsia, Chlamydia. Concept of Phyllosphere and rhizosphere.

Diversity of Microbial World B: Classification, general characteristics and structure of Viruses, Prions, Virusoids & Viroid. General features of virus reproduction. DNA & RNA Viruses with the example of TMV & Pox Virus.General characters and structure of bacteriophage (T_4 and Lambda phage).

UNIT 2

Culture techniques in microbiology: Pure culture techniques and contaminations, Physical and chemical methods of sterilization. Synchronous culture, continuous culture and batch culture.

Growth: Definition of growth, mathematical expression of growth. Growth curve, Growth yield, Effect of nutrient concentration on growth. Factors affecting growth: nutrients, temperature, oxygen, pH, osmotic pressure.

Growth measurement: Measurement of Bacterial, growth by measuring cell number, cell mass and cell activity. Cell count - direct and indirect method, turbidometric method, Plate count method, membrane filter count method, dry weight and wet weight method by measurement of cellular activity.

UNIT 3

Microbe identification: Identification of Microorganism commonly used in the laboratory based on Morphological and Biochemical parameters

Reproduction and genetic recombination in bacteria – Binary fission, conjugation, transformation, transduction and sexduction.

Antibiotics – types and origin of antibiotics, production, mode of the action. Antibiotic resistance.

SUGGESTED READINGSs

- General Microbiology by **C. B. Powar and H. F. Daginawala**,
- A Text book of Microbiology by **R. C. Dubey and D. K. Maheshwari**
- A Textbook of Fungi by **H.C. Dubey**
- Microbiology: **R. P. Singh**
- General Microbiology by **Davis and Harper**,
- General Microbiology Stanier, **R.Y, J.L. Ingraham, M. L. Wheetis and P.R. Painter**
- Microbial Biotechnology **byTrivedi**
- Microbiology **P.D. Sharma.**
- Microbiology by **M. J. Pelczar**
- Microbiology :**Prescott:**
- Textbook of Microbiology by **Ananthanarayan and Paniker**

- Microbiology**- Sullia and Shantharam**
- BIOS Instant Notes in Microbiology by **Baker**
- Brock Biology of Microorganisms**(** Pearson **)by Madigan Michael T. , Martinko John M. , et al.**
- Practical Microbiology **by Maheshwari D.K.**
- Experiments in Microbiology, Plant Pathology and Biotechnology **by K.R. Aneja**

PAPER 2

TITLE: BIOMATHEMATICS AND BIOSTATISTICS

UNIT 1

Set Theory: Set, subset, Set operations (union, intersection, difference, symmetric difference & complement), DeMorgan's Laws, Venn Diagrams and its simple applications.

Logarithm: logarithm and Anti-logarithm (definition & laws of logarithm, use of logarithm table)

Calculus: limits of a function (basic idea of limit of functions without analytic definition), derivative of a function, differentiation of standard functions, algebra of derivatives, integration of standard functions and integration of product of two functions.

UNIT 2

Matrix Theory: Matrices: definition and notation, types of matrices, Equality of matrices, Algebra of matrices (addition, scalar multiplication and multiplication), transpose of a matrix, Symmetric and skew-symmetric matrices, minors and cofactors of a square matrix, adjoint of a matrix and inverse of a matrix (upto order 3), solutions of homogenous and non-homogenous linear equations upto three variables by matrix method.

Permutations and combinations: Factorial Notation, simple permutation, permutation when all the objects are not distinct, combination,Binomial Theorem.

UNIT 3

Probability Theory: Classical & axiomatic definition of probability, theorems on simple probability.

Standard distribution with important properties, simple problems involving binomial, Poisson's and normal variables, distribution and standard error, confidence level, testing of hypothesis (t-test and f-test (ANOVA) method), measures of Central tendency (Mean, Median and Mode of an statistical data), measures of dispersion (measures of location and desperation).

SUGGESTED READINGS

- H. S. Bear: Understanding Calculus, John Wiley and Sons (Second Edition); 2003.
- E. Batschelet: Introduction to Mathematics for Life Scientists, Springer Verlag. International Student Edition. Narosa Publishing House. New Delhi (1971,1975)
- Edmondson and D. Druce : Advanced Biology Statistics, Oxford University Press; 1996.

PAPER 3

Practical based on theory Paper 1 and 2

SEMESTER IV

PAPER 1

TITLE: MOLECULAR BIOLOGY

UNIT 1

Molecular basis of life: Concept of Genetic material, Nucleic acid (DNA and RNA), Experimental evidences for nucleic acid as genetic material,Structure of DNA, Chargaff's rule and base composition, Types of DNA (A, B and Z),

DNA as hereditary material: Evidence for semiconservative replication, Enzymes and proteins involved in DNA replication in prokaryotes and its comparison with eukaryotes, DNA repair mechanism

Gene concept: Modern concept of gene,overlapping genes, pseudo genes.organization of mtDNAandcpDNA, Cryptic genes. Insertion elements, Transposons, retrotransposon, Transposable elements in Drosophila and maize.

UNIT 2

Transcription in prokaryotes: Concept of transcription, Enzyme and proteins involved in transcription in bacteria, Mechanism of transcription in bacteria, RNA types with special reference to the structure of t-RNA, m-RNA degradation

Transcription in Eukaryotes: Molecular mechanism of transcription in Eukaryotes, Enzymes involved in eukaryotic transcription, RNA splicing and RNA processing**,**transport and degradation of mRNA

Genetic code: Properties of genetic code, codon assignments, chain initiation and chain termination codons, wobble hypothesis, exception of universal genetic code

UNIT 3

Translation: Mechanism of translation and protein synthesis in Prokaryotes and its comparison with eukaryotes

Regulation of gene expression in prokaryotes: Operon model for regulation of gene expression in bacteria, *Lac* operon and trp operon (negative and positive regulation)

Eukaryotic gene regulation: Levels of control of gene expression in eukaryotes (mRNA degradation and protein degradation control brief idea), Gene battery model, Homeotic gene concept

SUGGESTED READINGS

- Molecular Biology by **David P. Clark BA**
- Molecular Biology of the Cell-by **Bruce Alberts, Alexander Johnson, et al.**
- Cell Biology by **Gerald Karp**
- The Cell: A Molecular Approach by **Geoffrey M. Cooper and Robert E. Hausman**
- Molecular Cell Biology by **Harvey Lodish, Arnold Berk, et al.**
- Cell and Molecular Biology - **De Robertis, E.D.P. and De Robertis. E.M.F.**
- Freifelders Essentials Of Molecular Biology by **George M Malacinski**
- Molecular Cell Biology by **James E. Darnell, etc., et al.**
- Molecular Biology of the Gene-**Watson**,
- Molecular Biology: **Robert Weaver**
- Molecular Biology - **David Clark**
- Essential Genes - **Benjamin Lewin**
- Principles of Molecular Biology by **Veer Bala Rastogi**

PAPER 2

TITLE:BIOCHEMISTRY AND BIOENERGETICS

UNIT 1

Concept of metabolic energy: Thermodynamics of energy transformation in biological system, Endergonic and exergonicmetabolic processes, ATP as universal currency of free energy in biological system and causes of energy richness of ATP

Glucose metabolism: Glycolytic pathway and its regulation, homo lactic fermentation, alcoholic fermentation, energetics of fermentation. glycogen breakdown and gluconeogenesis.

Metabolic energy generation pathway: Citric acid cycle and its regulation, Electron transport and oxidative phosphorylation, pentose phosphate pathway

UNIT 2

Carbohydrates: Classification of carbohydrates. Chemical structure and properties ofmonosaccharides ,disaccharides, oligosaccharides & polysaccharides, Starch, cellulose and glycogen.

Lipids: Classification, properties of lipid aggregates, biological significance. Fatty acid oxidation and glyoxalate pathway

Amino acids and Vitamins: General properties, peptide bond, essential and non-essential amino acids. Isoelectric points ; Vitamins**:**water- and fat-soluble vitamins, deficiency and diseases.

UNIT 3

Protein chemistry: Classification, different levels of protein structure, forces stabilizing protein structure. Protein folding (Chaperone Model)

Enzymescharacteristics: General characteristics of enzymes, mechanism of enzyme action,factor effecting enzyme action, Classification of enzymes, zymogens, co-enzymes and co-factors,Ribozymes, abzymes and isoenzymes.

Enzyme kinetics and inhibition: Kinetics of enzyme with special reference to Michaelis an Menton equation, Competitive and non-competitive inhibition of enzyme. Allosteric regulation of enzymes. Factors contributing to catalytic efficiency of enzymes.

SUGGESTED READINGS

- Analytical Biochemistry by **Holme, D. J. & Peek. H.**
- Basic Concepts in Biochemistry A Student's Survival Guide by **Gilbert. H. F.**
- Biochemistry by **Rawn J. D.**
- Biochemistry by **Todd, W. B, Mason, M. Bmggen. R. V. &Macmillan.**
- Biochemistry by **Voet&Voet**
- Biochemistry by **Mathews** 3rd Ed.
- Biochemistry The Chemical Reactions of Living Cellsby**Metzler.D.E**.
- Biochemistry**-Zubay, J**.
- **Lehningers** Biochemistry; **Nelson and Cox**
- Biochemistry: **Styrer**
- Biochemistry**: U satyanaran**
- **Harper's** Biochemistry
- Biochemistry- **J.L.Jain**

PAPER 3

Practical based on theory Paper 1 and 2

<u>**SEMESTER V**</u>

<u>**PAPER I**</u>

TITLE: ANIMAL BIOTECHNOLGY

UNIT 1

Principle of Animal cell tissue culture : Principle and basic techniques in animal cell culture, Types of Cell Culture, cell lines, isolation of cell line,Cell viability and cytotoxicity , Cell cloning, Application of cell culture

Animal Cell culture techniques: Culture media types, contaminations and their laboratory management, Differentiation,characterization and growth of cultured cells, bioreactors for large scale culture of cells, cell fusion, Biohazard, risk and safety in laboratory

Organ culture and Tissue Engineering:organotypic models**,** technique of organ and histotypic culture, advantages, applications and limitations. Tissue engineering, tissue modeling and Artificial skin,

UNIT 2

Stem cell biology: Concept and properties of stem cell, Types of stem cell and cell lines, source and importance of stem cell. Customization of stem cells and stem cell replacement therapy, Human embryonic stem cell research

Hybridoma technology: Principle and production of hybridoma cell, hybridoma technology,Productionand properties of Monoclonal antibodies (*Mabs*). Application of Monoclonal antibodies in disease diagnosis and as therapeutic agents with special reference to Immunotoxins and cancer therapy.

Assisted Reproductive technology: Artificial insemination, In-vitro fertilization, , Embryo transfer technique (Human), Manipulation of reproduction in human, Embryo cloning, test tube baby, Animal cloning through somatic nuclear transfer techniques(Dolly the first mammalian clone)

UNIT 3

Transgenic animals and Bioethics: Principle and importance of transgenic animals, different methods of production of transgenic animals(Cattles, goat,pigs, chickens and fish), Societal risk and bioethics

Gene Therapy: Introduction, types of gene therapy, vectors in gene therapy, major achievements, problems and prospects, Intellectual property rights and patenting

Pharmaceutical biotechnology: Human protein replacement (blood proteins, insulin, Human growth hormone, Clotting factors), Therapeutic agents for human disease (Erythropoietin, interferons, tissue plasminogen activator),Recombinant Vaccines

SUGGESTED READINGS

- Culture of Animal Cells, **R.IFreshney, Wiley-Leiss.**
- Animal Cell Culture Techniques, **M. Clynes, Springer Verlag**.
- Animal Biotechnology- **M.M Ranga**
- Animal Cell Culture and Technology by **Michael Butler**
- Textbook of Animal Biotechnology by **Carlos Wyatt**
- Recombinant DNA Vaccines: Rationale and Strategy by **Richard Isaacson**
- Textbook of Biotechnology by **H.K. Das**
- Biotechnology : **B. D. Singh**
- Biotechnology: **P. K. Gupta ;** Biotechnology : **U Satyanarayana**

PAPER 2

TITLE: ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY

UNIT 1

Environment and Pollution: Concept of environment, Components of environment, Environmental pollution-types, nature and sources.

Global environmental problems: Global warming and greenhouse effect, global ozone problem, Acid rain, Biotechnological approach of monitoring and management of pollution and Environmental sustainability

Biotechnology and energy production: Non-renewable and renewable energy resources. Conventional fuels and their major impacts, Concept of clean fuel technology: Biomass energy and biofuels, Bioassessment of Environmental Quality

UNIT 2

Biotechnology and Sewage treatment: Concept and composition of sewage and sludge, Treatment and disposal of municipal solid and liquid wastes,

Biodegradation: Concept of Xenobiotics**,** Biomagnification, Eutrophication, and Biodegradation**,** biodegradation of plastics. Pesticides, herbicides, oil spills, cellulose and hydrocarbons.

Bioremediation: Concept of bioremediation, Microbial consortium in bioremediation with special to *Pseudomonas,* Genetic engineering approach for efficient bioremediation with special reference to genetically engineered superbugs, Bioremediation of contaminated soil and wastelands

UNIT3

Microbes inAgriculture: Foods from microorganism (vinegar, dairy products, single cell proteins), vitamin B_{12}, Microbes in production of Bioinsecticides, Biopesticides, and Biofertilizers (*Rhizobium, Azotobacter* and *Anabaena azolla*),

Microbes in industry: Microbial production of citric acid, amylases, proteases, alcohol beer, wine, biogas, methane, hydrogen. Biodegradable plastics

Microbes in mining: Use of microbes in mining, (Copper and Uranium),BiomineralizationBiosorption, Bioleaching

SUGGESTED READINGS

- Environmental Science, **S.C. Santra**
- Environmental Biotechnology, **Pradipta Kumar Mohapatra**
- Environmental Biotechnology-Concepts and Applications, **Hans-Joachim Jordening and Jesef Winter**
- Waste Water Engineering. **Metcalfand Eddy, Tata McGraw hill**
- Agricultural Biotechnology, **S.S. Purohit**
- Environmental Microbiology: Methods and Protocols, **Alicia L. Ragout De Spencer, John FT Spencer**
- Introduction to Environmental Biotechnology, **Milton Wainwright**
- Principles of Environmental Engineering, **Gilbert Masters**
- Principles of fermentation Technology, **Salisbury. Whitaker and Hall**
- Industrial Microbiology –**Cassida**
- Wastewater Engineering **- Metcalf & Eddy.**

PAPER 3

TITLE: IMMUNOLOGY AND MEDICAL BIOTECHNOLOGY

UNIT 1

Human Immune system: Concept of Immunology and immune system, types of immunity (innate immunity and acquired immunity), Immune system and its organization (Primary and secondary lymphoid organs)

Cells ofthe immune system: Lymphoid immune cells(B-lymphocytes and T lymphocytes) and myeloid immune cells

Antigens and Antibodies: Structure and properties of antigens, antigenic determinant, epitope, paratope and haptens, structure and properties of immunoglobulins, classes of Immunoglobulins (IgG, IgA, IgM,IgD and IgE).

UNIT 2

Major Histocompatibility Complex: Concept of Major Histocompatibility complex (MHC) and their classes, Antigen Presentation and processing,

Immune response: Cell mediated (cellular immunity) and antibody mediated (humoral) immunity and complement system, inflammatory responses

Hypersensitivity: Hypersensitivity reactions, Graft rejection and organ transplantation

UNIT3

Autoimmunity and Autoimmune diseases: Self- tolerance and autoimmunity, Single organ autoimmune diseases(Hashimoto's*Thyroiditis, Pernicious and hemolyticAnemia, Diabetes I, Grave's disease and Myasthenia Gravis*), Systemic autoimmune diseases(*Rheumatoid Arthritis, Systemic Lupus,Multiple sclerosis*)

Immunodeficiency diseases and Vaccines: Primary and secondary immunodeficiency diseases, causes, origin and treatment with special reference to SCID, AIDS and COVID-19, Vaccine and its type, Development of vaccines

Immunological techniques: Role of Monoclonal antibodies in disease diagnosisand Radio-immunoassay, Immunoblotting techniques (Elisaand RIA technique principle and applications), Fluorescence activated cell sorting, Widal test, Immune hematology- R.A. factor test

SUGGESTED READINGS

- Essential immunology- **Roitt**
- Immunology - **Kuby**
- **Janeway's**Immunobiology.
- Basic and Clinical Immunology. **PeakmanM, and Vergani D**
- Immunology **Richard C and Geiffrey S.**
- Basic Immunology- **Abbas Litchman**
- Cellular and Molecular Immunology- **Abbas Litchman**
- Elements of Immunology- **Fahim Halim Khan**
- Immunology**- Tizard**

PAPER 4

A) Practical based on theory Paper 1,2 and 3

B) Project Report

SEMESTER VI

PAPER 1

TITLE: PLANT BIOTECHNOLOGY

UNIT 1

Plant Tissue Culture technique: Introduction/Concept, History, Scope and Applications of plant tissue culture, Basic technique of plant tissue culture, preparation and selection of plant tissue culture media.

Cellular totipotency and in-vitro differentiation: Concept of totipotency its genetic basis, mechanism and significance in plant tissue culture. Dedifferentiation and callus culture, redifferentiation and organogenesis, somaclonal variations

Plant cell culture techniques: Principle and methodology of cell suspension culture, Micropropagation of elite plants through cell suspension culture, Production of secondary metabolites and Molecular farming, Biotransformation, germplasm conservation

UNIT 2

Protoplast technique: Protoplast isolation, Protoplast culture,Somatic hybridization and protoplast fusion techniques (chemical and electro-fusion). selection of hybrids, Cybridization and production of cybrids, Applications of somatic hybrids andcybrids.

Haploid culture: Concept of androgenesis and gynogenesis**,** haploid production through anther and pollen culture, production of pure lines through haploid culture.

Micro- propagation techniques: axillary bud, shoot-tip and meristem culture, production of virus free plants. Embryo culture, embryo rescue, and its applications, Somatic embryogenesis and synthetic seed technology and its application

UNIT 3

Gene transfer in plants: Direct or vector-less gene transfer in plants (micro projectile bombardment, microinjection, liposome mediated gene transfer electroporation), Calcium phosphate mediated gene transfer), Vector mediated gene transfer through Binary and co-integrate vectors, Ti plasmid and Agro-infection, Agrobacteriummediated gene transfer in plants, virus mediated gene transfer, Gene targeting in plants

Transgenic Plants: Transgenic stability and expression, marker gene in plant transformation, Development of transgenic plants for resistance to biotic stresses (insect/pest resistance, bacterial and fungal disease resistance, virus resistance) and abiotic stresses (herbicide resistance).

Transgenic plant and human health:transgenic plants for nutritional enhancement in crop plants, transgenic plants for improved nitrogen fixation, transgenic plants as bioreactors, Terminator seed technology,

SUGGESTED READINGS

- Plant Biotechnology- **Hopkins**
- Plant Biotechnology by**Shain-dow Kung and Charles J. Arntzen**
- Introduction To Plant Biotechnology by **CHAWLA H S**
- Plant Biotechnology: The Genetic Manipulation of Plants by **Slater**
- An Introduction to Plant Tissue Culture. **M.K. Razdan**,
- Plant Biotechnology by **Singh B.D.**
- Plant Tissue and Organ Culture fundamental Methods" by **Gamburg OL and Philips GC**

- Plant Biotechnology” by **Krishna G K A Elangovan S Devika**
- Experiments in Plant Tissue Culture, **J.H. Dodds and L.K. Roberts**
- Plant Biotechnology and Transgenic Plants, **K.M.O. Caldenty. W.H. Barz and H.L. Wills. Marcel Dekker**
- Plant Biotechnology, **J. Hammond, P. McGarvy and V. Yusibov.**
- Plant Cell & Tissue Culture for the production of Food Ingredients, **T-J Fu, G Singh and W.R. Curtis**
- Plant Tissue Culture: Theory & Practice, **S.S. Bhojwani and M.K. Razdan**

PAPER 2

TITLE: RECOMBINANT DNA TECHNOLOGY AND GENETIC ENGINEERING

UNIT 1

Introduction: History, scope and application of Recombinant technology/genetic engineering.Principle of in-vivo gene cloning

Tools in Recombinant DNA technology

1. **Gene cloning enzymes:**Concept of restriction modification system and discovery of restriction enzymes,Restriction enzymes used in gene cloning and mode of their action, Ligases, polymerases, Alkaline phosphatases, Kinases. Transferases and other enzymes used in Genetic engineering
2. **Gene cloning vectors:** Concept, and nomenclature of gene cloning vectors. Properties of an ideal vector, Plasmid vector, Bacteriophage vector, cosmids, Phagemid, M13 vector, Vectors for cloning in eukaryotic cells YACs and BACs., Co-integrate and Binary vectors, Expression vector

UNIT 2

Methodology of in –vivo gene cloning: Construction of Recombinant DNA molecules, Isolation of DNA of interest,Modification of cut ends of DNA and role of linkers and adaptors, Integration of DNA inserts with cohesive and blunt ends into vector molecules

Methods of Gene transfer and gene cloning in animals: Gene transfer methods in animals, Cloning and expression of foreign genes in mammalian cells, integration of DNA into mammalian genome- different methods

In-vitro gene cloning: Gene Amplificationthrough Polymerase chain reaction (PCR) – principle, enzymes used, primer design, Types of PCR techniques, Genomic and c-DNA libraries preparation and uses

UNIT 3

DNA sequencing and synthesis: Maxam-Gilbert's and Sanger's method. Automated sequencing. DNA microarrays, Artificial DNA synthesis, Human genome sequencing project.

Genome Mapping: Concept and applications. Restriction enzyme digestion and restriction mapping. Molecular probes, molecular marker (RFLP, RAPD, AFLP, SNTP),

Analytical technique in Genetic Engineering: DNA separation through electrophoresis, Blotting techniques: Southern and Northern analysis, DNA finger printing and profiling PAGE, Western blotting, dot-blots and slot blots techniques

SUGGESTED READINGS

- Molecular Biotechnology: Principles and Applications of Recombinant DNA by **Bernard R. Glick and Jack J. Pasternak**

- DNA Technology: The Awesome Skill. **Alcamo IE.**
- Gene Cloning and DNA Analysis - **Brown TA.**
- Biotechnology-Applying the Genetic Revolution. **Clark DP and Pazdernik NJ.**
- Principles of Gene Manipulation and Genomics -**Primrose SB and Twyman RM.**
- Molecular Cloning -A Laboratory Manual Sambrook J, **Fritsch EF and Maniatis T**.
- Genetic Engineering (Oxford Higher Education) by **Smita Rastogi and Neelam Pathak**
- Recombinant Dna Technology and Genetic Engineering by **K Rajagopal**
- Molecular Biology and DNA Recombinant Technology by **R.N. Kumar**
- Introduction to Genetic Engineering **by N. Nicholl**
- Genetic Engineering: Principles and Methods by **Jane K. Setlow**

PAPER 3

TITLE: BIOINFORMATICSANDNANOBIOTECHNOLOGY

UNIT1

Bioinformatics: Introduction, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics. Biological Database and Database Retrieval system

Sequence Alignments: Introduction, Concept of Alignment, Pairwise and Multiple Sequence Alignment (MSA), FASTA, BLAST, MSA by CLUSTALW. Introduction of [Scoring Matrices, Percent Accepted Mutation (PAM), Blocks of Amino Acid Substitution Matrix (BLOSUM)].

Applications of Bioinformatics: Methods of Phylogeny, Software for Phylogenetic Analyses. Concept of Genomics, transcriptomics, Proteomics and Metabolomics Structural Bioinformatics in Drug Discovery.

UNIT 2

Introduction- Concept of Nanotechnology and Nanobiotechnology, History and importance of nanobiotechnology in modern science.

Nanomaterials: Concept of nanomaterials -Types and Synthesis of nanomaterials, protein based nano structures, DNA based nano structures,

Applications of nanobiotechnology in biosensors, drug delivery and gene therapy, disease diagnosis and therapy, risk potential of nanomaterials.

UNIT 3

Cell interaction: Introduction of Cell-to-cell interactions, Cell adhesion-integrins, selectins, cadherins. Cell Junction- Tight andgap junctions, Desmosomes.

Principles of cell signaling: Overview of receptor in cell signaling, Secondary messengers (cAMP), Calcium Calmodulin.

Signaling Pathways: GPCR mediated Cell Signaling.Receptor Protein Tyrosine Kinase and MAP Kinase Pathway of cell signaling.Nanoparticle mediated cell signaling

SUGGESTED READINGSs

- Introduction to Bioinformatics **Dhananjaya**.
- Essential Bioinformatics – **JinXiong**
- Bioinformatics- **Jhumur Das**
- Instant Notes on Bioinformatics-
- Bioinformatics **Higgins & Taylor** (2000).
- **Springer's** Bioinformatics
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- Bioinformatics **Baxavanis**.
- Understanding Bioinformatics- **Marketa Zvelebil& Jeremy O. Baum**
- Nanobiotechnology: Concepts, Applications and Perspectives by **Christof M. Niemeyer and Chad A. Mirkin**
- Nanobiotechnology Handbook by **Tiffany Gardner**
- Nanobiotechnology: concepts, applications & perspectives **Niemeyer and Mirkin ed**.
- Nanobiotechnology in molecular diagnostics: current techniques and applications **Jain, KK.**
- "A Textbook of Nanoscience and Nanotechnology", Tata McGraw Hill Education **T. Pradeep**
- "Bionanotechnology", John Wiley & Sons, **David S Goodsell,**

PAPER 4

A) Practical based on theory Paper 1,2 and 3

B) Project Report

Skill Enhancement Course in Biotechnology:

(Optional)

TITLE: BIOPROCESSING AND ITS APPLICATIONS

- History and design of fermenters. Basic function of fermenter
- Construction of fermenter: Control of temperature, aeration and agitation.
- Fermentation processes: Batch fermentation, Fed Batch Fermentation, Continuous Fermentation and Scale-up Fermentation.
- Fermenters: types and application of different types of fermenters and general outline of fermentation process.
- Downstream Processing: Extraction and purification of microbial metabolites.
- Fermentation and fermentable microbes.
- Fermentation products: Alcoholic and Non-alcoholic beverages.
- Immobilization of cells and enzymes: Methods, Techniques, stabilization, effect of immobilization on enzyme properties.
- Application of immobilized enzymes and cells.
- Basic ideas of Entrepreneurship

SUGGESTED READINGS

- Principles of fermentation Technology, **Salisbury. Whitaker and Hall**
- Biochemistry **– U. Satyanarayan**

Centre For Microbiology

Ewing Christian College, Prayagraj

III SEMESTER

Paper – I (Microbial Metabolism)

UNIT I: Biomolecules and Bioenergetics

1. Bioenergetics: Biological system and general Laws of thermodynamics, concept of entropy, High energy bonds, biological oxidation and redox potentials
2. Structure and function of Biomolecules: Carbohydrates, Lipids, Proteins and Nucleic acids.

UNIT II: Metabolic pathways

1. Metabolism – Anabolism and Catabolism, structure and properties of ATP, Phosphorylation
2. Eukaryotic and Prokaryotic cellular components involved in microbial metabolism.
3. Metabolic pathways: Basic concept and design, Glycolysis, TCA cycle, Pentose phosphate pathway, Electron Transport Chain. Oxidative Phosphorylation

UNIT III: Enzymes and Enzyme Kinetics

1. Introduction to enzymes and coenzymes, units of enzyme activity, enzyme nomenclature and classification. Enzyme kinetics, Effect of substrate concentration on Michaelis Menten Equation, Determination of Km and its significance, effect of pH and temperature on rates of enzymes catalyzed reaction.
2. Enzyme inhibitors and their importance, chemical methods of active site studies, introduction of multi substrate enzymes, allosteric enzyme and enzyme regulation, iso-enzymes, enzyme immobilization.

UNIT IV: Bacterial photosynthesis:

1. Classification of photosynthetic bacteria: anoxygenic photosynthetic bacteria, purple bacteria (purple sulphur bacteria, purple non sulphur bacteria, green bacteria, green sulphur bacteria), metabolism in photosynthetic bacteria. Photophosphorylation

Paper – II (Microbial Genetics)

UNIT I:

1. History and scope of Microbial Genetics, Law of Inheritance
2. Genome Organization - DNA – A, B, Z and Triplex DNA, RNA, organization of bacteriophage genome – PhiX174, lambda, T4.

UNIT II

1. Genome Replication, Prokaryotic and Eukaryotic Transcription, Transcript Processing,
2. Translation, Regulation of gene expression in prokaryotes and eukaryotes.

UNIT III

1. Mutations: DNA damage and Repair, Types of Mutation, Oncogenes and Tumor suppressor genes, Gene Disruption and Gene Targeting.
2. Transposable elements – classes of transposable elements, nomenclature of transposable elements, insertion sequences (IS elements), plasmids, vectors, cosmids

UNIT IV

1. Mechanism of recombination, Types of Recombination - General Recombination, Mismatch Repair, Gene Conversion, Site Specific Recombination.
2. Transduction: Generalized transduction, Abortive transduction, Specialized transduction, use of transduction in gene mapping.
3. Transformation: Competence, Mechanism of transformation, Transfection
4. Conjugation, The F- factor, High frequency recombination (Hfr) strains.

28/11/2024 25/11/2021 25/11/2024

POL 654 : GOVERNMENT AND POLITICS IN INDIA
(ELECTIVE)

Unit-I

1. Nature of Indian Federalism – Main Areas of Tension between the Centre and the States – Commissions on Centre State Relations – Rajmanar and Sarkaria - Changing Nature of Federalism Under Coalition Politics.

Unit-II

2. Nature of Fundamental Rights and Directive Principles of State Policy -Their Changing Relationship in the light of Judicial Decisions – Golaknath and Keshavnand Bharti Case.

Unit-III

3. a) Changing Role of the President and Prime Minister in the Era of Coalition Politics.
   b) Decline of Legislature vis- a- vis the Executive.
   c) Judicial Independence – Judicial Review – Judicial Activism and Public Interest Litigation.

Unit-IV

4. Decentralization and Participatory Democracy – Changing Nature of Panchayati Raj in India – Significance of the 73rd and 74th Amendments.

Unit-V

5. The Party System in India – Recent Trends – Role of Regional Parties – Elections and Voting Behavior – Electoral reforms.
6. Pressure Groups in Indian Politics:

   a) Business groups

   b) Agrarian Groups

   c) Trade Unions.

B.A. Vth Semester

Paper-II

Public Administration with Special Reference to India

Unit-I

- Meaning, Scope & Significance of Public Administration.
- NPA & NPM
- Organisation – Meaning, Type & Bases
- Principles of Organisation –
  - (i) Span of control
  - (ii) Unity of Command
  - (iii) Hierarchy
  - (iv) Centralization & Decentralization

Unit-II

- Environmental Settings : Constitution, parliamentary government, federalism, planning & socialism.
- Impact of liberalization & Globalization on Administration.
- Centre-State relations : Legislative, Administrative & Financial.

Unit-III

- Structure of Administration : Central Secretariat, Cabinet Secretariat, Prime Minister Office, ~~State Secretariat, Chief Secretariat.~~ Deleated
- Generalist Vs. Specialist

Unit-IV

- Parliamentary Control over Financial Administration-
  - I- Public Accounts Committee
  - II- Estimates Committee
  - III- Committee on Public Undertakings
  - IV- Comptroller & Auditor General.

B.A. Vth Semester

Paper-III

Theory and Practice of International Relations-I

Unit-I

- The Study of International Relations : Meaning, Nature and Scope.
- Approaches to the Study of IR : Realist & Liberal.

Unit-II

- Cold War : Origin, Causes & Development
- Detente and its effects.
- New Cold War
- Impact of Cold War and Disintegration of USSR.

Unit-III

- Features of Present world order.
- West-Asia and problem of Palestine
- China in International politics.

Unit-IV

- United Nations : Nature, function and Role.
- Arms control and Nuclear Disarmament (SP. Ref. to N.P.T., CTBT, PNE).

B.A. VIth Semester

Paper-III

Theory and Practice of International Relations-II

Unit-I

- Indian Foreign Policy : Basic Principles
- Development of Indian Foreign Policy Since 1947 to present.

(vi)

Unit-II

- Non Aligned Movement
- North-South Dialogue & NIEO
- India and USA
- India and Russia

Unit-III

- India and its neighbours : Areas of cooperation and issues of conflict
- India and China
- India and Pakistan

Unit-IV

- Globalization : Its effect on developing countries.
- Issues of Environmentalism and International Terrorism.
- Regional Organisation ASEAN, SAARC.

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Physical Education

Revised Syllabus from 2021-22

Semester I (Paper-I)

PRINCIPLES OF PHYSICAL EDUCATION

Unit-I

- Meaning and definition of Physical Education
- **Misconceptions of physical education**
- Misnomer substitutes for Physical Education: Physical Training, Drill, Physical Culture, Play, Gymnastics, sports and games
- Aims and objectives of Physical Education
- Need and Importance of Physical Education
- Relationship of Physical Education with General Education
- Physical education as an Art or Science.

Unit-II

- Philosophies of Physical Education: **Definition, Philosophy and science, components of philosophy, importance of philosophy in physical education.**
- General philosophies applied to physical education: Idealism, Naturalism, Realism, Pragmatism
- **Health and wellness- its importance, benefits and challenges, Development and maintenance of wellness**

Unit-III

- Physical Education and Sports as a social institution and their influence on society, Importance of Sociology in Physical Education and Sports
- Socialization through Sports at Home, Institution and Community.
- Role of Physical Education and Sports in National Integration.
- **Culture: Meaning, features and importance**
- Physical activities and Sports as a men's cultural heritage.

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Physical Education

Revised Syllabus from 2021-22

Semester I (Paper-II)

History of Physical Education

Unit-I

Historical development of physical education:

- Greece: Homeric period, Spartan period, Early Athenian Period, Later Athenian period
- Rome: Early Roman period, Later Roman period
- **Germany:**
  -18th century to the middle of 19th century- Johan Bernhard Basedow, John Christopher Guts Muths, Federik Ludwig John, Adolph Speiss
  -19th century to Middle to Nazi Regime
  -Physical Education under the Nazi Regime
  -Period after the second World War
- **Sweden**
- **Denmark**
- **Great Britain**

Unit-II

History of physical Education in Indian Perspective before Independence:

- **Vedic age**
- **Epic age**
- **Historical Age**
- **Nalanda Period**
- **Age of Chivalry/Rajput period**
- **Muslim Period**
- **British Period**

Unit-III

History of physical Education in Indian Perspective after Independence:

- **Central Advisory Board of Physical Education and Recreation**
- **All India Council of Sports**
- **Enquiry Committees**
- **National Discipline**
- **National Cadet Corps and Auxilary Cadet Corps**
- **National Fitness Corps**
- **National Physical Fitness Programme**
- **Netaji Subhas National Institute of Sports**
- **Sports Authority of India**
- **National Sports Policy**
- **Indian Olympic Association**
- **National Sports Federation**

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Physical Education

Revised Syllabus from 2021-22

Semester II (Paper-I)
SCIENTIFIC BASIS OF PHYSICAL EDUCATION

Unit-I

Biological Basis of Physical Education

- Growth and Development, Differences between growth and development.
- Factors affecting growth and development.
- Various stages of growth and development.
- Age and Sex differences in relation to Physical activities and Sports.
- Effect of Heredity and Environment on growth and development.
- Chronological Age, Anatomical Age and Physiological Age, Mental Age
- **Body Classification: Sheldon's Classification- Endomorph, Mesomorph & Ectomorph**
- **Practical implications of Biological Principles**

Unit-II

Psychological Basis of Physical Education

- Meaning of Psychology and Sports Psychology.
- Psychological factors effecting physical performance.
- Psychological characteristics of an adolescent.
- Problem of an adolescent.
- The role of Physical education and sports in solving the problems of an adolescent.
- Meaning , definition , need, types, role of motivation in physical education and sports
- Meaning, nature and types of emotion in physical education and sports.

Unit-III

Learning and Transfer of Training:

- **Meaning of learning**
- **Nature of motor skill learning**
- **Principles of motor skill learning**
- **Learning curve**
- **Characteristics of learning curve**
- **Types of learning curve**
- **Implication of learning curve in physical education and sports**
- **Transfer of Training : Meaning and definition, Types of transfer of training, Theories of transfer of training, Factors affecting transfer of training**

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Physical Education

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Semester II (Paper-II)

Major Sport events and Recreation

Unit-I

Olympic Games

- **Importance of Olympic and Asian Games**
- **Aims of the Olympic Movement.**

Ancient Olympic Games

- **Brief History**
- **Significance of the Ancient Games.**
- **Rules of eligibility for competition, Conduct of the games and awards.**

Modern Olympic Games:

- **The Revival of Modern Olympic Games.**
- **International Olympic Committee and its function.**
- **Organisation and Conduct of the Games.**
- **The Olympic Flag, Ceremonial Flag and Olympic Motto.**
- **Olympic Torch.**
- **Differences and Similarities in the Ancient and Modern Olympics.**

Unit-II

- **Asian Games.**
- **Olympic Council of Asia**
- **Afro-Asian Games.**
- **South Asian Federation Games.**
- **Common wealth Games.**
- Various Awards in Sports and games: Arjuna Award, Dronacharya Award, R.G. Khel Ratna Award, **MAKA *Trophy***

Unit-III

Recreation:

- **Meaning and definition of recreation**
- **Aim and objectives of recreation**
- **Types of recreation, Need and importance of recreation in modern society.**
- **Recreation providing agencies(Government agencies, Voluntary agencies, Private agencies & Commercial agencies)**
- **Nature and types of recreational activities**

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Physical Education

Revised Syllabus from 2021-22
Semester III (Paper-I)
Anatomy in Physical Education

Unit-I

- Meaning and definition of Anatomy.
- **Subdivisions of anatomy**
- Need and importance Anatomy in Physical Education and Sports.
- Definition, structure and functions of Cell.
- Essential properties of living organism.

Unit-II

- Definition of tissues.
- Classification and structure of tissues.
- **Structure of Heart**
- **Structure of Lungs**
- **Structure of Digestive System & Accessory organs**
- **Structure of Urinary System**
- **Structure of skeleton of the upper limb**
- **Structure of Skeleton of the lower limb**

Unit-III

- Types of Bones and names of various bones of the body.
- Structure of bone
- Joints and its types.
- Major movements around the joints.
- Muscles and its types
- Structure of skeletal Muscle
- **Name of various skeletal muscles.**

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Physical Education

Revised Syllabus from 2021-22

Semester III (Paper-II)

ORGANISATION AND MANAGEMENT IN PHYSICAL EDUCATION

Unit-I

- Management: Meaning, Definition, Importance, aims & objectives and Principles of management.
- Function of management: Planning, organizing, Directing, Controlling, Coordinating)
- Scheme of Organization: School, college & University.
- **Sports management in schools and colleges: Preparation of out-of-town games, Transportation, parents permits and risk certificates, finances for trip, equipments, game details, eligibility records, game contract, trip personnel's, participation record books, general management duties and policies, contracting officials.**

Unit-II

- Supervision: Meaning, Definition, and Principles of supervision.
- Evaluation: Meaning, Definition, need & Importance.
- Leadership: Meaning, Definition, Form of leadership, Traits of leadership, Qualities of a good leader in physical education and sports
- **Financial Management in physical education and sports in school, college and universities: Definition of financial management, objectives of financial management, scope of financial management, principles of financial management, Budget and its planning, Budget proposal model, accounting in management.**

Unit-III

- Public relation: Definition, need, Importance, principles, Techniques.
- Facilities & Equipment: care& maintenance.

  Intramural & Extramural Competitions:
- Meaning of Intramural and Extramural Competitions
- Importance of Intramural and Extramural Competitions
- Organization of Intramural and Extramural Competitions.
- Play days, Sports for All, Sports Days and Exhibition.

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Physical Education

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Semester IV (Paper-I)

Physiology in Physical Education

Unit-I

- **Meaning and definitions of Physiology**
- **Subdivisions of physiology**
- **Need and importance of physiology in physical education and sports**
- Function of circulatory system(Coronary circulation, pulmonary circulation, Systemic circulation)
- Composition and function of Blood; maintenance of Blood supply.
- Function of Lymphatic system

Unit-II

- Functions, processes, mechanism of Digestive System.
- Function of Liver, Gall Bladder and Pancreas
- Functions of Urinary system
- Function of respiratory system
- Mechanism of respiration

Unit-III

- Meaning, main Organs and Parts of Nervous System: Brain, Spinal Cord, Nerves.
- Functional Classification of nervous System.
- The endocrine glands: Pituitary gland, Thyroid gland, Parathyroid glands, Thymus gland and Adrenal gland.

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Physical Education

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Semester IV (Paper-II)

Methods in Physical Education

Unit-I

- Meaning and scope of teaching methods in physical education
- Comparing methods in physical education and general education
- Factors which influence methods of teaching in physical education
- Types of Teaching Methods: Lecture method, Command method, Project method, Discussion method, Group directed-practice method, Demonstration/imitation method
- Principles of Teaching Physical Education activities
- Steps in effective Teaching-Learning process in physical education.

Unit-II

- **Teaching Aids: Criteria forAudio- Visual aids, Black Boards, Bulletin Boards, Magnetic Boards, Pictures, Graphic Devices, Illustrated Text Books, Models and specimens, Projectile Devices, Recording, Television, Slides, Posters, Charts**

- Types of Tournaments –Elimination, League, Combination, Consolation, Challenges
- Methods of Promoting Physical Education – Demonstration, Sports Meet, Exhibition, Mass Display, Play day, Incentives.

Unit-III

Officiating:

- **Principles of officiating**
- **Importance of officiating**
- **Qualities of good Referee/Official**
- **Duties of Referee/Official: Pre-game, During game and After game**
- Marking of play fields : football, volleyball, basketball, Badminton, Kabaddi, Kho-kho, Track and field marking

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Physical Education

Revised Syllabus from 2021-22

Semester V (Paper-I)
Health Education

Unit-I

Health and Health Education

- Meaning, definition.
- Dimensions of health.
- Objectives of health education.
- Principles and importance of Health Education.

Unit-II

- Personal Health and Hygiene, Effect of smoking and Alcohol on health.
- School Health Program.
- Communicable Diseases: Mode of transmission, methods of prevention.
- Environmental problems and their effects on Health.

Unit-III

- Classification of foods, proximate principles and role of various nutrients.
- Balanced Diet, Elements & functions of Balanced diet, Factors affecting diet.
- Daily energy requirements
- Diet , pre and post competition
- Understanding body height & weight charts

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Physical Education

Revised Syllabus from 2021-22

Semester V (Paper-II)

ATHLETIC INJURIES & REHABLITATION

Unit-I

Sports injuries:

- Introduction to sports injuries.
- Role of trained personnel in the management of the sports injuries.
- Rehabilitation: Definition, objectives and scope.

Prevention of Injuries:

- Factors causing sports injuries.
- Complications of incomplete treatment.
- Common sports injuries and their immediate treatment: Sprain, Strain, Dislocation, Fracture, Contusion, Abrasion, Bruise etc.
- Effects and uses of the therapeutic modalities: Cold therapy, Hot therapy, Infra-red lamp, Contrast Bath, Wax bath therapy

Unit-II

Massage:

- Meaning and Definitions of massage
- Principles of massage
- Guidelines for massage
- Contradictions of massage
- Effect of massage

Unit-III

Common massage technique and their therapeutic uses:

Classification of massage techniques:

1. On the basis of depth of body tissue affected: Light massage & Deep massage technique
2. On the basis of body region massaged: General massage and Local Massage
3. On the basis of Nature and Characteristics of techniques: **4 types of massage manipulation:–**

I. Stroking: (It has two types) a) Effleurage b)Stroking

II. Pressure : (it has three types)
   a. Kneading(4 types) i) Squeezing ii) Stationary iii) Circular iv) Ironing
   b. Petrissage (3types): i) Picking up ii) Wringing iii) Rolling
   c. Friction (2 types): i) Transverse ii) Circular

III. Percussion(Tapotement)(one type)
   a. Tapotement: i) Hacking ii) Clapping iii)Beating iv) Pounding

IV. Vibratory Techniques (2 sub types)
   a. Vibration
   b. Shaking

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Physical Education

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Semester V (Paper-III)

Sports Training

Unit-I

- Definition of Sports Training
- Aim of Sports Training
- Characteristics of Sports Training
- Principles of Sports Training and Conditioning
- Warming up and cooling down in sports and its significance in sports.
- General Guidelines for warming up and cooling down.

Unit-II

Training of Strength and Endurance:

Strength Training–

i. Factors determining strength
ii. Types of strength
iii. Development of strength(Forms of strength exercises, Types of muscular contraction-Isotonis, Isometric, Eccentric and Isokinetic contractions)
iv. Methods of strength training(Simple method system, Combination method system, Super set method system, Pyramid method system, Plyometric or Reactive method, Circuit training)
v. Strength training for children.
vi. Strength training for women.
vii. Suggestions for prevention of physical damage and injuries.

Endurance Training-

i. Benefits of endurance
ii. Forms of endurance/types of endurance
iii. Factors determining endurance
iv. Means and methods for endurance development((a)Duration of load method- Constant method, Slow constant method, Fast constant method, Varied pace method, Alternating Method, Fartlek, (b)Interval running method (c)Repetition training method (d) Competition and Test method)

Unit-III

Training of Speed, Flexibility and Coordinative abilities

Speed Training:

i. Factors determining speed
ii. Forms of speed/types of speed
iii. Means of speed development(Reaction speed, Speed of movement, Acceleration speed, Sprinting speed-Acceleration run, Ins and Outs, Differential races, Speed endurance- pace races, Repeated high intensity runs).
iv. Speed Barrier- Delaying of speed Barrier, Tackling of Speed Barrier)

Flexibility-

i. Importance of flexibility
ii. Factors affecting flexibility
iii. Form of flexibility
iv. Methods of flexibility training

Coordinative abilities- types of coordinative abilities and development of coordinative abilities.

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Physical Education

Revised Syllabus from 2021-22
Semester VI (Paper-I)

KINESIOLOGY

Unit-I

- Introduction: Definition, Aims and Objectives of Kinesiology, Brief history of Kinesiology(Ancient Era, Renaissance, Nineteenth century onwards),
- Importance of kinesiology in the field of physical education and sports.
- Fundamental concepts of Axes & planes, Centre of gravity, line of gravity
- **Fundamental movements of the major segments of the body-** Flexion, Extension, Abduction, Adduction, Rotation, Inward rotation, Outward rotation, Circumduction, Pronation, Supination, Dorsiflexion, Planter flexion, Inversion, Eversion, Elevation

Unit-II

- **Functional/kinesiological classification of muscles.**
  a. Arrangement of muscle fibers and shape - Fusiform type , Parallel type, Pennate type, Triangalar type, sphincter type
  b. Classification of muscles according to the number of joints over which the muscle passes-one joint,two joint, multiple joint.
  c. Classification of the muscles according to the type of muscle action or function- Agonist,Antagonist,Synergist
  d. Classification of muscles according to myoglobin content-Red twitch,White twitch
  e. Classification of muscles according to type of muscle contraction- Isotonic, Isometric,Isokinetic
  f. Classification according to orientation of line of pull in relation to the joint-Flexors, Extensors, Abductors, Adductors
- **Role of muscles-Movers or agonist, Antagonist, Fixator or stabilizers, Synergists, Neutralizers.**
- **Terminology of muscular attachments/features-**Size, Shape, Direction of fibers, location, number of origin, origin and insertion, action.
- **Principal actions of the following muscles** : Gastrocnemius, thigh group, muscles of chest, abdominal muscles, trapezius, deltoid, triceps and biceps.

Unit-III

- Definition and principles derive from :- Concept of Force, friction, mass, weight, acceleration, speed and velocity, pushing and pulling.
- Types of motion, Newton's laws of motion, Application of Newton's Laws of motion in sports **activities.**
- Types of Equilibrium, Principles of equilibrium and their application.
- Types of Levers, Mechanical advantage.
- Concept of Projectile.

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Physical Education

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Semester VI (Paper-II)

Modern concept of balanced posture.

Unit-I

Postural Concept: Definition, values of good posture, causes & drawbacks of bad posture.

-Muscles of abdomen , importance of strong abdominal wall.

Therapeutic Exercises:

- **Definition and scope**
- **Classification, therapeutic effects and uses of the Following:**
  (a)Active exercises (Free, Assisted and Resisted exercises)
  (b)Passive Exercises (Relaxed and Forced exercises).

Unit-II

First Aid: Meaning, definition and importance of first aid in Physical Education and Sports with special reference to drowning, dislocation of a joints, fracture of bones, sprain and strain.

- **Contents of first aid box.**
- **Principles of first aid.**
- **Function of first aider.**

Unit-III

Common postural deviations, their causes and remedial measures:

- **Kyphosis**
- **Scoliosis,**
- **Lordosis**
- **Knock knees and Bow legs,**
- **Flat Foot**

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Physical Education

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Semester VI (Paper-III)
Exercise Physiology

Unit-I

- **Meaning and definitions of exercise Physiology**

General Physiological Concepts:

- **Introduction**
- **Vital Capacity**
- **Second Wind**
- **Oxygen Debt**
- **Fatigue**
- **Blood Pressure**
- **Stich in the Side**

Unit-II

Physical Fitness:

- **Meaning, definition and components of physical fitness**
- **Benefits of physical fitness.**
- **Factors influencing physical fitness.**
- **Development of physical fitness.**
- **Testing Physical fitness:- AAPHER Physical fitness Test**

Unit-III

Effect of Training on body systems:

- **Effect of exercise on muscular system**
- **Effect of exercise on skeletal system.**
- **Effect of exercise on Respiratory system**
- **Effect of exercise on Digestive System**
- **Effect of exercise on Circulatory System.**
- **Resistance exercises for major muscles of the body: Biceps, Triceps, Gastrocnemius, Thigh group group(anterior,Posterior, medial & lateral), Abdomen, Back & chest muscles.**

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B.COM SEMESTER SCHEMES 2020 (ONWARDS)

SEMESTER –I

PAPER CODE	TITLE	MAXIMUM MARKS		CREDITS
		THEORY	TUTORIAL	
1COMTH1	ACCOUNTING-I	75		2
1COMTH2	BUSINESS LAW-I	75		2
TUTORIAL 1			50	2
1COMTH3	BUSINESS ECONOMICS-I	75		2
1COMTH4	BUSINESS COMMUNICATION-I	75		2
TUTORIAL 2			50	2
1COMTH5	MONEY,BANKING&FOREIGN EXCHANGE-I	75		2
1COMTH6	BUSINESS ORGANISATION AND MANAGEMENT-I	75		2
TUTORIAL 3			50	2
	AECC			2
	SEMESTER TOTAL	450	150	20

SEMESTER-II

PAPER CODE	TITLE	MAXIMUM MARKS		CREDITS
		THEORY	TUTORIAL	
2COMTH1	ACCOUNTING-II	75		2
2COMTH2	BUSINESS LAW-II	75		2
TUTORIAL 1			50	2
2COMTH3	BUSINESS ECONOMICS-II	75		2
2COMTH4	BUSINESS COMMUNICATION-II	75		2
TUTORIAL 2			50	2
2COMTH5	MONEY,BANKING&FOREIGN EXCHANGE-II	75		2
2COMTH6	BUSINESS ORGANISATION AND MANAGEMENT-II	75		2
TUTORIAL 3			50	2
	AECC			2
	SEMESTER TOTAL	450	150	20

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B.Com Syllabus for First Semester

Detailed Course Contents

B. Com. First Year (Part - I)

Paper Code: 1COMTH1

ACCOUNTING-I

1. **Nature, Principles and Concept of Accounting:**

(a) Nature of Accounts, Bases of Accounting, Users of Accounting Information.

(b) Principles of Accounting- Accounting Concepts and Conventions.

(c) Indian Accounting Standards- a brief study.

2. **Government Accounting and Lease Accounting:**

(a) ***Government Accounting:*** Meaning, Objectives, Principles, Structure of Funds, Compilation of Accounts and Functions of Treasury.

(b) ***Lease Accounting:*** Meaning, Significance, Classification of Leases- Operating and Finance, Accounting treatment.

3. ***Royalty Accounts:*** Basic Terms- Royalty, Dead Rent, Short Working etc., Entries in the books of Lessee and Lessor. **Practical Problems**

4. ***Accounts of Installment Retailing:***

(a) ***Hire Purchase System***: The System and its Operation, Analysis of Installment from Accounting View Point, Entries in Hire Purchasers' Books, Entries in Hire Vendors' Books, The System Appropriate to the Sale of Large number of Articles of Small Value. **Practical Problems**

(b) **Installment Payment Method**: System and its Operation, Entries in the Books of the Buyer, Entries in the Books of the Seller, Comparison with Hire Purchase System. **Practical Problems**

PAPER- II: BUSINESS LAW-I
Paper code: 1COMTH2

1. Law of Contract:

The Indian Contract Act, 1872 Sections 1 to 31, 56, 64,65,68,70 to 75, 124, 126, 148 to 151, 170, 172, 182 to 189, 201 and 211 to 225.

2. Sale of Goods Act, 1930:

Contract of Sale- Essentials of a Contract of Sale, Sale and Agreement to Sell; sale and gift, Sale and Barter, Sale and Bailment; Subject Matter of contract of sale, Types of goods, Effect of destruction of subject matter; Price- Mode of fixing the price; Conditions and Warranties, Implied Condition and warranties; Doctrine of Caveat Emptor; Transfer of ownership and title, Performance of contract of sale; Unpaid seller- Rights of unpaid seller; Suit for breach of contract; Sale by Auction.

3. The Limited Liability Partnership Act, 2008:

Salient Features, Difference between LLP and Partnership, LLP Agreement, Partners and Designated Partners- Duties and Responsibilities, Incorporation and Registration, Extent of liability of LLP and Partners, Dissolution.

Suggested Readings:

1. Garg, Saxena, Sharma & Chawla: Mercantile Law; Kalyani Publishers, Ludhiana
2. Shukla & Sahai: Business Law, Sahitya Bhawan Publication, Agra (Hindi)
3. V. M. Baijal: Commercial Law, PPB, Allahabad (Hindi & English)
4. Singh R. K. & Amit Singh: Vanijya Sanniyam; Astha Pub., Allahabad
5. Singh R. K. & P. S. Sarnwal: Commercial Law; Kitab Mahal, Allahabad

Paper-III: Business Economics-I

PAPER CODE : 1COMTH3

1. Introduction:

(a) Concept, Nature, and Scope of Business Economics.

(b) Utility Analysis: Concept and Form of Utility; Laws of Diminishing Marginal Utility and Equi Marginal Utility.

(c) Consumer's Surplus (Marshallian and Hicksian Approaches)

2. **Demand Analysis:**

(a) Concept and Classification of Demand; Determinants of Demand; Law of Demand.

(b) Elasticity of Demand: Concept of Elasticity of Price-Demand; Income-Demand, and Cross- Demand; Degree and Measurement, Methods of Elasticity of Price-Demand; Relationship of Elasticity of Price-Demand with Law of Diminishing Marginal Utility.

(c) Demand Forecasting: Concept, Determinants, Objectives of Demand Forecasting; Methods of Demand Forecasting for Established Products of a Firm. Importance of Demand Forecasting.

3. **Production Analysis:** Concept of Production; Laws of Production/ Variable Proportion and Return to Scale, Economies and Diseconomies of Scale.

Suggested Readings:

1. P.N.Chopra: Business Economics, Kalyani Publishers, Ludhiana
2. H.K.Singh& Meera Singh: Buisness Economics; Kalyani Publishers, Ludhiana (Hindi)
3. D.D. Chaturvedi, S.L.Gupta & Anand Mittal: Managerial Economics, Brijwasi Book Distributors, Delhi
4. K.K. Dewett: Modern Economic Theory; Shyam Lal Charitable Trust, New Delhi

Paper-IV: Business Communication-I

PAPER CODE :1COMTH4

1. **Elements of Communication**: (a) Forms of Communication: Formal and Informal, Interdepartmental, Verbal and Nonverbal; Active Listening and Critical Thinking (b) Communication Channels (c) Communication Breakdown (d) Communicating Ethics (e) Soft Skills-Personality Traits; Interpersonal Skills; Leadership

2. **Communication in Business Environment**: (a) Business Meetings, Notice, Agenda, Minutes (b) Press Releases (c) Corporate Communication: Internal and External, Group Discussion, Seminars, Presentations.

3. **Report Writing**: Types of Reports, Steps in Business Report Writing, Styles, Sample Reports, Reporting of Proceedings of a Meeting.

4. **Letter Writing**: Types of letters, Parts of Business Letters, Format of Business Letters, Full Block, Block, Semi Block, Simplified; Request Letters, Good News Letters, Persuasive Letters, Sales Letters. How to make Business Letters' Effective.

Suggested Readings:

1. *Ajai Kumar Singhal, Varinder Kumar & T.D. Malhotra*: Business Communication & Computer: Kalyani Publication, Ludhiana
2. *Dinesh Kumar, B.P. Yadav & Sanjai Goswami*: Business Communication and Computer; Astha Publications, Allahabad

Paper – V: Money, Banking and Foreign Exchange-I

PAPER CODE: - 1COMTH5

1. **Money**: Definition, Functions, Significance and Classification; Role of Money in Different Economies – Capitalist, Socialist and Mixed.

2. **Demand for and Supply of Money**:

Demand for Money: Concept Approaches: Classical, Keynesian, Portfolio Balance and Wealth Adjustment.

Supply of Money: Concept, Approaches: Conventional, Chicago, Gurley – Shaw and the RBI Approach

3. **Value of Money**:

a) Meaning and Determination – Quantity Theory of Money – Cash Transaction Approach; Cash Balance Approach, Real Balance Approach and Income – Expenditure Theory.

b) Measurement of Value of Money – Index Number, Effect of Changes in the Value of Money – Inflation and Deflation

4. **The Money Market**:

(a) Definition; Composition; Characteristics; Significance and Defects.

(b) The Institutions of Money Market: Non-Banking Financial Companies- Scope, Extent and Regulations.

(c) Money Market Instruments: Calls Money Market, The Bill Market in India, Commercial Papers, Certificates of Deposits, Commercial Bills and Treasury Bills.

Suggested Readings:

1. D. M. Mithani: Money Banking, International Trade & Public Finance; HPH, Mumbai
2. Hari Gopal Das: Money Banking and Foreign Exchange: Sharda Pustak Bhawan,
3. Singh R. K. & Singh Amit: Mudra Banking Aur Antarrastriya Vyapar; Astha Pub., Allahabad

Paper – VI: BUSINESS ORGANISATION AND MANAGEMENT -I

PAPER CODE:-1COMTH6

1. **Introduction:** Components and Objectives of Business, Manufacturing and Service Sectors, Impact of Liberalization and Globalization, Start-Up, Make in India and Skill Development Movement.

2. **Social Responsibility and Ethics**

3. **Emerging opportunities in Business:** Franchising, Outsourcing and E-Commerce: Features, Issues, Problems and Scope.

4. **Location of Business Units:** Meaning, Importance and Factors Affecting Location, Weber's Deductive Theory, Sergeant Florence's Inductive Theory.

5. **Business Combination:** Meaning, Causes, Types and Forms of Combinations, Advantages and Evils of Combination, Combination in Indian Industries.

Suggested Readings:

1. Jagdish Prakash: Business Organisation & Management; Kitab Mahal, Allahabad (Hindi & English)

2. B. P. Singh & T. N. Chhabra: An Introduction to Business Organisation & Management; Kitab Mahal, Allahabad

3. M. Motihar: Business Organisation and Management, Sharda Pustak Bhawan, Allahabad (English & Hindi)

B.Com Syllabus for Second Semester

Detailed Course Contents

B. Com. First Year (Part - I)

Paper Code: 2COMTH1

Paper Name: ACCOUNTING-II

1. Reserves and Funds:

Reserves for Ascertained, Anticipated and Contingent Liabilities, Reserve Funds, Specific Funds (Dividend Equalization Fund, Insurance Fund), Sinking Funds, Secret Reserves.

2. **Accounting of Insurance Claims**: Stock Insurance, Loss of Profit Insurance. **Practical Problems**

3. **Amalgamation of Companies**: Amalgamation in the Nature of Merger and Amalgamation in the Nature of Purchase; Purchase Consideration; Pooling of Interest Method and Purchase Method; Entries Relating to Realization Expenses. Accounting Entries, **Practical Problems**

4. **Accounting of Holding Companies**: Holding Companies- Its Rational Legal Definition, Advantages and Disadvantages; Consolidated Balance Sheet; Minority Interest, Cost of Control, Pre-acquisition and Post-acquisition Profit. **Practical Problems**

5. **Liquidation of Company**: Order of Payment; Preferential Creditors; Contributories; Liquidator's Final Statement of Account. **Practical Problems**

Suggested Readings:

1. Jagdish Prakash: Advanced Accountancy; PPB, Allahabad (Hindi & English)
2. Ramendu Roy: Accounting Principles and Practice; PPB, Allahabad (Hindi & English)

Paper Name: BUSINESS LAW -II

Paper code: 2COMTH2

1. Negotiable Instruments Act, 1881:

Definition, Legal Presumptions, Types of Negotiable Instruments, Holder and Holder in Due Course, Maturity of Negotiable Instruments, Endorsement, Crossing of Cheques.

2. Law of Insurance:

Insurance Contract, Characteristics of Insurance Contract/ Principles of Insurance; Doctrine of Subrogation; Reinsurance; Double Insurance; Kinds of Insurance- Life Insurance- Life Insurance Contract and its characteristics; Non Life Insurance/ General Insurance- Marine Insurance Contract and its characteristics; Fire Insurance Contract and its characteristics; Difference between Life Insurance and General Insurance.

3. U.P. Shops and Commercial Establishments Act, 1962:

Definition of Commercial Establishment; Registration of Shop and Commercial Establishment; Hours of Business; Holidays and Leaves; Wage, Deductions and Notices for Discharge; Employment of Children and Women; Enforcement and Penalties.

Suggested Readings:

1. Garg, Saxena, Sharma & Chawla: Mercantile Law; Kalyani Publishers, Ludhiana
2. Shukla & Sahai: Business Law, Sahitya Bhawan Publication, Agra (Hindi)
3. V. M. Baijal: Commercial Law, PPB, Allahabad (Hindi & English)
4. Singh R. K. & Amit Singh: Vanijya Sanniyam; Astha Pub., Allahabad
5. Singh R. K. & P. S. Sarnwal: Commercial Law; Kitab Mahal, Allahabad

Paper Name : Business Economics-II

PAPER CODE :2COMTH3

1. ***Cost and Revenue Analysis:***

(a) **Cost Analysis**: Concept and Classification of Cost; Cost-Output Relationship; Significance of Cost Analysis in Business Decision making.

(b) **Revenue Analysis**: Concept of Revenue; Classification of Revenue; Revenue Output Relationships.

2. ***Pricing Analysis***: Market Competition Forms; Pricing of Output under Perfect Competition; Monopoly; Discriminating Monopoly and *Imperfect Competition.*

3. ***Theories of Distribution:***

(a) Ricardian and Modern Theories of Rent

(b) Keynesian Liquidity Preference and Modern Theories of Interest

(c) Marginal Productivity and Modern Theories of Wage

Suggested Readings:

1. *P.N.Chopra:* Business Economics, Kalyani Publishers, Ludhiana
2. *H.K.Singh & Meera Singh:* Business Economics; Kalyani Publishers, Ludhiana (Hindi)
3. D.D. Chaturvedi, S.L.Gupta & Anand Mittal: Managerial Economics, Brijwasi Book Distributors, Delhi
4. K.K. Dewett: Modern Economic Theory; Shyam Lal Charitable Trust, New Delhi

PAPER NAME : Business Communication-II

PAPER CODE: 2COMTH4

1. **Memo Writing:** Advantages, Disadvantages, Memo Format, How to write Effective Memos- Pre Writing Stage, Writing Stage, New Writing Stage, Specimens.

2. **Job Application and Resume Writing:** (a). Types of Application Letters- Solicited and Prospecting, Specimen of Job Application Letters, (b). Resume Writing- Physical Appearance, Layout of the Resume, Specimens

3. **Business Language and Presentation:** Importance of Business Language; Oral Presentation: Importance, Characteristics, Presentation Plan, Power Point Presentation, Visual Aids.

4. **Technology and Business Communication:** Role and Significance of Technology in Business Communication, E-Mail, Text Messaging and Modern Techniques like Video Conferencing and Social Networking: Process and Precautions.

Suggested Readings:

1. Ajai Kumar Singhal, Varinder Kumar & T.D. Malhotra: Business Communication & Computer: Kalyani Publication, Ludhiana
2. Dinesh Kumar, B.P. Yadav & Sanjai Goswami: Business Communication and Computer; Astha Publications, Allahabad

Ajai

PAPER NAME : Money, Banking and Foreign Exchange-II

PAPER CODE :- 2COMTH5

1. **Monetary Policy**: Meaning, Objectives, Suitable Monetary Policy for a Developing Country like India, Instruments of Monetary Policy.
2. **Banking**: Definition, Functions, Significance and Types of Banks, Banking Operations, Process and Limits of Credit Creation.
3. **Central Banking**: Functions of Central Banking, Objectives and Methods of Credit Control (with special reference to RBI).
4. **Digital Banking**: Meaning, Benefits, Mobile Banking, e-payments, RTGS, NEFT, ECS-Critical Evaluation.
5. **Foreign Exchange**: Meaning and problem of foreign exchange Determination of Exchange Rate: Mint Parity Theory, Purchasing Power Parity Theory and Balance of Payments Theory; Liberalized Exchange Rate Mechanism (LERM).
6. **I. M. F.**: Objectives, Organization and Working. The Problems of International Liquidity. Special Drawing Rights.

Suggested Readings:

1. D. M. Mithani: Money Banking, International Trade & Public Finance; HPH, Mumbai
2. Hari Gopal Das: Money Banking and Foreign Exchange: Sharda Pustak Bhawan,
3. Singh R. K. & Singh Amit: Mudra Banking Aur Antarrastriya Vyapar; Astha Pub., Allahabad

PAPER- VI BUSINESS ORGANISATION AND MANAGEMENT-II

PAPER CODE: - 2COMTH6

1. **Nature and Scope of Management**: Concept of Management, Management as a Science and as an Art, Levels of Management, Role and Responsibility of Management, Evolution of Management Thought- Classical, Neo-Classical and Modern.

2. **Functions of Management**:

(a) Planning: Nature, Types, Significance and Limitations, Management by Objective (MBO).

(b) Decision Making: Types, Process, Rational Decision Making and its Limitations.

(c) Organising: Concept, Types, Divisions and Levels; Authority and Responsibility; Delegation of Authority, Centralization and Decentralization of Authority.

(d) Directing: Principles and Techniques.

(e) Communication: Process, Levels, Types and Barriers.

(f) Controlling: Process and Methods.

(g) Coordination: Concept, Techniques and Barriers.

3. **Major Theories of Management**: Scientific Management (F. W. Taylor), Administrative Management (Henri Fayol), Behavioural Theory (Elton Mayo).

Suggested Readings:

1. Jagdish Prakash: Business Organisation & Management; Kitab Mahal, Allahabad (Hindi & English)

2. B. P. Singh & T. N. Chhabra: An Introduction to Business Organisation & Management; Kitab Mahal, Allahabad

3. M. Motihar: Business Organisation and Management, Sharda Pustak Bhawan, Allahabad (English & Hindi)

SEMESTER –III

PAPER CODE	TITLE	MAXIMUM MARKS		CREDITS
		THEORY	TUTORIAL	
3COMTH7	COST ACCOUNTING-I	75		2
3COMTH8	BUSINESS STATISTICS-I	75		2
	TUTORIAL1		50	2
3COMTH9	AUDITING-I	75		2
3COMTH10	COMPANY LAW-I	75		2
	TUTORIAL2		50	2
3COMTH11	FINANCIAL MANAGEMENT-I	75		2
3COMTH12	BUSINESS EVIRONMENT-I	75		2
	TUTORIAL3		50	2
	SEC			2
	SEMESTER TOTAL	450	150	20

SEMESTER-IV

PAPER CODE	TITLE	MAXIMUM MARKS		CREDITS
		THEORY	TUTORIAL	
4COMTH7	COST ACCOUNTING-II	75		2
4COMTH8	BUSINESS STATISTICS-II	75		2
	TUTORIAL1		50	2
4COMTH9	AUDITING-II	75		2
4COMTH10	COMPANY LAW-II	75		2
	TUTORIAL2		50	2
4COMTH11	FINANCIAL MANAGEMENT-II	75		2
4COMTH12	BUSINESS EVIRONMENT-II	75		2
	TUTORIAL3		50	2
	SEC			2
	SEMESTER TOTAL	450	150	20

22/11/21

22/11/21

22/11

A. Chandra 22/11/21

D. Pandey 22/11

B.Com Syllabus for Third Semester

Detailed Course Contents

B. Com. Second Year (Part - II)

PAPER NAME: COST ACCOUNTING-I

Paper Code: 3COMTH7

1. Nature, Principles, Objectives, Importance and Limitations of Cost Accounting; Installation of an Ideal Costing System: Steps in installing a Costing System, Difficulties in Installing a Costing System.

2. **Material**:

a. **Purchase**: Centralized purchasing, Decentralized Purchasing, Purchase Procedure.

b. **Storage of Material**: Stores department, classification and codification, Bin Card, Two Bin System, Stores Ledger Card, Difference between Store ledger and Bin Card, Treatment of Spoilage, Wastage and Scrap of Material.

c. **Issue of Material**: Requisition note, Material returned note, Material transfer note, Methods of pricing of Material issued: Cost price methods, Average cost price methods and Notional price method.

d. **Control**: Need, responsibility, Methods of Inventory Control: ABC Analysis and EOQ concept, perpetual inventory system, periodic stock taking system.

3. **Labour**: Time keeping and Time Booking, Methods of Time Keeping, Methods of Time Booking, Job Card System, Types of Job Card, Methods of Remunerating Labour, Various Incentive Plans, Group Bonus Scheme, Other Incentive Schemes, Labour turnover, Measurement of Labour Turnover.

4. **Overheads**: Classification; Allocation, Apportionment and Re-apportionment, Principles of apportionment, Methods of Re-apportionment, Absorption of Overheads, Methods of Absorption of Overheads.

5. **Single Unit or Output Costing**: Cost-sheet, Production Account. **Practical Problems**.

6. Calculation of Tender Price / Quotation Price. **Practical Problems**.

7. **Contract Costing – Practical Problems.**

Suggested Readings:

1. Ajai Kumar Singhal: Cost Accounting – A Multidimensional Approach, PPB, Alld.
2. S. P. Jain & K. L. Narang: Cost Accounting: Principles and Practice; Kalyani Publishers, Ludhiana
3. Jagdish Prakash & Devesh Prakash: Cost Accounting; PPB, Allahabad
4. M. C. Shukla, T. S. Grewal & M. P. Gupta: Cost Accounting: Text and Problems; S. Chand & Company, New Delhi
5. Singh, R. K. & Shiv Shanker Shukla: Lagat Lekhankan; Kitab Mahal, Allahabad (Hindi & English)
6. A.K.Garg: Cost Accounting: An Analytical Study, Swati Prakashan, Meerut, 250001

B. Com. Part- II

PAPER NAME : Business Statistics-I

PAPER CODE : 3COMTH8

1. **Introduction**: Meaning, Importance and Limitation; Collection, Classification, Tabulation and Presentation of Data.
2. **Measures of Central Tendency**: Mean, Median, Mode, Geometric Mean, Harmonic Mean, Relation between averages.
3. **Measures of Dispersion**: Range Method, Mean Deviation, Standard Deviation, Coefficient of Variation, Quartile Deviation.
4. **Measures of Skewness**: Karl Pearson's Coefficient of Skewness, Bowley's Coefficient of Skewness.
5. **Correlation**: Graphic and Scatter diagram method, Karl Pearson's Coefficient of Correlation, Spearman's rank Correlation Coefficient.

Suggested Readings:

1. Ramendu Roy: Principles of Statistics; PPB, Allahabad (Hindi & English)
2. K. L. Gupta: Business Statistics; Navyug Shahitya Sadan, Agra
3. D. N. Elhance: Fundamentals of Statistics; Kitab Mahal, Allahabad
4. S. P. Gupta: Statistical Methods; S. Chand & Sons, New Delhi
5. R. K. Singh & D. K. Verma: Advanced Statistics (Uchchtar Sannkhikiya); PPB, Allahabad (Hindi)

PAPER NAME : Auditing-I

Paper code : 3COMTH9

1. **Introduction:** Meaning, Scope, Objective and Limitation of Auditing, Audit Process, Classification of Audit – Interim, Final and Continuous Audit, Internal and External Audit, Audit Standards and Audit Guidelines, Commencement and Conducting an Audit, Audit Programme, Test Checking and Routine Checking, Difference between Audit and Investigation.

2. **Internal Check**: Meaning, Objective, Implications, Distinction with Internal Control and Internal Audit, Essentials of a Sound System of Internal Check, Internal Check System with regard to specific areas – Purchase and Trade Creditors, Sales and Trade Debtors, Stock and Work-in-Progress, Wages and Salaries, Reliance of Auditor on Internal Check System.

3. **Vouching of Transactions**: Meaning, Objective, Significance and General Principles of Vouching, Vouchers and Their Reliability, Vouching of Specialised Transactions, Vouching of Trading Transaction, Vouching of Cash Transactions.

4. **Verification and Valuation**: Meaning, Objective and Principles of Verification and Valuation, General Considerations for Valuation of Assets, Guidelines on Verification of Assets issued by Institute of Chartered Accounts of India, Verification and Valuation of various Assets and Liabilities.

Suggested Readings:

1. Jagdish Prakash: Auditing – Principles, Practices & Problems; Kalyani Publishers, Ludhiana (Hindi & English)
2. G. D. Verma, Pradeep Kumar, Baldev Sachdeva & Singh: Auditing – Theory and Practice; Kalyani Publishers, Ludhiana

PAPER NAME : Company Law-I

PAPER CODE :- 3COMTH10

1. **Introduction**: Characteristics; Lifting of Corporate Veil; Types of Companies including One Person Company, Small Company and Dormant Company; Association Not for Profit; Illegal Association; Formation of Company; Promoters, their Legal position.

2. **Documents**: Memorandum of Association, Article of Association; Doctrine of Constructive Notice and Indoor Management, Prospectus-Shelf and Red Herring Prospectus, Misstatement in Prospectus, Book building Issue.

3. **Shares and Debentures**: Issue, Allotment, Call and Forfeiture of Share; Buyback of Share, Issue of Sweat Equity Share, ESOP, Bonus Issue, Right Issue and Redemption of Debentures.

4. **Management**: Classification of Directors, Women Directors, Independent Directors, Small Share Holder's Directors; Disqualification, Director Identity Number (DIN); Appointment Removal of Director; Key Managerial Personnel, Managerial Remuneration, Company Secretary- Qualification, Appointment and Status.

Suggested Readings:

1. G.K. Kapoor: Corporate Laws & Secretarial Practices; Premier Book Company, New Delhi
2. Avtar Singh: Company Law; Eastern Book Company, Lucknow
3. Garg, Chawla & Gupta: Company Law; Kalyani Publishers, Ludhiana (Hindi & English)
4. M.C.Kuchhal: Modern Company Law: Shree Mahavir Book Depot, New Delhi
5. Himanshu Srivastava, Mohit Bahal: Company Law; Shuchita Prakashan, Allahabad

PAPER NAME : Financial Management-I

PAPER CODE :- 3COMTH11

1. **Financial Management:** Nature, scope and objectives and functions.

2. **Financial decision making:** Relevance and objectives- Wealth maximization vs. Profit maximization, Basic dimensions of financial decisions- Risk and Return.

3. **Financial Planning;** Concept, Process, characteristics of Sound Financial Plans; Factors Affecting Financial Plan.

4. **Concepts in Financial Planning:** Trading on Equity, Capital Gearing, Sources of capital; Long term capital, Short term capital.

5. **Financial Reporting as the basis of Financial Management:** Structure of Financial Statements: Statement of Financial Position (Balance Sheet), Statement of Earnings (Income Statement).

6. **Statement of Cash Flows and Funds Flow:** Concept, Process and Relevance.

7. **Capitalisation:** Theories of Capitalisation, Causes, Consequences and Remedies of over & under capitalization.

Suggested Readings:

1. Rustagi, R.P. Fundamentals of Financial Management, Taxmann, 13th Ed..

2. Khan, M.Y & Jain, P.K.: Financial Management; Tata McGraw Hill, New Delhi.

3. Pandey, I. M.: Financial Management; Vikas Publishing House, New Delhi.

4. Chandra, Prasana: Financial Management; Tata McGraw Hill, New Delhi, 2008.

5. H.K Singh & Sankalp Srivastava: Business Finance; PPB, Allahabad (Hindi & English)

PAPER NAME : Business Environment

PAPER CODE : 3COMTH12

1. **Business Environment**: Concept, Components, Features, Scope of Business Environment, Interaction between Business and Environment, Fundamental Rights and Directive Principles of the State.

2. **Economic System:** Nature, Determinants of Economic system- Capitalistic, Socialistic, Mixed.

3. **Policies**: New Industrial Policy, Foreign Trade Policy- Export Promotion and Import Substitution, Fiscal Policy, Fiscal Deficit, Deficit Financing.

4. **Regional Imbalance and Social Injustice**: Nature, Objective, Scope, Causes and Suggestions.

5. **Consumer Protection**: Rights, Need, Awareness, Salient Features of Consumer Protection Act, 1986.

Suggested Readings:

1. Rosy Joshi & Sangam Kapoor: Business Environment; Kalyani Publishers, Ludhiana

2. A. K. Malviya: Business Environment; PPB, Allahabad (Hindi)

3. Singh, R. K. & Sudhir Sinha: Business Environment; Astha Publication, Allahabad

4. Singh R. K. & Amit Singh: Vyavashayik Paryavaran; Astha Pub., Allahabad

B.Com Syllabus for fourth Semester

B. Com. Second Year (Part - II)

PAPER NAME: COST ACCOUNTING-II

Paper Code: 4COMTH7

1. **Job and Batch Costing - Practical Problems.**

2. **Process Costing**: Simple Process Cost Account, Transfer to Warehouse, Abnormal wastage and abnormal efficiency, Normal wastage account, Joint products and By-products; Oil crushing, Refining and Finishing processes, Transfer price – Inter process. **Practical Problems.**

3. **Reconciliation of Cost and Financial Accounts – Practical Problems.**

4. **Operating Costing (only transport and hotel) – Practical Problems.**

5. **Standard Costing and Variance Analysis (Material and Labour only) – Practical Problems.**

6. Budgetary Control, Performance Budgeting and Zero Base Budgeting.

Suggested Readings:

1. Ajai Kumar Singhal: Cost Accounting – A Multidimensional Approach, PPB, Alld.

2. S. P. Jain & K. L. Narang: Cost Accounting: Principles and Practice; Kalyani Publishers, Ludhiana

3. Jagdish Prakash & Devesh Prakash: Cost Accounting; PPB, Allahabad

4. M. C. Shukla, T. S. Grewal & M. P. Gupta: Cost Accounting: Text and Problems; S. Chand & Company, New Delhi

5. Singh, R. K. & Shiv Shanker Shukla: Lagat Lekhankan; Kitab Mahal, Allahabad (Hindi & English)

6. A.K.Garg: Cost Accounting: An Analytical Study, Swati Prakashan, Meerut, 250001

PAPER NAME: Business Statistics-II

PAPER CODE: 4COMTH8

1. **Analysis of Time Series**: Moving average method, Least Square Method, Seasonal Variations, Irregular Fluctuations.

2. **Index Number**: Un-weighted Index number, Changing and Shifting of Base, Weighted Index number, Cost of living Index Number, Fisher's Ideal Index Number, Reversibility Tests.

3. **Interpolation**: Parabolic Curve method, Newton's method, Binomial expansion method, Lagrange's method.

4. **Probability**: Classical and Axiomatic definitions, Addition theorem, Multiplication theorem (**elementary problems only**).

5. **Statistical Organisation in India** - CSO and NSSO

Suggested Readings:

1. Ramendu Roy: Principles of Statistics; PPB, Allahabad (Hindi & English)
2. K. L. Gupta: Business Statistics; Navyug Shahitya Sadan, Agra
3. D. N. Elhance: Fundamentals of Statistics; Kitab Mahal, Allahabad
4. S. P. Gupta: Statistical Methods; S. Chand & Sons, New Delhi
5. R. K. Singh & D. K. Verma: Advanced Statistics (Uchchtar Sannkhikiya); PPB, Allahabad (Hindi)
6. Singh R. K. & S. Shankar; Business Statistics; Kitab Mahal, Allahabad

PAPER NAME : Auditing –II

PAPER CODE :4COMTH9

1. **Company Auditor**: Appointment, Rotation, Qualifications, Disqualifications, Remuneration, Removal, Rights, Duties, Powers and Liabilities of Company Auditor.

2. **Auditor's Report**: Scope, Contents, Qualified, Modified and Unqualified Audit Report, Consideration for making Qualifications in Audit Reports, Specimen of Audit Reports.

3. **Audit of Banking and Insurance Companies**: Features and special points relating to Audit of Banking Company and Insurance Company.

4. **Cost Audit and Management Audit**: Meaning, Objectives, Significance and Process of Cost Audit and Management Audit, Professional Misconduct in Cost Accountants Act, Distinction between Management Audit and Cost Audit.

5. **Tax Audit and Secretarial Audit:** Meaning, Objectives, Process.

Suggested Readings:

1. Jagdish Prakash: Auditing – Principles, Practices & Problems; Kalyani Publishers, Ludhiana (Hindi & English)

2. G. D. Verma, Pradeep Kumar, Baldev Sachdeva & Singh: Auditing – Theory and Practice; Kalyani Publishers, Ludhiana

PAPER NAME: COMPANY LAW-II

PAPER CODE: - 4COMTH10

1. **Meeting**: Meeting of Shareholder and Board; Types of Meeting, Convening and Conduct of Meeting, Postal Ballot, e-Voting, Quorum, Proxy, Minute.

2. **Distribution of Profits**: Profit and Ascertainment of Divisible Profits; Declaration and Payment of Dividend; Unpaid Dividend Account; Investor Education and Protection Fund

3. **Corporate Social Responsibility (CSR):** Applicability of CSR; Types of CSR Activities; CSR Committee and Expenditure; Net Profit for CSR; Reporting Requirements.

4. **Winding Up**: Concept and Modes of Winding Up; National Company Law Tribunal (NCLT); Special Courts.

5. **E-Governance, XBRL**: Features of e-Governance, Benefits of MCA 21, Digital Signature, XBRL Filing, Benefits of XBRL.

Suggested Readings:

1. G.K. Kapoor: Corporate Laws & Secretarial Practices; Premier Book Company, New Delhi

2. Avtar Singh: Company Law; Eastern Book Company, Lucknow

3. Garg, Chawla & Gupta: Company Law; Kalyani Publishers, Ludhiana (Hindi & English)

4. M.C.Kuchhal: Modern Company Law: Shree Mahavir Book Depot, New Delhi

5. Himanshu Srivastava, Mohit Bahal: Company Law; Shuchita Prakashan, Allahabad

PAPER NAME: Financial Management-II

PAPER CODE: - 4COMTH11

1. **Long term investment decisions:** Capital Budgeting Process- Features, Significance, Types of capital budgeting decisions, Accounting Profit vs. Cash Flows.

2. **Techniques of Capital Budgeting:** Payback Period Method, Accounting Rate of Return, Net Present Value (NPV), Internal Rate of Return (IRR), and Profitability Index.

3. **Cost of Capital:** Concept, importance, components: Cost of Equity, Cost of Retained Earnings, Cost of Debt and Cost of Preference Capital, Weighted Average Cost of Capital (WACC).

4. **Leverage Analysis:** Concept of leverages, Operating and Financial leverages: Importance; Combined leverage.

5. **Dividends:** Kinds & determinants; Cash and stock dividends. Dividend policy and retained earnings, Walter Formula.

6. **Concept of Working Capital**: Operating cycle, Net and gross working capital, Factors affecting working capital requirements.

7. **Components of Working Capital**: Current assets financing, Need for adequate working capital, Liquidity vs. profitability.

Suggested Readings:

1. Rustagi, R.P. Fundamentals of Financial Management, Taxmann, 13th Ed..

2. Khan, M.Y & Jain, P.K.: Financial Management; Tata McGraw Hill, New Delhi.

3. Pandey, I. M.: Financial Management; Vikas Publishing House, New Delhi.

4. Chandra, Prasana: Financial Management; Tata McGraw Hill, New Delhi, 2008.

5. H.K Singh & Sankalp Srivastava: Business Finance; PPB, Allahabad (Hindi & English)

PAPER NAME: BUSINESS ENVIRONMENT-II

PAPER CODE: 4COMTH12

1. **Competition**: Meaning, Salient Features of Competition Act, 2002, CCI- Competition Commission of India, CAT- Competition Appellate Tribunal.

2. **Legal Environment**: Regulatory Authorities and their functions, Telecom Regulatory Authority of India (TRAI), Insurance Regulatory and Development Authority (IRDA), Food Safety and Standards Authority of India (FSSAI).

3. **International Environment of Business**: Multinational Corporation, Foreign Collaboration, Joint Venture, Foreign Direct Investment (FDI), Implication of WTO.

4. **Environment Protection**: Need for Sustainable Development, Components of Environment, Salient Features of Environment Protection Act, 1986, National Green Tribunal.

Suggested Readings:

1. Rosy Joshi & Sangam Kapoor: Business Environment; Kalyani Publishers, Ludhiana

2. A. K. Malviya: Business Environment; PPB, Allahabad (Hindi)

3. Singh, R. K. & Sudhir Sinha: Business Environment; Astha Publication, Allahabad

4. Singh R. K. & Amit Singh: Vyavashayik Paryavaran; Astha Pub., Allahabad

SEMESTER –V

PAPER CODE	TITLE	MAXIMUM MARKS		CREDITS
		THEORY	TUTORIAL	
5COMTH13	INCOME TAX LAW AND ACCOUNTS -I	75		2
5COMTH14	GOODS AND SERVICES TAX-I	75		2
	TUTORIAL1		50	2
5COMTH15	ENTREPRENUERSHIP AND SMALL BUSINESS-I	75		2
5COMTH16	INTERNATIONAL TRADE AND TARIFFS-I	75		2
	TUTORIAL2		50	2
5COMTH17(A,B,C)	OPTIONAL PAPER I	75		2
5COMTH18(A,B,C)	OPTIONAL PAPER II	75		2
	TUTORIAL3		50	2
	SEC			2
	SEMESTER TOTAL	450	150	20

SEMESTER-VI

PAPER CODE	TITLE	MAXIMUM MARKS		CREDITS
		THEORY	TUTORIAL	
6COMTH13	INCOME TAX LAW AND ACCOUNTS –II	75		2
6COMTH14	GOODS AND SERVICES TAX-II	75		2
6COMTU1	TUTORIAL		50	2
6COMTH15	ENTREPRENUERSHIP AND SMALL BUSINESS-II	75		2
6COMTH16	INTERNATIONAL TRADE AND TARIFFS-II	75		2
6COMTU2	TUTORIAL		50	2
6COMTH17(A,B,C)	OPTIONAL PAPER I	75		2
6COMTH18(A,B,C)	OPTIONAL PAPER II	75		2
6COMTU3	TUTORIAL		50	2
	SSEC			2
	SEMESTER TOTAL	450	150	20

22/11/21 22/11/21 22.11.21 22/11/21 22/11

B.Com Syllabus for Fifth Semester

Detailed Course Contents

B. Com. Third Year (Part -III)

Paper name : Income Tax Law and Accounts-I

Paper Code: 5COMTH13

1. (a). Basic Concept: Assessee, Types of Assessees, Assessment Year, Previous, Year, Gross Total Income, Total Income, Tax Evasion and Tax Avoidance. (b). Residential Status and Tax Incidence, Tax liability,. (C). Exempted Incomes under Section 10. (d). Agricultural Incomes; Meaning, Types, Integration of Agriculture Income with Non-agricultural Incomes.
2. Computation of Income under Salaries Head
3. Computation of Income under Income from House Property Head
4. Computation of Income under Profit and gains of Business or Profession Head
5. Set off Carry forward of Losses.

NOTE: The course contents shall be modified by the Head of the Department as applicable on 1st July of each Academic Year according to the prevailing tax laws.

Suggested Readings:

1. V. P. Gaur & D. B. Narang: Income Tax – Law & Practice; Kalyani Publishres, Ludhiana
2. Ahuja, Girish & Ravi Gupta: Systematic Approach to Income Tax; Bharat Law House, New Delhi
3. H. C. Mehrotra: Income Tax Law; Sahitya Bhawan, Agra
4. V. K. Singhania: Students' Guide to Income Tax, Taxman Publications (P) Ltd. Delhi

PAPER NAME :Goods and Services Tax-I

PAPER CODE : 5COMTH14

1. **Basic Concepts**: Taxable person, Assessee, Types of Assesses, Meaning of Goods and Services, Difference between CGST, SGST, IGST, UTGST, Input Service, Input Tax, Output, Output Tax, place of business, place of supply, reverse charge, exempted goods, various rate of taxes, benefits of GST.

2. **Registration**: Procedure of registration, compulsory registration, Deemed registration, cancellation and revocation of registration.

3. **Composition Levy**: Meaning, specified rates, persons not eligible for composition scheme, person eligible to opt composition scheme with drawl of composition scheme, payment of tax, returns, penalty and fines.

Note: The course contents shall be modified by the Head of the Department as applicable on 1st July of each academic year according to the Prevailing Tax Laws.

Suggested Readings:

1. Himanshu Srivastava, Mohit Bahal: GST; Shuchita Prakashan , Allahabad

2. Ekta Verma, Prabhat Agarwal: Goods & Services Tax, Shikha Publications, Allahabad

3. Dr. Vinod K. Singhania: Students' Guide To GST & Customs Law, Taxmann Publications Pvt. Ltd., New Delhi

PAPER NAME: ENTREPRENUERSHIP AND SMALL BUSINESS-I
PAPER CODE: 5COMTH15

1. **Entrepreneurship**: Concept; Functions; Elements; Quality of a Successful Entrepreneur; Theories of Entrepreneurship; Role of Entrepreneur in Economic Development.

2. **Dimensions of Entrepreneurship**: Intrapreneurship, Technopreneurship; Cultural Entrepreneurship; International Entrepreneurship; Netpreneurship; Ecopreneurship and Social Entrepreneurship.

3. **Entrepreneurship Development**: Environmental Factors Affecting Entrepreneurial Development, Entrepreneur Development Programmes and their Critical Evaluation; Government Policies and their Effects, Role of Government and Other Institutions.

4. **Entrepreneurial Sustainability**: Public and Private System of Stimulation, Support and Sustainability of Entrepreneurship. Requirement Availability and Access to Finance Marketing Assistant, Technology and Industrial Accommodation.

5. **Business Plan Preparation**: Sources of Business Ideas and Tests of Feasibility. Significance of Writing the Business Plan/ Project Proposal, Contents of Business Plan/ Project Proposal. Designing Business Processes, Location, Layout, Operations, Planning and Control; Preparation of Project Report.

Suggested Readings:

1. Vasant Desai: Dynamics of Entrepreneurial Development and Management, HPH
2. S.B. Srivastava: A Practical Guide to Industrial Entrepreneurs, S. Chand & Sons
3. S.S.Khanka: Entrepreneurship and Small Business Management, S. Chand & Sons
4. K Ramchandran, Entrepreneurial Development, McGraw Hill Education
5. Singh, Nagendra P. Emerging Trends in Entrepreneurial Development, New Delhi; ASEED

PAPER NAME: International Trade and Tariffs-I

PAPER CODE: 5COMTH16

1. **International Trade**: nature, Scope, Objectives, International Vs Domestic Trade, Strategies of International Trade.

2. **Institutional Environment**: Nature, Scope, Objective and functioning of GATT, WTO, UNCTAD, World Bank, IMF.

3. **Theories of International Trade**: Classical Theory, Ricardian Theory, Haberler's Theory, Hecksher-Ohlin Theory.

4. **Anti-Dumping Duties**: Meaning, Principles, Agreement, Determination of Normal Value and Export Price, Institutional Agreement and Procedure in India.

5. **Subsidies and Countervailing Duties**: Meaning, Dumping Vs Subsidy, WTO Provisions, Agreements Categories of Subsidies, Countervailing Measures.

Suggested Readings:

1. Bhalla, V.K. Srivaramn: International Business, S.Chand Publishing, New Delhi
2. Subbarao, P: International Business, Himalaya Publishing House, New Delhi
3. Charles, W.L. Hill, and Jain, Arun Kumar: International Business, New Delhi: Tata McGraw Hill
4. Justin, Paul: International Business: Text and Cases. Prentice Hall of India, Ltd

SEMESTER V

OPTIONAL GROUPS (any ONE of them)

Group-'I': Financial Services

PAPER NAME: Insurance and Risk Management-I

PAPER CODE: 5COMTH17A

1. **Principles of Insurance**: Principle of Cooperation, Insurable Interest, Utmost Good Faith, Indemnity, Subrogation, Causa-Proxima, Over and Under Insurance, Contribution, Pro-Rata Clause, Paid-Up Value, Re-Insurance.

2. **Life Insurance**: Procedure for effecting Life Insurance , Kinds of Life Insurance Policies, Whole Life, Endowment and Term Policies, Group Insurance, Policy Conditions, Nomination and Assignment, Claims Settlement.

3. **Life Insurance Premium**: Factors affecting premium of Life Insurance Policies, Methods of Premium Computation, Importance of Mortality Tables in Premium Computation.

4. **Valuation, Surplus and Bonus**: Objects of Valuation, Sources of Surplus, Bonus.

Suggested Readings:

1. M.Motihar: 'Principles and Practice of Insurance'; Sharda Pustak Bhavan, Allahabad
2. M.N. Mishra: 'Insurance Principles and Practice'; S.Chand & Co. Ltd, New Delhi
3. M. Arif Khan: 'Theory and Practice of Insurance', Educational Book House, Aligarh
4. Michael Crouchy, Dan Galai, Robet Mark: 'The Essentials of Risk Management'; McGraw Hill Professional , New York.

PAPER NAME : Banking Law and Practices-I

PAPER CODE : 5COMTH18A

1. **Bank-Customer Relationship**: Definition of Customer, Bank Customer Relationship and its special features, Termination of the relationship, Bank Pass Book.

2. **Customer Accounts**: Opening of Account, Operation of Account, Special Customers of a Bank-Minor, Married Women, Lunatic, Drunkard, Joint Accounts, Partnership Firms, Joint Stock Company and Trustees.

3. **Employments of Bank Funds**: Cash Reserve and other Non-Earning Assets, Earning Assets: Money at Call and Short Notice, Investment, Loans and Advances, Discounting of Bill.

4. **Modes of Securing Advances**: Personal Security, Guarantee and indemnity and Collateral Securities: Lien, Pledge, Mortgage and Hypothecation.

5. **Securities of Advances**: General Principles for secured advances, Types of Collateral Securities – Stock Exchange Securities, Goods, Documents of Title of Goods, Life Insurance Policies, Immovable Property, Fixed Deposit Receipt, Book Debts.

6. **Banking Regulation Act**: Bank License – Issue, Suspension and Revocation, Inspection of Bank Offices, Branch Expansion, Bank Books, Records and Returns, Bank Accounts and Audit.

Suggested Readings:

1. S. N. Maheshwari: Banking Law and Practice; Kalyani Publishers, Ludhiana
2. G. K. Varshney: Law & Practice of Banking; Sahitya Bhawan Publications, Agra
3. Gordon & Natarajan: Banking Theory, Law and Practice; HPH, Delhi
4. B. M. L. Nigam: Law and Practice of Banking, Vikas Publication, New Delhi

Group-'J': Financial Market Analysis

PAPER NAME: Stock Market Operations-I

PAPER CODE: 5COMTH17B

1. **Stock Exchanges**: Meaning, Functions, Significance, Development of Stock Market in India and Overseas Stock Exchanges.
2. **Stock Exchanges in India**: BSE and NSE and MCX; Functions, Recent Development in Stock Exchanges.
3. **Secondary Market Players**: Role and Functions of Brokers, Sub- Brokers, FIIs and DIIs, Depository Participants and Custodians.
4. **Depositories** – Need, Functions, operations and services (NDSL, CDSL).
5. **Stock Market Trading Mechanism**: Buying and selling of stocks: using brokerage and analysts' recommendations; Stop loss, Open order, limit order, and market order.
6. **Screen Based Tradings** – BOLT, NEAT, long and short position, Short Selling, Demat trading, Stock Market Clearing House – Functions and Importance.

Suggested Readings:

1. Preeti Singh: Investment Management Security Analysis & Portfolio Management, HPH, New Delhi.
2. V. A. Avadhani: Investment and Securities Market in India; HPH, New Delhi.
3. Bhole, L. M. Financial Markets and Institutions, Tata McGraw Hill, Delhi.
4. H. R. Machirajn: Indian Financial System; Vikas Publications.

PAPER NAME: Capital and Security Market-I

PAPER CODE: 5COMTH18B

1. **Indian Financial System** – Introduction, Indian Financial system with understanding of different markets- Money Market vs. Capital Market.

2. **Capital Market:** Meaning and features, Role in capital formation, Link between Primary Market and Secondary Market.

3. **Capital Market Intermediaries:** Merchant Bankers, Underwriters, sub-underwriters Portfolio Managers, Brokers, Sub-brokers, Registrar and transfer agents.

4. **Primary Market/ New Issue Market -** Methods of Issuing New Securities (Primary market), IPO, FPO, Offer for Sale, Private Placement, Rights Issue, Bonus Issue.

5. **Book Building Method:** Role of Lead manager/Merchant bankers in issue, Red - Herring Prospectus, ASBA, Green Shoe option - Sweat equity, ESOPs, Listing of securities.

6. **Debt market Instruments** : Government Securities: bonds- Zero Coupon Bonds, Deep Discount Bonds, Convertible bonds, Commodity bonds, Floating rates bonds.

Suggested Readings:

1. V. A. Avadhani: Investment and Securities Market in India; HPH, New Delhi

2. Bhole, L. M. Financial Markets and Institutions, Tata McGraw Hill, Delhi.

3. H. R. Machirajn: Indian Financial System; Vikas Publications.

4. Gordon and Narrajan, Financial Markets and Services, Himalaya Publishing House, New Delhi.

Group-'K': Functional Management

PAPER NAME: Human Resource Management-I

PAPER CODE: 5COMTH17C

1. **Introduction**: Evolution of Human Resource Management (HRM); Concept, Objectives and Functions of HRM; HRM in the Indian Scenario.
2. **Human Resource Planning**: Concept; Process and Need.
3. **Job Analysis**: Concept and Process.
4. **Recruitment and Selection**: Concept and Process.
5. **Human Resource Development**: Concept, HRD Matrix.
6. **Training and Development**: Concept, Need and Methods.

Suggested Readings:

1. V. A. Avadhani: Investment and Securities Market in India; HPH, New Delhi
2. Bhole, L. M. Financial Markets and Institutions, Tata McGraw Hill, Delhi.
3. H. R. Machirajn: Indian Financial System; Vikas Publications.
4. Gordon and Narrajan, Financial Markets and Services, Himalaya Publishing House, New Delhi.

PAPER NAME: Marketing Management-I
PAPER CODE : 5COMTH18C

1. **Introduction**: Marketing – Concept, Functions and Importance. Marketing Management – Concept, Objectives, Functions and Significance.

2. **Product Planning & Development**: Definition, Classification of Product, Stages of Product Life Cycle (PLC) and Factors affecting PLC. Product Planning – Genesis and Importance of Product Planning in Marketing. Product Development: Meaning, Principle of Product Development, Stages of New Product Development and Factors affecting development of New Products.

3. **Pricing**: Meaning, Objectives, Price Policies and Strategies and Methods of fixing prices.

4. **Marketing Research**: Meaning, Objectives, Types, Techniques, Advantages and Limitations.

Suggested Readings:

1. A. K. Malviya: Marketing Management; PPB, Allahabad (Hindi)
2. C. B. Memoria, Pradeep Jain & Priti Mitra: Marketing Management; Kitab Mahal,
3. Beller & Berkman: Readings in Marketing Management; HPH, Bombay
4. D. Amar Chand, B. Varadharajan: An Introduction to Marketing; Vikas Publishing House Pvt. Ltd., New Delhi.
5. Singh R.K. & Amit Singh, Vipran Prabandh; Astha Pub., Allahabad

B.Com Syllabus for Sixth Semester

Detailed Course Contents

B. Com. Third Year (Part -III)

Paper name : Income Tax Law and Accounts-II

Paper Code: 6COMTH13

1. Assessment of Capital Gains **Practical Problems**
2. Income from Other Sources. **Practical Problems**
3. (a). Deductions from Gross Total Income (b). Assessment of Individual, HUF and Firm. **Practical Problems**
4. (a). Filing of Returns (b). Permanent Account Number (c). Rebates and Reliefs.
5. (a). Income of other Persons included in assessee's Income (b). Advance Payment of Tax (c). Powers of Central Board of Direct Taxes (CBDT) and Assessing Officer (d). Tax Planning for an Individual, (e). Types of Assessment, (f). Tax Deduction at Source (TDS).

NOTE: The course contents shall be modified by the Head of the Department as applicable on 1st July of each Academic Year according to the prevailing tax laws.

Suggested Readings:

1. V. P. Gaur & D. B. Narang: Income Tax – Law & Practice; Kalyani Publishres, Ludhiana
2. Ahuja, Girish & Ravi Gupta: Systematic Approach to Income Tax; Bharat Law House, New Delhi
3. H. C. Mehrotra: Income Tax Law; Sahitya Bhawan, Agra
4. V. K. Singhania: Students' Guide to Income Tax, Taxman Publications (P) Ltd. Delhi

PAPER NAME : GOODS AND SERVICES TAX-II

PAPER CODE: 6COMTH14

1. **Input Tax Credit**: Meaning, Eligibility and Conditions for taking input tax credit, situation in which ITC not allowed, Reversal of ITC, availability of credit in special circumstances.

2. **Returns**: Procedure of filling returns, periodicity of returns, various forms for filling of returns, final return, notice to return defaulters, levy of late fee.

3. **Assessment and Refund**: Self-Assessment, Provisional Assessment, Scrutiny of Returns, Assessment of Unregistered Persons, Summary Assessment, Refund.

Note: The course contents shall be modified by the Head of the Department as applicable on 1st July of each academic year according to the Prevailing Tax Laws.

Suggested Readings:

1. Himanshu Srivastava, Mohit Bahal: GST; Shuchita Prakashan , Allahabad
2. Ekta Verma, Prabhat Agarwal: Goods & Services Tax, Shikha Publications, Allahabad
3. Dr. Vinod K. Singhania: Students' Guide To GST & Customs Law, Taxmann Publications Pvt. Ltd., New Delhi

PAPER NAME: ENTREPRENUERSHIP AND SMALL BUSINESS-II
PAPER CODE: 6COMTH15

1. **Creativity**: Nature, Constituents, Types; Techniques of Creative Thinking- Focus Groups, Brainstorming, Attitude Analysis, Synectics; Innovation- Types and Phases. Knowledge Management and its role in Innovation.

2. **Rural Entrepreneurship**: Definition, Meaning, Need, Approaches, Opportunities and Challenges; Rural Entrepreneurship and Rural Development; Growth of Rural Entrepreneurship in India.

3. **Start- Up**: Mobilising Resources for Start-Up, Accommodation and Utilities, Preliminary Contracts with the vendors, suppliers, bankers, principal customers; Contract Management; Basic Start-Up problem, Ease of Doing Business, Make in India.

4. **Sustaining Employee Interest**: Main Provisions of Minimum Wage Act, 1948 and Employee Provident Fund Act, 1952.

Suggested Readings:

1. Vasant Desai: Dynamics of Entrepreneurial Development and Management, HPH
2. S.B. Srivastava: A Practical Guide To Industrial Entrepreneurs, S. Chand & Sons
3. S.S.Khanka: Entrepreneurship and Small Business Management, S. Chand & Sons
4. K Ramchandran, Entrepreneurial Development, McGraw Hill Education
5. Singh, Nagendra P. Emerging Trends in Entrepreneurial Development, New Delhi; ASEED

PAPER NAME: International Trade and Tariffs-II

PAPER CODE: 6COMTH16

1. **Exchange Control**: Meaning, Characteristics, Objectives, Techniques, Exchange Control in India.

2. **Foreign Exchange market**: Features, Participants, Operations, Spot and Forward Market.

3. **Devaluation and Depreciation of Currencies**: Meaning, Objective, Scope, Reasons and Effects, Devaluation Vs Depreciation of Currencies.

4. **Foreign Trade Promotion Measures**: Special Economic Zones (SEZs) and 100% Export Oriented Units (EOUs); Measures for Promoting Foreign Investments into and from India.

5. **Import and Custom Duties**: Tariff and Non-Tariff measures; Nature, Objects, Types of Custom Duty, Role of Customs in International Trade.

Suggested Readings:

1. Bhalla, V.K. Srivaramn: International Business, S.Chand Publishing, New Delhi
2. Subbarao, P: International Business, Himalaya Publishing House, New Delhi
3. Charles, W.L. Hill, and Jain, Arun Kumar: International Business, New Delhi: Tata McGraw Hill
4. Justin, Paul: International Business: Text and Cases. Prentice Hall of India, Ltd

SEMESTER VI

OPTIONAL GROUPS (any <u>ONE</u> of them)

Group-'I': Financial Services

PAPER NAME: Insurance and Risk Management-II

PAPER CODE: 6COMTH17A

1. **Fire Insurance**: Fire Insurance Contract Principles, Types of Fire Insurance Policies, Fire Policy Conditions, Claims Settlement.

2. **Marine Insurance**: Marine Insurance Contract, Express and Implied Warranties under Marine Insurance, Types of Marine Policies, Policy Conditions/ Clauses, Claims Settlement.

3. **Risk Management**: Objectives and Scope of Risk Management, Classification of Risks, Risk Management Process: Risk Analysis, Risk Control, Risk Financing, Risk Manager's Role and Responsibilities.

4. **Risk Management Strategies**: Risk Avoidance, Risk Reduction, Risk Retention, Risk Combination, Risk Transfer, Risk Sharing, Risk Hedging, Insurance as a Risk Management Tool.

Suggested Readings:

1. M.Motihar: 'Principles and Practice of Insurance'; Sharda Pustak Bhavan, Allahabad
2. M.N. Mishra: 'Insurance Principles and Practice'; S.Chand & Co. Ltd, New Delhi
3. M. Arif Khan: 'Theory and Practice of Insurance', Educational Book House, Aligarh
4. Michael Crouchy, Dan Galai, Robet Mark: 'The Essentials of Risk Management'; McGraw Hill Professional , New York.

PAPER NAME : Banking Law and Practices-II

PAPER CODE : 6COMTH18A

1. **Banking Regulation Act**: Bank License – Issue, Suspension and Revocation, Inspection of Bank Offices, Branch Expansion, Bank Books, Records and Returns, Bank Accounts and Audit.

2. **Payments Bank:** Types, Working, RBI Guidelines and Regulations.

3. **The Insolvency and Bankruptcy Code, 2016**: Salient Features, Need and Resolution Process.

4. **Norms of Bank Financing**: Brief study of the recommendations of Tandon Committee, K. Kannan Committee, Chore Committee.

5. **Liberalised Exchange Rate Mechanism (LERM)**: Detailed study. Tarapore Committee Report of 2000 and Report II of 2006 on Capital Account Convertibility

6. **Special Banking Problems in India**: Core Banking; Non-Performing Assets (NPA), Prompt Corrective Action (PCA), Amalgamation and Merger of Banks, Bank Frauds.

Suggested Readings:

1. S. N. Maheshwari: Banking Law and Practice; Kalyani Publishers, Ludhiana

2. G. K. Varshney: Law & Practice of Banking; Sahitya Bhawan Publications, Agra

3. Gordon & Natarajan: Banking Theory, Law and Practice; HPH, Delhi

4. B. M. L. Nigam: Law and Practice of Banking, Vikas Publication, New Delhi

Group-'J': Financial Market Analysis

PAPER NAME: Stock Market Operations-II

PAPER CODE: 6COMTH17B

1. **Stock Market Indices**: BSE Sensitive Index (SENSEX), NSE Nifty, Calculation of stock market indices, free float.

2. **Share Price Movements**: BSE Sensitive Index (SENSEX), NSE Nifty, Calculation of stock market indices, Factors Influencing Share Price Fluctuations, Stock market frauds.

3. **Stock Market Risks**: Risk-Return Trade-Off; Systematic vs. Non-Systematic Risks; Components of Risks-Market Risk, Foreign Exchange Risk, Interest Rate Risk, Liquidity Risk, Purchasing Power Risk, Currency Fluctuation risk.

4. **Futures and Options (Call and Put)**: Meaning, Rationale, types and pay-offs. Terminology: Spot Price and Exercise price, Margin money, Mark to Market, In the Money, Out of money contracts, hedging, Swap contracts.

5. **Investor Protection and Legal Framework in India**: Role of SEBI and stock exchanges in investor protection; Investor grievances and investors' redressal system, insider trading, investors' awareness.

Suggested Readings:

1. Preeti Singh: Investment Management Security Analysis & Portfolio Management, HPH, New Delhi.

2. V. A. Avadhani: Investment and Securities Market in India; HPH, New Delhi.

3. Bhole, L. M. Financial Markets and Institutions, Tata McGraw Hill, Delhi.

4. H. R. Machirajn: Indian Financial System; Vikas Publications.

PAPER NAME: Capital and Security Market-II

PAPER CODE : 6COMTH18B

1. **Masala Bonds-** Origin, Benefits and features
2. **Credit Rating Agencies-**Role and Importance.
3. **Funds from International Markets:** ADRs and GDRs, FCCBs and Euro Issues.
4. **Role of Mutual Funds in Capital Market** – Concept and need, AMCs, Net Asset Value, Types of Mutual funds: Open ended, closed ended, equity, debt, hybrid, money market, Different investment options- SIP, SWP,STP.
5. **Venture Capital and Alternate Investment Funds (AIFs):** Meaning, Growth, Role and Functions.
6. **Regulation and guidelines:** The Securities Contracts (Regulation) Act, 1956, SEBI, objectives. Functions, Guidelines for new issue market, Steps taken to improve capital market, Merger of SEBI with FMC.

Suggested Readings:

1. V. A. Avadhani: Investment and Securities Market in India; HPH, New Delhi
2. Bhole, L. M. Financial Markets and Institutions, Tata McGraw Hill, Delhi.
3. H. R. Machirajn: Indian Financial System; Vikas Publications.
4. Gordon and Narrajan, Financial Markets and Services, Himalaya Publishing House, New Delhi.

Group-'K': Functional Management

PAPER NAME: Human Resource Management-II

PAPER CODE : 6COMTH17C

1. **Organisational Development**: Concept, Need and Process.

2. **Sustaining Employee Interest**: Human Relations: Concept and Need; Wage and Salary Administration- Needs, Principles, Components, Methods of Wage Payment.

3. **Performance Appraisal**: Need and Methods, Potential Appraisal vs. Performance Appraisal.

4. **Management of Industrial Relations**: Concept, Causes for Poor Industrial Relations; Management of Indiscipline; Industrial Disputes: Concept, Causes and Prevention of Industrial Disputes.

5. **Leadership & Motivation**: Concept, Qualities of an Effective Leader, Leadership styles, Factors of Motivation, Theories of Motivation: McGregor's, Maslow and Herzberg's.

6. Human Resource Audit and Research.

Suggested Readings:

1. Ajai Kumar Singhal: Human Resource Management; Sharda Pustak Bhawan, Allahabad (English & Hindi)
2. A. K. Malviya: Human Resource Management; PPB, Allahabad (Hindi)
3. T. N. Chabbra: Human Resource Management – Concept and Issues; Dhanpat Rai & Co., Delhi
4. V.S.P. Rao: Human Resource Management-text and cases, Excel Books
5. Singh R. K. & Singh Amit: Manav Sansadhan Prabandh; Astha Pub., Allahabad

PAPER NAME: Marketing Management-II
PAPER CODE: 6COMTH18C

1. **Promotional Tools**: Promotion Mix: Personal Selling, Sales Promotion.

2. **Advertising**: Meaning, Objectives, Media of Advertising; Factors affecting Media Selection, Publicity.

3. **Rural Marketing**: Concept, Significance and Difficulties in Rural Marketing.

4. **Channels of Distribution**: Meaning, Functions, Distribution Systems and Factors affecting choice of channels of distribution. Wholesaler and Retailer - Concept, Functions and Services. New Retailing System

Suggested Readings:

1. A. K. Malviya: Marketing Management; PPB, Allahabad (Hindi)
2. C. B. Memoria, Pradeep Jain & Priti Mitra: Marketing Management; Kitab Mahal,
3. Beller & Berkman: Readings in Marketing Management; HPH, Bombay
4. D. Amar Chand, B. Varadharajan: An Introduction to Marketing; Vikas Publishing House Pvt. Ltd., New Delhi.
5. Singh R.K. & Amit Singh, Vipran Prabandh; Astha Pub., Allahabad

Department of Botany

EWING CHRISTIAN COLLEGE, PRAYAGRAJ

(An Autonomous Constituent College of University of Allahabad)

Syllabus of Master of Science(M.Sc.) Programme in Botany Under Choice Based Credit system (w.e.f Acadmic Session 2017-2018) including Modified Syllabus (w.e.f . Academic session 2020-21)

DISTRIBUTION OF COURSES, MARKS AND CREDITS IN SEMESTER I,II,III AND IV OF M. Sc PROGRAM IN BOTANY UNDER CHOICE BASED CREDIT SYSTEM

Semester No.	Course code	Paper No.	Title of the Paper	Marks	Credits
I	BOT 101	I	Phycology and Bryology	100	03
	BOT 102	II	Mycology	100	03
	BOT 103	III	Pteridology and Paleobotany	100	03
	BOT 104	IV	Gymnosperms	100	03
	BOT 105	Pract I	Lab. work based on course BOT 101 and BOT 102 (Excursion/Field work/ Project)	100	04
	BOT 106	Pract II	Lab. work based on course BOT 103 and BOT 104 (Excursion/Field work/ Project)	100	04
			Total	600	20
II	BOT 201	I	Plant morphology, Economic botany and Ethonobotany	100	03
	BOT 202	II	Anatomy and Reproductive biology of Angiosperms	100	03
	BOT 203	III	Plant Physiology	100	03
	BOT 204	IV	Cytogenetics and Plant breeding	100	03
	BOT 205	Pract I	Lab. work based on course BOT 201 and BOT 202 (Field work/ Project)	100	04
	BOT 206	Pract II	Lab. work based on course BOT 203 and BOT 204 (Field work/ Project)	100	04
			Total	600	20
III	BOT 301	I	Taxonomy of Angiosperms	100	03
	BOT 302	II	Plant Ecology	100	03
	BOT 303	III	Microbiology and Phytopathology	100	03
	BOT 304	IV	Biochemistry and Molecular biology	100	03
	BOT 305	Pract I	Lab. work based on course BOT 301 and BOT 302 (Excursion/Field work/ Project)	100	04
	BOT 306	Pract II	Lab. work based on course BOT 303 and BOT 304 (Excursion/Field work/ Project)	100	04
			Total	600	20
IV	BOT 401	I	Plant Biotechnology	100	03
	BOT 402	II	Bioanalytical techniques,Bioinformatics, Bioethics and Biostatistics	100	03
	BOT 403	III	Dissertation/Thesis	100	05
	BOT 404	IV	Elective Papers	100	03
		404 A	Molecular Cytogenetics		
		404 B	Applied Microbiology		
		404 C	Ecology and Environment		
		404 D	Taxonomy of Angiosperms		
		404 E	Paleobotany		
		404 F	Morphology of Seed plants		
	BOT 405	Pract I	Lab. work based on course BOT 401 and BOT 402 (Project)	100	04
	BOT 406	Pract II	Lab. work based on course BOT 404 (Field work/ Project)	100	02
			Total	600	20
			GRAND TOTAL	2400	80

Paper I

1[st] SEMESTER

BOT 101: PHYCOLOGY AND BRYOLOGY

Unit I

Introduction to phycology, Principles and systems of classification of algae, Comparative account of algal pigments, food reserves, cell wall, flagellation, chloroplasts and eye-spots, their phylogenetic and taxonomic importance.

Cell structure and thallus organization, heterocyst and akinete development and their role; chromatic adaptations and reproduction in Cyanophyta, distribution and ecology of cyanobacteria.

Unit II

Range of thalli and methods of reproduction in Chlorophyta, evolutionary tendencies in Chlorophyta. A brief account of Bacillariophyta, Pyrrophyta, Haplophyta, Crysophyta, Xanthophyta, Euglenophyta and Prochlorophyta, and other related and recent new groups. Thallus organization and reproduction in Phaeophyta and Rhodophyta.

Unit III

General introduction including broad outline of classification and evolutionary trends in bryophytes. Distribution of the group in India, general features and adaptation to land habit. Origin and evolution of gamatophyte and sporophyte generation. Endemism and endemic liverwort genera of India. Bryophyte ecology, Moss protonema, protonemal differentiation and bud induction. Regeneration in bryophytes. Economic uses, chemistry of bryophytes, fossil history.

Unit IV

Hepaticopsida/ Marchantiophyta: distribution: Global and Indian. General characteristics, morphology, anatomy and life history of **Marchantiales**(*Plagiochasma, Asterella, Cryptomitrium, Targionia, Cyathodium*);**Monocleales**(*Monoclea*);**Sphaerocarpales** (*Sphaerocarpus, Reilla*); **Calobryales**(*Calobryum, Haplomitrium*);**Metzgeriales**(*Riccardia, Metzgeria, Pallavicinia*);**Jungermanniales**(*Radula, Herberta, Porella, Frullania*);**Treubiales**(*Apotreubia*)

Unit V

Anthocerotophyta: distribution – Global and Indian, general features, Morphology, anatomy and life history of **Anthocerotales** (*Anthoceros, Notothylas*).

Bryopsida / Musci: distribution: Global and Indian, general features, morphology and anatomy, life history of **Sphagnales**(*Sphagnum*), **Andreales** (*Andrea*)**Andreaeobryales**(*Takakia*); **Polytrichales**(*Polytrichum,Pogonatum*); *Tetraphidales*(*Tetraphis / Georgia*),**Buxbaumiales**(*Buxbaumia*),**Bryales**(*Bryum, Rhodobryum, Funaria*).

SUGGESTED READINGS:

- **Bold, H.C. and Wynne, M.J.**, 1985, Introduction to the Algae, 2nd Edition, Prentice-Hall Inc.
- **Dixon, R.** , Biology of Rhodophyta, Koelt Science Publisher, West Germany
- **Fritsch, F.E.**, Structure and Reproduction of Algae, Vol. I & II, Cambridge University Press, Cambridge
- **Gangulee, H.C. and Kar, A.K.**, 2011, College Botany Vol. II. New Central BookAgency, Kolkata
- **Geissler and Greene SW** (1982) Bryophyte Taxonomy, methods, practices and floristic exploration. J Cramer, German
- **Graham Robin South and Alan Whittick**, 1998, Introduction to Phyclogy, Blackwell Scientific Publication
- **Janice. M. Glime**, 2006, Bryophyte Ecology.
- **Kashyap S. R.** 1972, Liverworts of the Western Himalayas & the Punjab Plains. Part 1 & 2.
- **Lee, Robert Edeward**, 2008, Phycology, Fourth edition, Cambridge University Press
- **Parihar N. S.** 1965, An Introduction to Embyophyta- Bryophyta. Central Book Depot. Allahabad.
- **Richardson DHS** (1981) The Biology of mosses. John Wiley & Sons, Inc New York.
- **Shaw AJ and B Goffinet** (2000) Bryophyte Biology. Cambridge University Press.
- **Singh, Pande, Jain**, 2010, A Text Book of Botany, Rastogi Publication, Meerut

M. Sc. Semester I Paper 2

MYCOLOGY

Code: BOT1TH2

Unit I

General Mycology: Introduction to fungi and their significance to humans, general characteristics of fungi, Fungal cell and cell walls, Specialized fungal structures, Asexual reproduction and spores in fungi, Sexual reproduction, Fungal classification and molecular methods of fungal taxonomy; Heterothallism, Parasexual cycle and sex hormones in fungi.

Protozoa: General characteristics of Acrasiomycota, Dictyosteliomycota, Myxomycota, Plasmodiophormycota and life cycles of *Plasmodiophora*

Unit II

Straminipila: General charecteristics of Hyphochytridiomycota, Labyrinthulomycota and Oomycota, Saprolegniales (*Saprolegnia, Achlya*), Pythiales and Peronosporales

Chytridiomycota: General characteristics and classification, Chytridiales (*Synchytriu, Olpidium*), Blastocladiales (*Allomyces*)

Unit III

Zygomycota : General charecteristics and classification of class Zygomycetes and Trichomycetes, Mucorales (special reference to evolutionary tendencies in asexual and sexual reproduction), Salient feature of order Zoopagales,Entomophthorales and Glomales

Ascomycota: General charecteristics with special reference to development of ascus and ascospores, ascocarp, Taphrinales (*Protomyces, Taphrina*) Schizosaccharomycetales, Saccharomycetales, Eurotiales, Sordariales (*Neurospora*), Xylariales, Hypocreales, Claviceptales (*Claviceps*), Erysiphales, Pezizales,Helotiales ,Dothidiales and Pleosporales

Unit IV

Basidiomycota: General charecteristics with special reference to dolipore septum, clamp connection, basidium and basidiospores, basidiocarp; Classification and general account of Uredinales, Ustilaginales, Auriculariales, Tremellales,Agaricales, Boletales, Lycoperdales, Nidulariales, Sclerodermatales,

Deuteromycota: General charecteristics and classification of class Hyphomycetes and Coelomycetes.

Unit V

Fungal Symbiosis: Introduction to lichens, the symbiotic relationship and classification of lichens, methodology for lichens taxonomy, morphology and anatomy of thallus, reproduction, physiology, ecological aspects and chemistry , conservation, culture, bioprospection and economic importance of lichens, Mycorrhiza

Suggested readings:

1. Webster, John, 1980, Introduction to Fungi, Cambidge University Press
2. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996, Introductory Mycology, Wiley
3. Carlile, M.J., Watkinson S.C. and Booday, G.W. , 2001, The Fungi, Academic Press

4. Maheshwari, R., 2012, Fungi: Experimental Methods in Biology, CRC Press, Boka Raton, Florida
5. Deacon, J.W., Blackwell, M. 1997, Introduction to Modern Mycology, Oxford
6. Webster, John and Roland, W.S., 2007, Introduction to Fungi, Cambridge University Press.
7. Hale, M.E. (1983), The biology of lichens(3rd ed.). Edward Arnold.
8. Hawksworth, DL & Hill, DJ 1984: The Lichen-Forming Fungi. - Blackie, Glasgow and London. 158 pp
9. Galun, M. (ed.) (1988) CRC Handbook of Lichenology. Volume I. - CRC Press, Inc., Boca Raton.
10. Galun, M. (ed.) (1988) CRC Handbook of Lichenology. Volume II. - CRC Press Inc., Boca Raton.
11. Galun, M. (ed.) (1988) CRC Handbook of Lichenology. Volume III. - CRC Press, Inc., Boca Raton
12. Awasthi,D.D.2000. A hand book of Lichens : Bishen Singh Mahendra Pal Singh.,Dehradun
13. Awasthi,D.D.2000.Lichenology in Indian subcontinent: Bishen Singh Mahendra Pal Singh.,Dehradun
14. Culberson,C.F. 1979.Chemical and Botanical Guide to Lichen Products,OttoKoeltz Sci Publishers, Germany
15. Singh G. P. and Singh K.P., 2005, Macrolichens of Sikkim, Botanical survey of India, ministry of environmen & forests.
16. Brown D. H., Hawksworth D. L. & Bailey R. H. 1976, Lichenology: Progress & problems, Academic Press. London.
17. Smith A. L.(1921) Lichens, Cambridge university Press
18. Orange A, James PW and White FJ (2001) Microchemical methods for identification of lichens. British Lichen Society.
19. Thomas H. N. (2001) Lichen Biology, Cambridge University Press.
20. Clair L and Seaward M. R. D. (2004) Biodeterioration of stone surfaces: Lichen and Biofilms as weathering agent of rock and cultural heritage, Kluwer academic publishers.
21. Kershaw K. A. (1985) Physiological Ecology of Lichens, Cambridge University Press
22. Longton R. E. (1988) Biology of polar bryophytes and lichens, the press syndicate of the university of Cambridge.
23. Casselman D. K. (2001) Lichns dyea: the new source book, Studio vista publication.
24. Nimis P.L. and Wolseley P.A. (2002) , Monitoring with Lichen, Kluwer academic publishers
25. Karner I., Beckett R. and Varma A.(2002), Protocol in Lichenology, Springer-Verlag Berlin Heidelberg New York.
26. Baron G. (1999) Understanding Lichens, Richmond Publishing co.
27. Ahmadjian, V. 1993. The Lichens symbiosis. Jhon Wiley & Sons.
28. Nayaka, S and Upreti, DK. 2013. The Lichens of Uttar Pradesh. UP State Biodiversity Board

Paper III

BOT103: PTERIDOLOGY AND PALEOBOTANY

Unit I

General introduction of pteridophytes, their peculiar features and similarities and dissimilarities with bryophytes and gymnosperms, Pteridophytes classification based on molecular data by Smith et al. 2006. World distribution of pteridphytes with special reference to India, Economic importance ofpteridophytes, ecology of pteridophytes; Endangered pteridophytes their conservation.

Unit II

Early land plant and their evolution, Origin and evolution of pteridophytes with special reference to Telome theory and stelar theory, Stomatal structures in pteridophytes, Spores of pteridophytes. Apogamy, Apospory and parthenogenesis. Sex organs ,gametophytes and embryogeny in pteridphytes, Cytogenetics of pteridophytes., ecology of pteridophytes, Heterospory and origin of seed habits in Pteridophytes

Unit III

Comparative morphology, anatomy, reproductive biology and evolutionary studies sof the following groups:,Psilopsida, Lycopsida, Sphenopsida and monographic study of *Psilotum, Lycopodium, Isoetes*and *Equisetum.*

Unit IV

Filicopsida: Comparative morphology, anatomy, reproductive biology and evolutionary studies of the following orders. Coenopteridales, Ophioglosales, Marattiales and monographic studies of *Ophioglossum, Osmunda, Lygodium, Cyathea, Gleichenia, Adiantum, Pteris, Christella* and aquatic ferns.

Unit V

Paleobotany: Concept of Paleobotany, Scope and objectives of Paleobotanical studies Introduction to structure of earth, types of rocks and dating the past,Geological time scale. Types of fossils, Process of fossilization, Techniques of Fossil study, Reconstruction of plant fossils.

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SUGGESTED READINGS

- **Agashe S.N.** 1995. Paleobotany. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- **Arnold A.C.** 2005. An Introduction to Paleobotany. Agrobios (India). Jodhpur.
- **Eames E.J.** 1983. Morphology of Vascular Plants. Standard University Press.
- **Eames, E.J.** (1936) Morphology of Vascular plant-lower group. Tata Mc Graw Hill, New Delhi
- **Gifford, Ernest, M., Foster, Adriance.S.**, 1989, Morphology and Evolution of vascular plant. W. H. Freeman; Third Edition.
- **Ogura, Yuzuru.**, 1972, Comparative Anatomy of Vegetative Organs of The Pteridophytes.Gebr. Borntraeger; 2nd edition.
- **Parihar, N. S.**, 1977, The Biology and Morphology of The Pteridophyte. Central Book Depot.
- **Rashid, A**, 2011, An Introduction to Pteridopyta, 2nd edition, (Reprint), Pub. Vikas Publishing House

- **Rashid, A.1999**, An Introduction to Pteridophta: Diversity,Development,Differentiation. Vikas Publishing House Pvt Ltd.
- **Sharma O.P.** 1990. Textbook of Pteridophyta. MacMillan India Ltd. Dehi.
- **Smith G.M.** (1955). Cryptogamic Botany Vol II. McGraw Hill.
- **Sporne K.R.** 1986. The morphology of Pteridophytes. Hutchinson University Library, London.
- **Stewart W.N. and Rothwell G.W.** (2005). Paleobotany and the Evolution of Plants. 2nd Edn. Cambridge University Press.
- **SundarRajan S.** 1999. Introduction to Pteridophyta. New Age International Publishers, New Delhi.
- **Taylor.** T.H Edith L. Tailor.MichaelKrings2009,Palaeobotany:The biology and Evolution of Fossil Plants Amsterdam ; Boston, Mass. : Academic Press, c

Paper IV

BOT104: GYMNOSPERMS

Unit I

General introduction of gymnosperms with special reference to its salient features, similarities and dissimilarities with other groups like pteridophytes and angiosperms. Classifications of gymnosperms. Economic importance and biotechnology of gymnosperms

Unit II

Origin and Evolution of gymnosperms with special reference to Progymnosperms and origin of seeds. Global distribution of gymnosperms with special reference to Indian plants. Endangered gymnosperms, their conservation and present status.

Unit III

Comparative morphology, anatomy, reproductive biology and phylogenetic studies of the classPteridospermopsida, Cycadopsida, Pentoxylopsida, Bennettitopsida,

Unit IV

Comparative morphology, anatomy, reproductive biology and phylogenetic studies of the class Coniferopsida and Taxopsida

Unit V

Comparative morphology, anatomy, reproductive biology and phylogenetic studies of the class Ephedropsida and Gnetopsida

SUGGESTED READINGS:

- **Bhatnagar, S.P. Moitra, Alok.** 1996. Gymnosperms. New Age International.
- **Chamberlain, Charles Joseph,B.**1863, Gymnosperm S;Structure and Evolution. Chicago,Ill.,The University of Chicago Press
- **Chhaya Biswas and B.M.Johri.** The Gymnosperm. Springer; 1997 edition (16 April 2014)
- **PantD. D.** 2002, An Introduction to Gymnosperms, Cycas, and Cycadales, BirbalSahni Institute of Palaeobotany.

Paper I

2[nd] SEMESTER

BOT201: PLANT MORPHOLOGY, ECONOMIC BOTANY AND ETHNOBOTANY

Unit I

Introduction of morphology and including brief historical account. External organization of higher plants; Morphology of root, stem, leaf and their morphological modifications and adaptations. Floral morphology and morphology of fruits and seeds. Morphological phenomenon: Symmetry, Polarity and differentiation.

Unit II

Food Plants: Cereal crops, legume or pulses, vegetables, fruit, oil and fats, spices, condiments, sugar yielding plant. Food adulterants and their adverse effect.

Unit III

Beverages and Mastication(Tobacco, Catechu, Areca nut, cannabis, coca, tea, coffee); timber, fibre, petro crops and biofuels;tannins, dye stuffs, rubber, gums and resin.

Unit IV

Pharmacognosy: Medicinal and Aromatic Plants: Medicinal plant, aromatic plants, insecticidal, herbicidal and sacred plants, active principles of medicinally important plants (Alkaloids,Flavonoids, Steroids, terpenoids, phenolics etc. Entrepreneurship exposure to botanical resourses.

Unit V

Ethnobotany: Concept, scope and objective and medicoethnobotanical significance of plants and their application in treatment of diseases by tribals and Vaidyas. Conservation and propagation of these plants. Concept of Indigenous (Ayurveda, Siddha and Unani) system of medicine.

SUGGESTED READING:

- **Hill, Albert F.**, Economic Botany: A Textbook of Useful Plants and Plant Products. McGraw-Hill publications, New York
- **Jain S.K. 1989,** Methods and approaches in Ethnobotany, Society of Ethnobotanists, Lucknow
- **Kocchar, S.L.,** Economic Botany in the Tropics. Macmillan Publisher,
- **Sammbamurthy, A. V. S. S.,** A Textbook of Modern Economic Botany, CBS Publications.
- **WickensGE ,2004,** Economic Botany: Principles and Practices, Springer.

M. Sahney
N Bhowmik

Paper II

BOT202: ANATOMY AND REPRODUCTIVE BIOLOGY OF ANGIOSPERMS

Unit I

Introduction of anatomy including brief historical account. Internal organization of higher plants. Cell and its inclusions, cellular organization, Microscopic and sub-microscopic structure and organization of cell wall; Secretary and excretory structures; transfer cells.Meristems: organization of root apical meristem (RAM) and shoot apical meristem (SAM) and their differentiation. Xylem and phloem: Ontogeny and structure of components and phylogeny.

Unit II

Primary and secondary structure of root and stem, Origin of lateral roots, root-stem transition, nodal anatomy and its evolutionary significance.anomalous secondary growth; Vascular cambium and its derivatives periderm, Leaf –structure and function with special reference to epidermis. Systematic significance of trichomes and stomata.

Unit III

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Introduction to life history of angiosperms, brief history of plant embryology; Anther: Structure and development wall layers and their role; Microsporogenesis: Cytoplasmic reorganization during microsporogenesis, Pollen wall morphogenesis and anther dehiscence; Development of male gametophyte, ultrastructure, abnormal male gametophyte, Ovule: Ontogeny, structure, integuments and nucellus specialized structures, megasporogenesis; Development of embryo sac, subcellular details of constituent cells and their function, major types.

Unit IV

Pollination and pollen germination, Pollen-pistll interaction: Role of pollen wall proteins and stigma surface proteins, pollen tube growth in pistil, fertilization and apomixes; Endosperm: Major types, ultrastructure and histochemistry; Embryo: Polarity in embryo differentiation, major types,Polyembryony;

Unit V

Experimental embryology : Anther and pollen culture, ovary and endosperm culture). Palynology (Pollen morphology,wallstrartification and NPC nomenclature)Embryology and palynology in relation to Taxonomy;

SUGGESTED READINGS:

- **Arthur J.Eames; Laurence H.Mac Daniels** (1951), An Introduction To Plant Anatomy, published by London; New York: Mc Graw Hill.
- **Bhojwani, S.S. and Bhatnagar, S.P.**, Embryology of Angiosperms, Vikash Publishing House, New Delhi
- **Carquist,S.**,1961,Comparative Plant Anatomy Holt, Rinehart and Winston, published by New York Press.
- **Dickison,William C.**,2000 ,Integrated Plant Anatomy, published by Academic Press. London.

- **Pandey, B.P.,** Angiosperms-Taxonomy, Emrbyology and Anatomy, S. Chand and Co., New Delhi
- **Ray F.Evert** ,2007, Esau's Plant Anatomy, published by John Wiley and Sons, Inc.Hoboken New Jersey
- **Kashinath Bhattacharya, ManasRanjanMajumdar, Swati Gupta Bhattacharya,** A Text of Palynology, published by New Central Book Agency.
- **Barrett SCH** ,2008Major Evolutionary Transitions in Flowering Plant Reproduction. Univ.of Chicago Press
- **O'Neill SD & Roberts JA,**2002 Plant Reproduction, Sheffield Academic Press.
- **Shivanna KR,**2003 Pollen Biology and Biotechnology. Enfield, New Hampshire, U.S.A.:Science Publishers

Paper III

BOT203: PLANT PHYSIOLOGY

Unit I

Transport and translocation of water and solutes: Plant water relations, concept of water potential, mechanism of water transport through Xylem, mineral nutrition, nutrient uptake, solute transport, comparison of xylem and phloem translocation, phloem loading and unloading,

Unit II

Nitrogen metabolism, respiration and lipid metabolism: Biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and reduction, ammonium assimilation, foliar nitrogen nutrition. Interaction of nitrogen assimilation with carbon metabolism. Glycolysis, TCA cycle, electron transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, Cyanide resistant respiration, Lipid metabolism

Unit III

Photochemistry and photosynthesis: History of photosynthesis, photosynthetic apparatus, photoreceptor, light reaction of photosynthesis, photo oxidation of water mechanism photophosphorylation, Structure and function of Rubisco and PEP Carboxylase, carbon assimilation, Calvin cycle, photorespiration and its significance, C_4 cycle, CAM pathway

Unit IV

Plant growth substances and signal molecules: Chemical structure, physiological effects and mechanism of action of auxin, gibberellins, cytokinins, ethylene, abscisic acid. Growth regularly nature of Polyamines, Jasmonic acid Salicylic acid and Brassinosteroids, systemin, secondary metabolite and plant defense

Unit V

Growth and Development Aspects: Metabolic changes during seed germination, factors affecting seed germination and dormancy, breaking of dormancy, biochemistry of flowering: initiation and

Sensory photobiology: Phytochromes and crypto chromes and their photochemical and biochemical properties, photo physiology of light-induced responses, cellular localization, molecular mechanism of action of photomorphogenic receptors, signaling and gene expression

SUGGESTED READINGS:

- **Berg, J.M,Tymoczko J.L; Stryer.** L., 2006 Biochemistry , 6th Edition, freeman and Company New York.
- **Buchanan B, Gruissem G and Jones R.** (2000) Biochemistry and Molecular Biology ofPlants, American Society of Plant Physiologists, USA.
- **Davies P J.** (2004) Plant Hormones: Biosynthesis, Signal Transduction, Action. 3rd Edition,Kluwer Academic Publisher, Dordrecht, Netherlands.
- **Hopkins, W.G. and Huner N.P.A.**, 2009, Introduction to Plant Physiology, 4th Edition Wiley International Edition, John Wiley & Sons, USA
- **Jones,Russell L. Buchanan,Bob B. Guissem, Wilhelm.**, 2002, Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists.
- **Peter Scott,** Physiology and Behaviour of Plants. Wiley-Blackwell.
- **Salisbury Frank Boyer and Cleon Ross**, 1991, Plant Physiology, CA
- **Taiz and Zeiger**, 2010, Plant Physiology, 5th Edition , Sinurer Associates

Paper IV

BOT204: CYTOGENETICS AND PLANT BREEDING

Unit I

Basic concept and organization of Chromosome: Chromosome structure, nucleosome, nucleosome solenoid,euchromatin and heterochromatin,Centromere and telomere, special type of chromosomes- Polytene chromosomes, lampbrush chromosomes, B chromosomes. Chromosomal basis of heredity and cell division. Meiosis and Mendelism.

Unit II

Inheritance Genetics:, Principles of Mendelian Inheritance and interaction of genes, Cytoplasmic inheritance involving chloroplast and mitochondria, mitochondrial and chloroplast genomes, interaction between nuclear and cytoplasmic genes, Sex determination in plants.

Unit III

Cytogenetics and Induced Variations: Gene concept; allele concept, multiple alleles, isoalleles, PseudoallelesLinkage and recombination: Concept of Linkage, evolution of linkage concept, cis and trans arrangement of linked gene, kinds of linkage, germinal and somatic crossing over, detection of crossing over, kinds of crossing over.

Unit IV

Mutation: Spontaneous and induced mutations, point mutation, transitions, transversions, physical and chemical mutagens, molecular basis of mutations.

Numerical alterations in chromosomes: Euploidy, polyploidy and its significance, aneuploidy. autopolyploidy, allopolyploidy, Induction of trisomics and monosomics

Structural changes in chromosomes: Deficiency, duplication, inversion, translocation heterozygotes.

Unit V

Plant Breeding: Breeding systems, methods, selection in self and cross pollinated crops, male sterility, self-incompatibility, heterosis and hybrid vigour,

SUGGESTED READING:

- **Acquaah G** ,2007. Principles of Plant Genetics and Breeding, Blackwell Publishing Ltd.USA.
- **Albert B. Bray, D Lewis, J Raff, M. Robert, K. and Walter** 1989, MolecularBiology of the Cell (SeconEdition) Garland Publishing Inc, New York.
- **Allard RW** (1999). Principles of Plant Breeding (2nd Edition), John Wiley and Sons
- **Burnham, C.R** 1962. Discussions in Cytogenetics. Burgess Publishing Co.Minnesota.
- **Clark, M.S. and Wall, W.J.** 1996, Chromosomes : The Complex Code. Chapman & Hall, London.
- **Gardner and Simmons Snustad**., 2005 (Eighth Edition). Principles of Genetics, JohnWiley and Sons, Singapore.
- **Gupta, P.K.**, Cytogenetics, Rastogi Publication, Meerut
- **Hartl and Jones** ,2007. Genetics – Analysis of Genes and Genomes, 7th edition, JonesandBarlett publishers.
- **Lewine, Benjamin, Jones and Bartlet**, Genes X, Sudburry, Masschusetts
- **Ram J. Singh** ,2002. Plant Cytogenetics, 2nd edition, CRC Press. Simmonds (1995). Evolution of Crop Plants (2nd Edition) Longman.
- **Sariu C,** 2004 (Sixth Edition) Genetics. TATA McGraw-Hill Publishing Company Ltd.,New Delhi.
- **Sharma, A.K. and Sharma, Archana**. 1985. Advances in Chromosome and Cell Genetics. Oxforu & IBH Publishing Co., Calcutta.
- **Snustad, D.P and Simmons, M.J** 2000. Principles of Genetics (Second Edition).
- **Stebbins, G.L.**1950, Variation and Evolution in Plants. Columbia Univ. Press, New York.
- **Strickberger 2005**. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., NewDelhi.
- **Swanson, C. P.**, Mertz, T.F. and Young, W.J. Cytogenetics : The Chromosomes in Division, Inheritance and Evolution (2nd Edn). Englewood Cliff, Prentice-Hall, New Jersey.

3rd Semester

Paper I

BOT301: TAXONOMY OF ANGIOSPERM

Unit I

Latin diagnosis, definition and use of taxonomic terms, history of plant taxonomy in India, history of plant classification, needs and aim of classification, hierarchy and delimitation of taxa and their practical consideration, Artificial, Natural and Phylogenetic system of classification critical study of Takhtajan's system.

Unit II

Characteristics and phylogeny of orders and families:Nymphaeales: Nymphaeaceae, Caryophyllales: Phytolaccaceae, Nyctaginaceae, Portulacaceae, Polygonales: Polygonaceae, Violales: Passifloraceae, Malvales: Teliaceae, Sterculiaceae, Utricales: Moraceae, Myrtales: Combretaceae, Onagraceae, Sapindales: Sapindaceae, Rutales: Rutaceae, Meliaceae, Rubiales: Apocynaceae, Boraginales: Boraginaceae, Oleales: Oleaceae, Lamiales: Scrophulariaceae, Bignoniaceae,Verbenaceae, Commelinales: Commelinaceae, Juncales: Cyperaceae, Typhales: Typhyaceae

Unit III

Needs and aim of nomenclatures, International Rules of Botanical Nomenclature, Concept of species genus, family with special reference to the type concept. Interrelationship of plant taxonomy with morphology, anatomy, embryology, palynology, cytology, genetics, phytogeography and Chemistry.

Unit IV

Recent advances in taxonomy, Biosystematics, serology and molecular systematic including barcode and phylocode, and numerical taxonomy, Phenetics, Cladistics, an introduction of angiosperm phylogeny group (APG).

Unit V

Taxonomic literatures viz., Floras, Monographs, Botanical Dictionaries, etc., Taxonomic societies/associations, Indigenous flora of the country with special reference to local flora, Prospects of Taxonomy in Urbanization-Ornamental-indoor and outdoor plants, A general knowledge of Herbarium and Botanical garden of the world and India, organization of Botanical Survey of India and its role. Biodiversity and its conservation with special reference to India.

SUGGESTED READINGS:

- **Bhattacharyya, B. and B. M. Johri**. 1998. Flowering Plants-Taxonomy and Phylogeny. Narosa Publishing House, New Delhi.
- **Crawford, DJ.** 1990. Plant molecular systematics. Macromolecular approaches. John Wiley & Sons, Inc. USA.
- **Davis, PH and Heywood VH.** 1991. Principles of Angiosperm Taxonomy. Krieger Publishing Company.\
- **Duthie J. S.:** Flora of upper Gangetic plains, Calcutta superintendent, government printing India.
- **Forey, PL.** 1993. Cladistics: A Practical course in Systematics. Clarendon Press.
- **Harborne, JB and Turner, BL.** 1984. Plant Chemosystematics. Academic Press.
- **Heywood, V. H. and Moore, D. M.** 1984. Current Concepts in Plant Taxonomy.Oxford University Press.
- **Jain, S.K. and Rao, R.R.** 1977. A Handbook of Field and Herbarium Methods. Today and Tomorrow's Printers and Publishers, New Delhi.
- **Jones, SB.** 1986. Plant Systematics. McGraw Hill.
- **Judd,W.S.,Christopher,S.,Campbell.,Kellogg,A.E.,Stevens,P.F.**1999. Plant Systematics:A Phylogenetic Approach. Sinauer Associates Inc. Publishers.
- **Leadlay E. and Jury S.**, Taxonomy and plant conservation, The cornerstone of the Conservation and the Sustainable use of Plants, Cambridge university press 2006.
- **SubramaniamN.N** , Taxonomy of Angiosperm, Vikas publishing house Pvt Ltd.
- **Pandey, A. K., J.V.V. Dogra & Wen, J.** 2006. Plant Taxonomy: Advances and Relevance. CBS Pvt. Ltd.
- **Pullaiah, T.** 2007. Taxonomy of Angiosperms. Regency Publications, New Delhi.
- **Rao, R. R.** 1994. Biodiversity in India (Plant Aspects), Bishan Singh Mahandrapal Singh, Dehradun.
- **Sharma, O. P.** 1993. Plant Taxonomy. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- **Simpson M. G.**, 2006, Plant Systematics. Elsevier Academic Press.
- **Singh, G. 2004**. Plant Systematics: An integrated approach. Science Publishers, INC.
- **Singh, Gurucharan**, Plant Systematics- Theory and Practices, Oxford and I.B.H. Publishing Co. New Delhi
- **Singh, MP, Singh, BS and Dey S.** 2002. Plant Biodiversity & Taxonomy. Daya Publishing House, New Delhi.
- **Singh, V. and Jain, D.K.**, Taxonomy of Angiosperms. Rastogi Publication, Meerut
- **Sivarajan, VV.** 1991. Introduction to principles of plant Taxonomy, edited by NKB Robson. Press Syndicate of University of Cambridge.
- **Sokal, RR and Sneath PHA.** 1963. Principles of Numerical Taxonomy. W.H. Freeman.
- **Soltis PE, Soltis DE and Doyle JJ.** 1992. Molecular Systematics of Plants. Chapman & Hall, New York.
- **Stace , CA.** 1989. Plant Taxonomy and Biosystematics. Press Syndicate of University of Cambridge.
- **Stuessy, TF, Crawford, DJ, Soltis, DE and Soltis PS.** 2014. Plant Systematics: The origin, interpretation, and ordering of plant biodivesirty. Koeltz Scientific Books, Konigstein.
- **Sumbhamurti A. V. S. S.**, Taxonomy of Angiosperm, I. K. international Pvt Ltd.
- **Subramanyam, NS.** 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt Ltd.
- **Takhtajan A. 2009**. *Flowering plants*, 2nd edn. St. Petersburg Russia: Springer
- **Verma, B. K.** 2010. *An introduction to Taxonomy of Angiosperms.* PHI Learning Pvt. Ltd. New Delhi.

Paper II

BOT302: PLANT ECOLOGY

Unit I

Population ecology: Introduction to ecology, and environmental terminology, population dynamics, vegetation organization and development: population characteristics, population growth forms, density dependent and density independent controls, population structure (distribution, aggregation, isolation territoriality) energy partitioning , r - and k-selection, concept of carrying capacity. Wild life sanctuaries, botanical gardens.threatened and endangered plant species and endemism.

Unit II

Community ecology: Concepts of community and continuum, analysis of communities (analytical and synthetic characters), community coefficients, competition, ecological niche, succession, mechanism of ecological succession (relay floristic and initial floristic composition facilitation, tolerance and inhibition models), concept of climax. Major terrestrial biomes, biogeographical area of India, major vegetations.

Unit III

Ecosystem: Ecosystem organization, structure and function: primary production (methods of measurement), energy dynamics (tropic organization, energy flow pathway, energy quality, ecological efficiencies), biogeochemical cycles.

Unit IV

Pollution ecology : Pollution and climate change: kinds, sources and effects of pollution, heavy metals (Pb, Cd, Hg), greenhouse gases (CO_2, CH_4, N_2O, CFCs), green house effect and global warming, ozone layer depletion and ozone hole, acid rain.

Unit V

Enviromental Management: Introduction and scope of environmental management, concept of sustainable development. Environmental impact assessment, role of biodiversity in ecosystem stability, general account of remote sensing and its application, environmental, energy and green audit, Environmental management and safety, International summits and treaties related with environment.

SUGGESTED READING:

- **Barrow, C.J.** 2005, Environmental Management : Principles & Practices
- **Khitaliya. R. K** ,2008, Environmental Management and Conservation
- **Odum, E. P. and Barret G.W.** 2005. Fundamentals of Ecology. Cengage publication
- **Odum, E.P., 1983.** Basic Ecology., Saunders College Publishing Oxford.
- **Roy S.** 2003, Environmental Science : a comprehensive treatise on Ecology and Environment, publishing syndicate, Kolkota.
- **Sharma P.D.** Ecology and Environment, Rastogi Publication.
- **Singh, J.S., Singh S.P. and Gupta S.R.** 2006. Ecology Environment and Resource Conservation. Anamaya Publishers

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Paper III

BOT303: MICROBIOLOGY AND PHYTOPATHOLOGY

Unit I

History and Developmental Microbiology, History of Plant Pathology, General techniques used in microbiology and plant pathology, Microbial evolution, Systematics and taxonomy of microorganisms. Primitive organisms, their metabolic strategies and molecular coding. The microbial cell: general organization of cell and cell wall of prokaryotes, eukaryotes and Archaea, Viruses – structure, chemical composition, replication and classification of viruses. General account of Mycoplasma.

Unit II

Growth- growth kinetics and regulation, effect of environmental factors on growth, batch and continuous cultures, nutritional classification of microorganisms, Microbes in extreme environment: The basis of extremophiles and their applications, thermophile and halophiles. Quorum sensing in Bacteria: gram negative bacteria: LUXI LUXR-Type: gram positive bacteria: peptide mediated quorum sensing.

Unit III

Application of microbiology in industrial, agriculture and waste water management: symbiotic nitrogen fixation, *Rhizobium, Azotobacter Cyanobacteria (Anabaena, Azolla etc.),* Mycorrihizal symbiosis. Major industrial products from microbes viz., beverages, antibiotics, secondary metabolites, recombinant prrroducts. Biodegradation by microbes, sewage pollution control, control of oil spills, super bugs.

Unit IV

Classification of Plant Diseases, Kinds and amount of losses, Parasitism and disease development, symptoms, Epidemiology, Control of plant diseases, quarantines and inspection, physical, chemical, cultural and biological methods of disease control, Genetic Engineering and Plant Pathology.

Unit V

Plant diseases caused by fungi, bacteria, viruses and mycoplasma/phytoplasma and their control measures

SUGGESTED READINGS:

- **Agrios, G. N.**, 1988. Plant Pathology, Academic Press.
- **Aneja, KR, Jain, P and Aneja, KR**. 2008. A Text book of Basic and Applied Microbiology. New Age International Publishers, New Delhi.
- **Bishen, PS.** 2014. Microbes in Practice. I.K. International Publishing House Pvt. Ltd.
- **Comelissen, CN, Harvey, RA and Fisher, BD**. 2012. Microbiology. Lippincott Williams & Wilkins.
- **Dhingra, O.D. and James, B. Sinclair,** 1995. Basic Plant Pathology Methods, CRC Press
- [illegible] 2003. Molecular Plant Pathology, Bios Scientific Publisher.

- **Madigan, M.T., Martinko, J.M., Dunlap, P.V., Clark, D.P.**, 2011. Brock Biology oMicroorganisms. 13th edition, Pearson Education Inc.
- **Pelczar, JM, Chan, ECS and Krieg, MR.** 1993. Microbiology. Tata McGraw Hill.
- **Singh, R. S.**, 2008. Principles of Plant Pathology, Oxford and IBH Publishing Co. Pvt Ltd.
- **Stanier, R.Y., Ingraham, J.L., Wheelis, M.L., Painter, P.R.**, 1987. General Microbiology. Fifth edition. MacMillan.
- **Talaro, K.P., Chess, B.** 2011, Foundations in Microbiology. 8th edition. McGraw-Hill.
- **Tortora, G.J., Funke, B.R., Case, C.L.** 2003, Microbiology: An Introduction. Benjamin Cummins
- **Willey, J.M., Sherwood, L., Woolverton, C.J.**, 2010. Prescott's Microbiology. 8th edition, McGraw-Hill.

M. Sc. Semester III

Paper 4 Code: BOT3TH4

PLANT BIOCHEMISTRY AND MOLECULAR BIOLOGY

Unit I

Bioenergetics: Law of thermodynamics, concept of enthalpy and entropy and their significance in biological systems, Water biochemistry, high energy molecules, redox potential

Carbohydrates: Structure and physic-chemical properties of carbohydrates, biological significance, important, glycoprotein

Lipids: Classification, structure and properties of important lipids, biological significance of glycolipids, fatty acid biosynthesis and storage lipids and their catabolism.

Unit II

Amino acids and Proteins: Structure and physiochemical properties of amino acids; Proteins: Primary, secondary, tertiary and quaternary structure of proteins, physical and chemical properties of proteins and biological significance; Protein folding, Ramachandran plot

Enzymes: Properties,classification, physico-chemical nature, enzyme kinetics mechanism of action and regulation, allosteric regulation, Enzyme inhibition, Ribozyme, abzyme, Coenzymes, Vitamins

Unit III

DNA: Structure and conformation of nucleic acids; DNA as genetic material, Structure and types of DNA, DNA topology, DNA melting and hyperchromic effect, Replicationof DNA (prokaryotes and eukaryotes),DNA damage and repair

RNA: Mechanism oftranscription of DNA (eukaryotes and prokaryotes), RNA processing and splicing, transport of m-RNA, RNA editing and post-transcriptional modification

Unit IV

Protein synthesis: Genetic code, Role of different types of RNA in protein synthesis, Structure of tRNA and wobbling, Mechanism of translation (initiation, elongation and termination), Post-translational modification,

Regulation of Protein synthesis: Regulation of gene expression at transcription level in prokaryotes (positive and negative regulation), Regulation of protein synthesis in eukaryotes, Protein targeting to organelles,

Unit V

Cell signaling: Principle of cell signaling, Overview of receptors, Secondary messengers, G-proteins, Phospholipids, signifying role of cyclic nucleotides, Calcium-calmodulin cascade

Signaling mechanism: Diversity in protein kinase and phosphates specific signaling mechanism, GPCR, RTKs, Ras-MAP Kinase pathway

Suggested readings:

1. Conn, E. .E, Stumpf, P K, Bruening, G and Doi, R Y. 1987, Outlines of Biochemistry, 5th Edition, John Wiley and Sons,New York.
2. Nelson, D .L. and Cox, M.M., 2008, Lehninger Principles of Biochemistry, Fifth Edition, W. H. Freeman & Co, New York, USA.

3. Berg, J.M., Tymoczko, J.L. & Stryer, L. 2011, Biochemistry, Seventh Edition, Freeman & Co., New York, USA.
4. Weil, J.H., 1990, General Biochemistry, Sixth Edition, Wiley Eastern Limited, New Age International Limited, New Delhi.
5. Lea P.J. and Leegood R.C., 1999, Plant Biochemistry & Molecular Biology, Second Edition John Wiley & Sons, NewYork.
6. Buchanan, B., Gruissem, W., & Jones, R.L., 2002, Biochemistry and Molecular Biology of Plants. American Society of PlantBiologists, USA.
7. Lodish, Harvey, Berk , Arnold, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Anthony
8. Bretscher, Hidde Ploegh, Paul Matsudaira Molecular Cell Biology, 6th Ed. W.H. Freeman and Comp., New York
9. Bourton E. Tropp, Molecular Biology, 4th Ed., Jones & Barlett learning
10. Brown, T.A., DNA Cloning and Gene Sequencing Willey-Blackwell, Oxford
11. Genes IX by Benjamin Lewin, Jones and Barlett
12. Y Gerld Karp , Cell and Molecular Biology 6th Ed., John Willey & Sons
13. Cooper , G.M. and Robert, E. Hausman The Cell: A Molecular Approach 5th Ed . (Co-published by ASM Press and Sinaurer Assoc. Inc.)
14. Watson, JD, Baker, TA, Bell, SP, Gann, A, Levine, M and Richard, L. 2008. Molecular Biology of the Gene. Pearson Education Inc.
15. Murray, R, Murray, RK, Bender, D, Gotham, KM, Kennelly, PJ, Rodwell, V and Weil, PA. 2012. Harpers Illustrated Biochemistry 29th Edition. McGraw Hill.
16. Verma, PS. 2004 Cell Biology, Genetics, Molecular Biology: Evolution and Ecology. S. Chand Limited.
17. Jain, JL. 2004. Fundamentals of Biochemistry. S. Chand Limited.
18. Gupta, SN., 2011. Biochemistry. Rastogi Publication., Meerut.

M. Sc. Semester IV

Paper 1

Code: BOT4TH1

PLANT BIOTECHNOLOGY

Unit I

Recombinant DNA technology: A brief introduction to Biotechnology and Genetic Engineering, Recombinant DNA technology and in-vivo gene cloning; Restriction endonucleases; DNA Modifying enzymes, Gene cloning and expression vectors, Markers and reporter genes; Linkers and adaptors; Screening of recombinant clones

Unit II

Gene cloning and identification: Polymerase chain reaction: Principle, method, variants and their practical application;Genomic and cDNA library;Molecular markersand its application;Functional genomics;Gene sequencing, Modern approaches for the analysis of plant genome and proteome; DNA microarray, RNA interference, Gene silencing and Genome editing

Unit III

Gene transfer methods: Vectorless and vector (*Agrobacterium*)mediated genetic transformation in plants, Regeneration methodologies and screening of transformants; Genetic engineering and its application in Agriculture: Genetic manipulation for pest resistance, abiotic and biotic stress tolerance, improvement of crop yield and quality; Molecular farming,Transformation of chloroplast genome and its advantage;

Unit IV

Plant tissue culture techniques: General introduction, history and scope;Tissue culture techniques and and culture media; Concept of cellular totipotency; dedifferentiation, redifferentiation throughOrganogenesis and Somatic embryogenesis; Synthetic seed technology, Androgenesis and haploid culture techniques; Micropropagation and clonal propagation through meristem culture, Somaclonal variations

Unit V

Plant cell and protoplast culture: Protoplast isolation, culture and regeneration, Somatic hybridization and cybridization, hybrid selection; Possibilities, achievements and limitations of protoplast research; Production of secondary metabolites through Cell culture and Biotransformation;Applications of plant tissues culture and plant biotechnology in Agriculture, Pharmaceutical industries, Cryopreservation germplasm and biodiversity conservation; Biosafety concerns in Plant Biotechnology

Suggested Readings:

1. Larry, Snyder and Wendy Champnees, Molecular Genetics of Bacteria, ASM Press Washington, DC
2. Jermy, W Dale and Simon F Park Molecular Genetics of Bacteria, IVth Edition - John Wiley and Sons Ltd.
3. Joseph ,W Lengler, Gerhart Drews and Hans G. Schlegel Biology of the Prokaryotes Blackwell Science Ltd., Oxford Masschusetts
4. Benjamin, Lewine- Jones and Bartlett, Genes X Publishers Sudburry, ... Michael Levine and Richard Losick Molecular

6. Stanly, R, Maloy, John Cronan and David Freifelder, Microbial Genetics Narosa Publisher, New Delhi
7. Bernard, R., Glick and Jack J. Pasternak, Molecular Biotechnology: Principles and application of recombinant DNA ASM Press, Washington, D.C
8. T.A., Brown, Genomes - Garland Science (Taylor & Francis Group), New York & London
9. Molecular Biology of the Cell Alberts Bruce, Johnson Alexander, Lewis Julian, Raff Martin, Roberts Keith and Walter Peter- Garland Science (Taylor & Francis Group), New York & London
10. Lodish, Harvey, Berk Arnold, Zipursky S. Lawrence, Matsudaira Paul, Baltimore David and James E. Darnell-Molecular Cell Biology.
11. Dubey, RC.,2008, Advanced Biotechnology. S. Chand & Company. PVT. LTD.

PAPER II

BOT402: BIOANALYTICAL TECHNIQUES, BIOINFORMATICS, BIOETHICS AND BIOSTATISTICS

UNIT I

Biophysical techniques: Principle and Techniques of Centrifugation, Separation of Sub-cellular Fractions, Ultracentrifugation, isopycnic, density gradient centrifugation; Spectroscopy - Basic Concept, MALDI-TOF, Mass Spectroscopy,X-Ray Diffraction, NMR And ESR Spectroscopy; Microscopy: Light, Phase Contrast, Confocal, Fluorescence, Scanning and Transmission Electron Microscopy. Labeling Techniques (Radiolabeling and Fluorescent Labeling of Biomolecules and their detection, Safety Guideline).

Unit II

Biochemical techniques: Chromatography (Basic Concept, Paper, TLC, HPLC, gas chromatography Ion Exchange, affinity Chromatograph); Electrophoresis (Definition and Principle of Electrophoresis, Buffers and Solutions, Agarose Gel Electrophoresis, Polyacrylamide Gel Electrophoresis (PAGE), Native PAGE, SDS-PAGE); 2D-Electrophoresis,Isoelectric Focusing (IEF): Principles and Kinds of pH Gradients used In IEF- Immobilized pH Gradients.

Unit III

Molecular Techniques: Isolation And Purification of Nucleic Acids and Proteins, BlottingTechniques: Principles, Southern, Northern, Western and Dot Blots;ELISA, RIA; Genome Mapping: RFLP, RAPD, AFLP, SSR, SNP,FISH, Mc FISH, Molecular probing DNA Sequencing: Various Methods of DNA Sequencing- Sanger's Dideoxy Method, Maxam& Gilbert Method), Flow cytometry. Genome Editing.

Unit IV

Bioinformatics and bioethics: Data base, Overview Of Sequence Analysis Genome Information Resources, Bioinformatics Tools, Similarity Searching Tools: BLAST and FASTA, Phylogenetic Analysis Methods.

Bioethics. Concept of bioethics, benefits and harm, protection of environment, biosphere and biodiversity, Intellectual Property Right: Organization of patent offices in India with significance, world Intellectual Property Right (WIPO), role of worldwide academy of WIPO, procedure of obtaining patent, copy right and trade mark, kinds of patent classification, patent criteria, career in IPR, definition of IPR, kinds of property, website of important patent office.

Unit V

Biostatistics: General concepts and terminology, sampling methods, Measures of location, scale and shape, contingency tables and chi-square test, comparison of means: t-test, multiple range tests, Simple experimental design and analysis of variance, correlation and regression analysis, Introduction to multivariate methods,Types of statistical software and their application in analysis of data

SUGGESTED READINGS:

- **Attwood TK and Parry-Smith DJ** (2004) Introduction to Bioinformatics, Pearson Education(Singapore) Pvt. Ltd.
- **David Edwards** (Ed.) (2007) Plant Bioinformatics: Methods and Protocols, Humana Press, New Jersey, USA
- **Green, M. R. and Sambrook,** J. 2000, Molecular Cloning: a laboratory manual (4th Edition) Cold Spring Harbor Laboratory Press.
- **Pagano M, Gauvreau K** (2007) Principles of Biostatistics. Thomson India Edition, New Delhi.
- **Rosenkrantz WA** (2009) Introduction to Probability and Statistics for Science, Engineering and Finance. CRC Press, Boca Raton.
- **Wilhelm Gruissem, Russell L.Jones,** 2000, Biochemistry and molecular biology of plants. American Society of Plant Physiologists,
- **Wilson, K. and Walker, J.,** 2000, Practical Biochemistry: principles & techniques (5th Edition), Cambridge University Press. ISBN 0521799651.

Paper III

BOT 603: Dissertation / Thesis

The topic would be decided by the candidate in consultation with the respective supervisor. Dissertation / thesis will be based on existing branches of botany and the title will be decided keeping the view on the modern aspect in the related discipline. It will be the part of semester IV; however, the title of dissertation / thesis will be assigned by concerned faculty member/board in the beginning of semester III to provide sufficient time to complete dissertation / thesis.

Paper IV

Elective Papers

There shall be SIX elective papers, and student has to opt only one

BOT604 (A) MOLECULAR CYTOGENETICS

Unit I

Cell components and their significance: Molecular structure and functionsof cell wall and plasma membrane, cell signalling ; new insights in structure and function of cytoplasmic cellorganelles ; Organization and function of mitochondrial and chloroplast genomes and transfer of these genes. Nucleus: its components, detailed structure of nuclear pore complex and nuclear lamina, nucleolus and nuclear transport. Structure and function of plant cytoskeletal genes and gene products.

Unit II

Cytogenetics: : Chromosome: Structure and nomenclature, centromere and telomere; karyotype analysis,, Chromosomal aberrations,Ploidy changes: Haploids, polyploids and aneuploids; Molecular basis of mutations; Transposons and their use in mutagenesis and gene tagging in plant systems; Oncogenes and cancer; Cell turn over: cell cycle regulations, check points, cancer and apoptosis

Unit III

Mendelian and Non Mendelian genetics: Meiosis; Chromosome theory of inheritance; Mendelian laws; Gene interactions; Organelle inheritance,Linkage, Crossing over, linkage maps,sex linked inheritance. Sex determination: mechanisms, Population genetics andQuantitative genetics.

Unit IV

Molecular Genetics: Modern concept of gene, genetic code, gene mapping, gene structure, expression and regulation.DNA replication;transcription - RNA polymerases, transcription factors, Introns, RNA splicing, RNA stability - cap structure and function, polyadenylation; translation, posttranslationalmodifications.

Unit V

Recombinant DNA technology: Restriction and nucleic acid modifying enzymes; restriction mapping; choice of vectors;plasmids, phages, cosmids, plant viruses, synthetic DNA vectors; cDNA and genomic libraries; cloning; PCR and its applications;Principles of DNA sequencing.Genetic transformation.

SUGGESTED READINGS:

- **Albert B. Bray, D Lewis, J Raff, M. Robert, K. and Walter** 1989, MolecularBiology of the Cell (SeconEdition) Garland Publishing Inc, New York.
- **Bernard, R., Glick and Jack J. Pasternak**, Molecular Biotechnology: Principles and application of recombinant DNA ASM Press, Washington D.C

- **Clark, M.S. and Wall, W.J.** 1996, Chromosomes : The Complex Code. Chapman & Hall, London.
- **Cooper , G.M. and Robert, E. Hausman**The Cell: A Molecular Approach 5th Ed . (Co-published by ASM Press and Sinaurer Assoc. Inc
- **Gardner and Simmons Snustad**., 2005 (Eighth Edition). Principles of Genetics, JohnWiley and Sons, Singapore.
- **Gupta, P.K.**, Cytogenetics, Rastogi Publication, Meerut
- **Karp , G.**,2008 Cell and Molecular Biology concepts and experiments 6th Ed., John Willey & Sons
- **Lea P.J. and Leegood R.C.**, 1999, Plant Biochemistry & Molecular Biology, Second Edition John Wiley & Sons, NewYork.
- **Lewine, Benjamin, Jones and Bartlet**, Genes X, Sudburry, Masschusetts
- **Lodisch H, Berk A, Kaiser CA, Krieger M, Scott MP, Bretscher A, Ploegh H and Matsudaire P**, 2008; Molecular Cell Biology. WH Freeman & Co., New York.
- **Nelson, D .L. and Cox, M.M.,** 2008, Lehninger Principles of Biochemistry, Fifth Edition, W. H. Freeman & Co, New York, USA.
- **Ram J. Singh** ,2002. Plant Cytogenetics, 2nd edition, CRC Press. Simmonds (1995). Evolution of Crop Plants (2nd Edition) Longman.
- **Sharma, A.K. and Sharma, Archana**. 1985. Advances in Chromosome and Cell Genetics. Oxford & IBH Publishing Co., Calcutta.
- **Strickberger 2005**. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., NewDelhi.
- **Swanson, C. P.**, Mertz, T.F. and Young, W.J. Cytogenetics : The Chromosomes in Division, Inheritance and Evolution (2ndEdn). Englewood Cliff, Prentice-Hall, New Jersey.
- **Watson, JD, Baker, TA, Bell, SP, Gann, A, Levine, M and Richard, L.** 2008. Molecular Biology of the Gene. Pearson Education Inc.

BOT604 (B) APPLIED MICROBIOLOGY

Unit-I

Microbial Ecology and Environmental Microbiology: Microbiology of Air, Water and Soil. Microbiology of Solid Wastes, Sewage (Waste water) and Industrial Waste, Bioleaching and Biomining

Unit-II

Food Microbiology: Microbiology of Foods, Milk and Dairy Products

UNIT III

Industrial Microbiology: Microbial production of organic acids, antibiotics, amino acids, enzymes, vitamins etc.

Agricultural Microbiology: Microbes-Plant Associations, Microbial Biofertilizers and Biopesticides, Microbial Bioremediation of Agricultural Product, Biodegradation of Pesticides

Unit-V

Medical Microbiology: Infection and Diseases, Human Diseases caused by Fungi, Bacteria and Viruses, their diagnostics and managements.

BOT604 (C) ECOLOGY AND ENVIRONMENT

Unit-I

Plant Ecology : Characteristics of a population, population growth curves, population regulation and r and k selection, concept of metapopulation. Ecological succession: Types, mechanisms, change involved in succession.

Unit-II

Community Ecology: Nature of communities, community structure and attributes, analytical, quantitative and qualitative characters and synthetic characters, levels of species diversity and its measurement edges and ecotones, life forms.

Unit-III

Ecosystem Ecology: Ecosystem – structure and function, major ecosystems, energy flow, mineral cycling (C, N, P), primary production and measurement, structure and function ofterrestrial and aquatic ecosystems.

Unit-IV

Applied Ecology: Environmental pollution, green house gases their sources and greenhouse effect, global warming; ozone depletion biodiversity, biodiversity management, Project tiger, biosphere reserves, conservation biology, principles of conservation, conservation and management strategy,.

Unit-V

Environmental Management: Introduction and scope of environmental management, concept of sustainable development. Environmental impact assessment, role of biodiversity in ecosystem stability, general account of remote sensing and its application, environmental, energy and green audit, Environmental management and safety, International summits and treaties related with environment.

BOT604 (D) ADVANCED TAXONOMY OF ANGIOSPERM

Unit I

History of plant Taxonomy of the world, history of plant classification of the world, Modern system of classification. Angiosperm Phylogeny Group (APG): Outline of Classification, function and Application

Unit II

International Code of Nomenclature (ICN): Principles, rules and recommendations and appendices; application of nomenclature.

Unit III

Biodiversity: characterization, generation maintenance and loss, magnitude, distribution and conservation, remote sensing. Indigenous flora of the country with special reference to local flora and flora of the special habitats, Methods of plant identification.

Unit IV

Inter relationship of plant taxonomy with morphology, anatomy, embryology, palynology, cytology, genetics, phytogeography and Chemistry. Biosystematics, serology and molecular systematic and numerical taxonomy.

Unit V

Botanical gardens, Herbarium, digital herbarium and their significance, Herbarium techniques, Applications of plant taxonomy in medicine, forensic science and urbanization (indoor and outdoor plants).

BOT604 (E) PALEOBOTANY

Unit I

Basic geological information – structure of Earth Types of rocks, stratigraphy, basic concepts of continental drift and plate tectonics. Dating the past, Geological time scale.. Fossilization process, Types of fossils, including chemical fossils and nannofossil, techniques to study fossils, reconstruction and nomenclature of fossil--- concepts of Parataxa and Eutaxa, objectives of palaeobotany.

Unit II

Prebiotic Environment, chemical evolution and origin of life, Pre Cambrian life, Indian Pre cambrain

Unit III

Emergence of first seed plants, preovules, diversification of Gymnosperms in geological time scale. First Angiosperms, Angiosperm palaeofloristics. Concept of Indian Gondwana sequence, stratigraphy and correlation of Gondwana sequence in Peninsular Indian basins. Mega and microfloristics of Indian Gondwana formation. Indian Perigondwana floras.

Unit IV

Applied Palaeobotany Life as fuel maker, sources of natural fossil fuels, Peat, coal and its varieties, constitution of coal, Coal Palynology, coal maceral, Petroleum – its origin, migration and concentration , palynology in oil exploration.

Unit V

Fundamentals of Paleofloristics, Palaeogeography and Palaeoclimatology. Applicaion of Palaeopalynology .Plant and animal interactions correlation
Archaeobotany with special reference to phytoliths and palynological studies.

BOT604 (F) MORPHOLOGY OF SEED PLANTS

Unit 1

Origin and evolution of seed plants : Heterospory and origin of seed habit, Origin and evolution of ovules, concept of seed and its development in plants, Structure and types of seeds in gymnosperms and angiosperms (dicotyledons and monocotyledons), germination of seeds and development of seedlings, vivipary,origin and evolution of gymnosperms and angiosperms and their affinities

Unit II

General features of gymnosperms ,classification of gymnosperms (traditional and modern approach), world distribution of gymnosperms, gymnosperms of India and their distribution, economic importance and impact of gymnosperms on human society, biotechnology and conservation of gymnosperms. General features of angiosperms their adaptation and economic importance.

Unit III

Vegetative and reproductive morphology of Pteridospermales, Bennettitales, Pentoxylales and cycadales.

Unit IV

Unit V

Morphology of flowering plants: Morphology of shoot system (stem, buds, leaves and phyllotaxy), root system and their modifications in angiosperms, Inflorescence and flower morphology, flower as a modified shoot, morphology of fruits.