SYLLABUS OF THE COURSE
(Experiential Learning) 2020-2021

S.B.M.S. COLLEGE,SUALKUCHI

Major Course in Computer Science
at TDC(Science) Level

Eligibility: Higher Secondary (Science) pass with Mathematics as one of the subjects at the Higher Secondary level securing minimum pass mark in the subject.

A student taking major in Computer Science must have Mathematics and one of the subjects Physics/Electronics/Statistics as general course at TDS(Sc) level.

(Course break-up)

Semester - 1

Paper Code	Paper Name / Topics	Marks	Classes / week	Credit
M101	Introduction to Computer Fundamentals and Programming	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M102	Basic Electronics	75 marks (Internal 15 marks)	6	6
M103	Practical Programming in C Basic Electronics -	Total 50 marks 30 marks (Internal - 6 marks) 20 marks (internal 4 marks)	4 laboratory sessions	4

Semester - 2

Paper Code	Paper Name/Topics	Marks	Classes / week	Credit
M201	ICT Hardware	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M202	Discrete Mathematics	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M203	Practical ICT Hardware	50 marks (Internal 10 marks)	4 laboratory sessions	4

Semester - 3

Paper Code	Paper Name /Topics	Marks	Classes / week	Credit
M301	Data Structure	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M302	Computer Organization and Architecture	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M303	Practical Data Structure	50 marks (Internal 10 marks)	4 laboratory sessions	4

Semester - 4

Paper Code	Paper Name / Topics	Marks	Classes / week	Credit
M401	Operating System	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M402	Database Management System	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M403	Practical Operating System DBMS	Total 50 marks 15 marks (Internal 3 marks) 35 marks (Internal 7 marks)	4 laboratory sessions	4

Semester - 5

Paper Code	Paper Name/Topics	Marks	Classes / week	Credit
M501	Object Oriented Programming using C++	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M502	Computer Oriented Numerical Methods and Statistical Techniques	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M503	Computer Networks	75 marks	6	6

		(Internal 15 marks)	(5 lectures + 1 tutorial)	
M504	Microprocessor and Assembly Language Programming	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M505	Practical Object Oriented Programming Computer Networks	Total 75 marks 45 marks (Internal 9 marks) 30 marks (Internal 6 marks)	6 laboratory sessions	6
M506	Practical Computer Oriented NMST Microprocessor and Assembly Language Programming	Total 75 marks (Internal 15 marks) 30 (Internal 6 marks) 45 marks (Internal 9 marks)	6 laboratory sessions	6

Semester - 6

Paper Code	Paper Name / Topics	Marks	Classes / week	Credit
M601	Automata Theory and Languages	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M602	Web Technologies	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M603	System Administration using Linux	75 marks (Internal 15 marks)	6 (5 lectures + 1 tutorial)	6
M604	Practical Web Technologies System Administration using Linux	75 marks (Internal 15 marks) 40 marks (Internal 8 marks) 35 marks (Internal 7 marks)	6 laboratory sessions	6
M605	Project	150 marks (Internal 30 marks)	12 (4 tutorials + 8 laboratory sessions)	12

DETAILED SYLLABUS

M101 INTRODUCTION TO COMPUTER FUNDAMENTALS AND PROGRAMMING

Full marks: 75 (Internal 15)

Fundamentals   **Marks :15**

Major components of a Digital Computer (A brief introduction of CPU, Main memory, Secondary memory devices and I/O devices) Keyboard, monitor, mouse, printers, Secondary storage devices (floppy disks, hard disks and optical disks), backup system and why it is needed ? Bootstrapping a Computer. Representation of numbers (only a brief introduction to be given) and characters in computer. ASCII. EDCDIC and Gray codes. Interpreter, Assembler, Linker and Loader. Definition and concepts of algorithm and its different implementations-pseudo code, flowchart and Computer programs.

Number System: Binary, Hexadecimal, Octal, BCD, and conversions of number systems. Representation of signed integers, Sign and magnitude, 1's complement and 2's complement representation. Arithmetic operations using 2's complement representation and conditions for overflow/underflow and its detection.

Introduction to C: **Marks : 25**

Elementary data types , variables, constants and identifiers. Integer, character floating point and string constants . variable declarations. Syntax and semantics. Reserved word. Initialization of variable during declarations Constant data types. Expression in C, precedence and associativity of C operators, unary, binary and ternary operators. C arithmetic operators, assignment operators, relational operators, logical operators and bit –wise operators . L-value and R-value. Side effects of operators. Expression statement.

Conditional Statement-if, if-else, switch

Iterative Statement-white, do-while, for

Other Statement –break , continue, goto, return, null Statement, block Statement. Function: function declaration. Calling a function. Parameters –Call by value, Call by reference and its absence in C. Recursion and how it works.

Cast and sizeof operator. Automatic type Conversion.

Simple programs like programs to compute an arithmetic expression, unit conversion, the sum of a series (like trigonometric series), GCD, factorial (both recursive and non-recursive version), fibonacci number (both recursive and non-recursive version), generation of prime numbers, reversing digits of an integer, finding the square root of a number, prime factors of an integer, base conversion of numbers, test if three points form a triangle and classify triangles as right angled, isosceles, equilateral etc., roots of a quadratic equation, generation of simple patterns of characters on screen.

Arrays and pointers: **Marks : 12**

Storage classes : Automatic, External, Static, Register. Scope and lifetime of variables.

Arrays and pointers and corresponding operators. Pointer arithmetic.

Programs using arrays and pointers like sum, average, minimum, maximum of an array of numbers. Add and delete an element of an array. Merge two sorted arrays. String manipulation programs like addition, subtraction, multiplication and their combinations. Sum of rows, columns, and diagonal elements of a matrix. Transpose of a matrix. Linear search, binary search. Selection sort and bubble sort.

Structures and Files: **Marks 8**

Structure – declaration and use. Structure member resolution and structure pointer member resolution operators.

Programs to show the use of structure.

Standard C library.

Files in C—opening, closing, reading and writing of files. Seeking forward and backward. Simple examples of file handling programs.

Suggested Reading:

1. Programming with C, B.S. Gottfried, Tata Mc-Graw Hill.
2. Programming in ANSI C, E.Balagurusamy, Tata McGraw – Hill
3. The C Programming Language, B.W. Kernighan and D.M.Ritchie, PHI
4. Computer Fundamentals, Anita Goel, Pearson, 2010.

M102 BASIC ELECTRONICS

Full marks: 75 (Internal 15)

Basic principles of Electricity and Electrical Circuits: Ohm's law, Kirchoffs Law, Norton and Thevenin's theorems, temperature coefficient, specific resistance of materials. Basic equation of capacitor, Relationship between current, charge, voltage, permittivity, parallel plate capacitor, its equation. Basic Equation of inductor, Relationship among voltage, current and field.
(8)

Conductors, Insulators, and Semiconductors. Intrinsic and Extrinsic semiconductors, P-type, N-type Semiconductors. Junction Diode. Biasing. V_I Characteristics. Other Semiconductor Devices: Zener Diode, Photo Diode, Varactor, SCR, LED, LDR.

Transistor: PNP and NPN, photo transistor. CC, CE, CB configurations. Biasing of transistors. V-I relations, Load Line. FET and MOSFET. Op-Amps & Integrated Circuits. **(8)**

Power rectifier and filter: Rectifier, filter. Working of a simple power supply using transformer, rectifier and filter. **(8)**

Boolean Algebra and Logic Gates: De Morgan's theorem, Boolean Identity. OR, AND, NOT, NAND, NOR and Ex OR gates. Truth Tables. Positive and Negative logic. **(12)**

Reduction Techniques: Standard representation of Boolean expressions, SOP and POS forms, Combinational and sequential circuits, Minterm and Maxterm expressions, Map reduction techniques, K-Map. Code Conversions: Binary to Gray, BCD to decimal etc. **(12)**

Binary Arithmetic: Half Adder, Full Adder. Multiplexer, Demultiplexer, Decoder, Encoders, Comparators. Flip Flops: S/R, J/K, D and T. Latches, Digital Counters. Registers. **(12)**

Books:
1. Digital Logic and Computer Design, M. M. Mano, PHI
2. Electronics Devices and Circuits: Millman and Halkias; Tata Mc Graw Hill.
3. Digital Computer Electronics: Malvino; Tata Mc Graw Hill.

M103 PRACTICAL

Part 1- Programming in C: 30 marks (Internal 6 marks)

At least 20 programming assignments have to be done by each student from the following list. The assignments should be selected in such a way that all the features of C language are covered.

1. Write a program to convert a given temperature value from Fahrenheit scale to Centigrade scale and vice versa.
2. Write a program to display ASCII value of a character.
3. Write a program to check whether a number is perfect or not.
4. Write a program to find out the biggest of three numbers using nested if.
5. A company insures its drivers if either of the following conditions are satisfied
   - Driver is married.
   - Driver is an unmarried, male and above 30 years of age.
   - Driver is unmarried, female and above 25 years of age.
   Write a program to decide if a driver is to be insured using logical operators.
6. Write a program to read a list of positive integers terminated by -1 and display the odd and even numbers separately and also their respective counts.
7. Write a program to read values of n and x and print the value of y using switch case where
   a. $y=n+x$ when n=1
   b. $y=1+x/n$ when n=2
   c. $y=n+3x$ when n=3
   d. $y=1+nx$ when n>3 or n<1.
8. Write a program to n values of sales and then calculate the commission on sales amount where the commission is calculated as follows:
   a. If sales <= Rs.500, commission is 5%.
   b. If sales > 500 but <= 2000, commission is Rs 35 plus 10% above Rs 500.
   c. If sales > 2000 but <= 5000,commission is Rs 185 plus 12% above Rs.2000.
   d. If sales > 5000 ,commission is 12.5%.
9. Write a program to find out minimum, maximum, sum and average of n numbers without using array.
10. Write a program to find out the roots of a quadratic equation. Use proper testing to find checks for real and complex roots.
11. Write a program to print the digits of a number in words. (eg. if a number 841 is entered through the keyboard your program should print "Eight Four One".)
12. Write a program to print the PASCAL Triangle up to the n-th row where n is an input to the program.
13. Write a function to return the HCF of two positive integers. Write a main function to read two positive integers and print their HCF and LCM by using the above function.
14. Write a program to convert a decimal number into binary number using function.
15. Write a program to display the result of sine series using function.
16. Write a program to find the sum of the following series

$$1+x-x^3/3!+x^5/5!-x^7/7!+\ldots\ldots$$ corrected up to the 3 decimal place.

17. Write a program to read n numbers in a sorted array and insert a given element in a particular position

18. Write functions to compute the factorial of a number using both recursive and non-recursive procedure.

19. Write a program to print the values of ^nc_r and ^np_r for given positive integers $n \geq r > 0$. Use a function fact(n) to return the factorial of a non-negative integer.n.
$$^nc_r = n!/r!*(n-r)! \quad ^np_r = n!/(n-r)!$$

20. Write a program to display the first n Fibonacci numbers using function.

21. Write a program to display the prime numbers within a given range. Write a function to check whether a given integer is prime or not and use it.

22. Write a program to Multiply two matrices using function

23. Write a program to display the upper Triangle and lower Triangle of a given square matrix using function.

24. Write a function to check if a given square matrix is symmetric or not. Write a main function to implement it.

25. Write a program to read a m X n matrix and calculate the Row sum and Column Sum of the matrix

26. Write a function to read in an integer and print the representation of the number using the sign and magnitude representation scheme using 8 bits. The program should check for overflow/under flow conditions. The left most bit is to be used as the sign bit.

27. Write a program to merge two sorted arrays.

28. Write a program to implement selection sort using function.

29. Write a program to count the number of vowels in a string.

30. Write a program to concatenate two strings using function (without using library function).

31. Write a program to convert a string from upper case to lower case and vice versa.

32. Write a program to swap two numbers using function (pass the pointers).

33. Write a program to sort n number of strings in ascending order using pointer.

34. Write a program using pointers to copy a string to another string variable (without using library function).

35. Declare a structure of a student with details like roll number, student name and total marks. Using this, declare an array with 50 elements. Write a program to read details of n students and print the list of students who have scored 75 marks and above.

36. Create a structure to store the following information of employees.
    a. Employee's number, name, pay and date of joining.
    It has been decided to increase the pay as per the following rules:

    Pay <= Rs.3000 : 20% increase
    Pay <= Rs.6000 but > Rs.3000 :15% increase
    Pay > Rs.6000 : no increase

    Write a program to implement the above structure.

37. Write a program to read a text file and count the number of vowels in the text file.

38. Write a program to copy a text file to another file.

Part 2 - Basic Electronics: 20 marks (Internal 4 Marks)

Each student should do at least 10 assignments from the following list. This should have assignments from each of the following units.

BASIC ELECTRICAL CIRCUITS:

1. Verification of Voltage Division Rule
2. Verification of Current Division Rule.
3. Verification of the Thevenin's Theorem and determines the equivalent Circuit.
4. Verification of the Norton's Theorem and determines the equivalent Circuit.

SEMICONDUCTOR DEVICES:

5. Determination of V-I characteristics of Semiconductor Diode and draw it's Load Line and determine knee voltage.
6. Study of the reverse bias characteristics of a Zener Diode.
7. Design a Half Wave rectifier using semiconductor Diode. Use filtering to reduce Ripple.
8. Design a Full Wave rectifier using semiconductor Diode. Use filtering to reduce Ripple.
9. Design a Full Wave Bridge rectifier using semiconductor Diode. Use filtering to reduce Ripple.
10. Study of the static characteristics of the BJT in C-E mode and to determine h parameters.
11. Study of the static characteristics of the BJT in C-B mode and to determine h parameters.
12. Design a single stage RC coupled amplifier using BJT in C-E mode and to determine its voltage gain
13. Design a amplifier using BJT in C-B mode and to determine its voltage gain
14. Design of a emitter follower or CC amplifier and measure voltage gain.

DIGITAL CIRCUIT AND DESIGN:

15. List and verify the truth table of common Digital IC of the TTL series and display. Common logic gates are AND gate, OR gate, NOT gate, NAND gate, NOR gate, EXOR gate.
16. Verification of DeMorgan's Theorems.
17. Design a Half adder using digital logic gates. Verify its truth table.
18. Design a Full adder using digital logic gates. Verify its truth table.
19. Design of R-S Flip Flop; modify it to D Flip Flop. Verify the truth tables.
20. Design of a J-K Flip flop, verify the truth table.

OP AMP and IC555:

21. Study of the OP AMP as inverting and non inverting amplifier using IC741.
22. Study of the OP AMP as adder and subtractor.

M201 ICT HARDWARE

Full marks: 75 marks (Internal 15)

UNIT I: Evolution of computer system, Modern computer, Classification of computer, Personal Computer hardware: Monitor, Keyboard, Mouse, Scanner, printer, speaker   **(12)**

UNIT II: Hard Disk Drive: logical structure and file system, FAT, NTFS. Hard disk tools: Disk cleanup, error checking, de fragmentation, scanning for virus, formatting, installing additional HDD. New trends in HDD. Floppy Disk Drive   **(12)**

UNIT III: Optical Media, CDROM, theory of operation, drive speed, buffer, cache, CD-r, CD-RW, DVD ROM, DVD technology, preventive maintenance for DVD and CD drives, New Technologies. Driver installation, Writing and cleaning CD and DVD.   **(12)**

UNIT IV: Processor: Intel processor family. Latest trends in processor, Motherboard, Sockets and slots, power connectors. Peripheral connectors. Bus slots, USB, pin connectors. Different kinds of motherboards. RAM, different kinds of RAM. RAM up gradation. Cache and Virtual Memory concept.

(12)

UNIT V: SMPS. BIOS. Network Interface Card, network cabling, I/O Box, Switches, RJ 45 connectors, Patch panel, Patch cord, racks, IP address.   **(12)**

BOOKS RECOMMENDED :

1. Comdex; Hardware and Networking Course Kit; Dream Tech press
2. PC hardware : A beginners Guide; Ron Gilster; Tata Mc Graw Hill.

M 202 DISCRETE MATHEMATICS

Full Marks : 75 (Internal 15)

Sets, relations and functions:
Sets, relations, properties of binary relations, closures of relation, equivalence relations, equivalence classes and partitions. Partial ordering relations and lattices. Functions, one-to-one and onto, principles of mathematical induction.

(12)

Graph theory:
Basic Definition of graph. connectivity of graph, cut points cycles, Hamiltonian graphs, trees, different characterisation of trees, bipartite graph,
Algorithms on graph, Breadth first search, Depth first search.

(12)

Combinatorics:
Basic of counting principles, principle of inclusion-exclusion, application of inclusion and exclusion. Pigeonhole principle, generalized Pigeonhole principle and its application, permutations and combinations, permutations with repetitions, combinations with repetitions, permutations of sets with indistinguishable objects.

(12)

Matrices :
Row and column operations, vectors and matrices, partitioning of matrices, representing relations using matrices, Determinant of a square matrix, minor, cofactor, the Cayley-Hamilton theorem, inverse of a matrix, product form of inverse. Rank of a matrix. Solutions of simultaneous linear equations, existence of solutions, solution by Gaussian elimination, Eigen values and Eigen vectors.

(12)

Logic:
Connectives, truth tables, Normal forms- CNF, DNF, Converting expressions to CNF and DNF, Theory of inference, Propositional calculus. Boolean Algebra. Predicate calculus (only introduction), predicates and quantifiers.

(12)

Suggested readings:

1. Elements of Discrete Mathematics, C. L. Liu, Mc-Graw Hill International Ed.
2. Discrete Mathematics and its Applications, K. H. Rosen, Mc-Graw Hill International Ed.
3. Discrete Mathematics structures with applications to Computer Science, J. P. Tremblay and R. Manohar, Mc-Graw Hill
4. Discrete Mathematics, N. Ch.SN Iyengar, K.A. Venkatesh, V. M. Chandrasekaran, P. S. Arunachalam, Vikash Publishing House Pvt Ltd.
5. Logic for Computer Science, J. H. Gallier, J. Wiley and sons.

M203 PRACTICAL

Full Marks: 50 (Internal 10)
ICT Hardware
Objectives:
The Practical introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like Windows OS, LINUX OS, device drivers. Basic system administration in Linux which includes: Basic Linux commands in bash, Create hard and symbolic links, Text processing, Using wildcards In addition hardware and software level troubleshooting process, tips and tricks would be covered.

Different ways of hooking the PC on to the network and internet from home and workplace and effectively usage of the internet. Configuring the TCP/IP setting. Usage of web browsers, email, newsgroups and discussion forums would be covered. In addition, awareness of cyber hygiene, i.e., protecting the personal computer from getting infected with the viruses, worms and other cyber attacks would be introduced. The students should perform the following tasks.

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva.

Task 3: Every student should individually install MS windows on the personal computer. They should learn how to format and partition a hard disk. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Basic commands in Linux

Task 6: Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva

Task 7: Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

Task 8: The test consists of various systems with Hardware / Software related troubles, Formatted disks without operating systems. Installation of antivirus software, configure their personal firewall and windows update on their computer. Then they need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

M301 DATA STRUCTURE AND ALGORITHM

Full marks: 75 (Internal 15)

Definition :   Marks : 5

Concept of Data Types, elementary structure, words and their interpretations, packed words

Arrays :

Types, memory representation, address translation functions for one & two dimensional arrays, different examples.

Linked Structure: Marks : 15

Singly and doubly linked list, circular and non circular, list manipulation with pointers , example involving insertion and deletion of elements and their comparative studies with implementations using array structure

Stacks and Queues

Definitions, representation using array and linked list structure, application of stack and queues in simulation, postfix conversion and evolution of arithmetic expressions

Binary trees: Marks:12

Definition, quantitative properties, memory representation, Trees traversal algorithms (recursive and non-recursive), threaded trees, BFS, DFS

Searching :   Marks : 18

Linear and binary search algorithms, performance and complexity, binary search trees (construction ,insertion , deletion and search) Concept of optimal binary search trees.

Sorting:

Terminology, performance evaluation, sorting algorithms (non recursive, recursive description, Complexity, advantages and disadvantage, implementation)

Bubble sort, insertion sort, selection sort, Tree sort, heap sort, quick sort, merge sort & radix sort. External Sorting.

Analysis of Algorithm

                                                                             Marks: 10

Time and Space complexity of algorithms, average case and worst case analysis, asymptotic notation as a measure of algorithm complexity, Ɵ and O notation. Analysis of sorting algorithms- Selection sort, Bubble sort, Insertion sort, Heap sort, Quick sort and analysis of searching algorithms – linear search and binary search.

Suggested readings:

1. Data Structure , Horowitz and Sahani, Narosa
2. Introduction to Data Structures in C, A.N.Kamthane, Pearson, 2007.
3. Data Structure using C and C++, Langsam, Augentein & Tanenbaum
4. Data Structures using C, S.K.Bandyopadhyay, K.N.Dey, Pearson.

M302 COMPUTER ORGANIZATION AND ARCHITECTURE

Full marks: 75 (Internal 15)

Introduction: Marks:10

Functional units of a computer, basic instructions (zero, one, two, three addresso, interconnection of functional units, bus structure, memory locations, memory addresses, memory operations, instruction and instruction sequencing (straight line sequencing and branching).

Fixed and floating point representation of numbers. Normalized floating point representation and arithmetic operations using normalized floating point numbers. IEEE standard for binary floating point representation
Addressing modes, stack, subroutine, I/O instructions.

Register Transfer Logic: Marks: 8

Introduction, interregister transfer, arithmetic microoperation, logic microoperation, shift microoperation, Conditional control statements, fixed point binary data, instruction code, design of a simple computer.

Processor logic design: Marks: 12

Processor organization, design of arithmetic and logic circuit, status register, design of accumulator.

Control logic design: Marks 12

Hardware control, microprogrammed control block disgram, symbolic microprogram, microprogrammed CPU organization.

I/O Subsystem: Marks: 8

Program controlled I/O, Interrupts: enabling and disabling interrupts, handling interrupts from multiple sources (priority control), DMA.

Memory subsystem: Marks: 10

Semiconductor memory, SRAM, DRAM, ROM, speed size and cost, Cache memory, mapping functions.

Suggested Reading:

1. Digital logic and Computer Design, M.Morris Mano, PHI publication
2. Computer Architecture, Hamachar, Vranesic and Zaky.
3. Computer Organization and Architecture; William Stallings, Pearson.

M303 PRACTICAL

Full Marks: 50 (Internal 10)
Each student should do at least 15 assignments from the following list.

1. Implement binary search and linear search algorithms on arrays.
2. Implement following sorting algorithms :
    i) Bubble sorting
    ii) Insertion sort
    iii) Heap sort
    iv) Quick sort
    v) Merge sort
3. Write a program to create a singly linked list and insert an element at the beginning, end, and at a given position of the linked list.

4. Write a program to create a singly linked list and delete an element from any position of the linked list.

5. Write a program to create a singly linked list. Write functions for
    i. counting the number of elements in a list
    ii. to search for a given element in a list. If the item has been found then it should return the position at which the item was found; otherwise it should return -1 to indicate not found.
6. Write a function to concatenate two linked lists.

7. Write a function to merge two sorted linked lists.

8. Write a program to create a doubly linked list and insert an element at any position.

9. Write a program to create a doubly linked list and delete an element from a given position.

10. Write a program to create a circular linked list and insert / delete an element at any position.

11. Write a program to implement a stack using
    i) array structure
    ii) linked list structure
12. Write a program to implement two stacks using a single array.

13. Write a program to evaluate a postfix expression using stack.

14. Write a program to convert an infix expression into a postfix expression.

15. Write a program to implement a queue using array.

16. Write a program to implement a queue using linked list.

17. Write a program to implement a circular queue using array.

18. Write a program to implement a circular queue using linked list.

19. Write a program to create a binary search tree using link representation and display the elements in preorder, in order and post order using recursive function.

20. Write a program to create a binary search tree using link representation and
    i) search
    ii) delete an item from the binary search tree.

M401 OPERATING SYSTEM

Full marks: 75 (Internal 15)

Introduction: **Marks:8**

What is an operating system, batch systems, multiprogrammed, time-sharing systems, personal-computer systems, parallel systems, distributed systems, real-time systems.

Processes: **Marks:8**

Process Concept, Thread, design issues of thread, user space thread and kernel space thread. Usage of thread. Process states, Operation on Processes:- creation and termination. Implementation of process:- process table.

Process Synchronization: **Marks:8**

Race condition, Critical-Section, mutual exclusion. Solution to race condition and synchronization: - disabling interrupt, test-and-set-lock, Peterson's solution, semaphore, mutex, monitor, message passing. Classical problems:- The Dining philosopher, sleeping barber and readers-and-writers (bounded buffer) problems and their solution.

Scheduling: **Marks:8**

Basic Concepts, preemptive and non preemptive scheduling. Scheduling Algorithms. Types of scheduling: - batch, interactive and real-time. Goals of scheduling algorithms. FCFS, SJF, RR, priority, multiple queues, three-level scheduling.

Deadlocks: **Marks:8**

System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock. Banker's algorithm.

Memory management: **Marks:8**

Multiprogramming. Address binding (relocation), and protection. Swapping. Virtual memory: - logical versus physical address space, paging, page fault, page table and its entries, demand paging, multi level page table, TLB, its entries and working. Page replacement algorithms: - LRU, optimal, NRU, FIFO, second chance, clock, NFU. Working set. What is segmentation, what are its benefits and drawbacks.

File system: **Marks:8**

What is file, file naming, file types(directory, regular, device), sequential access and random access files, file attributes, operations on file, hierarchical directory structure, path name(relative and absolute), operation on directories, disk layout, disk partition, file system layout, disk block allocation:-contiguous allocation linked list allocation, FAT, i-nodes, directories in UNIX, file system security

I/O management: **Marks: 4**

Basic principles and overall structure of I/O management subsystem, Device controllers, layers of the I/O subsystem:- interrupt handlers device driver, device independent I/O software and user space I/O software.

Suggested reading:

1. Modern Operating System, Tanenbaum, PHI Publication.
2. Operating System by Galvin

402 DATABASE MANAGEMENT SYSTEM

Full marks: 75 (Internal 15)

File structure: Marks: 5

Record storage and primary file organization: memory hierarchies and storage devices, Storage of Data Bases, Placing file records on disks: Records and its Types, Files, Fixed length records and variable length records, Record Blocking, allocating file blocks on disks, operation on files.

Issues in Physical Design : Concept of indexes

Overview of Database Management System: Marks : 15

Definition of DataBase, Traditional File Approach vs. DBMS approach, Characteristics of the Data Base Approach, DBMS user, Role of a DBA, Advantage of using DBMS, DBMS architecture,   Data independence

ANSI/SPARC 3 level architecture.

Relational Models: Marks: 20

Fundamental integrity rules: entity integrity, referential integrity, Relational algebra(Select , Project, Cross ,Product , theta join, equi join, natural join, outer join),Set Operation

ANSI SQL –92 Standard : DDL, DML, SQL constructs(Select .. From… Where… Group by ….. Having… Order by….), Insert, Delete, Update, View, Definition and use, nested quires, Constraints considers(NOT NULL , UNIQUE, Check Primary key. Foreign key)

Database design: Marks : 20

Conceptual model, logical model, physical model.

ER model as a tool for conceptual design-entities, attributes and relationships, weak and strong entities, conversion of ER model into relational schema. DFD.

Normalization: informal design guidelines for relational schemas (overview level), functional dependencies, different types of keys. Normal forms (first, second, third, BCNF).

Functional dependency diagram and relational database design from it.
Suggested reading:

1. Introduction to database management system, C.J. Date
2. Fundamentals of Database Systems, Elmasri & Navathe; Pearson Education.
3. An introduction to Database systems; Bipin C. Desai; Galgotia publications.
4. Database Systems - Concept, Design and Applications; S.K.Singh; Pearson Education.

M403 PRACTICAL

Full marks 50 (Internal 10)

Part 1-Operating System: 25 marks (Internal 5)

Each student should do at least 12 assignments from the following list.

1. Write a program to create a child process that starts looping and then terminates.

2. Write a program to show that the child can be set up to ignore a signal from its parent.

3. Write a program to show that a process can ignore a signal.

4. Write a program to create a thread which prints "We are proud to be Indians" and terminates.

5. Write a program to demonstrate how to "wait" for thread completions by using the Pthread join routine. Threads are explicitly created in a joinable state.

6. Write a program to create a thread in which print "We are proud to be Indians" and pass multiple arguments using structure during its creation.

7. Write a program to compute the dot product of two vectors.

8. Write a program to compute the dot product of two vectors and also show the use of mutex variables.

9. Write a program to create threads, the main thread creates three threads. Two of these threads increment a counter variable while third thread watches the value of the counter variable. When the counter variable reaches a predefined limit, the waiting thread is signaled by one of the incrementing threads. The waiting thread "awakens" and then modifies the counter. The program continues until the incrementing threads reach a final value and also print the final value.

10. Write a program to fork() a child process so that we have two processes running. Each process communicates via a semaphore. The respective process can only do its work (not much here) When it notices that the semaphore track is free when it returns to 0. Each process must modify the semaphore accordingly.

11. Write a program to show how 2 processes can talk to each other using kill() and signal(). We will fork() 2 process and let the parent send a few signals to it's child.

12. Write a program to show attaching and detaching shared memory.

13. Write a program to show the communication between two processes through shared memory.

14. Write a program to implement Banker's Algorithm.

15. Write a program to simulate synchronization of Sleeping Barber problem.

16. Write a program to simulate Dining Philosophers Algorithm.

Part - 2 Database Management System
Full marks : 25 (Internal 5 marks)

1. Create a table *Employee* with the following columns:
    Emp_no (numeric) primary key
    Emp_name (string)
    Join_date (Date)
    Basic_pay_fixed_at (numeric)
    Date_of_birth (Date)

Insert the following data into the table.

Emp_no.	Emp_name	Join_date	Basic_pay_fixed_at	Date_of_birth
1001	Charles Babbage	01-Jun-2000	8000.00	03-10-1973
1002	George Boole	01-Jul-2001	5000.00	04-12-1972
1003	E.F. Codd	01-Jun-2001	8000.00	06-03-1969
1004	Bill Gates	01-Jul-2003	5000.00	09-10-1995
1005	Tony Greig	01-Aug-2004	8000.00	04-05-1985

2. Create the following two tables and insert data into the tables.
 Player (Roll no.→Primary Key)

Roll no.	Name
10	Vijay Amrithraj
20	Leander Paes
30	Mahesh Bhupathi
40	Sania Mirza

Match (Match_no→Primary key,Roll no→Foreign key)

Match_no	Roll_no.	Match_Date	Opponent
1	20	10-Jul-2008	Washington

2	30	12-Jan-2008	Sampras
3	20	12-Aug-2008	Borg
4	30	20-Mar-2008	Vijay

Perform the following two operations:

(i) Perform EQUIJOIN operation to retrieve data from both the files.

(ii) Perform OUTERJOIN operation to retrieve the unmatched records.

3. Design an ER diagram for a **BANK** database schema. To consider that each Bank can have multiple branches, and each branch can have multiple Accounts and Loans for customer. Also to specify the non weak & weak entity types, key attributes & key types, relationship types, instances, constraints and participations.

3. Create a table **Student** taking the attributes given bellow

        Roll_no, Student_name, Address, Date_of_addmission, Class

        Section and Contact_no.

Write appropriate queries to perform the following operations:

a) To insert values in the Student table.

b) To delete values from Student table

c) To list the names of all students which roll_no > 20.

d) To search for students who got admitted before 01-01-2006.

e) To change the name of the student whose roll number is 10 to Amar.

4. Create tables **Department** and **Employee** with the attributes given bellow.

        Employee (EmpNo , Empname, Address, Dno)
        Department (Dno, Dname, Location)

Dno in Employee is a foreign key.

Write appropriate queries to perform the following operations:

a) To insert values in the tables.
b) To retrieve the names and addresses of all Employees working in the Finance department.
c) To print the location where Administration department is located.

d) to delete all information regarding a particular employee.

5. Create table **Student** and **Course** taking the attributes given bellow.

   Student (Roll_no, Name, Semester, Course_no(Foreign key))

   Course (Course_no, Course_name)

Write appropriate queries for the following operations:

   a) To retrieve names of all students who are admitted to the course 'BCA'.

   b) To retrieve the names of all students whose course name is 'BCA' and who are in the 3rd semester.

   c) To display details of all courses in which more than 100 students got admitted.

   d) For course being offered, display the course name and number of students admitted to the course.

6. Create tables **Employee**, **Department**, **Location**, **Works_on**, and **Project** taking the attributes given bellow.

   Employee (Fname, Lname, Empno, Bdate, Address, Salary, Dnumber)

   Department (Dname,Dnumber,Mgrno)

   Locations(Dnumber, DLocation)

   Works_on(Empno, Pnumber, Hours_per_day)

   Project(Pname, Pnumber, Location,Dnumber (Foreign))

   Dependent(Empno, Dependent_name, Sex, DOB, Relationship)

Write appropriate queries for the following operations:

   a) Retrieve the names and addresses of all employees who work in the Finance department.
   b) To retrieve the names of all employees who works on all the projects controlled by department number 6
   c) For each department, print the name of the department and the name of the manager of the department.
   d) Retrieve the location where the Administration department is located.
   e) For every project located in Mumbai, list the project number, the controlling department and department manager's name and address.
   f) Find out how many employees are there in each department.

g) Find the total salary of all employees of the "Research" department, as well as the maximum, minimum and average salary in this department

h) Retrieve the name of all employees who have no dependent.

i) Alter the "Employee" table by deleting the coloumn Bdate.

j) Retrieve the Fname, Lname of all employees whose salary is higher than average salary.

k) For each department retrieve the department number, the number of employee in the department and their average salary.

l) Retrieve the name of all employees who have two or more dependent

m) Retrieve the details of all employees who works on project number 1,2,3

7. Create Table

   Client_master (Client_no, name, address, Bdue)

   Product_master(P_number,Description,saleprice,costprice)

   Sales_master(Salesmno,Sname,Addres,Salamnt,Remarks)

   Sales_order(O_no,Client_no,Odate,Delyaddr,Salesmno)

   Sales_order_detail(Order_no,Product_no, Qtyorder, product_rate,Qty_dispatched)

  Write appropriate queries to perform the following operations:

   i) List name of all clients having 'a' as the second letter in their names.

   ii) Retrieve the description and total Qty sold for each product.

   iii) Find product no. and description of non moving products (i.e product not being sold).

   iv)For each product being sold, list the product number and the total amount (in Rs.) sold.

   v) List all client who stay in 'Bangalore' or 'Mumbai'

   vi) List the clients who stay in a city whose First letter is 'M'

   vii) Find the names of clients who had purchased the item 'Trouser'.

   viii)   Find out if T-Shirt' has been ordered by any client and if so print the details of the client.

   ix) List details of all products whose unit price is more than Rs. 5000.00.

   x) Calculate the total amount (in Rs.) purchased by each client that has purchased items amounting more than Rs. 20000.

8. Create table

   Author(Author_id, Name, City, Country)

   Catalog (Book_id, Title, Author1_id, Author2_id, Publisher_id, Category_id, Year, Price)

   Publisher(Publisher_id, Name, City, Country)

Order_details(Order_no, Book_id, Quantity)

Category(Category_id, Description)

Order_summary(Order_no,Member_id,Odate,Amount,Ostatus)

Member(Member_id, Name, Address, Contact)

Assume that all books have at most two authors.

Write appropriate queries to perform the following operations:

a) Retrieve the title, author, and publisher names of all books published in 1999 and 2006.
b) Retrieve the title of all books whose one author is 'A Tanenbum'.
c) Get the details of all books whose price is greater than the average price of the books.
d) Get the names of all the books for which an order has been placed.
e) Get the names of all authors who have more than ten books in the catalog.
f) Get the details of the authors whose books are being sold from the book club.
g) Get the title and price of all books whose price is greater than the maximum of the category average.

M501 OBJECT ORIENTED PROGRAMMING

Full marks: 75 (Internal 15 marks)

Programming language C++ is to be used with this paper.

Introduction: Marks: 5

What is OOP .Introducing Object-Oriented Approach, Relating to other paradigms. Benefits of OOP and methods.

Basic terms and ideas: Marks: 8

Abstraction, Encapsulation, Inheritance, Polymorphism, Review of C, Difference between C and C++ - cin, cout, new, delete operators. Functions in C++: main function, function prototyping, call by reference, return by reference, functions- inline, friend, virtual, library.

Classes and Objects: Marks: 20

Encapsulation, information hiding, abstract data types, Object & classes, attributes, functions, C++ class declaration, member functions, State identity and behavior of an object, static data members and member functions, friend functions, constant member functions. Constructors and destructors, instantiation of objects, Default parameter value, object types, C++ garbage collection, Metaclass/abstract classes.

Operator overloading: Overload unary, binary operators, overloading binary operators using friends, manipulation of strings using operators.

Inheritance: Marks: 10

Inheritance-multilevel, multiple, hierarchical, hybrid, virtual base class, abstract class, Class hierarchy, derivation – public, private & protected, Aggregation, composition vs classification hierarchies.

Polymorphism: Marks: 10

Polymorphism, Categorization of polymorphism techniques: compile time polymorphism, Polymorphism by parameter, run time polymorphism- pointers to derived class, virtual; function, pure virtual function.

Files and Exception Handling: Marks: 7

Persistant objects, Streams and files, Namespaces,

Exception handling, Generic Classes.

Suggested readings:

1. Herbert Schild, " The complete reference to C++", Osborn McGraw Hill
2. R. Lafore, "Object Oriented Programming using C++", Galgotia Publications
3. **Ian Graham**, "Object Oriented Methods", Addison Wesley.

M502 COMPUTER ORIENTED NUMERICAL METHODS AND STATISTICAL TECHNIQUES

Full marks: 75 (Internal 15 marks)

Representation of numbers: **Marks: 8**
    Floating point representation, single and double precision, round off errors and truncation errors.

Solution of non-linear equation: **Marks: 8**
    Bisection method, Newtons method, Regula Falsi method, secant method, fixed point algorithm.

Solution of simultaneous linear equation: **Marks: 8**
    Basic elimination method, Gaussian elimination method, Gauss Jordan method, method of successive approximation.

Ordinary differential equation: **Marks: 8**
    Euler's method, Runge Kutta method, Milnes method.

Interpolation: **Marks: 7**
    Newton's interpolation, Lagrange's interpolation, Newton's divided difference method.

Numerical integration: **Marks: 7**
    Trapezoidal rule, Simpson rule, Newton's Cotes method.

Statistical methods: **Marks: 14**

Measure of central tendency: Mean, Median and Mode.

Probability, probability distribution, Binomial, Poison and normal distribution. Mathematical expectations, moments, correlation, regression.

Suggested Reading:

1.M.K.Jain, S.R.K.Iyenger, R.K.Jain, " Numerical methods for Scientific and Engineering Computation", Wiley Easterns.
2. K.E. Atkinson, "An introduction to numerical analysis", J.Willey and Sons.

503 COMPUTER NETWORKS

Full marks: 75 (Internal 15 marks)

INTRODUCTION   Marks:8

Usage of Computer Network, study of topology, concept of protocol, Connection less and connection Oriented Service, Layered architecture, study of OSI and TCP model.

PHYSICAL LAYER   Marks:8

Introduction to Guided and Unguided media, physical description of twisted pair, coaxial cable, and fiber optic cable, Maximum data rate of a channel (Nyquist and shannons law), Basic concepts of Modulation and demodulation, Data encoding techniques (Manchester and Differential Mancestar encoding)

Network connecting devices hub, repeater, bridge, switch, router, and gateway

LOGICAL LINK CONTROL   Marks: 8

Functions and services of DLL, Framing and Framing Methods, Concept of Error Control, Error Correcting code(Hamming code), Error detecting code(CRC), Concept of Flow Control, Piggybacking, Stop-and-Wait sliding window protocol, Pipelining techniques(Go backN, Selective Repeat).

MEDIUM ACCESS CONTROL   Marks: 8

What is MAC? Static Channel Allocation, Dynamic Channel Allocation, Pure ALOHA, Slotted ALOHA, Carrier Sense Protocol, 1-persistent CSMA, Non-PersistentCSMA, CSMA/CD, Ethernet(IEEE 802.3) and Ethernet Frame Format, Basic concept of Wireless LAN(IEEE 802.11), Binary Exponential Backoff Algorithm.

NETWORK LAYER]   Marks:12

Services and Functions of Network Layer, Virtual Circuit and Datagram Subnet, Routing, Distance Vector Routing, the Count-to-Infinity problem, Link State Routing, Congestion (definition and factors of congestion only), Definition of Quality of Service, Traffic shaping, Leaky Bucket and token Bucket Algorithm, Concept of IP Address.

TRANSPORT LAYER   Marks: 8

Functionality of transport Layer, Establishment and release of connection, TCP and UDP(Overview), Introduction to Sockets, port numbers.

APPLICATION LAYER   Marks: 8

Concept of E-mail, Telnet, WWW, DNS, HTTP, FTP, URL, SMTP, MIME.

Suggested Reading:

1. Computer Networks, Andrew S. Tanenbum, PHI Publication.

2. Data and Computer Communication, Stalling W, 5ed, PHI (EEE).

M504 MICROPROCESSOR AND ASSEMBLY LANGUAGE PROGRAMMING

Full marks: 75 (Internal 15 marks)

Internal Organization of 8085A microprocessor: **Marks: 4**

User Programmable registers, PC, SP, accumulator, flags, data bus, address bus, control bus, instruction word size, opcode format, data format, memory addressing, I/O addressing, address decoding for memory and I/O.

8085A microprocessor architecture: **Marks: 12**

Pinout of 8085A microprocessor, multiplexed address/data bus, control and status signal, demultiplexing of control signals, other signals, bus timings, fetch decode and execute cycle, timing diagram for opcode fetch memory read and memory write, interfacing memory and I/O.

Assembly language programming in 8085A microprocessor:

Marks: 20

Complete instruction set in detail, programming examples, logic operation, counters and time delays, stack and subroutine, processing arrays, bit manipulation.

Interfacing: **Marks: 12**

In and OUT instruction, decoding addresses, Interfacing LED, relay, seven segment display, switch, keyboard,.

Interrupts: **Marks: 12**

Vectored interrupts, interrupt priorities, general purpose programmable peripheral devices, 8255A control and status registers, programming 8255A, introduction to 8279, 8254 and 8237 (block diagrams and basic functions).

Suggested Reading :

1. Microprocessor Architecture, Programming and Application with the 8085 by Ramesh S.Gaonkar
2. Microprocessor and Microcomputer by B.Ram.

M505 PRACTICAL

Total Marks: 75 (Internal 15)

Practical Assignments based on M501 (OOP): 45 marks (Internal 9)
Each student should do at least 10 assignments from this list. The assignments are to be chosen in such a way that all the features of OOP are covered.

1. Define a class named *triangle* to represent a triangle using the lengths of the three sides. Write a constructor to initialize objects of this class, given the lengths of the sides. Write member functions to check
   - (a) if a triangle is isosceles
   - (b) if a triangle is equilateral.

   Write a main function to test your functions.

2. Define a structure **employee** with the following specifications.
   Empno: Integer
   Ename:20 character
   Basic, hra, da: float

   Calculate()   : a function to compute net pay as basic+hra+da with float return type.
   Getdata():   a function to read values for empno, ename, basic, hra, da.
   Dispdata():   a function to display all the data on the screen

   Write a main program to test the program.

3. Define a class *complex* with two data members *real* and *imag* to represent real and imaginary part of a complex number.

   Write member functions

   rpart(): to return the real part of a complex number

   ipart() : to return the imaginary part of a complex number

   Add() : to add two complex numbers.

   Mul() : to multiply two complex numbers.

   Write constructors with zero, one and two arguments to initialize objects.

   // This is an example of polymorphism.

4. Define a class *point* with two data members *xordinate* and *yordinate* to represent all points in the two dimensional plane by storing their x co-ordinate and y co-ordinate values.

   Write member functions

   dist(): to return the distance of the point from the origin.

slope(): to return the slope of the line obtained by joining this point with the origin.

Write constructors with zero, one and two arguments to initialize objects.

Write a friend function to compute the distance between two points.

5. Define a class *String* with the following data members
    char *p;
    int size
and write member functions to do the following (without using library function) and using dynamic memory allocation.
    *   Length of the string
    *   Compare two string
    *   Copy one string to another.
    *   Reverse the string.
    *   Write suitable constructors and destructors. Write a copy constructor for the class.

6. For the class *complex* defined in 3 above, overload the <<, >>, + and * operators in the usual sense. Also overload the unary – operator.
7. For the class *string* defined in 5 above, overload the <<, >> and + operators where + is to be used for concatenating two strings.
8. Define a class *time* to store time as hour, minute and second, all being integer values. Write member functions to display time in standard formats. Also overload the ++ and -- operators to increase and decrease a given time by one second where the minute and hour values will have to be updated whenever necessary.
9. Define a class to store matrices. Write suitable friend functions to add and multiply two matrices
10. Define a class *student* with the following specification:
    rollno   :integer
    sname   :20 characters

    Derive two classes *artsst* and *scst.* The class astst will represent students belonging to Arts stream and the class scst will represent students belonging to science stream. The artsst class will have additional data members *ph, hs, en* and **as** to store marks obtained by a student in three subjects Philosophy, History, English and Assamese. The class scst will have additional data members *ph, ch, ma and eg* to store marks obtained in Physics, Chemistry, Mathematics and English.

    Write the following member functions in the classes artst and scst

    ctotal()   : A function to calculate the total marks obtained by a student

    takedata()   : function to accept values of the data members

    Showdata()   :   function to display the mark sheet of a student .
11. Define a abstract base class *figure* and add to it pure virtual functions

    display() to display a figure

get() to input parameters of the figure
area() to compute the area of a figure
perimeter() to compute the perimeter of a figure.
Derive three classes *circle, rectangle* and *triangle* from it. A circle is to be represented by its radius, rectangle by its length and breadth and triangle by the lengths of its sides. Write a main function and write necessary statements to achieve run time polymorphism.

12. Write an interactive program to compute square root of a number. The input value must be tested for validity. If it is negative, the user defined function *my_sqrt()* should raise an exception.
13. Write a class template for storing an array of elements. Overload the << and >> operators. Write a member function to sort the array in descending order.

Practical Assignments based on M 503: 30 marks (Internal 6)

Avoid using Loopback Communication for the assignments,1-4:

1. Write a server socket program using TCP/IP in java where the client side will send a request for an existing file to the server side and if the file exists in the server then send the contents of that particular file to the client in reply, otherwise display a message "file does not exist on the server", if exists displays the contents on the client side.

2. Develop a chat application using TCP/IP in java.

3. Develop a client-server application using TCP/IP in java to input user's information and finally send them to the server and store there in a file.

4. Develop a server socket program where the client takes principal, rate of interest and number of years and send them to the server. In the server receive this information and find the simple interest and finally send the result to the client again and display it on the client's VDU.

5. Configure a Local Area Network (Wired/Ethernet) in Linux environment. Configure the network interface card using ifconfig command and also explore ping, ifdown and ifup commands.

M506 PRACTICAL

Total Marks: 75 (Internal 15)

Practical Assignments based on M502 (CONMST): 30 marks (Internal 6 marks)

Each student should do at least 10 assignments from this list. The assignments are to be chosen in such a way that all the topics are covered.

1. Write a program to find the positive root of the equation $2x - \log_{10} x - 7 = 0$, correct to 4 places of decimals using N-R method.

2. Write a program to find $3x - \cos x - 1 = 0$ that lies between 0 and 1, correct to 4 places of decimal by using Bisection method.

3. 3. Write a program to find the root of the equation $x e^x - 3 = 0$ that lies between 1 and 2 correct to 4 places of decimal by using Regula-Falsi method.

4. Implement Euler's method.

5. Implement R-K method.

6. Implement Simpson's method.

7. Write a program to find mean for direct series.

8. Write a program to find mean for continuous distribution.

9. Write a program to find median for individual series.

10. Write a program to find median for direct series.

11. Write a program to find median for continuous series.

12. Write a program to calculate lower quartile.

13. Write a program to calculate upper quartile.

14. Write a program to calculate different deciles.

15. Write a program to calculate different percentiles.

16. Write a program to calculate mode for discrete distribution.

17. Write a program to calculate mode for continuous distribution.

18. Write a program to calculate harmonic and geometric means for any distribution.

19. Write a program to calculate probability using binomial distribution.

20. Write a program to calculate probability using Poisson distribution.

Practical Assignments based on M503 (MALP): 45 marks (Internal 9 marks)

1. Write a program to add two 8 bit numbers & store it in a memory location 8820h.

2. Write a program to copy a block of memory from one location 8820h to another location 8840h.

3. Write a program to perform the addition of two 16 bit numbers.

4. Write a program to add two numbers & store it in a register **e**.

5. Write a program to load two unsigned numbers in register b & c. Subtract b from c. If the result is in 2's complement, convert the result in absolute magnitude & display it.

6. Write a program to find the difference of two numbers & store the result in a memory location 8830h.

7. Write a program to find the larger / smaller of two given numbers.

8. Write a program to subtract two numbers and add it to a given memory location.

9. Write a program to perform x+y–5, where x and y are 16–bit numbers.

10. Write a program to find 2's complement of a number.

M601 AUTOMATA THEORY AND LANGUAGES

Full marks: 75   (Internal 15)

Finite Automata   Marks: 12

DFA, NFA, NFA with ε-moves. Equivalence of DFA and NFA. Reduction of the number of states in a finite automata.

Regular Languages and Regular Grammar   Marks: 12

Concept of languages and grammar. Regular expressions. Connection between regular expressions and regular languages. Regular grammars, Right and Left-Linear Grammars. Equivalence between Regular languages and Regular grammars.

Properties of Regular Languages   Marks: 8

Closure under simple set operations- union, intersection, concatenation, complementation and star-closure. Decision algorithms for emptiness, finiteness and infiniteness, equality. Proof of non-regularity using Pigeonhole principle and using pumping lemma for regular languages.

Context free languages   Marks: 12

Context-free grammars, leftmost and rightmost derivations, derivation trees. Parsing and Ambiguity in grammars and languages. Simplification of Context free Grammars- removing useless productions, empty-productions and unit-productions. Normal forms- Chomsky and Greibach normal forms.

Pushdown Automata   Marks: 8

Definition and language accepted (acceptance by empty stack and final state and their equivalence). Pushdown Automata and Context free languages. Deterministic PDA and Deterministic Context free Languages.

Properties of Context free Languages   Marks: 8

Pumping Lemma for CFL. Using Pumping Lemma to show certain languages not to be Context free. Closure properties of CFL – closure under union, concatenation and star-closure. and showing that CFLs are not closed under intersection and complementation. Decision algorithms for emptiness, finiteness and infiniteness.

Suggested Reading

1. An introduction to Formal Languages and Automata, Peter Linz, Narosa.
2. Introduction to Automata Theory, Languages and Computation, Hopcroft and Ullman, Addison Wesley.
3. K. L. P. Mishra, N. Chandrasekaran; Theory of Computer Science (Automata, Languages and Computation), P. H. I.
4. T. H. Cormen, C. E. Leiserson and R. L. Rivest, Introduction to Algorithms, Tata-Mcgraw Hill Publishers.

M602 WEB TECHNOLOGIES

Full marks: 75 (Internal 15)

Overview of the World Wide Web and the internet: Marks: 5

A brief history of TCP/IP and the Internet, Internet services-email, telnet, ftp , Internet components, the birth of web, web page, home page, web site, types of Internet connection- dial up, DSL, Broadband, VSAT, WiFi

Web Servers and Browsers: Marks: 5

Web browsers-Netscape navigator and IE, Web browser helper applications, Web servers, Web server architecture

Internet architecture: Marks: 5
IP addresses and its working, domain name system, URL

Inside the firewall: Marks: 8
Firewall, proxy server, overview of intranet security, web server security, username/password authentication. COM, DCOM, CORBA.

Linking database to the web   Marks: 7
JDBC, ODBC- CGI and ASP, Dynamic page creation and advantages

HTML editors and tools   Marks: 10
Basic HTML, HTML tags, creating list in HTML, hyperlinks, multimedia, HTML forms, tables in HTML, frames in HTML, image maps, style sheets in HTML. DHTML, XML-Introduction, Need for XML, Advantages, simple XML programs, DTD.

Java Script   Marks: 10
Client side Scripting languages, history of JavaScript, Java vs. Java Script, Creating interactive documents using JavaScript.

Using Visual Basic Script   Marks: 10
The benefits of VBScript, Interacting VBScript with HTML forms, VBScript variables and operators, VBScript flow of control statements, Server Side scripting languages Introduction.

Suggested Readings:

1. The Internet –Complete M.L Young ; Tata McGraw Hill
2. Using CGI by J.Dwight , M.Erwin, R. Niles: Prentice Hill
3. Mastering JavaScript and Jscript by J.Jaworski ;BPB Publication
4. Dynamic HTML –the definitive references by D.Godman: Shroff Publishers
5. Understanding XHTML by D.P Nagpal: Wheeler Publishing.

M603 SYSTEM ADMINISTRATION USING LINUX

Full marks: 75 (Internal 15)

Unit I :   **Marks:12**
What is System Administration? Duties of a System Administrator. Basic features of the Linux operating system. Installation requirements,Partioning the Hard drive in Linux,Installing the Linux syatem, installing and configuring softwares in linux,Linux kernel program, system Startup and Shutdown. Standard I/O,Standard error,redirection and piping.

Unit II :   **Marks: 12**
Basics of Linux file system: hierarchy and types. absolute and relative path names.Basic commands for files and directories- ls,cp,mv,rm,mkdir,rmdir,more,creating and viewing files, mounting and unmounting file systems and partitions. Structure of /etc/fstab file and its purpose. I-node, directories, hard link, symbolic link. setting user and group ownership of files and access permissions, study of different linux shells (sh, bash, csh, zsh). Environment variable. Bash variables, login vs non-login shells. Shell script basics. Introduction to grep, awk, perl

Unit III :   **Marks: 12**
Basic commands for starting and stopping processes, basic process attributes and their role in access control. Examining the list of running processes on the system and understand the data presented there. Background process,Sending signals to processes and modifying process priorities. Job control. Crontab file format, Backup and Restore procedure, configuring the print queue, selecting the printer driver, editing the printer configuration, deleting printer setting default printer.

Unit IV :   **Marks: 12**
Managing user accounts: Adding a user,password,Creating Groups,adding and deleting groups,viewing user account information,understanding the 'root' account, implementing sudo. What is file ownership and access permission,,System monitoring and logging,Monotoring memory usage, disk space usage and I/O activity. Logging and its necessity, Customizing ststem Log information.

Unit V: **Marks: 12**
The rules governing IP address classes and netmasks, Network Address,Netmask and Gateway.configuring Interface with ifconfig,adding routes, ping,netstat,traceroute,telnet,Understanding the significance of the /etc/services file and well known port numbers. Basics of configuring NFS, NIS, DNS, FTP, Squid Proxy,DHCP server,iptables and firewall.Basic Network Security Issues.

Suggested Readings
1.Red Hat Linux:Proffitt:PHI

2.Introduction to system Administration:IBM series:PHI

3.Essential System Administration:Frisch:O'REILLY

M604 PRACTICAL

Total Marks: 75 (Internal 15)

Practical Assignments based on M602 : 40 marks (Internal 8 marks)

<u>HTML</u>

(At least 17 assignments has to be done from this group)

1. Create a HTML document consisting of HTML heading, paragraphs and images.

2. Create a HTML document and insert comments in the HTML source code and insert horizontal lines.

3. Construct HTML document to set the font of a text , size of the font, style of the font.

4. Create a HTML document to show how to create hyperlinks.

5. Create a HTML document to use an image as a link.

6. Create a HTML document to open link in a new browser window.

7. Create a HTML document to jump to another part of a document (on the same page).

8. Create a HTML document to insert images from another folder or another server.

9. Create an image-map, with clickable regions.

10. Create a HTML document with all table elements (Table, Caption, Table Row, Table Data element, Table Heading Element, THEAD, TFOOT, TBODY)

11. Create HTML document to make an unordered list, an ordered list, different types of ordered lists, different types of unordered lists, Nested list, Definition list.

12. Create HTML form with the all FORM elements (text fields, password field, Checkboxes, Radio buttons, Select elements, Drop-down list with a pre-selected value, Textarea (a multi-line text input field) and buttons.

13. Create HTML document with all Frame elements (FRAMESET, FRAME, NOFRAMES, and INLINE FRAME).

14. Create a HTML document to add AUDIO and VIDEO.
15. Create a HTML document to aligning images
   (Let the image float to the left/right of a paragraph)

16. Create a HTML document to jump to a specified section within a frame

17. Construct a HTML document with CSS to Set the background colour of a page.
18. Construct a HTML document with CSS to set an image as the background of a page
19. Construct HTML document with CSS to Set the text color of different elements and align the text.

20. Construct HTML document to set different colours to visited/unvisited links, Specify a background colour for links

XML

21.Construct an XML document that contain information about products of an organization.
22. Construct an XML document that contain information of 5 students (such as roll no., name , address, class).
23.Construct an XML document that contain details of 10 books.

JAVAScript

(At least 10 assignments has to be done from this group)

24. Write a program in javasrcript to accept a name from the user and display the same name in an alert box.
25. Write a program in javasrcript to display a message in a confirm box.
26. Write a program in javasrcript to display the message 'time is running out' in the status bar.
27. Write a program in JavaScript to enter marks of a student and find his/her grade according to the following:
      if marks>=90 then grade A
      if marks>=80 then grade B
      if marks>=70 then grade C
      if marks>=60 then grade D
     else fail.
28. Write a program in JavaScript to create a button and when the button is clicked the message 'Hello World' is displayed on an alert box..
29. Write a program in JavaScript to accept 2 nos from the user and show the working of all arithmetic operators.
30. Write a program in JavaScript to accept 2 strings and concatenate them.
31. Write a program in JavaScript to display the current date and time.
32. Write a program in JavaScript to find the length of an array.
33. Write a program in JavaScript to check whether a string is palindrome or not.
34. Write a program in JavaScript that responds to a mouse click anywhere on the page (using mouse click).
35. Write a program in JavaScript to display the contents of a check box in a alert box.

36. Write a program to validate a form in the user id and password forms.

37. Write a program in JavaScript to crate a welcome cookie, Button animation, Image map with added JavaScript
Simple timing, Timing event in an infinite loop

VBScript

(At least 6 assignments has to be done from this group)

38. Write a program in VBScript to create a variable.
39. Write a program in VBScript to uppercase to lowercase.
40. Write a program in VBScript to Create an array
41. Write a program in VBScript using conditional statements loop
42. Write a program in VBScript using loop.
43. Write a program in VBScript to display Date and Time
44. Write a program in VBScript to display the current month and day.

ASP

45. Write a program in ASP to interact with a user in a form that uses the "get" method.
46. Write a program in ASP to interact with a user in a form that uses the "post" method.
47. Write a program in ASP to interact with a user in a form with radio buttons.
48. Write a program in ASP to create a welcome cookie.

Practical Assignments based on M603 : 35 marks (Internal 7 marks)

Each student should do at least 12 assignments from the following list.

1. Develop an application with a form and two buttons such that on clicking the button "Enlarge' a bigger circle will be displayed on the form and on clicking the button 'Shrink' a smaller circle will be displayed on the same form.

2. Develop an interactive Interest calculator application that takes Principal amount (P), Rate of Interest (R), and Number of years (N) through textbox input and displays Simple Interest, Compound Interest and Difference between Simple and Compound Interest.

3. Create a digital calendar to display date in the format DD::MM::YYYY and time in the 12-hour format HH:MM:SS AM/PM.

4. Develop an application using pop-up menus where there will be five menus with each menu item having two sub-menus, and on clicking each sub-menu item a different form will be displayed.

5. Develop a simple audio player application.

6. Develop a simple video player application.

7. Develop an application showing the use of a slider such that integers 1,2,---10 will be displayed as the slider is moved.

8. Develop a simple text editor application.

9. Develop an application showing the use of all possible GUI components (textbox, list, drop-down menu, radio, etc.) for new bank account creation, and on submit display the entered data.

10. Develop the Tic-Tac-Toe game in GUI environment.

11. develop an application showing five different animations in five separate forms on the statement "Welcome to GUI Programming".

12. Develop an application using database connectivity (any convenient DBMS) to store and display complete student information of the department.

13. Develop an application using database connectivity (any convenient DBMS) to store and display complete book information for the departmental library.

14. Develop an application using database connectivity (any convenient DBMS) to store and display complete member information for a club.

15. Develop an application using database connectivity (any convenient DBMS) to manage and display complete accounts for the Freshmen Welcome Meet.

M605 PROJECT

Total Marks: 150 (Internal 30)

Each student will be assigned some project work at the starting of the sixth semester. The objective of the project is to train the student to independently search, identify and study real-life important topics in CS/IT; to develop skills among students in a particular field of CS/IT; and to expose students to the world of technology, innovation, and research. Each student (or group of at most 2 students) is expected to take a unique problem under the guidance/supervision of a faculty member of the department. The problem should be such that the students get a chance to explore one or two technologies in depth and grab good command over those technologies after successful completion of the project. Repetition of the problems already attempted by students of the previous years should not be encouraged unless the problem has exceptionally great research importance and scope. Application problems, if found interesting and arisen at the demand of a particular situation, may also be assigned; but typical information management systems with just two or three simple database tables and/or data-entry forms are to be discouraged. The project may be done in other Institutes/Organizations with prior permission from the concerned department of the College and in this case also one project supervisor should have to be from the concerned department in the College. The work will have to be submitted in the form of a dissertation. Project presentation and evaluation will have to be done as per the regulation of TDC for semester system of G.U. with choice based credit and grading system.

BACHELOR OF BUSINESS ADMINISTRARION (BBA) SYLLABUS
GAUHATI UNIVERSITY

First Semester:
1.1 Elective English and Business Communication
1.2 Business Economics
1.3 Business Mathematics
1.4 Principles of Management
1.5 Computer Fundamentals (MS Office)

Second Semester:
2.1 Personality and Personal Skill Development
2.2 Indian Economic Scenario
2.3 Business Statistics
2.4 Financial Accounting
2.5 Computer Application

Third Semester:
3.1 Organisation Behaviour
3.2 Marketing Management
3.3 Cost and Management Accounting
3.4 Production and Operational Management
3.5 Office Organisation and Management

Fourth Semester:
4.1 Human Resource Management
4.2 Marketing Research
4.3 Financial Management
4.4 Management of Services
4.5 Business Laws

Fifth Semester:
5.1 Summer Project
5.2 Industrial Relation
5.3 Advertising and Sales Promotion
5.4 Working Capital Management
5.5 Consumer Behaviour and Retailing

Sixth Semester:
6.1 Sales and Distribution Management
6.2 Taxation Laws
6.3 Rural Marketing
6.4 Export Marketing
6.5 Entrepreneurship and Small Business Management

DEPARTMENT OF BOTANY

GAUHATI UNIVERSITY

B. Sc. Programme

Effective from Academic Session 2013-2014

BOTANY MAJOR COURSE
DEPARTMENT OF BOTANY
GAUHATI UNIVERSITY

B.Sc. Syllabus under Semester System

Course Structure

Semester(s)	Course(s)	No. of Papers		Total Marks	Number of Classes/ week	Credits
First Semester	Major (Botany)	Theory:	02	150	6/ Paper	6/ Paper
		Practical:	01	50	4	4
	Subsidiary Papers	Theory:	02	150	6/ Paper	6/ Paper
		Practical: Nil				
	English	Theory:	01	50	4	4
Second Semester	Major (Botany)	Theory:	02	150	6/ Paper	6/ Paper
		Practical:	01	50	4	4
	Subsidiary Papers	Theory:	02	150	6/ Paper	6/ Paper
		Practical: Nil				
	English	Theory:	01	50	4	4
Third Semester	Major (Botany)	Theory:	02	150	6/ Paper	6/ Paper
		Practical:	01	50	4	4
	Subsidiary Papers	Theory:	02	100	4/ Paper	4/ Paper
		Practical:	02	100	4/ Paper	4/ Paper
	Environmental Studies	Theory:	01	50	4	4
Fourth Semester	Major (Botany)	Theory:	02	150	6/ Paper	6/ Paper
		Practical:	01	50	4	4
	Subsidiary Papers	Theory:	02	100	4/ Paper	4/ Paper
		Practical:	02	100	4/ Paper	4/ Paper
	Environmental Studies	Theory:	01	50	4	4
Fifth Semester	Major (Botany)	Theory:	04	300	6/ Paper	6/ Paper
		Practical:	02	150	6/ Paper	6/ Paper
Sixth Semester	Major (Botany)	Theory:	04	300	6/ Paper	6/ Paper
		Practical:	02	150	6/ Paper	6/ Paper

Summary of the Course Structure

Sl. No.	Courses		Total no. of papers	Total Marks	Total Classes/ week	Total Credits
01	Major (Botany) Semester (s): $1^{st}+2^{nd}+3^{rd}+4^{th}+5^{th}+6^{th}$		Theory: 16	1200	96	96
			Practical:08	500	48	48
02	Subsidiary Papers Semester (s): $1^{st}+2^{nd}+3^{rd}$		Theory: 08	500	32	32
			Practical:04	200	16	16
03	English		Papers: 02	100	08	08
04	Environmental Studies		Papers: 02	100	08	08
05	Total	Major	24	1700	144	144
		Subs	12	700	48	48
		Eng	02	100	08	08
		Env. Sc.	02	100	08	08
06	**Grand Total**	**Total No. of Courses:04**	**40**	**2600**	**208**	**208**

FIRST SEMESTER
Allotment of Marks and Credits

Paper(s)	Course work	Internal Assessment	Total	Credit	Class/week
M 101 (Theory)	60	15	75	6	6
M 102 (Theory)	60	15	75	6	6
M 103 (Practical)	40	10	50	4	4
Total	**160**	**40**	**200**	**16**	**16**

Examination Time: Theory……….3 (Three Hours)
Practical………4 (Four Hours)

Course Content
Paper: M 101 (Theory)
(Plant Kingdom, Algae and Fungi)

A. Plant Kingdom: 10

UNIT I: Classification of plant kingdom and criteria, diversity, form, life span, nutrition and ecological status

B. Algae: 30

UNIT II: General characteristics, classification, morphology, reproduction, phylogeny and economic importance of Algae

UNIT III: Life history of Chlorophyceae (*Volvox, Coleochaete, Chara*), Xanthophyceae (*Vaucheria)*, Cyanophyceae (*Anabaena, Nostoc*)

UNIT IV: Bacillariophyceae (General account), Phaeophyceae (*Ectocarpus, Fucus*), Rhodophyceae (*Polysiphonia*)

C. Fungi: 20

UNIT V: General characters, cell structure, nutrition, reproduction and sexuality; Economic importance of Fungi

UNIT VI: Classification, phylogeny and life history of main classes of fungi with special reference to the types as mentioned; Phycomycetes (*Phytophthora, Mucor*); Ascomycetes (*Saccharomyces, Penicillium*); Basidiomycetes (*Puccinia, Agaricus*); Deuteromycetes (*Cercospora, Colletotrichum*)

Course Content
Paper: M 102 (Theory)
(Bryophytes and Pteridophytes)

Bryophytes: **30**

UNIT I: Classification and general account of structure, morphology, anatomy and Phylogenetic relationship among Hepaticopsida with reference to *Riccia* and *Marchantia*.

UNIT II: Classification and general account of structure, morphology, anatomy and Phylogenetic relationship among Anthocerotopsida with reference to *Anthoceros*.

UNIT III: Classification and general account of structure, morphology, anatomy and Phylogenetic relationship among Bryopsida with reference to *Sphagnum* and *Polytrichum*. Economic importance of Bryophytes

Pteridophytes: **30**

UNIT IV: Classification, comparative study of morphology, anatomy, reproduction, stellar diversity, heterospory and seed habit with reference to Psilopsida (*Psilotum*).

UNIT V: Classification, comparative study of morphology, anatomy, reproduction, stellar diversity, heterospory and seed habit with reference to Lycopsida (*Lycopodium, Selaginella*).

UNIT VI: Classification, comparative account of morphology, anatomy, reproduction, stellar diversity, heterospory and seed habit with reference to Sphenopsida (*Equisetum*) and Pteropsida (*Adiantum and Marsilea*)

Course Content
Paper: M 103 (Practical)

(Division of marks: Algae-6, Fungi-6, Bryophytes-6, Pteridophytes-6, Techniques-2, Field records etc. 8 & *Viva-voce* -6=40)

Study of eukaryotic organisms (Algae and Fungi) through permanent preparation (mounting and staining)

I. Study of morphology and reproductive structures of the following types:

1) Algae: *Volvox, Chara, Ectocarpus, Fucus, Polysiphonia, Anabaena*
2) Fungi: *Phytophthora, Mucor, Penicillium, Puccinia, Agaricus, Colletotrichum*
3) Bryophytes: *Riccia, Marchantia, Anthoceros, Polytrichum, Sphagnum*
4) Pteridophytes: *Lycopodium, Selaginella, Equisetum, Adiantum, Marsilea*

II. Techniques of permanent preparation of types studied (slides) and herbarium
III: Field studies, submission of field reports and collections
IV. *Viva-voce*

SECOND SEMESTER
Allotment of Marks and Credits

Paper(s)	Course work	Internal Assessment	Total	Credit	Class/ week
M 101 (Theory)	60	15	75	6	6
M 102 (Theory)	60	15	75	6	6
M 103 (Practical)	40	10	50	4	4
Total	**160**	**40**	**200**	**16**	**16**

Examination Time: Theory ….…..3 (Three Hours)
                             Practical………4 (Four Hours)

Course Content
Paper: M 201 (Theory)
(Gymnosperms, Paleobotany and Plant Anatomy)

Gymnosperms: **20 Marks**

UNIT I: Classification, evolutionary significance and salient features and significance of gymnosperms.

UNIT II: Comparative study of morphology, anatomy and reproduction of Cycadales (*Cycas*), Coniferales (*Pinus, Cryptomeria, Thuja*), Ginkgoales (*Ginkgo*) and Gnetales (*Gnetum*)

Paleobotany: **20 Marks**

UNIT III: General account, anatomy and reproduction of Psilophyta (*Rhynia*), Lepidodendrales (*Lepidodendron*) and Sphenophyllaes (*Sphenophyllum*)

UNIT IV: Process of fossilization. General account, anatomy and reproduction of Cycadofilicales (*Lyginopteris*), Bennettitales(*Williamsonia*) and Cordaitales (*Cordaites*)

Plant anatomy: **20 Marks**

UNIT V: Cell wall and cell membrane: Origin, ultra structure, chemical constituents and function of Cell wall and cell membrane, Models of cell membrane and organization

UNIT VI: Tissues and their classification: Theories of structural development and differentiation of roots and shoots, different tissue systems and their functions, Anatomy of primary monocot and dicot roots, secondary growth of stems and roots.

Course Content
Paper: M 202 (Theory)
(Cell Biology)

UNIT I: Introduction to cell biology: Introduction to cell, membrane structure and function, membrane pump, membrane carrier, membrane channels, membrane physiology

UNIT II: Chromatin, chromosome and cell nucleus, Chemical and physical structure of chromosome, Nuclear structure and dynamism, special types of chromosome and their significance.

UNIT III: Cellular organelles and membrane trafficking, post translational targeting of protein, mitochondria, peroxisomes, endoplasmic reticulum, secretary membrane system and golgi apparatus, endocytosis and endosomal membrane system

UNIT IV: Signaling mechanism, signal transduction and signal protein

UNIT V: Cell cycle: G phase and regulation of cell proliferation, S-phase, G2-phase mitosis and cytokinesis, meiosis

UNIT VI: Structure and function of **DNA** and RNA

Course Content
Paper: M 203 (Practical)

(Division of marks: Gymnosperm-6, Paleobotany-6, Plant Anatomy-8, Cell Biology-6, Field records etc. 8 & *Viva-voce* -6=40)

1. Gymnosperm: *Cycas, Pinus, Cryptomeria, Gnetum, Thuja*
2. Paleobotany: Specimen and slides studies in theory paper
3. Plant Anatomy: Study of gross anatomical details of cells, tissues and various other organs of plants
4. Study of anomalous structure: Primary and secondary growth in stems covered under theory syllabus
5. Study of various stages of mitosis and meiosis using appropriate stain and plant materials

THIRD SEMESTER

Allotment of Marks and Credits

Paper(s)	Course work	Internal Assessment	Total	Credit	Class/week
M 301 (Theory)	60	15	75	6	6
M 302 (Theory)	60	15	75	6	6
M 303 (Practical)	40	10	50	4	4
Total	**160**	**40**	**200**	**16**	**16**

Examination Time: Theory ……....3 (Three Hours)
                            Practical………4 (Four Hours)

Course Content
Paper: M 301 (Theory)
(Ecology, Plant Geography, Evolution)

Ecology: **Marks: 40**

UNIT I: Introduction, Ecosystem structure (abiotic and biotic components), Plant adaptations in response to water, temperature and light.

UNIT II: Population ecology: Population characteristics; Ecotypes; Ecads. Community ecology: Community characteristics; Frequency; Density; Cover; IVI; Life forms, Biological spectrum and its significance.

UNIT III: Ecosystem ecology: food chain, food web, ecological pyramids; Ecosystem function (Energy flow, Biochemical cycles), Ecosystem services, Ecosystem resilience; Ecological succession: Types and pattern.

UNIT IV: Environmental pollution: Water pollution: Sources and kinds, impact of pollution on aquatic ecosystem, eutrophication of water bodies; Air pollution: sources and kinds, impact on plants, acid rain; Soil pollution: Sources and kinds, impact on plants and ecosystems.

Plant Geography: **Marks: 10**

UNIT V: Phytogeographical regions of India; Factors regulating distribution of plants, endemism, isolation and speciation; Vegetation of India with special reference to North Eastern Regions; Major biomes of the world.

Evolution: **Marks: 10**

UNIT VI: Evidences, theories and mechanism of evolution; Origin of new species. Gene pool; Genetic drift; Changes in gene frequencies in population

Course Content
Paper: M 302 (Theory)
(Instrumentation and Laboratory Techniques)

Instrumentation: **Marks: 30**

UNIT I: Microscopy: Working principles of Electron, Phase contrast and fluorescence microscopy; Image documentation: Camera lucida- principle, types; microphotography, digital imaging-advantages of digital camera and digitization.

UNIT II: Types and techniques of micro technique, Principles and applications of hot air oven, incubators, autoclave, laminar air flow chamber, centrifuge, lux meter, pH meter

UNIT III: Chromatography: Introduction, definition, concept of partition coefficient, Paper chromatography- principle, method, advantages; TLC and column chromatography: principle, method, advantages and disadvantages; Spectroscopy: principle, Beer and Lambert's law, mechanics of measurement; Spectrophotometer- working principle and applications.

Laboratory Techniques: **Marks: 30**

UNIT IV: Fixatives and stains: principles, types, procedures and applications; Methods of sterilization and culture media; Mounting media

UNIT V: Field and herbarium techniques, preservation of museum and herbarium specimens, preservation techniques for special types of plants (submerged aquatic plants, succulent and xerophytes, palm, canes and bamboos)

UNIT VI: Preparation of normal, molal, molar, ppm and percent solutions; Somogyi's reagent, Biuret reagent, Nessler's reagent, different indicators

Course Content
Paper: M 303 (Practical)
Ecology, Laboratory Instrumentation and Laboratory techniques

(Division of marks: Ecology-14, Instrumentation-6, Laboratory Techniques-6, Field records etc. 8 & *Viva-voce* -6=40)

Ecology:

1. Determination of abundance and frequency of species by quadrate method.
2. To measure the dissolved oxygen content in polluted and unpolluted water samples.
3. Study of anatomical peculiarities with reference to ecological adaptations (xerophytes and hydrophytes; at least 3 plant samples for each type)
4. Soil testing for the presence of Phosphorus, Potassium, Nitrate.

Instrumentation and Laboratory Techniques:

1. Image documentation of suitable botanical microscopic preparation by using camera lucida.
2. Microtomy- Preparation and processing of suitable material up to block preparation, Sectioning, staining and mounting and permanent slides preparation.
3. Demonstrations- TLC chromatogram.
4. Demonstration of different types of instruments as per theory syllabus mentioning their principles, functions and uses.
5. Preparation of different stains, solutions and reagents as per theory paper.
6. Submission of field report, permanent slides and practical records.

FOURTH SEMESTER
Allotment of Marks and Credits

Paper (s)	Course work	Internal Assessment	Total	Credits	Classes/ week
M 401 (Theory)	60	15	75	6	6
M 402 (Theory)	60	15	75	6	6
M 403 (Practical)	40	10	50	4	4
Total	**160**	**40**	**200**	**16**	**16**

Examination Time: Theory ……..…3 (Three Hours)
                   Practical………4 (Four Hours)

Course Content
Paper: M 401 (Theory)
(Morphology, Palynology, Embryology of Angiosperms)

Morphology: **Marks: 20**

UNIT I: Origin and evolution of Angiosperms; Inflorescence and flowers. Morphology of stamens and carpel

UNIT II: Telome theory, Phyllode theory, Carpel polymorphism, Inferior ovary. Role of morphology in plant classification.

Palynology: **Marks: 10**

UNIT III: Aspects and prospects of Palynology, historical perspective, pollen morphology, methods of studying pollen, pollen production and sterility

Embryology of Angiosperms: **Marks: 30**

UNIT IV: Basics of embryology, microsporogenesis and megasporogenesis, development of male and female gametophytes, Types of embryosacs and evolutionary significance

UNIT V: Fertilization, embryo development, polyembryony, apomixes, endosperm development, types, hautorial structure, experimental embryology: role in crop improvement

Course Content
Paper: M 402 (Theory)
(Plant Taxonomy)

UNIT I: Objectives, Principles and Evolutionary Trends in Taxonomy,

UNIT II: History of plant classification; Concept of species, genus and family, Concept of classificatory systems i.e. Artificial, natural, Phylogenetic, phenetic, cladistic, and APG; Detail study of Bentham and Hooker, and Takhtajan system of classifications.

UNIT III: Principles and rules of binomial nomenclature; ICBN- Historical developments, rules and recommendations; rules of priority and its limitations, type concepts and its applications; concept of biocode

UNIT IV: Modern Trend in Plant Taxonomy and classification; Role of anatomy,embryology, palynology in plant classification, Numerical Taxonomy, Chemotaxonomy, Cytotaxonomy, and Serotaxonomy

UNIT V: Affinities, phylogeny, economic importance and comparative studies of the following families: Magnoliaceae, Ranunculaceae, Fabaceae, Mimosaceae, Caesalpinaceae, Malvaceae, Apiaceae, Euphorbiaceae, Solanaceae, Verbenaceae, Lamiaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Asteraceae.

UNIT VI: Affinities, phylogeny, economic importance and comparative studies of the following families: Arecaceae, Poaceae, Musaceae, Zingiberaceae, Liliaceae, Orchidaceae

Course Content
Paper: M 403 (Practical)
(Morphology, Palynology, Embryology, Plant Taxonomy)

(Division of marks: Morphology-5, Palynology-5, Embyology-5, Plant Taxonomy-11, Field records etc. 8 & *Viva-voce* -6=40)

Morphology:

1. Study of special types of inflorescences – Cyathium, Hypanthodium, Verticillaster, Hypanthium

2. Study of special types of Fruits – Spurious fruits (Dillenia); Aggregate fruits (Custard apple, Michelia, Periwinkles, Polyalthia); Multiple fruits (Pine apple, Jack fruit).

Palynology:

1. Study the morphological nature of pollen grains by permanent preparation of pollen slides from the plant materials available in the locality.

Embryology:

Study from permanent preparation of slides
1. T.S. of young Anther; T.S. of mature Anther.
2. Male gametophyte
3. L.S. of different types of Ovules.
4. L.S. of ovule showing different nuclear stages of embryo sac.
5. L.S. of ovule showing types of Endosperm
6. L.S. of Embryo – Dicotyledonous, Monocotyledonous

Plant Taxonomy:

1. Description of specimen from members of locally available Dicotyledonous and Monocotyledonous families included in the theory.
2. Description of specimens with preparation of keys up to generic level of locally available plants.
3. Submission of at least 20 numbers of herbarium of plant materials as per theory syllabus and palynology slides.

Field trips:

1. Study of vegetation, local and different localities in the country through Academic excursions.

FIFTH SEMESTER

Allotment of Marks and Credit

Paper	Course work	Internal Assessment	Total	Credit	Class /week
M 501 (Theory)	60	15	75	6	6
M 502 (Theory)	60	15	75	6	6
M 503(Theory)	60	15	75	6	6
M 504 (Theory)	60	15	75	6	6
M 505 (Practical)	60	15	75	6	6
M 506 (Practical)	60	15	75	6	6
Total	**360**	**90**	**450**	**36**	**36**

Examination Time: Theory ……..…3 (Three Hours)
Practical………4 (Four Hours)

Course Content
Paper: M 501 (Theory)
(Microbiology and Immunology)

UNIT I: General Microbiology: History and development, scope of Microbiology, introduction to microbial world, microbial taxonomy and its modern trends

UNIT II: Microbial nutrition, growth and metabolism, microbiology of soil, air and water, role of microorganisms in biogeochemical cycles (N, C, S cycles) in nature, biological nitrogen fixation

UNIT III: Distinguishing features of Actinomycetes, Archaebacteria and Mycoplasma

UNIT IV: General account; Classification of Bacteria, Modern concept of Bacterial cell, Reproduction and Growth of Bacteria- genetic recombination; General account of Rickettsiae, Chlamydeae and diseases caused by them

UNIT V: General characteristics; Classification of viruses, Nature of Viruses, Viroids, Virusoides, Prions, Replication of viruses – Lytic Cycle and Lysogenic Cycle (Bacteriophage), Transmission of viruses

UNIT VI: Concept of immunology, types of immunity, cell mediated and humoral immunity, primary and secondary immune responses, antigen and antibody- structure and classes

Course Content
Paper: M 502(Theory)
(Plant Pathology and Lichen)

Plant Pathology: **Marks: 50**

UNIT I: General account and historical development; Common symptoms of plant disease; Types of plant diseases according to major causal agents; Disease resistance; Physiology of parasitism; Host-parasite interaction.

UNIT II: Concept of disease cycle, mechanism of disease development, dissemination and transmission of plant pathogens, Epidemiology and Disease forecasting

UNIT III: Defense mechanism: concept and definition; structural, chemical and biochemical mechanisms

UNIT IV: Study of following diseases with reference to causal organisms, symptoms, disease cycle and control measures:

Late blight of potato, Rust of wheat, Grey blight of tea, White rust of crucifers, Powdery mildew of pea, Leaf spot disease of cabbage, Citrus canker, Yellow mosaic of bhindi, , papaya and Tobacco mosaic virus (TMV) disease

UNIT V: Plant disease management- chemical control, biological control and development of transgenic for controlling plant diseases

Lichen: **Marks: 10**

UNIT VI: Lichens: General account, classification, structure and reproduction

Course Content
Paper: M 503 (Theory)
(Cytogenetics, Plant Breeding and Biometrics)

Cytogenetics: **Marks: 30**

UNIT I: Principles of inheritance- Mendel's Laws, deviations to Mendel's law- Incomplete dominance, Co-dominance, Quantitative and polymeric gene interaction, sex linked inheritance, Non-mendelian inheritance, extra chromosomal inheritance

UNIT II: Structural and numerical changes of chromosome: Structural changes- Chromosomal aberrations and evolutionary significance; Numerical changes- Euploidy (Polyploidy) and evolutionary significance

UNIT III: Linkage and crossing over, recombination and cytological basis of crossing over, linkage map

Plant Breeding: **Marks: 20**

UNIT IV: Principles of plant breeding-Introduction, selection, hybridization and back cross method

UNIT V: Heterosis and inbreeding depression- genetic basis; male sterility

Biometrics: **Marks: 10**

UNIT VI: Mean, mode, median, standard deviation, t-test, chi-square test, measurement of gene frequency, Hardy-Weinberg equilibrium

Course Content
Paper: M 504 (Theory)
(Applied Botany)

UNIT I: Algae as food, feed, medicine and commercial products, role of algae in soil fertility

UNIT II: Fungi- Role of fungi in agriculture, fungi as food, medicine and commercial products (Antibiotics, alcohols), mycotoxins and mycotoxicosis, Lichens as indicator plants, mycorrhiza and its role in plant development, Allergy and allergens

UNIT III: Bacteria- useful and harmful effects, role of bacteria in agriculture, medicine, bioremediation, serology

UNIT IV: Breeding for disease resistance, induced mutation and crop improvement, induction of polyploidy and crop evolution

UNIT V: Deforestation and its effect on environment, impact of climate change

UNIT VI: Application of plant growth regulators in agriculture, methods of plant propagation-grafting, layering and budding; bonsai, indoor gardening

Course Content
Paper: M 505 (Practical)
(Microbiology, Plant Pathology and Lichen)

(Division of marks: Microbiology-25, Plant Pathology-15, Lichens-4, Field records etc. 8 & *Viva-voce* -8=60)

Microbiology:

1. Gram staining of Bacteria
2. Preparation, Sterilization of culture media: Basic liquid media (Broth) for cultivation of bacteria; Basic solid media for routine cultivation of fungi.
3. Isolation of soil microorganisms by the serial dilution and agar plating method.

4. Isolation of microorganisms from air.
5. Isolation of fungal pathogens from diseased plant parts.
6. Pure culture technique: Streak-plate methods; Pour-plate method.
7. Counting of bacterial cells using haemocytometer

Plant pathology:

1. Isolation and culture of plant pathogen and establishment of Koch's postulates and their pathogenicity.
2. Study of plant diseases like Late blight of potato; Black rust of *Justicia* and wheat; Leaf spot disease of cabbage; Grey blight disease of tea; Citrus canker; Yellow mosaic disease of papaya and bhindi; Tobacco mosaic virus representing Fungal, Bacterial and Viral diseases studying their symptoms and by making permanent slides where ever possible.
3. Collection, identification and preparation of field notes on diseased specimen of any locality (at least 10 numbers).

Lichen:

1. Study the thallus morphology of Foliose; Crustose; Fruticose Lichens.

Course Content
Paper: M 506 (Practical)
(Cytogenetics, Plant Breeding, Biometrics and Applied Botany)

(Division of marks: Cytogenetics-15, Plant Breeding-15, Applied Botany-12, Field records etc. 10 & *Viva-voce* -8=60)

1. Karyotype study in onion, garlic and Aloe vera
2. Study of chromosomal aberration in *Tradescantia* / Rhoeo
3. Study of gene interaction
4. Study of emasculation process in any plant
5. To work out mean, mode, standard deviation and standard error
6. Isolation of *Rhizobium* from root nodules
7. Counting of pollen grains in honey samples
8. Submission of permanent slides (at least 5 numbers)
9. Submission of practical notebooks and collected specimens showing applied aspects

SIXTH SEMESTER
Allotment of Marks and Credit

Paper	Course work	Internal Assessment	Total	Credits	Class /week
M 601 (Theory)	60	15	75	6	6
M 602 (Theory)	60	15	75	6	6
M 603(Theory)	60	15	75	6	6
M 604 (Theory)	60	15	75	6	6
M 605 (Practical)	60	15	75	6	6
M 606 (Practical)	60	15	75	6	6
Total	**360**	**90**	**450**	**36**	**36**

Examination Time: Theory ……..…3 (Three Hours)
Practical………4 (Four Hours)

Course Content
Paper: M 601 (Theory)
(Molecular Biology and Plant Biochemistry)

Molecular Biology: **30 Marks**

UNIT I: Structure and organization of gene, expression and regulation of gene (Lac operon concept), Genetic code; properties and evidences

UNIT II: DNA replication, different forms of RNA and their roles, concept of exons and introns, Transcription and Translation in Prokayotes

UNIT III: Mutation: Point mutation-transition, transversion, frameshift mutation, molecular mechanism (tautomerization, alkylation, deamination, base analogues, dimerization)

Plant Biochemistry: **30 Marks**

UNIT IV: Nitrogen metabolism, Amino acid metabolism and protein synthesis

UNIT V: Enzymes- Classification and nomenclature of enzymes, Enzyme as biocatalyst, properties and function

UNIT VI: Carbohydrate metabolism - Structure of monosaccharides, disaccharides and polysaccharides

Course Content
Paper: M 602 (Theory)
(Bioinformatics, Computer Application and Biotechnology)

Bioinformatics: **Marks: 20**

UNIT I: Introduction to Bioinformatics, branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics, biological databases, classification format of databases, biological database retrieval system

UNIT II: Application of Bioinformatics: Basics of Molecular phylogeny, drug discovery and drug design, DNA data bank, genomics, proteomics and their application in crop improvement

Computer Applications: **Marks: 10**

UNIT III: Basics of computer, use of operating system (MS Office), Data representation, Internet browsing and searching of biological data using search engines

Biotechnology   **Marks: 30**

UNIT IV: History, scope and significance of biotechnology

UNIT V: Plant Tissue culture-different techniques, micropropagation, meristem culture, embryo culture, somatic embryogenesis, pollen culture and development of haploid plants, somaclonal variation, transgenic plants

UNIT VI: Plant genetic engineering, techniques and applications: (restriction enzymes, construction of DNA libraries, DNA fingerprinting, DNA sequencing), application in agriculture and medicines

Course Content
Paper: M 603 (Theory)
(Plant Physiology)

UNIT I: Plant-soil-water relationship: component and classification of soil, Soil to plant-water potential, osmotic potential, Movement of water within the plant body: absorption, transpiration and its significance, factors, mechanisms of transpiration, ascent of sap

UNIT II: Mineral nutrition and mineral salt absorption, criteria of essentiality of elements, micro and macro nutrients- specific functions and deficiency symptoms, mineral salt absorption

UNIT III: Photosynthesis: photolysis of water, cyclic and non-cyclic photophosphorylation, electron transport system, C3 cycle, photorespiration and glycolytic metabolism (C2 cycle), CAM pathway, C4 cycle, chemosynthesis

UNIT IV: Respiration: Aerobic respiration, Glycolysis (EMP, PPP) and TCA cycles and its regulation, anaerobic respiration mechanism and factors

UNIT V: Translocation of organic solutes: mechanism of translocation, diffusion, Munch hypothesis, source and sink relationships, phloem loading and unloading

UNIT VI: Growth and development: Phages of growth, growth regulation-physiological role and mechanism of action (Auxins, cytokinins, GA, ABA, ethylene); Physiology of flowering - photoperiodism and vernalization; seed dormancy-types and causes, methods of overcoming dormancy; senescence and aging; stress physiology-concept of biotic, abiotic and xenobiotic stresses.

Course Content
Paper: M 604 (Theory)
(Plant Resource Utilization)

UNIT I: Origin of Cultivated Plants: Concept of centers of origin; Plant introduction; Crop domestication; Classification of plant resources on the basis of their uses; Cereals: Rice, wheat and their role in green revolution; Leguminous plant resources: soybean, arhar dal, pea - their products and uses

UNIT II: Beverages: Tea, Coffee and cocoa - their sources, products and uses; Spices and condiments: Sources and uses of black pepper, cinnamon, clove, bay leaf, turmeric, zinger; Oil: Mustard, groundnut, castor and citronella

UNIT III: Fibers - Botany and uses of cotton, jute and ramie; Fruits - orange, pineapple, banana; Products and byproducts of sugar industry - Sugarcane, sugar beat

UNIT IV: Timber and non-timber plant resources: sal, gamari, teetasopa; Botany and uses of cane and bamboo, Para-rubber, herbal dye (henna, manjistha, bixa); Botany and uses of medicinal plants (*Holarhhena, Rauvolfia, Catharanthus, Taxus, Plumbago, Azadirachta, Andrographis*)

UNIT V: Pharmacognosy: Pharmacognosy and its importance in medicinal plant uses

UNIT VI: Ethnobotany- Definition, concept and scope; discipline and sub-disciplines of ethnobotany, importance of traditional knowledge in relation to plant uses and IPR (Intellectual Property Rights)

Course Content
Paper: M 605 (Practical)
(Molecular Biology, Biotechnology, Bioinformatics and Computer Application)
(Division of marks: Molecular Biology-14, Biotechnology-10, Bioinformatics-10, Computer Application-10, Field records etc. 8 & *Viva-voce* -8 = 60)

Molecular Biology:

1. Prepare the standard curve of protein and determine protein content in plant materials by Biuret method.
2. Separate and identify amino acids present in plant extract by (i) Paper Chromatography, (ii) Thin Layer chromatography.
3. Quantitative estimation of reducing sugar and total sugar by Somogyi's method.
4. Separate and identify chlorophyll pigments by Paper Chromatography.
5. Determine Titratable Acid Number (TAN) in Bryophyllum leaves.
6. Estimation of Total Nitrogen by Micro Kjeldahl method.

Biotechnology:

1. Preparation and sterilization of the medium, Slant preparation and Inoculation - MS medium.
2. Micro propagation of some important plants.
3. Study of Genetic engineering Techniques (photographs): FISH, DNA Fingerprinting, DNA Sequencing, Gene gun, Ti plasmid.
4. Study of steps of genetic engineering techniques from photographs (Bt cotton, Golden rice, Flavr Savr tomato)
5. Construction of Restriction Map from the data provided.
6. Aseptic seed germination - legume seed
7. Study of different bio fertilizers.
8. Homology Modeling through the BLAST (For Genes)

Bioinformatics:

1. Nucleic acid and protein databases.
2. Sequence retrieval from databases.
3. Sequence alignment.
4. Sequence homology and Gene annotation.
5. Construction of phylogenetic tree

Computer Application: As per theory syllabus

Course Content
Paper: M 606 (Practical)
(Plant Physiology and Plant Resource utilization)

(Division of marks: Plant Physiology-25, Plant Resource Utilization-20, Field records etc. - 7 & *Viva-voce* -8=60)

Plant Physiology:

1. Determine the osmotic potential of cell sap by plasmolytic method.
2. Determine the water potential of plant tissue.
3. Determine the stomatal index, stomatal frequency and estimate the transpiration rate of different types of leaves.
4. Study the effect of temperature on the rate of imbibitions and determine the Q_{10}.
5. Determine RQ of different plant materials (Seeds, Leaf buds, Flower buds).
6. Extract and separate chloroplast pigments by solvent method and Paper chromatography
7. Determine effect of CO_2 concentration on the rate of photosynthesis.

Plant Resource Utilization:

1. Chemical tests for tannins (Tea); Alkaloids (*Vinca rosea*)
2. Pharmacognosical studies of both crude and powdered drugs - Zinger, Holarrhena, Rauwolfia
3. Histochemical test for *Curcuma longa*, starch in non-lignified vessels (Zingiber); Alkaloid (*Andrographis*, Neem and *Plumbago*)

BOTANY GENERAL COURSE
GAUHATI UNIVERSITY
B.Sc. Syllabus under Semester System

Course Structure

Semester(s)	Course(s)	No. of Papers	Total Marks	No. of Classes/w	Credit (s)
1st	Botany General	01 (E101) Theory	75	6	6
2nd	Botany General	01 (E201) Theory	75	6	6
3rd	Botany General	02 E301-Theory E302-Practical	50+50 (100)	(4+4) 8	(4+4) 8
4th	Botany General	02 E401-Theory E402-Practical	50+50 (100)	(4+4) 8	(4+4) 8
5th	Botany General	02 E501-Theory E502-Practical	100+100 (200)	(8+8) 16	(8+8) 16
6th	Botany General	02 E601-Theory E602-Practical	100+100 (200)	(8+8) 16	(8+8) 16
Total Marks			**750**	**60**	**60**

FIRST SEMESTER
Allotment of Marks and Credits

Paper(s)	Course work	Internal Assessment	Total	Credit	Class/week
E 101 (Theory)	60	15	75	6	6
Total	**60**	**15**	**75**	**6**	**6**

Examination Time: Theory 3 (Three) Hours

COURSE CONTENT
Paper: E 101(Theory)
(Diversity of Microbes and Cryptogams)

UNIT I: Introductory Botany: Classification of plant kingdom, Importance of plant for human life and support system

UNIT II: Algae - General characters, classification, Life history and Economic importance of Cyanophyceae (*Anabaena*), Chlorophyceae (*Volvox, Oedogonium*), Phaeophyceae (*Ectocarpus*), Rhodophyceae (*Polysiphonia*)

UNIT III: Viruses, Bacteria, and Lichen - General account of viruses, Bacteriophages, Transmission of viruses; Classification of bacteria, Ultra structure of bacterial cell, reproduction and economic importance of bacteria; Lichen - General Account and economic importance

UNIT IV: Fungi and Plant Pathology- General Characters, cellular organizations, nutrition, reproduction, classification, and Economic importance; Life history of Phycomycetes (*Phytophthora, Mucor*); Ascomycetes (*Saccharomyces. Penicillium, Peziza*); Basidiomycetes (*Puccinia*); Deuteromycetes (*Helminthosporium*); Plant disease symptoms, disease cycle and control measures

UNIT V: Bryophytes - Morphology, structural organization, habit, reproduction, classification and life histories of the following: Hepaticopsida (*Marchantia*); Anthocerotopsida (*Anthoceros*) and Bryopsida (*Funaria*)

UNIT VI: Pteridophytes - Origin and evolutionary trends, classification, morphological and anatomical characteristics and life cycles of the following: Lycopsida (*Lycopodium, Selaginella*); Sphenopsida (*Equisetum*); Pteropsida (*Pteris*)

SECOND SEMESTER
Allotment of Marks and Credits

Paper(s)	Course work	Internal Assessment	Total	Credit	Class/week
E 201 (Theory)	60	15	75	6	6
Total	**60**	**15**	**75**	**6**	**6**

Examination Time: Theory   3 (Three) Hours

COURSE CONTENT
Paper: E 201(Theory)
(Cell Biology and Genetics)

UNIT I: Structure of prokaryotic and eukaryotic cell, ultra structure of nucleus, mitochondria, and chloroplast

UNIT II: Chromosome organization - morphology of chromosome, types of chromosome; structure and function of DNA and RNA and their replications

UNIT III: Cell division - Mitosis and meiosis and their significance

UNIT IV: Gene expressions - Structure of genes, protein synthesis, regulation of gene expression in prokaryotic and eukaryotic cell

UNIT V: Mendelian genetics - Laws of segregation and independent assortment, allelic and non-allelic interactions, incomplete dominance

UNIT VI: Linkage and crossing over and their significance; Changes in chromosome structure and number and their role in evolution, mutations- spontaneous and induced

THIRD SEMESTER
Allotment of Marks and Credits

Paper	Course work	Internal Assessment	Total	Credit	Class/week
E 301 (Theory)	40	10	50	4	4
E 302 (Practical)	40	10	50	4	4
Total	**80**	**20**	**100**	**8**	**8**

Examination Time: Theory: 3 Hours
                    Practical: 4 Hours

Course Content
Paper: E 301 (Theory)
(Diversity of Seed Plants and their Systematic)

UNIT I: Gymnosperms: Introduction, general characters, classification, Origin & Evolution of seed habit.

UNIT II: Morphology of vegetative and reproductive structures, anatomy of stem & leaf, and life cycle of the following types: *Cycas, Pinus, Gnetum*

UNIT III: Fossilization processes, General characteristics of Cycadofilicales, Bennettitales.

UNIT IV: Taxonomy of angiosperms: Introduction, Scope and objectives, Binomial Nomenclature, Taxanomic Ranks, General accounts of systems of classification – artificial, natural, phylogenetic. Salient features of classification systems with merits and demerits of Bentham and Hooker; Engler and Prantl.

UNIT V: Diversity of flowering Plants: Systematic position (Bentham & Hooker system) distribution, general characters, floral formula, floral diagram, distinguishing characters and economically important plants of the following families.
1. Magnoliaceae, 2. Malvaceae, 3. Papilionaceae, 4. Caesalpinaceae, 5. Mimosaceae, 6. Apiaceae, 7. Euphorbiaceae, 8. Lamiaceae, 9. Solanaceae, 10. Verbenaceae, 11. Asteraceae, 12. Poaceae, 13. Orchidaceae

Course Content
Paper: E 302 (Practical)
(Diversity of Microbes and Cryptogams, Cell Biology and Genetics, Diversity of Seed Plants and their Systematics)

(Division of Marks: Diversity of Microbes and Cryptogams: 10; Cell Biology and Genetics: 10; Diversity of Seed Plants and their Systematics:10; practical records etc. 5; *Viva –voce:*5)

1. Study of vegetative, reproductive bodies of genera included under Algae, Fungi (inclusive of plant diseases) of theory syllabus.
2. Study of morphology, anatomy and detailed reproductive structures of Bryophyta and Pterydophyta genera included under theory syllabus.
3. Gram staining of Bacteria.
4. Examination of stages of Mitotic and Meiotic cell divisions.
5. Gymnosperms: Study morphology and anatomy of leaf/stem, detailed reproductive structures of *Cycas, Pinus, Gnetum.*
6. Study of fossil specimens and slides.
7. Angiosperms: Description of specimen from representative of locally available plants belongs to the families included in theory syllabus.
8. Submission of Practical Note Books, Permanent slides.
9. Field work report

FOURTH SEMESTER
Allotment of Marks and Credits

Paper	Course work	Internal Assessment	Total	Credit	Class/ week
E 401 (Theory)	40	10	50	4	4
E 402 (Practical)	40	10	50	4	4
Total	**80**	**20**	**100**	**8**	**8**

Examination Time: Theory: 3 Hours
                       Practical: 4 Hours

Course Content
Paper: E 401 (Theory)
(Plant Physiology and Biochemistry)

UNIT I: **Plant water relations**: **Plant-water relations:** Different bio-physio-Chemical phenomenon: definition, phenomenon and Importance of permeability, diffusion, osmosis, Plasmolysis, imbibition, Absorption of water-Introduction, mechanism of water absorption (Active and passive theories), Ascent of sap: Definition, mechanism- (root pressure theory, capillarity, Imbibitional and transpiration pull theories), Transpiration: Definition, types, structure of stomata. Mechanism of opening and closing of stomata (Starch- sugar, K^+ (Potassium ion) pump theory)

UNIT II: **Mineral nutrition:** Essential macro and micro elements and their role in plants (deficiency, symptoms, disease and functions)**,** Translocation of organic solutes: Introduction, direction of translocation, Mechanism: Mass flow or munch hypothesis, protoplasmic streaming theory

UNIT III: **Plant metabolism:** Photosynthesis: introduction, Ultra structure of chloroplast, photosynthetic pigments, concepts of two Photo systems, Light phase: cyclic and non cyclic photophoshorylation (z- scheme)**,** Dark phase: calvin cycle (C3) Hatch and Slack cycle (C4) and crassulacean acid metabolism, significance of photosynthesis**,** Respiration: Intorduction, Types of respiration - Aerobic: Glycolysis, TCA cycle ETS (Oxidative phosphorylation) respiration

UNIT IV: **Growth and Development:** Growth and growth hormones: Phases of growth, factors affecting growth, Plant growth substances, hormones and their Practical applications; Seed dormancy: Introduction, methods of breaking Seed Dormancy, factors affecting seed dormancy; Physiology of flowering: Photoperiodism (LD/SD/DN plants) Vernalization and Devernalization; Plants movements: Classification of movements, Movements of curvature. Movements of variation (paratonic –nastic)

UNIT V: Biochemistry: Elementary biochemistry: Introduction, different organic constituents of the cell, Functions of carbohydrates (mono /oligo / polysaccharides) starch, Cellulose, Hemicellulose, proteins and nucleic acids,

lipid, alkaloids, gums, mucilage and organic acids; Nitrogen metabolism: Introduction, physical and biological nitrogen fixation, nitrogen in soil, ammonification and nitrification, denitrification; Enzymes: Introduction, nomenclature and classification, mechanism and mode of action. Concept of holoenzymes, apoenzymes, coenzymes and cofactors.

COURSE CONTENT
Paper: E 402 (Practical)
(Plant Physiology and Biochemistry)

1. Determine the osmotic potential of cell sap by plasmolytic method.

2. Determine the Diffusion Pressure Deficit (DPD) of plant cells.

3. Determine the effect of time period on the rate of imbibition in different types of seeds.

4. Determine the relation between absorption and transpiration.

5. Measure the effect of different environmental conditions on the rate of transpiration of a twig by Ganong's Potometer.

6. Determine the effect of CO_2 concentration on the rate of photosynthesis.

7. Determine RQ of different plant materials (Germinating seeds, Leaf buds, Flower buds).

8. Qualitative analysis of plant materials to prove the presence of Sucrose, Glucose, Proteins, Fats and Cellulose.

9. Qualitative analysis of Plant ash to prove the presence of Iron, Potassium, Calcium, Magnesium, Phosphorus.

FIFTH SEMESTER
Allotment of Marks and Credits

Paper	Course work	Internal Assessment	Total	Credits	Class/week
E 501 (Theory)	80	20	100	8	8
E 502 (Practical)	80	20	100	8	8
Total	**160**	**40**	**200**	**16**	**16**

Examination Time: Theory: 3 Hours
                   Practical: 4 Hours

COURSE CONTENT
Paper: E 501 (Theory)
(Structure, Development and Reproduction in Flowering Plants)

UNIT I: Basic body plan of flowering plant, modular type of growth, diversity in plant forms – annuals, biennials and perennials, Histological organization of root and shoot apices, various theories of cellular organization

UNIT II: Types of tissue: Meristematic tissue – meristem, structure and types based on origin and position, Permanent tissue: Simple, Complex and Secretary, Epidermal tissue: Trichomes and Stomata.

UNIT III: Anatomy: Primary structure of root, stem and leaf of Monocot and Dicot, Secondary growth in root and stem, Wood anatomy: Growth rings, heart wood and sap wood, Periderm: Origin, structure and functions, Floral biology

UNIT IV: Embryology: Microsporogenesis and development of male gametophyte, megasporogenesis and development of female gametophyte, Double fertilization and its significance.

UNIT V: Development of dicot embryo, Structure, development and types of endosperms, Fruit: Development and maturation of fruit, types and parts of fruits, fruit dispersal strategies, Vegetative propagation: Grafting, layering and budding.

UNIT VI: Seed: Types of seed, germination of seeds-types and nature and dispersal of seeds, factors affecting germination

COURSE CONTENT
Paper: E 502 (Practical)
(Structure, Development and Reproduction in Flowering Plants)

1. Study of non-living cell inclusion (ergastic maters): Starch grains, Aleurone grains, Raphides, Cystolith.

2. Study of types of stomata.

3. Study of epidermal hairs.

4. Study of secondary growth in thickness by permanent preparation of differentially stained slide: *Amaranthus, Boerhavia, Mirabilis, Bougainvillea, Dracaena, Tinospora*.

5. Study from permanent slide: T.S. through young and mature anther; Male gametophyte; L.S. of ovule showing different nuclear stages of embryo sac; L.S. of ovule showing types of Endosperm; L.S. of Embryo – Dicotyledonous, Monocotyledonous.

6. Study of spurious fruits, aggregate fruits, composite fruits (at least 2 types each).

7. Study the adaptation in fruits and seeds for dispersal through air (at least 4 types).

8. Demonstrate the process of: Budding; Air layering; Scion grafting.

9. Practical Records, Permanent slides to be submitted in the examination.

SIXTH SEMESTER
Allotment of Marks and Credits

Paper	Course work	Internal Assessment	Total	Credits	Class/week
E 601 (Theory)	80	20	100	8	8
E 602 (Practical)	80	20	100	8	8
Total	**160**	**40**	**200**	**16**	**16**

Examination Time: Theory: 3 Hours
Practical: 4 Hours

COURSE CONTENT
Paper: E 601 (Theory)
(Ecology and Utilization of Plants)

Ecology:

UNIT I: Introduction, concept, definition, Autecology and Synecology,   Ecosystem Ecology: Introduction, ecological organization – species population, community ecosystem and biosphere, Kinds of ecosystem, structure and function of ecosystem, abiotic components, biotic components and their role.

UNIT II: Ecological succession-Types and pattern, food chain, food web, ecological pyramid

UNIT III: Bio-geo-chemical cycles-concept, details of Nitrogen and carbon cycle, Composition and functioning of ecosystem: i) Simple – pond ecosystem, ii) Complex – forest ecosystem, iii) Artificial – crop land ecosystem.

UNIT IV: Ecological grouping of plants with reference to their significance of adaptive external and internal features: Hydrophytes and Xerophytes. Environmental pollution with special reference to Air and Water pollutions - causes, effects and control measures; Green house effect.

Utilization of Plants:

UNIT V: Classification of plants on the basis of Botanical sources and uses of Rice, Wheat, Maize,

UNIT VI: Sugar cane, Gram, Pea, Coffee and Tea, Black pepper, Turmeric, Clove, and mustard - Their uses and botanical sources

UNIT VII: Non timber plant products - Cotton, Jute, Rubber, Bamboo, and Jatropha. Their uses and botanical sources

UNIT VIII: Timber and medicinal plant resources: Teak, Sal, Rauvolfia, Neem, Cinchona- their uses and botanical sources

COURSE CONTENT
Paper: E 601 (Practical)
(Ecology and Utilization of Plants)

Ecology:
1. Determine the frequency and density of herbaceous species by quadrate method
2. Study the anatomical features of some common

    Hydrophytes: Root of Eichhornia, Petiole of Eichhornia, stem of Hydrilla, Petiole of Nymphaea.

    Xerophytes: Leaf of Nerium, Leaf of Thevetia, Leaf of Grass.

3. Test for the presence of inorganic salts in the soil: Chloride, Sulphate, Phosphate.

Utilization of Plants:

1. Study the morphology, parts used, chemical nature and uses of the following plants
    a) Cereals – Rice.

    b) Pulses and legumes – Pea.

    c) Beverages – Tea.

    d) Fibres – Cotton, Jute

    e) Fats and oils –Mustard.

    f) Spices – Black pepper, Turmeric.

    g) Medicinal – Rauvolfia, Neem.

    h) Fuel – Jatropha.

    i) Sugar-Sugar cane

BOTANY MAJOR
REFERENCES
FIRST SEMESTER
PAPER: M 101

PLANT KINGDOM

Dutta A. C.	:	Botany for Degree Students

ALGAE

1. Chapman, V.J. & D.J. Chapman	:	The Algae.
2. Kumar, H.D, & H.N. Singh	:	A Text Book of Algae
3. Pandey, B.B	:	A Text Book of Botany - Algae.
4. Sharma. O.P	:	Text Book of Algae
5. Singh, S.K. & S. Srivastava	:	A Text Book of Algae.
6. Vashishta, B.R	:	Botany for degree students –Algae.

FUNGI

1. Alexopoulos, C.J	:	Introductory Mycology.
2. Dube., H.C.	:	A Text Book of Fungi.
3. Purohit, S.S.	:	Viruses, Bacteria and Mycoplasma.
4. Sharma, O.P.	:	Text Book of Fungi.
5. Singh, S.K. & S. Srivastava	:	A Text Book of Fungi.
6. Srivastava, J.P.	:	An introduction of Fungi.
7. Vashista, B.R.	:	Botany for Degree students. Part II. Fungi.

PAPER: M 102

BRYOPHYTES

1. Chopra, R.N.	:	Bryophyta
2. Gupta, S.K.	:	Introductory Botany Vol II - Bryophyta and Gymnospems
3. Parihar, N.S	:	An Introduction to Embryophyta.
4. Puri, P.	:	Bryophytes.
5. Rashid, A.	:	An Introduction to Bryophyta.
6. Singh, S.K.	:	Text Book of Bryophyta.
7. Vashishta, B.R.	:	Botany for degree student –Bryophyta.

PTERIDOPHYTES

1. Pandey, B.P.	:	A Text Book of Bryophyta, Pteridophyta and Gymnosperms
2. Parihar, N.S.	:	An introduction to Embryology. Vol-II. Pteridophyta and Gymnosperms
3. Rashid, A.	:	Pteridophyta.
4. Singh, S.K.	:	Pteridophyta.
5. Vashishta, P.C.	:	Botany for Degree Students, Vol IV – Vascular Cryptogams (Pteridophyta),

SECOND SEMESTER
PAPER: M 201

GYMNOSPERMS
1. Bhatnagar, S.P. & A. Moitra	:	Gymnosperms.
2. Chamberlain, C.J	:	Gymnosperm, Structure and Evolution.
3. Vasishta, P.C	:	Gymnosperm.

PALAEOBOTANY
1, Agashe, S.N.	:	Palaeobotany.
2. Andrews, Jr.H.N.	:	Studies in Palaeobotany.
3. Arnold, C.A	:	An Introduction to Paleobotany
4. Meyen, S.V.	:	Fundamentals of Palaeobotany.
5. Shukla.A.C. & S.P. Mistra	:	Essentials of Palaeobotany.
6. Taylor, T.N.	:	Palaeobotany-An Introduction to Fossil ` Plant Biology

PLANT ANAOTMY
1. Eames, A.J. & Mac Daniels	:	An Introduction to Plant Anatomy.
2. Esau, K.	:	Plant Anatomy.
3. Fahn, A.	:	PLANT Anatomy.
4. Pandey, B.P.	:	Plant Anatomy.
5. Vashista, P.C.	:	A text Book of plant Anatomy.

PAPER: M 202

CELL BIOLOGY
1. Berry, A.K.	:	A Text Book of Cell Biology
2. Power, C.B.	:	Cell Biology.
3. Rastogi, S.C.	:	Cell biology.
4. Singh S.P & B.S. Tomar	:	Cell biology.
5. Sundara Rajan, S.	:	Introduction Cell Biology.

THIRD SEMESTER
PAPER: M 301

ECOLOLGY
1. Odum, E.P.	:	Fundamentals of Ecology
2. Odum, E.P.	:	Basic Ecology
3. Sharma, P.D	:	Ecology and Environment.
4. Shukla, R.S & I.P.S. Chandel	:	Plant Ecology and Soli Science.
5. Shukla,R.S. & P.S. Chandel	:	A Text Book of Plant Ecology
6. Samba Murty, S.	:	Ecology
7. Vasishta, P.C.	:	Plant Ecology.
8. Verma, V. A.	:	Text Book of plant Ecology.
9. Weaver & Clements	:	Plant Ecology.

EVOLUTION
1. Strickberger	:	Evolution.

PAPER: M 302

BIOLOGICAL INSTRUMENTATION
1. Bajpai, P.K. : Biological instrumentation & methodology.
2. Rana, S.V.S. : Biotechniques – Theory and Practice.

PLANT MICROTECHNIQUE
1. Johansen, D.A. : Plant Microtechnique.
2. KHASIM, J.K. : Botanical Microtechnique, Principles and Practice.
3. Prasad and Prasad : Outlines of Botanical Micro technique.
4. Sas. Joe E : Botanical Microtechnique.

FOURTH SEMESTER
PAPER: M 401

MORPHOLOGY
1. Eames, A.J. : Morphology of Angiosperms.
2. Rao, A. : Morphology of Angiosperms.

PALYNOLOGY
1. Erdtman, G. : Pollen Morphology and Plant Taxonomy.
2. Faegri, K. & J. Iverson : Text Book of Pollen Analysis.
3. Nair, P.K.K. : Pollen Morphology of Angiosperms.
4. Saxena, M.R. : Palynology – A treaties.
5. Shivana & Johri : The Angiosperm Pollen.
6. Shivana, K.R. & N.S. Rangaswami: Pollen Biology.

EMBRYOLOGY OF ANGIOSPERMS
1. Bhojwani, S.S & S.P. Bhatnagar : The Embryology of Angiosperms.
2. Dwivedi, J. N. : Embryology of Angiosperms.
3. Johri, B.D. : Embryology of Angiosperms.
4. Maheshwari, P. : An Introduction to the Embryology of Angiosperms.
5. Pandey, B.P. : Embryology of Angiosperms.
6. Pandey, S.N. & A. Chadha : Plant Anatomy & Embryology.

PAPER: M 402

PLANT TAXONOMY AND SYSTEMATIC BOTANY
1. Lawrence, G.H.M. : Taxonomy of Vascular Plants.
2. Mitra, J.N. : An Introduction to Systematic Botany and Ecology.
3. Mondal, A.K. : Advanced Plant Taxonomy.
4. Mukherjee, S.K. : College Botany (Vol. III).
5. Naik, V.N. : Taxonomy of Angiosperms.
6. Pandey, P.B : Taxonomy of angiosperms (Syastematic Botany)

7. Pandey, B.P : Taxonomy of Angiosperms.
8. Saxna, N.B. & S. Saxena : Plant Taxonomy.
9. Sharma, A.K. & R. Sharma : Taxonomy.
10. Singh, G. : Plant Systematics.
11. Singh, V. & D.K. Singh : Taxonomy of Angiosperms.
12. Sivarajan, V.V. : Introduction to Principles of Plant Taxonomy.
13. Vashista, P.C : Taxonomy of Angiosperms.

FIFTH SEMESTER
PAPER: M 501

MICROBIOLOGY
1. Dubey, R.C & D.K. Maheswari : A Text Book of Microbiology.
2. Kaushik, P. : Microbiology.
3. Kumar, H.D. & S. Kumar : Modern Concept of Microbiology.
4. Pelczar, Chan and King : Microbiology
5. Purohit, S.S. : Microbiology.
6. Rangaswami, R. & C.K.J. Panikar : Text Book of Microbiology.
7. Sharma, P.D. : Microbiology and Pathology.
8. Singh, U.S. & K. Kapoor : Introductory Microbiology.
9. Trivedi, P.C. Pandey, S. &
   Seema Hadauria : Text Book of Microbiology.

VIRUS
1. Biswas,S.B. & A. Biswas : An Introduction to Virus.
2. Madahar, C.L. : Introduction of Plant Virus.
3. Purohit, S.S. : Viruses, Bacteria and Mycoplasma

BACTERIA
1. Clifton, A. : Introduction to Bacteria
2. Madahar, C.L. : Introduction of Plant Virus
3. Singh, V. & V. Srivastava : Introduction of Bacteria.

IMMUNOLOGY
1. Banerjee, A.K. & N. Banerjee : Fundamentals of Microbiology and Immunology.

PAPER: M 502

PLANT PATHOLOGY
1. Bilgrami & Dube : A Text Book of Modern Plant Pathology.
2. Mehrotra, R.S. : Plant Pathology.
3. Pandey, B.P. : Plant Pathology, Pathogen and Plant Diseases.
4. Pathak, V.N. : Fundamentals of Plant Pathology.
5. Rangaswami, G. : Diseases of Crop Plants of India.
6. Sharma, P.D. : Plant Pathology.
7. Singh, R.S. : Plant Diseases.

8. Singh, R.S.	:	Introduction to Principles of Plant Pathology.
9. Trivedi, P.C.	:	Plant Disease and its Management.
10. Trivedi, P.C.	:	Plant Pathology.

LICHEN

| 1. Misra, A. & R.P. Agarwal | : | Lichens – A Preliminary Text. |

PAPER: M 503

CYTOGENETICS

1. Gupta, P.K.	:	Genetics.
2. Powar, C.B.	:	Essential of Cytology
3. Pawar, C.B.	:	Genetics- (Vol. I & II).
4. Strickberger	:	Genetics
5. Shukla & Chandel.	:	Cytogenetics & Plant Breeding
6. Sundararajan, S.	;	Cytology
7. Verma, P.S. & V.K. Agarwal	:	Genetics.

PLANT BREEDING

1. Chauduri, H.K.	:	Elementary Principles of Plant Breeding.
2. Singh, B.D.	:	Plant Breeding.
3. Singh, S.P. Lakhi Ram Singh, Srivastava, J.P.	:	Plant Breeding.

BIOSTATISTICS

1. Gupta, S. C.	:	Fundamentals of Statistics
2. Jasra, P.K. & Gurdeep Raj	:	Biostatistics.
3. P.N. Arora & P.K. Malhan	:	Biostatistics.
4. Steve Selvin.	:	Biostatistics: how it works.

SIXTH SEMESTER
PAPER: M 601

MOLECULAR BIOLOGY

1. Arora, M.P. & Chandra Kanta	:	Molecular Biology.
2. Gupta, P.K.	:	Cell and Molecular Biology.
3. Kar, D.K. & S. Halder	:	Cell Biology, Genetics, Molecular Biology.
4. Kumar, H.D.	:	Molecular biology and biotechnology.

BIOTECHNOLOGY

1. Dubey R.C	:	A text book of Biotechnology.
2. Ignachimuthu, S.	:	Basic biotechnology.
3. Ramawat, K.G. & S. Goyal	:	Comprehensive Biotechnology.
4. Singh, B.D.	:	Biotechnology: Expanding horizons
5. Trivedi, P.C.	:	Plant Biotechnology.

PLANT TISSUE CULTURE

1. Kalyan Kumar, D.	:	An Introduction to plant tissue culture.
2. Narayanaswamy, S.	:	Plant Cell & Tissue Culture

PAPER: M 602

BIOINFORMATICS

1. Attwood, T.K.	:	Introduction to Bioinformatics.
2. Bansal, M.	:	Basic Bioinformatics.
3. Ghosh, Z. & B. Mallick	:	Bioinformatics: Principles and Applications.
4. Harisha, S.	:	Fundamentals of Bioinformatics Text Book.
5. Ignacimuthu, S.	:	Basic Bioinformatics.
6. Mukherjee, A.	:	Bioinformatics.
7. Ranga, M.M.	:	Bioinformatics.
8. Sundararajan, S. & R. Balaji	:	Introduction to Bioinformatics.

COMPUTER APPLICATIONS

1. Bangia, R.	:	Learning Computer Fundamentals.
2. Norton, P.	:	Introduction to Computers.
3. Rajaraman, V.	:	Fundamentals of Computers.
4. Sinha, P.K.	:	Computer Fundamentals.

PAPER: M 603

PLANT PHYSIOLOGY

1. Ahmed, M.	:	Plant Physiology.
2. Gill, D.S.	:	Plant Physiology
3. Malik, C.P.	:	Plant Physiology.
4. Mukherji, S, & A.K. Ghosh	:	Plant Physiology.
5. Pandy, S.N.	:	Plant Physiology.
6. Salisbury & Ross	:	Plant Physiology
6. Verma, V.	:	A Text Book of Plant Physiology.
7. Wilkins, M.B.	:	Advanced Plant Physiology.

PAPER: M 604

ECONOMIC BOTANY

1. Govind Prakash and S.K. Sharma	:	Introductory Economic Botany.
2. Hill, A. (adapted by O.P. Sharma)	:	Economic Botany.
3. Nehra, S.	:	Economic Botany.
4. Pandey, B.P.	:	Economic Botany.
5. Pandey & Chaddha	:	Economic Botany
6. Subramanyam, Samba Murty	:	Economic Botany

PHARMACOGNOSY
1. Quadri & Shah : Pharmacognosy

ETHNOBOTANY
1. Jain, S.K. : Glimpses of Indian Ethnobotany.
2. P.C.Trivedi : Ethnobotany.

PLANT BIOCHEMISTRY
1. Gill, D.S. : Plant Physiology.
2. Jain, J.L. : Fundamentals of Biochemistry.
3. Lehninger, A.L. : Principles of Biochemistry,
4. Nagini, S. : Text Book of Biochemistry.
5. Power, C.B. & G.R. Chatwal : Biochemistry.

BOTANY GENERAL COURSE
REFERENCES

FIRST SEMESTER
PAPER: E 101

ALGAE
1. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol. I)
2. Pandey, B.B : A Text Book of Botany - Algae.
3. Sharma. O.P : Text Book of Algae
4. Singh, S.K. & S. Srivastava : A Text Book of Algae.
5. Vashishta, B.R : Botany for degree students –Algae.

FUNGI
1. Dube., H.C. : A Text Book of Fungi.
2. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol. I)
3. Sharma, O.P. : Text Book of Fungi.
4. Srivastava, J.P. : An introduction of Fungi.
5. Vashista, B.R. : Botany for Degree students. Part II. Fungi.

VIRUS
1. Biswas,S.B. & A. Biswas : An Introduction to Virus.
2. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol. I)

BACTERIA
1. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol. I)
1. Singh, V. & V. Srivastava : Introduction of Bacteria.

PLANT PATHOLOGY
1. Pandey, B.P. : Plant Pathology, Pathogen and Plant Diseases.
2. Rangaswami, G. : Diseases of Crop Plants of India.
3. Sharma, P.D. : Plant Pathology.

4. Singh, R.S.   :   Plant Diseases.
5. Singh, R.S.   :   Introduction to Principles of Plant Pathology.

BRYOPHYTES
1. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol. I)
2. Parihar, N.S   :   An Introduction to Embryophyta.
3. Puri, P.   :   Bryophytes.
4. Rashid, A.   :   An Introduction to Bryophyta.
5. Vashishta, B.R.   :   Botany for degree student –Bryophyta.

PTERIDOPHYTES
1. Mitra J. N., Mitra D & Chaudhuri S. K: Studies in Botany (Vol. I)
2. Pandey, B.P.   :   A Text Book of Bryophyta, Pteridophyta and Gymnosperms.
3. Parihar, N.S.   :   An introduction to Embryology. Vol-II. Pteridophyta and Gymnosperms
4. Rashid, A.   :   Pteridophyta.
5. Vashishta, P.C.   :   Botany for Degree Students, Vol IV – Vascular Cryptogams (Pteridophyta),

SECOND SEMESTER
PAPER: E 201

CELL BIOLOGY
1. Power, C.B.   :   Cell Biology.

CYTOGENETICS
1. Gupta, P.K.   :   Genetics.
2. Verma, P.S. & V.K. Agarwal   :   Genetics.

THIRD SEMESTER
PAPER: E 301

GYMNOSPERM
1. Chamberlain, C.J   :   Gymnosperm, Structure and Evolution.
2. Mitra J. N., Mitra D & Chaudhuri S. K.:   Studies in Botany (Vol. I)
3. Vasishta, P.C   :   Gymnosperm.

PALAEOBOTANY
1. Arnold, C.A   :   An Introduction to Paleobotany
2. Shukla.A.C. & S.P. Mishra   :   Essentials of Palaeobotany.

PLANT TAXONOMY AND SYSTEMATIC BOTANY
1. Mitra, J.N.   :   An Introduction to Systematic Botany and Ecology.
2. Mondal, A.K.   :   Advanced Plant Taxonomy.
3. Mukherjee, S.K.   :   College Botany (Vol. III).

| 4. Pandey, P.B | : | Taxonomy of angiosperms (Syastematic Botany) |
| 5. Vashista, P.C | : | Taxonomy of Angiosperms. |

FOURTH SEMESTER
PAPER: E 401

PLANT PHYSIOLOGY
1. Mitra J. N., Mitra D & Chaudhuri S. K.:	Studies in Botany (Vol.II)
2. Mukherji, S, & A.K. Ghosh	:	Plant Physiology.
3. Verma, V.	:	A Text Book of Plant Physiology.

FIFTH SEMESTER
PAPER: E 501

PLANT ANAOTMY
1. Mitra J. N., Mitra D & Chaudhuri S. K:	Studies in Botany (Vol.I)
2. Pandey, B.P.	:	Plant Anatomy.
3. Vashista, P.C.	:	A text Book of plant Anatomy.

EMBRYOLOGY OF ANGIOSPERMS
1. Bhojwani, S.S & S.P. Bhatnagar	:	The Embryology of Angiosperms.
2. Dwivedi, J. N.	:	Embryology of Angiosperms.
3. Johri, B.D.	:	Embryology of Angiosperms.
4. Maheshwari, P.	:	An Introduction to the Embryology of Angiosperms.
5. Pandey, B.P.	:	Embryology of Angiosperms.
6. Pandey, S.N. & A. Chadha	:	Plant Anatomy & Embryology.

SIXTH SEMESTER
PAPER: E 601

ECOLOLGY
1. Samba Murty, S.	:	Ecology
2. Sharma, P.D	:	Ecology and Environment.
3. Shukla, R.S & I.P.S. Chandel	:	Plant Ecology and Soli Science.
4. Shukla,R.S. & P.S. Chandel	:	A Text Book of Plant Ecology
5. Samba Murty, S.	:	Ecology
6. Vasishta, P.C.	:	Plant Ecology.
7. Verma, V. A.	:	Text Book of plant Ecology.

ECONOMIC BOTANY
1. Govind Prakash and S.K. Sharma	:	Introductory Economic Botany.
3. Nehra, S.	:	Economic Botany.
4. Pandey, B.P.	:	Economic Botany.
5. Pandey & Chaddha	:	Economic Botany
6. Subramanyam, Samba Murty	:	Economic Botany

TDC (MAJOR) COURSE

First Year

SEMESTER I

PAPER M 101 **Physical Chemistry** **(Total Marks 75)**

Unit 1.1 Chemical Thermodynamics (Marks 25)

Definition of thermodynamic terms, closed, open and isolated system; surroundings, energy, heat, work, internal energy. The first law, calculation of work done during expansion of gas, thermodynamic reversibility, heat capacity, enthalpy and its significance, significance of heat and work.

State functions and differentials; variation of internal energy and enthalpy with temperature, Joule-Thomson experiment and liquefaction of gases; relation between C_p and C_V; Calculation of work done on adiabatic expansion; relation between P, V and T in adiabatic processes.

Thermochemistry- standard enthalpy changes, derivation of Hess's law and Kirchhoff's law. Relation of reaction enthalpy with changes in internal energy. Calculation of bond dissociation energies from thermochemical data.

Unit 1.2 Chemical Thermodynamics (Marks 20)

The second law, entropy changes in reversible and irreversible processes. Clausius inequality, calculation of entropy changes during various processes.

Helmholtz function and Gibb's function and the direction of spontaneous change. Thermodynamics of chemical reactions - Equilibrium constant of a reaction in terms of standard Gibb's function, dependence of equilibrium constant of temperature and pressure.

Standard entropy of a reaction and standard Gibbs function of formation. Maxwell's relations and derivation of thermodynamic equation of state; Gibb's-Helmholtz equation, variation of Gibb's function with pressure and temperature. Brief idea of partial molar quantity, chemical potential and Gibb's-Duhem equation.

Third law of thermodynamics – Nernst heat theorem.

Unit 1.3 Chemical Kinetics (Marks 20)

Concept of reaction rate and rate laws. Order and molecularity of reaction. Integrated rate expression for zero, first and second order reactions. Half-life period.

Consecutive and concurrent reaction. Steady state and rate determining step approximation. Simple problems on Steady State approximation. Experimental determination of rate and order of reaction. Temperature dependence of reaction rate and

Arrhenius plots.

Kinetics of chain reaction, H_2-Br_2 reaction, thermal decomposition of ethanol, branching and non-branching chain reaction - $H_2 + O_2 \rightarrow H_2O$ reaction. Homogeneous catalysis, acid-base catalysis. Enzyme catalysis, Michalis-Menten equation, effect of pH and temperature. Zeolites and its uses in cracking and reforming of petroleum.

Internal assessment   **(Marks 10)**

PAPER M 102   **Organic Chemistry**   **(Total Marks 75)**

Unit 1.4   **Introduction to Organic Compounds**   **(Marks 15)**

IUPAC nomenclature of organic compounds. Hybridization of carbon in organic compounds. Bond angles, bond length and bond energies. Electron delocalization effects in organic compounds, tautomerism. Hydrogen bonding and its effect on the properties of organic molecules. Acid-base behaviour, pK_a values and factors effecting acidity/ basicity of organic compounds.

Unit 1.5   **Stereoisomerism**   **(Marks 20)**

Types of steroisomerism - conformational and configurational isomers, enantiomers & diastereomers, π-distereomers- differences in physical and chemical properties of π-diastereomers. Syn/anti, cis/trans & E/Z designation. Stereomutation of π-diastereomers. Cis- trans isomerism in cycloalkanes- (upto 6- membered rings)

Enantiomers - optical activity, asymmetry, dissymmetry or chirality, racemic modification, & methods of resolution of racemic modification & projection formula- Flying-wedge formula, Fischer, Newman & Sawhorse projection. Criteria for showing optical activity, examples of optically active molecules without chiral centre, Atropisomerism.

Unit 1.5 Organic Reaction Mechanism1   **(Marks 30)**

Idea of driving force, activation energy, transition state, energy profile diagrams, concept of kinetic and thermodynamic control of reactions, Homolytic and heterolytic bond fission, Types of reagents-electrophiles and nucleophiles. Types of reaction intermediates- carbocations carboanions, carbenes, free radicals nitrenes arynes.

Mechanism of organic reactions

    A. Addition reactions : electrophilic, nucleophilic and free radical mechanism.

      B) Substitution reactions : electrophilic, nucleophilic and free radical mechanism

    B. Elimination reaction : β−elimination reaction - base catalysed and pyrolytic elimination reactions.

    Internal Assessment   **(Marks 10)**

PAPER M 103   Practical   (Total Marks   50)

A. **General Experiment** *(any one of the following to be done in Exam)*
   (Marks   30)

   1. To determine the solubility of a given salt at different temperatures and to plot solubility curve.

   2. To determine water of crystallization of hydrated salt by ignition and weighing.

   3. Determinations of the concentrations of sodium carbonate and sodium hydroxide in a given mixture.

   4. To study the kinetics of the reaction between H_2O_2 and iodide ion.

   5. Kinetics of Clock reaction between $S_2O_3^{2-}$ and HCl.

   6. Study the adsorption of oxalic acid on activated charcoal

   7. Estimation acetic acid in vinegar by conductometry.

   8. Column chromatographic/ TLC separation of pigments from green leaves.

   9. Separation of a mixture of benzoic acid, 2-naphthol and 1,4-dimethoxybenzene by solvent extraction and identification of their functional groups.

   10. Paper chromatographic separation and identification of sugars.

B. **Sessional   (Marks   10)**

C. **Viva   (Marks   10)**

Semester II

PAPER M 201   Physical Chemistry   (Total Marks   75)

Unit 2.1 Gaseous State   (Marks   20)

Deviations from ideal behaviour, van der Waals equation of state, Virial equation of state, Critical phenomena, Equation of Corresponding States. Kinetic theory of gases, distribution of molecular speeds. Mean, root mean square and most probable speeds, Collision cross section, Mean free path.

Transport properties, Flux and Fick's law of diffusion, thermal conductivity and viscosity of gas from kinetic theory.

Degrees of freedom, Principle of equipartition of energy. Molecular basis of heat capacity.

Unit 2.2 Liquid State   (Marks   10)

Structure of liquid (qualitative treatment) – structure of liquid water and ice. Physical properties of liquid – determination of vapour pressure, capillary action, determination of surface tension and viscosity. Refractive index of liquids. Elementary idea of structure, physicalproperties and uses of liquid crystals.

Unit 2.3 Colligative Properties   (Marks   10)

Thermodynamic treatment of colligative properties. Ostwald's law and Henry's law. Definition of colligative property, ebullioscopy, cryoscopy, calculations based on relative lowering of vapour pressure and solubility of an ideal solute. Osmosis, van't Hoff's equation. Abnormal colligative properties.

Real solution – activity, activity coefficient.

Unit 2.4 Electrochemistry   (Marks   25)

Ion transport and conductivity. Molar conductance and its temperature dependence. Kohlrausch's law. Mobility of ions and conductivity. Transport number of ions and its determination.

Debye-Huckel-Onsager equation, Stokes-Einstein relation. Activity of ions. Debye-Huckel theory (elementary ideas) of strong electrolytes. Ionic strength of solutions.

Electrochemical cells, measurement of emf, electrode potenmtial, sign convention. Different types of electrodes, the calomel electrode. Nernst equation, the electrochemical potential and its measurement. Equilibrium constants and activity coefficients from standard electrode potentials.

Concentration cell with and without transference, Galvanic cells, Fuel cell, Batteries and Dry cell. Corrosin.

Strong and weak electrolytes, dissociation equilibria of weal electrolytes. Ostwald's dilution law. pK of acids and bases. Buffer solution. Henderson Hasselbach equation. Buffer action.

Internal Assessment   (Marks 10)

PAPER M 202   Organic Chemistry   (Total Marks   75)

Unit 2.5   Stereoisomerism   (Marks 10)

Conformation of molecules - ethane, butane, cyclohexane, relative stability of conformers.

Concept of topocity and prostereoisomerism, criteria of establishing topocity of groups, atoms and faces, designation of stereoheterotopic atoms, groups and faces.

Unit 2.6 Reaction Mechanism 2
(Marks 15)

a) Mechanism of electrophilic aromatic substitution. Directive influence of groups, activation and deactivation of aromatic rings, o/p ratio, mechanism to be given with examples.

b) Mechanism of nucleophilic aromatic substitution. Intermediate complex mechanism, benzyne mechanism. Directive influences in benzyne mechanism. Cine substitution, methods of trapping benzyne intermediates.

Unit 2.7 Organic Compounds   (Marks 40)

I. Aliphatic Compounds: General methods of preparation, physical properties, reactions and

functional group transformation of

- a. Saturated and unsaturated hydrocarbons
- b. Alkyl halides
- c. Primary, secondary and tertiary alcohols, diols, triols
- d. Carbonyl compounds
- e. Carboxylic acids
- f. Nitro compounds, and
- g. Primary, secondary and tertiary amines

II. Aromatic Compounds: General methods of preparation, Physical properties, Reactions and

functional group transformation of aromatic (benzene) compounds.

- h. Benzenes and arenes
- i. Aromatic Halogen compounds
- c. Phenols and benzyl alcohols
- d. Aromatic carbonyl compounds

e) Aromatic carboxylic acids

f) Aromatic nitro compounds

g) Aromatic amines and

h) Polynuclear hydrocarbons-naphthalene, anthracene.

Internal Assessment   **(Marks 10)**

PAPER M 203   Organic Practical   (Total Marks 50)

   A.   Qualitative Organic Analysis   (Marks 30)

   Analysis of an organic compound & identification by

   a) Detection of N, S, Halogens   b) Test for functional groups

   c) Solubility, melting point, boiling point

   d) Preparation of a derivative and determination of its melting point

   (Distribution of Marks : Detection of elements – 5, Test for Functional group – 10, solubility, aromaticity, unsaturation test, mp/bp – 8, Preparation of derivative & mp – 5, Identification – 2)

   B.   Sessional   (Marks   10)

   C.   Viva   (Marks   10)

Second Year

Semester III

PAPER M 301   Structure and Bonding   (Total Marks 75)

Unit 3.1 Atomic Structure   (Marks 40)

Learning Structure of hydrogen-like atoms and their representation in quantum mechanical terms. Basic quantum mechanical ideas and principles leading to atomic structure (outline only without details) :

a) Particle character of radiation - black body radiation phenomenon - Planck's hypothesis :   Postulates and explanation for black body radiation.

   b) Wave character of particles-electron diffraction.

c) Discrete nature of energy levels of atomic and molecular systems, line spectra of atoms (e.g., hydrogen) and molecules (e.g.N_2O).matter-de Broglie hypothesis.

d) Dual nature of matter-de Broglie hypothesis. e) The defining limit of classical mechanics-the uncertainty principle.

f) Definition of micro and macro particles.

g) Necessity of quantum mechanical equation.

h) Schrodinger equation-statement and identity of terms. Energy eigenvalues-expression alone. Energy eigenfunctions: Setting up of expressions of radial(R) and angular(Y) parts for $1s,2s,2p_o,2p_{+1},2p_{-1},2p_x,2p_y,2p_z$ orbital, Born interpretation of the wave functions, Orbital concept-one electron wave functions, Plots of and ψ^2 for $1s,2s,2p,2p_x,2p_y,2p_z,3d_{xy},3d_{zx}$ orbital. n,l,m quantum numbers-origin and significance(outline only).

i) The concept of spin and spin quantum numbers (outline only).Many electron atoms. Electron repulsion in the He atom. Pauli's exclusion principle. Aufbau principle and electron configuration of many electron atoms.

j) Effective nuclear charge-shielding and penetration effects. Electron Configuration of atoms.

Unit 3. 2 Chemical Bonding I
(Marks 25)

Lewis electron pair bond. Valence bond approach to bonding in diatomic molecules-outline of concept of overlap (HF and H_2). Resonance and resonance energy in HF and benzene. Bond moments and dipole moments (outline with simple pictorial representation). Percent ionic character of HCl and HF bonds. Formal charges on atoms in molecules. Concept of electro negativity -explanation of molecular properties on the basis of electro negativity.

Internal Assessment   **(Marks 10)**

PAPER M 302   **(Total Marks 75)**

Unit 3.3   Chemical Bonding II   (Marks 20)

Shapes of molecules- VSEPR theory, hybrid orbital and hybridization in polyatomic molecules-influence of hybridization on bond length, bond angle and other properties of molecules including shapes and dipole moments. Effects of structure on molecular properties- steric effects and electronic effects.

Unit 3.4   Chemical Bonding III   (Marks 25)

Molecular orbital theory of homonuclear diatomic molecules (N_2, O_2, F_2,CO, NO etc).Graphical representation of angular parts of the wave function(H_2^+ molecule ion).Energy levels, electronic configuration of ground states of diatomic molecules.

Setting up of the wave functions and energy level diagrams for H_2 molecules without calculations. Multicentre bonding(diborane);MOs of simple triatomic systems (BeH_2, H_2O, NO_2);Multiple bonding, orbital picture and energy of ethane,ethyne and benzene; Huckel' s aromaticity rule.Delocalisition vs. Resonance; bond energy; bond length and covalent radii. Bonding in metals (band theory); properties consequent from Band theory.

Unit 3.5   Ionic Bonds and Solids   (Marks 20)

Types of solids, macroscopic properties of solids, properties of ionic compounds; types of unit cells; crystal lattices and Miller indices; crystal system and Bravais lattices.Closed packed structures, ionic radii; radius ratio and structures; Spinel and Perovskite structures, Lattice energy of ionic solids; Born- Haber cycle-calculations; Covalent character of ionic bonds-Fajan's rules of polarization. Inter-molecular forces-dipole moment and molecular polarisability. Molecular solids; Hydrogen bonding and its effect on physical properties.

Internal Assessment   **(Marks 10)**

PAPER M 303   Practical
(Total Marks 50)

A. **Qualitative Inorganic Analysis   (Marks 30)**

Analysis of a mixture of salts containing total of five cations and anions including insoluble   salts and interfering anions.

Marks distribution :

1. Physical properties and solubility 2 marks

2. Preliminary Dry tests   4 marks

3. Dry test for acid radicals   4 marks

4. Wet test for acid radical   4 marks

5. Confirmatory test   2 marks

6. Group analysis   4 marks

7. Conclusion and remarks (2x5=10) 10 marks

B. **Sessional   (Marks   10)**

C. **Viva   (Marks   10)**

Semester IV

PAPER M 401   **(Total Marks 75)**

Unit 4.1   Properties of Inorganic Compounds   **(Marks 25)**

Groupwise and periodwise trends in physical and chemical properties of elements and their compounds with illustrative examples from Groups 1, 2, and 13-17. The following should be emphasized, explaining the factors affecting these trends-

(a) Electronic configuration, effective nuclear charge, Slater's rule, size of atoms, ions and atomic orbital.

(b) Ionization energy and electron affinity of atoms.

(c) Tendency for homo and hetero catenation, the energy of M-M, M-O and M-X bonds

    (M=element, X=halogen).

(d) Tendency to use vacant d-orbital and electropositive character of metals.

(e) Electro negativity of elements.

(f) Melting point and boiling point of elements and their compounds.

(g) Solubility of salts and molecules in water.

(h) Relative acid –base strength of Lewis and protonic acids with reference to oxides,

    hydroxides and oxoacids.

(i) Electrode potentials and redox behaviour in aqueous solutions.

Unit 4.2 Chemistry of Non-transition Elements I   **(Marks 25)**

Polarizing power of cations, Polarisability of anions and consequences of Fajan's rules, the concept of chemical hardness and the theory and applications of Pearson's HSAB concept.

The Latimer diagram and Frost diagram and their uses.

Non aqueous solvents : liquid ammonia, liquid sulphur dioxide, liquid HF and liquid N_2O_4.

Preparation, properties, bonding and structure of the following (excepting where specific aspects have been mentioned):

  a. Ortho and Para hydrogen, hydrates, clathrates and inclusion compounds, binary metallic hydrides.

  b. Diborane and higher boron hydrides.

  c. Allotropes of carbon (including fullerenes), graphite, intercalation compounds,

carbides, cyanogens, oxides and oxoacids of carbon.

Unit 4.3 Chemistry of Non-transition Elements II   (Marks 15)

a. Allotropes of phosphorous, Hydrides, oxides and oxoacids of nitrogen and phosphorous, Hydrazine, Hydroxylamine and hydrogen azide, clinical use of NO and N_2O.

b. Super oxide and oxygen fluorides, Allotropes of sulphur, halides, oxides, hydrides, oxoacids and per acids of sulphur, mechanism of formation and depletion of ozone layer.

Internal Assessment   **(Marks 10)**

PAPER M 402   (Total Marks 75)

Unit 4.4 Chemistry of Non-transition Elements   (Marks 15)

a. Interhalogen compounds, polyhalides, pseudo halogen, oxides and oxoacids of halogens.

b. Noble gas compounds-xenon oxides and fluorides.

c. Inorganic chains, ring and cages: Silicate, Aluminosilicates, zeolites, silicones, Borazine, Phosphazine, S_4N_4, P_4, P_4O_6, P_4O_{10}, boron cage compounds, carboranes and metallocarboranes.

Unit 4.5 Chemistry of Metals   (Marks 25)

Bonding in metals, physical and chemical properties of metals, important alloys and intermetallic compounds. Occurrence and principles of extraction of Ni, Cr, Mn, Au, V and Mo. Physical and chemical properties of ionic compounds of alkali metals, alkaline earth metals and aluminium. Allotropes of tin, Inert pair effect in Sn, Pb and Tl, structure and properties of oxides, hydroxides and halides. Coordination compounds of Sn, Pb, As and Se. Zn, Cd, Hg: Stereochemistry of compounds, the mercurous ion, divalent compounds, coordination complexes.

Unit 4.6 Transition Metals   (Marks 25)

Electronic configuration and general periodic trends, comparative study of first transition series elements, preparation, properties and reactivity of oxides, hydroxides and halides of V-Cu.

Trends in physical and chemical properties of second and third transition series in comparison to the first, study of oxides and halides of Au,Ag,Mo,Ru,Rh,Ir,Pd and Pt.

Coordination Compounds: Werner's theory, structural and stereo isomers of complex compounds, survey of different types of ligands, IUPAC nomenclature of coordination compounds. Preparation, structure, bonding and reactivity of complexes containing the following as one of the ligands: CO, N_2, CN^-, O_2, CH_3COO^-, $C_2O_4^{2-}$, NH_3, en, acac.

Internal Assessment   **(Marks 10)**

PAPER   M 403   Practical   (Total Marks 50)

A. General Chemistry Experiments   (Marks 10)

   a. To determine the water of crystallization of green vitriol by titration with 0.1N $KMnO_4$ solution.

   b. To determine the hardness of water by EDTA titration.

   c. To determine temporary and permanent hardness of water by EDTA titration.

B. Inorganic Preparation   (Marks 20)

   a. Preparation of the following:

        1   Chrome alum and crystallization

        2   Tetra mine Cu(II) sulphate

        3   Cu(glycinate)$_2$

        4   Hexammine Ni(II)chloride

        5   Potassium trioxalato ferrate(III)

        6   Potassium trioxalato chromate(III)

        7   Cu(thiourea)complex

        8   Mohr's salt

   b. Characterization of the compound prepared

        Students should recrystallize the product and verify presence of anions and cations by

        qualitative analysis.

   C. Sessional   (Marks 10)

   D. Viva   (Marks 10)

Third Year

Semester V

PAPER M 501 : Quantum Chemistry   (Total Marks 75)

Unit 5.1   Quantum Theory   Marks 30

Review of experiments leading to the idea of quantization –

   (a). Black body radiation – Planck's hypothesis

   (b). Photoelectric effect – Einstein's explanation

   (c). Compton effect

Electron diffraction, de Broglie hypothesis, Heisenberg's uncertainty principle. Postulates of Quantum mechanics.

Wave functions, Operators, Eigen functions and eigen values, the Schrodinger postulates of operator transforms and the wave equation boundary conditions, normalization of the wave functions, expectation values. Interpretation of the wave function – orthogonal and orthonormal wave functions.

   Model systems – particle in 1D and 3D boxes – particle in a ring, harmonic oscillator and rigid rotator (detailed mathematical treatment not necessary) : coordinate systems – construction of

   Hamiltonian – potential function leading to potential energy term – Schrodinger equation, outline of solution, energy expression, wave functions, quantum numbers. Special features like degeneracy, energy level diagrams, plot of wave functions and their squares vs displacement from origin, zero point energy, quantum mechanical tunneling, force constant and bond strength (for harmonic oscillator), moment of inertia in 3D, angular momentum, space quantization of angular momentum (for rigid rotator).

   Qualitative discussion of all these topics.

Unit 5.2   Atomic Structure   Marks 20

The Hamiltonian and Schrodinger equation for hydrogen atom, energy levels and quantum numbers, the radial and the angular part of the wave function, construction of two dimensional plots of probability density and calculation of radial probability functions. The orbitals of hydrogen and hydrogen-like atmos, contour diagrams of electron density. Stern-Gerlach experiment, electron spin and spin quantum number – spin orbitals. Electron configuration of many electron atoms, Pauli's exclusion principle – illustration by He atom using wave functions.

Spin-orbit interactions, Russel-Saunder's coupling, Term symbols. Effect of magnetic

field on energy levels. Hund's rule.

Unit 5.3   The Nature of Chemical Bond   Marks 15

Schrodinger equation for a molecule, Born-Oppenheimer approximation. LCAO-MO theory as applied to H_2^+ and H_2 - drawback of MO theory. MO energy level diagram of homonuclear (O_2, N_2) and heteronuclear (HF, LiF, CO) diatomic molecules. Heitler-London theory – wave function and potential energy curve of H_2. Concept of resonance and hybridisation from VB theory. Term symbols of diatomic molecules. Huckel theory for ethene and benzene.

   Internal Assessment   **(Marks 10)**

PAPER M 502   Physical Chemistry   (Total Marks   75)

Unit 5.4   Molecular Reaction Dynamics   (Marks   15)

Collision theory, Activated complex theory; Erying equation – thermodynamic formulation. Theory of unimolecular reactions (Lindemann) – dynamic molecular collisions – potential energy surfaces – Molecular beam technique and results of molecular beam studies. Reactions in solution, Bronsted- Bjerrum equation, Kintic salt effect. Introduction to lasers, flash photolysis.

Unit 5.5   Photochemistry   (Marks   15)

Laws of photochemical equivalence, Quantum yield, chemical actinometry Kinetics of H_2-Br_2 , H_2-Cl_2 reactions, Dissociation of HI, Photostationary equilibrium, Dimerisation of anthracene.

Luminescence phenomenon – fluorescence, phosphorescence, Jablonski diagram, Photosensitised reactions, Quenching of fluorescence. Chemi and bio luminescence.

Photochemistry of air and air pollution.

Unit 5.6 Phase Equilibria   (Marks   20)

Definition of phase, meaning of components and degrees of freedom. Derivation of phase rule. Phase diagram of one component system (water). Phase diagram of two component system – eutectics, congruent and incongruent melting points, solid solutions.

Interpretation of liquid-vapour, liquid-liquid and liquid-solid phase diagrams. Distillation of partially miscible liquids.

Clausius Clapeyron equation for different phases. Systems of variable composition, partial molar quantities, Gibbs Duhem equation, Thermodynamics of mixing.

Chemical potential, chemical potential of a component in an ideal mixture – fugacity,

activity coefficients. Dependence of chemical potential on temperature and pressure.

Unit 5.7 Surface Chemistry   (Marks 15)

Introduction to solid surfaces, adsorption on surfaces – physisorption and chemisorption. Adsorption isotherms – Langmuir, Freundlich, BET equation. Determination of surface area, Catalytic activity at surface with examples.

Concept of surface excess, Gibbs equation, surface pressure and surface spreading.

Internal Assessment   (Marks 10)

PAPER M 503   Organic Chemistry   (Total Marks 75)

Unit 5.8 Organic Reaction Mechanisms   (Marks 35)

   A. **Molecular Rearrangements of the types**

   Nucleophilic or anionotropic : Whitmore 1,2 Shift, Wagner-Meerwein, Wolff, Hofmann, Lossen, Curtius, Schmidt, Beckman, Favorskii, Benzil- benzilic acid, Baeyer Villiger

   Free radical : Wittig

   Electrophilic or cationotropic :   Pinacol

   Special : Fries rearrangement (aromatic electrophilic substitution)

         Stevens (ion pairs in solvent cage/ radical pair)

   B. **Oxidation - reduction : common oxidizing and reducing agents.**

   i) Direct electron transfer: Clemmensen (Nakabayashi mechanism)

   ii) Hydride transfer

   iii) Hydrogen Atom Transfer: Bouveault-Blanc

   iv) Formation of ester intermediate: oxidation by dichromate, permanganate, etc.

   v) Displacement mechanism.

   vi) Addition- elimination.

   Oxidizing agents : Chromium oxide, selenium dioxide, Chromyl chloride, PCC, and Lead tetraacetate.

Catalytic hydrogenation (Pd, Pt, Raney Ni). Reduction by LAH, Sodium Borohydride and metals (Birch). Reduction of nitro group under various condition. Selective reduction- Rosenmund reduction, Lindlars catalyst.

C. Pericyclic Reactions

Definition and examples of 2+2 and 2+4 cycloadditions. The conservation of orbital symmetry. Woodward Hoffman rules. Diels Alder reaction, 1,3 Dipolar Cycloaddition. Sigmatopic rearrangements-Cope and Claisen rearrangements. Electrocyclic reactions- HOMO-LUMO approach.

Unit 5.9 Polynuclear Aromatics, Nitro and amino compounds, Organo S and organo P Compounds, Active methylene compounds and Heterocyclic compounds (Marks 30)

Polynuclear aromatic hydrocarbons

Structure, bonding, properties and reactivity of naphthalene and its derivatives. Anthracene, phenanthrene

and anthraquinone-important methods of synthesis.

Nitro and amino compounds

Synthesis, physical properties and reactivity of nitroalkanes, alkyl nitrates, alkyl nitriles, isonitriles and

aromatic nitro compounds. Synthesis, reactions and basicity of aliphatic and aromatic amines.

Diazotization and its mechanism. Distinction between primary, secondary and tertiary amines,

Quarternary ammonium salts, Hofmann exhaustive methylation and Hofmann degradation of amines.

Organo S and organo P compounds

Synthesis and reactions of thiols, thioethers and aliphatic sulphonic acids. Phosphines, Phosphorous esters

and phosphorous ylides- Wittig reaction.

Active methylene compounds

The active methylene groups, synthesis of compounds containing active methylene groups (Ethylacetoacetate, Diethylmalonate and cynaoacetic ester) and their use in organic synthesis.

Heterocyclic compounds

IUPAC nomenclature, Synthesis, structure and bonding, properties (basicity, aromaticity) and reactions of pyrrole, furan, thiophene, pyridine, indole and quinoline.

Internal Assessment **(Marks 10)**

PAPER M 504   Inorganic Chemistry **(Total Marks 75)**

Unit 5.10   Bonding in Coordination Compounds **(Marks 25)**

Symmetry elements and Symmetry operation, Point group classification, Symmetry of octahedron, tetrahedron and square planar complexes, Structure and symmetry of inorganic compounds(coordination 2-8), Shape and symmetry of s,p and d orbital.

Crystal field theory, factors affecting 10 Dq value, crystal field stabilization energy, Magnetic properties from crystal field theory, high spin and low spin complexes, structural and thermodynamic affects of orbital splitting, octahedral coordination in Spinels. Adjusted crystal field (or Ligand field) theory, Molecular orbital theory of octahedral complexes (without and with p bonding).

Metal-metal bonding and quadruple bonds.

Unit 5.11   Organometallic Compounds **(Marks 30)**

Synthesis, structure and bonding of complexes with olefins, acetylene, allyl, cyclopentadiene and arenas. IUPAC nomenclature. Effective Atomic number rule, Transition metal to carbon sigma bonds.

Homogeneous catalysis by transition metal complexes (isomerzation, hydrogenation, hydroformylation and Ziegler-Natta Polymerization).

Synthesis and structure of organomettalic compounds of Sn and Pb, Organometallic compounds of Zn, Cd and Hg.

Unit 5.12   Bioinorganic Chemistry I **(Marks 10)**

Essential and trace elements and their biological role, Importance of Na/K salts and calcium in biology.

Uptake and storage of iron, Introduction to the structure and function of hemoglobin, Synthetic dioxygen carriers, Dioxygen toxicity.

Internal Assessment **(Marks 10)**

PAPER M 505 Practical (Total Marks 75)

A. Inorganic Quantitative Analysis (Marks 40)

Estimation of inorganic ions by volumetric, complexometric, gravimetric, redox and precipitation methods.

The following one-component systems should be estimated first: Cu, Fe, Ca, Mg, Ni, Cl and SO_4^{2-}. This should be followed by separation and estimation of individual ions in two-component systems of-

    a. Cu and Fe

    b. Fe and Ca

    c. Ca and Mg

    d. Cu and Ni and

    e. Cl^- and SO_4^{2-}.

(Any one of the above mixtures will be given for estimation in examination. Determination of marks: Preparation of standard solution and standardization 10 marks. Separation of components 5 marks, Completion of the experiment 10 marks, and Results 25 marks.)

B. Chromatographic separation of cations by paper/TLC (Marks 15)

    Colorimetric estimation of Cu^{2+}.

    (Any one of these two experiments is to be done in the examination)

C. Sessional (Marks 10)

D. Viva (Marks 10)

PAPER 506 Practical (Total Marks 75)

A. Organic preparation (Marks 25)

    Any one of the following will have to be done in the examination :

    a). Acetylation : Preparation of - acetanilide from aniline and aspirin from salicylic acid.

    b). Benzoylation : Preparation of benzanilide from aniline.

    c). Nitration : Preparation of - *m*-dinitrobenzene and *p*-nitroacetanilide from acetanilide.

d). Halogenation : Preparation of *p*-bromoacetanilide from acetanilide and 2,4,6-
   tribromophenol from phenol.

e). Diazo-coupling : Preparation of methyl orange.

f). Oxidation : Preparation of benzyl from benzoin.

g). Reduction : Preparation of *m*-nitroaniline from *m*-dinitrobenzene.

(Distribution of marks : Yield & Quality of the compound – 10, Recrystallisation & melting

point – 10, completion – 5.)

C. Organic quantitative analysis   (Marks 30)

Any one of the following experiments will be asked in the examination :

a). Determination of the equivalent mass of a carboxylic acid by direct titration method.

b). Determination of saponification equivalent of an ester.

c). Determination of amount of glucose by titration with Fehling solution.

d). Estimation of urea by hypobromite method.

(Disttribution of Marks : Theory – 4, Preparation of standard solution & standardization – 6,

   completion – 5, Result – 15.)

D. Sessional   (Marks 10)

E. Viva   (Marks 10)

Semester VI

PAPER M 601 Spectroscopy   (Total Marks   75)

Unit 6.1   Introduction to Spectroscopy   (Marks 10)

The nature of electromagnetic radiation. The regions of spectrum. Mechanism of interaction of electromagnetic radiation with matter. Absorption and emission spectroscopy. Basic elements of practical spectroscopy. Representation of spectrum – the width of spectral line. Intensity of spectral lines. Selection rules for various transitions. The Beer-Lambert law, molar absorption coefficient and absorbance. Molecular motion

and energy – degree of freedom. Moment of inertia.

Unit 6.2   Rotational, Vibrational and Raman Spectroscopy (Marks 20)

Rotational spectra of diatomic molecules – rigid rotator concept – determination of bond length – effect of isotopic substitution – spectra of non-rigid rotator. Vibrational spectra of diatomic molecules – harmonic and anharmonic oscillator model – Morse potential - calculation of force constants – effect of isotope - vibrations of polyatomic molecules, overtone and combination bands (H_2O, CO_2). Diatomic vibrating rotor – vibration rotation spectrum of CO. Principle of Raman spectroscopy – rotational and vibrational Raman spectra of linear molecules – rule of mutual exclusion.

Structure elucidation by IR spectroscopy – finger print region and group frequencies – effect of hydrogen bonding (alcohol, keto-enol) and coordination to metal.

Unit 6.3 Electronic spectroscopy   (Marks 15)

Electronic transitions and selection rule - spectrum of atomic hydrogen – fine structure, spectra of H-like atoms.

Electronic transitions in diatomic molecules – Selection rule - Born Oppenheimer approximation – vibrational coarse structure - Frank Condon principle – electronic transitions in polyatomic molecules.

Structure elucidation by electronic spectroscopy – chromophore, auxochrome – absorption due to ethylenic chromophore – Woodward's rule. Electronic transitions in conjugated polyenes from particle in a box model. Effect of solvents on electronic transition, quantitative estimation by spectrophotometry.

Introduction to photoelectron spectroscopy and its applications in simple diatomic molecules.

Unit 6.4 Spin resonance spectroscopy   (Marks 10)

Interaction between spin and magnetic field – Nuclear spin – Nuclear magnetic resonance spectroscopy – ^1H NMR – presentation of the spectrum - chemical shift and its unit – chemical shifts for simple organic molecules (alkane, alkene, alkyne, arenas, aldehydes, carboxylic acids and esters). Spin-spin coupling and high resolution ^1H NMR spectra of ethanol, ethyl benzoate, 2-iodopropane, cyanohydrin.

Basic concept of electron spin resonance spectroscopy – presentation of the spectrum – hyperfine structure – esr of H- atom , deuterium atom.

Unit 6.4 Mass spectroscopy   (Marks 10)

Mass spectroscopy - principle – idea of mass spectrometer – fragmentation pattern – nitrogen rule - simple applications in structure elucidation (butane, ethane, acetone) – McLafferty rearrangement (hexanoic acid, pentanal).

Internal Assessment   (Marks 10)

PAPER M 602   Physical Chemistry   (Total Marks   75)

Unit 6.4   Solid State   (Marks   20)

Laws of Crystallography, Miller indices, Symmetry in solids, Bragg's law, Introduction to X-ray crystallography and determination of structure of solids. Packing in solid – octahedral hole, tetrahedral hole, radius ratio.

Dislocation in solids – Schottky and Frenkel defects, Dielectric property of solids, Concept of piezo and ferro electricity. Electrical property of solids (conductor, insulator, n type and p type semiconductors. Super conducting materials. Magnetic properties of solids (dia-, para-, ferro- and antiferro magnetism).

Uni 6.5   Macromolecules and Colloids   (Marks   20)

Colloids : Definition, sols, lyophobic colloids. Structure, surface and stability of colloids. Sruface-active agents, micelle formation, critical micellar concentration, electrical double layer and Electrokinetic phenomena.

Molecular weight of macromolecules – number average and mass average molecular weight. Determination of molecular weight of macromolecules. Condensation and addition polymerization. Introduction to polymerization kinetics.

Unit 6.6   Statistical Thermodynamics   (Marks   20)

Molecular energy levels and Boltzmann distribution, molecular partition function and its significance. Translational, rotational anf vibrational partition functions. Molecular significance of heat and work. Statistical thermodynamics of monatomic and diatomic gases. Applications of statistical thermodynamics for calculation of heat capacity, residual entropy and equilibrium constants.

Unit 6.7   Data Analysis   (Marks   5)

Types of errors. Propagation of errors. Accuracy and Precision. Significant figures. Least square analysis. Average standard deviation. Uncertainty in the measurement of physical quantities.

Internal Assessment   **(Marks 10)**

PAPER M 603   Organic Chemistry   (Total Marks   75)

Unit 6.8   Organic Photochemistry, Polymers and Fibres   (Marks 20)

Theory of photochemistry: photophysical processes, electronic excitation, excited states, Jablonski diagram, Franck-Condon Principles. Fluorescence and phosphorescence, ET process, photosensitizers, Einstein's law of photochemical equivalence, quantum yield.

Typical photoreactions: Photoreaction of benzophenone, photolytic reactions of ketones,

Norrish type I & Norrish type II reactions, *cis-trans* isomerisation and dimerisation, cycloaddition of olefins.

Polymers and fibres: Addition and condensation polymers, Preparation of vinyl polymers, synthesis of terylene, nylon, Elastomers-natural rubber, synthetic rubber, Urea formaldehyde resins.

Biopolymers: Polysaccharides-structure of cellulose and starch, lignins, Proteins-polypeptides and polynucleotides.

Unit 6.9   Biochemistry   (Marks 20)

Structure of cell: lipids and structure of cell membrane; membrane transport

Basic molecules of living systems and their structures-Carbohydrates, proteins, nucleic acids.

Amino acids, peptides and polypeptides: Primary, secondary, tertiary and quarternary structure of proteins. Structure and functions of hemoglobin and and myoglobin.

Enzymes and their function as catalysts: chymotrypsin and lisozyme. Metalloenzymes, carboxypeptidase and peptide hydrolysis. Coenzymes and vitamins.

Structure and hydrogen bonding in purines and pyrimidines.

Structure of nucleotides and nucleosides. Structure of RNA and DNA.

Gene and genetic code: biosynthesis of DNA (replication), RNA (transcription) and proteins (translation)

Fundamentals of biological energy production-Glycolysis, Krebs cycle, Photosynthesis, respiration, oxidative phosphorylation and ATP synthesis.

Unit 6.10   Natural Products and Medicinal Chemistry   (Marks 25)

Terpenes: Definition, isolation and classification, isoprene rule. Isolation, structure determination, and synthesis of important terpene- citral.

Alkaloids: nicotine only. Definition, classification and functions of hormones.

Definition and classification of carbohydrates. Structure, configuration and reactions of glucose.

Drugs-physiological effect of their structure. Classification Chiral drugs and asymmetric synthesis. Antibiotics and their action. Anticancer and antimalarial drugs. Immunity and AIDS.

Sulpha drugs- their mechanism of action. Preparation of aspirin, quinine, chloroquin, paracetamol, phenacitin, sulphanilamide and other sulpha drugs.

Cisplatin

Internal Assesment   (Marks 10)

PAPER M 604   Inorganic Chemistry   (Total marks 75)

Unit 6.10   Spectra of coordination compounds   (Marks 25)

Free ion terms and their splitting in octahedral symmetry, Orgel diagram, Laporte selection rule, vibrionic coupling and colour of complexes, Electronic spectra of $M(H_2O)_6^{n+}$ complex ions.

Principles of colorimetric determination of metals, Thermodynamic stability, Stepwise formation constants, the chelate effect, kinetic lability and inertness, Mechanism of ligand displacement reactions in octahedral and square planar complexes, Determination of composition of ionic compounds by conductometry, Theory of redox and complexometric titrations.

Unit 6.11   Bioinorganic Chemistry II   (Marks 15)

Metalloproteins and their role in photosynthesis, respiration, Nitrogen fixation (comparison with Haber's process).

Toxicity due to Metal ions (Fe, Cu, Al, Hg, Pb, Cd, As). The effect of gases and polluted environments (CO_2, CO, NO, SO_2, CN, nitrate, nitrite and phosphate)

Importance of metal salts in diet, diagnosis, chemotherapy and as medicines.

Unit 6.12   Nuclear Chemistry, Lanthanides and Actinides
(Marks 25)

Physical properties of the proton and the neutron, Structure of the nucleus, Mass defect and binding energy, Radioactive decay and equilibrium, Nuclear reaction Q value, nuclear cross sections.

Theory of radioactive disintegration, Rates of disintegration, the radiochemical series, Transmutation of elements and artificial radioactivity, Fission and fusion, Nuclear reactors and their use, Methods of measurement of radioactivity.

Isotopes of elements (discovery, atomic weights), Methods of separation of isotopes, Application of isotopes (Tracer technique, neutron activation analysis, radiocarbon dating).

Lanthanides: Electronic configuration, stability of oxidation states, Lanthanide contraction, Coordination compounds, Separation of lanthanides.

Actinides: Discovery, electronic configuration, oxidation states, magnetic properties, Comparison with lanthanides.

PAPER M 605   Practical   (**Total Marks 75**)

Physical Chemistry Experiments :

At least 10 experiments are to be performed from the list of experiments given below:

1. To determine the cooefficient of viscocity of a given liquid by Ostwald viscometer.

2. To determine the composition of a given mixture by viscosity method.

3. To determine the surface tension of a liquid by stalagmometer.

4. To determine the composition of a given mixture by surface tension method.

5. To determine the mutual solubility curve of phenol and water.

6. To determine the molecular mass of a volatile liquid by Victor Meyer's method

7. To determine the specific rotation of an optically active substance by polarometric method.

8. To determine the specific reaction rate of hydrolysis of methylacetate catalyzed by hydrogen

     ions at room temperature

9. To find the rate of decomposition of H_2O_2 catalyzed by Fe^{3+} ions.

10. To test the validity of Beer-Lambert's law using colorimeter.

11. To study the rate of acid catalyzed iodination of acetone.

12. To obtain Freundlich isotherm for adsorption of oxalic acid on activated charcoal.

13. To study the distribution of iodine between CCl_4 and water.

14. To prepare arsenous sulphide sol and compare the precipating power of mono, di and trivalent

     cations.

15. To verify Debye, Huckel, Onsagar equation for sodium chloride.

16. Conductometric titration HCl vs NaOH, Oxalic acid vs NaOH, Acetic acid vs NaOH.

17. Potentiometric titration HCl vs NaOH, Oxalic acid vs NaOH, Acetic acid vs NaOH.

Distribution of marks :

Theory   :   Marks   10

Presentation of results including tabulation of data ,

drawing of graphs, systematic reporting   :   Marks   25

Completion   :   Marks   10

Results   :   Marks   10

Sessional   :   Marks   10

Viva   :   Marks   10

PAPER M 606   **Project work (6 months)**   **(Total Marks 75)**

Investigation of a particular assignment given to individual student. Different project to be given to each student.

Distribution of marks:

1. Internal to be given by a Board of examiners which will include all the teachers of the Department.   25 marks

2. External   25 marks

3. Presentation of the project by the student (external + Board of examiners) 15 marks

4. Internal (to be given by the supervisor only)   10 marks

TDC (GENERAL) COURSE

First Year

PAPER E 101   GENERAL CHEMISTRY   (Total Marks   75)

Unit 1.1   Structure of matter   (Marks 20)

Origin of quantum theory – Black body radiation , Photoelectric effect – quantization of energy. Calculations based on Bohr's theory of H-atom – atomic spectra of hydrogen. Qualitative treatment of dual nature of matter (de Broglie equation), Heisenberg's uncertainty principle, Schrodinger's time independent equation, physical interpretation of the wave function. Solution of Schrodinger equation for the electron of H-atom (qualitative idea only), quantum numbers, orbital, Radial function and angular function, plots of radial function (qualitative idea only), effective nuclear charge, energy of the orbitals. Electron spin and spin quantum number.

Many electron atoms – electronic configuration – aufbau principle, Pauli's principle, Hund's rule.

Unit 1.2   Covalent bonding   (Marks 15)

Valence bond approach : Lewis electron pair bonds (H_2, HF, O_2, N_2, CO, NO, NH_3, H_2O, H_2O_2). Shapes of molecules – principle and applications of valence shell electron pair repulsion theory (Examples : BF_3, CH_4, NH_3, H_2O, PCl_5, SF_6, XeF_4, IF_7). Hybridisation (in BeH_2, C_2H_2, C_2H_4, CH_4, BF_3, CO_3^{2-}, PCl_5, SF_6 and benzene). Resonance (in benzene, O_3, CO_3^{2-}, NO_3^-), resonance energy, delocalization in benzene.

Polar molecules – the concept of electronegativity (Pauling and Mulliken scale). Dipole moment and bond moment (CO_2, H_2O, NH_3, NF_3). Percentage ionic character of bonds (in HF, HCl, HBr).

Unit 1.3   Ionic bonding and intermolecular forces   (Marks 8)

Ion pairs and ionic bond, properties of ionic compounds, lattice energy (Example NaCl). Calculation of lattice energy and heats of formation of ionic compounds using Born-Haber cycle. Ionic radii and factors effecting ionic radius, radius ratio and structure of ionic crystals. Covalency in ionic compounds – Fajans rules. Results of polarization on melting points, boiling points and solubility.

Intermolecular forces, hydrogen bond, structure of ice.

Unit 1.4   States of matter   (Marks 22)

Postulates of kinetic theory of gases – derivation of expression for pressure from kinetic theory. Calculation of rms speed and average kinetic energy. Maxwell's distribution of molecular speeds (no derivation) – effect of temperature and molar mass of gas.

Deviation from ideal behaviour, van der Waals equation of state, critical constants and their derivation from van der Waals equation.

Heat capacities of gases, degrees of freedom, principle of equipartition of energy.

Structure of liquids, kinetic molecular model and properties of liquid. Definition and experimental measurement of vapour pressure (dynamic method), surface tension (drop number method) and viscosity (Ostwald method). Variation of these properties with temperature.

Crystal lattices, unit cells of the seven crystal systems. Density of cubic unit cell. The fcc, bcc and simple cubic systems. Closed packed structures. Imperfections in solids (introduction to Schottky and Frenkel defects)

Internal Assesment **(Marks 10)**

SEMESTER – II

PAPER 201   GENERAL CHEMISTRY   (Total Marks 75)

Unit 2.1   Hydrocarbons I   (Marks 20)

(a). Introduction to classification and nomenclature of organic compounds on the basis of

their functional groups

(b). Alkanes : Preparation (Wurtz, Kolbe, Corey-House reactions) and their properties and reactions. Homolytic bond fission. Free radical generation and reactivity. Photochlorination of alkanes.

(c). Cycloalkanes : preparation of cyclopropane, cyclobutane, cyclopentane, cyclohexane. Strain theory and stability. Reactions of cyclopropane.Conformations of cyclohexane, disubstituted cyclohexane. Free rotation of σ-bonds, rotamers of n-butane, their nomenclature and stability.

(d). Alkenes : Preparation (elimination of alkyl halides, alcohols, Wittig reaction, pyrolysis of esters). Reactions of alkenes. π-diastereomerism, stability and interconversion. Markownikov and Zaitzeff rule. Mechanism of electrophilic addition reaction.

(e). Alkynes and alkadienes : Preparation, properties, reactions of alkynes (ethyne, propyne, butyne as example). Addition reactions of alkynes with polar reagents, ozonolysis, catalytic hydrogenation (Lindlar's catalyst). Preparation of 1,3-butadiene and isoprene. 1,2- and 1,4-addition of conjugated dienes.

Unit 2.2   Hydrocarbons II   (Marks 15)

(a). Reactive intermediates: carbocations and carbanions – their shape, generation, stability and reactions

Stereochemistry : Classification – geometrical (simple examples involving alkenes,

cis-trans and *E-Z* nomenclature) optical and conformational isomers. Basic concepts of erythro and threo isomers, asymmetry, enantiomerism, diastereomerism, dissymmetry, meso structures. Chirality and prochirality. Racemization, racemic mixtures, resolution of racemic mixtures. D-L and R-S notation.

(b). Alkyl halides and 1,2-dihalides : Preparation, properties and reactions of alkyl halides. Mechanism of S_N1 and S_N2 reactions, E_1 and E_2 reactions. Effect of solvent, substrate and other factors on the mechanism. Substitution vs elimination. Conversion of alkyl halides to alcohols, ethers, amines, thioethers and thiols. Preparation and synthetic uses of Grignard reagent.

Unit 2.3 Hydrocarbons III   (Marks 8)

(a). Preparation and synthetic uses of diazomethane, ketene.

(b). Aromatic hydrocarbons : IUPAC nomenclature. Aromaticity. Preparation and reactions of benzene. Mechanism of electrophilic aromatic substitution. Activation, deactivation and directive influence of groups. Conversion of benzene to its derivatives and vice versa. Preparation and properties of naphthalene, anthracene.

Unit 2.4 Chemical Thermodynamics   (Marks 15)

Basic definitions and concepts. The zeroth law, nature of work and heat. The first law of thermodynamics – enthalpy and internal energy. Relation between C_p and C_V. Relation between P, V and T in adiabatic processes.

Thermochemistry – enthalpy of reaction, relation between H and U. Standard enthalpy changes. Hess law and Kirchhoff's law. Calculation of bond energy from thermodynamic data.

The second law of thermodynamics. Carnot cycle. Enttropy and spontaneity, calculation of entropy changes during vapourisation and fusion. Trouton's rule. Free energy, standard free energy and its significance, dependence of free energy on temperature and pressure. Free energy change and equilibrium constant. Thermodynamic criteria for chemical equilibria.

Unit 2.4 Phase Rule   (Marks 7)

Definition of phase, component and degrees of freedom. Phase rule. Phase diagram of water and sulphur systems.

Ideal and non-ideal solutions.

Principle of fractional distillation of liquid-liquid mixtures, azeotrope.

Internal Assesment   (Marks 10)

PAPER E 301 GENERAL CHEMISTRY (Total Marks 50)

Unit 3.1 Chemistry of non-transition elements I (Marks 13)

Groupwise study of physical properties, chemical reactivity of elements and their important compounds- oxides and hydroxides, oxyacids, halides, hydrides (Groups 1,15,16,17).

Periodicity : General trends in size, ionization energy, electron affinity and electronegativity, first and second row anomalies, diagonal relationships, the use of d-orbitals by third period elements, catenation and inert pair effect (in Pb and Tl).

Inorganic chains, rings and cages: Synthesis, structure and reactions of silicones, borazine and Diborane.

Unit 3.2 Chemistry of non-transition elements II (Marks 5)

Carbides and Nitrides. Interhalogen compounds, polyhalides, pseudohalogens-synhesis and structure. Noble gas compounds-synthesis, structure and bonding.

Unit 3.3 Transition elements (Marks 14)

Comparative study of elements of first transition series with emphasis on electronic configuration, relative stability of oxidation states , ionization potentials, redox potentials, reactivity.

Occurrence, principles of extraction of Cr, Mn and Ni and their important compounds (example-$KMnO_4, K_2Cr_2O_7$).

Werrner theory, types of ligands, Isomerism and IUPAC nomenclature of coordination complexes. Chelates.

Essential and trace elements useful to life and an introduction to their biological role. Toxicity due o metals and non-metals. Use of metal compounds in medicine.

Unit 3.4 Electrochemistry (Marks 13)

Galvanic cells-description and working process. Standard electrode potentials and electromotive force(emf).The Nerst equation and calculation of cell potential.Concentration cells. Relation between cells emf and equilibrium onstant. Standard and reference electrodes. Measurement of pH. Commercial applications of galvanic cells-dry cell, lead storge battery, fuel cells.

Conductance of electrolytes- specific ad molar conductance. Measurement of conductance and application of conductance measurement. Conductometric titrations. Variation of molar conductivity with concentration . Kohlrausch's law of independent migration of ions. Transport number of ions and their determination.

Internal Assesment   **(Marks 5)**

PAPER E 302   PRACTICAL   (Total Marks 50)

1. Qualitative Organic Analysis   (Marks 25)

a) Detection of N, S and halogens in organic compounds.

b) Detection of functional groups (one among the following)

-OH(alcoholic), -OH (phenolic), -CHO, C=O, -COOH, $-NO_2$, $-NH_2$, hydrocarbon.

(Students have to perform analysis of at least 5 liquid and / or solid organic samples and record the results systematically in practical note book)

2. General experiments   (Marks 10)

a. Paper chromatographic separation of cations of Group I

  b. Determination of the solubility of a salt at a given temperature.

(In the examination, any one of the above experiment will be allotted by lot)

3. Sessional examination   (Marks 10)

        (Marks to be awarded by holding an examination at the end of the session)

4. Viva - voce   (Marks 5)

<u>SEMESTER IV</u>

PAPER E 401 GENERAL CHEMISTRY (Total Marks 50)

Unit 4.1 Aliphatic and aromatic hydroxyl compounds and ethers (Marks 10)

Classification of alcohols, 1^0, 2^0, 3^0 alcohols and their distinguishing reactions. General methods of preparation, properties and general reactions of primary alcohols, glycols and glycerol. Basic concept of hydrogen bonding and their influence on properties of organic compounds. Willamson's ether synthesis and hydrolysis of ethers.

Benzyl alcohol-preparation and reaction. Synthesis and reactions of phenols. Acidity of phenols and substituted phenols. Electrophilic aromatic substitution ofphenols. Synthesis of Bakelite.

Unit 4.2 Aliphatic amines and aniline (Marks 4)

1^0, 2^0, 3^0 amines. Basicity of amines. Preparation , properties and reactions of 1^0 amines. Synthesis, properties and reactions of aniline. Basicity of aniline and substituted aniline. Electrophilic aromatic substitution. Diazonium ions and their synthetic utility.

Unit 4.3 Aliphatic and aromatic carbonyl compounds (Marks 5)

General methods of preparation and reactions of carbonyl compounds(formaldehyde, acetaldehyde, acetone and 2-butanone as example). Difference in reactivity of aldehyde and ketones. Polarization of carbonyl group. Nucleophilic addition of aldehydes and ketons, mechanism with examples. Preparation and reactions of benzaldehyde and acetophenone.

Unit 4.4 Aliphatic and aromatic carboxylic acids (Marks 4)

Acidity of carboxylic acids, and substituted carboxylic acids. General methods of preparation , properties and reactions of aliphatic carboxylic acid(methanoic ethanoic and propanioc acid as examples)

Synthesis , properties and reactions of benzoic acid. Acidity of substituted benzoic acids. Conversion of carboxylic acids to their derivatives.

Synthetic uses of ethylacetoacetate and diethylmalonate.

Unit 4.5 Amino acids, carbohydrates, fats and oils (Marks 4)

Elementary ideas of amino acids, essential amino acids,optical activity, DL nomenclature. Synthesis and reaction of glycine. Simple methods of preparation of dipeptides.

Monosaccharides: Open chain and ring structure of glucoseand fructose. Concept of mutarotation, anomers, epimers. Reaction of glucose and fructose.

Structure, physical properties and differences of Fats, Oils and Soaps. Analysis of Fats and Oils

Unit 4.6 Chemical kinetics and surface chemistry (Marks 13)

Reaction rates and rate laws. Order and molecularity of a reaction. Differencial and integrated rate equation of first and second order reactions. Experimental determination of reaction rates and order of reaction. Consecutive reactions. Chain Reactions. Steady state approximation. Effect of temperature on reaction rate, Arhenius equation. Collision throry of reaction rate(qualitative treatment only)

Homogeneous catalysis, acid base catalysis.Physisirption and chemisorption. Freundlich and Langmuir adsorption aisotherms, their validity and significance. Heterogeneous catalysis-adsorption theory (qualitative treatment only).

Colloids-Classification, preparation and purification, structure and stability.

Surfactants-definition, micelle formation and critical micelle concentration.

Unit 4.6 Ionic equilibrium (Marks 5)

Dissociation equilibria of weak electrolytes, Ostwald's dilution law, strengths of acids and bases. Solubility products and application in analytical chemistry.pH and pH scale. Henderson-Hasselbach equation and calculation of pK values. Buffer solutions and buffer action, uses of buffer solutions in chemistry and biology.

Internal Assesment (Marks 5)

PAPER E 402 PRACTICAL (Marks 50)

1. Qualitative Inorganic Analysis   (Marks 15)

Identification of not more than 3 radicals in a mixture of the following :

Cation : Hg^{2+}, Pb^{2+}, Cu^{2+}, Bi^{2+}, Cd^{2+}, As^{3+}, Sb^{3+}, Sn^{2+}/Sn^{4+}, Fe^{2+}/Fe^{3+}, Cr^{3+}, Al^{3+}, Co^{2+},

Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Mg^{2+}

Anions : Cl^-, Br^-, I^-, NO^-_2, NO_3^-, S^{2-}, SO_4^-, F^-, BO_3^{3-}, PO_4^{3-}, AsO_4^{3-}

(Presence of Na^+, K^+, NH_4^+ and CO_3^{2-} radicals are to be ignored and not to be reported)

(At least 4 salt mixtures have to be done by each student in practical class keeping records

carefully. Distribution of marks : Result 5x3=15 marks)

2. Quantitative Inorganic Analysis   (Marks 20)

Estimation by volumetric method of any one of the following :

a. Fe (II)- By standard $KMnO_4$ solution

b. Fe (III) – By standard $K_2Cr_2O_7$ solution

c. Cu (II) – By Iodometric method.

(Standardization will have to be done by each student and will be required to be reported.)

(Distribution of Marks : Preparation of standard solution -3 marks, Standardization/ Reduction -4 marks, Completion of experiment -5 marks, and Result-8 marks)

3. Sessional examination   (Marks 10)

(Marks to be awarded by holding an examination at the end of the session)

4. Viva - voce   (Marks 5)

SEMESTER V

PAPER E 501   GENERAL CHEMISTRY   (Total Marks 100)

Unit 5.1 Chemistry of materials   (Marks 15)

Electrical properties of solids : Band theory (from MO theory), conductors, insulators and semi-conductors. Intrinsic and extrinsic semiconductors (examples from chemical compounds and explanation of electrical property from band theory). Superconductivity and examples of superconducting materials, Ferroelectric and Piezoelectric materials, Preparation of electronic grade pure silicon.

Magnetic properties of solids : Ferro and antiferro magnetism (examples from chemical compounds).

Applications of clays, geolites, ceramics, glass and liquid crystals.

Unit 5.2 Principles of chemical analysis   (Marks 15)

Principles of separation and identification of a mixture of cations and anions (qualitative

analysis), Application of solubility product and Common ion effect in chemical analysis.

Principles of estimation of metals quantitatively by complexometric methods, Principle of acid-base titration, Theory of indicators.

Principle and application of solvent extraction. Basic principles of chromatography, nature of adsorbent, solvent system; R_f values. Different types of chromatographic methods and their applications.

Unit 5.3 Principles and applications of spectroscopy-1 (Marks 20)

The nature of electromagnetic radiation, the regions of electromagnetic spectrum, the energy tionlevels of hydrogen atom (from Bohr's theory), the line spectrum of hydrogen.

Electronic spectroscopy : The Beer-Lambert law, Molar adsorption co-efficient and absorbance, the selection rules for electronic transition, the influence of vibrations in molecular spectra, Re-emission of energy by excited molecules (fluorescence and phosphorescence).

Structural elucidation by UV-Visible spectroscopy, Colour and electronic transitions. Quantitative estimation by Colorimetric method.

Vibrational Spectroscopiy : Introduction to vibrational energy levels in diatomic molecules, Fundamental vibrational modes of water molecule.

Conditions of Infrared and Raman activity in molecules, simple examples of structure elucidation by Infrared and Raman spectroscopy.

Unit 5.4 Principles and applications of spectroscopy-2 (Marks 15)

Basic principles of Mass Spectroscopy, Application of Mass Spectroscopy in structure elucidation of simple organic compounds.

Basic principles of Nuclear Magnetic Resonance (NMR) spectroscopy, representation of NMR spectra. Approximate Chemical Shifts of simple organic molecules and functional groups.

Unit 5.5 Nuclear chemistry (Marks 15)

Nuclear charge, isotopes and isobars, nuclear compositions, structure and properties (size, mass, binding energy and shape). Nuclear reactions –Radioactivity, rates of radioactive decay. Artificial radioactivity. Nuclear fission and fusion. Nuclear reactors.

Applications of Radioactivity; Radioisotopes and their uses, Radiocarbon dating, Nuclear medicines. Environmental hazard due to nuclear radiation.

Unit 5.6 Lanthanides and actinides (Marks 10)

Chemistry of Lanthanide and Actinide elements : Electronic configuration, oxidation states, properties, reactions and uses.

Internal Assessment   (Marks 10)

PAPER E 502   PRACTICAL   (Total Marks 100)

1. Physical Practical (any one of the following)   **(Marks 40)**

   (a). To study the distribution of iodine between two immiscible solvents at room

   temperature.

   (b). To determine the water of crystallization in ferrous sulphate by titration with 0.1 N

   $KMnO_4$ solution.

   (c). To determine the water of crystallization in hydrated salt by ignition and weighing.

   (d). To determine coefficient of viscosity of a given liquid by Ostwald's viscometer.

   (e). To study the CST of phenol-water system.

   Distribution of Marks : Theory - 10, Reporting & Results – 20, Completion – 10.

2. Preparation of Organic compounds   **(Marks 35)**

   (a). Tribromoaniline from aniline

   (b). Tribromophenol from phenol

   (c). *m*-dinitrobenzene from nitrobenzene

   (d). Benzil from benzoin

   (e). Phthalic anhydride from phthalic acid

   (f). Iodoform from acetone

   (g). Osazone from glucose

Distribution of Marks : Yield & Quality - 20, Recrystallisation & melting point – 5, Completion – 10.

3. Sessional   **(Marks 10)**

4. Viva   **(Marks 15)**

SEMESTER VI

PAPER E 601   GENERAL CHEMISTRY   (Total Marks 100)

[INDUSTRIAL, ENVIRONMENTAL AND BIOLOGICAL CHEMISTRY]

Unit 6.1 Industrial Chemistry – Inorganic   (Marks 20)

Water : Modern methods of water treatment and purification.

Fertilisers : Different types of N and P fertilizers, manufacture of ammonia, ammonium nitrate, urea phosphates and superphosphates. Nitrogen fixation by plants.

Glass : Various types of glass fibers, optical glass, glazing and vitrification, glass ceramics.

Cement : Various types of cement, their composition and manufacture. Portland cement, setting of cement.

Paints : Constituents of different paints, Role of binder and solvent, Lead and Zinc containing paints. Paints of common use.

Metals and Alloys : General procedure of extraction of metals. Manufacture, properties, composition and uses of important alloys. Manufacture of steel and stainless steel. Galvanisation, rusting and corrosion.

Unit 6.2 Industrial Chemistry – Organic   (Marks 20)

Polymers : Types of polymers and polymerization process. Manufacture, structure, properties and applications of –

    a. Synthetic rubber (including principle of cross-linking and vulcanization)

    b. Synthetic fibers

    c. Plastics

    d. Foaming agents

    e. Resins

    f. Silicones

Coal : Fisher-Tropsch process. Chemicals from coal.

Petroleum : Manufacture and industrial reactions of ethane, propane, butadiene, acetylene and xylene. Synthesis of methanol from natural gas. Cracking of petroleum,

knocking and octane number. Synthetic petrol, LPG and CNG. Biodiesel.

Oils, Fats and Detergents : Catalytic hydrogenation of vegetable oil and fat for production of soap, synthesis of detergents. Principles of cleansing action.

Enzymes in industries : Production of alcohol by fermentation of starch and sugar (reaction conditions, nature of enzymes used, structural transformation during reaction). Preparation and use of cellulose.

Unit 6.3 Environmental Chemistry   (Marks 20)

Composition of the atmosphere. Photochemical reactions in the atmosphere. Vehicle exhausts and photochemical smog, Acid rain, Carbon monoxide and its effects, Suspended particulate matter – size and effects on health. Dual role of ozone in the atmosphere – tropospheric ozone and stratospheric ozone, ozone hole. Carbondioxide and other gases responsible for global warming. Measures to control air pollution.

Quality of water for drinking and other purposes. Permissible limits. Common water pollutants – organic and inorganic. Heavy metals and their toxic effects. Pollution of water through use of chemical fertilizers. Fluoride contamination and fluorosis. Pollution due to mining. Measures taken to control water pollution.

Unit 6.4 Biological Chemistry   (Marks 15)

The cell and its components, the structure of cell membrane, transport of ions and molecules across the membrane. Transport of ions and molecules across the membrane.

Molecular structure and function of amino acids, peptides, polypeptides, conformations of proteins, primary, secondary, tertiary and quaternary structure of proteins.

Structure of purines and pyrimidines, base pairing hydrogen bonds, nucleosides and nucleotides. The double helical structure of DNA and structure of RNA. Basic ideas of gene and heredity. The genetic code and genetic mutation. Biosynthesis of DNA (replication), RNA (transportation) and protein (translation).

Enzymes and their role (with a few examples). Catalysis by enzymes, Lock-key hypothesis. Specificity of enzyme action, inhibition and denaturation.

Vitamins and their importance, Coenzymes, examples of various vitamins and coenzymes. Basic idea of nutrition.

Transformation of energy by cells : elementary idea of chemical reactions involved in glycolysis and Kreb's cycle, photosynthesis and respiration, oxidative phosphorylation.

UNIT 6.5 Natural products and medicines   (Marks 15)

Terpenes : Classification, structure and isolation.

Alkaloids : Classification, structure and isolation. Physiological action of alkaloids.

Steroids and Hormones : Elementary introduction, structure functions of hormones, neutrotransmitters.

Medicines : Structure and uses of aspirin, quinine, penicillin, tetracycline. Sulpha drugs and the mechanism of their action. Cancer and anti-cancer drugs.

Internal Assesment   **(Marks 10)**

PAPER E 602   Practical   (Total Marks 100)

    1. Physical Practical (any one of the following)   **(Marks 40)**

(a). To determine the hardness of water by complexometric titration.

(b). To determine the equivalent mass of carboxylic acid titrimetrically.

(c). To study the kinetics of the reaction between $S_2O_3^{2-}$ and HCl (initial rate method).

(d). To study the kinetics of acid catalysed hydrolysis of ester (titrimetry).

(e). Conductometric titration between strong acid and strong base.

(Distribution of Marks :   Theory - 10, Reporting & Results – 20, Completion – 10.)

    2. Preparation of Inorganic compounds   (Marks 35)

       Double salt (chrome alum, Mohr's salt) and Complex (potassium trioxalatoferrate (III),

       potassium trioxalatochromate(III))

(Distribution of Marks : Yield & Quality - 20, Qualitative test – 5, Completion – 10.)

    3. Sessional   (Marks 10)

    4. Viva   (Marks 15)

SYLLABUS : EDUCATION
THREE YEAR DEGREE COURSE (TDC)
MAJOR AND GENERAL
SEMESTER SYSTEM (Credit Based)
EFFECTIVE FROM 2011 – 2012
GAUHATI UNIVERSITY

COURSE STRUCTURE
TDC SYLLABUS FOR EDUCATION
(General Course)
W.E.F. August, 2011

Year	Semester	Paper	Title of the Paper	Marks	Class per Week	Credit
1stYear	1st Semester	1.01	Foundation of Educational Theories and Principles	75	6	6
	2nd Semester	2.01	Educational Psychology	75	6	6
2nd Year	3rd Semester	3.01	Development of Education in India	100	8	8
	4th Semester	4.01	Sociological Foundations of Education	100	8	8
3rd Year	5th Semester	5.01	Emerging Issues and Education	100	8	8
		5.02	Educational Measurement and Educational Statistics	100	8	8
	6th Semester	6.01	Educational Technology	100	8	8
		6.02	Environmental and Population Education	100	8	8
Total	6	8		750		60

Foundation of Educational
Theories and Principles
Paper: 1.01 (Credits-6)
(General Course)

Objectives :
1) To be acquainted with scientific and sound principles and theories of education.
2) To understand the concept, nature and scope of education.
3) To gain knowledge about different aims of education.
4) To be familiarized with different dimensions of Education such as the learner, the teacher and the curriculum.
5) To acquire knowledge about the concept of discipline and freedom.
6) To expose the students to modern trends of education – particularly value education.

Unit: 1: Meaning, Concept and Scope of Education
- Meaning of Education
- Definition of Education
- Nature of education-Education as a process and product
- Scope of Education

Unit-2: Aims and Objective of Education
- Importance of Aims of Education Determinants of aims
- Individual and Social aim of Education
- Cultural and Vocational aim,
- Democratic aims

Unit: 3: Forms of Education
- Formal Education: School- Functions and responsibility of School, relation ship between school and society.
- Informal education: Educational role of family, Social institution-religious institutions, state.
- Non formal Education –Distance and open education.

Unit: 4: Dimensions of education
- The Learner–Its innate endowment and environment, Learner-Centered Education
- The teacher-Qualities and responsibilities
- The Curriculum-Meaning and concept, Need and importance, Principles of curriculum construction, Co-curricular activities-definition, types and importance

Unit: 5: Discipline and freedom –
- Meaning, concept and need of discipline,
- Discipline and order,
- free-discipline,
- Maintenance of school discipline-problems and means.

Unit: 6: Value education –
- Meaning of human values and their determinants
- Different Types of values
- Need and Importance of value Education
- Realization of values through Education –Role of family, school and teachers

Reference Books :
1) Safaya and Saiyda– Educational Theory and Practice
2) Ross J.S. – The Ground Work of Educational Theory.
3) Banerjee, A — Philosophy and Principles of Education, Kolkatta, B.B. Kundus and Sons.
4) Passi, B.K. and Singh, P — Value Education, Agra, H.P. Bhargava Book House.
5) Âõ1n¸»± ûîÂÏò – ¿úŽÂ±îÂQ, &»±ýÃÃ±éÂÏ ùûþ±äÇ¼
6) öÂ±á»îÂÏ, ¿òùÏ÷± Õ±1n¸ üýÃÃËû±áÏüßÁù Ð òîÅÂò ¿úŽÂ±îÂQ¼

Educational Psychology
Paper: 2.01 (Credits-6)
(General Course)

Objectives :
1) To enable the students to understand the relation between education and psychology and different methods of educational psychology.
2) To enable the students to understand learning process, memory, attention, instinct and emotion.
3) To acquaint the students with the concept of personality, type and trait theories.
4) To understand the concept of intelligence - nature and different theories.

Unit-1: Psychology and Education
- Educational Psychology -its meaning and definitions.
- Relation between education and psychology,
- Scope of educational psychology.
- Methods of educational psychology –Introspection, observation and experimentation,
- Application of educational psychology in teaching and learning process

Unit-2: Learning
- Learning –Meaning and nature of learning,
- Theories of learning – Connectionism-trial and error & Laws of Learning, Conditioning – classical conditioning and operant conditioning, Gestalt theory-learning by insight,
- Motivation and learning

Unit-3: Memory and Attention and Interest
- Meaning and types of memory,
- Marks of good memory,
- Economic methods of memorization,
- Forgetting and its causes
- Attention-meaning and concept, types and determinants ,
- Interest –meaning and conditions.
- Educational implication of attention and interest.

Unit-4:- Instinct and emotion
- Instinct –Meaning, concept, modification of instinct,
- Emotion –meaning and concept,
- Place of instinct and emotion in education

Unit-5: Personality,
- Meaning of personality
- Type and trait theories –type theory -Seldon and Jung
- Trait theory-Adler

Unit-6; Intelligence
- Meaning of Intelligence , concept, definition, nature,
- Theories- two factors theory, Multifactor theory, Group factors theory.

Reference Books :
1) Skinner, Charles E. – Educational Psychology
2) Hunt, M.P. – Psychological Foundations of Education.
3) Whittakar – Introduction to Psychology.
4) Safaya, R.N, Shukla, C.S and Bhatia, B.D. – Modern Educational Psychology
5) Âõ1n¸»±, ûîÂÏò – ¿úŽÂ± ÷Ëò±¿Âõ:±ò¼

Development of Education in India
Paper: 3.01 (Credits-8)
(General Course)

Objectives :
1) To acquaint the students with the ancient and medieval system of education in India.
2) To help the students to understand the development of education in India during the British Period.
3) To acquaint the students with the development of education in India during post independence period.
4) To acquaint the students with the development of education in Assam.

Unit- 1
- A synoptic view of ancient and medieval system of education
- A synoptic view of educational activities of christian missionaries and East India Company

Unit- 2
- Charter Act of 1813,
- Macaulay Minutes
- Bentinck's Resolution of 1835
- Woods Despatch-1854

Unit- 3
- Indian Education Commission -1882 and its impact on the subsequent development of education.
- Lord Curzon's Educational Policy-1904-Secondary and University Education.
- Growth of national consciousness and National movement and its impact in education with reference to Gokhales Bill.

Unit- 4
- Saldler Commission Report-1917- Secondary and University Education.
- Wardha scheme of education-1937.
- Sargent report-1944.

Unit--5
- Constitutional provision of Indian Education,
- Radhakrishnan Commission-1948-Aims of University education and the impact of recommendations on Aims.

Unit- 6
- Recommendations of Secondary Education Commission (Mudaliar Commission-1953) Organizations, Curriculum, Examination and impact on subsequent development.
- Recommendations of Education Commission (Kothari Commission 1964-66) Objectives and structure of Education.

Unit- 7
- National policy on education 1986–Objectives, main features,
- Revision of NPE - Ramamurti Review Committee 1990.
- Janardhana Reddy Committee 1991-92.

Unit-8
- Development of education in Assam.
- Primary Education
- Secondary Education.
- University Education.
- Women Education.

Reference Books :
1) Nurullah, S and Naik – A Students History of Education in India, Macmillian.
2) Safaya and Saiyda – Development, Planning and Problems of Indian Education, New Delhi – Dhanpat Roy and Sons.
3) Rao, K. Sudha- Educational Policies in India Analysis and Review of Promise and Performance – NUEPA 2009.
4) Âõ1n¸»±, ûîÂÏò – öÂ±1îÂ1Â ¿úŽÂ±1 ý×ÃÃ¿îÂýÃÃ±ü1 ÕñÉûþò, &»±ýÃÃ±éÂÏ ùûþ±äÇÂ¼
5) ÎðÃ»Ï, Î1íÅ – öÂ±1îÂ1Â ¿úŽÂ± ý×ÃÃ¿îÂýÃÃ±ü¼
6) Âõ1ðÃÍù, ðÃMÃÃ ÕæÃ™L± – öÂ±1îÂ1Â ¿úŽÂ± ÂðÅ1?Ï, &»±ýÃÃ±éÂÏ ùûþ±äÇÂ¼

Sociological Foundations of Education
Paper: 4.01 (Credits-8)
(General Course)

Objectives :
1) To acquaint the students with education as a social process.
2) To inculcate the knowledge of Education from the social perspective.
3) To understand education as a determinant of social change and development.
4) To develop social habits and attitudes in the students and to make them socially adjustable.

Unit: 1 Education and Sociology :
- Educational sociology-meaning, nature, scope,
- Need and importance of sociological approach in education,
- Educational sociology and Sociology of education

Unit: 2 Social group and Leadership :
- Social group—definitions characteristics and classifications,
- Social interactions and their educational implications,
- Group dynamics,
- Leadership –role of education in leadership training.

Unit: 3— Education and society :
Education--
- as a social system,
- as a socialization process,
- as a process of social progress
- as a process of social control

Unit: 4 Education and social change :
- Education and social change – its meaning and concept,
- Agencies of social change,
- Education as a factor of social change with special reference to India

Unit: 5 Social Organization-disorganization:
- Social Organization-its concept,
- Factors influencing social organization-folkways, mores and their educational implications.
- Social Disorganization-types, causes, prevention.

Unit: 6 Culture and Education :
- Culture – Meaning, definition, nature and importance.
- Education and cultural change.
- Cultural diffusion and integration

Unit: 7 Education and modernization :
- Modernization – Concept and Characteristics.
- Education and modernization

Unit: 8: Social problems relating to Education in India :
- Equalization of educational Opportunity.
- Social Education, Delinquency, Child labour, Drug abuse.

Reference Books:
- Brown, F.J. – Educational Sociology, New Delhi – Prentice Hall of India.
- Harlambos, M – Sociology, Oxford University Press.
- Ogburn, W.F. and Nemkoff – A Handbook of Sociology, New Delhi – Eurasia Publishing House.
- Mathur, S.C. — A Sociological Approach of Indian Education
- Rao, Shanker — Sociology.

Emerging Issues and Education
Paper: 5.01 (Credits-8)
(General Course)

Objectives :
1) To acquaint the learner with the emerging issues in education.
2) To develop awareness and understanding about different literacy programmes, women empowerment, Human rights, globalization, vocationalization of secondary education.
3) To develop in students basic understanding regarding students indiscipline –its causes and remedies.
4) To acquaint the students about the need and importance of national integration and International understanding and the role of education in promoting them.

Unit: 1 Universalization of primary education for national development
- Significance of universalization of primary education,
- Nature of universal literacy programme in India,
- Need and importance of literacy,
- Literacy programmes in India- ----
    -----National Adult Education Programme (NAEP),
    ----- National Literacy Mission (NLC)
    -----Total Literacy Campaign (TLC),
    ----- District Primary Education Programme (DPEP),
    ------Sarva Shiksha Abhiyan (SSA),
    ------ Right of Children to Free and Compulsory Education Act
- Problems and remedial measures

Unit: 2 Education for women's equality and empowerment:
- Problem of woman education with special reference to Assam,
    –Literacy percentage of women,
    --Inadequate nutrition and technology,
    ---Existing prejudices against women,
- Women empowerment—Meaning and objectives
- Governmental efforts for achieving quality life, equality of opportunities, and social justice in relation to women.
- Role of Education in women empowerment
- Role of NCERT in women empowerment

Unit: 3 Education and Human Rights
- Human Right-- Meaning and concept,
- Universal Declaration of Human Rights by U.N.
- Human rights and Indian Constitution
- Importance of Human Rights in National development
- Education and Human Rights- Role of educational institutions in promoting Human Rights

Unit: 4 Education for National Integration and International Understanding
- National Integration -- Meaning and concept,
- International Understanding – Meaning and concept,
- Factors of National Integration and International Understanding
- Role of education in promoting National Integration and International Understanding

Unit: 5 Globalization and Education
- Globalization – Meaning and perspective.
- Causes of Globalization ,
- Impact of Globalization in India

Unit: 6 Student Indiscipline
- Student Indiscipline Meaning
- Causes and remedies

Unit: 7 Vocationalization of Secondary Education
- Vocationalization of Secondary Education –Concept
- Importance of vocationalization of Secondary Education
- Vocationalization of Secondary Education in India – Problems and solutions.

Reference Books :
1) Prashar, M.R. – Education and Human Rights.
2) Singh, M.S. – New Trends in Education.
3) Mohanty, J – Indian Education in the Emerging Society, New Delhi – Sterling Publishers Pvt. Ltd.

Educational Measurement and Educational Statistics
Paper: 5.02 (Credits-8)
(General Course)

(Educational Measurement)

Objectives :
1) To help the students to acquire knowledge of the concept of measurement and evaluation in education.
2) To develop an understanding of different types of educational tests and their uses.
3) To acquaint the students with the characteristics of a good measuring instrument and the procedure of constructing educational and psychological tests.
4) To help the students to be acquainted with the concept and application of statistics in Education.

Unit: 1: Measurement and evaluation in education,
- Concepts of Educational measurement –Its nature, functions
- Evaluation-Its meaning, Characteristics, basic principles,
- Relationship between measurement and evaluation,
- Test ,Examination and evaluation,
- Importance of evaluation in education

Unit: 2: Measuring tools
- Measuring tools: Educational tests - essay type, objective type and semi objective type – and their classifications,
- Errors in measurement,
- Characteristics of a good test

Unit: 3 Educational Achievement Test
- Educational Achievement Test - meaning and classification,
- Construction of test,
- Teacher made tests and their classification,
- Uses of Educational Achievement test

Unit: 4: New Trends in evaluation
- Reporting Test result –cumulative Record Card,
- Grading and continuous evaluation,
- Formative and Summative evaluation

(Educational Statistics)

Unit: 5: Statistics in education and Measures of central tendency
- Meaning and need of Statistics in education and psychology, Different method of statistics
- Measures of central tendency and their uses –Mean from ungrouped data and grouped data (Long and Short method)

Unit: 6 Measures of variability
- Measures of variability –Concept
- Quartile deviations,
- Standard deviation-(grouped and ungrouped data-short method), Combined S.D

Unit: 7 - Coefficient of correlation
- Coefficient of correlation – Meaning and types,
- Rank difference method and interpretation of result

Unit: 8: Graphical presentation of data
- Graphical presentation of data - Advantages of graphical presentation of data.
- Basic principle of constructing a graph,
- Different types of graph – histogram, polygon,

Reference Books :
1) Binod, K. Sahu – Statistics in Psychology and Education, New Delhi – Kalyani Publishers.
2) Garrett, H.E. – Statistics in Psychology and Education, Mumbai – Vakils, Feffer and Simons Pvt. Ltd.
3) Mangal, S.K. – Statistics in Psychology and Education, New Delhi – Prentice Hall of India.
4) Asthana, Bipin – Measurement and Evaluation in Psychology and Education, Agra – Vinod Pustak Mandir.
5) Ebel, L. Robert and David, A Frisline – Essentials of Educational Measurement, New Delhi – Prentice Hall of India Private Limited.
6) Goswami, Marami – Measurement and Evaluation in Psychology and Education, Hyderabad, Neel Kamal Publications.
7) Îá±¦¤±÷Ï,   ÷1÷Ï   –   ¿úŽÂ±îÂ   Âó¿1÷±Âó   Õ±1n¸ ÷ÓùÉ±ûþò, Õü÷ ÂõÅBÁ ¿ëÂËÂó±¼
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Educational Technology
Paper: 6.01 (Credits-8)
(General Course)

Objectives :
1) To enable the students to understand the concept and scope and objectives of Educational Technology.
2) To acquaint the students about teaching technology, behavioural technology and instructional technology.
3) To make the students understand about communication process, teaching aids, system approach and use of computer and internet in educational technology.

Unit -1 Educational Technology
- Meaning, Nature and, scope of Educational technology
- Objectives of educational technology at macro level
- Importance of educational technology
- Types of Educational technology

Unit -2 Teaching Technology
- Meaning and nature of teaching technology
- Operation of teaching phases --- preactive, interactive and post active phases

Unit -3 Behavioural Technology
- Behavioural technology-meaning and nature.
- Micro teaching-meaning and objectives
- Different phases of micro-teaching
- Merits and demerits of micro-teaching

Unit -4 Instructional technology
- Instructional technology –meaning and nature
- Programmed instruction – meaning, nature and principles
- Types of Programmed instruction – Linear Branching, mathetics and others
- Merits and demerits of Programmed instruction

Unit -5 Communication and Interaction
- Communication, -Concept and nature
- Types of classroom communication – verbal, non-verbal
- Classroom communication its barriers and solutions

Unit -6 Teaching Aids
- Educational Technology and Teaching aids,
  --- Importance of Teaching aids,
  --- Classification of teaching aids,
  --- Principles of Selection and uses of teaching aids
- Multimedia in education - approach in education

Unit -7 System Approach
- System approach in educational technology – meaning and definition
- Procedural steps in the system approach in educational technology

Unit -8 Computer and Education
- Computer –organization and operation,
- Computer in Education,
- Different uses of computer in education,
- Advantages and disadvantages of Computer, Assisted Instruction
- Internet and education

Reference Books :
1) Kulkorni, S.S. – Introduction to Educational Technology, New Delhi – Oxford and IBH Publishers Co.
2) Das, R.C – Educational Technology, New Delhi Sterling Publishers.
3) Sharma, R.A. – Technology of Teaching, Meerut – International Publishing House.
4) Skinner, B.F. – The Technology of Teaching, New York – Appleton.
5) Barbora, R.D. & Goswami, Deepali — Educational Technology.
6) Goswami Meena, Kumari — Educational Technology
7) Îá±¦¤±÷Ï   ÷1÷Ï   –   ¦§±îÂßÁ   ÷ýÃÃù±1   ¿úŽÂ± >¶ûÅ¿M□Ã¿Âõ:±ò, Õü÷ ÂõÅßÁ ¿ëÂËÂó±¼

Environmental and Population Education
Paper: 6.02 (Credits-8)
(General Course)

(A) Environmental education

Objectives :
1) To enable the students to understand the concept scope and importance of environmental education.
2) To enable the students to understand the programmes of environmental education at different levels of education.
3) To make the students aware of environmental stressors and disaster management education.

Unit -1 Environmental education
* Meaning and definition of Environment
* Environmental Education – Concept, objective and scope.
* Importance of Environmental education.
* Relationship between man and environment- ecological perspective
* Environmental degradation- Pollution – Types – Preventive Steps

Unit -2 Environmental education at different Levels of Education
* Programme of environmental education for
  -----primary, secondary and higher levels.

Unit -3 Environmental awareness and attitude change
* Awareness and attitude change through formal education
* Role of formal and non formal education
* Role of NGO

Unit -4 Environmental stressors and Disaster Management Education
* Environmental stressors –Natural and man-made
* Disaster Management Education for coping with the environmental situations

(B)Population Education

Objectives :
1) To enable the students to understand the effect of population growth on poverty, health and hygiene.
2) To enable the students to understand the importance of population education in school levels.

Unit -5 –Concept of Population Education
* Population education : Concept, objectives and scope
* Need and importance of population education

Unit -6 – Population Growth and Population Dynamics in India –
* Distribution of population- Age, Sex, Rural-Urban
* Causes of population growth
* Consequences of population growth

Unit -7 - Population and Quality of life
* Population in relation to socio –economic development, health status, heath services, nutrition,
* Effect of population growth on natural resources and environment
* Population and literacy campaign in India

Unit -8 Population Education and school
* Scope of population education in schools,
* Teacher role in creating awareness of population problems
* Use of Mass media – (Newspapers, Radio,   T.V) and Audio-Visual Aids

Reference Books :
1) Sharma, R.A. – Environmental Education, Meerut, Surya Publication
2) Mahapatra, D – Environmental Education, Kalyani Publishers
3) Rao, D.G. – Population Education, Sterling Publishers
4) Kuppuswami B – Population Education, Asia Publishing House.

TDC SYLLABUS FOR EDUCATION : (MAJOR COURSE), G.U,

Year	Semester	Paper	Title of the Paper	Marks	Class per Week	Credit
1st Year	1st Semester	1.01	Foundation of Educational Theories and Principles	100	8	8
		1.02	Educational Psychology	100	8	8
	2nd Semester	2.01	Development of Education in India	100	8	8
		2.02	Sociological Foundations of Education	100	8	8
2nd Year	3rd Semester	3.01	Emerging Issues and Education	100	8	8
		3.02	Measurement and Evaluation in Education	100	8	8
	4th Semester	4.01	Educational Technology	100	8	8
		4.02	Environmental and Population Education	100	8	8
3rd Year	5th Semester	5.01	Philosophy of Education	75	6	6
		5.02	Educational Thinkers- Oriental and Occidental	75	6	6
		5.03	Teacher Education	75	6	6
		5.04	Teaching –Learning Method and Pedagogy	75	6	6
		5.05	Statistics in Education	75	6	6
		5.06	Practical paper	75	6	6
	6th Semester	6.01	Developmental Psychology	75	6	6
		6.02	Continuing Education and Distance Education	75	6	6
		6.03	Special Education	75	6	6
		6.04	Guidance and Counselling	75	6	6
		6.05	Educational Management and Administration	75	6	6
		6.06	Project Work	75	6	6
Total	**6**	**20**		**1700**		**136**

Foundation of Educational
Theories and Principles
Paper: M 1.01 (Credits-8)
(Major Course)

Objectives :
1) To be acquainted with 'scientific' and sound principles of education.
2) To understand the concept, nature and scope of education
3) To gain knowledge about different aims of education.
4) To be familiarized with different dimensions of education such as the learner, the teacher and the curriculum.
5) To acquire knowledge about the concept of discipline and freedom.
6) To create awareness among the students about the latest trends and current educational thoughts.

Unit: 1: Meaning, Concept and Scope of Education
- Meaning of Education
- Definition of Education
- Nature of Education-Education as a process and product
- Scope of Education

Unit-2: Functions of Education
- Functions towards the individual
- Functions towards the society

Unit-3: Aims and Objective of Education
- Importance of Aims of Education, Determinants of aims
- Individual and Social aim of Education
- Cultural and Vocational aim,
- Democratic aims
- Objectives of Education –(four fundamental objectives of education in present era)
  -----Learning to Know
  -----Learning to do
  -----Learning to live together
  -----Learning to be

Unit: 4 Forms of Education
- Formal Education: School- Meaning and characteristics, Functions and responsibility of School, relationship between school and society.
- Informal Education: Meaning and Characteristics, Educational role of family, Social institution-State, and religious agencies.
- Non formal Education – Meaning and characteristics, Agencies of Non formal Education

Unit: 5: Dimensions of Education
- The Learner–Learner-Centered Education–Meaning, Characteristics.
- The teacher-Qualities and responsibilities (General)
- The Curriculum-Meaning and concept, Need and importance, Principles of curriculum construction
- Co-curricular activities-definition, types and importance

Unit: 6: Discipline and Freedom –
- Meaning, concept and need of discipline,
- Discipline and order,
- free-discipline,
- Maintenance of school discipline-problems and means.

Unit: 7: Value education –
- Meaning of human values
- Different Types of values (moral .social and Aesthetic)
- Need and Importance of value Education
- Realization of values through Education –Role of family, Society ,School and Teachers

Unit: 8: Education for Leisure
- Education for leisure—Concept
- Significance of Education for leisure in modern society
- Types of leisure time activities –as entertainment, as recreation, as personal development
- Organization of leisure time activities at secondary levels of education

Reference Books :
1) Banerjee A.- Philosophy and Principles of Education, Kolkata, B.B. Kunda and sons
2) Purkail, B.R. – Principles and Practices of Education
3) Ross, J.S. – The Groundwork of Education of Theory.
4) Safaya, R.N. and Shaiyda, B.D. – Development of Educational Theory and Practice, New Delhi, Dhanpat Rai Publishing Co.
5) Raymont, T – Principles of Education.
6) Passi, B.K. & Singh, P. — Value Education, Agra, H.P. Bhargava Book House.
7) Âõ1n¸»±, ûîÂÏò – ¿úŽÂ±îÂQ¼

Educational Psychology
Paper: M.1.02 (Credits-8)
(Major Course)

Objectives :
1) To enable the students to understand the relation between education and psychology and different methods of educational psychology.
2) To enable the students to understand learning, process, memory, attention, instinct and emotion.
3) To acquaint the students with the concept of personality, type and trait theories.
4) To understand the concept of intelligence - nature and different theories.
5) To understand the nature of creative talent and processes and of creative individuals and the implication for indentifying and nurturing such talent.
6) To enable the students to understand the concept and process of adjustment and mental health and hygiene for promotion of mental health.

Unit-1: Psychology and Education
- Educational Psychology -its meaning and definitions.
- Relation between education and psychology,
- Scope of educational psychology.
- Methods of educational psychology –Introspection ,observation and experimentation,
- Application of educational psychology in teaching and learning process

Unit-2: Memory and Attention and Interest
- Meaning and types of memory,
- Marks of good memory,
- Economic methods of memorization,
- Forgetting and its causes
- Attention-meaning and concept, types and determinants ,
- Interest –meaning and conditions.
- Educational implication of attention and interest.

Unit-3- Instinct and Emotion
- Instinct –Meaning, concept, modification of instinct,
- Emotion –Meaning and concept, Relationship between instinct and emotion
- Place of instinct and emotion in education

Unit-4: Learning
- Learning –Meaning and nature of learning,
- Learning and maturation
- Theories of learning --- Connectionism, trial and error & Laws of learning,
  --- Conditioning –classical conditioning and operant conditioning,
  --- Gestalt theory-learning by insight,
- Motivation and learning –meaning ,type, techniques for motivation

Unit-5: Personality,
- Meaning of personality
- Type and trait theories –type theory -Seldon and Jung
- Trait theory-Adler and Rogers
- Psycho-analytic theory-Freud

Unit-6: Intelligence
- Meaning of Intelligence , concept, definition, nature,
- Development of I.Q
- Theories- two factors theory, Multifactor theory, Group factors theory,

Unit-7: Creativity
- Creativity- Meaning and nature
- Characteristics of creative person
- Relationship between Creativity and Intelligence
- Problems of creative child in education
- Role of teacher in development of creativity

Unit-8: Adjustment and Mental Health,
- Concept,-adjustments
- Mechanism adjustment-defense, escape, withdrawal, compensatory,
- Meaning and concept of Mental health and hygiene,
- Characteristics of mentally healthy person
- Principle of mental hygiene-preventive ,constructive, curative measures,
- Implication for education

Reference Books :
1) Skinner, Charles. E – Educational Psychology
2) Hunt, M.P. – Psychological Foundations of Education
3) Crow A and Crow A – Educational Psychology
4) Whittakar, J.O. – Introduction to Psychology
5) Woolfolk, Anita – Educational Psychology
6) Mangal, S.K. – Advanced Educational Psychology, New Delhi, Prentice Hall.
7) Âõ1n¸»±, ûîÂÏò – ¿úŽÂ± ÷Ëò±¿Âõ:±ò¾

Development of Education in India
Paper: 2.01 (Credits-8)
(Major Course)

Objectives :
1) To acquaint the students with the ancient and medieval system of education in India.
2) To help the students to understand the development of education in India during the British Period.
3) To acquaint the students with the development of education in India during post independence period.
4) To enable the students to understand the development of education in Assam.

Unit- 1-
8) Special features of development of institutionalized education in India-
   (a) Vedic (b) Buddhist and (c) Medieval
- A synoptic view of educational activities of East India Company and Christian Missionaries in India.

Unit-2
- Charter Act of 1813, Anglicist – Classicist controversy
- Macaulay Minutes, Bentinck's Resolution 1835
- Woods Despatch 1854

Unit-3
- Indian Education Commission (Hunter Commission)-1882 and its impact on the subsequent development of education
- Lord Curzon's Educational Policy
- Growth of national consciousness, and National movement and its impact in education with reference to Gokhales Bill 1911

Unit-4
- Essential features of the Saddler Commission Report-1917,
- Hartog committee report,
- Wardha scheme of education-1937,
- Sargent report-1944

Unit-5
- Constitutional provision of Indian Education,
- Radhakrishnan Commission-1948-Aims of University education and the impact of recommendations on Aims.

Unit-6
- Secondary Education Commission 1952-53 Its Recommendation on organizations, curriculum and examination – Impact on subsequent development.
- Education Commission 1964-66 – Recommendations on objectives and structure of education.

Unit-7
- National Policy on Education 1986 –Objectives and Main Features,
- Revision of NPE - Ramamurti Review Committee – 1990
                 - Janardhana Reddy Committee – 1991-92

Unit-8
- Development of education in Assam in the field of   – Primary Education
                                                            – Secondary Education
                                                            – University Education
                                                            – Women Education

Reference Books :
1) Altekar, A.S. – Education in Ancient India
2) Mukherjee, R.K. – Education in Ancient India
3) Zaffar – Education in Muslim Period
4) Nurullah, S and Naik, J.P. – A Students History of Education in India 1800-1973, Macmillan India Ltd.
5) Mukherjee, S.N. — Education in India Today and Tomorrow, Acharya Book Depot.
6) Ghosh, Suresh Chandra — The History of Education in Modern India (1757-1986), New Delhi, Orient Longman Ltd.
7) Âõ1n¸»±, ûîÂÏò - ö±1îÂ1Â ¿úŽÂ±1 ý×ÃÃ¿îÂýÃÃ±ü1 ÕñÉûþò, &»±ýÃÃ±éÂÏ ùûþp±äÇÂ¼
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Sociological Foundations of Education
Paper: 2.02 (Credits-6)
(Major Course)

Objectives :
1) To acquaint the students with education as a social process.
2) To inculcate the knowledge of Education from the social perspective.
3) To understand education as a determinant of social change and development.
4) To develop social habits and attitudes in the students and to make them socially adjustable.

Unit: 1 Educational sociology-concept
- Educational sociology-meaning, nature, scope,
- Need and importance of sociological approach in education,
- Educational sociology and Sociology of education

Unit: 2 Social group and Leadership
- Social group—definitions characteristics and classifications,
- Social interactions and their educational implications,
- Group dynamics,
- Leadership –role of education in leadership training.

Unit: 3— Education and society
Education--
- as a social system,
- as a socialization process,
- as a process of social progress
- as a process of social control

Unit: 4 Education and social change
- Education and social change – its meaning and concept,
- Agencies of social change,
- Education as a factor of social change with special reference to India

Unit: 5- Social Organization-disorganization:
- Social Organization-its concept,
- Factors influencing social organization educational implications of folkways and mores
- Disorganization-types, causes,
- Preventions of social disorganizations

Unit: 6 Education and Culture
- Culture – Meaning definition and nature
- Importance of Education in Culture
- Cultural change and Cultural Lag

Unit: 7-Modernization
- Modernization – Concept and Characteristics
- Modernization Vs Westernisation

Unit: 8- Social problem relating to Education in India
- Imbalance in education and Equalization of Educational Opportunity,
- Minimum Development Goal (MDG) in regard to education
- Child Labour

Reference Books :
1) Brown , F.J. – Educational Sociology, New Delhi – Prentice Hall of India
2) Harlambos, M – Sociology, Oxford University Press.
3) Ogburn, W.F. and Nemkoff, W.F. – A Handbook of Sociology, New Delhi – Eurasia Publishing House.
4) Bhushan Vidya and Sachdeva, D.R. – An Introduction to Sociology.
5) Paraluis, A.P. and Paraluis, R.I. – The Sociology of Education.
6) Mathur, S — A Sociological Approach of Indian Education.
7) Rao, Shankar — Sociology.

Emerging Issues and Education
Paper-(M) 3.01 (Credits-8)
(Major Course)

Objectives :
1) To acquaint the learner with the emerging issues in education.
2) To develop awareness and understanding about different literacy programmes, women empowerment, Human rights, globalization, vocationalization of secondary education.
3) To develop in students basic understanding regarding students indiscipline –its causes and remedies.
4) To acquaint the students about the need and importance of national integration and International understanding and the role of education in promoting them.
5) To acquaint the students with meaning, importance and means of life skill education.
6) To develop understanding about concept, importance, methods and programmmes of Peace Education.

Unit: 1 Universalization of primary education for national development
- Significance of universalization of primary education,
- Nature of universal literacy programme in India,
- Need and Importance of Literacy
- Literacy programmes in India-
  -----National Adult Education Programme (NAEP),
  ----- National Literacy Mission (NLC)
  ----- Total Literacy Campaign (TLC),
  ----- District Primary Education Programme (DPEP),
  ------Sarva Shiksha Abhiyan (SSA),
  ------Right of Children to Free and Compulsory Education Act
- Problems and remedial measures

Unit: 2 Education for women's equality and empowerment:
- Problem of women education with special reference to Assam
  -- Literacy percentage of women,
  -- Inadequate nutrition and technology,
  -- Existing prejudices against women,
- Women empowerment—Meaning and objectives
- Governmental efforts for achieving quality life, equality of opportunities and social justice in relation to women.
- Role of Education in women empowerment
- Role of NCERT in women empowerment

Unit: 3 Education and Human Right
- Human Right-- Meaning and concept,
- Universal Declaration of Human Rights by U.N.
- Human Rights and Indian constitutions
- Importance of human Rights in National development
- Child Right and Democratic Education
- Education and Human Rights- Role of educational institutions in promoting human Rights

Unit: 4 Education for National Integration and International Understanding
- National Integration - Meaning and concept,
- International Understanding – Meaning and Concept.
- Factors of National Integration and International Understanding
- Role of education in promoting National Integration and International Understanding

Unit: 5 Globalization and Education
- Globalization – Meaning and perspective
- Causes of Globalization ,
- Impact of Globalization in India

Unit: 6 Student Indiscipline and Life skill Education
- Student Indiscipline - Meaning, causes and remedies
- Life skill Education – Meaning, importance and means

Unit: 7 Vocationalization of Secondary Education
- Vocationalization of Secondary Education –Concept
- Importance of vocationalization of Secondary Education
- Vocationalization of Secondary Education in India
- Problems of Vocationalization and suggestion to solve them

Unit: 8 Education for Peace
- Education for Peace - Concept and importance
- Method and Programmes of Peace Education.

Reference Books :
1) Prashar, M.R. – Education and Human Rights
2) Singh, M.S. – New Trends in Education.
3) Mohanty, J – Indian Education in the Emerging Society, New Delhi, Sterling Publishers Pvt. Ltd.
4) Jha, Prabeen Kumar – Educating Human Rights in Psycho, Social Perspective, Agra H.P. Bhargava Book House.

Measurement and Evaluation in Education
Paper: 3.02 (Credits-8)
(Major Course)

Objectives

1) To help the students to acquire knowledge of the concept of measurement and evaluation in education.
2) To develop an understanding of different types of educational tests and their uses.
3) To acquaint the students with the characteristics of a good measuring instrument and the procedure of constructing educational and psychological tests.
4) To acquaint the students about intelligence test, personality test, aptitude, interest and attitude test, and educational achievement test.
5) To enable the students to understand about new trends in evaluation

Unit: 1: Measurement and Evaluation in Education,

- Concept of Educational Measurement –Its nature, functions
- Evaluation-Its meaning, Characteristics, basic principles,
- Relationship between measurement and evaluation,
- Test ,Examination and evaluation,
- Steps of evaluation in education,
- Importance of evaluation in education

Unit: 2: Test Construction

- General Procedure of Test Construction and standardization
- Item Analysis

Unit: 3: Measuring tools

- Different types of Tools
- Errors in measurement,
- Characteristics of a good test
- Validity, Reliability, Objectivity and Norms (Meaning, factors and method of determination types)

Unit: 4-: Intelligence Test

- Intelligence Test-- meaning
- Individual and group test of Intelligence –Binet test ,Army Alpha and Army Beta test,
- Uses of Intelligence test,

Unit: 5 -Personality Test

- Personality test meaning
- Questionnaire technique - MMPI,
- Rating scale,
- Projective tests,

Unit: 6 – Aptitude, Interest and Attitude Test

- Aptitude test- Types of Aptitude, uses of aptitude test
- Measurement of Interest- Kuder interest inventory-
- Measurement of attitude -Thurston and Likert scale

Unit: 7 - Educational Achievement Test

- Educational Achievement Test - meaning and classification,
- Construction of test Educational Achievement Test
- Different types of Educational Achievement Test
- Uses of Educational Achievement Test

Unit: 8 - New Trends in evaluation

- Normed referenced and criterion referenced test,
- Reporting Test result –cumulative record card,
- Grading and continuous evaluation,
- Formative and summative evaluation

Reference Books :

1) Freeman, F.S. – Theory and Practice of Psychological Measurement.
2) Thorndike, R.L. and Hagen, E.P. – Measurement and Evaluation in Psychology and Education, John Wiley and Sons.
3) Binod K. Sahu – Statistics in Psychology and Education, New Delhi – Kalyani Publishers.
4) Garrett, H.E. – Statistics in Psychology and Education Mumbai-Vakil, Feffer and Simons Pvt. Ltd.
5) Guildford, J.P. – Fundamental Statistics in Psychology and Education Mc Graw Hill Book Co.
6) Srivastava, A.B.L. and Sharma, K.K. – Elementary Statistics in Psychology and Education, New Delhi, Sterling Publishers Pvt. Ltd.
7) Mangal, S.K. – Statistics in Psychology and Education, New Delhi, Prentice Hall of India Pvt. Ltd.
8) Asthana, Bipin – Measurement and Evaluation in Psychology and Education Agra, Vinod Pustak Mandir
9) Anastasi, A – Psychological Testing, New York, The McMillian Co.
10) Goswami, Marami – Measurement and Evaluation in Psychology and Education, Hyderabad, Neel Kamal Publications.
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Educational Technology
Paper: 4.01 (Credits-8)
(Major Course)

Objectives
1) To enable the students to understand the concept and scope and objectives of Educational Technology.
2) To acquaint the students about teaching technology, behavioural technology and instructional technology.
3) To make the students understand about communication, process, teaching aids, system approach and use of computer and internet in educational technology.
4) To acquaint the students with innovations in Education through Educational Technology – Team Teaching, E-Learning and E-Library

Unit -1-Educational Technology
- Concept, Meaning, Nature and Scope of Educational technology
- Objectives of Educational Technology at Macro Level and Micro Level
- Importance of educational technology in conventional and distance mode of education
- Types of Educational Technology

Unit -2-Teaching Technology
- Meaning and nature of teaching technology,
- Operation of teaching – phase pre-active, interactive and post active phases

Unit -3 - Behavioural technology :
- Behavioural technology-meaning and nature
- Micro teaching-meaning and objectives
- Different phases of Micro-Teaching
- Merits and Demerits of Micro teaching

Unit -4 -Instructional technology :
- Instructional technology –meaning and nature
- Programmed Instruction – meaning, nature and principles
- Types of Programmed instruction – Linear, Branching, Mathetics and others
- Merits and demerits of programmed instruction

Unit -5 Communication and Interaction
- Communication - meaning and nature
- Types of classroom communication, verbal, non-verbal
- Classroom communication its barriers and solutions

Unit -6 Teaching Aids :
- Educational Technology and Teaching Aids.
- Importance of Teaching Aids.
- Classification of Teaching Aids.
- Principles of Selection and Use of Teaching Aids.
- Multimedia Approach in Education.

Unit -7 System Approach
- System approach in educational technology – meaning and definition.
- Procedural steps in the system approach in educational technology.
- Flow diagram

Unit -8 Computer and Education
- Computer –organization and operation,
- Computer in Education,
- Different uses of computer in education,
- Advantages and disadvantages of Computer Assisted Instruction.
- Internet and education

Unit -9 –Innovations in Education through Educational Technology
- Team Teaching, E-learning, E-Library

Reference Books:
1) Rao, Usha – Educational Technology
2) Sampath K, Pannerselvan A. Santhanam, S – Introduction to Educational Technology.
3) Sarma, A.R – Educational Technology
4) Kulkarni, S.S – Introduction to Educational Technology, New Delhi, Oxford and IBM Publishers Co.
5) Das, R.C. – Educational Technology, New Delhi, Sterling Publishers
6) Skinner, B.F – The Technology of Teaching, New York, Appleton
7) Sharma, R.A. – Technology of Teaching, Meerut, International Publishing House.
8) Barbora, R.D. & Goswami, Deepali — Educational Technology.
9) Goswami Meena, Kumari — Educational Technology
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Environmental Education and Population Education
Paper: M.4.02 (Credits-8)
(Major Course)

A) Environmental Education

Objectives :
1) To enable the students to understand the concept, scope and importance of environmental education.
2) To enable the students to understand the programmes of environmental education at different levels of education.
3) To make the students aware of environmental stressors and knowledge on disaster management education.

Unit -1 Environmental Education
- Concept and definition of environment
- Importance of Environmental Education
- Relationship between man and environment - Ecological and Psychological perspective;
- Environmental degradation- and education for sustainable development

Unit -2 Environmental education at different Levels of Education
- Programme of environmental education for
  -----primary, secondary and higher levels

Unit -3 Environmental awareness and attitude change
- Awareness and attitude change through formal education
- Role of Formal and Non-Formal education
- Role of NGO

Unit -4 Environmental stressors and Disaster Management Education
- Environmental stressors –Natural and man-made
- Disaster Management Education for coping with the environmental situations
- Environmental Education –its problems and prospects
  with special reference to Assam

(B) Population Education

Objectives :
1) To enable the students to understand the effect of population growth on poverty, health and hygiene
2) To enable the students to understand the importance of population education in school levels

Unit -5 –Concept of Population Education
- Population education: concept, Nature and scope and objectives
- Need and importance of population education

Unit -6 –Population growth and Population Dynamics in India
- Causes of population growth in India
- Consequence of population growth
- Policies and programme of government of India regarding population control

Unit -7 - Population and Quality of life
- Population in relation to socio –economic development, health status, heath services, nutrition,
- Effect of population growth on natural resources and environment

Unit -8- Population Education and Schools
- Population Education and Schools-Scope of population education in schools,
- Teacher role in creating awareness of population problems
- Method and approaches: Inquiry approach, Observation, Self study, Discussion, Assignment
- Use of mass media (Newspapers, Radio, T.V) and Audio-Visual Aids

Reference Books :
1) Sharma, R.A. – Environmental Education, Meerut – Surya Publications
2) Mahapatra, D – Environmental Education – Kalyani Publishers
3) Rao, D.G. – Population Education, Sterling Publishers
4) Kuppuswami B, Population Education, Asia Publishing House
5) Baldev, K.P. – Population Crisis in India, National

Philosophy of Education
Paper: M.5.01 (Credits-6)
(Major Course)

Objectives :
1) To make students understand how philosophical ideas have influenced educational ideas.
2) To acquaint with the relationship between philosophy and education.
3) To acquire knowledge about the three major philosophies of education — Idealism, Naturalism and Pragmatism.
4) To familarise with the Indian schools of philosophical thought — Vedic, Buddhist and Islamic thought.

Unit -1: Philosophy and education
- Meaning and definition of philosophy, its nature,
- Relationship between Education and philosophy,
- Importance of philosophy in education.

Unit -2 Western philosophy -1
- Naturalism –meaning ,characteristics ,principles,
- Education and naturalism,
- Its impact on aims, curriculum, methods of teaching, discipline and role of teacher

Unit -3 Western philosophy -2
- Idealism- meaning ,characteristics ,principles,
- Education and Idealism
- Its impact on aims, curriculum, methods of teaching, discipline and role of teacher

Unit -4 Western philosophy -3
- Pragmatism- meaning, characteristics, principles,
- Education and Pragmatism,
- Its impact on aims, curriculum, methods of teaching discipline and role of teacher

Unit -5 Indian schools of philosophy
- Vedic Philosophy
- Yoga
- Buddhist philosophy of education
  --- Educational Implications of Buddhist philosophy
- Fundamental Concepts of Isalamic thought
  --- Educational Implications of Isalamic thought

Unit – 6 - Social philosophy of education -Democracy
- Meaning and significance of Democracy
- Basic principles of Democracy
- Democracy and Education with reference to
  - aims, curriculum, discipline, Method of teaching and
  - role of teacher

Reference Books :
1) Brubachar, J.S. — Modern Philosophies of Education, Mc Graw Hill.
2) Dewey, John — Democracy and Education Free Press.
3) Rusk, R.R. — Philosophical Bases of Education
4) Sutharamu, A.S. — Philosophies of Education
5) Chatterjee, S and Dutta, D.M. — An Introduction to Indian Philosophy
6) Sarma-Mani — Educational Practices of Classical Indian Philosophies, Agra, H.P. Bhargava Book House.

Educational Thinkers - Oriental and Occidental
Paper: 5.02 (Credits-6)
(Major Course)

Objectives :
1) To enable the students to understand the philosophy of life of different educational thinkers and their contribution to present day educational thought.
2) To enable the students to learn about the views of the Western and Indian thinkers on aim, curriculum, method of teaching, discipline and role of teacher

Unit: 1- Rousseau
- Philosophy of life
- Educational philosophy and his views with special reference to aims, curriculum, Role of teacher, Method of teaching and Discipline
- Significant contribution to present day educational thought - an appraisal

Unit: 2 – John Dewey
- Philosophy of life
- Educational philosophy and his views with special reference to aims, curriculum, Role of teacher, Method of teaching and discipline
- Significant contribution to present day educational thought - an appraisal

Unit: 3 – John Henrich Pestalozzi
- Philosophy of life
- Educational philosophy and his views with special reference to aims, curriculum, Role of teacher, method of teaching and Discipline
- Significant contribution to present day educational thought - an appraisal

Unit: 4 – Mahatma Gandhi
- Philosophy of life
- Educational philosophy and his views with special reference to aims, curriculum, Role of teacher, method of teaching and Discipline
- Significant contribution to present day educational thought - an appraisal

Unit: 5 – Swami Vivekananda
- Philosophy of life
- Educational philosophy and his views with special reference to aims, curriculum, Role of teacher, method of teaching and Discipline
- Significant contribution to present day educational thought - an appraisal

Unit: 6- Rabindranath Tagore
- Philosophy of life
- Educational philosophy and his views with special reference to aims, curriculum, Role of teacher, Method of teaching and discipline
- Significant contribution to present day educational thought - an appraisal

Reference Books :
1) Mukherjee, K.K. – Some Great Educators
2) Rusk, R – Doctrines of the Great Educators, Mc Millian
3) Chaube, S.P. – Ideals of the Great Western Educators, Neelkamal Publications.
4) Goswami, M.K. — Educational thoughts and Essays, New Delhi, Asian Book Pvt. Ltd.

Teacher Education
Paper: 5.03 (Credits-6)
(Major Course)

Objectives :
1) To acquaint the learner with the concept, aims, scope and development of teacher education in India.
2) To develop understanding about the different policies and practices and quality assurance in Teacher education along with the needs and importance of in-service training programmes.
3) To acquaint the learner with skilled based and competency based teacher education.
4) To develop understanding about professional ethics and accountability of teacher.
5) To acquainted the learner with different organizations involved in teacher education.

Unit: 1: Teacher education concept and brief history in India
- Teacher education – concept ,aims ,and scope
- Objective of teacher education
- Development of teacher education in India

Unit: 2 Teacher Education for different Levels of Education
- Preparation of teachers for
    - --- Pre-primary,
    - --- Primary, and
    - --- Secondary stages (Pre-services)
- In-service training programme –its need and importance

Unit: 3: Policies and practices and Quality Assurance in teacher education
- A critical appraisal of the present system of teacher education in India-a study of the various Policies and practices in teacher education in post-independence era,
- Quality Assurance in teacher education
- Present problems of teacher education and suggestions for solution

Unit: 4 Teacher education and Educational Technology
- Skill-based and Competency based teacher education
- Interaction analysis – Flanders interaction analysis
- Simulated Social Skill Training (SSST)

Unit: 5 Teacher's Role, Professional Ethics and Accountability
- Teacher's Role –
    - --- As a facilitator of learning
    - --- In transaction of curriculum
    - --- As a link between school and society
- Role Expectations of Teacher in the Twenty first century
- Professional ethics and accountability of teacher

Unit: 6 –Organizations for Teacher Education
- District education for Education and Training(DIET),
- State Council for Educational Research and Training (SCERT),
- National Council for Educational Research and Training (NCERT),
- National Council for Teacher Education (NCTE),
- Central Institution of Educational Technology (CIET),
- National University of Educational Planning and Administration (NUEPA)
- Regional College of education in India and their functions

Reference Books :
1) Sharma, Sashi Prabha — Teacher Education, Principles, Theories and Practices, New Delhi, Kaniska Publishers.
2) Fhanders, Ned, A — Analysing Teacher Bahaviour London, Wesly Publishing Company.
3) Gurry, P — Education and the training of Teachers, London Longmans, Green and Company.
4) Mukherjee, S.N. — Education of Teachers in India Vol. I and II, New Delhi S. Chand and Company.
5) Bhargava, M. and Saikia, L. Rasul — Teacher in 21st Century-Challenges, Responsibilities, Creditability, Agra, Rakhi Prakashan.

Teaching – Learning Method and Pedagogy
Paper: 5.04 (Credits-6)
(Major Course)

Objectives :
1) To acquaint the students with the teaching learning process, the principles, maxims fundamental of teaching.
2) To develop an understanding of the various methods and devices of teaching.
3) To acquaint students with levels, strategies and models of teaching.
4) To understand about teaching effectiveness and classroom management.
5) To develop a positive attitude towards the teaching profession.

Unit: 1-- Teaching and learning process
- Teaching- meaning / concept ,nature
  - Teaching as arts and science
- Criteria of good teaching
- Relation between teaching and learning,
- Factors affecting teaching learning process.
- Principles of teaching
- Maxims of teaching,
- Fundamentals of teaching
- Taxonomy of Educational Objectives : Cognitive, Affective and Psychomotor

Unit: 2 – Teaching Methods-
- Significance of Methods of teaching
- Characteristics of good method of teaching
- Lecture, demonstration, problem solving and programme instruction
- Function of teacher as facilitator, as a counselor, as a researcher

Unit: 3-Teaching Devices-
- Narration, Explanation, Illustration and Questioning
- Drill and Review as Fixing Devices

Unit: 4—Levels and strategies of Teaching -
- Teaching Levels — strategies and models
- Teaching strategies- Meaning, nature, Types- autocratic and democratic strategies

Unit: 5 - Teaching effectiveness—
- Meaning and Characteristics of teaching effectiveness
- Classroom Management—Meaning and Strategies

Unit: 6 – Teaching Models-
- Teaching Models- Meaning, functions and types
- Model of teaching
  - Inquiry Training Model
  - Concept Attainment Model (CAM)
  - Value Analysis Model (VAM)
- Feasibility of Models of Teaching in Classroom.

Reference Books :
1) Passi, B.K. — Becoming Better Teacher, Micro Teaching Approach, Ahmedabad, Sahitya Mudranalaya
2) Singh, Amarjit — Classroom management, New Delhi, Kanishka Publishers.
3) Siddiqui, M.H. — Models of Teaching, New Delhi, APH Publishing Corporation.
4) Krishnamacharyulu, V — Classroom Dynamics, Hyderabad, Neel Kamal Publications Pvt. Ltd.
5) Khan, Sharif and Akbar, Rashid — School Teaching, New Delhi, APH Publishing Corporation.
6) Joshi, A — Models of Teaching, Agra, H.P. Bhargava Book House.
7) Joyce, Bruce and Weil, Marsha — Models of Teaching, New Delhi Prentice Hall of India.
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Statistics in Education
Paper: 5.05 (Credits-6)
(Major Course)

Objectives :
1) To enable the students to understand the basic concept of statistics.
2) To acquaint the students with different statistical procedures used in Education.
3) To give detailed knowledge about Descriptive Statistics
4) To familiarize the students about the Normal Probability Curve and its applications in Education.

Unit: 1- Statistics in education and Measures of central tendency
- Statistics- Meaning and Nature
- Need of Statistics in education and psychology,
- Different method of statistics
  -- Organization of data (frequency distribution)
- Measures of central tendency and their uses –
  ---Mean from grouped and ungrouped data (long and short method) combined mean,
  ---Median from ungrouped and grouped data,
  ---Mode

Unit: 2 Graphical presentations of data
13) Graphical presentation of data -Advantages of graphical presentation of data.
14) Basic principle of constructing a graph,
9) Different types of graph –histogram, polygon, Cumulative frequency percentage curve (Ogive)

Unit: 3-Measures of variability
- Measures of variability –Concept, Types and their uses ,merits and demerits
- Quartile deviation,
- Standard deviation-(grouped and ungrouped data-short method), Combined S.D

Unit: 4- Measures of relative position-
- Percentile,
- Percentile Rank- calculation from frequency distribution and ordered data

Unit: 5--Measures of relationship- Coefficient of correlation
- Coefficient of correlation – Meaning and types,-
- Product-moment method and interpretation of result
- Rank difference method and interpretation of result

Unit: 6 –Normal Probability Curve, Kurtosis, Skewness
- Normal distribution and Normal Probability Curve-meaning and characteristics
- Uses of Normal Probability Curve in education
- Applications of Normal Probability Curve
- Deviation from Normality-Causes and measures- Kurtosis and Skewness

Reference Books :
1) Garrett, H.E. — Statistics in Psychology and Education, Mumbai, Vakils, Feffer and Simons Pvt. Ltd.
2) Binod, K. Sahu — Statistics in Psychology and Education, New Delhi, Kalyani Publishers.
3) Mangal, S.K. — Statistics in Psychology and Education, New Delhi — Prentice Hall of India.
4) Elhance, D.N. — Fundamentals of Statistics Allahabad, Kitab Mahal.
5) Kausal, T.K. — Statistical Analysis, New Delhi, Kalyani Publishers.
6) Goswami, Marami – Measurement and Evaluation in Psychology and Education, Hyderabad, Neel Kamal Publications.
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Practical paper
Paper: 5.06 (Credits-6)
(Major Course)

Objectives :
1) To enable the students to understand the concept of experimental psychology.
2) To understand the methods of conducting various psychological experiments and tests.
3) To develop scientific attitude amongst students.

The candidates will be required to perform at least 12 laboratory experiments. Marks for practical examination will be distributed as:

A) Psychological practical without apparatus	20
B) Psychological practical with apparatus	20
C) Physiological Drawing	10
• Viva-voce	15
• Note Book	10
Total	75

A. (Psychological Practical without Apparatus)

Unit: 1— Memory- Immediate memory span

Unit: 2--Attention – Division of attention

Unit: 3—Learning -- Whole versus Part Leaning

Unit: 4 – Imagination—Ink Blot Test

Unit: 5 – Association—Free Association Test, Controlled Association test, Free Vs Controlled Association Test

Unit: 6 – Motivation – Knowledge of result on performance

Unit: 7 – Fatigue – Mental work and fatigue

Unit: 8 – Personality – Personality test for introversion and extroversion

B. (Psychological Practical with Apparatus)

Unit: 9 – Mirror Drawing Apparatus- Trial and Error learning and Bilateral transfer

Unit: 10– Punch Board Maze or other Maze -- Maze learning

Unit: 11 – Tachistoscope -- Spans of Attention, Span of Apprehension
Unit: 12 – Memory Drum-- Memorization between meaningful materials and nonsense materials

C. (Physiological Drawing)
Unit: 13 ---- Human Brain,
Unit: 14----- Receptors- Eye and Ear.
Unit: 15 ---- Effectors- Endocrine Glands

Reference Books:
1) Woods Worth R.S. and Schlosberg, H – Experimental Psychology, London, Methuen
2) Postman, L and Egan, J.P. – Experimental Psychology, Ludhiana, Harper and Row, Kalyani Publishers
3) Postman Egan – Experimental Psychology – An Introduction Ludhiana, Kalyani Publishers
4) Das, P.C. – Experiment and Measurement in Education and Psychology, Guwahati, ABD
5) Saikia, L.R. – Psychological and Statistical Experiment in Education, Guwahati
6) Meguigam, F.J. – Experimental Psychology, New Delhi, Prentice Hall of India.
7) Fox, Charles — A Text Book of Practical Psychology, New Dehli, Akansha Publishing House.
8) Nataraj, P — Manuals of Experiments in Psychology, Mysore, Srinivasa Publications.
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Developmental Psychology
Paper: 6.01 (Credits-6)
(Major Course)

Objectives :
1) To enable the students to understand the basic concepts relating to development.
2) To acquaint the students about heredity and environmental factors affecting pre-natal development
3) To enable the students to understand the development aspects during infancy and childhood.
4) To enable the students to understand the development aspects of adolescence, importance of adolescence period and problems associated with this stage.

Unit -1: Introduction to Development Psychology
- Developmental at Psychology – Concept, meaning and scope
- Method of Studying Development
- Hereditary factors — pre-natal development and its importance
- Conditions affecting pre-natal development
- Environmental factors and development

Unit -2 Developmental Aspects During Infancy
- Characteristics of Infancy
- Developmental Aspects
  — Physical Development
  — Motor Development
  — Sensory Development
  — Emotional Development
  — Speech Development
  — Cognitive Development

Unit -3 Development During Childhood
- Emotional development — common emotional patterns, emotional control.
- Social development during early childhood, influence of family and school in the process of socialization.
- Personality development — Influence of family and school on personality development.

Unit -4 Adolescence Psychology
- Need and importance of studying adolescent behaviour.
- Goals of adolescence
- Adolescence— age of transition
- Physiological growth and intellectual development during adolescence.

Unit -5 Social Development
- Social Development during Adolescence
- Influence of family and peer in their social relationships
- Social Maturity
- Factors affecting social adjustment

Unit – 6 Emotional and Personality Development
- Emotional Development during Adolescence
- Personality Development during Adolescence
- Adjustment problems and Juvenile Delinquency

Reference Books:
1) Bee, H. and Denise Boyd — The Developing Child, Pearson Education Inc. India Edition.
2) Cole, L — Psychology of Adolescence, New York, Rinchart and Winsten.
3) Goswami, G (2008) – Child Development and Child Care, Guwahati, Arun Prakashan.
4) Hurlock, E.B. — Developmental Psychology – A life span approach, Tata Mc Graw Hill Publishing Com. Ltd.
7) Thompson, G.G. — Child Psychology, Bombay, The Times of India Press (Indian reprint)
8) Hurlock, E.B — Child Development, Tata Mc. Graw Hill Publishing Com. Ltd.
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Continuing Education and Distance Education
Paper: 6.02 (Credits-6)
(Major Course)

Group –A
(Continuing Education)

Objectives :
1) To enable the students to understand the concept of continuing education and its relevance to the changing society.
2) To acquaint the students with methods and techniques of continuing education.
3) To make the students understand the development of Adult Education in India, Kinds of Adult Education Programme in India and the major problems conformating adult education.
4) To enable the students to understand the meaning, characteristics, merits and demerits of distance education and its growth in India.
5) To acquaint the students with the different forms of instructional strategies in distance education along with the distance mode of learning.

Unit: 1 -- Continuing Education
- Continuing Education- its meaning and scope
- Different aspects of continuing Education – Fundamental Education, Adult Education, Social Education and Extension Education – their meaning and nature.
- Agencies of Continuing Education.
- Role of University in adult/continuing education.
- Significance / importance of Continuing Education

Unit: 2 – Continuing Education – Methodologies
- Different methods of Continuing Education
- Role of Mass Media in Continuing Education
- Strategies and devices of Continuing Education.
- Methods of Teaching Adults.

Unit: 3 -- Adult Education
- Development of Adult Education in India
- Kinds of adult education programme in India
- Functional Literacy programme—Role of National Literacy Mission (NLM)
  Total Literacy Programme / Campaign
- Planning adult education programme in India for rural women
- Problems of Adult Education in post independent India and their solutions

Group –B
(Distance Education)

Unit: 4- Distance Education and its Development
- Distance Education-meaning, Characteristics and teaching –learning components
- Distinction Education open learning and distance education.
- Need and importance of distance education
- Structures of IGNOU's distance learning programmes
- Growth of distance education Distance teaching- learning system in India
- Distance education and the goals of equality of opportunity
- Merits and demerits of distance education

Unit: 5- Instructional Strategies in Distance Education
- Different forms of instructional materials in Distance Education
- Non print media- Radio and Television
- Information and Communication Technology (ICT) and their application in Distance Education

Unit: 6 – Distance Mode of Learning
- The content, methodology of design of student support services in distance education and their management.
- Distance Education and rural development
- Role of distance education in teacher training programme
- Role of distance Education in the promotion of women education.

Reference Books :
1) Styler, W.E. — Adult Education in India, London Oxford University Press.
2) Rogers, Alam — Teaching Adults, Sterling Publishers Pvt. Ltd.
3) Thakur, Devendra — Adult Education and Mass Literacy, New Delhi, Deep and Deep Publications.
4) Sharma, Madhulika — Distance Education, Concepts and Principles, New Delhi, Kanishka Publishers.
5) Pramji, S — Distance Education, New Delhi, Sterling Publishers Pvt. Ltd.
6) Ansari, N.A — Adult Education in India, New Delhi, S. Chand and Company Ltd.
7) Saiyadin, M.S. – Challenges in Adult Educations, New Delhi, Macmillian India Ltd.
8) Mohanty, S.B. — Life Long and Adult Education, New Delhi, Ashish Publishing House.
9) Goswami, D — Literacy and Development, Guwahati, DVS Publishers.

Special Education
Paper: 6.03 (Credits-6)
(Major Course)

Objectives :
1) To help the students to understand the meaning and importance of special education.
2) To acquaint the students with the different government policies and legislations regarding persons with disabilities
3) To familiarise the students with the different types of special children with their behavioural characteristics.
4) To enable the students to know about the different issues, education provisions and support services of special children.

Unit: 1- Special Education
- Special Education-Meaning ,scope and objectives
- Basic principles of Special Education
- Importance of Special Education
- Special Education Services
- Development of Special Education with reference to India

Unit: 2- Government policies and Programmes and Special Education
- Objectives of education for challenged children in the International year of Disabled Persons,1981 with specific reference to India
- National Policy on Education 1986
- The Integrated Education Scheme 1992 for the Mildly Challenged
- Human Rights as per the UN Standard Rules 1994
- The Persons with Disabilities (PWD) Act 1995

Unit: 3 Physically Challenged Child
- Physically Challenged Child-Definitions and types
- Psychological and Behavioural Characteristics
- Educational programmes

Unit: 4 - Mentally Retarded and Emotionally Disturbed Child
- Mentally Retarded-Definitions and types
- Psychological and Behavioural Characteristics
- Educational Programmes
- Emotionally Disturbed Child-Definitions and Types

Unit: 5 – Child with learning Disability
- Child With learning Disability-- Definitions and types
- Psychological and behavioural characteristics
- Educational programmes

Unit: 6- Educational intervention and issues in Special Education
- Nature and objectives of special schools
- Support services provided in these schools
- Concept of remedial teaching (for LD children)
- Role of school, family and community in educating exceptional child
- Teacher Education for special schools
- Concept of mainstreaming, Labeling Integrated schools, inclusive education, Deinstitutionalization

Reference Books :
1) Bhargava, M — Exceptional Children, Agra H.P. Bhargava Book House
2) Chapman, E.K. — Visually Handicapped Children and Young People, London, Routhedga and Kegan Paul.
3) Kotwal, P. — Special Education, Delhi – Authors Press.
4) Mangal, S.K. — Educating Exceptional Children – An Introduction to Special Education, New Delhi, PHI Pvt. Ltd.
5) Kar, Chintamani — Exceptional Children – Their Psychology and Education, New Delhi, Sterling Publishing Pvt. Ltd.

Guidance and Counselling
Paper: 6.04 (Credits-6)
(Major Course)

Objectives :
1) To enable the students to understand the concept, nature, scope, need and importance of guidance.
2) To enable the students to understand the meaning, purpose and functions of different types of guidance.
3) To enable the students to understand about the different types of guidance programmes and their organization.
4) To enable the students to understand the meaning, nature, objectives, need and importance, types, steps, and techniques to counselling.
5) To enable the students to understand the relationship of guidance and counseling, their problems and ways for improvement.
6) To enable the students to understand the role of school counsellor and qualities of a good counsellor

Unit: 1 – Concept of Guidance
- Guidance – Meaning, nature and scope
- Need and importance of guidance in education
- Types of guidance
- Role of the teacher in guidance

Unit: 2 - Educational Guidance
- Educational Guidance Meaning purpose and functions
- Guidance in Elementary School
- Guidance in Secondary School

Unit: 3 – Vocational Guidance
- Vocational Guidance-- Meaning purpose and functions
- Relationship between Educational Guidance and Vocational Guidance
- Career and occupational information

Unit: 4 Organization of Guidance Programme
- Principles of organization
- Group guidance
- Individual inventory
- Information orientation service
- Placement services and
- Follow up services

Unit: 5 - Counselling
- Counselling –Meaning, nature and scope
- Needs and Importance
- Different types
- Steps and Techniques
- Qualities of a good Counsellor

Unit: 6 – Guidance and Counselling
- Relationship between guidance and counselling
- Problems of guidance and counselling
- Ways to improve guidance and counselling
- Role of school counsellor in guidance programme.

Reference Books :
1) Crow, L.D.I., Crow, A — An Introduction to Guidance.
2) Bhatia, K.K. — Principles of Guidance and Counselling, Kalyani Publishers, 2009.
3) Agarwal, Rashmi — Educational Vocational Guidance and Counselling; Principles, Techniques and Programmes, Shipra Publication, 2010.
4) Charles Kiruba & Jyothsna, N.G. — Guidance and Counselling, Neelkamal, Publication Pvt. Ltd. First Edition, 2011
5) Madhukar, I — Guidance and Counselling, New Delhi, Authors Press.
6) Mc. Daniel, H.B. — Guidance in the Modern School. New York, Rinechart and Winston.
7) Traxler, A.E. and North, R.D. — Techniques of Guidance, New York, Harper and R.W.
8) Gururani, G.D — Guidance and Counselling, Educational, Vocational and Career Planning, New Delhi, Akansha Publishing House.

Educational Management and Administration
Paper: 6.05 (Credits-6)
(Major Course)

Objectives :
1) To enable the students to understand the basic concepts of management, organization and administration
2) To provide knowledge on Types, Principles and Functions of Educational Management
3) To infuse knowledge on educational supervision, institutional planning and educational administrative structure of India in general and Assam in particular.

Unit: 1- Concept of Educational Management
- Educational management-Meaning nature scope and Objectives
- Meaning of school administration and school organization
- Difference between educational management, administration and school organization
- Educational administration vs. school administration
- Characteristics of successful Educational management

Unit: 2 – Principles and Types of Educational Management
- General principles of Educational management
- Types of Educational Management-
  -- Centralized and decentralized
  -- Autocratic, Democratic and Laissez faire
  -- Participatory management

Unit: 3 Functions of Educational Management
- Functions of Educational Management
  – Planning, Organization, Directing and Controlling
- Role of Head of the institution and teacher in Management

Unit: 4 – Educational Supervision
- Supervision- meaning, nature and scope
- Inspection vs. Supervision
- Types of Supervision – academic and administrative
- Importance of Supervision

Unit: 5 –Institutional Planning
- Institutional Planning – meaning, nature and characteristics
- Types of Institutional Planning
- Steps in Institutional Planning
- Importance of Institutional Planning
- Educational planning – School Time table and co-curricular activities

Unit: 6 -Administrative structure of Education India and Assam
- Educational structure of education in the Central Government- role of MHRD
- Central –State relation in Education in India Statutory/Autonomous Organization
- Some problems of Educational Administration
- Administration of School Education in Assam

Reference Books :
1) Krishnamacharyulu, V. - School Management and System of Education, Neelkamal Publication PVT. LTD. Hyderabad
2) Sharma, R.A. — Educational Administration and Management Meerut, Surya Publication.
3) Aggarwal, J.C. — Educational Technology and Management, Agra, Vinod Pustak Mandir
4) Harold, J & Elsabree Willard, S — Elementary School Administration and Supervision, Eurasia Publishing House Pvt. Ltd.
5) Mukherji, S.N. — Administration, Planning and Finance (Theory & Practices) Acharya Book Depot, Baroda.

Project Work
Paper: 6.06 (Credits-6)
(Major Course)

Each candidate is required to complete any one project related to any area of the syllabus to be evaluated by internal and external examiners jointly through viva voce test. The project work will have to be completed according to following —

- Identification of the problem/topic
- Formulating the objectives
- Review the relevant / related literature (if any)
- Writing the hypotheses (wherever possible)
- Field identification-scope and delimitations
- Nature of information / data required — their sources
- Collection and organization of data, analysis and drawing conclusion
- Reporting

Submitted by
Prof. Lutfun Rasul Saikia
Head Department of Education
and Chairman, CCS (Under Graduate)
Gauhati University
Date : 1st February, 2011

T.D.C. PROGRAMME IN HISTORY UNDER SEMESTER SYSTEM

MAJOR COURSE

FIRST SEMESTER

Paper No.
101	Introduction to History
102	History of India (up to A. D. 300)

SECOND SEMESTER

203	History of India (300-1200 A. D.)
204	History of Ancient Civilizations of the World

THIRD SEMESTER

305	India under the Turko-Afghans
306	History of Assam (5th Century A. D. to 1228)

FOURTH SEMESTER

407	India Under the Mughals
408	History of Europe (1453-1789)

FIFTH SEMESTER

509	India under the East India Company
510	History of Assam (1228-1826)
511	History of Europe (1789-1870)
512	History of Science and Technology in Pre-Colonial India
513	History of Great Britain (1485-1820)
514	History of China (1839-1949)

SIXTH SEMESTER

615	India under the Crown
616	History of Assam (1826-1947)
617	History of Europe (1871-1945)
618	World since 1945
619	History of Japan (1853-1941)
620	Project

T.D.C.PROGRAMME IN HISTORY UNDER SEMESTER SYSTEM

GENERAL COURSE

FIRST SEMESTER

1.1 Early India up to 1200 A.D.

SECOND SEMESTER

2.2 Early Assam up to 1228 A. D.

THIRD SEMESTER

3.3 History of India (1206-1526)
3.4 History of Assam (1228-1826)

FOURTH SEMESTER

4.5 History of India (1526-1757)
4.6 History of Europe (1453-1815)

FIFTH SEMESTER

5.7 History of India (1757-1857)
5.8 History of Europe (1815-1945)

SIXTH SEMESTER

6.9   History of India (1857-1947)
6.10 History of Assam (1826-1947)

GUIDELINES OF SYLLABUS FOR TDC IN HISTORY UNDER SEMESTER SYSTEM

1. The Under-Graduate course in History is of six semesters covering three calendar years.

2. There are a total of 20 courses in Major and 10 courses in General in the six semesters. The 1st, 2nd, 3rd & 4th Semester courses of Major are of 100 marks, 5th & 6th Semester courses are of 75 marks [Total marks: 1700 (100 X8) =800 + (75X 12) =900] In General course ,1st & 2nd Semester courses are of 75 marks each, 3rd & 4th semester courses of 50 marks each and 5th & 6th semester courses of 100 marks each.

3. There will be continuous assessment of students throughout the semester. The evaluation of the performance of the students will be based on both internal and external examinations. The internal examination will cover 20% of the marks and the remaining 80% will be covered by the external examination.

4. There are 8 credits per course of 100 marks each, 6 credits for 75 marks each and 4 credits for 50 marks each.

5. Each course of 100 & 75& 50 marks will have 2 & 1& 1 credit respectively, earmarked for internal assessment and the remaining credits for external examination.

6. The **internal assessment** of each course, of Major & General, of 100/75/50 (other than the Academic Project mentioned below) will be evaluated on the basis of the following components:

Unit Test:
- There will be two unit tests of 12 /10/10 marks each. The average of the two will be counted.

Assignment:
- There will be a Home Assignment of 8 /5 marks.

In courses of 50 marks each students shall be assessed on the basis of unit test only, and there shall be no home assignment

The answer scripts and marks will be submitted to the Head of the Department of History of the concerned college for onward transmission to the University.

7. As per the UGC guidelines, a minimum of 75% attendance is required for appearing in any semester examination.

ACADEMIC PROJECT

- The subject matter of the Project/ Projects will be selected by the Department of the respective colleges

- The themes could be of national, regional or local interest relating to the discipline of History

- The Project Report must be between 4000 and 5000 words

- The Report should be neatly typed in double space and in A-4 size paper , 12 font, Times New

Roman

- The students must be informed about the themes of the Project by the beginning of the Sixth semester.

- The Report should include names of reference books and other sources consulted.

- It must be submitted on a date to be fixed by the Department of the respective colleges.

- The component of the Internal Evaluation will include **10** (ten) marks for presentation of the Report and **5** marks for a *viva-voce* examination.

- The *viva voce* examination will be conducted by a Board of at least 3 members. Members of the Board will comprise of the teachers of the Department of the college and may include teachers from the History faculty of other colleges.

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MAJOR COURSE

PAPER-101

Marks-100 (80+20)
Credit- 8 (6 + 2)

INTRODUCTION TO HISTORY

Unit I: Meaning and scope of History:
   i) Collection and selection of data
   ii) Objectivity in History

Unit II: Categorization of History:

   i) Economic
   ii) Social
   iii) Political
   iv) Literary
   v) Intellectual
   vi) Diplomatic
   vii) Universal
   viii) Legal

Unit-III: History and other Disciplines
   i) Archaeology
   ii) Geography
   iii) Sociology
   iv) Economics
   v) Political Science
   vi) Philosophy
   vii)Literature

Unit IV: Traditions of Historical writing:
   i) Greco- Roman Traditions
   ii) Chinese Tradition
   iii) Early Indian Historiography
   iv) Medieval Indian Historiography
   v) Modern Indian Historiography

Reading list:

Sheikh Ali, *History: Its Theory and Methods*

E. Sreedharan, *A Textbook of Historiography 500B BC to AD 2000,*

N.Subramaniam, *Historiography*

E.H.Carr, *What is History?*

<u>**PAPER 102**</u>

Marks-100 (80+20)
Credit- 8 (6+2)

HISTORY OF INDIA (UPTO A.D.300)

Unit-I: Introduction:
    i) Geographical background
    ii) Survey of sources- Literature, Archaeology, Epigraphy, and Numismatics
Pre-History Phases:
    i) Paleolithic, ii) Mesolithic, iii) Neolithic

Unit II: Proto-History: Harappan Culture
    Vedic Culture: i)   Polity
                      ii) Society
                      iii) Economy
                      vi) Religion

Unit III: State formation in 6th century B.C.: Janapadas and Mahajanapadas
           Rise of new religious movements in Northern India: Buddhism
                 and Jainism   I
       Mauryan Empire -- Economy, Society and Religion,and Art.

Unit IV: Post-Mauryan Invasions and their impact

    i) Bactrian Greeks, Scytho-Parthians, Kushanas
    ii)Economic development-Land grants, Urban growth, Crafts, Trade and Trade routes,
    Coins and Currency, Indo-Roman Trade.
    Sangam Age: Literature, Society, Economy

<u>**Reading List**</u>:

R.Thapar   *Early India*

R.S.Tripathi   : *History of Ancient India*

A.L.Basham   : *The Wonder that was India*

D.D.S.Kosambi   : *The Culture and Civilization of Ancient India in Historical Outline*

H.C.Roychoudhury   : *Political History of Ancient India*

N. Shastri   : *A History of South India*

R.Thapar   : *A History of India, Vol. I*
K. A N.Shastri   : *A Comprehensive History of India Vol. II*

R.K.Mookherjee   : *The Gupta Empire*

R.C.Mazumder (ed)   : *The History and Culture of the Indian People Volumes I-IV*

PAPER 203

Marks-100 (80+20)
Credit- 8 (6+2)

HISTORY OF INDIA (300 AD -1200 A.D.)

Unit I: Age of the Guptas:
    i) Emergence and consolidation of Gupta power
    ii**)** State and Administrative Institutions
    iii) Socio-Economic changes, Agrarian structure, Trade and Commerce.

    iv) Cultural developments: Art and Architecture, Literature

Unit-II: Post-Gupta period:
    i)Harshavardhana

    ii) Polity, Society, Economy

Unit-III: Rise of Regional powers:
    i) Pratiharas
    ii) Rastrakutas
    iii) Cholas

Unit-IV: Foreign Invasions:
    i) Hunas
    ii) Arabs
    iii) Ghaznavids & Ghorids

Reading List:

R.S.Tripathi   : *History of Ancient India*

A.L.Basham   : *The Wonder that was India*

D.D.Kosambi : *The Culture and Civilization of Ancient India in Historical Outline*

H.C.Roychoudhury   : *Political History of Ancient India*

N.Shastri   : *A History of South India*

R.Thapar   : *A History of India, Vol. I*

RS.Tripathi   : *History of Kanauj to the Muslim Conquest*

K. A N.Shastri   : *A Comprehensive History of India Vol. II*

R.C.Mazumdar (ed)   : *The History and Culture of the Indian People Volumes I-IV*

S. K. Altekar	: *The Rastrakutas and their Times*
K. N. Shastri	: *The Cholas*
J. C. Harle	: *Art & Architecture of the Indian Subcontinent*

PAPER 204

HISTORY OF ANCIENT CIVILIZATIONS OF THE WORLD

Unit I: Ancient Egypt:

    i)The Old Kingdom-Egyptian writing, building of Pyramids.
    ii) The Middle Kingdom-Imperial Egypt, Egyptian Art & Architecture.
    iii) The New Kingdom – Emergence and Decline.

Unit II: Ancient Mesopotamia:

i)Early Sumer,

ii)Sumerian writing,

iii)System of irrigation,

iv)City states of Sumer

v)Temples and Religion,

vi)Hammurabi's Code of Laws.

Unit III: Chinese Civilization:

i)Early dynastic; Classical literature;

ii)Confucius

iii)Han Dynasty

iv)Tang Dynasty

v)Chinese Trade

vi)Chinese Art

Unit IV: Ancient Greece:

 i) Rise of city- states;

ii)Athenian Democracy

iii)Art; Literature, Philosophy & Science

Ancient Roman:

i) Rise of City States

ii) Roman Empire

iii) Trade and Commerce

Reading list:

	: Encyclopedia Britannica of Social Sciences
C. J. H. Hayes &	
P. T. Moon	: Ancient and Medieval History (Relevant Chapters)
W. N. Weech	:History of the World
H. S. Lucus	:A Short History of Civilization
C. E. Van Sickle	:A Political and Cultural History of the Ancient World
C. E. Robinson	:A History of Rome
C. E. Robinson	:A History of Greece

Marks-100 (80+20)
Credit- 8 (6+2)

INDIA UNDER THE TURKO-AFGHANS

Unit I: Survey of sources

Unit-II :Foundation and Consolidation of the Sultanate,

    i)Causes of the success of the Turks
    ii) Expansion under the Khaljis: Conquest, Administration and Economic reforms.
    iii) Tughluqs: Muhammad-bin Tughluq and Firoze Shah Tughluq.

Unit-III: Fragmentation of the Sultanate and Rise of Provincial Kingdoms:

    i)Bahmani and Vijaynagar Kingdoms

    ii) Kingdoms of Gujrat and Bengal
    iii) Rise of Afghans: Shar Shah
Unit IV: State, Society and Economy
    i)Central and Military organization, *Iqta,*
    ii)Bhakti and Sufi movements
    iii)Agriculture, Trade and Commerce

Reading list

R.C.Mazumdar	: *The Delhi Sultanate* (Bharatiya Vidya Bhawan)
V.A.Smith	: *Oxford History of India* (Relevant Chapters)
Iswari Prasad	: *Medieval India*
K.M.Ashraf	: *Life and Conditions of the People of Hindustan (1200-1550 A.D.)*
Mohammad Habib & K.A.Nizami (ed)	: *Comprehensive History of India Vol. I-V*
J. L. Mehta	: *Advanced study in History of Medieval India Vol. I*
K.N.Choudhury	: *Trade and Civilization in the Indian Ocean*
	: *An Economic History from the Rise of Islam to 1750*
P. Jackson	: *The Delhi Sultanate*
Satish Chandra	: *Medieval India: From Sultanate to the Mughals Part I, Delhi Sultanate (1205-1526)*

HISTORY OF ASSAM (5th CENTURY A.D. TO 1228)

UNIT-I: Brief survey of sources

i) Literary sources: Indigenous, Foreign

ii) Archaeological sources: Epigraphic, Numismatic, Material remains

Unit-II: Ancient Assam: A Brief Outline
   i)   Society
   ii)   Economy
   iii)   Religion

Unit-III: Ruling Dynasties and Political institutions:

i)   Varmanas, Salastambhas, Palas

ii) Administrative system: Form of Govt., Central and Provincial administration, Judiciary,
      Sources of Revenue

Unit-IV: Post Pala Political Condition:

i) Invasions from the West: Palas of Bengal; Sultans of Bengal

ii) Emergence of petty Chieftains: Western Assam, Eastern Assam.

Reading list

K.N.Barua   : *Early History of Kamrupa*
E.A.Gait   : *A History of Assam*
P.C.Choudhury   : *The History of Civilization of the people of Assam*
S.L.Barua   : *A Comprehensive History of Assam*
H.K.Barpujari (ed) : *The Comprehensive History of Assam, Vol. I*
R.G.Basak   : *History of North-East India*
N.N.Basu   : *Social History of Kamrupa Volumes I-III*

Marks-100 (80+20)
Credit- 8 (6+2)

INDIA UNDER THE MUGHALS

Unit-I: i) Advent of the Mughals and struggle for existence
ii) Consolidation and territorial expansion: Akbar, Jahangir, Shahjahan, Aurangzeb

iii) Mughal Administration and Institutions- Administrative structure, Land-Revenue system, Mansabdary system, Zamindari and Jaigirdari systems.

Unit-II: State and Religion:
i) Religious policy of Akbar and Aurangzeb.
ii) Society and Economy
iii) Trade and commerce under the Mughals.

Unit-III: Rise of the Maratha Power under Shivaji, Administrative structure, Revenue system, Disintegration of the Maratha power

Unit-IV: Decline of the Mughal Empire and the advent of the Europeans.

Reading list

V.A.Smith	: *Oxford History of India* (Relevant Chapters)
Iswari Prasad	: *Medieval India*
Mohammad Habib & K.A.Nizami (ed)	: *Comprehensive History of India Vol.I-V*
R.C.Mazumdar	: *The Mughal Empire* (Bharatiya Vidya Bhawan)
	: *Advanced study in History of Medieval India Vol.I & II*
S.R.Sarma	: *Mughal Government and Administration*
K.N.Choudhury	: *Trade and Civilization in the Indian Ocean*
	: *An Economic History from the Rise of Islam to 1750*
J.N.Sarkar	: *Mughal Administration*
W.A.Moreland	: *Akbar to Aurangzeb*
Stuart Gordon :	*The Marathas 1600-1818*
G.S.Sardesai	: *A New History of the Marathas*
I.S.Quresi	: *The Administration of Mughal Empire*

Marks-100 (80+20)
Credit- 8 (6+2)

HISTORY OF EUROPE (1453-1789)

Unit I: Transition from Medieval to Modern Age
  i) Feudalism
  ii) Beginning of the Modern Age
  iii) Renaissance and its impact on Europe
  iv) Reformation and its impact. Martin Luther. Peace of Augsburg , Zwingli and Calvin
  v) Counter Reformation and its effects.

Unit II: i)Thirty Years War: Causes and effects.

ii) Rise of Nation-States in Western Europe.

iii)The Edict of Nantes; Henry IV; Richelieu; Mazarin's contribution

iv)France   under Louis XIV.

Unit III: i) Rise of Prussia and Austria: Frederick the Great and MariaTheresa; War of Austrian Succession, Seven Years War
ii)Enlightened despotism- Joseph II, Maria Theresa
iii)Making of Modern Russia: Peter the Great, Catherine II and Warm Water Policy,
iv)Partition of Poland

Unit IV: i) Genesis and growth of Capitalism, Imperialism, Mercantilism and World Conflict
ii) Evolution World Politics, The Maritime ascendancy of Holland and its collapse
iii) The Anglo- French struggle; triumph of British imperialism.

Reading list

Meenaxi Phukan	: *Rise of the Modern West*
C.J.H.Hayes,	: *History of Europe* (Relevant Chapters)
M.W.Baldwin and	
C.W.Cole	
H.A.L.Fisher	: *History of Europe Book II and Book III (*Relevant Chapters)
Euan Cameron (ed)	: *Early Modern Europe*: *An Oxford History*
T.C.W.Blanning (ed)	: *The Short Oxford History of Europe:* The Eighteenth Century

Marks- 75(60 + 15)
Credit- 6 (5+1)

INDIA UNDER THE EAST INDIA COMPANY

Unit-I: i) Background: Political, Social and Economic changes in mid eighteenth century

:ii) Tools of British expansion: War and diplomacy: Bengal, Mysore, Marathas, North-East Rohillas, Oudh, Central India, Sindh and Punjab, Subsidiary Alliance and Doctrine of Lapse.

Unit -II: Consolidation of British rule:
i) Administrative system-Central, Provincial, District and Judicial administrative system.
ii) Land Revenue settlements- Permanent settlement, Ryotwari settlement and Mahalwari settlement.

Unit-III: Impact of Colonial Rule on Rural Economy:
i)   Commercialization of agriculture and its effects
ii)   Decline of Cottage industries
iii)   Rural indebtedness

Unit IV: Popular resistance to Company's rule:
i) Peasant and Tribal movements
ii) Revolt of 1857: causes, nature, and results

Reading list

P.E.Roberts   : *History of British India*
Percival Spear   : *The Oxford History of India*
S.Gopal   : *British Policy in India*
R.C.Mazumdar (ed)   : *British Paramountcy and Indian Renaissance*
Sumit Sarkar   : *Modern India*
M.H.Fisher ed.   : *Politics of the British Annexation of India 1757-1857*
Ranajit Guha   : *Elementary Aspects of Peasant Insurgency in Colonial India*
                    : *Rule of Property for Bengal: An Essay on the Idea of Permanent Sattlement*

Marks- 75 (60 + 15)
Credit- 6 (5+1)

HISTORY OF ASSAM (1228-1826)

Unit I: Sources:

i) Literary sources: Indigenous, Foreign; Archaeological sources: Epigraphic, Numismatic, Material remains

ii) Political Condition of the Brahmaputra Valley at the beginning of the 13th Century-- Foundation and consolidation of Ahom Rule , The kingdom of Kamrup-Kamata, Rise and decline of the Kock kingdom

Unit-II: Mughal invasion and Ahom resistance
   i) Abu Bakr
   ii) Mir Jumla
   iii)Ram Singh

Unit III: Zenith of the Ahom Rule and Internal Dissension:
   i) Rudra Singha
   ii) Rajeswar Singha
   iii) Momarian Rebellion
   iv) Burmese invasions
   v) Dissension in Western Assam

Unit-IV: Political institutions, Society, Economy and Religion:
   i)Ahom and Koch administrative systems
   ii)Ahom Tribal Relations
   iii)Brief outline of Society, Economy and Religion:

Reading list

E.A.Gait	: *A History of Assam*
S.L.Barua	: *A Comprehensive History of Assam*
L.Devi	: *Ahom Tribal Relations*
P.Gogoi	: *The Tai and Tai Ahom Kingdoms* (Relevant Chapters)
H.K.Barpujari	: *The Comprehensive History of Assam,* Vol. II-III
R.G.Basak	: *History of North-East India*
N.N.Basu	: *Social History of Kamrupa* Volumes I-III
S.K.Bhuyan	: *Anglo-Assamese Relations*

PAPER 511

HISTORY OF EUROPE (1789-1870)

Unit I: The French Revolution
i)Crisis of the Ancient Regime
ii) Intellectual Currents,
iii)Participation of the Social Classes.

Unit II: i) Rise and Fall of Napoleon: Internal Reforms, Napoleonic Wars and Continental System, Fall of Napoleon, The Congress of Vienna

ii)The European State System after Napoleon, Concert of Europe, Revolutions of 1830 and 1848 and their repercussions

Unit III: i)Eastern Question
ii) Napoleon III : Foreign Policy

Unit IV: The Unification of Italy and Germany

Reading list

C.D.Hazan : *Europe Since 1815*
Lipson C.J.H.Hayes, : *Eurupe in the 19th Century*
M.W.Baldwin & : *History of Europe* (Relevant Chapters)
C.W.Cole
Carlton J.H.Hayes : *Contemporary Europe since 1870*
D. Thompson : *Europe since Napoleon*
H .A.L.Fisher : *History of Europe*, Book III
C.D .M.Ketelbey : *A History of Modern Times from 1789*
J.A.R.Marriott : *A History of Europe from 1815 to 1939*
T.C.W.Blanning (ed) : *The Short Oxford History of Europe: the Nineteenth Century*

PAPER 512

Marks-75(60 +15)
Credit- 6 (5+1)

HISTORY OF SCIENCE AND TECHNOLOGY IN PRE-COLONIAL INDIA

Unit I: i) Stone Age technology: Paleolithic, Mesolithic, Neolithic .
ii) Bronge Age technology, Tools, Metallurgy and crafts

Unit-II: Iron Age culture: Use of iron and its impact. Painted gray ware (PGW) and Northern Black polished ware (NBPW) cultures

Unit-III: Early developments in science and technology:' Aryabhatta, Varahmihira, Brahmagupta, Bhaskara I, Charaka.

Unit IV: Technological developments in Medieval period. Persian wheel, Agro. industries, metal technology, gun-powder, textiles, bridge-building

Reading list:

1. A. Roy and S. K. Bagchi (eds) *Technology in Ancient and Medieval India,*

2. D. P. Chattapadhya, *History of Science and technology in Ancient India,*
3. D. D. Kosambi, *An Introduction to the Study o fIndian History,*
4.RS. Sharma, *Material Culture and Social Transformation in Ancient India,*
5. Irfan Habib, *Pre-history,* People's History series,
6. T. Raychoudhury & Irfan Habib (eds) *Cambridge Economic History of Indian Vol. I. X. 1200C 1750.*

PAPER 513

Marks- 75(60 + 15)
Credit- 6 (5+1)

HISTORY OF GREAT BRITAIN (1485-1820)

Unit-I: England under the Tudors:

i)Transformation from feudalism to absolute monarchy
ii) The Renaissance and Reformation in England
iii) Colonial and Commercial development

Unit-II: England under the Stuarts:

i) Conflict between the Crown and Parliament
ii) The Establishment of the Commonwealth and Protectorate under Cromwell
iii) The Restoration of monarchy

Unit-III: Constitutional Developments:

i) Bill of Rights
ii) Act of Settlement
iii) Evolution of Cabinet system of government under the Hanoverians

U nit-IV: Industrialization and its Social impact.

Reading list
S.t.Warner,   : *The New Groundwork of British History* (Relevant Chapters)
C.H.K. Marten   : *A Shorter History of England and Great Britain*
D.E.Muir
AD. Cross   : *A Shorter History of England and Great Britain*
RMuir   : *A short History of British Commonwealth*
G.RElton   : *England under the Tudors*
G.M. Trevelyan   : *England under the Stuarts*
G.M. Trevelyan   : *English Social History*

PAPER 514

Marks-75 (60 + 15)
Credit- 6 (5+1)

HISTORY OF CHINA (1839 - 1949)

Unit-I:i) China in the 19th Century: Condition of China before the advent of the imperialist powers, Canton commercial system

ii) Opening of China: Opium Wars, treaties with the imperialist powers; struggle for concession in China , Increasing Western economic interest

Unit-II : Popular and Reform Movements:

i)Taiping; self- strengthening and reforms in the Chinese states
ii)Boxer Rebellion and its consquence

Unit-III: Emergence of Nationalism in China:
i) Revolution of 1911, Sun Yet Sen,
ii)Emergence of the Republic

Unit-IV: Growth of Communism in China:
i) Political crisis in the 1920's
ii) Communist movement of 1928-1949, Mao Tse Tung.

Reading list

H.M. Vinacke	: *A History of the Far East in Modern Times*
P.H.Clyde B.F.Beers	: *The Far East*
John Fairbank et al	: *East Asia: Traditional and Transformation*
LiChien-Mung	: The Political History of China (1840-1928)

PAPER 615

Marks-75(60 +15)
Credit- 6 (5+1)

INDIA UNDER THE CROWN

Unit-I: British administrative changes after the Revolt of 1857:
i)Act for the Better Government of India (1858)
ii)Queen's Proclamation.
Iii) Provincial administration
iv)Local Bodies
v)Changes in the Army

Unit-II: Cultural Awakening in the 19th century:
i) Spread of Western Education-Emergence of Intelligentsia, Growth of Press
ii)Social Reform Movements: Arya Samaj, Brahma Samaj, Prarthana Samaj,
Theosophical Society, Aligarh Movement, Ramakrishna Mission

Unit-III:i) Indian Nationalism: Emergence of the Indian National Congress, Moderates and Extremists, Partition of Bengal and Swadeshi Movement

ii) National Movement under Gandhi : Non-Co-Operation Movement, Growth of Revolutionary activities, Communal consciousness, Civil Disobedience Movement

Unit-IV: Towards Independence:

i) Quit India Movement

ii) Partition of India

iii) Women's participation in the Freedom Struggle

Reading list

P.E.Roberts	: *History of British India*
Percival Spear	: *The Oxford History of India*
S.Gopal	: *British Policy in India*
R.C.Mazumdar (ed)	: *British Paramountcy and Indian Renaissance*
R.C.Mazumdar	: *Struggle for Freedom*
Bipan Chandra	: *India's Struggle for Independence*
Sumit Sarkar	: *Modern India*
Bipan Chandra	: *Rise and Growth of Economic Nationalism*
A. R. Desai	: *Social Background of Indian Nationalism*

J. Krishnamurti ed.   : *Women in Colonial India. Essays of Survival, Work and the State*

PAPER 616

Marks-75(60 + 15)
Credit- 6 (5+1)

HISTORY OF ASSAM (1826-1947)

Unit I: Advent of the British
     i)   Administrative Reorganization under David Scott.
     ii)   Annexation of Lower Assam
     iii)   Anti-British uprisings (1826-1830)
     iv)   Annexation of Upper Assam
     v)   Repercussions of the Revolt of 1857.

Unit II: Territorial Expansion:
     Cachar, Manipur, Jayantia Hills, Khasi Hills, Garo Hills, Naga Hills, Lushai Hills.

Unit-III: Changes in the Economic structure:

     i)Agrarian System
     ii) Growth of modem industries- Tea, Coal and Oil
     iii) Development of Transport and Communication

Unit IV: i) Political Awakening: Education,
Press, Public Associations

     ii) National Movement in Assam-Swadeshi Movement, Non-Cooperation movement, Civil-Disobedience movement, Quit India movement,Role of women

Reading list

H.K.Barpujari	: *Assam in the Days of the Company*
H.K.Barpujari (ed)	: *Political History of Assam, Vol. I*
A.C.Bhuyan and S.Dey (ed)	: *Political History of Assam Vol. II & III*
H.K.Barpujari (ed)	: *The Comprehensive History of Assam Vol. IV & V*
P.Goswami	: *Assam in the Nineteenth Century; Industrialization and Colonial Penetration*
K.N.Dutta	: *Landmarks of the Freedom Struggle in Assam*
E.A.Gait	: *A History of Assam*

PAPER 617

Marks-75(60 + 15)
Credit- 6 (5+1)

HISTORY OF EUROPE (1871-1945)

Unit I: i) Internal developments in France: The Republican Constitution of 1875, Relations between the State and the Church

ii) Internal Developments in Germany and Italy: Kulturkamph, Economic Developments in Germany, Socialism and the German Reich, Internal Developments in Italy

Unit II: Internal problems of Russia up to 1917:

i) Revolution of 1905
iv) Revolutions of 1917

Unit III: World War I and aftermath

i) Factors responsible for the World War I

ii) Peace settlement
iii) The League of Nations: Achievements and Failures

Unit IV: World War II: Origin, Entry of U S A, Defeat of the Axis Power

Reading list

C.D.Hazen	: *Europe Since 1815*
E. Lipson :	*Europe in the 19th and 20th Centuries*
M.W.Baldwin &	: *History of Europe* (Relevant Chapters)
C.W.Cole	
C. J.H.Hayes :	*Contemporary Europe since 1870*
C.D .M.Ketelbey	: *A History of Modern Times from 1789*
J.A.R.Marriott	: *A History of Europe from 1815 to 1939*
T.C.W.Blanning (ed)	: *The short Oxford History of Europe: the Nineteenth Century*
J. Evans	: *The Foundation of a Modern State in 19th Century Europe*
James Joll	: *Origin of the First World War*
Anthony Wood	: *History of Europe 1815-1960*

PAPER 618

Marks-75(60 + 15)
Credit- 6 (5+1)

WORLD SINCE 1945

Unit I: i) UNO- Structure, Difference with the League of Nations, Peace-keeping and other activities of UNO
ii) Cold War

Unit-II: Conflict in the Middle-East:
i) Arab- Israel Conflict, Suez Crisis of 1956,
ii) Iran-Iraq war,The gulf war (1970-91)

Unit-III: China, Korean War, Vietnam.

Unit IV: Africa after Decolonization- Problems of the African states:
i) Ghana
ii) South Africa.

Reading list

W. C. Langsam   : *The World since 1919* (Relevant Chapters)
F. Lee Benns   : *Europe since1914 in its World Setting* (Relevant Chapters)
Geir Lundestad   : *East, West, North, South: Major Development in International Politics*
S. N. Dhar   : *International Relations and world Politics since 1919* (Relevant Chapters)
A. C. Roy   : *International Relations since 1919* (Relevant Chapters)
M. G. Gupta   : *Foreign Policies of Major World Powers*
Lewis Gaddis :   *The United States and the Origins of the Cold War, 1941-1947*

PAPER 619

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Marks-75 (60 + 15)
Credit- 6 (5+1)

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HISTORY OF JAPAN (1853-1941)

Unit-I: i) Tokuguwa Shogunate: End of Isolation, Commodore Perry and the Treaty of Kanagawa (1854), The Harris Treaty

Unit-II: i) Meiji Restoration: Processes of modernization, Social, Military and Economic, and Political

       ii) End of Feudalism

       iii) Meiji constitution

Unit-III: Emergence of Japan as a world power:

       i) Sino-Japanese Relations

       ii) Anglo-Japanese Alliance

       iii) Russo-Japanese war

Unit-IV: Japan between the two world wars:,

       i) Washington Conference

       ii) Rise of Militarism

       iii) Manchurian crisis and aftermath

Reading list

H.M. Vinacke	: *A History of the Far East in Modern Times*
P.H.Clyde B.F.Beers	: *The Far East*
John Fairbank et al	: *East Asia: Traditional and Transformation*
C.Yanaga,	: *Japan since Perry*

PAPER-620

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Marks-75 (60 + 15)

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PROJECT

T.D.C.PROGRAMME IN HISTORY UNDER SEMESTER SYSTEM

GENERAL COURSE

PAPER 1.1

EARLY INDIA UPTO 1200 AD

Unit-I: Ancient Civilizations

  i)   Harappan Culture
  ii)   Vedic Civilization

Unit-II: Condition of India in the 6th century B.C.:
  i)   Rise of Janapadas and Mahajanapadas
  ii)   Buddhism, Jainism .

Unit-III: Emergence of Territorial States & Foreign invasions

  i)   Greek invasion of Alexander the Great and its effects,
  ii)   The Mauryas: State & Administratioin
  iii)   Post Mauryan period: Sungas, Western Kshatrapas, Satavahanas & Kushanas
  iv)   Chieftains of the Chera, Pandyas in the Far South
  v)   The Gupta Empire and its contemporaries

Unit-IV: Rise of Regional Powers in the Post Gupta period:
  i) The Pusyabhutis & Harshavardhana
  ii) The Cholas,
  iii) The Pallavas,
  iv)TheChalukyas,

Unit-V: Post Harshavardhana Polity:
  i)North India: Gurjara- Pratiharas, Palas & Senas
  ii) Deccan: Rashtrakutas & their contemporaries
  iii) Invasions of the Arabs, Ghaznavids & Ghorids and their impact

Reading list:

R.S.Tnpathi	: History of Ancient India
R.C.Majumdar,	: An Advanced History of India
H.C.Raychoudhury	: Political History of Ancient India
M. Wheeler	: Indus Valley Civilization
D. D. Kosambi	: The Culture and Civilization of Ancient India an Historical Outline

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PAPER 2.2

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Marks-75(60+15)
Credit- 6 (5+1)

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EARLY ASSAM UPTO 1228 AD.

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Unit-I: A brief survey of the sources:
 i)Literary
ii) Archaeological

Unit-II: Ancient Assam:

i)Society

ii) Economy

iii)Religion

Unit-III: Political dynasties:
    i)Varmana
    ii)Salastambha
    iii) Pala

Unit-IV: Political Institutions:
i)Central and Provincial administration
ii) Judicial administration
iii)Revenue administration,

Unit-V: Political condition of Assam in the Post-Pala period.

<u>**Reading list**</u>

E. A.Gait   **:** A History of Assam
K. L. Baruah   : Early History of Kamrupa
P. C. Choudhury   : The History Civilization of the People of Assam
S. L. Barua   : A Comprehensive History of Assam
H. K. Barpujari   : The Comprehensive History of Assam Vol. I

Marks-50(40 + 10)
Credit- 4(3+1)

HISTORY OF INDIA (1206-1526)

Unit I: Survey of Sources

Unit-II: Foundation and consolidation of the Sultanate

Unit-III: Expansion of the Delhi Sultanate
    i)Khaljis
    ii)Tughluqs:

Unit-IV: The Rise of Provincial kingdoms:
    i)Gujrat
    ii)Bengal
    ii)Bahmani
    iii)Vijaynagar

Unit-V: State, Society and Economy:
    i)Central Military organization, Iqta
    ii) Bhakti & Sufi Movements
    iii)Agriculture, Trade and Commerce

Reading list

Ishwari Prasad	: A Short History of Muslim Rule in India
R. C.Majumdar et.al.	: An Advanced History of India
V. Smith (Revised and edited by AL Bashan et.al)	: Oxford History of India
Satish Chandra	: Medieval India: From Sultanate o the Mughals, Part-I Delhi Sultanate

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PAPER 3.4

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Marks-50(40 + 10)
Credit- 4(3 +1)

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HISTORY OF ASSAM (1228-1826 AD.)

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Unit-I: Rise of Territorial States:
 i)Foundation and consolidation of the Ahom kingdom
 ii)The kingdom of Kamrup-Kamata
 iii)Emergence of the Koch power

Unit-II: Ahom-Mughal Conflicts-
 i) Pratap Singha
 ii) Jayadhwaj Singha
 iii) Chakradhwaj Singha
 iv) Gadahar Singha

Unit-III: Zenith of the Ahom rule:

 i)Rudra Singha
 ii) Siva Singha
 iii) Rajeswar Singha

Unit-IV:Decline and downfall of the Ahoms:

 i) Moamaria uprising-factors and consequences
 ii)Burmese invasions and its repercussion

Unit-V: Political Institutions, Society and Economy:
 i)Outline of the administrative systems of the Ahom and Koch kingdoms
 ii)Society in medieval Assam
 iii)Economy medieval Assam

Reading list

E. A.Gait	**:** A History of Assam
S. L. Barua	: A Comprehensive History of Assam
H. K. Barpujari	: The Comprehensive History of Assam Vol. II
P. Gogoi	: The Tai and Tai Kingdoms (Relevant Chapters)
R. G. Basak	: History of North East India
N. N. Basu	: Social History of Kamrupa Vols I-III

Marks-50(40 + 10)
Credit- 4(3+1)

HISTORY OF INDIA (1526-1757AD.)

Unit-I: Advent of the Mughals and territorial expansion:

i) Babur,

ii) Akbar

iii) Jahangir

iv) Aurangzeb

Unit-II: Rise of the Afghans under Sher Shah Sur and his administration

Unit-III: Mughal administration:

i)Mansabdari System

ii) Central and Provincial administration

iii)Land revenue system

Unit-IV: Rise and disintegration of the Maratha power

Unit-V: Advent of the Europeans:
   i)Portuguese
   ii) Dutch
   iii) French
   iv) English

Reading list:
Ishwari Prasad   : A Short History of Muslim Rule in India
R. C.Majumdar et.al.   : An Advanced History of India
I.S.Quresi   : The Administration of Mughal Empire
J. F.Richards ed.   : New Cambridge History of India: The Mughal Empire

Marks-50(40+10)
Credit- 4(3+1)

HISTORY OF EUROPE (1453-1815)

Unit-I: Transition from medieval to Modern Age:
 i) Renaissance and its impact on Europe
 ii)Reformation and its impact-Martin Luther, Zwingli and Calvin;Counter Reformation

Unit-II: Thirty Years' War
 i)Causes
 ii)Effects

Unit-III: The French Revolution:
 i)Causes
 ii)Effects

Unit-IV: Napoleon:
 i)Rise of Napoleon
 ii)Napoleon's reforms
 iii)Continental system
 iv) Downfall of Napoleon

Unit-IV: Congress of Vienna

Reading list
C.J.H.Hayes et.al.   : History of Europe (Relevant Chapters)
C.J.H.Hayes   : Modern Europe to 1870
Meenaxi Phukan   : Rise of Modern West
H.A.L.Fisher   : history of Europe

Marks-100 (80+20)
Credit- 8 (6+2)

HISTORY OF INDIA (1757-1857)

Unit-I: Background
i)Political condition
ii)Society

Unit-II: Establishment and consolidation of the British as a political power:

i) Anglo French Rivalry
ii) Battle of Plassey
iii)Dual Government
iv) Battle of Buxar

Un!t-III: Administrative Policies and Reforms:
i) Warren Hastings: Administration
ii) Cornwallis:Permanent Settlement; Judicial Administration,
iii) Bentinck:Reforms

Unit-IV: British expansionist policies:
i) Lord Wellesley: Subsidiary Alliance
ii) Lord Hastings: Relations with Gurkhas, Sikhs, Rajputs, and Pindaris
iii) Lord Dalhousie: Doctrine of Lapse
iv)Anglo-Mysore relations
 v) Anglo-Maratha relations.

Unit-V: Revolt of 1857:
 i)Factors
 ii) Consequences

Reading list

R. C.Majumdar et.al. : An Advanced History of India
Pervical Spear   : The Oxford History of Modern India
Bipan Chandra   : India's Struggle for Independence
P. E. Roberts   : History of British India
Sumit Sarkar   : Modern India

Marks-100 (80+20)
Credit- 8 (6+2)

HISTORY OF EUROPE (1815-1939)

Unit- I:
i) Concert of Europe
ii) Revolution of 1830
iii) Revolution of 1848

Unit-II:
i) Unificatiion of Germany
ii)Unificatioin of Italy

Unit-III:
i) Formation of Triple Alliance and Triple Entente
ii) Russian Revolutions of 1917

Unit-IV:
i) Causes of the First World War
ii) League of Nations-Achievements and failure

Unit-V:
i) Rise of Fascism and Nazism
ii) Circumstances leading to the Second World War.

Reading list

C.J.H.Hayes et.al. : History of Europe (Relevant Chapters)
C.J.H.Hayes   : Modern Europe to 1870
C.D.Hazen   : Europe since 1815
C. D.M. Ketelbey   : A History of Modern Times from 1789
J. A. R. Marriott   : A History of Europe from 1815-1939

Marks-100 (80+20)
Credit- 8 (6+2)

HISTORY OF INDIA (1858-1947)

Unit-I: British administrative changes after the Revolt of 1857:
    i)Act for the Better Government of India (1858)
    ii)Queen's Proclamation.
    Iii) Provincial administration
    iv)Local Bodies
    v)Changes in the Army

Unit-II: Administrative reforms:

i)Lord Ripon

ii)Lord Lytton

iii)Lord Curzon

Unit-III: Socio-Religious Reforms:

i)Arya Samaj

ii) Brahmo Samaj

iii)Prarthana Samaj

iv)Aligarh Movement

v)Theosophical Society

Unit-IV: National Awakening:

i)Rise of Indian Nationalism

ii)Emergence of Indian National Congress

iii) Partition of Bengal and Swadeshi Movement

Unit-V: National Movement under Gandhi:

i)Non-Co-Operation Movement

ii) Civil Disobedience Movement

iii) Quit India Movement

iv) Partition of India

Reading list

R. C.Majumdar et.al.　: An Advanced History of India
Pervical Spear　　　　: The Oxford History of Modern India
Bipan Chandra　　　　: India's Struggle for Independence
Sumit Sarkar　　　　 : Modern India
S. Gopal　　　　　　 : British Policy of India

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PAPER 6.10

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Marks-100 (80+20)
Credit- 8 (6+2)

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MODERN ASSAM (1826-1947 AD.)

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Unit-I: Advent of the East India Company and administrative changes:
  i) David Scott
  ii) Jenkins

Unit-II: Resistance to British Rule:
  i)Anti British uprisings (1826-1830)
  ii)Revolt of 1857 and Assam

Unit-III: British territorial expansion:
  i) Assam
  ii)Cachar and Manipur
  ii)Jayantia Hills, Khasi Hills, Garo Hills, Naga Hills and Lushai Hills

Uni -IV: New awakening:
  i) Educatioin
  ii) Press
  iii)Political Associations

Unit-V: Highlights of the National Movement in Assam:
    i)   Swadeshi movement
    ii) Non-co-operation Movement
    iii)Civil Disobedience Movement
    iv) Quit-India Movement

Reading list

E. A.Gait   **:** A History of Assam
S. L. Barua   : A Comprehensive History of Assam
H. K. Barpujari(ed.)   : The Comprehensive History of Assam Vol. IV & V
H. K. Barpujari   : Assam in the Days of the Company
R. G. Basak   : History of North East India
K. N. Dutta   : Landmarks of the Freedom Struggle of Assam

GAUHATI UNIVERSITY
Revised Syllabus of Mathematics (Major and General)
For
1ˢᵗ , 2ⁿᵈ, 3ʳᵈ, 4ᵗʰ, 5ᵗʰ and 6ᵗʰ Semester
Course Structure: Mathematics (Major and General)

Semester	Major course content	Credit	Classes per week	Marks		General Course content	Credit	Classes per week	Marks
1ˢᵗ Semester	M 104- Algebra and Trigonometry	8	8	100		E-101 Classical Algebra and Trigonometry	6	6	75
	M 105- Calculus	8	8	100					
2ⁿᵈ Semester	M – 204 Co-ordinate Geometry	8	8	100		E-201 Abstract Algebra and Matrices	6	6	75
	M -205 Differential Equation	8	8	100					

Semester	Major course content	Credit	Classes per week	Marks		General Course content	Credit	Classes per week	Marks
3rd Semester	M 304Abstract Algebra	8	8	100		E-303 Calculus: Methods and Applications	8	8	100
	M-305 Linear Algebra and Vector	8	8	100					
4th Semester	M -404 Real Analysis	8	8	100		E-403 Co-ordinate Geometry and Vector Analysis	8	8	100
	M- 405 Mechanics	8	8	100					

Semester	Major course content	Credit	Classes per week	Marks		General Course content	Credit	Classes per week	Marks
5th Semester	M-501 Real and Complex Analysis	6	6	75		E-503 Statics and Dynamics	8	8	100
	M- 502 Topology	6	6	75		E-504 Numerical Methods and Spherical Astronomy	8	8	100
	M-503 Spherical Trigonometry and Astronomy	6	6	75					
	M- 504 Rigid Dynamics	6	6	75					
	M-505 Probability	6	6	75					
	M-506 Optimization Theory	6	6	75					

Semester	Major course content	Credit	Classes per week	Marks		General Course content	Credit	Classes per week	Marks
6th Semester	M-601- Hydrostatics	6	6	75		E-603 Linear Algebra and Complex Analysis	8	8	100
	M-602 Numerical Analysis	6	6	75		E- 604 Advanced Calculus	8	8	100
	M-603 Computer Programming in C	4(Th) + 2 (Pr)	4(Th) + 2 (Pr)	75					
	M-604 Discrete Mathematics	6	6	75					
	M 605 Graph and Combinatorics	6	6	75					
	M- 606 Project	6	6	75					

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1st Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(Major Course)
Paper-M104

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Algebra and Trigonometry Marks: 100 (80 + 20 internal), Lectures 40

Unit 1: Relations ,Equivalence relations, mapping, binary composition.   10 marks

Unit 2: Groups, subgroups,cosets, Lagrange's theorem on order of a subgroup of a finite group, Euler's theorem, Fermat's theorem, subgroup generated by a set, cyclic groups, permutation groups, normal subgroups, quotient groups.   20 marks

Unit 3: Complex numbers as ordered pairs of real numbers, geometrical representation and polar form of complex numbers,modulus,argument and their properties, complex equations of straight line and circle.De'Moiver's theorem, expansion of cosx and sinx in positive integral powers of x, logarithm of a complex number, exponential and trigonometric functions of a complex variable, Euler's expansion of cosine and sine, hyperbolic functions, inverse functions, Gregory's series.   20 marks

Unit 4: Relation between the roots and coefficients of a general polynomial equation in one variable, transformation of equations,Descarte's rule of signs, symmetric functions of roots, solution of cubic equation by Cardon's method.   10 marks

Unit 5: Symmetric, skew symmetric, Hermitian and skew Hermitian matrices, elementary operations on matrices, adjoint and inverse of a matrix, rank of a matrix, invariance of rank under elementary operations, normal form, solution of a system of linear equations by matrix method.   20 marks

Text Books:

1. Higher Algebra (Classical)- S.K. Mappa,Asoke prakasan. (for unit2 and 3).
2. Higher Trigonometry—Das and Mukherjee:Dhur and Sons.
3. A Course in Abstract Algebra—Khanna and Bhambri(for unit1).
4. Matrices—F. Ayers, Schaum series (for unit4).

1st Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(Major Course)
Paper-M105
Calculus Marks: 100 (80 + 20 internal), Lectures 40
Unit 1:,.Successive differentiation, standard order on nth order derivatives and Leibnit'z theorem, partial differentiation, partial derivatives of first and higher orders for functions of two and three variables, Euler's theorem on homogeneous functions.   20 marks
Unit 2:,Tangents and normals—angle of intersection of two curves, length of tangent, normal, subtangent and subnormal, pedal equations, angle between radius vector and tangent, length of perpendicular from pole to the tangent, lengths of polar subtangent and polar subnormal, pedal equation of a curve from its polar equation, concavity and points of inflexion and their criteria.
Curvature—definition of curvature and radius of curvature, derivation of arc, formula for Radius of curvature, circle of curvature.
Asymptotes—definition and working rules for determination of asymptotes(in case of Cartesian equations).
Singular points, double points, cusp, node, conjugate point, multiple point, determination Of multiple points of the curve f(x,y)=0.
Curve tracing—tracing of catenary,cissoid,asteroid, cycloid, folium of Descartes, cardioide,lemniscate.   20 marks
Unit3: Integrals of the form

$$\int \frac{(px+q)}{\sqrt{ax^2+bx+c}}dx, \int (px+q)\sqrt{ax^2+bx+c}\,dx, \int \frac{dx}{(px+q)\sqrt{ax^2+bx+c}}\quad.$$

Integration of rational functions of sinx and cosx. Reduction formulae for integration of the following functions:

$$x^n e^{ax}, x^m \sin nx, x^m \cos nx, x^n (\log x)^m, \frac{1}{(x^2+k^2)^n}, \sin^n x, \cos^n x, \sin^p x \cos^p x (p>0,q>0).,$$

$\tan^n x, \cos ec^n x, \cos^m x \cos nx$. Properties of definite integrals.   20 marks
Unit4: Rectification,Quadrature, volume and surface area of solids of revolution.
        20 marks

Text Books:

1.Differential Calculus—Shanti Narayan. S. Chand and Co.

2. Integral Calculus—Das and Mukherjee. S. Chand and Co

Reference Books;

1. Differential and Integral Calculus: Frank Ayers and E. Mendelson. Schaum's outline series.

2. Integral Calculus(an Introduction to Analysis) Maity and Ghose. New central book Agency.

1st Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(General Course)
Paper-E101

Classical   Algebra and Trigonometry Marks:75 (60 + 15 internal), 30 Lectures

Unit-1(10marks) Inequalities involving arithmetic, geometric and harmonic means, Cauchy Schwarz inequality.

Unit-2(15marks): (sequence and series): sequence of real numbers, bounded, convergent and non- convergent sequences. Uniqueness of the limit and boundedness of a convergent sequence. Cauchy sequence, Cauchy's general principle of convergence(proof of the necessary part only). Subsequences, Convergence and divergence of monotonic sequences. Algebraic operations of limit(statements of the theorems without proof). Sandwich theorem.

Infinite series, statements of basic properties of infinite series(without proof). Absolute and Conditional Convergence, Tests for convergence: Comparison test, Ratio test,Raabe's test, Leibnitz's test.

Unit-3(20marks): (Trigonometry): Geometrical Representation of Complex numbers—the Argand plane. Polar   form of a complex number. Modulus, amplitude and their various properties. Complex equations of straight line and circle. De Moiver's theorem. Expansion of cosx and sinx in positive integral powers of x. Exponential and trigonometric function of a complex variable. Euler's expansion for cosine and sine. Gregory's series. Hyperbolic functions.

Unit-4(15 marks):(Relation between roots and coefficients) : Relation between roots and coefficients of a polynomial equation of degree n with special reference to cubicequations.Symmetric functions of roots. Cardon's method of solution of a cubic equation.

Text Book:
1. S. K Mappa: Higher Algebra(Classical). Ashok Prakasan,Kolkata.
2. Das and Mukherjee: Higher Trigonometry(U N Dhar and Sons)
3. A. R. Basistha: Matrices: Krishna Prakasan Mandir, Meerut.

Reference Books :
1. Chandrika Prasad: A text book on Algebra and theory of equations-Pothisala Pvt. Ltd.
2. R.S.VERMA: Text book on trigonometry: Pothisala Pvt. Ltd.

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2nd Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(Major Course)
Paper-M204

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Co-Ordinate Geometry 100 (80 + 20 internal), Lectures 40
Unit 1:,.Transformation of coordinate axes, pair of straight lines. 　　　　15 marks

Unit 2: Parabola, parametric coordinates, tangent and normal, ellipse and its conjugate

diameters with properties, hyperbola and its asymptotes, general conics: tangent,

condition of tangency, pole and polar, centre of a conic, equation of pair of tangents,

reduction to standard forms, central conics, equation of the axes, and length of the axes,

polar equation of a conic, tangent and normal and properties. 　　　　25 marks

Unit 3; Plane, straight lines and shortest distance. 　　　　15 marks

Unit 4: Sphere, cone and cylinder, central conicoids, ellipsoid, hyperboloid of one and

two sheets, diametral planes, tangent lines, director sphere, polar plane, section with a

given centre, enveloping cone and cylinder. 　　　　25 marks

Text Books:

1. R. M. Khan—Analytical Geometry of two and three dimension and vector

   analysis. New Central Book agency.

2. R. J. T. Bell-- Analytical Geometry.

Reference Books;

1. Analytical Geometry by Askwith.

2. Analytical Geometry byB. Das

3. Analytical Geometry by Shanti Narayan.

4. Analytical Geometry by S. L. Loney.

5. Analytical Geometry by J.M.Kar.

6. Analytical Geometry Bansilal.

7. Coordinate Geometry of two dimension.

8. Solid Geometry by Zameeruddin and Khanna.

2nd Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(Major Course)
Paper-M205

Differential Equation 100 (80 + 20 internal), Lectures 40

Unit1: Origin of ordinary differential equations, degree and order of ordinary differential equations, equations of 1st order and 1st degree, 1st order and higher degree differential equations, method of solving higher degree equations solvable for x,y and p.Clairaut's form and singular solutions, orthogonal trajectories. 15 marks

Unit 2: Linear ordinary differential equations with constant coefficients, Exact ordinary Differential equations, homogeneous linear ordinary differential equations and Bernoulli's equations. 15 marks

Unit 3: Linear differential equations of 2nd order with variable coefficients, standard methods, transformation of the equation by changing the dependent variable, independent variable, method of variation of parameters. 15 marks

Unit 4: Simultaneous linear differential equations, total differential equations. 15 marks

Unit 5: (Partial differential equation): Partial differential equations of 1st order, Lagrange's solutions, some special types of equations which can be solved by methods other than he general method, Charpit's general method of solution. 20 marks

Text Books:

1.Differential Equation---Piaggio.

2 Theory and Problems of Differential equation—Frank Ayers. Schaum outline Series.

Reference Books.

1. An Introduction to ordinary differential Equation: E.A. Codington. Prentice Hall, India.

2. Elementary Differential Equation and Boundary Value Problem-W.R. Boyce and P.C.Diprima, John Wiley.

3. Ordinary and partial differential Equation: M.D. Raisinghania. S. Chand and Co.

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2nd Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(General Course)
Paper-E201
Abstract Algebra and Matrices Marks:75 (60 + 15 internal), 30 Lectures

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Unit 1(Group Theory): Definitions and examples of groups. Permutation groups. Cyclic groups. Subgroups, Cosets, Lagrange's theorem on the order of a subgroup of a finite group. Normal subgroups, Quotient groups. Idea of homomorphism and Isomorphism of groups.

20 marks

Unit 2(Ring Theory): Definition, examples and simple properties of Rings. Integral Domains, Fields and their elementary properties.

20marks

Unit 2(Matrices): Types of matrices, algebra of matrices,Adjoint and inverse of a matrix, its existence and uniqueness, rank of a matrix, invariance of rank of a matrix under elementary transformations(Proofs are not required), Solution of a system of linear equations by matrix method.

20 marks

Text Books:

1.V.K. Khannaand S. K. Bhambri: A course in Abstract Algebra. Vikash Pub. House.

2.S. Singh and Q. Zameerruddin: Modern Algebra. . Vikash Pub. House

**Revised Syllabus of Mathematics
For
Three year Degree Course
(Major Course)
Paper-M304**

Abstract Algebra Marks:100 (80 + 20 internal), Lectures 40

Unit 1: Homomorphism of groups, Fundamental theorems of homomorphism, Caley's theorem.   20 marks

Unit 2: Rings Integral domains division rings and fields, subrings,characteristic of a ring, idempotent and nilpotent elements in a ring, principle ,prime, maximal ideals, simple rings, definition and examples of vector space and its subspaces.   20 marks

Unit 3: Inner automorphisms, automorphisms groups,conjugacy relation, normaliser, centre of a group, class equation and Cauchy's theorem, Sylow's theorems,(statement and applications).   20 marks

Unit 4: Ring homomorphisms,quotient rings, field of quotients of an integral domain, Euclidean rings, polynomial rings.   20 marks.

Text Books:

1.A Course in Abstract Algebra: Khanna and Bhambri, Vikas Pub. House.

2.Algebra Vol-1 and Vol-2: I.S. luther AndPassi. Narosa Pub.

3.A Text Book of Degree Mathematics Book II by P. Rajkhowa and N.R. Das. Asian Book Pvt. Ltd.

Reference Books:

1.Modern Algebra- Surjit Singh and Q. Zameeruddin, Vikas Pub. House.

2. Fundamentals of Abstract Algebra: Malik,Mordersonand M.K. Sen, Mc Graw Hill.

3. A First Course in Abstract Algebra: J.B. Fraleigh.

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3rd Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(Major Course)
Paper-M305

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Linear Algebra and Vector 100 (80 + 20 internal), Lectures 40
Linear Algebra:
Unit 1: Sums and direct sum of subspaces, linear span, linear dependence and independence and their basic properties, basis, finite dimensional vector spaces, existence theorem for bases, invariance of the number of elements of a basis, dimensions, existence of complementary subspace of a subspace of finite dimension, dimension of sum of subspaces, quotient spaces and its dimension.   15 marks

Unit 2: Linear transformations and their representation as matrices, the algebra of linear transformations, the rank nullity theorem, change of basis, dual spaces.   10 marks

Unit 3: Eigenvalues ,eigenvector, characteristic equation of a matrix, Cayley Hamilton theorem, minimal polynomial, characteristic and minimal polynomial of linear operators, existence an uniqueness of solution of a system of linear equations.   15 marks

Vector:

Unit 4: Scalar triple product, vector triple product, product of four vectors.   10 marks

Unit 5: Continuity and derivability of a vector point function, partial derivatives of vector point function, gradient, curl and divergence, identities.   20 marks

Unit 6: vector integration, line, surface and volume integrals, Green, Stokes and Gauss' theorems.   10 marks

Text Books;

1.Linear Algebra by Hoffman and Kunze.
2. Linear Algebra by Lipschutz. Schauam Outline Series.
3. Vector Analysis by Spiegel. . Schauam Outline Series.

Reference Books:
1. Matrix and Linear Algebra by K. B. Datta, Prentice Hall of India.
2. Linear Algebra by Bhattacharya, Nag pal, Jain. Wiley.
3. Vector Analysis by M. D. Raisinghania, S. Chand And Co.

3rd Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(General Course)
Paper-E303

Calculus: Methods and applications Marks:100 (80 + 20 internal), Lectures 40

Unit1: Familiarity with the properties of continuous functions without proofs. Differentiation, successive differentiation,Lebnitz's theorem. Tangents and Normals.
10 marks

Unit2:Rolle's theorem, Lagrange's Mean Value theorem, meaning of the signof derivative, Cauchy's Mean Value theorem, Taylor's theorem, Maclaurin's theorem, Maclaurin's infinite power series for a given function; expansions of e^x ,sinx,cosx, log(1+x)and allied functions. Indeterminate forms, Maxima and Minima(single variable). **10 marks**

Unit3: Working knowledge of the limit and continuity of a functions of two or more variables. Partial differentiation. Euler's theorem on homogeneous functions(two variables), total differentiatials and differentiation of composite functions(statement of formulae without proof.). Maxima and minima of a function of two variables and working rules(without proof) for their determination.
10 marks

Unit4: Curvature of plane curves, Asymptotes, Working rules for finding asymptotes parallel to the co-ordinate axes
10 marks

Unit5: Unit5: Reduction formulae. Properties of definite integrals. **10marks**

Unit6: Quadrature of plane areas, Rectification of plane curves **5 marks**
Unit7: Differential equation of first order and first degree; solution by variable separable methods;homogeneous equations, linear equations and equations reducible to linear forms; exact differential equations; first order higher degree equations solvable for x, y andp;Clairaut's form and singular solutions. **10 marks**

Unit8: Linear differential equation with constant coefficients ; homogeneous linear ordinary differential equations. **10 marks**

Unit9: Simple applicationsof ordinary differential equations. **5 marks**

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Text Books:

1.Piaggio: Differential equations.

2. B.C. Deka: Ordinary differential equation.

3. Raisinghania: Ordinary differential equation, S. Chand

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4th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(Major Course)
Paper-404

Real Analysis 100 (80 + 20 internal), Lectures 40

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Unit1: Characterization of the real number system R as a complete Archimedean ordered field, neighbourhoods, open set, closed set, limit point of a set Bolzano-Weierestress theorem for a set, nested interval theorem.

Sequence of real numbers, bounded and unbounded sequences, subsequences, limit of a sequence, Bolzano-Weierestress theorem for bounded sequences, limit superior and limit inferior, convergent and divergent sequence, Cauchy sequences, Cauchy's principle of convergence, convergence and divergence of monotonic sequences, algebraic operation on limits, sandwich theorem, Cauchy theorem on limit. 20 marks

Unit 2: Infinite series, convergence ,divergence and Cauchy's general principle of convergence, introduction and removal of brackets, multiplication of series and double series, comparison test, Cauchy's root test, D'Alembert's ratio test(with proof),statement (without proof) of Raabe's test, logarithmic test, Gauss test, Cauchy's condensation test, Cauchy's integral test for testing the convergence of series of positive terms, Abel's theorem, alternating series and Leibnitz's test, absolute and conditional convergence, statement and application of Riemann theorem and Dirichlet's theorem(without proof) on the rearrangement of terms of an infinite series. 25 marks

Unit 3: ($\Box$,δ) definition of limit and continuity of a function of single variable, properties of continuous functions in closed interval, sequential continuity, inverse function and monotonic function, uniform continuity. 15 marks

Unit 4: Derivability of a function of single variable, algebra of derivatives, Darboux's theorem, intermediate value theorem for derivatives, Roll's theorem, mean value theorems, intermediate forms, Taylor's theorem, Taylor's and Maclaurin's infinite series, expansion of e^x, $\sin x$, $\cos x$, $\log(1+x) and (1+x)^m$,maxima-minima of a function of single variable and two variables (reducible to single variable). 20 marks

Text Books:

1. A Text Book of Degree Mathematics Book I by P. Rajkhowa and N.R. Das. Asian Book Pvt. Ltd.

2. Principles of Real Analysis by s.C. Malik , New age international.

3. A course of Mathematical Analysis by Shanti Narayan, S. Chand and Co.

Reference Books:

1.Differential calculus by Maity and Ghose,New central Book Agency, Calcutta.

2. Real Analysis by S. k. Mappa.

3. Principle of Mathematical Analysis by walter Rudin.

4th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(Major Course)
Paper-405

Mechanics 100 (80 + 20 internal), Lectures 40

Unit 1: Parallel forces, couples, reduction of coplanar forces, analytical condition of equilibrium of coplanar forces, friction.   20 marks

Unit2: Centre of gravity of a plane area, arc and a sector of a curve, C.G of solids and surface of revolution, C.G of areas bounded by a given curve.   10 marks

Unit3: Principle of virtual work-in two dimensions, forces in three dimensions.Poinsot's central axis, wrenches, null lines and planes.   10 marks

Unit 4: Stable and unstable equilibrium.   10 marks

Unit5: Velocities and acceleration along radial and transverse directions and along tangential and normal directions, motion in a straight line under variable acceleration, simple harmonic motion and elastic string.   10 marks

Unit6: Motion on smooth and rough plane curves, motion in resisting medium, motion of particles of varying mass.   10 marks

Unit7: Central orbit and Kepler's laws of planetary motion.   10 marks

Text Books:

1. Statics by S. L. Loney, C.U.P.
2. Dynamics by S. L. Loney, C.U.P.
3. Dynamics9 part1) Ramsey.

Reference Books:

1. Theoretical mechanics by Besant and Ramsey.
2. A Text Book on Statics by R.S. Verma.
3. Theoretical Mechanics, Schaum series.
4. Dynamics by M.Ray, S. Chand and Co.

4th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(General Course)
Paper-E403

Calculus: Coordinate Geometry and Vector Analysis Marks:100 (80 + 20 internal), Lectures 40

Two dimensional geometry:

Unit 1: Transformation of coordinate axes. Pair of straight lines.   **8 marks**
Unit 2: Circle: parametric form, tangent and normal, pole and polar, orthogonal circle, condition of orthogonality of circles, equation of parabola and its parametric form, tangent and normal.   **7 marks**
Unit 3: Ellipse ,tangent and normal, conjugate diameters, hyperbola and its asymptotes.   **10 marks**
Unit 4: General equation of second degree and the conditions for representing a pair of straight lines, parabola, an ellipse and a hyperbola, the equation of tangent, condition of tangency of a line, centre and reduction to standard forms. Polar equations of conics.   **10marks**

Three dimensional geometry:

Unit 5: Plane, straight lines, in three dimensions, shortest distance.   **10 marks**
Unit 6: Sphere, circle in three dimensions.   **5 marks**
Unit 7: Cone and cylinder 9 Elementary concept only)   **10 marks**

Vector analysis:

Unit 8: Scalar triple product, vector triple product, Product of four vectors $(a\times b).(c\times d)$, $(a\times b)\times.(c\times d)$,   **10 marks**

Unit 9: Vector point function,continuity and differentiation of vector point function. Partial derivatives of vectors, curl, grad, divergence and identities(Cartesian coordinates only) **10marks**

Text Books:
1. S. L. Loney: the elements of coordinate geometry. Macmillan.
2. B. Das: Analytical coordinate geometry
3. J.M. kar: analytical geometry of the conic section.
4. N. Saran and S, N Nigam: Introduction to vector analysis.Pothisala Pub.
5. A.R. Vasishtha: Vector analysis. Krisna Prakasan.
6. M. D. Raisinghania:Vector Analysis. S. Chand and Co
7. Dass, Saxena, Raisinghania: Solid g

5th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(Major Course)
Paper-M501
Real and Complex Analysis   Marks : 75 (60 + 15 internal), Lecture : 30

Unit1: Limit and continuity of a function of several variables, partial derivatives, differentiability, Young's and Schwarz's theorems, differentials of higher orders, differentiation of composite functions, change of variables , Taylor's theorem for two variables, implicit functions, only statement of implicit theorem on two variables with its applications, jacobians, maxima and minima, LaGrange's method of multipliers.

12 marks

Unit2: Riemann integral, integrability conditions, Riemann integral as a limit, some classes of integrable functions , the fundamental theorem of integral calculus, statement and application of M.V. theorems of integral calculus.   12 marks

Unit3: Improper integrals and their convergence, various forms of comparison tests, absolute and conditional convergence, Abel's and Dirichlet's tests, beta and gamma functions, Frullani's integral, integral as a function of parameter(excluding improper integrals), continuity, derivability and integrability of an integral as a function of a parameter.   12 marks

Unit4: Theorems on limit and continuity of a function of complex variable, uniform continuity, differentiability of a function of complex variable, analytic functions, Cauchy-Riemann equations, harmonic functions, differentials, derivatives of elementary functions, L'Hospital's rule , stereographic projection.   12 marks

Unit5: Rectifiable curves, integral along an oriented curve, fundamental Cauchy theorem, proof applying green's theorem, Cauchy integral formula, mobius transformation, fixed points, inverse points and critical mappings, conformal mappings.

12 marks

Text Books:
1. A course of Mathematical Analysis by Shanti Narayan, S. Chand and Co.
2. Mathematical analysis by S. C. Malik and S. Arora, New age international.
3. A text Book for Degre Mathematics PartI by P. Rajkhowa and N. R. Das, asian Books pvt. Ltd
4. Complex variable by Spiegel, Schaumoutline Series.

Reference Books:
1. A First course in mathematical Analysis by D. Soma Sundaram and B. Choudhury.
2. Complex Variable by J.N.Sharma,Krishna Prakasan.
3. Integra; calculus by Maity and Ghose,New central Book Agency, Calcutta

5th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course (Major Course)
Paper-M502

Topology   Marks : 75 (60 + 15 internal), Lecture : 30

Unit1: Definition and examples of metric spaces, neighbourhoods, limit points, interior points, open and closed sets, closure and interior, equivalent metrics, subspace of a metric space, Cauchy sequences, completeness, Cantor's intersection theorem.   20 marks

Unit2: Dense subsets, Baire's category theorem, separable, second countable and first countable spaces, continuous functions, extension theorem, uniform continuity,isometry and homeomorphism.   10 marks

Unit3:   Compactness, sequential compactness, totally bounded spaces, finite intersection property, continuous functions and compact sets, connectedness, components, continuous functions and connected sets.   10 marks

Unit4: Definition and examples of topological spaces, metric topology, closed sets, closure, Kuratoski closure operator and neighbourhood systems, dense subsets, neighbourhoods, interior, exterior and boundary, accumulation points and derived sets, bases and sub bases, subspaces and relative topology, continuous functions and homeomorphism.   10 marks

Unit5: Definition and examples of normed linear spaces, Banach spaces, inner product spaces and Hilbert space, some elementary properties.   10 marks

Text Books:

 1.Introduction to topology and modern analysis by G.F. Simmons.

 2. Functional analysis by B.V.Limaye.

Reference Books:

 1. Topology by Munkers, prentice Hall, of India.

 2. General Topology by Lipschutz, Schaumoutline series.

5th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course (Major Course)
Paper-M503

Spherical Trigonometry and Astronomy   Marks : 75 (60 + 15 internal), Lecture : 30

Unit1: Section of a sphere by a plane, spherical triangles, properties of spherical and polar triangles, fundamental formulae of spherical triangles, sine formula, cosine formula, sine-cosine formula, cot formula, Napier's rule of circular parts.   15 marks.
Unit2: The standard(or geometric) celestial sphere, system of coordinates, conversion of one coordinate system to the another system, diurnal motion of heavenly bodies, sidereal time, solar time(mean), rising and setting of stars, circumpolar star, dip of the horizon, rate of change of zenith distance and azimuth, examples.   15 marks
Unit3: Planetary motion: annual motion of the sun, planetary motion, synodic period, orbital period,Keplar's law of planetary motion, deduction of Keplar's law from Newton's law of gravitation, the equation of the orbit, velocity of a planet in its orbit, components of linear velocity perpendicular to the radius vector and to the major axis, direct and retrograde motion in a plane, laws of refraction: refraction for small zenith distance, general formula for refraction,Cassini's hypothesis, differential equation for refraction, effect of refraction on sunrise, sunset, right ascension and declination, shape of the disc of the sun.   15 marks
Unit4: Geocentric parallax, parallax of the moon, right ascension and declination, parallax on zenith distance and azimuth, stellar or annual parallax, effect of parallax on the star longitude, and latitude, effect of stellar parallax on right ascension and declination.
Lunar eclipses section of the shadow cone at moon's geocentric distance, condition of lunar eclipse in terms of it, solar eclipses, the angle subtended at the earth's center by the

centers of the sun and the moon at the beginning or end of a solar eclipse, condition of solar eclipse in terms of this angle, idea of ecliptic limits, frequency of eclipses.

<div align="right">15 marks</div>

Text Book:
1.Spherical Astronomy by W.M. Smart.

Reference Books:
1. Spherical Astronomy by B. Sarma.
2 Spherical Astronomy by S. Malik.
3 Spherical Astronomy by G. Prasad
4   Spherical Astronomy by Ball.

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5th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course (Major Course)
Paper-M504

Rigid Dynamics   Marks : 75 (60 + 15 internal), Lecture : 30

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Unit1: Moments and products of inertia, parallel axes theorem, theorem of six constants,

the momental ellipsoid, equimomental systems, principle axes.   15 marks

Unit2: D'Alembert's principle, the general equation of motion of a rigid body, motion of

the centre of inertia and motion relative to the centre of inertia.   15 marks

Unit3: Motion about a fixed axis, the compound pendulum, centre of percussion.

<div align="right">10 marks</div>

Unit4: Motion of a body in two dimension under finite and impulsive forces.   10 marks

Unit5: Conservation of momentum and energy, generalized coordinates, LaGrange's

equations, initial motions.   10 marks

Text Books:

1.An elementary treatise on the Dynamics of a particle and of Rigid bodies by S. L. Loney.

2. Dynamics partI by A. S. Ramsey

3. Theoretical Mechanics by Spiegel, Schaum Series.

4 Analytical Dynamics by F. Charlton.

5th Semester

Revised Syllabus of Mathematics
For
Three year Degree Course (Major Course)
Paper-M505

Probability   Marks : 75 (60 + 15 internal), Lecture : 30

Unit1: Random experiment, sample space , events, classical definition of probability and the theorems of total and compound probability based on this definition, axiomatic approach to the notion of probability, important theorems based on this approach, conditional probability and independent events, Bay's theorem.   15 marks

Unit2: Random variables, discrete and continuous probability distributions, probability function and distribution function, probability mass function and probability density function, joint distributions, marginal distribution, independent random variables, change of variables, conditional distribution.   15 marks

Unit3: Mathematical expectation, basic theorems on expectation(proofs required only in case of discrete random variables), variance and standard deviation, moments and moment generating functions, covariance conditional expectation and conditional variance, Chebyshev's inequality, law of large numbers.   15 marks

Unit4: Some important probability distributions: Binomial, Poisson and Normal.

15 marks

Text Books:

1.Probability and Statistics by Spiegel, Schaum outline Series.

2. Elements of Probability and Statistics by A. P. Baisnab and M.Das. Tata McGraw Hill.

Reference Books:

1. An introduction to probability theory and its applications by W. Feller.

2. Introduction to Mathematical Probability by J.V.Uspensky

3. Mathematical Statistics by Kapur and Saxena

5th Semester

Revised Syllabus of Mathematics
For
Three year Degree Course (Major Course)
Paper-M506

Optimization Theory Marks : 75 (60 + 15 internal), Lecture : 30

Unit1: Partitioning of matrices, simultaneous equations, basic solution, point sets, lines and hyper planes, convex sets and their properties, convex functions, convex cones.

10 marks

Unit2: General linear programming problems, mathematical formulation of a linear programming problem, linear programming problem in matrix notation, feasible solution, basic solution, degenerate basic solution, necessary and sufficient condition for the existence of non-degenerate basic solution, graphical method for the solution of a linear programming problem.   10 marks

Unit3: simplex method: fundamental theorem of linear programming problem, basic feasible solution from feasible solution, determination of improved basic feasible solution, optimality conditions, alternative optimal solution, conditions for alternative optimal solution, theory and application of the simplex method of solution of a linear programming problem, Charne's M-technique, two phase method.   20 marks

Unit4: Principles of duality in linear programming problem, fundamental duality theorem, simple problems.   10 marks

Unit5: The Transportation and Assignment problem.   10 marks

Text Books:

1. linear Programming by G. Hadley, Narosa pub. House.
2. Linear programming Methods and Applications by S.L.Gass, McGraw Hill,New York.
3. Linear Programming by R.K.Gupta.
4. Operation Research by Kanti Swaroop, P.K.Gupta and ManMohan, S.Chand and Co, New Delhi.

5th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(General Course)
Paper-E503
Statics and Dynamics Marks:100 (80 + 20 internal), Lectures 40

Statics:

Unit 1: Parallel forces, Couple, System of coplanar forces and conditions of equilibrium.   **10 marks**

Unit 2: Centre of gravity of plane curves and areas, arc and sector of a circle and a parabola.
10 marks

Unit 3: Friction, laws of friction, cone of friction, angle of friction, limiting friction, equilibrium of a particle on a rough inclined plane.   **10 marks**

Unit 4: Machines, Mechanical advantage, velocity ratio, three systems of pulleys.
                                                                                         10 marks

Dynamics:

Unit 5: Components of velocity and acceleration along radial and transverse direction and along tangential and normal directions, angular velocity and its relation with linear velocity, relative velocity.   **8 marks**

Unit 6: Rectilinear motion with variable acceleration, vertical motion under inverse square law and other laws of forces.   **8 marks**
10 marks

Unit 7: Simple harmonic motion.   **5marks**

Unit 8: Motion of a projectile, range on an inclined plane.   **6 marks**

Unit 9: Impulse , impulsive forces, work and energy. Conservation of linear momentum and conservation of energy   **8marks**

Unit 10: Impact of elastic bodies(direct impact only)   **5 marks**

Text Books:
1 S. L. Loney: Statics. Cambridge University Press.
2 Das and Mukherjee: Statics. U N Dhar and Sons..
3 R. S Verma. A text book of Statics.
4. Das and Mukherjee: Analytical Dynamics. U N Dhar and Sons
5 M. Rey:A Text Book on Dynamics. S Chand and Co.
6 S. L. Loney: An elementary treatise on the Dynamics of a particle and Rigid bodies.   Macmillan C

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5th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(General Course)
Paper-E504
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Numerical Method and Spherical Astronomy Marks:100 (80 + 20 internal), Lectures 40

Numerical Method:

Unit1: Finite Difference operators and their operations on functions of a single variable.   **10 marks**

Unit2: Interpolation with equal intervals, Newton's forward and backward formula, divided difference, Lagrange's interpolation formula.   **10 marks**

Unit 3: Roots of algebraic and transcendental equations (Geometric method of initial approximation of roots) Bisection method, Iteration method, Newton –Raphson method for non repeated roots.   **10 marks**

Text Books:
1. Goyal Mittal; Numerical Analysis
2. H. C Saxena; Finite difference and Numerical Analysis.S Chand and Sons.
3. M.K Jain and Iyenger: Numerical Methods, problem and solutions.

Spherical Astronomy:

Unit4: Spherical triangle and its properties, polar triangle and its properties, Sine and cosine formulae, four parts formulae, sine-cosine formulae.   **10 marks**

Unit5: Celestial sphere—three coordinate systems and their relations, examples.   **10 marks**

Unit6: Altitude of a body on the meridian, altitude of the celestial pole, rising and setting of stars, circumpolar stars, signs of zodiac.   **10 marks**

Unit7: Planetary motion and Kepler's laws, deduction of Kepler lawsfrom Newton's law of gravitation, the equation of Orbit, velocity of a planet in its orbit, examples.

Unit8: Parallex: geometric and annular parallex. **10 marks**
10 marks

Text Books:
1.Gorokh Prasad : Astronomy.
2. K.K.De; A Text Book on Astronomy.(Book Syndicate pvt Ltd. Calcutta.).
3. S. Malik.: Spherical Astronomy, Kedar Nath, Ram Nath, Meer

6th Semester

Revised Syllabus of Mathematics
For
Three year Degree Course (Major Course)
Paper-M601

Hydrostatics Marks : 75 (60 + 15 internal), Lecture : 30

Unit1: Pressure equation, condition of equilibrium, lines of force, homogeneous and heterogeneous fluids, elastic fluids, surface of equal pressure, fluid at rest under action of gravity, rotating fluids. 15 marks

Unit2: Fluid pressure on plane surfaces, centre of pressure, resultant pressure on curved surfaces. 15 marks.

Unit3: Equilibrium of a floating body, curves of buoyancy, surface of buoyancy, stability of equilibrium of floating bodies, meta centre, work done in producing a displacement, vessel containing a liquid. 15 marks

Unit4: Gas law, mixture of gases, internal energy, adiabatic expansion, work done in compressing a gas, isothermal atmosphere, connective equilibrium. 15 marks

Text Books:

1.A Treatise on Hydromechanics partI Hydrostatics by W.H.Besant and A.S.Ramsey.

2. Hydrostatics by J.M.Kar, K.P.Basu pub. Co. Calcutta.

3. Hydrostatics by M.Ray, S.Chand and Co.

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6th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course (Major Course)
Paper-M602

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Numerical Analysis Marks : 75 (60 + 15 internal), Lecture : 30
Unit1: Normalized floating point representation of real numbers and operations using it, normalization and its consequence, errors in arithmetic operations, absolute and relative error, truncation and round off errors, approximation and significant figures.   10 marks
Unit2: Calculus of finite difference: different interpolation formulae with remainder terms, finite difference operators and their operations on function of a single variable, interpolation with equal and unequal intervals,Newton;s formulae, Lagrange's formula, Gauss, Bessel and sterling's formula,Hermite interpolation.   20 marks
Unit3: Numerical differentiation and integration: Numerical differentiation with the help of different interpolation formulae, general quadrature formula, trapezoidal rule, Simpson's one third and three eighth rule, Weddel's rule, Newton-Cote's formula, Gauss quadrature formula,Chebycheve's formula.   20 marks
Unit4: Solution of polynomial and transcendental equations: Bisection method, secant method, regula falsi method, Newton-Raphson method, rate of convergence and comparison of methods.   10 marks
Text Books:
1. Numerical methods by S. Balachandra Rao and C.K.Santha, Univ. Press.
2. Numerical Analysis, Schaum Outline Series.
3. Numerical Analysis by Kunz.
Reference Book:

1.Numerical methods for Mathematics, Science and Engineering by J.H. Mathews.

6th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course (Major Course)
Paper-M603

Computer Programming in C Marks: 75 (40Theory + 20 Practical and 15 internal),

Lecture: 30

Unit1: Brief introduction of central processing, main memory, secondary memory, input/output devices, operating system and its need, representation of numbers and characters in computer, machine level language and high level language, compiler,interpreter,assembler,linker, loader, editor, debugger, algorithm, flowchart and computer programmes, decision table and trees, efficiency and analysis of algorithm. Introduction to C-requirement of programming language to solve problems.   10 marks

Unit2: Elementary data types⊗variables, constants and identifiers, integer, character, floating point and string constants, variable declaration,initializationof variables during declaration, constant data types),Syntax and semantics, reserved words, expression in C(operator precedence and associatively, unary, binary and ternary operators, C arithmetic operators, assignment operators, relational operators, logical and bitwise operators, L-value and R-value, expression statement, cast and size of operator, automatic type conversion.   10 marks

Unit3:Conditional Statement:if,if-else,switch.Iterative statement: while, do while. For. Arrays and pointers(preliminary ideas).
Other statements: break, continue, go to, return, null statement, block statement
                                                                                             10 marks

Unit4:Function (function declaration, calling a function by value, call by reference and its absence in C),storage class(automatic register,static,external);recursion and how it works(use of machine stack for storing return address, parameters and local variables),conversion of recursive programmes to non-recursive version.   10marks

Programmes for practical (Internal)   **20 marks**

To evaluate an arithmetic expression, to find gcd,factorial, Fibonacci number, prime number generation, reversing digits of an integer, finding square root of a number, roots of a quadratic equation, sum of different algebraic and trigonometric series, base conversion, towers of Hanoi, test for Palindrome, addition subtraction and multiplication of matrices, to find the greatest and smallest of a finite number of numbers, interpolation and solution of transcendental equation.

Text books:
1.E. Balaguruswamy-Programming in ANSI C, Tata McGraw Hill.
2. E. Balaguruswamy-Programming with C, Schaum Series.
3.Let us C-Y. Kanetkar, B.P. Publication.

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6th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course (Major Course)
Paper-M604

</div>

Discrete Mathematics Marks : 75 (60 + 15 internal), Lecture : 30
Unit1:Divisibility theory: Peano's axiom, well ordered principle, mathematical induction, division algorithm, the basis representation theorem, prime numbers, unique factorization theorem.   **10 marks**
Unit2: (Congruence's): Basic properties of congruence's, residual systems, linear congruence's and their solutions, special divisibility tests, the Chinese remainder theorem and its applications, Fermat's Little theorem and Wilson's theorem. Polynomial congruence's.   **10 marks**

Unit3: Diophantine equation: linear Diophantine equation, the equation $x^2+y^2=z^2$ and $x^4+y^4=z^4$. Fermat's last theorem, representation of a number by two or four squares.   **10 marks**
Unit4: Number theoretic function: Euler's phi function, Euler's theorem, combinatorial study of the Euler's phi function, the function τ and σ, basic theorems on $\tau(n)$ and $\sigma(n)$, the Mobious function, multiplicative arithmetic function, inversion formula, greatest integer function.   **10 marks**

Unit5:Propositional Calculus: operation on statements, truth function, laws of propositional logic, Boolean algebra of statement bundles, adequate system of connectives, binary connectives 'Nor' and 'and'.   **10 marks.**
Unit6: Boolean Algebra: disjunctive normal form(DNF), Complement of Boolean expression in DNF, construction of a Boolean function corresponding to a Boolean expression, conjunctive normal form(CNF), Complement of Boolean expression in CNF, transformation of normal form to the other form, applications.   **10 marks**

Text Books:

1 Elementary Number Theory-David .M .Burton, University Book stall, New Delhi.
2. Introduction to Discrete Mathematics- M.K.Sen, Allied publisher.
3.Discrete Mathematics: Applied Combinatories and Graph Theory-Michal Towusend.

Reference Books:
1. Number Theory- G.E. Andrews, Hindustan Pub. Co.
2. Basic Number Theory-S.B.Malik, Vikash pub. House.
3. A first Course in Number Theory-K.C.Chowdhury, Asian Books Pvt. Ltd.
4. Elements of discrete Mathematics-C.L.Liu Mc Graw Hill, Comp.c. Series

6th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course (Major Course)
Paper-M605

Graph and Combinatorics Marks : 75 (60 + 15 internal), Lecture : 30

Unit: 1 : Elementary combinatorics, Rules of sum and product, two models of counting, sample and distribution model of counting. Examples and solution. Integer solution of an equilateral problem.   20 marks

Unit 2: Varities of Graphs, Walks and connectedness, degrees, problem of Ramsey, intersection graphs, operations on graphs.   10 marks

Unit 3 : Block, Cut points. Bridges, Block graphs, Cut point graphs, Trees, Characterization of trees.   10 marks

Unit 4: Connectivity and Line connectivity, Graphical variation of Menger's theorem.   10 marks

Unit 5: Travessavility : Eulerian graphs, Hamiltonian graphs and their characterizations   10 marks

Text Books:
1. Introduction to discrete Mathematics- M.K. Sen. Allied Publishers
2. Discrete Mathematics/; Applied Combinatorics and Graph Theory- Michael Towusend.
3. Basic Graph Theory: K.R. Parthasarathi
4. Elements of discrete mathematics- C.L. Liu, Mc Graw Hill (International Edition), Computer Science Series.

6th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(General Course)
Paper-E603
Linear Algebra and Complex analysis Marks:100 (80 + 20 internal), Lectures 40
Linear Algebra:

Unit1: Definition and examples of vector spaces, elementary properties of R^n and C^n as vector spaces, subspaces of a vector space, union, intersection and sum of two subspaces, subspace generated by a subset of vector space   **10 marks**

Unit2: Definition, example and elementary properties of linearly dependent and independent set, basis and dimension of a vector space, examples of finite dimensional and infinite dimensional vector space, finitely generated space   **10 marks**

Unit 3: Linear mapping—definition and examples, algebraic properties of
linear mappings.   **10 marks**

Unit 4: Elementary transformation. Reduction to echelon and normal form, determination of the rank of a matrix by elementary transformation.   **10 marks**

Unit 5: Eigenvalues ,eigenvectors, characteristic equation, statement of Cayley-Hamilton theorem, verification of Cayley-Hamilton theorem and determination of the inverse of a matrix with the help of it.   **10 marks**

Text Books:

1A. R. Vasistha Modern Algebra: krisna Prakasan.

2A. R. Vasistha Matices : krisna Prakasan.

3.Bhattacharya and Jain : linear Algebra.

4. H.C Saxena and M. D Raisinghania; Matrices, S. Chand and Co..

Complex Analysis;

Unit1: Complex variable and single valued function of a complex variable,, the elementary functions, limit and continuity and theorems on them, uniform continuity, derivatives, analytic functions, Cauchy –Riemann equations 9 proof of only necessary part), harmonic function. **15 marks**

Unit2: Rectifiable curves, integral along a oriented curve, fundamental Cauchy theorem, Cauchy integral formula. **15 marks**

Text Books;

1.Spiegel: Complex variable-Schaum Series

2-J. N. Sarma: Functions of a Complex variable

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6th Semester
Revised Syllabus of Mathematics
For
Three year Degree Course
(General Course)
Paper-E604
Advanced Calculus Marks:100 (80 + 20 internal), Lectures 40

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Unit1: Metric space, definition and examples, R, R^2, R^3, R^n as metric spaces, Neighbourhoods, open spheres, open sets, limit points, closed spheres, closed sets, closure and interior of a set, Bolzano- Weirstrass theorem for bounded infinite sets of **R**,Cauchy sequences in a metric space, definition and simple examples of complete metric spaces. **20 marks**

Unit2: Riemann integral up to Fundamental theorem of integral calculus **20 marks**

Unit3: Elementary idea of improper integrals, Beta and Gamma functions**.** **20 marks**

Unit 4: Definitions of double and triple integrals, working knowledge about the methods of their calculations including change of variables(Theorems to be assumed without proof), application of Beta and Gamma functions in determination of area and volume. **20 marks**

Text Books;

1.Seymour. lipschutz: General Topology Schaum Outline Series..

2-Shanti Narayan:A Course of Mathematical analysis. S. Chand and Co.

3. Spiegel; Advanced Calculus. Schaum Outline Series.

4.S. C. Malik. Principles of Mathematical Analysis. New Age International.

GAUHATI UNIVERSITY

Syllabus for
Undergraduate Course (Three year)
under
Semester system
in
PHYSICS
2010

GAUHATI UNIVERSITY
Gopinath Bordoloi Nagar
Guwahati-781014
Assam: India

Undergraduate Course Syllabus Under semester system
<u>Physics Major</u>

1. The undergraduate Course of the Gauhati University is a three year Course. There are six university examinations during the course, the Semester-I, Semester-II, Semester-III,

Semester-IV, Semester-V, and Semester-VI held each at the end of six months covering three calendar years.

2. The subject Physics can be studied as Major Course or General/Subsidiary Course.
3. A student pursuing Major Course in Physics should have Mathematics and another subject as General/Subsidiary Course subject. For a student having Major Course in Physics, General/Subsidiary Course subjects are completed during first four semesters.
4. English is a compulsory subject in Semester-I and Semester-II and Environmental studies is another compulsory subject in the Semester-III and semester-IV.
5. A student pursuing General/Subsidiary Course in Physics has to study two other subjects of General/Subsidiary Course (out of these two one should be Mathematics) during the first four semesters along with compulsory subjects English (during 1st and 2nd semester) and Environmental studies (during 2nd and 3rd semester). During last two semesters of the course a student has to study any one of the General/Subsidiary Course subjects studied during the first four semesters along with General/Subsidiary Course of Physics
6. The structure of detailed syllabus for Semester-I, Semester-II, Semester-III, Semester-IV, Semester-V, and Semester-VI for the Physics Major and General/Subsidiary Courses, including number of Papers in each Semester is given below in detail.
7. Credit = Number of Classes per week. 20% Internal Assessment for all papers.

Abbreviations used:

Yr=Year
Sem=Semester
C=Credit
Th=Theory
Pr=Practical
Prj=Project
L=Lecture (1Lecture=45 minutes)
M=Major, G=General
Gen=General/Subsidiary Subject
Ex=External
In=Internal

Grand Total Marks =1700(Major) + 900(General) = 2600
Grand Total Credit =136(Major) + 72(General)   = 208

Structure of Physics Major Course under Semester System

Yr	Sem	Subjects	TotalMark MajorPrac (In + Ex)	Total Marks MajorTheory (In + Ex)	TotalMark GenerlPract (In + Ex)	Total Marks GenerlTheory (In + Ex)	Totalcredit (C)	
							M	G
1st	I	**Physics Major -101Th**		15+60=75			6	
		Physics Major -102Th		15+60=75			6	
		Physics Major -103Pr	10+40=50				4	
		Elective –E101(Math)				15+60=75		6
		Elective –E102				15+60=75		6
		English				10+40=50		4
		Physics Major -201Th		15+60=75			6	

Yr	Sem	Subjects						
	II	Physics Major -202Th		15+60=75			6	
		Physics Major -203Pr	10+40=50				4	
		Elective-E201(Maths)				15+60=75		6
		Elective-E202				15+60=75		6
		English				10+40=50		4
2nd	III	Physics Major -301Th		15+60=75			6	
		Physics Major -302Th		15+60=75			6	
		Physics Major -303Pr	10+40=50				4	
		Elective-E301(Maths)				20+80=100		8
		*Elective-E302			10+40=50	10+40=50		4+4
		Environmental Studies				10+40=50		4
	IV	Physics Major -401Th		15+60=75			6	
		Physics Major -402Th		15+60=75			6	
		Physics Major -403Pr	10+40=50				4	
		Elective-E401(Maths)				20+80=100		8
		*Elective-E402			10+40=50	10+40=50		4+4
		Environmental Studies				10+40=50		4
		Total	200	600	100	800	64	72

Yr	Sem	Subjects	Total Marks in Major Practical(In + Ex)	Total Marks in Major Theory(In + Ex)	Total Credit(C) (Major)
3rd	V	Physics Major -501Th		15+60=75	6
		Physics Major -502Th		15+60=75	6
		Physics Major -503Th		15+60=75	6
		Physics Major -504Th		15+60=75	6
		Physics Major -505Pr	15+60=75		6
		Physics Major -506Pr	15+60=75		6
	VI	Physics Major -601Th		15+60=75	6
		Physics Major -602Th		15+60=75	6
		Physics Major -603Th		15+60=75	6
		Physics Major -604Th		15+60=75	6
		Physics Major -605Pr	15+60=75		6
		Physics Major -606Prj	15+60=75		6
		Grand Total		800+900=1700	64+72=136

*For Elective with Practical.

Marks distribution for Physics Major Course

Yr	Sem	Paper	Topics	Marks (Ex)	Total Marks (Ex)	Total Marks (In)	Grand Total Marks	Total Credit (C)
1st	I	101(Th)	(a) Mathematical Methods-I	20	60	15	75	6
			(b) Mechanics	40				
		102(Th)	(a) Waves and Oscillations	40	60	15	75	6
			b) Ray Optics	20				
		103(Pr)					50	4
	II	201(Th)	(a) Mathematical Methods-II	35	60	15	75	6
			(b) Properties of Matter	25				
		202(Th)	Heat and Thermodynamics	60	60	15	75	6

		203(Pr)					50	4
2nd	III	301(Th)	(a)MathematicalMethods-III	25	60	15	75	6
			(b) Electrostatics	35				
		302(Th)	(a) Current Electricity	45	60	15	75	6
			(b) Magnetostatics	15				
		303(Pr)				50	50	4
	IV	401(Th)	(a) Mathematical Methods-IV	40	60	15	75	6
			(b) Introduction to Computer and Computer Language	20				
		402(Th)	(a) Wave Optics	40	60	15	75	6
			(b)Special theory ofRelativity	20				
		403(Pr)					50	4
3rd	V	501(Th)	(a)Mathematical Methods-V	30	60	15	75	6
			(b) Classical Mechanics	30				
		502(Th)	Atomic Physics	60	60	15	75	6
		503(Th)	(a) Quantum Mechanics	40	60	15	75	6
			(b) Astrophysics	20				
		504(Th)	Electronics	60	60	15	75	6
		505(Pr)					75	6
		506(Pr)					75	6
	VI	601(Th)	Nuclear Physics	60	60	15	75	6
		602(Th)	(a)Mathematical Methods-IV	15	60	15	75	6
			(b) Solid state Physics	45				
		603(Th)	(a) Modern Optics	40	60	60	75	6
			(b) Electromagnetic Theory	20				
		604(Th)	(a) Statistical Mechanics	30	60	15	75	6
			(b)Computer Applications	30				
		605(Pr)					75	6
		606(Prj)					75	6
			Total				**900**	**72**

Grand Total Marks =1700(Major) + 900(General) = 2600
Grand Total Credit =136(Major) + 72(General) = 208

Syllabus for Physics Major Course
FIRST SEMESTER

PAPER: 101 (THEORY)   **Total Marks: 60**
(a) MATHEMATICAL METHODS-I: Total marks: 20
1. *Vector analysis*: Vectors, Scalars, Vector algebra, Product rules, Vector fields, scalar fields.
2. *Vector differentiation*: Ordinary derivatives of vectors, space curves, Partial derivatives of vectors, Differentials of vectors, Concept of gradient, divergence and curl. Application of above concept to simple physical phenomena.   **20 Lectures**

(b) MECHANICS: Total Marks: 40
1. Non-inertial systems and fictitious forces, rotating frame of reference, fictitious/apparent force in a rotating co-ordinate system, Coriolis force, Coriolis and centrifugal forces produced as a result of earth's rotation. Deflection of a freely falling body, effect of

4

Coriolis force on the horizontal straight line motion of a body on the surface of the earth.

8 Lectures

2. Work-energy theorem, integral of the equation of motion, conservative forces, potential energy, conservative force as the negative gradient of potential energy, curl of a conservative force, non-conservative forces, general law of conservation of energy.

7 Lectures

3. Mechanics of a system of particles, centre of mass, motion of the centre of mass, conservation of momentum, calculation of centre of mass of (i) non-uniform rod, (ii) semicircular arc (iii) semi-circular disk and (iv) solid hemisphere. Laboratory frame of reference and centre of mass frame of reference, two dimensional elastic collision in laboratory frame of reference and centre of mass frame. **10 Lectures**

4. Angular momentum, angular momentum of a system of particles in terms of the centre of mass co-ordinate, conservation law of angular momentum, angular momentum and fixed axis rotation of a rigid body, moment of inertia, calculation of moment of inertia for spherical bodies (shell, hollow and solid). The compound pendulum, determination of g by Kater's pendulum. **9 Lectures**

5. Gravitation, gravitational field and potential due to spherical shell and solid sphere.

6Lectures.

Suggested books:

(a)

1. Mathematical methods for physicists, Arfken and Weber (Academic Press)
2. Mathematical Methods, M.C. Potter, J. Goldberg (Prentice Hall, India)
3. Mathematical Physics, Rajput and Yogprakash (Pragati Prakashan, Meerut)
4. Vector Analysis, Murray R. Spiegel (Schaum Series)

(b)

1. An Introduction to Mechanics, D. Kleppner and R. J. Kolenkow
2. Mechanics, D.S. Mathur
3. Mechanics, .S. Hans, S.P. Puri
4. Physics Part-I, Halliday and Resnick

PAPER: 102 (THEORY)   Total Marks: 60
(a) WAVES AND OSCILLATIONS: Total marks: 40

1. *Harmonic Motion*: Simple Harmonic motion, Composition of two simple harmonic oscillations at right angles, Lissajous figures. Free, damped and forced oscillations, resonance, and sharpness of resonance. **10 Lectures**

2. *Wave Motion*: Wave motion in an elastic medium, characteristic of progressive waves, mathematical representation of a progressive wave. Differential wave equation in one dimension, solution of wave equation (method of separation of variables). Energy density of plane progressive waves, Superposition of waves. Stationary waves, characteristics of stationary waves. **10 Lectures**

3. *Sound Waves*: Velocity of longitudinal waves in a solid bar. Intensity of sound wave. Units of intensity. Acoustics of auditorium, reverberation, Sabine's law. **6 Lectures**

4. *Fourier analysis*: Fourier analysis and evaluation of Fourier coefficients. Application of Fourier analysis to square and saw tooth waves. Equation of transverse vibration of a stretched string, energy of vibrating string, plucked string and struck string.

14 Lectures

(b) RAY OPTICS: Total Marks: 20

1. *Fermat's principle*: Fermat's principle and its application in establishing laws of reflection and refraction at spherical and plane boundaries. **5 Lectures**

2. *Matrix method*: Translation matrix and Refraction Matrix, use of matrix method in

refraction at a spherical surface and refraction through thin lens. **3 Lectures**

3. *Lens system*: Sign convention, conjugate foci, relation for refraction of paraxial rays at single spherical surface, interrelation among lateral, longitudinal and angular magnification, Lagrange's law and Helmholtz equation and its modification for telescopic system. **5 Lectures**

4. *Defects of image*: Spherical aberration and its magnitude for thin lens for object at finite distance and condition for minimum aberration when object is at infinity, Minimization of spherical aberration by using suitable lens of different radii of curvature and by aplanatic surface, Qualitative idea about coma, astigmatism and distortion, Chromatic aberration, circle of least confusion, achromatism of two thin lenses separated by a distance. **7 Lectures**

Suggested books:

(a)
1. Text book of Sound- K.Bhattacharjee;
2. Sound- P.K.Chakraborty and S.B.Choudhury;
3. Physics of vibrations and waves- H.J. Pain
4. A Text Book of Sound- N. Subramanyam and Brij Lal

(b)
1. Light – K.G. Mazumdar
2. A Text book of Light- B Gosh and K G Mazumdar.
3. Geometrical and Physical optics – P.K. Chakraborty
4. Optics – A. Ghatak
5. Optics – E Hecht
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PAPER: 103 (TEST OF LABORATORY SKILL AND PRACTICAL) Total Marks: 50
 (a) TEST OF LABORATORY SKILL: **Total Marks: 20**
 (Time allotted for Test of laboratory skill is one hour)

1. Identification of active and passive components of an electronic circuit.

2. Familiarization with operation of basic measuring and test equipments(analog and digital multimeters, function generator, Cathode ray oscilloscope)

3. To use a multimeter for identification of different terminals of (i) diode and (ii) transistor.

4. To find the value of resistor from colour code and verify by measuring the resistance by multimeter.

5. To make connections using soldering.

6. To measure small distances and angles using different varnier scales attached to (i) traveling microscope, (ii) polarimeter and (iii) spectrometer.

7. To check the condition of a lead-acid battery – (i) acid strength by common hydrometer, (ii) acid level and (iii) emf(using multimeter).

8. To check the condition of capacitor using multimeter.

(b) PRACTICAL: **Total Marks: 30**

(One experiment should be performed in three hours)

1. To measure the extension of an experimental wire due to different pulling forces using Searle's apparatus and hence determine the Young's modulus of the material of the wire.

2. Study the variation of angle of twist of a given rod at different lengths from the fixed end, with torque & then determine the rigidity modulus of the material of the rod.

3. To study the variation of time period of a bar pendulum about different point of suspension and use the result to find the value of g at a place.

4. To determine the frequency of a tuning fork by Melde's experiment.

5. To determine the moment of inertia of a cylinder or a rectangular parallelopiped about two different axes of symmetry by torsional oscillation method.

6. To determine the spring constant and mass from vertical oscillations of a loaded spring and hence to determine the modulus of rigidity of the material of the spring.

7. To determine the surface tension of fruit juice extracted from various citrus fruit using Jagers method. **(Additional experiment for those Colleges having Star College Scheme)**

Minimum number of experiments to be completed by each student during the semester is five.

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SECOND SEMESTER

PAPER: 201 (THEORY)   Total Marks: 60
(a) MATHEMATICAL METHODS-II: Total marks: 35

1. *Integration of vectors*: Ordinary integration of vectors. Line integral, surface integral and volume integrals and their applications to simple problems.Green's theorem in the plane Gauss's divergence theorem, Stokes' theorem and their applications.   **12 Lectures**
2. *Curvilinear co-ordinate system*: Curvilinear co-ordinates, Unit vectors and scale factors in curvilinear co-ordinates systems, orthogonal curvilinear co-ordinates, plane polar co-ordinates, right circular cylindrical co-ordinates and spherical polar co-ordinates. Arc length, area and volume elements in each of these systems. Divergence, curl and Laplacian in plane polar co-ordinates, right circular cylindrical co-ordinates and spherical polar co-ordinates. Application of above concept to simple physical phenomena.
                                                                            15 Lectures
3. *Gamma and Dirac Delta function*: Elementary introduction to Gamma function and Dirac Delta function.   **8 Lectures**

(b) PROPERTIES OF MATTER: Total Marks: 25
1. *Elasticity*: Different type of elastic constants and relation among them. Energy in a strained body, torsion of a rod, torsional oscillation, bending of beam, bending moment, cantilever, depression of a cantilever considering the weight of the beam.   **12 Lectures**
2. *Surface tension*: Surface tension, relation between surface tension and surface energy E=S-T dS/dT, excess pressure inside a curved liquid surface. Determination of surface tension by ripple method.   **7 Lectures**
3. *Viscosity*: Poiseullie's equation for flow of a liquid through narrow tube. Determination of viscosity by rotating viscometer.   **6 Lectures**

Suggested Books:
(a)
   1. Introduction to Mathematical Physics, C. Harper (Prentice Hall, India)
   2. Mathematical methods for physicists, Arfken and Weber (Academic Press)

3. Mathematical Methods, M.C. Potter, J. Goldberg (Prentice Hall, India)
4. Introduction to Electrodynamics (for vector analysis part), D. J. Griffith.
5. Mathematical Physics, Rajput and Yogprakash (Pragati Prakashan, Meerut)
6. Vector Analysis, Murray R. Spiegel (Schaum Series)

(b)
1. Properties of Matter, D.S. Mathur
2. General Properties of Matter, Newman and Searle
3. Physics Part-I, Halliday and Resnick
4. General Properties of Matter, Sengupta and Chatterjee

PAPER: 202 (THEORY)   **Total Marks: 60**
HEAT AND THERMODYNAMCS: **Total Marks: 60**

1. Kinetic theory of gases, pressure exerted by a gas using spherical polar coordinates, degree of freedom, law of equipartition of energy, Maxwell Law of velocity distribution, Maxwellian mean free path, transport phenomena – viscosity, Brownian motion (Einstein's – Langevin's theory), experimental determination of Avogadro's number, examples of Brownian motion.   **15 Lectures**
2. Equation of state of a gas, Andrew's experiment, Van der Waal's equation of state, critical constants and law of corresponding states. Thermal conductivity, Fourier equation for rectilinear flow of heat and its solution.   Platinum resistance thermometer Thermal conductivity, Fourier equation for rectilinear flow of heat and its solution. Platinum resistance thermometer.   **15 Lectures**
3. Zeroth and first law of thermodynamics, specific heats of gases, isothermal and adiabatic processes. Reversible and irreversible processes, conversion of heat into work, Carnot cycle, Carnot's theorem. Second law of thermodynamics: Heat engine, Kelvin-Planck statement of second law, Clausius' statement of second law, equivalence of Kelvin-Planck and Clausius' statements, Kelvin's thermodynamical scale of temperature and its relation to perfect gas scale, Clausius formulation of entropy, entropy changes in reversible and irreversible processes, entropy of ideal gas, relation between entropy and probability.   **15 Lectures**
4. Enthalpy, Gibbs-Helmholtz function, Maxwell's thermodynamic relations and their applications, Gibbs phase rule, triple point, Joule-Thomson effect, adiabatic demagnetization. Black body radiation, Kirchoff's law of radiation, radiation pressure, Stefan-Boltzmann law, Wein's displacement law, Rayleigh-Jean's law, Planck's radiation law.   **15 Lectures**

Suggested books:
1. A treatise on Heat - Saha and Srivastava
2. Advanced Textbook on Heat – P.K.Chakravarty
3. Heat and Thermodynamics- Zemansky and Dittman
4. Thermodynamics, Kinetic Theory and Statistical Thermodynamics – Sears and Salinger.

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PAPER: 203 (PRACTICAL)   **Total Marks: 50**

(One experiment should be performed in four hours)

1. To determine the focal length of a given convex mirror with the help of a convex lens.
2. To determine the coefficient of linear expansion of the material of given metal rod by

optical lever method.

3. To determine the value of J, the mechanical equivalent of heat by Joule's calorimeter.

4. To study the variation of resistance of a thermistor with temperature and then to measure an unknown temperature of a liquid with it.

5. To determine the refractive index of a liquid by using a plane mirror and a convex lens.

6. To determine the thermal conductivity of the material of an Indian Rubber Pipe.

7. To create a desired potential drop in a potentiometer and then determine the emf of a given cell with the help of it.

8. To convert a given galvanometer into a voltmeter of given range and than calibrate it with help of an ammeter and standard resistance.

9. To determine the temperature of the filament of a torch bulb by studying the change of its resistance with current and known value of temperature coefficient of the material of the filament.

10. Determination of surface tension of water solutions of minerals or organic compounds using capillary method and study the variation of surface tension with concentration. **(Additional experiment for those Colleges having Star College Scheme).**

Minimum number of experiments to be completed by each student during the semester is seven.

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THIRD SEMESTER

PAPER: 301 (THEORY)   Total Marks: 60
(a) MATHEMATICAL METHODS-III: Total Marks: 25

1. Properties of matrices, Transpose matrix, complex conjugate matrix, Hermitian matrix, special square matrix, unit matrix, diagonal matrix, co-factor matrix, adjoint of a matrix, self-adjoint matrix, symmetric matrix, anti-symmetric matrix, unitary matrix, orthogonal matrix, trace of a matrix, inverse matrix.
12 Lectures

2. Eigenvalue problems, Cayley-Hamilton Theorem, Diagonalization of matrices.
6 Lectures

3. Co-ordinate transformations, rotation in two dimensions, rotation in three dimensions.

7 Lectures
(b) ELECTROSTATICS: Total Marks: 35

1. Electric field, Electric field due to a uniformly charged (a) wire, (b) ring, and (c) disc.   **4 Lectures**

2. Divergence of Electric field, Gauss's law in integral and differential form, Applications of Gauss's law. Curl of an electric field, Electric potential, electric potential due to a uniformly charged - (a) wire, (b) ring, and (c) disc. Electric dipole, Potential and field due to a dipole, dipole in a uniform external electric field, dipole-dipole interaction. Multipole expansion of electrostatic potential due to a volume distribution of charge.   **10 Lectures**

3. Electrostatic boundary conditions. Electrostatic energy: Energy of (a) an assembly of point charges, (b) uniformly charged sphere. Laplace's and Poisson's equations, boundary conditions and Uniqueness theorem, Solutions of Laplace's equation in one

dimension: Electric potential and intensity (a) inside an infinite parallel plate capacitor, (b) inside spherical capacitor, and (c) due to a long and uniformly charged conductingwire.   **10 Lectures**

4. Method of electrical image with examples of (a) infinite grounded conducting plane and (b) grounded conducting sphere.   **4 Lectures**

5. Dielectrics: induced dipoles, atomic polarisability, polar and nonpolar molecules, polarization. The electric field of a polarized object, bound charges, The electric field inside a dielectric, Gauss's law in the presence of dielectrics, Electric displacement, linear dielectrics, susceptibility, permitivity and dielectric constant, Clausius-Mossotti equation.   **7 Lectures**

Suggested Books:

(a)

1. Introduction to Mathematical Physics, C.Harper (Prentice Hall of India).
2. Mathematical methods for physicists, Arfken and Weber (Academic Press, Harcourt India Private Ltd).
3. Mathematical Methods, M.C. Potter, J Goldberg (Prentice Hall of India).

(b)

1. Introduction to Electrodynamics - David J.Griffiths

2. Electrostatics and Magnetostatics - B.B.Laud

PAPER: 302 (THEORY)   Total Marks: 60

(a) CURRENT ELECTRICTY: Total Marks: 45

1. Electric current density, continuity equation, Ohm's law, Applications of Kirchoff's law to solve electrical network problem, Kelvin double bridge for low resistance measurement, moving coil ballistic galvanometer and its sensitivity.   **10 Lectures**

2. Electromagnetic induction: Self and mutual induction, coefficient of coupling, reciprocity theorem, self induction of a long solenoid, mutual induction of two solenoids, measurement of L and M using d.c. source and ballistic galvanometer.

   10 Lectures

3. Transient growth and decay of current in LR, CR and LCR circuits, oscillatory discharge. Thermo electricity: Coefficients of thermo-emf, thermoelectric power.

   8 Lectures

4. Alternating current: Generation of alternating current, Phasor (complex number method) method of analyzing a.c. circuits, current and potential across resistive, inductive and capacitive elements and their phase relationships, power factor, LR, CR and LCR (series and parallel) circuits, quality factor, resonance; Maxwell's LC bridge and Anderson's bridge.   **10 Lectures**

5. Rotating magnetic field, a.c. motor, transformer, reflected impedance in transformer, use of transformer.   **7 Lectures**

(b) MAGNETOSTATICS: Total Marks: 15

1. Magnetic field, Lorentz force, Cyclotron motion, cycloid motion, Biot-Savart law, Magnetic field due to a steady current in (a) straight conductor and (b) a circular coil.

Divergence and Curl of a magnetic field. **7 Lectures**

2. Ampere's circuital law: magnetic field due to a (a) long straight conductor and (b) an infinite solenoid carrying a steady current, Magnetic scalar and vector potential. Force and torque on a current loop in a uniform magnetic field, Current loop as a magnetic dipole. **8 Lectures**

Suggested Books:

(a)
1. Electricity and Magnetism - D.Chattopadhyay and P.C.Rakshit.
2. Electricity and Magnetism - Berkeley Series.
(b)
1. Electrostatics and Magnetostatics – B.B.Laud

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PAPER: 303 (PRACTICAL)   Total Marks: 50

(One experiment should be performed in five hours)

1. To determine the horizontal component of earth's magnetic field using deflection and vibration magnetometer.

2. To determine the horizontal component of earth's magnetic field with the help of a tangent galvanometer and copper voltameter.

3. To determine the current flowing through an external circuit using potentiometer.

4. To compare the values of two given low resistances using a potentiometer.

5. To determine the internal resistance of a given cell using a potentiometer.

6. To study the growth and decay of current in an RC circuit for three different values of R. Compare the experimental values of time constant with theoretical values.

7. To determine the value of a given low resistance by drop of potential method using a meter bridge.

8. To determine the end correction of a meter bride and than to determine the specific resistance of the material of a given wire with help of the meter bridge using end correction.

9. To convert a given galvanometer into an ammeter of given range and than calibrate it with the help of a copper voltameter.

10. Preparation of a scientific and technical report on a given topic through internet browsing. (**Additional experiment for those Colleges having Star College Scheme**).

Minimum number of experiments to be completed by each student during the semester is seven.

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FOURTH SEMESTER

PAPER: 401 (THEORY)   Total Marks: 60
(a) MATHEMATICAL METHODS-IV: Total Marks: 40

1. ***Differential Equations***: Second order linear differential equations, series method of solutions (Frobenius), Legendre's differential equations, Legendre's polynomial, Hermite's differential

equations, Hermite's polynomial, generating function, spherical harmonics, orthogonal properties & recurrence relations. **25 Lectures**

2. ***Probability theory***: Mutually exclusive events, theorem of total probability, compound events and theorem of compound probability. Probability distributions -Gaussian distribution, mean and standard deviation. **15 Lectures**

(b) INTRODUCTON TO COMPUTER AND COMPUTER PROGRAMMING:
Total Marks: 20

1. Functional organisation of a digital computer-CPU, memory, input/output unit. Flowcharts, Algorithms, High level Computer languages, programming in one high level language (eitherFORTRAN-95 or C or C^{++}). Data types, different types of variables, important commands, I/O statements, relation and logical statements, transfer statements, string manipulation, subscripted variables, Functions and subroutines. **20 Lectures**

Suggested books:
(a)
   1. Introduction to Mathematical Physics, C.Harper (Prentice Hall of India).
   2. Mathematical methods for physicists, Arfken and Weber (Academic Press,
   3. Harcourt India Private Ltd).
   4. Mathematical Methods, M.C. Potter, J Goldberg (Prentice Hall of India).

(b)
   1. Programming with C – B. Gotterfield
   2. Understanding Fortran 77 – M. Boillot
   3. Fundamentals of Computer – V. Rajaraman
   4. Introductory methods of Numerical Analysis – S. Sastry
   5. Let us C – Kenetkar

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PAPER: 402 (THEORY)   **Total Marks: 60**
(a) WAVE OPTICS: **Total Marks: 40**

1 ***Interference***: Concept of light wave and its equation, complex representation of superposition of waves, meaning of coherence, to show that interference fringes are hyperbolic in general, condition for straight fringes, Stokes' law, interference due to Fresnel's biprism, interference by a plane parallel film, wedge shaped film, colour of thin film, Newton's rings, Michelson interferometer and its application for finding difference in wavelengths.   **15 Lectures**

2 ***Diffraction***: Difference between Fresnel and Fraunhofer classes, half-period zones and strips, Zone plate and its lensing property, diffraction at a straight edge and at a circular aperature (with reference to microscope), Fraunhofer diffraction due to a single slit, double slit and transmission gratng, wavelength measurement by the plane transimission grating, resolving power of a grating, theory of concave grating.   **15 Lectures**

3 ***Polarisation***: Double refraction, optic axis and $CaCO_3$ crystal, plane, circular and elliptically polarised light, Retarding plates and their uses for producing and analysing different polarised light, specific rotation of plane of polarisation and half-shade polarimeter.   **10 Lectures**

(b) SPECIAL THEORY OF RELATIVITY: **Total Marks: 20**

1. ***Formulation of Special Theory of Relativity and Relativistic Kinematics***: The need for a new model of kinematics (relativity). Electromagnetism and null result of Michelson-Morley experiment, negation of ether concept. Postulates of special theory of

relativity. Galilean transformation (Newtonian kinematics) and Lorentz transformation. Application of Lorentz transformation,. Length contraction, time dilation and their examples and application to physical situations (viz. muon decay). Relativistic transformation of velocity. Relativistic Doppler Effect and twin paradox.   **12 Lectures**

2. ***Relativistic Momentum and Energy, Space-time:*** Relativistic momentum and energy. Equivalence of mass and energy. Massless particles (i.e. photons). The geometry of space-time and space-time interval. Time-like and space-like events .Concept of four-vectors and Minkowski space. 8 **Lectures**

Suggested Books:
(a)
    1. Light – K.G. Mazumdar
    2. A Text book of Light- B Gosh and K G Mazumdar.
    3. Geometrical and Physical optics – P.K. Chakraborty
    4. Optics – A. Ghatak
    5. Optics – E Hecht

(b)
    1. Concept of Modern Physics-A. Beiser 2002 or later editions.

    2. An introduction to Mechanics- D Klppner and R J Kolenkow 1987 or later editions.

    3. The Feynan Lectures on Physics Volume- R P Leighton and M Sands 1997 or later editions.

PAPER: 403 (PRACTICAL)   Total Marks: 50
(One experiment should be performed in five hours)

1. To adjust and focus the given spectrometer using Schuster's method and then determine the refractive index of the material of the prism.

2. To determine the width of a single slit by observing the diffraction pattern of monochromatic light.

3. To determine the focal length of two lenses and their combination by displacement method.

4. To determine he wavelength of light emitted by a monochromatic source with the help of Newton's ring arrangement.

5. To study the variation in liquid column height with diameter of capillary tube and determine the surface tension of the liquid.

6. To determine the value of acceleration due to gravity using Katter's Pendulum.

7. To determine the magnifying power of a telescope by angular method and compare this value obtained by linear method.

8. To study the variation of optical rotation with concentration for sugar solution using polarimeter and Sodium light and hence determine the specific rotation of sugar.

9. To determine resolving power of a plane transmission grating.

10. To study the variation of absorption of light with the concentration of an organic solution using spectrophotometer (**Additional experiment for those Colleges having Star College Scheme**).

Minimum number of experiments to be completed by each student during the semester is seven.

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FIFTH SEMESTER

PAPER: 501   (THEORY)   Total Marks: 60
(a) MATHEMATICAL METHODS-V: Total Marks: 30

1. Algebraic operation, Argand diagram, vector representation, complex conjugate, Euler's formula, De-Moiver's theorem.   **5 Lectures**
2. Analytic function of a complex variable, Derivative of F(z) and its analyticity, contour integrals, equivalent contours, Cauchy integral theorem, differentiation under integral sign.   **13 Lectures**
3. Series expansion: Taylor and Laurent series and their simple applications. Residues, Zeros, isolated singular points, evaluation of residues. Evaluation of definite intragrals.   **12 Lectures**

(b) CLASSICAL MECHANICS: Total Marks: 30

1. Central force motion, two body central force motion, two body motion as a one body problem, general properties of central force motion, Energy and momentum as constants of motion in central force, Energy equation involving only the radial motion, energy diagram and nature of orbits.   **8 Lectures**
2. Application of central force problem to motion under inverse square force field, solution of the equation of the path to find the nature of the orbits as hyperbolic, parabolic and elliptic.   **8 Lectures**
3. Constraints, generalized co-ordinates, principle of virtual work, D' Alembert's principle and Lagrange's equations of motion, simple applications of Lagrangian formulations (i) Atwood machine (ii) simple pendulum (iii) Keplerian motion (iv) bead sliding on rotating wire.(v)compound pendulum,(vi)linear harmonic oscillator Hamilton's principle, calculus of variation, shortest distance between two points as example, Lagrange's equations from Hamilton's principle, Hamiltonian of a system, Hamilton's canonical equations of motion, applications of Hamilton's equations to simple problems like simple pendulum, Kepler's problem., Poisson brackets.
                                                    14 Lectures

Suggested books:
(a)
1. Introduction to Mathematical Physics, C. Harper (Prentice Hall of India).
2. Mathematical methods of physicists, Arfken and Weber (Academic Press, Harcourt India Private Ltd).
3. Mathematical Methods, M.C. Potter, J Goldberg (Prentice Hall of India).
(b)
1. Classical Mechanics, S.N. Biswas (Books and Allied (P) Ltd).
2. Classical Mechanics, H. Goldstein (Narosa Publishing House).
3. An Introduction to Mechanics, Kleppner and Kolenkow (Tata McGraw- Hill).
4. Introduction to Classical Mechanics, Takwale and Puranik (Tata McGraw-Hill).
5. Classical Mechanics A modern Perspective, Barger & Olsson (McGraw Hill International).

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PAPER: 502 (THEORY)   Total Marks: 60
ATOMIC PHYSICS: Total Marks: 60

1. ***Positive rays and their analysis:*** Thomson's mass parabola method; Aston's mass spectrograph, Bainbridge mass spectrograph. **10 Lectures**
2. Rutherford's nuclear atom model, alpha scattering expt; deduction of the scattering formula. **8 Lectures**
3. ***Atomic spectra:*** Bohr's theory of hydrogen spectra; energy level diagram; Ritz combination principle; resonance, excitation, critical and ionization potentials; fine structures of the spectral lines; Sommerfeld's extension of the Bohr's theory. **12 Lectures**
4. ***Vector atom model :*** Spectra of alkali atoms; Bohr magneton; spinning electron; quantum numbers; Pauli's exclusion principle; explanation of the periodic classification of the elements; spectroscopic notations; source of radiation in external fields- normal Zeeman effect; anomalous Zeeman effect; Paschen-Back effect; Stark effect; Stern-Garlach experiment. **15 Lectures**
5. ***X-rays:*** Continuous and characteristic X-rays Mosley's law, Compton effect. **8 Lect.**
6. ***Scattering of light:*** Rayleigh scattering formula; colour of the sky; polarisation of the scattered light; Raman effect, experimental study of Raman effect, quantum theory of Raman effect, application of the effect. **7 Lectures**

Suggested Books:
1. Atomic Physics – John Yarwood
2. Concept of Modern Physics – A. Beiser
3. Atomic and Nuclear Physics – S. N. Ghosal

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PAPER: 503 (THEORY)   **Total Marks: 60**
(a) QUANTUM MECHANICS: **Total Marks: 40**

1. Development of quantum mechanics in light of Black body radiation, failure of classical idea, Plank's quantum hypothesis, photoelectric effect and Compton effect.   **5 Lectures**
2. Matter wave: Wave particle duality, de Broglie wave associated with moving particles-(i) non relativistic and (ii) relativistic case, verification of matter waves by (i) Davisson Germer's experiment and (ii) G.P. Thomson's electron diffraction experiment. **8 Lectures**
3. Complimentary principle of Neils Bohr, Heisenberg's Uncertainty Principle, Gamma ray microscope experiment, application of Uncertainty Principle.   **7 Lectures**
4. Wave function and its probabilistic interpretation as probability amplitude; Continuity equation, probability density and probability current density J; Normalisation condition and normalised wave function; properties of well behaved wave function in quantum mechanics. Wave packets, Superposition of waves, phase velocity and group velocity and their relation.   **8 Lectures**
5. Introduction to operator formalism, Dynamical variable as operator (position, momentum and Hamiltonian), Eigenvalues and eigenfunction; Expectation value, Ehrenfest's theorem. Schrodinger wave equation – (i) time dependent and (ii) time independent.. Correspondence Principle. Application of Schrodinger's wave equation –(i) one dimensional step potential (ii) one dimensional potential barrier, Reflection and transmission coefficients and tunneling effect, (iii) a particle in a one dimensional potential well of infinite depth (iv) one dimensional harmonic oscillator.(v) Theory of hydrogen atom- separation of variables, radial solution.   **12 Lectures**

(b) ASTROPHYSICS: **Total Marks: 20**
1. ***Astrophysical Co-ordinates:*** Celestial coordinate systems, The right Ascension, Declination and Altitude-Azimuth coordinate systems. The ecliptic and annual motion of

the Sun across the sky the Signs of Zodiac. Identifications of the Constellations and bright stars. **5 Lectures**

2. *Concept of time*: Sidereal time and solar time; Greenwich Mean Time(GMT), standard time and local time; Julian date and its importance in astronomical observation.**5 Lectures**

3. *Stellar Magnitude system and Distance measurement*: The Stellar magnitude system and its relation with luminosity. Apparent and absolute magnitude and their relations with distances. Trigonometric and spectroscopic parallax to determine the distances. Difference magnitude systems. **5 Lectures**

4. *Spectral Classification and H.R. Diagram*: Spectral classification, color index, H-D classification. The H-R Diagram. Steller evolution and the evolutionary track of a star.
   5 Lectures

Suggested Books:

(a)
   1. Perspectives of Modern Physics-Beiser A. (1969)
   2. Introduction to the Quantum Theory- Park D. (1974)
   3. Theory and Problems of QUANTUM MECHANICS - Schaum Series
   4. Introduction to the Quantum Mechanics-Griffiths D.J.
   5. Classical Mechanics-N.C. Rana and P.S. Joag.

(b)
   1. Introduction to Astrophysics – H.L. Duorah & Kalpana Duorah
   2. ASTRONOMY – a Self Teaching Guide – Dinah L. Moche
   3. Sky Atlas-2000.0 - Wil Tirton (Cambridge, 1981)
   4. University Astronomy – JM Pasachoff and ML Kutner

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PAPER: 504 (THEORY)   **Total Marks: 60**
   ELECTRONICS: **Total Marks: 60**

1. Volt-ampere relation of P-N junction diode (deduction not necessary), Energy band diagram of P-N diode, photo diode, LED, varactor diode and zener diode. Rectifiers- half wave and full wave with resistive load, efficiency, ripple factor, filters- series inductor, shunt capacitor, L-section and Π-section. Voltage regulation and regulated Power Supply. Clipping and clamping circuits. **8 Lectures**

2. Thevenin, Norton and Millman theorem & maximum power transfer theorem. **6 Lectures**

3. Transistor, different mode of operations and characteristics of transistor, basic transistor amplifier, load line and operating point (Q point) of transistor, Stabilization of Q point, transistor biasing circuits, two port (four terminals) device and z, y and h parameters, h parameter equivalent circuit, analysis of transistor amplifier (CE) with h parameters, current gain, voltage gain and power gain, input and output impedance, Classification of amplifiers, Class A, Class B and Class C amplifiers, cascade amplifiers, small signal RC coupled amplifier (CE) and its voltage and current gain in low, mid and high frequency, frequency response curve, Phase relation between input and output, Power amplifiers, power dissipation, Harmonic distortion, large signal Push Pull Amplifier (Class B).
   14 Lectures

4. Concept of feedback, different types of feedback, advantages of negative feedback in amplifier, Barkhousen criterion, classification of oscillators, tuned collector oscillator, Phase shift(R-C) and Wein bridge oscillator, Multivibrators. **7 Lectures**

5. Direct Coupled Amplifier, differential amplifier, introduction to IC, OPAM, characteristics of an ideal OPAM, common and differential mode, CMMR, inverting, non-inverting mode of OPAM, OPAM as scale changer, adder, subtractor, differentiator

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and integrator. **6 Lectures**

6. Modulation, need of modulation, Theories of AM and FM, side-bands, power content in different parts of the modulated wave, band-width of AM and FM, modulators, amplitude modulation circuits, circuit of square law modulation and detection, SSB transmission, AM Transmitter (block diagrams), super heterodyne receiver (block diagram). Introduction to radio wave propagation, ground or surface wave, space or tropospheric wave and sky wave. Working and uses of CRO, Introductory idea of microprocessor. **12 Lectures**

7. Binary Number System, Decimal to binary conversion, Binary to decimal conversion, Binary addition and subtraction. OR, AND, NOT, NOR and NAND Logic gates using P-N junction diode and transistors, Boolean Algebra, De Morgan's Theorem, Sequential circuits, Latch, RS, JK, MSJK, D and T flip flops. Introduction to binary transmission ASK, FSK and PSK. **7 Lectures**

Suggested Books
1. Basic Electronics – B.L. Thereja
2. Electronics fundamentals and applications –D. Chattopadhyay and P.C. Rakshit
3. A Text Book Of Electronics –S.L. Kakani & K.C. Bhandari

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PAPER: 505 (PRACTICAL)   Total Marks: 75
(One practical should be performed in the examination from the following list in six hours)

1. To study the hydrogen spectrum by using plane transmission grating and spectrometer and hence determine the Rydberg constant.

2. To draw the characteristic curve of a photo cell and find the maximum velocity of the emitted electrons.

3. To determine the value of Planck's constant with the help of photo cell a monochromatic filter.

4. To determine the value of Stefan's constant by electrical method using an incandescent electric bulb.

5. To calibrate a spectrometer with spectral lines of known wavelength and hence determine unknown wavelength of spectral lines emitted by a given source.

6. To study the variation of refractive index of the material of a prism with known wavelengths of spectral lines of a source and hence determine the unknown wavelength of a spectral line emitted by a source.

7. To determine the wavelength of a monochromatic light emitted by given source using a biprism.

8. To determine he boiling point of the given liquid with the help of a Platinum Resistance thermometer.

9. To construct & calibrate a thermocouple and hence determine the melting point of a solid.

10. Draw a calibration curve for the variation of ionic conductivity of a solution with the pH value and then determine the ionic conductivity of a solution for a given pH value of the solution from the calibration curve. (**Additional experiment for those Colleges having Star College Scheme**).

Minimum number of experiments to be completed by each student during the semester

is seven.

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PAPER: 506 (PRACTICAL) Total Marks: 75
(One practical should be performed in the examination from the following list, in six hours)

1. To assemble and study the frequency response of an OPAMP in inverting negative feedback mode for three different feedback resistances and hence calculate upper half power point and band width. .(Using Breadboard).
2. To study the transfer characteristic of an OPAMP in negative feedback mode for different feedback loop.(Using Breadboard).
3. To verify De Morgan's theorem using IC 7400 and 7402. (Using Breadboard).
4. To study the input and output characteristics of a transistor in CB and CE configurations and determine the alpha and beta of the transistor.(Using Breadboard).
5. To measure the phase difference between the signal across R and C of an RC network using CRO and hence find the value of the resistor and frequency of the signal source. (Using Breadboard).
6. To draw the frequency response curve of RC coupled common emitter amplifier and hence determine 3dB points and band width. (Using Breadboard).
7. To trace the output wave form of a free running multivibrator for three different frequencies using CRO and hence measure the width of the output pulses and compare them ith theoretical values. (Using Breadboard).
8. To assemble (a) OR, (b) AND, (c) NOT and (d) NAND gate with resistance, diode and transistors using bread board and verify their truth table. (Using Breadboard).
9. To draw the forward bias characteristic of a semiconductor diode and the reverse bias characteristic of a Zener diode and hence determine their DC and AC resistances. Also determine the breakdown voltage of the Zener diode (Using Breadboard).
10. Using Excel package draw graph, π diagram and histogram of a given sample of data. **(Additional experiment for those Colleges having Star College Scheme).**

Minimum number of experiments to be completed by each student during the semester is seven.

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SIXTH SEMESTER

PAPER 601 (THEORY) Total marks: 60

NUCLEAR PHYSICS: Total marks: 60
1. *Nuclear forces and Stability of Nuclei*: Concept of packing fraction and binding energy, binding energy curve and its significance. Nucleon-nucleon forces – qualitative discussions on nuclear force. Brief outline of Yukawas meson theory, Nuclear stability, neutron proton ratio in stable nuclei, stability curve, odd-even rules of nuclear stability.
      8 Lectures
2. *Alpha decay*: Cause of alpha decay, basic α-decay process, range and energy of α-decay, α-decay systematics, Geiger Nuttle rules, Qualitative discussion on the theory of α-decay.
    6 Lectures
3. *Beta-decay*: Types of β-decays, conditions of $β^+$ & $β^-$ decay and K capture, β-ray

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spectrum, Pauli's neutrino hypothesis. **5 Lectures**

4. *Gamma-rays:* γ-rays and their origin. Interaction of γ-particle with matter. **2 Lectures**

5. *Nuclear models*: Evidence in favour of liquid properties of nuclei, Liquid drop model, Bethe-Weisackar's mass formula. Applications of mass formula – estimation of fission energy, prediction of most stable member of an isobaric family. Shell model (Basic concepts only). **8 Lectures**

6. *Nuclear Reactions*: Types of nuclear reactions, conserved quantities of nuclear reaction, energies of nuclear reaction – Q-value & its experimental determination. Exoergic & endoergic reactions. Cross-section of nuclear reaction and its unit. Nuclear fission and chain reaction, critical size, controlled chain reaction and basic principle of nuclear reactor. Nuclear fusion reaction – basic concepts of fusion reactions, fusion barrier, fusion and thermonuclear reactions (PP chains only). **15 Lectures**

7. *Accelerators*: Necessity of charge particle acceleration – construction and working principle of linear accelerator. Construction and working principle of a cyclotron. **5 Lectures**

8. *Detectors*: Principles of detection of charge particles. Construction and working principle of gas filled detectors. Ionization chamber – its construction & working principle. **5 Lectures**

9. *Cosmic rays*: Origin of cosmic rays, primary & secondary cosmic rays and their composition. The East West effect. Latitude, longitude & altitude effect, Extensive Air Shower (EAS). **6 Lectures**

Suggested Books:
1. The Atomic Nucleus - R. D. Evans
2. Concept of Modern Physics -y A. Beiser
3. Nuclear Physics -S. N. Ghosal
4. Introductory Nuclear Physics - K. S. Krane
5. Nuclear physics - I. Kaplan
6. Atomic & Nuclear Physics - A. B. Gupta & D. Ghosh
7. Atomic & Nuclear Physics

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PAPER: 602 (THEORY)   Total marks: 60
(a) MATHEMATICAL METHODS: Total marks: 15

Introduction to tensor, transformation of coordinates, contravariant and covariant tensor, tensorial character of physical quantities, symmetric and antisymmetric tensors, kronecker delta. Rules for combination of tensors- addition, subtraction, outer multiplication, contractions and inner multiplications. **15 Lectures**

(b) SOLID STATE PHYSICS: Total Marks: 45
1. The idea of amorphous and crystalline solids, The crystal lattice and translation vectors, unit cell, types of crystal lattice, Miller indices, diffraction of X-rays, use of Bragg's law to the determination of lattice constants. **10 Lectures**
2. The different types of crystal bonding: ionic, covalent, metallic, Van der Waal and hydrogen bondings, cohesive energy of ionic crystal, Madelung constant. **5 Lectures**
3. Free electron theory of metals, Boltzmann's equation of state, electronic specific heat, electrical and thermal conductivity of metals, Wiedemann-Franz law.(Quantum Mecanical treatment to be used).Bloch theorem in one dimension, Kronig-Penny

model of energy bands of solids, distinction among metal, insulator and semiconductor, intrinsic and extrinsic semiconductors (qualitative discussion only).

15 Lectures

4. Introductory concept of superconductivity, Meissner effect, types I and type II superconductors. **5 Lectures**

5. Magnetic properties of solids: Magnetization, magnetic intensity, magnetic susceptibility, permeability, hysteresis, B-H curve and energy loss in hysteresis, different classes of magnetic material, magnetic moment, Bohr magneton, Larmor precession, Classical theory of paramagnetism(Langevin's theory and Curie law), Weiss theory(Quantum Mecanical treatment to be used), relation between para and ferromagnetism, Ferromagnetic domain. **10 Lectures**

Suggested Books

(a)
1. Introduction to Mathematical Physics, C. Harper (Prentice Hall of India).
2. Mathematical methods of physicists, Arfken and Weber (Academic Press, Harcourt India Private Ltd)
3. Mathematical Methods, M.C. Potter, J Goldberg (Prentice Hall of India).

(b)
1. Introduction to Solids by L.V. Azarof
2. Introduction to Solid State Physics by C.Kittel
3. Solid State Physics by A J Dekker
4. Solid State Physics by S O Pillai

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PAPER: 603 (THEORY)   **Total Marks: 60**

(a) MODERN OPTICS: **Total Marks: 40**

1. *Optics of crystals:* Wollaston prism, Rochon prism, Jones calculus, Interference of polarized light: interference due to crystal plates in plane polarised light, Babinet compensator. Principle of liquid crystal display. **8 Lectures**

2. *Lasers:* Characteristics of laser light, absorption Spontaneous emission, Stimulated emission, Einstein coefficients, Population inversion and light amplification, Essential components of the laser, Ruby and He-Ne laser (principles only). Elementary idea about non-linear optics: Second Harmonic Generation. **10 Lectures**

3. *Holography:* Formation of a hologram, Reconstruction of the hologram (mathematical aspect). **6 Lectures**

4. *Optical Fibers:* Types of fibers; propagation of a ray through step index fiber: numerical aperture, multipath dispersion; propagation through graded index fiber. Basic idea about communication through an optical fiber cable (Block diagram).

10 Lectures

5. *Optical components & Spectrographs:* Ramsden and Huygen's eyepieces, oil immersion objective, Prism spectrograph (Glass and quartz), Grating spectrograph. **6 Lectures**

(b) ELECTROMAGNETIC THEORY: **Total Marks: 20**

1. Electromagnetic field equation in integral and differential form, displacement current, Maxwell's equations, Energy Conservation Law-Poynting theorem and Poyntingvector. **6 Lectures**

2. Electromagnetic wave equation, velocity of electromagnetic wave, Monochromatic plane wave equation in free space and conducting medium. Reflection and Refraction of plane electromagnetic wave for normal and oblique incidence, Snell's law, reflection and transmission co-efficient, Fresnel's equations, Polarisation of

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electromagnetic wave, linear, circular and elliptical polarization, Brewster's law.

14 Lectures

Suggested books:

(a)
1. Optics -A Ghatak.
2. Optical Communication System-J. Gower.
3. Laser and Non linear optics – B.B. Laud
4. Optoelectronics and fiber optic communication – C.K. Sarkar and D.C. Sarkar

(b)
1. Electrodynamics by Griffith
2. Electricity and Magnetism by Laud

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PAPER: 604 (THEORY)   Total Marks: 60
(a) STATISTICAL MECHANICS: Total Marks: 30

1. Statistical system, and its coordinates, specification of a state in statistical mechanics, Macrostate and microstate, phase space, ensemble, Boltzmann entropy relation, ergodic hypothesis, postulate of equal a priori probability, density of phase points in phase space, Liouville' theorem.   **8 Lectures**
2. Symmetry of wavefunction, restriction regarding the number of particles in given state, different types of statistics- Maxwell-Boltzmann(MB), Bose-Einstein(BE) and Fermi-Dirac(FD) Statistics, Most probable distribution relation in MB, BE and FD statistics and their comparison. Degeneracy Factor, Density of state.   **7 Lectures**
3. Application of MB statistics to derive Maxwell distribution law (velocity, energy, momentum and frequency).   **5 Lectures**
4. Fermi energy and Fermi temperature, Fermi distribution function, Application of FD statistics to discuss electronic specific heat.   **5 Lectures**
5. Application of BE statistics to explain BE condensation and to derive Black body radiation formula.   **5 Lectures**

(b) COMPUTER APPLICATIONS: Total marks: 30

1. Programming exercise (either FORTRAN-95 or C or C^{++}): simple mathematical series generation and summation, sorting of numbers largest of n numbers, sorting a list ascending/descending order, solution of quadratic equation, solution of simultaneous linear equation, least square graph fitting (straight line and quadratic curve) of given data, iterative methods, implementation of Runge-Kutta 4th order method of solving differential equation and Simpson's rule for integration.

30 Lectures

Suggested Books:

(a)
1. Statistical Mechanics- B.K Agrawal and M. Eisner
2. Statistical Mechanics- R.K.Pathria

(b)
1. Programming with C – B. Gotterfield
2. Understanding FORTRAN 77 – M. Boillot
3. Fundamentals of Computer – V. Rajaraman
4. Introductory methods of Numerical Analysis – S. Sastry
5. Let us C – Kenetkar

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PAPER: 605 (PRACTICAL)   Total Marks: 75

(One practical should be performed in the examination from the following list, in six hours)

1. To study variation of potential drop with frequency across the inductor, capacitor and non-inductive resistor of a series LCR circuit for an ac signal and hence find the resonant frequency. Compare it with theoretical value.

2. To determine the Q- factor of a series resonance circuit containing L C and R for three different values of R.

3. To determine the value of 'J' (the mechanical equivalent of heat) by Callender and Bern's method.

4. To determine the value of self-induction of a coil with the help of Anderson's Bridge.

5. To determine the constant of a ballistic galvanometer by using a capacitor charged to a known potential difference.

6. To study the ripple factor of a half-wave and full-wave rectifier using semiconductor diode and L and Π section filter.(Using Breadboard).

7. To measure the phase difference between he sgnal accros R and C of an R-C network using CRO and hence find the value of the resistor and frequency of the signal.

8. To determine the temperature coefficient of the material of a given wire.

9. To study the detection of the cosmic ray on the earth surface using G.M. counter. **(Additional experiment for those Colleges having Star College Scheme)**.

   Minimum number of experiments to be completed by each student during the semester is six.

PAPER: 606 (PROJECT AND COMPUTER PROGRAMMING)   Total Marks: 75

(a) PROJECT: Total Marks: 40
(Experimental project work of any relevant topic within the syllabus of Physics, to be guided by a teacher and to be submitted along with a report)

(b) COMPUTER PROGRAMMING: Total Marks: 35

(One practical should be performed in the examination from the following list, in five hours)

1. To determine (a) mean, (b)standard deviation and (c)standard error of the given experimental data.

2. To analyse the supplied experimental data between two variables using least square straight line fitting programme.

3. To rearrange the supplied numerical data in ascending/descending order and find the largest/smallest number in a given list of numbers.

4. To solve for the two unknown variables in the given pair of simultaneous equations.

5. To find roots (real and distinct, real and repeated and imaginary) of a quadratic equation.

6. To generate Fibonacci numbers up to 200 and also to check whether the given number is a prime number.

7. To make a scientific presentation of procedure, data analysis and result of any one experiment from Paper-605 using power point.

8. Calculation of mean, mode, median, co-relation, regression, analysis of variance, χ-square of given data using Excel or SPSS. (Sample size should be large. It may be collected from internet). (**Additional experiment for those Colleges having Star College Scheme**).

Minimum number of experiments to be completed by each student during the semester is five.

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Undergraduate Course Syllabus Under semester system
Physics General/Subsidiary

1. The undergraduate General/Subsidiary Course in Physics under the Gauhati University is a three year six semester Course. There are six university examinations during the course, the 1st semester, 2nd semester, 3rd semester, 4th semester, 5th semester and 6th semester held each at the end of every six months.

2. A student who wants to study Physics as General/Subsidiary Course subject should have also Mathematics as one of the Subsidiary Course subject.

3. A student pursuing a General/Subsidiary Course in Physics has to study two other subjects of General/Subsidiary Course (out of these two one should be Mathematics) during the first four semesters along with compulsory subjects English (during 1st and 2nd semester) and Environmental studies (during 2nd and 3rd semester). During last two semesters of the course a student has to study any one of the General/Subsidiary Course subjects studied during the first four semesters along with General/Subsidiary Course of Physics. The structure of detailed syllabus and total number of papers in each semester is given below.

Structure for General/Subsidiary Course under semester system:

Year	Sem	Subjects	Total Marks (Physics)	Total Marks (Electives)	Total Credits (Physics)	Total Credits (Electives)	Grand Total Credit(C)
1st	1st	**Physics**	75		6		
		Elective		75		6	
		Elective		75		6	
		English		50		4	
	2nd	**Physics**	75		6		

Yr	Sem	Subject	Physics Marks	Other Marks	Physics Credit	Elective Credit	Total Credit
		Elective		75		6	
		Elective		75		6	
		English		50		4	
2nd	3rd	**Physics**	**100**		**8**		
		Elective		100		8	
		Elective		100		8	
		Environmental studies		50		4	
	4th	**Physics**	**100**		**8**		
		Elective		100		8	
		Elective		100		8	
		Environmental studies		50		4	
3rd	5th	**Physics**	**200**		**16**		
		Elective		200		16	
	6th	**Physics**	**200**		**16**		
		Elective		200		16	
	Total		**750**	1300	**60**	104	164

Yr	Sem	Subjects	Practical Marks (In+ Ex)	Theory Marks (In + Ex)	Total Marks (Physics)	Total Marks in other Elective Subjects	Total Credit (C)
1st	I	**Physics –E101 (Th)**		**15+60**	**75**		**6**
		Elective –E102 (Maths)		15+60		75	6
		Elective -E103		15+60		75	6
		English		10+ 40		50	4
	II	**Physics -E201 (Th)**		**15+60**	**75**		**6**
		Elective-E202		15 +60		75	6
		Elective-E203		15 + 60		75	6
		English		10+ 40		50	4
2nd	III	**Physics -E301 (Th)**		**10+40**	**100**		**8**
		Physics -E302 (Pr)	**10+40**				
		*Elective-E303+E304	10+40	10+ 40		100	4+4
		Elective-E305		20 + 80		100	8
		Environmental Studies		10+ 40		50	4
	IV	**Physics -E401 (Th)**		**10+40**	**100**		**8**
		Physics –E402 (Pr)	**10+40**				
		*Elective-E403+E404	10+40	10 + 40		100	4+4
		Elective-E405		20 + 80		100	8
		Environmental Studies		10+ 40		50	4
	V	**Physics -E501 (Th)**		**20 + 80**	**200**		**16**
		Physics -E502 (Pr)	**20+80**				
		Elective-E503				100	8
		Elective-E504				100	8
		Physics –E601 (Th)		**20 + 80**	**200**		**16**

3rd	VI	Physics -E602 (Pr)	20+80					
		Elective-E603					100	8
		Elective-E604					100	8
		Total				750	1300	164

* For Electives with Practical. Otherwise Total Marks=20+80=100 and Total Credit=8

Marks distribution for Physics General Course

Yr	Sem	Paper	Topics	Marks (Ex)	Total Marks (Ex)	Internal Total Marks	Grand Total Marks	Credit (C)
1st	I	101(Th)	(a) Mechanics	25	60	15	75	6
			(b) Properties of Matter	15				
			(c)Waves and oscillations	20				
	II	201(Th)	(a) Current Electricity	35	60	15	75	6
			(b) Electrstatics	15				
			(c) Magnetism	10				
2nd	III	301(Th)	(a) Heat	20	40	10	50	4
			(b)Thermodynamics	20				
		302(Pr)					50	4
	IV	401(Th)	Optics	40	40	10	50	4
		402 (Pr)					50	4
3rd	V	501(Th)	(a) Mathematical Physics	30	80	20	100	8
			(b) Atomic Physics	30				
			(c)Relativity	10				
			(d) Renewable Energy sources	10				
		502(Pr)					100	8
		601(Th)	(a) Nuclear Physics	30	80	20	100	8
			(b) Electronics	30				

		(c) Electromagnetic waves	10				
VI		(d) Solid-state Physics	10				
	602(Pr)					100	8
		Total				750	60

FIRST SEMESTER

PAPER: 101 (Theory)   **Total Marks: 60**

(a) Mechanics and properties of Matter: (Total Marks: 25+15=40)
Total Lectures=36
1. Conservative and non-conservative forces, force as gradient of potential.
2. Rotational motion, torque, angular momentum, conservation of angular momentum, work and power in rotational motion, KE of rotation, moment of inertia, theorems of moment of inertia, moment of inertia of rectangular plate, circular disc, cylinder, sphere (solid and hollow), body rolling without slip.
3. Gravitation: determination of G by Cavendish method, gravitational field and potentials due to solid sphere and spherical shell, Kepler's law of planetary motion, Newton's law of gravitation from Kepler's law, artificial satellites, geostationary satellite, eccentricity of orbit of a satellite, escape velocity.
4. Compound pendulum: equivalent simple pendulum, centers of suspension and oscillation, four points of equal time period, condition for minimum time period.
5. Elasticity: Hook's law, different kinds of elastic constants, work done in deforming a body, Relation among the elastic constants. Bending of beam fixed at one end and loaded at the other end, torsion of a rod.
6. Surface tension, relation between surface tension and surface energy, excess pressure inside soap bubble and liquid drop, rise of liquid in a capillary tube, Determination of surface tension by capillary method.
7. Streamline and turbulent flow, critical velocity, viscosity of fluids, Poiseuille's equation. Bernoulli's equation, its derivation and applications.

(b) Wave and Sound: (Total Marks: 20)
Total Lectures =14
1. Simple harmonic motion, differential equation of S.H.M., total energy of a particle executing S.H.M., oscillation of loaded spring. Free, damped and forced vibrations, resonance, sharpness of resonance, equation of wave motion, principle of superposition of waves, beats, stationary wave and Doppler's effect.
2. Velocity of sound in a homogeneous medium, effect of temperature and pressure on velocity of sound in air, intensity level of sound and its unit (bel and decibel).
3. Ultrasonic waves – production of ultrasonic waves, application of ultrasonic waves, principle of SONAR system.

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Suggested Books:

Mechanics - D.S. Mathur

Physics Part-I - Halliday and Resnick

A Text Book of Sound - N. Subramanyam and Brij Lal

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SECOND SEMESTER

PAPER: 201 (Theory)   Total Marks: 60

(a) Current Electricity: (Total Marks: 35)   Total Lectures =30
1. Electric current density, continuity equation, Ohm's law as $J = \sigma E$, Applications of Kirchoff's law to solve electrical network problem.
2. Moving coil ballistic galvanometer its sensitivity and uses.
3. Electromagnetic induction: Self and mutual induction, coefficient of coupling, reciprocity theorem, self induction of a long solenoid, mutual induction of two solenoids.
4. Transient growth and decay of current in LR, CR and LCR circuits.
5. Alternating current: Generation of alternating current, current and potential across resistive, inductive and capacitive elements and their phase relationships, power factor, concept of rotating magnetic field. a.c. motor, transformer, reflected impedance in transformer.

(b) Electrostatics: (Total Marks: 15)   Total Lectures =12
1. Gauss's theorem and its applications to determine field due to linear, plane and spherical charge distribution, potential due to dipole, derivation of field due to a dipole Mutual potential energy of two dipoles.
2. Capacity of parallel plate capacitor, spherical and cylindrical capacitor, effect of dielectric on capacity of capacitor, mechanical force on charged conductor, energy stored in a charged capacitor.
3. Dielectrics, Electric polarisation of dielectrics, polarizability, Relation between D, E, & P, Gauss's law in dielectric. Electrostatic boundary conditions in dielectric medium.

(c) Magnetism: (Marks: 10)   Total Lectures = 8
1. Electric current as source of magnetic field, Equivalent magnetic dipole produced by a current flowing though a circular conductor, magnetic dipole moment, force and couples on dipole placed in a uniform magnetic field, magnetic shell, potential due to magnetic shell, magnetic intensity, induction and intensity of magnetisation, magnetic susceptibility, permeability, hystersis and hystersis loss.
2. Dia, para and ferro magnetism, Atomic dipole moment, Langevin's Classical theory of para magnetism.

Suggested Books:

Electricity and Magnetism - D.Chattopadhyay and P.C.Rakshit.

Electricity and Magnetism –D.N. Vasudeva

Electricity and Magnetism - Berkeley Series

Electrostatics and Magnetostatics - B.B.Laud

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THIRD SEMESTER

PAPER: 301 (Theory)   **Total Marks: 40**

(a) Heat: (Total Marks: 20)
Total Lectures =18

1. Platinum resistance thermometer and thermocouple thermometer.
2. Kinetic theory of gases, expression of Maxwell's law of velocity distribution (deduction not necessary), degree of freedom, law of equipartition of energy, mean free path, Brownian motion.
3. Andrew's and Amagat's experiment, equation of state, Van-der-Waals' equation of state, reduced equation of state, critical constants.
4. Joule-Thomson effect, liquefaction of gases by Joule-Thomson effect.
5. Phase, first order phase transitions, Clausius–Clapyeron equation, Gibbs' phase rule, triple point.
6. Radiation: Kirchhoff's law and its applications, relation between radiation pressure and energy density, Black body radiation, expressions of Stefan-Boltzmann law, Wien's displacement law, Rayleigh-Jean's law and Planck's law of black body radiation.

(b) Thermodynamics: (Total Marks: 20)
Total Lectures =18

1. Zeroth law of themodynamics and concept of temperature.
2. Heat and work and their equivalence, First law of thermodynamics and concept of internal energy, Applications of first law of thermodynamics.
3. Inadequacy of first law of thermodynamics, Second law of thermodynamics, reversible and irreversible processes, isothermal and adiabatic processes, work done by perfect gas under isothermal and adiabatic expansion, Carnot engine and Carnot cycle, Thermodynamic scale of temperature.
4. Entropy, change of entropy in reversible and irreversible processes, Clousious inequality relation.
5. Maxwell's thermodynamic relations and their applications.

Suggested Books:

Heat and Thermodynamics - Zemansky and Dittman
A treatise on Heat - Saha and Srivastava

PAPER: 302 (Practical)   Total Marks: 50
One experiment to be performed in four hours

1. To study the elongation of a wire by different pulling forces using Searle's apparatus and find the value of Young's modulus.

2. To determine the value of g by bar pendulum.

3. To determine velocity of sound in moist air by resonant air column method.

4. To determine the specific resistance of the material of the given wire by Meter Bridge and then find the length of wire necessary to construct a one ohm coil.

5. To determine the emf of a cell using a cell of known emf with the help of potentiometer.

6. To determine the resistance per unit of the length of meter bridge wire by Carey-Foster method.

7. To convert a given galvanometer into a voltmeter of given range and then calibrate it with standard resistance and ammeter.

Minimum number of experiment to be completed during the semester is five.

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FOURTH SEMESTER

PAPER: 401 (Theory)   Total Marks: 40

Optics: (Total Marks: 40)
Total Lectures =36

1. Fermat's principle: application to reflection and refraction at plane and curved boundaries, reflection through combination of two thin lenses, dispersion produced by lens, spherical and chromatic aberration and their remedies, achromatic combination of lenses, spectrometer.
2. Huygen's wave theory: Formula for refraction at a spherical surface, formula for thin convex and concave lenses.
3. Interference of light: Fresnel biprism, colour of thin films, Newton's ring phenomenon.
4. Diffraction of light: Fresnel and Fraunhofer classes of diffraction, diffraction at a straight edge and single slit, diffraction grating.
5. Polarisation of light: plane polarised light, polarisation on reflection, Brewster's law, double refraction, Nicol prism, rotation of plane of polarization by optically active substances, specific rotation, polarimeter.
6. Ramsden's and Huygen's eye piece, aplanatic foci.
7. Michelson interferometer, resolving and dispersive power of grating, production and analysis of polarised light, retarding plates, Babinet's compensator.
8. Laser and its characteristics, stimulated absorption, spontaneous and stimulated emission, population inversion, basic elements of laser, Ruby laser (principle only).

Suggested Books:

Light – K.G. Mazumdar

A Text book of Light - B Gosh and K G Mazumdar.

Optics – A. Ghatak

PAPER: 402 (Practical)   Total Marks: 50
One experiment to be performed in four hours

1. To determine the modulus of rigidity of the material of a rod by static method.
2. To determine the moment of inertia of symmetrical body about an axis by torsional oscillation method.

3. To determine the focal length of a convex mirror with the help of a convex lens.
4. To determine the refractive index of a liquid by using plane mirror and convex lens.
5. To determine the electrochemical equivalent of copper by using an ammeter and copper voltameter.
6. To determine the value of a low resistance by drop of potential method using meter bridge.
7. To determine the internal resistance of a cell with the help of a potentiometer.

Minimum number of experiment to be completed during the semester is five.
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FIFTH SEMESTER

PAPER: 501 (Theory)   **Total Marks: 80**

(a) Mathematical methods: (Total Marks: 30)
Total Lectures =24
1. Vector Algebra, scalar and vector product with illustration from physics, vector triple products.
2. Vector calculus: Scalar and Vector fields with example from physics, space curve, differentiation of a vector with respect to a scalar, gradient of scalar, divergence and curl of vector with example from physics.
3. Line integral, surface integral and volume integral. Gauss's theorem, Stoke's and Green's theorem.
4. Curvilinear coordinate system, coordinate line and coordinate surface, unit normal vectors and unit tangent vectors, scale factor, orthogonal curvilinear coordinates, cylindrical polar and spherical polar coordinate systems.

(b) Atomic Physics: (Marks: 30)
Total Lectures =24
1. Positive rays: analysis of positive rays, Aston and Bainbridge mass spectrographs.

2. Bohr's theory of hydrogen spectra, energy level diagram, Ritz combination principle, excitation, critical and ionization potentials, fine structures of the spectral lines, Sommerfeld's extension of the Bohr's theory(Qualitative only).
3. Vector atom model, Bohr magnetron, spinning electron; quantum numbers; Pauli's exclusion principle, source of radiation in external fields- normal Zeeman effect.
4. X-rays: origin and production of x-rays, continuous and characteristic X-rays, Mosley's law; diffraction of X-rays by crystals, Bragg's law, Compton Effect.
5. Frank and Hertz experiment, matter wave, Davisson and Germer experiment.

(c) Relativity: (Marks: 10)
Total Lectures =6
1. Michelson–Morley experiment, postulates of special theory of relativity, Lorentz transformation equations (derivation not necessary), time dilation, length contraction, mass variation, mass energy relation, velocity addition theorem.

(d) Renewable energy sources: (Marks: 10)

Total Lectures =6
1. Need and importance, different renewable energy sources, solar energy, solar constant, instruments for measuring solar radiation, solar heaters (air and liquid), solar radiation concentrators (reflector etc.), solar cooker, photovoltaic effect, solar cells.

Suggested Books:

Vector Analysis - Murray R. Spiegel (Schaum Series)

Atomic & Nuclear Physics - A. B. Gupta & D. Ghosh

Concept of Modern Physics – A. Beiser

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PAPER: 502 (Practical)   Total Marks: 100
One experiment to be performed in five hours

1.   To determine the value of `H' with the help of a deflection and vibration magnetometer.
2.   To determine the surface tension of a liquid by capillary rise method.
3. To draw I-D curve for the given prism with the help of a spectrometer and hence find the angle of minimum deviation.
4. To determine the wavelength of sodium light by Newton's ring.
5. To determine the coefficient of linear expansion of a rod by optical lever method.
6. To determine the constant of a ballistic galvanometer by direct method.
7. To draw the characteristic curve of a photo cell and find the maximum velocity of emitted electron.

Minimum number of experiment to be completed during the semester is five.
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SIXTH SEMESTER

PAPER: 601 (Theory)   Total Marks: 80

(a) Nuclear Physics: (Marks: 30)
Total Lectures =24
1. Concept of a Nucleus – its composition, mass, volume, density and temperature, units and dimension.
2. Mass defect and packing fraction, total binding energy, binding energy per nucleon, binding energy curve & its significance, nucleon separation energy, nuclear reactions, Q-value of a reaction, exothermic & endothermic reactions.
3. Type of radioactive decays, radioactive decay law, concept of half life and disintegration constant, natural radioactivity, radioactive dating, Activity of radioactive sources, its unit. Radioisotopes – their production & uses.
4. Need of a particle accelerator, Linear Accelerator – its construction & working principle. Need of nuclear Detectors. Ionization Chamber – its construction & working principle.
5. Primary and secondary cosmic rays and their composition, EAS.

(c) Electronics: (Marks: 30)
Total Lectures =24
1. Semiconductors, P-N junction diode, unbiased and biased P-N junction, depletion layer, barrier potential, junction capacitance, volt-ampere relations (derivation not necessary), photo diode, Zener diode, LED and their uses. OR, AND, NOT, NOR and NAND Gates using diode and transistor.
2. Rectifier: half wave and full-wave, efficiency of rectification, ripple factor, idea of filter circuit.
3. Thevenin's and Norton's theorems, maximum power transfer theorem.
4. Transistor, different configurations and characteristics of transistor, alpha and beta of a transistor, transistor as amplifier.
5. Biasing and Q-point of a transistor, stability factors, biasing circuits.
6. Classification of amplifiers: class A, B, C, voltage and power amplifiers.
7. Two port four terminal device and z, y and h-parameters. Use of h-parameters to find input and output resistances, current, voltage and power gain of a small signal transistor amplifier.
8. Feedback and Barkhausen criterion for sustained oscillations, Tuned collector oscillator.

(c) Electromagnetic waves: (Marks: 10)
Total Lectures = 6
1. Electromagnetic wave spectrum, graphical representation of electromagnetic wave.
2. Maxwell's equations, wave equation in free space from Maxwell's equations, velocity of electromagnetic waves in free space, Pointing vector.

(d) Solid State Physics (Marks: 10)
Total Lectures =6
1. Crystalline and amorphous state of substances, single crystal and polycrystalline substances, basis, crystal lattice, unit cell, primitive unit cell, translation vectors, lattice parameters, directions, lattice planes, Miller indices, inter-planar spacing.
2. Crystallographic axes, Crystal systems and Bravais lattice.
3. Different types of bonding in solids, ionic, covalent, metallic and hydrogen bonding.
4. Classical free electron theory of metals.

Suggested Books:
Atomic and Nuclear Physics – S. N. Ghosal

Atomic & Nuclear Physics - A. B. Gupta & D. Ghosh

A Text Book of Electronics –S.L. Kakani & K.C. Bhandari

Solid State Physics by A J Dekker

Solid State Physics by S O Pillai

College Physics – K. N. Sharma & Neerja

Teach yourself Physics series – (Bharati Bhaban P&D)

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PAPER: 602 (Practical)   Total Marks: 100
One experiment to be performed in five hours

1. To determine the value of `g' by Kater's pendulum.

2. To determine the width of a given slit by observing diffraction pattern of monochromatic radiation and verify it using traveling microscope.

3. To determine the value of `J', the mechanical equivalent of heat by Joule's calorimeter.

4. To draw the characteristics of a given transistor with CB and CE configurations and determine the alpha and beta of the transistor.

5. To determine the angle of minimum deviation and angle of the prism with the help of a spectrometer and hence find refractive index of the material of the prism.

6. To assemble OR, AND and NOT gates using diode and transistor and verify their tuth tables.

7. To draw the characteristics of- (i) a forward biased PN diode and (ii) reverse biased Zener diode and hence determine the ac resistance of the PN diode and breakdown voltage of the Zener diode.

Minimum number of experiment to be completed during the semester is five.

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SYLLABUS FOR T.D.C. GENERAL COURSE IN PHILOSOPHY
APROVED BY C.C.S. PHILOSOPHY IN ITS MEETING HELD ON 4.12.2009

NO. & NAME OF THE PAPER   TOPICS (UNIT WISE)   MARKS (UNITWISE)

First Year

FIRST SEMESTER

E101/102. LOGIC I   Full marks 75

i. Nature of Logic: Argument and Argument Form, Truth and Validity	15
ii. Development of symbolic logic, its Characteristics	20
iii. Logical Constants, Propositional Variables, Truth-function, Truth-table Method	20
iv. Proposition, Modern Classification of Propositions	20

SECOND SEMESTER

E201/202. LOGIC II: Full marks 75

i. Shorter Truth-table Method	10
ii. Formal Proof of Validity ✓	20
iii. Quantification, Symbolization of Universal and Existential propositions	25
iv. Induction: Nature and kinds, grounds of induction	20

Second Year

THIRD SEMESTER

E304/ 305. GENERAL PHILOSOPHY I   Full marks 100

i. Nature & Scope of Philosophy	20
ii. Theories of knowledge: Rationalism, Empiricism. Kant's Critical theory	30
iii. Realism – Naïve and Scientific	25
iv. Idealism – Subjective (Berkeley), Objective (Hegel)	25

FOURTH SEMESTER

E404/405.   INDIAN PHILOSOPHY I   Full marks 100

i. The Astika-Nastika dichotomy in Indian Philosophy, the Upanisadic Philosophy 25
ii. Carvaka: Theory of Knowledge, Materialism 25
iii. Jainism: Syadvada and Anekantavada 20
iv. Buddhism: Four Noble Truths, Pratitya Samutpada, Anatmavada, Nirvana 30

Third Year

FIFTH SEMESTER

E503/506. GENERAL PHILOSOPHY II   Full marks 100

i. Theories of Truth: Correspondence, Coherence, Pragmatic   30
ii. Substance, Causality, Space and Time   30
iii. Freedom and Determinism   20
iv. Logical Positivism: general characteristics   10
v. Existentialism: General Characteristics   10

E. 504/507. INDIAN PHILOSOPHY II   Full marks 100

i. Nyaya: Perception and Inference   20
ii. Vaisesika: Categories of Dravya and Abhava   20
iii. Sankhya: Prakriti, Purusha, Evolution   25
iv. Yoga: Psychology   10
v. Samkara: Brahman, Maya, Ramanuja's Criticism of Maya   25

SIXTH SEMESTER

E603/606. ETHICS I   Full marks 100

i. Morality and Moral Philosophy   20
ii. Fact and Value   20
iii. Kant's Categorical Imperative   20
iv. Teleological Theories: Hedonism and Utilitarianism   20
v. Niskama Karma of the Gita   20

E.604/607. PHILOSOPHY OF RELIGION   Full marks 100
i. Nature and Scope of Philosophy of Religion   20
ii. Religion, Philosophy and Science   20
iii. Origin of Religion: anthropological and philosophical theories   30
iv. Arguments for the existence of God   30

BOOKS RECOMMENDED

LOGIC: (Paper E101/102 & E201/202)

1. *Introduction to Logic*: I. M. Copi, Carl Cohen
2. *Symbolic Logic*: I.M. Copi
3. *Introduction to Logic*: P. Suppes

For Reference:

1. *Introduction to Symbolic Logic*: Basson & Connor
2. *Logic: Informal,Symbolic and Inductive*: Chhanda Chakraborti

GENERAL PHILOSOPHY: (Paper E304/ 305. & E503/506)

1. Introduction to Philosophy: J.N.Sinha
2. An Introduction to Philosophy: S.P.Chakraborti

For Reference:

1. Problems of Philosophy: Bertrand Russell (OUP)
2. What Philosophy Is: Anthony O'Hear (Penguin)
3. Philosophy: A Guide Through the Subject: (ed.) A.C.Grayling (OUP)
4. Language, Truth and Logic: A. J. Ayer (Penguin)

INDIAN PHILOSOPHY: (Paper E404/405 & E. 504/507)

1. An Introduction to Indian Philosophy: Dutta and Chatterjee
2. Outlines of Indian Philosophy: M.Hiriyana
3. Indian Philosophy – A Popular Introduction: D. P. Chattopadhyaya (For Carvaka System)
4. A Critical Survey of Indian Philosophy: C. D. Sarma
5. Outlines of Indian Philosophy: J. N.Sinha

For Reference:

1. Indian Philosophy (in two volumes): S. Radhakrishnan
2. A History of Indian Philosophy: S. N. Dasgupta

ETHICS: (Paper E603/606)

1. Ethics: W. K. C. Frankenna

SYLLABUS FOR T.D.C. MAJOR COURSE IN PHILOSOPHY

PROPOSED BY C.C.S. PHILOSOPHY IN ITS MEETING HELD ON 4.12.2009

NO. & NAME OF THE PAPER   TOPICS (UNIT WISE)   MARKS (UNITWISE)

FIRST YEAR

FIRST SEMESTER

M. 104.   LOGIC I   **Full Marks 100**

i. Nature of Logic: Argument and Argument Form, Truth and Validity 20

ii. Logical Constants, Propositional Variables, Truth-function,

Truth-table Method   30

iii. Proposition, Modern Classification of Propositions   20

iv. the concept of set, operations on sets – union, intersection

and difference   30

M. 105. EPISTEMOLOGY AND METAPHYSICS I   **Full Marks 100**

i. Nature & Scope of Philosophy   20

ii. Knowledge by Acquaintance & Knowledge by Description   20

iii. Realism – Naïve and Scientific   30

iv. Idealism – Subjective (Berkeley), Objective (Hegel)   30

SECOND SEMESTER

M. 204. LOGIC II: **Full Marks 100**

i. Shorter Truth-table Method	20
ii. Formal Proof of Validity	30
iii. Standard Form of Categorical Syllogism, Venn-diagram Technique of Testing Syllogisms	30
iv. Quantification, Symbolization of Universal and Existential propositions	20

M. 205. EPISTEMOLOGY AND METAPHYSICS II   **Full Marks 100**

i. Theories of Truth: Correspondence, Coherence, Pragmatic	30
ii. Substance	20
iii. Causality, Space and Time	20
iv. Freedom and Determinism	20
v. Rejection of Metaphysics (Ayer)	10

SECOND YEAR

THIRD SEMESTER

M. 304. INDIAN PHILOSOPHY I   **Full Marks 100**

i.	The Astika-Nastika dichotomy in Indian Philosophy, the Upanisadic Philosophy	25
ii.	Carvaka: Theory of Knowledge, Materialism	25
iii.	Jainism: Syadvada and Anekantavada	20
iv.	Buddhism: Four Noble Truths, Pratitya Samutpada, Anatmavada, Nirvana	30

M. 305. HISTORY OF MODERN WESTERN PHILOSOPHY I   **Full Marks 100**

       i. Descartes: Method, Cogito ergo Sum, Mind-body relation   40

       ii. Spinoza: Substance, Attributes and Modes   30

       iii. Leibniz: Theory of Monads, Pre-established Harmony   30

FOURTH SEMESTER

M. 404. INDIAN PHILOSOPHY II   Full Marks 100

       i. Nyaya: Perception and Inference   20

       ii. Vaisesika: Categories of Dravya and Abhava   20

       iii. Sankhya: Prakrti, Purusa, Evolution   25

       iv. Yoga: Psychology   10

       v. Samkara: Brahman, Maya, Ramanuja's Criticism of Maya   25

M. 405. HISTORY OF MODERN WESTERN PHILOSOPHY II   Full Marks 100

       i. Locke: Empiricism   20

       ii. Hume: Impressions and Ideas, Causation, Self   40

       iii. Kant: Possibility of Synthetic Apriori Judgments, Space & Time,

       Categories   40

Third year

FIFTH SEMESTER

M. 501. GREEK PHILOSOPHY I   Full Marks 75

       i. Thales: Primary Stuff   10
       ii. Pythagoras: Theory of Numbers   15
       iii. Heracleitus: Doctrine of Flux   15
       iv. The Eleatic School: Parmenides, Zeno   20
       v. Democritus: Atomism   15

M. 502. CONTEMPORARY INDIAN PHILOSOPHY I   Full Marks 75

       i. Vivekananda: Practical Vedanta   20
       ii. Aurobindo: Evolution   20
       iii. Tagore: Humanism   15
       iv. Radhakrishnan: Intellect and Intuition   20

M. 503. CONTEMPORARY WESTERN PHILOSOPHY I   Full Marks 75

    i. Nature of Analytic Philosophy – General Introduction   15
    ii. Russell: Logical Atomism   15
    iii. Moore: Refutation of Idealism   15
    iv. Wittgenstein: Picture Theory, Language Games   15
    v. Ryle: Refutation of Cartesianism   15

M. 504. ETHICS I   Full Marks 75

    i. Morality and Moral Philosophy   15
    ii. Fact and Value   15
    iii. Concepts of Normative Ethics, Meta-Ethics & Practical Ethics   25
    iv. Teleological Theories: Hedonism and Utilitarianism   20

M. 505. PHILOSOPHY OF RELIGION I   Full Marks 75

    i. Nature and Scope of Philosophy of Religion   15
    ii. Animism, Totemism, Concept of Mana, Fetishism, Magic   20
    iii. Freud's Theory of the Origin of Religion   15
    iv. Foundations of Religious Beliefs: Reason, Revelation, Faith
       and Mysticism   25

M. 506. SOCIAL PHILOSOPHY   Full Marks 75

    i. Nature and Scope of Social Philosophy   15
    ii. Society and Individual   15
    iii. Terrorism, the Concept of Globalisation   15
    iv. Feminism: General Characteristics   15
    v. Marxism: Alienation, Class-struggle   15

SIXTH SEMESTER

M.601. GREEK PHILOSOPHY II   Full Marks 75

    i. Socrates: Virtue   15
    ii. Plato: Knowledge & Opinion, Doctrine of Ideas   30
    iii. Aristotle: Form and Matter, Causality   30

M.602. CONTEMPORARY INDIAN PHILOSOPHY II   Full Marks 75
Philosophy of Gandhi

    i. God, Truth and Religion   25
    ii. Non-violence, Satyagraha, Sarvodaya   25
    iii. Swadeshi, Trusteeship, Critique of Industrialization   25

M.603 CONTEMPORARY WESTERN PHILOSOPHY II   Full Marks 75

i. Common Features of Existentialism	15
ii. Kierkegaard: Three Stages of Existential Transformation, Subjectivity and Truth	15
iii. Nietzsche: Nihilism, Superman	15
iv. Husserl: Phenomenology – General Introduction	15
v. Sartre: Existence and Essence, Freedom	15

M.604. ETHICS II   Full Marks 75

i. Deontological Ethics: Kant's Categorical Imperative, The Gita theory of Niskama Karma	20
ii. Moore: Indefinability of Good	15
iii. A. J. Ayer: Emotivism	15
iv. Theories of Punishment	10
v. The Law of Karma	15

M.605. PHILOSOPHY OF RELIGION II   Full Marks 75

i. Otto's Idea of the Holy	15
ii. Symbolic Nature of Religious Language	15
iii. Arguments for the Existence of God	25
iv. Sankaradeva's Vaishnavism: God, Bhakti	20

M.606. PROJECT/ DISSERTATION   Full Marks 75

The Project will be in the form of a brief dissertation of the length between 10,000 – 12,000 words (typed or neatly hand-written). It may be either on a particular philosopher or on a particular topic relevant to the course. The same is to be carried out under the guidance of a teacher

Given below are some topics as examples:

i. The Concept of Human Rights – A philosophical Analysis
ii. Women's Liberation
iii. A Critical Account of Samkara's Philosophy
iv. Philosophical Ideas of Sankaradeva
v. Cartesian Dualism – A Critical Account
vi. Existentialism – A Critical Study

BOOKS RECOMMENDED:

A. LOGIC (Paper 104 & 204)
1. *Introduction to Logic*: I. M. Copi, Carl Cohen
2. *Symbolic Logic*: I.M. Copi
3. *Introduction to Logic*: P. Suppes

For Reference:
1. *Introduction to Symbolic Logic*: Basson & Connor
2. *Logic: Informal, Symbolic and Inductive*: Chhanda Chakraborti

B. EPISTEMOLOGY & METAPHYSICS (Paper 105 & 205)
1. Introduction to Philosophy: J.N.Sinha
2. An Introduction to Philosophy: S.P.Chakraborti

For Reference:
1. Problems of Philosophy: Bertrand Russell (OUP)
2. What Philosophy Is: Anthony O'Hear (Penguin)
3. Philosophy: A Guide Through the Subject: (ed.) A.C.Grayling (OUP)
4. Language, Truth and Logic: A. J. Ayer (Penguin)

C. INDIAN PHILOSOPHY (Paper 304 & 404)
1. An Introduction to Indian Philosophy: Dutta and Chatterjee
2. Outlines of Indian Philosophy: M.Hiriyana
3. Indian Philosophy – A Popular Introduction: D. P. Chattopadhyaya (For Carvaka System)
4. A Critical Survey of Indian Philosophy: C. D. Sarma
5. Outlines of Indian Philosophy: J. N.Sinha

For Reference:
1. Indian Philosophy (in two volumes): S. Radhakrishnan
2. A History of Indian Philosophy: S. N. Dasgupta

D. HISTORY OF MODERN WESTERN PHILOSOPHY (Paper 305 & 405)
1. A History of Philosophy: F. Thilly
2. Critical History of Western Philosophy: Barlingay and Kulkarni
3. A Critical History of Modern Philosophy: Y. Masih

For Reference:
1. Routledge History of Philosophy (in ten volumes)
2. A New History of Philosophy: Anthony Kenny (in four volumes)
3. History of Philosophy: F. Copleston (in nine volumes)
4. A History of Western Philosophy: D.W. Hamlyn (Penguin)

E. GREEK PHILOSOPHY (Paper 501 & 601)

1. A Critical History of Greek Philosophy: W. T. Stace
2. Early Greek Philosophy: J. Barnet
3. History of Greek Philosophy: B. A. G. Fuller

For Reference:
1. History of Philosophy: F. Copleston (Vol. 1)
2. Outlines of Greek Philosophy: Zeller
3. The Greek Thinkers: Gomperz
4. History of Greek Philosophy: W. K. C. Guthrie

F. CONTEMPORARY INDIAN PHILOSOPHY (Paper 502)

1. Contemporary Indian Philosophy: B. K. Lal
2. An Idealist View of Life: S. Radhakrishnan (relevant chapters)
3. Creative Unity: R. Tagore (Ch. I)
4. Complete Works of Swami Vivekananda (Vol. II)
5. An Introduction to Philosophy of Sri Aurobindo: S. K. Maitra

For Reference:
1. Chief Currents of Contemporary Philosophy: D. M. Datta
2. Twentieth Century Indian Philosophy: Nilima Sharma

G. CONTEMPORARY INDIAN PHILOSOPHY (Paper 602)
The Philosophy of Gandhi

1. The Philosophy of Mahatma Gandhi: D. M. Datta
2. The Moral and the Political Thoughts of Mahatma Gandhi: Raghavan N. Iyer (OUP)
3. Gandhi: Bhikhu Parekh (OUP)
4. Gandhism and Modern India: N. K. Bose

H. ETHICS (Paper 504 & 604)

1. Ethics: W. K. C. Frankenna
2. Introduction to Ethics: William Lillie
3. Problems of Analytical Ethics: D. K. Chakravarty
4. Ethics Since 1900: Mary Warnock
5. Manual of Ethics: J. N. Sinha
6. Concepts of Indian Philosophy: Saraswati Chennakeshavan
7. Contemporary Indian Ethics: Nilima Tandon
8. Ethics of the Hindus: S. K. Maitra

For Reference:
1. Principia Ethica: G. E. Moore (Ch. I)
2. Morality: Bernard Williams
3. Modern Moral Philosophy: W. D. Hudson
4. Traditional and Contemporary Ethics – Indian and Western: H. M. Joshi

I. CONTEMPORARY WESTERN PHILOSOPHY I (Paper 503)

1. Logic and Language: B. Russell (ed. Marsh)
2. The Concept of Mind: G. Ryle (Ch. I)
3. Moore's article: "Refutation of Idealism"
4. Philosophy of Wittgenstein: G. Pitcher
5. Wittgenstein: A. C. Grayling
6. Ludwig Wittgenstein: A. J. Ayer

For Reference:
1. Classics of Analytic Philosophy: R. R. Ammerman
2. Tractatus Logico Philosophicus: L. Wittgenstein
3. Philosophical Investigations: L. Wittgenstein

J. CONTEMPORARY WESTERN PHILOSOPHY II (Paper 603)

1. Six Existentialist Thinkers: H. J. Blackham
2. Existentialist Outlook: Margaret Chatterjee
3. Existentialism and Phenomenology: M. K. Bhadra
4. Existentialism: Mary Warnock
5. Existentialism: John Macquirre

For Reference
1. Existentialism and Humanism: J. P. Sartre
2. Logical Investigations: E. Husserl
3. Concluding Unscientific Postscript: Kierkegaard
4. Thus Spake Zarathustra: Nietzsche

K. PHILOSOPHY OF RELIGION I (Paper 505)

1. Introduction to Religious Philosophy: Y. Masih
2. Philosophy of Religion: John Hick
3. Philosophy of Religion: D. M. Edward
4. Classical and Contemporary Readings in Philosophy of Religion: John Hick

For Reference
1. Reason and Religious Belief: An Introduction to the Philosophy of Religion: Petersen and others (OUP)

L. PHILOSOPHY OF RELIGION II (Paper 605)

1. Religious Philosophy of Rudolf Otto: Sibnath Sarma
2. Philosophy of Sankaradeva: An Appraisal: (ed.) Nilima Sharma
3. The Unsung Colossus: Sivanath Barman

For Reference
1. Sankaradeva and His Times: Maheswar Neog

M. SOCIAL PHILOSOPHY (Paper 506)

1. A Hand Book of Social Philosophy: P. B. Chatterjee
2. Feminism: Margaret Chatterjee (OUP)
3. Globalisation: N. B. Stegger (OUP)
4. Marx's Writings on Sociology and Social Philosophy (Penguin)
5. Society: McIver & Page

For Reference

1. The Second Sex: Simone de Beauvoir
2. The Whole Woman: Germaine Greer (Transworld)

N. PROJECT/ DISSERTATION (Paper 606)

For carrying out the project work the student is advised to consult various relevant books and journals available in the library. Collection of materials from the internet, from sources such as *Wikipedia, Stanford Encyclopedia, Internet Encyclopedia of Philosophy* that are freely available in the net is also encouraged.

THREE YEAR DEGREE COURSE IN ZOOLOGY (MAJOR)

I SEMESTER

Paper No.	Name of the Paper	Total Marks	Credits
M-101	Biosystematics and Taxonomy	60+15=75	06
M-102	Animal Diversity-I (Non-Chordates)	60+15=75	06
M-103(P)	Practical	40+10=50	04
E-101		60+15=75	06
E-102		60+15=75	06
Eng-I	English-I	40+10=50	04
		400	**32**

II SEMESTER

Paper No.	Name of the Paper	Total Marks	Credits
M-201	Animal Diversity-II (Chordates)	60+15=75	06
M-202	Ecology, wildlife conservation and Management	60+15=75	06
M-203(P)	Practical	40+10=50	04
E-201		60+15=75	06
E-202		60+15=75	06
Eng-II	English-II	40+10=50	04
		400	**32**

III SEMESTER

Paper No.	Name of the Paper	Total Marks	Credits
M-301	Comparative Anatomy & Histology	60+15=75	06
M-302	Cell Biology	60+15=75	06
M-303(P)	Practical	40+10=50	04
E-301		40+10=50	04
E-302 (P)		40+15=50	06
E-304		40+10=50	04
E-305 (P)		40+10=50	04
Env.Stud. I	Environmental Studies-I	40+10=50	04
		450	**36**

IV SEMESTER

Paper No.	Name of the Paper	Total Marks	Credits
M-401	Developmental Biology	60+15=75	06
M-402	Genetics	60+15=75	06
M-403(P)	Practical	40+10=50	04
E-401		40+10=50	04
E-402 (P)		40+15=50	06
E-404		40+10=50	04
E-405 (P)		40+10=50	04
Env.St. II	Environmental Studies-II	40+10=50	04
		450	**36**

V SEMESTER

Paper No.	Name of the Paper	Total Marks	Credits
M-501	Animal Physiology	60+15=75	06
M-502	Biochemistry & Bioenergetics	60+15=75	06
M-503	Endocrinology & Immunology	60+15=75	06
M-504	Biological Techniques and Biostatistics	60+15=75	06
M-505(P)	Practical	60+15=75	06
M-506 (P)	Practical	60+15=75	06
		450	**36**

VI SEMESTER

Paper No.	Name of the Paper	Total Marks	Credits
M-601	Animal Behaviour	60+15=75	06
M-602	Evolution and Adaptation	60+15=75	06
M-603	Economic Zoology	60+15=75	06
M-604	Biotechnology, Bioinformatics and Computer application	60+15=75	06
M-605(P)	Practical	60+15=75	06
M-606 (P)*	Project	60+15=75	06
		450	**36**

M-606 either Practical Paper or Project

Total Marks for TDC (MAJOR) ZOOLOGY   **: 2600**
Total Credits for TDC (MAJOR) ZOOLOGY   **: 208**

TDC I SEMESTER (MAJOR)

PAPER M-101   **Total Marks-75 (60+15)**
                                                   Total Credits : 6

BIOSYSTEMATICS AND TAXONOMY

1.   Definition, basic concept and importance of Systematics and Taxonomy
2.   Concepts of different conventional and newer aspects in biosystematics
     a)   Chemotaxonomy
     b)   Cytotaxonomy
     c)   Molecular taxonomy
3.   Taxonomic procedures- taxonomic collections, preservation, method of identification, taxonomic keys- different types of keys.
4.   Concepts of taxonomic terms.
5.   Importance of classification.
6.   Theories of Biological Classification : Essentialism, Nominalism, Empricism, Cladism and Evolutionary classification, their merits and demerits
7.   Concept of species.
8.   Process of typification and different Zoological types
9.   International Code of Zoological Nomenclature (ICZN): Basic Concepts
10. Binominal nomenclature and Trinominal nomenclature

TDC I SEMESTER (MAJOR)

PAPER M-102   **Total Marks-75 (60+15)**
Total Credits : 6

ANIMAL DIVERSITY – I (NON-CHORDATES)

1. Classification of Animal Kingdom-Major and Minor Phyla

2. PROTOZOA : General characters and classification up to orders with examples. Nutrition, locomotion and reproduction in Protozoa.

3. PORIFERA : General characters and classification up to orders with examples Canal system of in Porifera

4. COELENTERATA : General characters and classification up to orders with examples. Polymorphism in Syphonophora, Coral and Coral Reef formation

5. PLATYHELMINTHES : General characters and classification up to orders with examples, Morphology and Life History of *Fasciola*.

6. ASCHELMINTHES : General characters and classification up to orders with examples. Morphology and life history of *Ascaris*. Life cycles and pathogenecity of parasites of man (*Plasmodium, Taenia, Ancylostoma, Wuchereria*), Parasitic adaptation in Helminthes.

7. ANNELIDA: General Characters and classification up to orders with examples. Coelom, Coelomoduct and Nephridia of Annelida, Structure and significance of *Trochophore* larva

8. ARTHROPODA: General characters and classification up to orders with examples. Appendages and digestive system of *Prawn*. Significance of *Peripatus* in evolution

9. MOLLUSCA : General character and classification up to orders with examples. Digestive and Nervous system of *Pila*, Torsion in Gastropoda

10. ECHINODERMATA : General characters and classification up to orders with examples, water-vascular system in Echinodermata, Larvae of Echinodermata.

TDC I SEMESTER (MAJOR)

PAPER M-103 (Practical)   **Total Marks : (40+10= 50)**
         Total Credits : 4

A. Dissection of the following invertebrate systems- (only one)   **10 Marks**

1. Leech   (i) Urinogenital system   (ii) Nervous System
2. Prawn   (i) Digestive system   (ii) Nervous system
3. Cockroach   (i) Nervous system   (ii) Reproductive system (Male and Female)
4. *Pila*   (i) Digestive system   (ii) Nervous system.

B. Mounting

Temporary:- Setae of Earthworm, Statocyst of *Prawn*, salivary apparatus of Cockroach, Radula of *Pila*   **3 Marks**

Permnent :- *Euglena, Hydra, Obelia* colony, Crustacean larvae   **4 Marks**

E. Indentification of prepared slides   **3 Marks**

Polystomella, Sponge spicules, T.S of *Asccaris*, Miracidium, Sporocyst and Cercaria larvae of liver fluke, T.S. of Leech (through crop region), Mouth parts of mosquito (*Culex*), Glochidium and Veliger larvae of Mollusca, T.S of arm of Starfish, Larvae of Echinodermata.

F. Study of Museum specimens   **10 Marks**

(Identification and classification upto Order. Generic name must be given)
Grantia, Spongilla, Physalia, Vallela, Metridium (Seaanemone), *Pennatula* (Sea Pen), *Gorgonia, Fasciola, Taenia, Ascaris* (Male and Female), *Amphitrite, Sipunculus, Aphrodite, pontobdella, Chaetopterus, Lepas, Limulus, Scolopendra* (Centipede) *Julus* (Millipede), *Carausius* (Stick insect), *Lepisma, Mantis, Bellostoma* (Giant water bug), *Peripatus, Dentalium, Chiton, Achatina, Pinctada* (Pearl Oyster) *Loligo, Mytilus, Cucumaria* (Sea Cucumber), *Echinus* (Sea urchin), *Clypeaster* (Cake- Urchin) *Ophioderma* (Brittle star).

G. Practical note book   **4 Marks**

H. Viva-voce   **6 Marks**

TDC II SEMESTER (MAJOR)

Paper M-201
Total mark : 60+15=75
Total Credits : 6

ANIMAL DEVERSITY- II (CHORDATIES)

General characters, outline of classification and plan of body organization in chordates

1. PROTOCHORDATES : General characters, classification of Protochordata up to suborders with examples.

2. HEMICHORDATA : Morphology and affinities of *Balanoglossus*.

3. UROCHORDATA : Structure and Retrogressive metamorphosis in Urochordata

4. CEPHALOCHORDATA : Structure and affinities of *Amphioxus*.

5. AGNATHOSTOMATA : Distinctive characters and classification, Ammocoete larva - its importance in evolution, Differences between *Lamprey* and Hagfish

6. PISCES : General characters, Classification up to orders with examples, Circulatory system, Nervous system and Sense organ of *Scoliodon*. Accessory respiratory organ and swim bladder in fish. Migration of fishes.

7. AMPHIBIA :General characters, Classification up to orders with examples, Respiration in Amphibia, Parental care in Amphibia

8. REPTILIA :General Characters Classification up to order with examples. Anatomical peculiarities and affinities of *Sphenodon*, Biting mechanism of poisonous snake.

9. AVES :Distinctive characters and classification up to orders with examples. Air sacs-significance and importance , Flight and perching mechanism in birds, Migration of bird.

10. MAMMALIA : Distinctive characters and classification up to orders with examples. General organization and affinities of Monotremata and Marsupialia. Receptor and sense organs in Mammals. Dentition in Mammals.

TDC II SEMESTER (MAJOR)

Paper M-202   **Total mark : 60+15=75**
                                                  Total Credits : 6

ECOLOGY, WILDLIFE CONSERVATION AND MANAGEMENT

ECOLOGY

                                                                          30

1. Definition, Aim and scope of ecology.
2. Ecological niche, habitat, biosphere, biome and ecotone.
3. Ecosystem - Types : Aquatic and Terrestrial, Food chain and ecosystem energetic
4. Biotic factors
5. Biogeochemical cycles- Nitrogen and phosphorus.
6. Pollution- Air, water, Soil and Noise.

WILDLIFE CONSERVATION AND MANAGEMENT   **30**

1. Definition of wildlife- Wildlife Act. 1972
2. Principles of wildlife conservation and management.
3. Wildlife Sanctuaries and National Parks of N.E Region with special reference to Kaziranga National Park and Manas National Park.
4. Conservation strategies of endangered species.
5. IUCN Red list categories. Endangered mammalian species of NE India.
6. Concept of Biosphere Reserve programmes
7. Ethology of Pigmy Hog and Golden langur.
8. Carrying capacity and its impact on wildlife population
9. Protective behaviour and family ties in primates

TDC II SEMESTER (MAJOR)

PAPER M-203 (PRACTICAL)   TOTAL MARKS : 40+10=50)
                                                       Total Credits : 4

Dissection of the following vertebrate systems (any one)   **10**
  Scoliodon
          i)   Afferent branchial system
          ii)   Efferent branchial system.
          iii)   Interent ear
          iv)   IX th and X th cranial nerves
  Pigeon
          i)   Flight muscles
          ii) Arterial system
  Rat
          i) Arterial System   (ii) Venous system
Mounting   **3**

Temporary- Blood film of Frog and mammal, Placoid scales Squamous and ciliated epithelium, striated and non-straiated muscle, Ampullae of Lorenzini, Pecten of bird.
Permanent- *Salpa, Doliolum,* T.S. through pharyngeal region of Amphioxus, T.S. of skin, stomach, intestine, liver pancreas, kidney, testis, ovary of mammals

Study of Bones   **2**
Axial and appendicular skeleton of fowl, Guineapig/ Rat. Different types of skull in birds.

Study of Museum Specimens   **10**
(Identification and classification upto order. Generic name must be given)
Balanoglossus, Herdmania, Amphioxus, Petromyzon, Myxine, Torpedo (Electric Ray), *Pristis* (Saw Fish*) Hippocampus* (Sea horse) *Syngnathus* (Pipe fish) *Monopterus* (Kuchia) *Tetradon, Cyprinus* (Common carp) *Hypopthalmichthys* (Silver carp) *Ctenopharyngodon* (Grass carp) *Clarias* (Magur) *Mystus, Ichthyophis, Necturus, Ambystoma, Axolotl larva, Alytes, Kachuga, Draco, Chemeleon, Varanus, Naja, Hydrophis, Alcedo* (King Fisher), *Pisus* (Wood packere)

ENVIRONMENTAL BIOLOGY   **5**
Estimation of dissolved O_2 in water. Estimation of free CO_2 in water, Measurement of temperature, PH of water sample (by meter/ Lovibund disc comparator), Relative humidity by wet and Dry bulb thermometer.
Practical Note Book   **4**
Viva Voce   **6**

TDC III SEMESTER (MAJOR)

Paper M-301 Total mark : 60+15=75
Total Credits : 6

COMPARATIVE ANATOMY AND HISTOLOGY

COMPARATIVE ANATOMY 30

1. Integument and its derivatives in vertebrates
2. Comparative anatomy of Heart, Aortic arches and succession of kidney in Vertebrates.
3. Organs of hearing and balancing in vertebrates.
4. Comparative anatomy of Thyroid
5. Comparative anatomy of respiratory system in vertebrates
6. Comparative anatomy of brain in vertebrates.

HISTOLOGY 30

1. Differentiation and organization of cells and maintenance of tissues.
2. Animal tissues - Types, structure and their functions : Epithelial, Muscular, Connective tissues (cartilage, bone, blood, lymph, areolar, adipose, reticular) and Nervous tissue.
3. Basic principles of fixation and staining
4. Classification, Composition and properties of dye.
5. Use of mordants and metachromatic dyes.
6. Principle and procedure of histological staining of carbohydrates, amino acids, proteins, lipids and nucleic acids.

TDC III SEMESTER (MAJOR)

Paper M- 302   **Total mark : 60+15=75**
                                                     Total Credits : 6

CELL BIOLOGY

1. Diversity of cell size and shape.
2. Cell theory.
3. Structure of prokaryotic and eukaryotic cells.
4. Physical and chemical properties of protoplasm
5. Structure of plasma membrane, its modifications and functions.
6. Chromosome- structure and functions.
7. Cell division - Cell division cycles. Mechanics of cell cycle, Membrane transport of small molecules and the ionic basis of membrane excitability. Intranuclear organization of the cell. Ultra structure and function of Mitochondria, Golgi bodies, Endoplasmic reticulum, Ribosome, Lysosome, exo and endocytosis.
8. Cellular energy transaction-role of Mitochondria and Chloroplast.
9. Cytoskeleton: Structure and function of centriole, Microtubules and Microfilaments - structure and dynamics. Mitotic apparatus and chromosome movements.
10. Cilia and flagella- Structure and cell movement.

TDC III SEMESTER (MAJOR)

M- 303 (PRACTICAL)   **Total Marks- 40+10=50**
                                                                   Total Credits : 4

1. Study of different types of cell (Representatives of prokaryotic and eukaryotic cell)
2. Staining techniques of nucleus and nucleolus
3. Preparation of physiological solution – buffers, Fixatives, stains (haematoxylin, Eosin, acetocarmine)
4. Preparation of histological slides from tissues as liver, Lung, Stomach, Intestine, Kidney, Pancreas, testes and Ovary.
5. Study of different tissue through permanent slides : Epithelial (Simple, squamous, cuboidal, columnar, Compound, stratified, transitional, muscular, bone, cartilage, areolar, tandon, adipose, reticular and nervous)
6. Laboratory Note Book   4
7. Viva Voce   6

TDC IV SEMESTER (MAJOR)

Paper M-401   **Total mark 60+15=75**
                                                   Total Credits : 6

DEVELOPMENTAL BIOLOGY

1. Developmental biology- aim and scope
2. Gametogenesis: spermatogenesis, Oogenesis, vitellogenesis, egg membrane.
3. Fertilization: sperm-egg interactions, biochemical events, post-fertilizations events.
4. Parthenogenesis- Natural haploid, diploid and cyclic parthenogenesis. Artificial stimulus for parthenogenesis and its significance.
5. Type of animal eggs.
6. Cellular dynamics in development.
7. Organizer and Induction
8. Fate map construction in frog and chick .
9. Organogenesis : Development of heart and eye in vertebrates
10. Development of chick embryo up to three germ layer formation.
11. Extra embryonic membranes in bird and mammal.
12. Placenta- different types, function and physiology.

TDC IV SEMESTER (MAJOR)

Paper M-402   **Total mark 60+15=75**
                                                        Total Credits : 6

GENETICS

1. Back cross and test cross.
2. Varieties of gene expressions- multiple alleles, lethal genes, pleiotropic genes, gene interactions, epistasis.
3. Linkage-its mechanism and significance, Experiment of linkage, Linkage map.
4. Crossing over- types and mechanism, Synaptinemal complex and genetic recombination, significance of crossing over.
5. Genetic basis of Sex determination
6. Genetic diseases in man
7. Nucleic acids-DNA and RNA, Chemical structure and function, Replication of DNA.
8. Structural changes in chromosomes (Chromosomal aberration)
9. Numerical changes in chromosome, Genetic consequences of changes in Chromosome.
10. Mutation- Molecular basis of mutation. Consequences of mutation.
11. Genetic code, transcription and regulation of protein synthesis
12. Regulation of gene expression
13. Sexuality and Recombination in Virus and bacteria.
14. Mitochondrial DNA
15. Human Karyotype - Nomenclature, Human genome
16. Cytogenetic effect of ionizing and non ionizing radiation.

TDC IV SEMESTER (MAJOR)

M- 403 (PRACTICAL)   **Total Marks- 40+10=50**
                                                      Total Credits : 4

DEVELOPMENTAL BIOLOGY

Slide Preparation (one) and Identification from the following: 10

1. Study of frog development through prepared slides and models
2. Study of whole mount preparation of chick embryos from 16-18 hours,
   24 -28 hrs. 33-36 hrs, 42-48hrs, and 72 hours of development.

GENETICS

Slide Preparation (Two) from the following: 20

1. Squash preparation for the study of mitosis in tadpole tail/ onion root tip.
2. Study of meiosis in tests of Gryllotalpa/ Grasshopper
3. Study of polytene chromosome in salivary glands of *Chironomous* or *Drosophila.*
4. Study of sex chromatin from buccal epithelium

Practical Note Book   4
Viva Voce   6

TDC V SEMESTER (MAJOR)

Paper M-501   Total mark 60+15=75
                                               Total Credits : 6

ANIMAL PHYSIOLOGY

1. Nutrition : Nutritional requirements, Digestion and absorption of dietary components (Carbohydrates, fats, proteins, vitamins, and minerals), Co-ordination and control of digestive activity (nervous and hormonal regulation), Functions of liver and pancreas.

2. Respiration : Types of respiration- Anaerobic and aerobic, Properties and function of respiratory pigments, Exchange of gases, Breathing, O_2 dissociation curve, Control of breathing

3. Body Fluids : Type of body fluids, Composition and function of different body fluids, Haemopoiesis, Buffer system in blood, Chloride shift, Blood groups and transfusion, Blood clotting mechanism

4. Heart and circulation : Types of heart- Myogenic and Neurogenic, Origin, conduction and regulation of heart beat, Cardiac cycle, Blood pressure.

5. Excretion: Types of nitrogenous wastes- ammonotelic, ureotelic and uricotelic, Physiology of urine formation. Regulation of urine formation

6. Nerve Physiology : Initiation and conduction of nerve impulse, Synapse and synaptic transmission through myelinated and nonmyelinated nerve fibres, Neuromuscular co-ordination

7. Muscle protein, chemistry of muscle contraction

8. Osmoregulation in vertebrates

TDC V SEMESTER (MAJOR)

Paper M-502   Total mark 60+15=75
                                                   Total Credits : 6

BIOCHEMISTRY AND BIOENERGETICS

BIOCHEMISTRY   **40**

1. Chemical foundation of biology- pH. pK, acids, bases, buffers free energy, isomerisation.
2. Classification and biological significance of carbohydrate, protein and lipid.
3. Assembly of macromolecular complexes, ribosome, chromatin and plasma membrane.
4. Enzymes- Nature and classification- Mechanism of enzyme action, Enzyme Kinetics.
5. Ornithine cycle.
6. Oxidation and biosynthesis of fatty acids.

BIOENERGITICS   **20**

1. First and second laws of thermodynamics
2. Oxidation- reduction potential with special reference to mitochondrial electron transport system. ATP in metabolism and in free energy production
3. Theories of oxidative phosphorylation

TDC V SEMESTER (MAJOR)

Paper M-503   **Total mark 60+15=75**
                                                  Total Credits: 6

ENDOCRINOLOGY AND IMMUNOLOGY

ENDOCRINOLOGY   30

1. Brief account of structural features histological structure and function of endocrine glands -Pituitary, Thyroid, Pancreas Adrenal and Gonads
2. Hypothalmo- hypophysial axis
3. Classification of hormones.
4. Mechanism of hormone action.
5. Synthesis of thyroxin.
6. Pancreatic hormones and metabolic regulation, physiological action of insulin and glucagon
7. Hormonal control of calcium homeostasis, chemistry and control of secretion of parathormone, calcium and vitamin D

IMMUNOLOGY   30
1. Basic immunological concepts
2. Innate and Acquired immunity
3. Components of immune system.
4. Cell mediated and humoral immune system.
5. Structure and function of antibodies.
6. Antigen- antibody interaction.
7. Immunization (Vaccination)
8. Hyper immunity (allergy, Immune deficiency, Autoimmunity, Basic concept).

TDC V SEMESTER (MAJOR)

Paper M-504   Total mark : 60+15=75
                                                     Total Credits : 6

BIOLOGICAL TECHNIQUES AND BIOSTATISTICS

BIOLOGICAL TECHNIQUES   30

1. Principle and uses of analytical instruments : pH meter, Colorimeter, Spectrophotometer, Ultra centrifuge.
2. Microsocopy- Working principle of light, electron Phase contrast and fluorescence microscopy.
3. Separation techniques in biology- elemetary knowledge of chromatography and electrophoresis.
4. Microtomy
5. Cryopreservation of egg and sperms
6. Use of radioisotope in biology. Autoradiography

BIOSTATISTICS   30

1   Statistics in Biology
2   Sampling techniques- Sample units and their selection
3   Correlation and regression analysis-linear.
4   Analysis of Variance, t-test.
5   Chi Square test (XY)
6   Use of computers in biology, computer application-data processing, language, computer Programmes for Biostatistical Analysis.
8   Utility of biostatistics.
9.   Mean-Arithmetic, Geometric and Harmonic mean. Median and Mode
10 Standard deviation, Standard error of mean
11 Graphic representation of data- Histogram,. Bar-diagram, Piediagram and O-give

TDC V SEMESTER (MAJOR)

Paper M- 505 (PRACTICAL)   **Total Marks- 40+10=50**
Total Credits : 4

PHYSIOLOGY

1. Demonstration of osmosis.
2. Effect of isotonic, hypertonic and hypotonic solution, acid and alkali on RBC.
3. Haemoglobin estimaration
4. Human blood grouping, ABO and Rh factor
5. Total count of RBC and WBC
6. Differential count of WBC
7. Preparation of Haemin crystal from blood
9. Study of cardiac cycle in Frog/Rat using Kymograph.
10. Normal and abnormal constituents of urine (Glucose and albumin)

Practical Note Book   4
Viva Voce   6

TDC V SEMESTER (MAJOR)

PAPER M- 506 (PRACTICAL)   **Total Marks- 40+10=50**
                                                  Total Credits : 4
BIOCHEMISTRY AND ENDOCRINOLOGY

BIOCHEMISTRY   **15**

1. Biochemical estimation of Glucose, total soluble proteins and total lipids.
2. Detection of enzyme activity-Salivary amylase, pepsin
3. Separation of amino acids by paper/thin layer chromatograph.
7. Estimation of ascorbic acid in lemon
8. Detection of presence of Vitamin A
9. Detection of mono-, di- and polysaccharides.

ENDOCRINOLOGY   **15**

1. Dissection and localization of selected endocrine glands : Throid, Pituitary, Pancreas,
   Adrenal, Testis and Ovary of Frog / Rat/Rabbit/Squirrel.
2. Histological study of endocrine glands- Thyroid, Adrenal, Pancreas, Testis and Ovary (Through prepared slides)

Practical Record   4
Viva Voce   6

TDC VI SEMESTER (MAJOR)

Paper M-601   **Total mark : 60+15=75**
                                                         Total Credits : 6

ANIMAL BEHAVIOUR

1. Introduction to Ethology
2. Scope and methods of ethology
3. Behaviour equipment-Sign, stimuli, stimulus filtering
4. Patterns of Behaviour
5. Individual behavioural Pattern
6. Homeing behaviour
7. Genetic basic of behaviour
8. Neural and hormonal control of behaviour
9. Circadian rhythm
10. Motivation : Models of motivation of motivation, feeding and drinking.
11. Learning behaviour : Types of learning , Habituation Conditional reflex, Insight learning , Association learning, Reasoning and Imprinting
12. Socio Biology : Social organization, Individual Social interactions, Animal communications, Dance language of honey bees, Aggregation, Social behaviour of bee, ant and monkey, Role of pheromones
13. Communication ; Chemical, Visual, Audio, Language of behaviour, Habittal Selection, Aggression,Territoriality, Dispersal

TDC VI SEMESTER (MAJOR)

Paper M-602   **Total mark 60+15=75**
                                                      Total Credits : 6

EVOLUTION AND ADAPTATION

EVOLUTION   50

1. Evolution- Origin of life
2. Spontaneous generation, formation of organic compound.
3. Evidences of organic evolution : Embryological and biochemical
4. Theories of organic evolution
5. Darwinism and Neo-Darwinism
6. Lamarckism and Neo-Lamarckism
7. Germplasm theory, Mutation theory
8. Modern synthetic theory
9. Concept of micro, macro and mega evolution.
10. Phylogeny of Horse
11. Evolution of Man.
12. Origin of Bird.
13. Speciation- Genetic and Geographical
14. Zoo-geography
15. Factor influencing animal distribution.
16. Geological time scale.
17. Fossils- Definition, fossilization and significance, dating of fossils

ADAPTATION   10

1. Principles of adaptation.
2. Types of adaptation- Aquatic, terrestrial and Volant adaptation.
3. Adaptive Radiation in mammal
4. Cryptic and warning coloration, Mimicry

TDC VI SEMESTER (MAJOR)

Paper M-603   Total mark 60+15=75
                                                  Total Credits : 6
ECONOMIC ZOOLOGY

1. **Sericulture**
    Nature of silk
    Concise account of four varieties of silk products and economics in India
    (Eri, Muga, Pat, Tasar), life cycle of silkworm - Muga and Eri
    Diseases, prevention and control measures of silkworm pest
    Rearing of silkworm- Muga and Eri.
    Environmental conditions for silkworm rearing-temperature
    Humidity, light and air.
    Storage, spinning and reeling of silk.

2. **Apiculture**
    External morphology of honey bee
    Bee colony-cast/members-the queen, worker and drone life histoy of honey bee
    Colony nests
    Caste distinction during development of honeybee.
    Economics of bee keeping

3. **Aquaculture**
    Aquaculture-Definition, Important groups of aquaculture.
    Fresh water fish groups in India
    Captive and culture fisheries.
    Fresh water prawn culture
    Pond fisheries- Construction and lay out of ponds of a fish farm.
    Composite fish culture
    Induced breeding
    Integrated fish farming

4. Lac Culture, enemies of lac, uses of lac

5. **Pest and pest Management**

    Definition of term pest. Types of pest
    Importance of pest control
    Principles of pest control- Cultural, Physical, Mechanical and Biological control of
    pest.
    Pesticides and their hazards
    Role of natural products in pest control
    Integrated pest management

TDC VI SEMESTER (MAJOR)

Paper M-604   Total mark 60+15=75
                                                   Total Credits : 6

BIOTECHNOLOGY, BIOINFORMATICS AND COMPUTER APPLICATION

BIOTECHNOLOGY   **45**

1. Basic concepts in genetic engineering
2. Enzymology of genetic engineering –Restriction enzymes, DNA Ligases,
3. Tissue culture
4. Media preparation and sterilization
5. Cell culture media preparation and cell harvesting methods
6. Cloning
7. Gene libraries- Construction of CDNA , mRNA, isolation
8. Transferring genes into animal oocytes, eggs, embryos and specific animal tissues.

BIONFORMATICS AND COMPUTER APPLICATION FOR BIOLOGISTS 15

1. Operating system DOS, WINDOWS, UNIX
2. Programming using C++
3. Computer aided techniques for data presentation, data analysis, statistical Techniques.

TDC VI SEMESTER (MAJOR)

PAPER M- 605 (PRACTICAL)   **Total Marks- 60+15=75**
                                                                    Total Credits : 6

ECONOMIC ZOOLOGY

1. Identification of different varieties of silkworms (Eri, Muga and Mulberry) Larval and adult stages.
2. Study of life history of Honey bee
3. Study of important pest of paddy, jute, tea, stored grain, cane sugar and vegetables.
   4. Identification of commercially important fishes- *Labeo gonius, Cirrhinus reba, Puntius sophore, Wallago attu, A seenghala, Labeo bata, Mystus vittatus Clarias batrachus, Heteropneustes fossilis, Channa marulius, Channa striatus. Notopterus notopterus. Hilsa ilisha, Anabas testudineus. Puntius javanica Cyprinus carpio, Hypophthalmichthys molitrise.*
5. Slide preparation : Pollen basket of honey bee, Different types of antenna, mouth parts, legs of insects
6. Dissection of Pituitary from any locally available fish.

Practical Record   4
Viva Voce   6

TDC VI SEMESTER (MAJOR)

PAPER M- 605 (PROJECT)   **Total Marks : 75**
                                            Total Credits : 6

PROJECT (Project work should be submitted in a bound paper form and shall be evaluated by External Examiner)
Content and Presentation : 50 Marks
Viva on Project   : 25 Marks

SYLLABUS

OF

B.VOC

IN

ANIMATION & GRAPHIC DESIGN

S.B.M.S. COLLEGE, SUALKUCHI

UNDER

GAUHATI UNIVERSITY

Level	QP	Sem	Mode		Subjects/ Job Role	Marks	
					Animation & Grapic Design Curriculum of SBMS College Sualkuchi		
			Th	S 1.1	Elements Of Graphic Design	75	
	Character		Th	S 1.2	Introduction to Drawing Aesthetics	75	
4	Designer	I	Pr	S 1.3	Character Design for Animation	100	
	MES/ Q 0502		Th	G 1.1	Communicative English -I	75	
			Th	G1.2	Fundamentals Of Computer	75	
			Th	S 2.1	Introduction to Digital Photography	75	H
	Camera		Th	S 2.2	Sound & Video Editing	75	H
	Operator	II	Pr	S 2.3	2D Animation	100	U
	MES/ Q 0902		Th	G 2.1	Communicative English -II	75	
5			Th	G 2.2	Fundamentals of Accounting	75	
			Th	S 3.1	Introduction to Sound Design	75	
			Th	S 3.2	Introduction to 3D Modeling & Texturing	75	
		III	Pr	S 3.3	Introduction to Digital Compositing	100	
			Th	G 3.1	Environmental Studies	75	
			Th	G3.2	Society & Culture Of Assam	75	
			Th	S 4.1	Creative Writing	75	U
			Th	S 4.2	Sound Synchronization and Expression	75	U
		IV	Pr	S 4.3	Advanced Digital Compositing	100	H
			Th	G 4.1	Personality Development	75	
6			Th	G 4.2	Fundamental Of HR & Marketing	75	
			Th	S 5.1	Introduction to Digital Film Making	75	
	VFX Editor		Th	S 5.2	3D Character Animation	75	
	MES/ Q 3501	V	Pr	S 5.3	Advanced 3D Modeling	100	
			Th	G 5.1	Fundamental of Entrepreneurship	75	
			Th	G 5.2	Soft Skills & Business Presentation	75	

			Th	S 6.1	Motion Picture Direction	75	U
7	**Live Action Director** MES/ Q 1301	VI	Th	S 6.2	gree Showcase Project Group (Sound/Animation/Vid	75	H
			Pr	S 6.3	Individual Project (Demoreel)	100	
			Th	G 6.1	Entrepreneurship Development	75	
			Th	G 6.2	Personality Enrichment	75	

SYLLABUS

OF

B.VOC

IN

FASHION TECHNOLOGY

S.B.M.S. COLLEGE, SUALKUCHI

UNDER

GAUHATI UNIVERSITY

Fashion Technology Curriculum of SBMS College Sualkuchi

Level	Qualification Pack	Sem	Mode	Sub Code	Subjects/ Job Role	Marks		
						Th	In	Pr
4	Hand Embroiderer AMH/Q 1001	I	Th	S 1.1	Elements & Principles of Design	40	15	20
			Th	S 1.2	Elements of Fashion	40	15	20
			Pr	S 1.3	Surface Adornment		100	
			Th	G 1.1	Communicative English -I	40	15	20
			Th	G1.2	Fundamentals Of Computer	40	15	20
5	Pattern Master AMH/Q1105	II	Th	S 2.1	Textile Science & Care	40	15	20
			Th	S 2.2	Garment Manufacturing Technology-I	40	15	20
			Pr	S 2.3	Drafting and Pattern Making		100	
			Th	G 2.1	Communicative English -II	40	15	20
			Th	G 2.2	Fundamentals of Accounting	40	15	20
		III	Th	S 3.1	Design Process	40	15	20
			Th	S 3.2	Garment manufacturing Technology-II	40	15	20
			Pr	S 3.3	Fashion Business		100	
			Th	G 3.1	Environmental Studies	40	15	20
			Th	G3.2	Society & Culture Of Assam	40	15	20
6	Export Manager AMH/Q 1603	IV	Th	S 4.1	Technical Fashion Sketch	40	15	20
			Th	S 4.2	Fashion Forecasting and Promotional Product Development	40	15	20
			Pr	S 4.3	Apparel Industry & Production Management		100	
			Th	G 4.1	Personality Development	40	15	20
			Th	G 4.2	Fundamental Of HR & Marketing	40	15	20
		V	Th	S 5.1	Portfolio Development	40	15	20
			Th	S 5.2	History of Costumes -I	40	15	20
			Pr	S 5.3	Couture Draping and Moulage		100	
			Th	G 5.1	Fundamental of Entrepreneurship	40	15	20

			Th	G 5.2	Soft Skills & Business Presentation	40	15	20
	Boutique Manager							
	AMH/Q 1903		Th	S 6.1	Apparel Accessories and Surface Ornamentation	40	15	20
7		VI	Th	S 6.2	History Of Costumes-II	40	15	20
			Pr	S 6.3	Apparel Marketing & Merchandising	100		
			Th	G 6.1	Entrepreneurship Development	40	15	20
			Th	G 6.2	Personality Enrichment	40	15	20