



Academic Calendar

PURE - SCIENCE &
BIO - SCIENCE

2019-2020

বঙ্গ বাসী কলেজ



Bangabasi Morning College

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BANGABASI MORNING COLLEGE



ACADEMIC CALENDAR

Session - 2019-2020

SCIENCE

BANGABASI MORNING COLLEGE



ACADEMIC CALENDAR Session - 2019-2020

PURE SCIENCE

Department of Computer Science 2	32
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BIO SCIENCE

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Computer Science Honours

Course Structure

Semester-I and II

Sem	Courses	Title	Credits
I	CMS-A-CC-1-1-TH (Core Course-1) Theory	Digital Logic(PR)	4
	CMS-A-CC-1-1-P (Core Course-1) Practical	Digital Circuits(EG)	2
	CMS-A-CC-1-2-TH (Core Course-2) Theory	Programming Fundamentals using C(SG , SK)	4
	CMS-A-CC-1-2-P (Core Course-2) Practical	Programming in C(SG)	2
II	CMS-A-CC-2-3-TH (Core Course – 3) Theory	Data Structure(SK)	4
	CMS-A-CC-2-3-P (Core Course – 3) Practical	Data Structure Lab.(SK)	2
	CMS-A-CC-2-4-TH (Core Course – 4) Theory	Basic Electronic Devices and Circuits(PR, MKB)	4
	CMS-A-CC-2-4-P (Core Course – 4) Practical	Basic Electronic Devices and Circuits Lab.(PR, MKB)	2

Semester-III and IV

Sem	Courses	Title	Credits
III	CMS-A-CC-3-5-TH (Core Course-5) Theory	Computer Architecture and Organization(EG)	4
	CMS-A-CC-3-5-P (Core Course-5) Practical	Computer Organization Lab(PR, MKB)	2
	CMS-A-CC-3-6-TH (Core Course-6) Theory	Computational Mathematics(SG)	4

	CMS-A-CC-3-6-P (Core Course-6) Practical	Computational Mathematics Lab(SK, EG)	2
	CMS-A-CC-3-7- TH(Core Course- 7)Theory	Operating Systems(SK)	4
	CMS-A-CC-3-7- P(Core Course- 7) Practical	Operating Systems Lab(SK)	2
	SEC-A-1(Theory) CMS-A-SEC-A-3- 1-TH	Computer Graphics(EG)	2
	SEC-A-2(Theory) CMS-A-SEC-A-3- 2-TH	IoT(Internet of things) ()	2
IV	CMS-A-CC-4-8- TH (Core Course - 8) Theory	Data Communication, Networking and Internet technology (BPR)	4
	CMS-A-CC-4-8-P (Core Course - 8) Practical	Computer Networking and Web Design Lab(BPR,PD)	2
	CMS-A-CC-4-9- TH (Core Course - 9) Theory	Introduction to Algorithms and its Applications(SG)	4
	CMS-A-CC-4-9-P (Core Course - 9) Practical	Algorithms Lab(SG)	2
	CMS-A-CC-4-10- TH(Core Course- 10)Theory	Microprocessor and Its Applications(EG)	4
	CMS-A-CC-4-10- P(Core Course- 10)Practical	Programming with Microprocessor 8085(EG)	2
	SEC-B-1(Theory) CMS-A-SEC-B-4- 1-TH	Information Security(PR, PD)	2
	SEC-B-2(Theory) CMS-A-SEC-B-4- 2-TH	E-Commerce	2

Part-III

V	Theoretical 100	A	Microprocessor (MKB)	50
		B	Computer Organization-II (EG)	50
		C	Computer Networks (BPR)	50
VI	Theoretical 100	A	Object-Oriented Programming (PR)	30
		B	Software Engineering (SG)	30

		C	Computer Graphics (EG)	30
		D	Database Management System (SG)	60
VII	Practical 100	A	Hardware: Microprocessor(MB) Programming & I/O Interfacing	100
		B	Software: RDBMS (SG)	50
VIII	Practical 100	A	Object-Oriented Programming (PR)	100
		B	UNIX Shell Programming (SK)	50

Semester-I

CMS-A-CC-1-1-TH: Digital Logic Core Course-1: Theory: 04 Credits: 60 hours

Introduction to Computer Fundamentals: (02 hours)

CPU, Primary and Secondary Storage, I/O Devices, Concept of Super, Mainframe, Mini and Personal Computer, System and Application Software (concept only).

Number Systems: (05 hours)

Weighted and Non-Weighted Codes, positional, Binary, Octal, Hexadecimal, Binary coded Decimal (BCD), Gray Codes, Alphanumeric codes, ASCII, EBCDIC, Conversion of bases, Parity bits, Single Error bit detection and correcting codes: Hamming Codes, Fixed and Floating Point Arithmetic: Addition, Subtraction, Multiplication and Division.

Boolean Algebra: (08 hours)

Fundamentals of Boolean Expression: Definition of Switching Algebra, Basic properties of Switching Algebra, Huntington's Postulates, Basic logic gates (AND, OR, NOT), DeMorgan's Theorem, Universal Logic gates (NAND, NOR), Minterm, Maxterm, Minimization of Boolean Functions using K-Map up-to four variables, Two level and multilevel implementation using logic gates, Simplification of logic expression.

Combinational Circuits: (20 hours)

Half adders, Full Adder (3-bit), Half Subtractor, Full Subtractor (3-bit) and construction using Basic Logic Gates (OR, AND, NOT) and Universal Logic Gates (NAND & NOR), Multibit Adder- Ripple Carry Adder, Carry Look Ahead adder, BCD Adder, 1'S & 2'S Complement Adder/Subtractor unit Construction using 4 bit Full adders units, 1 bit, 2 bit, 3 bit and 4 bit Comparators using basic logic gates. Data Selector-Multiplexer: Expansion (Cascading), Reduction, Function Realization, Universal function realization, Multifunction Realization. Encoders:- Realization of simple Encoders and priority Encoders using Basic and Universal Logic gates

Data Distributor:- De-multiplexer, Cascading. Chip Selector/Minterm Generator - Decoder- Function Realization, BCD Decoders, Seven Segment Display and Decoders. Parity bit and Code Converters: Parity bit Generator/Checker, Gray to Binary code converter, Binary to Gray Code Converter.

Sequential Circuits: (21 hours)

Set/Reset (SR) Latch: Using NAND and NOR gates, Gated S-R latches, D Latch, J-K Latch, T Flip Flop, Race around Condition, Master Slave J-K Flip Flop, Clock - Duty Cycle, Rising Time, Falling Time, Negative Edge Detector and Positive Edge Detector circuits, Edge Triggered SR, D and JK Flip Flop, Flip-Flop Conversions, Flip-Flops with Preset and Clear. Registers: Serial Input Serial Output, Serial Input Parallel Output, Parallel input Serial Output, Parallel Input parallel Output, Universal Shift Registers. Counters: Asynchronous

Counter: UP/DOWN Counters, Mod - N Counters, BCD Counter (Counter Construction using J-K and T Flip Flops). Synchronous Counter: UP/DOWN Counters, Mod-N Counters, Ring Counters, Johnson Counters

Integrated Circuits (Concept only): (04 hours)

Bipolar Logic Families: DTL, TTL NOT Gate, TTL NAND Gate, TTL NOR Gate, Open Collector, Fan-in, Fan-out;
MOS Logic Families: NMOS, PMOS, CMOS, SSI, MSI, LSI and VLSI classification

CMS-A-CC-1-1-P: Digital Circuits

Core Course-1: Practical: 02 Credits: 40 hours

Combinational Circuits:

1. Implementation of different functions using Basic and Logic gates, SOP, POS
2. Study and prove De-Morgan's Theorem.
3. Universal function using NAND and NOR gates
4. Implementation of half and Full adder (3-bit) using basic logic gates and Universal logic gates (NAND & NOR).
5. Implementation of half and Full Subtractor (3-bit) using basic logic gates and Universal logic gates (NAND & NOR).
6. 1 Digit BCD adder using 7483 and other logic gates.
7. Design 4 to 1 multiplexer using logic/Universal gates and implement full adder/full subtractor.
8. Using 74153 and 74151 implement full adder/ full subtractor and other functions.
9. Cascading of Multiplexers.
10. Design 2 to 4 decoder using basic / universal logic gates.
11. Study 74138 or 74139 and implement full adder / full subtractor and other functions.
12. Implementation of 1 bit Comparator using decoders.
13. Cascading of Decoders.
14. Design a parity generator and checker using basic gates.
15. Construct and study comparators using 7485.
16. Construct Comparator (2-bit) using logic gates
17. Design a seven segment display unit using Common anode/Common cathode and 7447 / 7448.
18. Study Priority Encoder Chip 74147/74148.

Sequential Circuits:

1. Realization of RS, D, JK Clocked/Gated Level Triggered Flip-Flop using basic/Universal logic gates.
2. Study and Conversion of Flip-Flops: D to JK, JK to D, JK to T, SR to JK, SR to D Flip-flop.
3. Design synchronous and asynchronous counters MOD-n (MOD-8, MOD-10) UP/ DOWN and connecting Seven Segment Display along with decoder for display of counting sequence.
4. Construction of ODD/EVEN 4 bit Synchronous Counter.
5. 4-bit binary arbitrary sequence synchronous counter.

Text/Reference Books

1. Digital Circuits, Vol - I & II, D. Ray Chaudhuri, Platinum Publishers.
2. Digital Systems - Principle & Applications, Tocci & Widmer, EEE.
3. Digital Logic & State Machine Design, Comer, Oxford.
4. Digital Principle & Applications, Malvino & Leach, McGraw Hill.
5. Digital Design, Morris Mano, PHI.
6. Digital Integrated Electronics- H.Taub & D.Shilling, Mc Graw Hill.
7. Digital Circuits and Design, Salivahan, Vikas

CMS-A-CC-1-2-TH: Programming Fundamentals using C

Core Course-2: Theory: 04 Credits: 60 hours

Introduction: (04 hours)

History, Basic Structure, Algorithms, Structured programming constructs.

C Programming elements: (08 hours)

Character sets, Keywords, Constants, Variables, Data Types, Operators- Arithmetic, Relational, Logical and Assignment; Increment and Decrement and Conditional, Operator Precedence and Associations; Expressions, type casting. Comments, Functions, Storage Classes, Bit manipulation, Input and output.

C Preprocessor: (06 hours)

File inclusion, Macro substitution.

Statements: (06hours)

Assignment, Control statements- if, if else, switch, break, continue, goto, Loops-while, do_while, for.

Functions: (06 hours)

Argument passing, return statement, return values and their types, recursion

Arrays: (07hours)

String handling with arrays, String handling functions.

Pointers: (10 hours)

Definition and initialization, Pointer arithmetic, Pointers and arrays, String functions and manipulation, Dynamic storage allocation

User defined Data types: (07 hours)

Enumerated data types, Structures. Structure arrays, Pointers to Functions and Structures, Unions

File Access: (06hours)

Opening, Closing, I/O operations.

CMS-A-CC-1-2-P: Programming with C

Core Course-2: Practical: 02 Credits: 40 hours

1. WAP to print the sum and product of digits of an integer.
2. WAP to reverse a number.
3. WAP to compute the sum of the first n terms of the following series, $S=1+1/2+1/3+1/4+.....$
4. WAP to compute the sum of the first n terms of the following series, $S =1-2+3- 4+5.....$
5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.
6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
7. WAP to compute the factors of a given number.
8. Write a macro that swaps two numbers. WAP to use it.

9. WAP to print a triangle of stars as follows (take number of lines from user):

```
      *
     ***
    *****
   ********
  **********
 **********
```

10. WAP to perform following actions on an array entered by the user :

- i) Print the even-valued elements
- ii) Print the odd-valued elements
- iii) Calculate and print the sum and average of the elements of array
- iv) Print the maximum and minimum element of array
- v) Remove the duplicates from the array
- vi) Print the array in reverse order

The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.

11. WAP that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.

12. Write a program that swaps two numbers using pointers.

13. Write a program in which a function is passed address of two variables and then alter its contents.

14. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.

15. Write a program to find sum of n elements entered by the user. To write this program, allocate memory dynamically using malloc() / calloc() functions or new operator.

16. Write a menu driven program to perform following operations on strings:

- a) Show address of each character in string
- b) Concatenate two strings without using strcat function.
- c) Concatenate two strings using strcat function.
- d) Compare two strings
- e) Calculate length of the string (use pointers)
- f) Convert all lowercase characters to uppercase
- g) Convert all uppercase characters to lowercase
- h) Calculate number of vowels
- i) Reverse the string

17. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.

18. WAP to display Fibonacci series (i) using recursion, (ii) using iteration.

19. WAP to calculate Factorial of a number (i) using recursion, (ii) using iteration.

20. WAP to calculate GCD of two numbers (i) with recursion (ii) without recursion.

21. Write a menu-driven program to perform following Matrix operations (2-D array implementation): a) Sum b) Difference c) Product d) Transpose

22. Copy the contents of one text file to another file, after removing all whitespaces.

23. Write a function that reverses the elements of an array in place. The function must accept only one pointer value and return void.

24. Write a program that will read 10 integers from user and store them in an array. Implement array using pointers. The program will print the array elements in ascending and descending order.

25. Add two distances in meter kilometer system using structure.

26. Add two complex numbers using structures.

27. Calculate the difference between two time periods using structures. These are only examples, more can be included related to the theory. Use open source C compiler.

Text/Reference Books:

1. Programming with C, Byron S. Gottfried, McGraw Hill.
2. The C Programming Language, Kernighan and Dennis, PHI.
3. The Complete reference C, Herbert Schildt, McGraw Hill.
4. Let Us C, Kanetkar, BPB Publication. 5. Programming in ANSI C, Balaguruswamy, McGraw Hill. 6. Programming Languages, Allen B. Tucker, Tata McGraw Hill.

Semester-II

CMS-A-CC-2-3-TH: Data Structure

Core Course-3: Theory: 04 Credits: 60 hours

Introduction to Data Structure: (01 hour)

Abstract Data Type.

Arrays: (05 hours)

1D, 2D and Multi-dimensional Arrays, Sparse Matrices. Polynomial representation (Polynomial Representation as Application).

Linked Lists: (09 hours)

Singly, Doubly and Circular Lists; Normal and Circular representation of Self Organizing Lists; Skip Lists, Polynomial representation (Polynomial Representation as Application).

Stacks: (05 hours)

Implementing single / multiple stack/s in an Array; Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Applications of stack; Limitations of Array representation of stack

Queues: (05 hours)

Array and Linked representation of Queue, Circular Queue, De-queue, Priority Queues

Recursion: (05 hours)

Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion; Understanding what goes behind Recursion (Internal Stack Implementation)

Trees: (15 hours)

Introduction to Tree as a data structure; Binary Trees (Insertion, Deletion, Recursive and Iterative Traversals on Binary Search Trees); Threaded Binary Trees (Insertion, Deletion, Traversals); Height-Balanced Trees (Various operations on AVL Trees).

Searching and Sorting: (10 hours)

Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Insertion Sort, Merge Sort, Quick sort, Shell Sort, Heap sort, Radix sort, Comparison of Sorting Techniques

Hashing: (05 hours)

Introduction to Hashing, Deleting from Hash Table, Efficiency of Rehash Methods, Hash Table Reordering, Resolving collision by Open Addressing, Coalesced Hashing, Separate Chaining, Choosing a Hash Function, Perfect Hashing Function.

CMS-A-CC-2-3-P: Data Structure Lab.

Core Course- 3: Practical: 02 Credits: 40 hours

1. Write a program to search an element from a list. Give user the option to perform Linear or Binary search. Use Template functions.

2. WAP using templates to sort a list of elements. Give user the option to perform sorting using Insertion sort, Bubble sort or Selection sort.
3. Implement Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list and concatenate two linked lists (include a function and also overload operator +).
4. Implement Doubly Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.
5. Implement Circular Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.
6. Perform Stack operations using Linked List implementation.
7. Perform Stack operations using Array implementation. Use Templates.
8. Perform Queues operations using Circular Array implementation. Use Templates.
9. Create and perform different operations on Double-ended Queues using Linked List implementation.
10. WAP to scan a polynomial using linked list and add two polynomial.
11. WAP to create a Binary Search Tree and include following operations in tree:
 - (a) Insertion (Recursive and Iterative Implementation)
 - (b) Deletion by copying
 - (c) Deletion by Merging
 - (d) Search a no. in BST
 - (e) Display its preorder, postorder and inorder traversals Recursively
 - (f) Display its preorder, postorder and inorder traversals Iteratively
 - (g) Display its level-by-level traversals
 - (h) Count the non-leaf nodes and leaf nodes
 - (i) Display height of tree
 - (j) Create a mirror image of tree
 - (k) Check whether two BSTs are equal or not
12. WAP to reverse the order of the elements in the stack using additional stack.
13. WAP to reverse the order of the elements in the stack using additional Queue.
14. WAP to implement Diagonal Matrix using one-dimensional array.
15. WAP to implement Lower Triangular Matrix using one-dimensional array.
16. WAP to implement Upper Triangular Matrix using one-dimensional array.
17. WAP to implement Symmetric Matrix using one-dimensional array.

These are only sample programs, more can be included related to the theory.

Text/ Reference Books:

- 1) Fundamentals of Data Structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed, Silicon Pr.
- 2) Data Structures: A Pseudocode Approach with C, Richard F. Gilberg and Behrouz A. Forouzan, Cengage Learning
- 3) Data Structures In C, Noel Kalicharan, CreateSpace Independent Publishing Platform.
- 4) Adam Drozdek, Data Structures and algorithm in C, Cengage Learning.
- 5) The C Programming Language, Brian W. Kernighan and Dennis Ritchie, Prentice Hall.
- 6) Sartaj Sahni, Data Structures, Algorithms and applications in C++, Second Edition, Universities Press, 2011.
- 7) Aaron M. Tanenbaum, Moshe J. Augenstein, Yedidyah Langsam, Data Structures Using C and C++, 2nd ed., PHI, 2009.

CMS-A-CC-2-4-TH: Basic Electronic Devices and Circuits
Core Course-4: Theory: 04 Credits: 60 hours

Basics of Circuit Theory: (04 hours)

KVL, KCL, Thevenin's, Norton's, Superposition, Maximum Power Transfer Theorem. Application to simple problems.

Theory of Semiconductor devices: (03 hours)

Semiconductor materials and their properties, classification based on energy band diagram, Intrinsic and extrinsic semiconductors, P & N type.

Diode and its applications: (09 hours)

Working Principle, construction and characteristics of PN junction diode, biasing, depletion region, Single Phase Half, Full wave and bridge rectifier using PN Junction diode, Circuit, Working principle, Calculation of Average DC current and Voltage, RMS, Ripple Factor, efficiency, Peak Inverse Voltage (PIV). Zener diode: Characteristics and its application as a voltage regulator

Bipolar Junction Transistor: (08 hours)

Principle of Junction Transistor (including current components, current gains), Types: CE, CB, CC), DC biasing in CE mode: Q-Point, load line analysis, Transistor as an amplifier. Inverter using transistors: Transfer characteristics and threshold voltages

Unipolar Junction Transistor: (08 hours)

Principle of JFET and MOSFET, Depletion and Enhancement mode operations, Concept of NMOS, PMOS and CMOS. CMOS circuits for basic logic gates (NOT, NAND, NOR)

PNPN Devices: (08 hours)

Working Principle of SCR, UJT, construction, characteristics and simple applications: SCR, DIAC, TRIAC, SCR regulated power supply, Switch Mode Power Supply (SMPS), qualitative study only. Concept and functions of Optoelectronic materials (LED, LCD, Photo Sensors and basics of Optical Fiber and Opto-couplers).

Operational Amplifiers (OPAMP): (12 hours)

Inverting Amplifier, Non-inverting Amplifier, Offset parameters, Inverting and Noninverting Adder, Differentiator, Integrator, Scale changer and Schmitt Trigger. Concept of Virtual ground, CMRR, Signal Generation using OPAMP: Monostable, Astable (Square wave generator)

Timer: (04 hours)

Construction and Functional description of 555, Mono-stable, Bistable and Astable Operation, VCO.

Data Acquisition: (04 hours)

R-2R ladder DAC, Weighted resistor type DAC, Flash Type ADC, Counter, Successive Approximation Register (SAR), Dual Slope ADC and Integrating Type.

CMS-A-CC-2-4-P: Basic Electronic Devices and Circuits Lab.

Core Course-4: Practical: 02 Credits: 40 hours

1. Study the forward characteristic of a p-n junction diode and calculate the static and dynamic resistance of the diode.
2. Construct a Full wave rectifier using power diodes and study its load regulation characteristics with or without capacitor filter.
3. Construct a Bridge rectifier using power diodes and study its load regulation characteristics with or without capacitor filter.
4. Construct a Zener Voltage regulator and study its load regulation characteristics.

5. Construct a positive and negative voltage regulator using Three terminal linear voltage regulator 78XX and 79XX. Study its load regulation characteristics.
6. Construct a variable positive voltage regulator using Three terminal linear voltage regulator LM317 and study its load regulation characteristics for different sets of output voltage.
7. Study the Output characteristics of a transistor in CE mode and calculate the gain from the graph.
8. Using Transistor to construct NOT or Invert Operation and draw the transfer characteristics and measure the threshold voltage.
9. Construct and study an Inverting Amplifier using OPAMP with different sets of inputs and feedback resistors and Calculate the gain from the graph.
10. Construct and study an Non-Inverting Amplifier using OPAMP with different sets of inputs and feedback resistors and Calculate the gain from the graph.
11. Construct and study an Inverting Adder using OPAMP.
12. Construct and study an Non-Inverting adder using OPAMP.
13. Construct and study a subtractor using OPAMP.
14. Construct and study the OPAMP as a differentiator.
15. Construct and study the OPAMP as a integrator.
16. Construct an Astable Multivibrator using Timer 555.
17. Study and construct a R-2R ladder digital to analog converter.
18. Convert an analog signal into digital using ADC 0809.

Text/Reference Books:

1. Electronic Devices & Circuits Theory, Boylested & Nashelsky, PHI.
2. Electronics fundamental & Application, Chattopadhyay, Rakshit, New Age International Publishers.
3. Op-Amps And Linear Integrated Circuits, R. A. Gayakwad, Prentice Hall.
4. Solid State Electronic Devices, Streetman, PHI.
5. Elements of Electronics, Bagde Singh, S Chand Publication.
6. Microelectronic circuits, Sedra Smith, Oxford.
7. Operational Amplifier and Linear Integrated Circuits, Coughlin Driscoll.
8. Electronic Devices and Circuits, Salivahanan, Suresh Kumar, McGrawHill education

Semester-III

CMS-A-CC-3-5-TH: Computer Organization and Architecture

Core Course- 5: Theory, Credits:04, Contact hours: 60.

Basic Structure of Computers (Qualitative Discussion)(5 hours)

Computer Types, Basic Functional Units, Basic Operational Concept, Bus Structure, Software, Performance, Multiprocessor and Multicomputer, IAS Computer, Historical perspectives.

Register Transfer and Micro-operation(5 hours)

Register Transfer Language, Register Transfer, Bus and Memory Transfers, Three State Bus Buffers, memory Transfer, Arithmetic and Logical micro-operations, Shift and Arithmetic shifts.

Basic Computer Organization and Design(05 hours)

Instruction Codes, Stored Program Organization, Indirect Address, Computer Registers, Common Bus System, Computer Instruction, Timing and Control, Instruction Cycle, fetch Decode, Register Reference Instructions, Memory Reference Instruction, Input-Output and Interrupt, Design of Basic Computer, Design of Accumulator Logic.

CPU Organization(06 hours)

Arithmetic and Logic Unit (ALU)- Combinational ALU, 2'S Complement Addition, Subtraction Unit, Booths Algorithm for Multiplication, Division Hardware using Restoration Division Algorithm.

General register organization, Control Word, Accumulator Based, Register Based, Stack Type CPU organization.

Control Unit(07 hours)

Hardwired Control Unit, Micro-programmed Control Unit: Control memory, Address Sequencing, conditional branching, mapping of instructions, subroutine, Design of Control Unit.

CPU Registers(06 hours)

Program Counter, Stack Pointer Register, Memory Address Register, Instruction Register, Memory Buffer Register, Flag registers, Temporary Registers.

Instructions.(3 hours)

Operational Code, Operands, Zero, One, Two and Three Address Instruction, Instruction Types, Addressing modes, Data Transfer and Manipulation instructions, Program control instructions.

CISC and RISC processors(03 hours)

Introduction, relative merits and De-merits.

Computer Peripherals(08 hours)

VDU, Keyboard, Mouse, Printer, Scanner (Qualitative approach).

Input / Output Organization(02 hours)

Polling, Interrupts, subroutines, Memory mapped IO, IO mapped IO, DMA, I/O Bus and Protocol, SCSI, PCI, USB, Bus Arbitration.

Memory(10 hours)

Primary memory: ROM, PROM, EPROM, EEPROM, Flash memory, RAM: SRAM, DRAM, Asynchronous DRAMs, Synchronous DRAMs, Structure of Larger Memories, RAMBUS Memory, Cache Memory: Mapping Functions, Replacement Algorithms, interleaving, Hit and Rate penalty, Virtual memories, Address Translation, Memory Management requirements, Secondary Storage: Magnetic Hard Disks, Optical Disks, Magnetic Tape Systems.

CMS-A-CC-3-5-P: Computer Organization Lab.

Core Course-5, Practical, Credits: 02, Contact hours:40.

- (1). Construct an Arithmetic Unit capable of performing 4-bit subtraction and Addition using 2's complement method. Use Parallel Adders and other necessary logic gates.
- (2). Construct a logical unit using logic gates capable of performing 4-bit, Bitwise ORing, ANDing, XORing and inversion.
- (3). Construct a 4-bit ALU unit which can perform the following operation;
Selection Function
S1 S0
0 0 Addition
0 1 Subtraction
1 0 XOR-ing
1 1 Complement
- (4). Construct a 2-bit Carry Look Ahead Adder using logic gates.
- (5). Study and Construct a 1-digit BCD/Decimal adder using parallel adders and other necessary logic gates.
- (6). Construct a Binary Multiplier using basic logic gates.
- (7). Construct a Binary Divider using basic logic gates.
- (8). Subtraction with 1's complement method using parallel adders and other necessary logic gates.
- (9). Construction of BCD Subtractor with 9'S complement method using parallel adders and logic gates.
- (10). Construction of BCD Subtractor with 10'S complement method using parallel adders and logic gates.

- (11). Binary magnitude comparators (up to 4 bits) using parallel adder and logic gates.
- (12). Construct a Binary 4-bit and 8-bit adder using logic gates.
- (13). Construct a Serial in Serial out 4-bit register.
- (14). Construct a 4-bit Universal Shift register.
- (15). Construct a 4 bit ring counter.
- (16). Construct a 4 - bit Johnson Counter.
- (17) Construct RAM (4-bit) and extend it
- (18). Horizontal and Vertical Cascading of Memory modules.
- (19). Code converters using memory modules.

Text/Reference Books

1. Computer System Architecture, Morris Mano, Pearson.
2. Computer Organization & Architecture, Williams Stallings, Pearson.
3. Computer Organization, Hamacher, Vranesic and Zaky, McGraw Hill.
4. Computer Architecture and Organization, Govindrajalu, Tata McGraw Hill.
5. Computer Architecture and Organization, J P Hayes, Tata McGraw Hill.
6. Structured Computer Organization, Andrew S. Tanenbaum, Austin, Pearson.

CMS-A-CC-3-6-TH: Computational Mathematics

Core Course- 6: Theory, Credits: 04, Contact hours: 60.

Introduction(10 hours)

Set Theory: Finite and Infinite Sets, Uncountable Infinite Sets, Relations: Properties of Binary Relations, Closure, Partial Ordering Relations, Equivalence, Functions: definition, one-to-one, onto and invertible, Mathematical Functions: Exponential and Logarithmic, Counting: Mathematical Induction, Pigeonhole Principle, Permutation and Combination, Binomial Theorem, Principle of Inclusion and Exclusion.

Introduction to Probability(10 hours)

Elementary events, Sample space, Classical and Axiomatic definition of Probability, Theorems on Total Probability, Conditional Probability, Bernoulli Trials and Binomial Distribution, Bayes' Theorem, Random Variables, Expectation, Variance, Standard Deviation.

Growth of Functions(4 hours)

Asymptotic Notations, Standard notations and common functions with simple examples.

Recurrences(6 hours)

Relations, Generating Functions, Linear Recurrence Relations with Constant Coefficients and their solution, Substitution Method, Recurrence Trees.

Numerical Methods (Algorithmic Approach)(20 hours)

Errors: Approximate and Rounding of Numbers, Significant digits, Errors and their types, Propagation of errors.

Interpolation: Newton Forward and Backward interpolation, Lagrange interpolation.

Solving a Set of Linear Equations: Gaussian Elimination, Gauss-Jordan, Iteration methods and their convergence conditions, Gauss-Seidel, Gauss-Jacobi Iterative Methods.

Solving Non-linear equations: Bisection, Regula-falsi, Secant and Newton-Raphson, their order of convergence.

Solving Differential Equations: Euler, Runge-Kutta second and fourth order methods.

Numerical Integration:

Trapezoidal and Simpson's 1/3rd rules.

Curve fitting :

Least square approximation, Linear regression, Polynomial regression, Fitting Exponential and Trigonometric functions.

Graph Theory(10 hours)

Basic Terminology, Models and Types, Multi graphs and Weighted graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs, Trees and their basic terminologies and properties.

CMS-A-CC-3-6-P: Computational Mathematics Lab.

Core Course- 6: Practical, Credits:02, Contact hours: 40.

Lab. based on Numerical Methods using C.

Text/ Reference Books:

1. Elements of Discrete mathematics, C.L. Liu & Mahapatra, Tata McGraw Hill.
2. Discrete Mathematics and Its Applications, Rosen, McGraw Hill.
3. Introduction to algorithms, T.H. Cormen, C.E. Leiserson, R. L. Rivest, Prentice Hall .
4. Discrete Mathematics with Algorithms, M. O. Albertson and J. P. Hutchinson, John Wiley Publication.
5. Discrete Structures, Logic, and Computability, J. L. Hein, Jones and Bartlett Publishers.
6. Essentials of Discrete Mathematics, D.J. Hunter, Jones and Bartlett Publishers.
7. Numerical Analysis and Computational Procedures by Mollah, New Central Book.
8. Computer Oriented Numerical Methods, 3rd Edition, V Rajaraman, PHI
9. Graph Theory With Applications To Engineering And Computer Science by Narsingh Deo, PHI.
10. Graph Theory by J.A. Bondy and U.S.R. Murty, Springer.
11. Introduction to Graph Theory by D B West, 2nd edition, Pearson Education

CMS-A-CC-3-7-TH: Operating Systems

Core Course- 7: Theory, Credit: 04, Contact hours: 60.

Introduction(6 hours)

Basic OS functions, types of operating systems- batch processing, multiprogramming, time sharing, multiprocessing, distributed and real time systems.

Operating System Organization(6 hours)

Processor and user modes, kernels, system calls and system programs.

Process(18 hours)

System view of the process and resources, process control block, I/O and CPU bound process, process hierarchy, concept of threads

Process Scheduling: Preemptive and non-preemptive scheduling, Long term scheduling, short term/CPU scheduling (FCFS, SJF, SRJF, RR and priority) and medium term scheduling

Process Synchronization: Concurrent processes, critical section, semaphores and application, methods for inter-process communication;

Deadlock(9 hours)

Definition, Prevention, Avoidance, Detection, Recovery.

Memory Management(14 hours)

Physical and logical address space; memory allocation strategies – fixed and variable partitions, paging, segmentation, virtual memory

File and I/O Management(5 hours)

Directory structure, file operations, file allocation methods, disk management.

Protection and Security(2 hours)

Policy mechanism, Authentication

CMS-A-CC-3-7-P: Operating Systems Lab.

Core Course- 7: Practical, Credit: 02, Contact hours: 40.

Shell programming in LINUX

1. Write a shell script to convert the content of a file from lower case to upper case.
2. Write a shell script to count the words, lines and characters of a given file. File name should be provided at run time.
3. Write a shell script that take a word from user and find out the frequency of the word in a given file.
4. Write a shell script that gets executed at the moment of user login and it displays Good Morning, Good afternoon, Good Evening, Good Night, depending upon the time at which the user logs on.
5. Write a shell script to print Pascal diamond.
6. Write a shell script to find a number using sequential search method.
7. Write a shell script to find a number using binary search technique.
8. Write a shell script to sort a set of integer numbers using bubble sort.
9. Write a shell script to find out the factorial of a given number.
10. Write a shell script to reverse a string and check whether it is a palindrome.
11. Write a shell script to find the roots of a quadratic equation $ax^2 + bx + c = 0$, considering all possible cases.
12. Write a shell script for menu based system to insert records for employees with employee ID, name, designation, salary in a data file, also display records when necessary. Display salary for the employee asked.

These are only examples, more can be included.

Text/ Reference Books

1. Operating Systems Concepts, A Silberschatz, P.B. Galvin, G. Gagne, John Wiley Publications.
2. Modern Operating Systems, A.S. Tanenbaum, 3rd Edition, Pearson Education.
3. Operating Systems: A Modern Perspective, G. Nutt, Pearson Education.
4. Operating Systems, Internals & Design Principles W.Stallings, PHI.
5. Operating Systems- Concepts and design, M. Milenkovic, Tata McGraw Hill.
6. Sumitabha Das , UNIX Concepts and Applications, Tata McGraw-Hill.
7. Understanding the Linux Kernel, D. P. Bovet and M. Cesati, O'Reilly.

CMS-A-SEC-A-3-1-TH: Computer Graphics

Skill Enhancement Course: SEC-A: Choice -1: Theory, Credit:02, Contact hours: 40.

Introduction(05 hours)

Basic concepts of Graphics Devices– CRT monitor, Monochrome and Color Monitor displaying technique only, Physical and logical units of graphics devices – Pixel and its different properties, Basic idea for image or picture formation using pixels – Raster Scan and Vector Scan.

Basic geometrical shapes formation algorithms(05 hours)

Concepts Co-ordinate System, Line Segment, Digital Differential Analyzer, Circle and arc segment, elliptic segment, Bresenham's and Midpoint scan conversion algorithms.

Two and Three Dimensional Transformations(14 hours)

Transformations operations - Translation, Rotation, Scaling. Reflection, Shearing and Inverse of these operations, Homogeneous coordinate system representation, matrix representation. Composite Transformations Operations – Basic ideas and matrix representations by matrix concatenation for a particular operation.

Two Dimensional Clipping(08 hours)

View port, window port, display device, Point Clipping, Line Clipping, Cohen-Sutherland line clipping algorithm, Sutherland Hudgeman polygon clipping algorithm

Projection(06 hours)

Basic Concept of Projection operation and its application, Classification – Perspective, Parallel and its subclasses, Principles of these projections (Geometric representation only, no Mathematical Foundation and algorithms)

Applications(02 hours)

Basic Concepts Computer Art, Animation – Animating and modeling of real world, Morphing – Classification of morphing and Application to the Advertisements and publicities.

Text/ Reference Books:

1. Computer Graphics by Zhigang Xiang, Roy Plastock, Schaum's Outlines Series.
2. Computer Graphics by Hearn & Baker, Pearson.
3. Procedural Elements for Computer Graphics by David F. Roger, 2nd Edition, TMH.
4. Computer Graphics by Foley, Van Dam, Feimer & John, Pearson.
5. Introduction to Computer Graphics and Multimedia, Mukhopadhyay and Chattopadhyay, Vikas publication.

Semester-IV

CMS-A-CC-4-8-TH: Data Communication, Networking and Internet Technology.
Core Course- 8: Theory, Credit: 04, Contact hours: 60.

Overview of Data Communication and Networking(04hours)

Introduction:

Data communications Components, data representation, direction of data flow (simplex, half duplex, full duplex).

Network Hardware: Physical structure (type of connection, topology), categories of network (LAN, MAN, WAN).

Internet: Brief history, Protocols and standards, Reference models: OSI reference model, properties of all the layers, TCP/IP reference model, their comparative study.

Physical Layer(12hours)

Data & Signals: Analog & Digital Data and Signals, periodic and non-periodic signals, composite signals, bandwidth, bit rate, transmission of digital signals.

Transmission Impairments: Attenuation, Distortion and Noise.

Data Rate Limits: Noiseless Channel: Nyquist Data rate, Noisy Channel: Shannon's Capacity, calculation of data rate using both limits.

Digital Transmission

Digital to Digital Conversion: Line coding, schemes (RZ, NRZ, Manchester, Differential Manchester), block coding.

Analog to Digital Conversion: Sampling, Nyquist rate of sampling, Pulse code modulation (PCM), Delta Modulation (DM), Adaptive Delta Modulation (ADM), parallel and serial transmission.

Analog Transmission

Digital to Analog: Amplitude shift keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Quadrature Amplitude Modulation (QAM).

Analog to Analog Conversion:

Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation.

Bandwidth Utilization Techniques(4 hours)

Multiplexing: FDM, Synchronous & Statistical TDM, WDM.

Transmission Medium(06hours)

Guided media: Twisted pair, Coaxial, Fiber optics.

Unguided: Radio waves, microwaves, Infrared, Antenna, Communication satellites (qualitative study only).

Switching and Telephone network(04hours)

Circuit switched networks, Packet Switched networks, Virtual Circuit switch.

Major components of telephone network, Dial up modem, DSL and ADSL modems, Cable TV for data transfer (qualitative study only)

Data link Layer(04hours)

Types of errors, framing (character and bit stuffing), error detection & correction methods, Linear and cyclic codes, checksum.

Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC (qualitative study only).

Physical addressing: MAC address and its format.

Medium Access sub layer(08hours)

Point to Point Protocol, Token Ring: Reservation, Polling. Multiple access protocols: Pure & Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA.

Channelization: FDMA, TDMA, CDMA (Qualitative study only).

Wired and Wireless LAN: Standards, fast Ethernet, Protocol 802.11, Bluetooth.

Network layer(11 hours)

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway,

Addressing: IP addressing, Subnetting, Routing techniques: static vs. dynamic routing ,

Protocols: RARP, ARP, IP, ICMP

Transport layer(03 hours)

Process to Process delivery: UDP, TCP

Application Layer(04hours)

Introduction to DNS, Remote logging, FTP, Electronic mail, WWW & HTTP

CMS-A-CC-4-8-P: Computer Networking and Web Design Lab

Core Course- 8: Practical, Credit: 02, Contact hour: 40.

Computer Networks: Practical(05 hours)

Familiarization with Networking cables (CAT5, CAT6, UTP), Connectors (RJ-45, T-connector), Hubs, Switches, LAN installation & configuration (peer-to-peer) process.

Web Design: Practical(20 hours)

Web page design by HTML

Handling HTML form

HTML

Capturing Form Data, GET and POST form methods, Dealing with multi value fields

Redirecting a form after submission.

Array(15 hours)

Anatomy of an Array ,Creating index based and Associative array, Accessing array

Looping with Index based array, with associative array using each() and for each()

Some useful Library function.

Text/ Reference Books:

1. Data Communication and Networking, B.A. Forouzan, Tata McGraw Hill.
2. Computer Networks, A.S. Tanenbaum, Pearson Education .
3. Data and Computer Communication, W. Stallings, Pearson Education.

4. Data & Computer Communication, Black, PHI.
5. Internet & World Wide Web: How to program, Harvey M. Deitel & Paul J. Deitel.
6. CGI Programming on the world wide web, Shishir Gundavaram, O'Reilly and Associates.

CMS-A-CC-4-9-TH: Introduction to Algorithms & its Applications
Core Course- 9: Theory, Credit: 04, Contact hours: 60.

Introduction to Algorithms(05 hours)

Definition, Characteristics, Recursive and Non-recursive algorithms.

Asymptotic Complexity Analysis of Algorithms(10 hours)

Space and Time Complexity, Efficiency of an algorithm, Growth of Functions, Polynomial and Exponential Complexity, Asymptotic Notations: Big O Notation and Small o notation, Big Ω and Small ω , Big Θ and Small ϕ Notations, Properties: Best case/worst case/average case analysis of well-known algorithms.

Algorithm Design Techniques(15 hours)

Concepts and simple case studies of Greedy algorithms. Divide and conquer: Basic concepts, Case study of selected searching and sorting problems using divide and conquer techniques: Dynamic programming: General issues in Dynamic Programming.

Graph Representation and Algorithm(25 hours)

Graph traversal algorithms: BFS, DFS, Minimal spanning trees: Prim's Algorithm, Kruskal's Algorithm, Shortest path algorithms: Floyd's Algorithm, Floyd-Warshall Algorithm, Dijkstra's Algorithm, Graph Coloring Algorithms.

Classification of Problems(05 hours)

Concept of P, NP.

CMS-A-CC-4-9-P: Algorithms Lab.

Core Course- 9: Practical, Credit:02, Contact hour: 40.

Lab. based on Graph Theory using C

Graph Algorithms:

Implementation of Graph algorithms: Single Spanning Tree Generation using - BFS, DFS, Minimal Spanning Tree Generation using - Prim's Algorithm, Kruskal's Algorithm, Shortest Path finding using - Floyd's Algorithm, Floyd-Warshall Algorithm, Dijkstra's Algorithm, Graph Partitioning Algorithm.

Text/References Books:

1. Introduction to Algorithms, Cormen, Leiserson, Rivest and Stein, TMH.
2. The Design and Analysis of Algorithms, Aho, Hopcroft and Ullman, Pearson Education.
3. The Art of Computer Programming, D.E. Knuth, Pearson Education.
4. Algorithm Design, Jon Kleinberg and Eva Tardos, Pearson Education.
5. Data Structures and Algorithms - K.Mehlhorn.
6. Computer Algorithms, S.Baase, Pearson Education.
7. Fundamentals of Computer Algorithms, E. Horowitz and Sahani, Galgotia
8. Combinational Algorithms- Theory and Practice, E.M. Reingold, J. Nievergelt and N. Deo, PHI.

CMS-A-CC-4-10-TH: Microprocessor and its Applications

Core Course- 7: Theory, Credits:04, Contact hours: 60.

Introduction to Microcomputer based system(03 hours)

Evolution of Microprocessor and Microcontrollers and their advantages and disadvantages.

Microprocessor Architecture and Memory Interfacing(14 hours)

Basic Architecture of Microprocessor 8085 and explanation of each block, Microprocessor 8085 pin out and signals, Addressing modes, Instruction Formats, Instruction Cycle, Clock Cycle, Multiplexed Address Data Bus, Control and Status signals, Microprocessor and Bus Timing, De-multiplexing of Address Data Bus, Generation of Control Signals for I/O and Memory, Basic concepts in Memory Interfacing, Address Decoding and memory Addresses.

Interfacing I/O Devices(10 hours)

Basic Interfacing concepts, Peripheral I/O instructions (I/O mapped I/O), Device Selection and data Transfer, Absolute and Partial Decoding, Input Interfacing, Interfacing I/O using decoders, Memory mapped I/O techniques, Data transfer schemes, Interfacing 8155 memory segment.

Programming 8085(10 hours)

Instruction Set of 8085, Different Programming Techniques, Stack and Subroutines, Counter and Time Delays, Code Conversion, BCD Arithmetic and 16 bit Data Operation.

Interfacing Peripheral Devices and Applications(13 hours)

Interrupts: 8085 Interrupt, RST instructions, Software and Hardware interrupt, multiple Interrupts and Priorities, 8085 Vectored Interrupts, Restart as Software Instructions.

Interfacing Digital to Analog Converters, Analog to Digital Interfacing, keyboard interfacing, interfacing 8255 (Mode - 0, BSR), Support IC chips- 8237/8257,8259

Microprocessor 8086(10 hours)

The 8086 microprocessor- Architecture, Instruction set, Addressing modes, Interrupts, Memory interfacing with 8086.

CMS-A-CC-4-10-P:Programming with Microprocessor 8085

Core Course- 10: Practical, Credits:02, Contact hours: 40.

1. Assembly Language Programming for Arithmetic Operations like Addition, Subtraction, Multiplication and Division on 8, 16 bit data.
2. Assembly Language Programming for different logical operations.
3. Assembly Language Programming for code conversions.
4. Assembly Language Programming for different sorting techniques.
5. Assembly Language Programming for memory block transfer.
6. Assembly Language Programming for AP series and Fibonacci series.
7. Assembly Language Programming for HCF, LCM etc.
8. Assembly Language Programming for Searching.
9. Assembly Language Programming for frequency distribution.
10. Block Replacement and transfer

Many more programs can be included related to the programming techniques of Microprocessor 8085

Text/Reference books

1. Microprocessor architecture, programming and applications with 8085/8085A, Ramesh Gaonkar, Penram International Publication (PRI).
2. Fundamental of Microprocessors and Microcontrollers, B.Ram, Dhanpat Rai Publications.
3. Microprocessors and Microcontrollers, Senthil, Saravanan, Jeevananthan, Oxford.
4. Advanced Microprocessors and Peripherals by Ray and Bhurchandi – McGrawHill.
5. Intel Corp. Micro Controller Handbook – Intel Publications.
6. Microprocessors and Interfacing Programming and hardware by Douglas V. Hall, McGraw Hill.

children in sexually explicit act, etc. in electronic form.
12) [Section 72] Breach of confidentiality and privacy.

Text/ Reference Books

1. Computer Security: Art and Science, M. Bishop, Pearson Education.
2. Information Security: Principles and Practice, M. Stamp, John Wiley & Sons.
3. Cryptography and Network Security, William Stallings, Eastern Economy Edition, PHI.
4. Understanding Cryptography, Paar and Pelzi, Springer.
5. Cryptography and Network Security, Behrouz A Forouzan, McGraw Hill Education.
6. Information Security Principles and Practices by M. Merkow, J. Breithaupt,, Pearson Education.
7. Computer Security: Concepts, Issues and Implementation by A. Basta, W.Halton, Cengage Learning India.

CMS-A-SEC-B-4-2-TH: E-Commerce

Skill Enhancement Course: SEC-B: Choice -2: Theory, Credit:02, Contact hours: 40.

An Introduction to Electronic commerce(05hours)

What is E-Commerce (Introduction And Definition), Main activities E-Commerce, Goals of E-Commerce, Technical Components of E-Commerce, Functions of E-Commerce, Advantages and disadvantages of E-Commerce, Scope of E-Commerce, Electronic Commerce Applications, 9 Electronic Commerce and Electronic Business (C2C) (C2G,G2G, B2G, B2P, B2A, P2P, B2A, C2A, B2B, B2C).

The Internet and WWW(10hours)

Evolution of Internet, Domain Names and Internet Organization (.edu, .com, .mil, .gov, .net etc.) , Types of Network, Internet Service Provider, World Wide Web, Internet & Extranet, Role of Internet in B2B Application, building own website, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Banner, Exchange, Shopping Bots.

Internet Security(10hours)

Secure Transaction, Computer Monitoring, Privacy on Internet, Corporate Email privacy, Computer Crime(Laws , Types of Crimes), Threats, Attack on Computer System, Software Packages for privacy, Hacking, Computer Virus(How it spreads, Virus problem, virus protection, Encryption and Decryption, Secret key Cryptography, DES, Public Key Encryption, RSA, Authorization and Authentication, Firewall, Digital Signature(How it Works).

Electronic Data Exchange(5 hours)

Introduction, Concepts of EDI and Limitation, Applications of EDI, Disadvantages of EDI, EDI model, Electronic Payment System: Introduction, Types of Electronic Payment System, Payment Types, Value Exchange System, Credit Card System, Electronic Fund Transfer, Paperless bill, Modern Payment Cash, Electronic Cash.

Planning for Electronic Commerce(05hours)

Planning Electronic Commerce initiates, Linking objectives to business strategies, Measuring cost objectives, Comparing benefits to Costs, Strategies for developing electronic commerce web sites.

Internet Marketing(05hours)

The PROS and CONS of online shopping, The cons of online shopping, Justify an Internet business, Internet marketing techniques, The E-cycle of Internet marketing, Personalization e-commerce.

Text/ Reference Books

1. E-Commerce Concepts, Models, Strategies by G.S.V. Murthy, Himalaya Publishing House.
2. The E-Commerce Book, Teffano Korper and Juanita Ellis, Morgan Kaufmann.
3. E-Commerce 2017, Kenneth C. Laudon and Carol Guercio Traver, Pearson.
4. E- Commerce, Kamlesh K Bajaj and Debjani Nag Tata McGraw-Hill Education.
5. Electronic commerce by Gray P. Schneider , International Student Edition.
6. E-Commerce, Fundamentals and Applications by Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, Wiley Student Edition.

Part-III**PAPER-V (THEORETICAL):100 Marks****Distribution of questions /marks:**

Q1.(Compulsory-20 Marks, any 10 short questions to be answered among 15,each carrying 2 Marks).Five questions to be answered from the remaining which consists of at least eight questions. (All questions are of 16 marks; questions may have subdivisions. At least one question to be answered from each group).

Group-A : Microprocessor**(50 Periods)**

	Topics	Numbers of Lectures
	Evolution of Microprocessor: Architecture of 8 bit and 16 bit microprocessor Machine Language Instructions,Addressing Modes,Instruction Formats,Instruction Sets,Instruction Cycle,Clock Cycles,Timing Diagrams,Programming a Microprocessor,Interrupts,Interfacing Concept-Memory Interfacing,I/O Interfacing and Ports-Ppi8255 Keyboard Interfacing, Display Interfacing Interrupt and subroutine handling,Methods of Interrupts,Priority and Management. Case Studies: 8085 and 8086 microprocessor.	

Group-B: Computer Organization –II**(50 Periods)**

	Topics	Numbers of Lectures
	ALU-Combinational ALU,2's Complement Addition,Subtraction Unit,Booth's Algorithm for multiplication and division. Memory Hierarchy: CPU Register, Cache Memory,Primary Memory (DRAM,SRAM,SAM,PAL,PLA),Secondary Memory and Virtual Memory ,Associative memory. CISC and RISC processors: Introduction,relative merits and demerits. Control Unit: Control Structure and Behaviour,Hardwired Control and Micro programmed control:Basic Concept,Parallelism in Microinstruction. I/O: Polling,Interrupts and subroutines,Memory mapped I/O and I/O mapped,DMA,I/O Bus and Protocol,SCSI,PCI,USB,Bus Arbitration. Computer Peripherals: VDU,Keyboard,Mouse,Printer,Scanner etc.	

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Group-C: Computer Networks

(50 Periods)

	Topics	Numbers of Lectures
	<p>Data Communication Concepts:Analog & digital Signals,Periodic & Non-Periodic signals,Time and Frequency Domain;Bandwith and data rate; Signal rate,Serial & Parallel transmission, Various modes of transmission: simplex/Half Duplex,Duplex, Features of guided and non-guided transmission media, Impairments.</p> <p>Purpose of Modulation & Encoding; AM, FM, PM ;Multiplexing: Purpose & Definition of FM & TDM.Goals of Computer Network, LAN, MAN and WAN.OSI & TCP/IP Architecture.</p> <p>Internet and Internet; Service and Clients; Ports; Domain Name Server (DNS);Accounts, Internet Service Providers; Connections: Dial Up, ISDN, ADSDN; Cable, Modem; E-mail: Account, Sending, Receiving, Mailing List, IRC, Voice and Videoed Conferencing,WWW,Browsers.</p>	

Text Books:

1. Computer architecture and Organizations by J.P.Hayes, TMH.
2. Computer System Architecture by M.Morris Mano.

PAPER-VI (THEORETICAL):100 Marks

Distribution of questions /marks:

Q1.(Compulsory-20 Marks, any 10 short questions to be answered among 15,each carrying 2 Marks).Five questions to be answered from the remaining which consists of at least eight questions. (All questions are of 16 marks; questions may have subdivisions.At least one question to be answered from each group).

Group-A :Object Oriented Programming

(30 Periods)

	Topics	Numbers of Lectures
	<p>Concepts:Difference with procedure oriented programming;Data Abstraction and Information Hiding:Objects,Classes and Methods, Encapsulation,Inheritance,Polymorphism,Object Oriented Programming through C++:Input/Output,Function and Operator Overloading,Constructors and Destructors,Copy Constructors and Assignment Operator,Overloading,Single and Multiple Inheritance,Polymorphism and Virtual Functions,Namespace,Exception Handling,Templates.</p>	

Group-B: Software Engineering

(30 Periods)

	Topics	Numbers of Lectures
	Software Engineering: Software Life Cycle,Different Models:Waterfall,Spiral;Software Requirement Analysis & Specification,Structured Analysis,DFD,Data Dictionary,Structured Design,Structure Charts,Software Testing:White Box and Black Testing,Software Quality Assurance.	

Group-C:Computer Graphics

(30 Periods)

	Topics	Numbers of Lectures
	Introduction: Co-ordinate System,Information Handling Software,Graphics Software,Area of Application ,Translatioun,Scaling,Matrix Representation,Rotation,Scaling,Matrix Representation,homogeneous Co-ordinate System,Composite transformation ,Inverse Transformation ,Computer Art,animation,Morphing,Projection & Clipping ,2D & 3D Transformations,Lines,Curves and their presentations.	

Group-D: Data Base Management System

(60 Periods)

	Topics	Numbers of Lectures
	Basic concept,File Management Systems ,advantages of DBMS,ANSIC/SPARC Architecture,Physical,conceptual and External Models,ER Diagram;Dta Models:Relational,Hierarchical,Network;File Organization:Sequential,Indexed Sequential,Random,Inverted;Query Languages,Relational Algebra,Relatiopnal Calculas , Functional Dependencies,Normal Forms:1NF,2NF and BCNF;Structured Query Languages (SQL) ,elementary concepts of Security,Itegrity.	

Text Books:

1. Object Oriented Programming with C++ by Balagurusamy,TMH.
2. Object Oriented Programming with C++ by Robert Lafore,PHI.

Paper-VII(Practical):

100 Marks

Group-A(Hardware:Microprocessor Programming & I/O Interfacing):

50 Marks

	Topics	Numbers of Lectures
	Experiment with 8085a based micro computing kits	

	<ol style="list-style-type: none"> 1) Data movement between register –register,register-memory , memory-memory. 2) Arithmetic operations on single byte,word and multi – byte integer,signed and hexadecimal operands. 3) Ordered arrangement of a set of operands. 4) Bubble Sorting ,sequential and Binary Search. 5) Block Replacement and transfer. 6) Parity Generator. 7) Delay Routines. <p>Interfacing:</p> <ol style="list-style-type: none"> 1) Display of Alphanumeric Characters on 7 segment displays. 2) Matrix Keyboard Interfacing and Identification of the keys. 	
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Duration of Examination : 4 hours

Marks Allotment:

- Sessional - 05 marks
- Viva –voce - 10 marks
- Experiment - 35 marks

Group-B(Software:RDBMS):

50 marks

	Topics	Numbers of Lectures
	RDBMS:ORACLE,SQL Server <i>Front Ends:Developer 2000,Visual Basic.</i> <i>Problems:Application Database with GUI.</i>	

Duration of Examination : 4 hours

Marks Allotment:

- Sessional - 05 marks
- Viva –voce - 10 marks
- Experiment - 35 marks

PAPER-VIII(Software Practical):

100 Marks

	Topics	Numbers of Lectures
	<p><i>Section I: Object Oriented Programming Language: C++, Visual C++ Programming</i> <i>Problems: Problem set should cover the basic features of the language and implementation of different algorithms covered in theoretical papers.</i></p> <p><i>Section-II: UNIX: Files and Directories, Copy, Delete, Rename Directory,</i></p>	

	Creation ,Navigation,Editor,Pipes and Filters,Pattern searching.Unix Sheell Programming. Platform: SCO UNIX,LINUX Problems: Problem set should cover the basic features of Unix/Linux and shell programming.	
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Duration of Examination : 6 hours

Marks Allotment:

Sessional - 10 marks

Viva –voce - 20 marks

Experiment - 70 marks

Section I- 40

Section II- 30

Text Books:

1. SQL/PL/SQL The Programming language of Oracle by Ivan Bayross,BPB
2. Unix Shell Programming by Y.Kanetkar,BPB.
3. Your UNIX:The Ultimate Guid by Sumitava Das.

Computer Science General

Semester-I

Courses	Topic	Periods	Credits
CMS-G-CC-1-1-TH Sem-1-Core Course-1 Theory	Computer Fundamentals and Digital Logic Design (PD)	60 hours	04
CMS-G-CC-1-P Sem-1-Core Course-1 Practical	Word Processing, Spreadsheet, Presentation and Web design by HTML/ PHP (PD)	40 hours	02

**CMS-G-CC-1-1-TH: Computer Fundamentals and Digital Logic Design
Core Course- 1: Theory: 60 Hours**

Group A: Computer Fundamentals (20 hours)

General Concepts:

Introduction to Computer and Problem Solving: Information and Data Hardware: CPU, Primary and Secondary storage, Cache Memory, I/O devices, Bus structure, BIOS

Software: Systems and Application. Generation of Computers: Super, Mainframe, Mini and Personal Computer, Work stations, Parallel machines (concept only).

Introduction to Programming Languages: Machine Language, Assembly Language, High Level Language.

Problem Solving: Flow Charts, Decision Tables and Pseudo codes.

System Software: Classifications- Operating Systems (OS); Translators – Compilers and Interpreters, Preprocessors, Assemblers, Loaders, Linkers, Line and Screen Editors, other utilities.

Virus: Concept, Detection and Protection

Multimedia: Basic Concept, associated hardware and software

Object Oriented Paradigm: Basic characteristics, Definition, Brief comparison with other types of programming paradigms.

Group B: Digital Logic Design(40 hours)

Number Systems and Codes: (08 hours) Number representation: Weighted Codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal(BCD), Conversion of bases. Complement notions. Binary Arithmetic, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC; Single Error-Detecting and Correcting Codes, Hamming Codes, Fixed point, Floating point representation.

Boolean Algebra: (08 hours) Fundamentals of Boolean Algebra, Switches and Inverters, Functionally Complete Gates (AND, OR, NOT), NAND, NOR, Switching function and Boolean Function. De Morgan's Theorem, Min-term, Max term, Truth tables and minimization of switching function upto four variables, Algebraic and K-map method of Logic circuit synthesis, two-level and multi-level.

Digital Electronics: (24hours)

Combinational Circuits: Realization of AND and OR Gates using diodes and NOT Gate using transistors, Standard Gate Assemblies, IC chips packaging nomenclature, Half and Full Adder(3 & 4 bit), Multi-bit adders – Ripple carry and Carry Look Ahead Adder, Adder/subtractor, BCD Adder, Data selectors/multiplexers – expansions, reductions, function realization, universal function realization, multi-function realization, Decoders: function realization, De-multiplexer and function realization, Encoder, Priority Encoder, Parity bit Generator/checker, Gray Code Generator, Code Converters, Keyboard encoder, Seven segment display unit, Comparators.

Sequential Circuits: Model of Sequential computing, Difference between Combinational and Sequential circuit, RS-Latch: using NAND and NOR Gates, RS Latch as a Static RAM Cell, Problems of Basic Latch circuits, Digital Clock – Duty Cycle, Rising time, Falling time, Clocked Flip Flops - SR, JK, D, T, Level Trigger and Edge Trigger, Excitation Functions of each flipflops, Flip-flops with Preset and Clear, Application of Flip-flops: Asynchronous Counter(UP/DOWN) upto 4 bit counter, Decade Counter, Mod – n Counter, Finite State machine Model – State Transition Diagram and Table, Synchronous Counters – different mod-n counters, Ring counter, Registers: Registers with parallel load, Shift Registers.

CMS-G-CC-1-1-P: Word Processing, Spreadsheet, Presentation and Web design by HTML/ PHP Core Course- 1: Practical: 40 Hours

Word Processing: (05 hours)

Document creation, saving, editing; Formatting text and paragraphs; header and footers; clipart, tables; tools, Inserting images, files; mail merge; margins; Hyphenation; page setups; OLE; Index and references; comments; templates; macros

Spreadsheet: (05 hours)

Workbook, worksheets, cell; address; entering, editing, formatting, filtering, sorting worksheet data; printing; charts; functions and formulas; macros; importing, exporting files;

Presentation: (05 hours)

Slides; formatting; wizard, layout; word art; animation.

Web Design: (25 hours)

Web page design can be taught in the laboratory classes by using HTML or PHP.

Text/ Reference Books:

1. Digital Circuits, Vol - I & II, D. Ray Chaudhuri, Platinum Publishers.
2. Digital Systems - Principle & Applications, Tocci&Widmer, EEE.
3. Digital Logic & State Machine Design, Comer, Oxford.
4. Digital Principle & Applications, Malvino& Leach, McGraw Hill.
5. Digital Design, Mano, PHI.
6. Computer Fundamentals, Anita Goel, Pearson Education.
7. Introduction to Computer Science, P.K.Sinha, P.Sinha, BPB Publication.

Semester-II

Courses	Topics	Periods	Credit
CMS-G-CC-2-2-TH Sem-2-Core Course-2 Theory	Algorithms and Data Structure (SG)	60 Hours	04
CMS-G-CC-2-2-P Sem-2-Core Course-2 Practical	Programming with C (SG,SK)	40 hours	02

CMS-G-CC-2-2-TH: Algorithms& Data Structure
Core Course- 2: Theory: 60 hours

Introduction: (04 hours)

Algorithms, ADT.

Arrays: (10 hours)

One dimensional and Two Dimensional Arrays, Row Major and Column Major Forms.

Linked List: (16 hours)

Singly and Doubly Linked List; Operations Like Insertion, Deletion. Searching.

Stacks and Queues: (16 hours)

Concepts of Stack and Queue; Insertion and Deletion of Elements; Array and Linked Representation: Prefix, Infix and Postfix Notation; Postfix Expression Evaluation, Infix to Postfix.

Searching: (04 hours)

Algorithm of Sequential, Binary Search Techniques.

Sorting: (10 hours)

Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort.

CMS-G-CC-2-2-P: Programming with C
Core Course- 2: Practical: 40 hours

Basic Structure: Character set, keywords, identifiers, constants, variables and type declaration. Sample programs, preprocessor.

Operators: Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, comma; operator precedence and associativity; arithmetic expression-evaluation and type conversion. Character I/O, Escape sequence and formatted I/O.

Branching and Looping: if, if-else, while, do-while, for.

Arrays: One-dimensional and 2-dimensional. Different types of uses. String handling with arrays – read and write, concatenation, comparison, string functions.

User defined functions: Need; Call by Reference and Call by value; return values and types; nesting of functions; recursion.

Structures: Initialization; arrays of a structure, arrays within structures, structure within structure, size of structures, Dynamic Storage Allocation.

Pointers: Declaration and Initialization; operators; pointer arithmetics; accessing variables, pointer & arrays, strings, functions, Linked lists, concepts and use in C with different examples.

File handling: Opening & Closing, I/O

Other Features: Bit level operations, macro definitions, union, command line arguments

Text/ Reference Books:

1. Data Structure ,Liptsuitz, S. Outline Series.
2. Data Structure, Ellis Horowitz and SartazSahani, Galgotia.
3. Data Structure using C, S.K.Bandyopadhyay and K.N.Dey, Pearson Education.
4. Data Structure and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education.
5. Programming in C. E. Balagurusamy, TMH. 6. Let us C, Y. Kanetkar, BPB Publication.

Semester-III

Courses	Topics	Periods	Credit
CMS-G-CC-3-3-TH Sem-3-Core Course-3 Theory	Computer Organization (PD)	60 hours	04
CMS-G-CC-3-3-P Sem-3-Core Course-3 Practical	Programming using Python (SG)	40 hours	02

CMS-G-CC-3-3-TH: Computer Organization
Core Course- 3: Theory: 60 hours

Basic Computer Organization: (15 hours)

IAS Computer, Von Neumann Computer, System Bus. Instruction Cycle, Data Representation, Machine cycle, CPU Organization: Arithmetic and Logic Unit, Control Unit, CPU Registers, Instruction Registers, Program Counter, Stack Pointer, CISC & RISC processors.

Instruction: (02 hours)

Operation Code and Operand, One, Two and Three address instruction. Instruction types.

Control Unit: (05 hours)

Control Structure, Hardwired Control and Micro programmed Control: Basic Concept, Parallelism in Micro-Instruction.

ALU: (10 hours)

Basic Structure of ALU, Addressing mode, Instruction Formats, Handling of interrupts and subroutines, Combinational ALU, 2's Complement Addition, Subtraction Unit, Booth's Algorithm for multiplication and division.

Memory: (15 hours)

Types of Memory: Primary and Secondary; RAM, ROM, EPROM, EEPROM, DRAM, SRAM, PLA. Different storage technology; Memory Hierarchy: CPU Register, Cache Memory, and Virtual Memory.

I/O: (08 hours)

Polling, Interrupts, DMA, I/O Bus and Protocol, Memory mapped I/O and I/O mapped I/O, I/O system organization and interfacing, Bus: SCSI, PCI, USB, Bus arbitration.

Computer Peripherals: (05 hours)

VDU, Keyboard, Mouse, Printer, Scanner etc.

PART-III

Paper-IV: 100 Marks (Theoretical 50 , Practical 50)

Group A (Theoretical) Full Marks : 50

Communication and Computer Networks

(60 Periods)

Name of Teachers	Topics	Numbers of Lectures
B.P.R	<p>Communication Concepts : Analog and Digital communication – basic concept and comparison. Signal types frequency spectrum, strength, bandwidth, data rate , channel capacity. S/N ratio, Modulation and demodulation, FSK, ASK.</p> <p>Transmission media (brief idea, characteristics, comparison): Guided (twisted pair , co-axial, optical fiber) and unguided (micro wave , satellite-geo synchronous and low-orbit , VSAT).</p> <p>Audio and Video communication systems: Analog and Digital telephone , AM & FM radio, cable TV network, ISDN, paging, cordless and cellular phones, ATM.</p> <p>Computer Networks: Distributed processing and resource sharing concepts . Classes-LAN, MAN, WAN.</p> <p>Architecture- OSI, TCP/IP and http protocol-brief study. Basic idea of protocols, routing, congestion control.</p> <p>LAN: Ethernet and Token Ring topology (principle of operation, characteristics, comparison). High speed LANs.</p> <p>Internetworking Modems, bridges and routers, connectivity concepts. Network security.</p>	

	The Internet: basic idea,DNS and URL,IP address,browsers. E-Mail: Architecture and services.	
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Distribution of questions:

Q1.(compulsory – 10 marks , any 5 questions to be answered out of 8, each carrying 02 marks)

Q2 to Q9.Any 5 questions to be answered out of 8,each carrying 08 marks.

Questions may have smaller subdivisions.

Text Books:

1. Data Communications and Networking by Behrouz A . Forouzan , 2nd or 4th Edition,TMH.
2. Data and computer communication by William Stallings,6th Edition , Pearson Education.

Group B (Practical)Full Marks-50

Group B1 & B2 together constitute Group B.

Group B1:Unix / Linux and Shell Programming

(36 Periods)

Name of Teachers	Topics	Numbers of Lectures
SK	Files & Directories: Copy ,delete,rename,compare files;create,navigate,remove directories,access vi editor,states of users,background jobs,Pipes & filters ; cut, paste and sort,pattern searching in a string ,Other internal and external commands. Shell Programming: Concept and simple programming problems.	

Group B2: Programming in Visual Basic

Name of Teachers	Topics	Numbers of Lectures
PD	Students should learn about programming on the following topics using the language,primarily through practical sessions,along with theoretical classes in between. Basic Features,building objects with classes,operations with objects,class libraries.Multitasking and multi reading applications;software design Involving forms,objects,events,functions,procedure and methods (32 bit programming).OBDC driver;Front end development for database.MFC based multimedia applications.	

Distribution of Questions:

Group A : One question to be answered out of four 20 marks

Group B : One question to be answered out of four 10 marks

Sessional Work- 10 marks, Viva –voce-10 marks

Duration of examination- 6 hours

Note : Problems to be assigned to a student by drawing lots in a manner similar to that followed in other practical examinations. The sessional work must be submitted in a word processed version with computer printout of problems, algorithms listings, output, discussions, graphs, charts, figures, Handwritten output will not be accepted under any circumstances.

Questions will not be package/product specific.

Text Books:

1. Your Unix The Ultimate guide by Sumitava Das, McGraw Hill
2. Unix Shell programming by Y Kanetkar.

Academic calendar for the session 2020-21
Bangabasi Morning College
Department of Mathematics

Under CBCS system

Course	Commencement of classes	Tentative date of University Examination		
		Internal Assessment(20)	Tutorial(15)	Theoretical(65)
Semester-I	July	3 rd week of November	4 th week of November	2 nd week of December
Semester-II	Within 7 days from the completion of previous semester	2 nd week of May	4 th week of May	2 nd week of June
Semester-III	Within 7 days from the completion of previous semester	3 rd week of November	4 th week of November	2 nd week of December
Semester-IV	Within 7 days from the completion of previous semester	2 nd week of May	4 th week of May	2 nd week of June

Syllabus Distribution(under CBCS system):

ODD SEMESTER		
Course	Course Details	Teacher
SEMESTER- 1		
MTMA (CC1) Co-Ordinator: Partha Bhattacharya	Unit-1: Calculus	PH
	Unit-2: Geometry	PB
	Unit-3: Vector Analysis	
MTMA (CC-2) Co-ordinator: Bikash Ch. Mandal	Unit-1: Complex Number, Theory of Equation, Inequality, Linear difference equation	BCM
	Unit-2: Relation, Mapping, Integers	PG
	Unit-3: Rank and inverse of Matrix, System of Linear equations	
MTMG (GE-1/CC1) Co-ordinator: Prithwiraj Halder	U1: Algebra(15), U3: Differential Equation(15)	BCM
	U2: Differential Calculus(25)	PH
	U4: Geometry(25)	PG
SEMESTER- 3		
MTMA(CC-5) Co-ordinator: Prithwiraj Halder	Theory of Real Functions	PH
MTMA(CC-6) Co-ordinator: Prithwiraj Halder	Ring Theory & Linear Algebra-I	PH PG
MTMA(CC-7) Co-ordinator: Bikash Ch. Mandal	ODE & Multivariate Calculus-I	BCM

MTMA(SEC-A) Co-ordinator: Subhabrata Dinda	C Programming Language	SD
MTMG(GE-3/CC-3) Co-ordinator: Partha Bhattacharya	Unit-1: Integral Calculus	PH
	Unit-2: Numerical Method	PB
	Unit-3: Linear Programming	BCM
MTMG(SEC-A) Co-ordinator: Subhabrata Dinda	C- Programming Language	SD

SEMESTER- 5

MTMA(CC-11) Co-ordinator: Partha Bhattacharya	Probability & Statistics	PB
MTMA(CC-12) Co-ordinator: Prithwiraj Halder	Group Theory-II	PH
	Linear Algebra-II	PG
MTMA(DSE – A(1)) Co-ordinator: Prithwiraj Halder	Advanced Algebra	PH
MTMA-DSE – B(1) Co-ordinator: Bikash Ch. Mandal	Optional Paper	PB, BCM
MTMG-DSE(1A) Co-ordinator: Partha Bhattacharya	Graph Theory/ Particle Dynamics	PB

EVEN SEMESTER

Course	Course Details	Teacher
SEMESTER- 2		
MTMA (CC-3) Co-Ordinator: Partha Bhattacharya	Real Analysis: Unit-1	PH
	Real Analysis: Unit-2	PB
	Real Analysis: Unit-3	
MTMA (CC-4) Co-ordinator: Bikash Ch. Mandal	Group Theory-I: Unit- 1	PH
	Group Theory-I: Unit- 2	PG
	Group Theory-I: Unit- 3	
MTMG (GE-2/CC-2) Co-ordinator: Bikash Ch. Mandal	U1: Differential Calculus-II	PH
	U2: Differential Equation-II	BCM
	U3: Vector Algebra	BCM
	U4: Discrete Mathematics	PB
SEMESTER- 4		
MTMA(CC-8) Co-ordinator:	Riemann Integration	PH
	Series of Functions	PB

SD	Prithwiraj Halder		
PH	MTMA(CC-9) Co-ordinator: Bikash Ch. Mandal	PDE & Multivariate Calculus-II	BCM
PB	MTMA(CC-10) Co-ordinator: Partha Bhattacharya	Mechanics	PB
BCM			
SD	MTMA(SEC-B) Co-ordinator: Subhabrata Dinda	Sage- R / Mathematical Logic	SD PG
	MTMG(GE-4/CC-4) Co-ordinator: Prithwiraj Halder	Unit-1: Algebra-II	PH
PB		Unit-2: Computer Science & Programming	SD
		Unit-3: Probability & Statistics	PB
PH	MTMG(SEC- B) Co-ordinator: Prithwiraj Halder	Mathematical Logic	PG
PG			
PH	SEMESTER- 6		
	MTMA(CC-13) Co-ordinator: Prithwiraj Halder	U1: Metric Space	PH
PB, BCM		U2: Complex Analysis	
	MTMA(CC-14) Co-ordinator: Partha Bhattacharya	Numerical Methods	PB, SD
PB	DSE A(2) Co-ordinator: Bikash Ch. Mandal	Optional Paper	BCM
	DSE B(2) Co-ordinator: Prithwiraj Halder	Point Set Topology	PH
Teacher	MTMG- DSE(1B) Co-ordinator: Bikash Ch. Mandal	Advanced Calculus / Mathematical Finance	PH, BCM, PB
PH			
PB			
PH			
PG			
PH			
BCM			
BCM			
PB			
PH			
PB			

Under (1+1+1) system

Course of study	Commencement of Classes	Mid-term exam	College Test	Result of College Test	Form Fill-up for University Exam	Tentative date of University Exam
Part-III	Within 7 days from completion of part-II exam	October	January	1 st week of February	February	April

Syllabus Distribution (under 1+1+1 system)
Mathematics Honours (Each Module contains 50 marks)

PART: III

Module	Topics	Marks	Name of Teachers
Module: IX	Analysis-III	50	Prithwiraj Halder
Module: X- Group- A	Linear Algebra- II and Modern Algebra-II	20	Pritam Ghosh
Module: X- Group- B	Tensor Calculus	15	Bikash Chandra Mandal
Module: X- Group- C	Differential Equation-II or Graph Theory	15	Bikash Chandra Mandal
Module: XI- Group- A	Vector Calculus	10	Partha Bhattacharya
Module: XI- Group- B	Analytical Statics-II	20	Bikash Chandra Mandal
Module: XI- Group- C	Analytical Dynamics of a Particle- II	20	Bikash Chandra Mandal
Module: XII- Group- A	Hydrostatics	25	Partha Bhattacharya
Module: XII- Group- B	Rigid Dynamics	25	Bikash Chandra Mandal
Module: XIII- Group- A	Analysis- IV	20	Prithwiraj Halder
Module: XIII- Group- B	Metric Space	15	Prithwiraj Halder
Module: XIII- Group- C	Complex Analysis	15	Prithwiraj Halder
Module: XIV- Group- A	Probability	30	Partha Bhattacharya
Module: XIV- Group- B	Statistics	20	Partha Bhattacharya
Module: XV- Group- A	Numerical Analysis	25	Partha Bhattacharya
Module: XV- Group- B	Computer Programming	25	Subhabrata Dinda
Module: XVI	Practical	50	BCM, PB, SD, PH

Mathematics (General) (1+1+1 system):

Module	Topics	Marks	Name of Teachers
Module: I - Group- A	Classical Algebra	20	Bikash Chandra Mandal
Module: I - Group- B	Analytical Geometry of Two Dimension	15	Partha Bhattacharya
Module: I - Group- C	Vector Algebra	15	Pritam Ghosh
Module: II - Group- A	Differential Calculus	25	Prithwiraj Halder
Module: II- Group- B	Integral Calculus	10	Prithwiraj Halder
Module: II- Group- C	Differential Equation	15	Pritam Ghosh
Module: III-Group- A	Modern Algebra	25	Prithwiraj Halder

Module: III-Group- B	Analytical Geometry of three Dimension	25	Partha Bhattacharya
Module: IV- Group- A	Differential Calculus	25	Prithwiraj Halder
Module: IV- Group- B	Integral Calculus	15	Bikash Chandra Mandal
Module: IV- Group- C	Differential Equations	10	Pritam Ghosh
Module: V - Group- A	Numerical Methods	20	Partha Bhattacharya
Module: V - Group -B	Linear Programming	30	Pritam Ghosh
Module: VI (Gr. A or Gr. B)	Group- A	50	Bikash Chandra Mandal
	Group- B		Partha Bhattacharya
Module: VII	Computer Science & Programming	50	Partha Bhattacharya
Module: VIII (Gr. A or Gr. B)	Group-A	50	Prithwraj Halder
	Group-B		Partha Bhattacharya

**Pritam Ghosh(P.G) – Guest Lecturer

BANGABASI MORNING COLLEGE

Department of Physics

Synopsis of Academic Calendar for Odd Semesters in Session 2019-2020 (July 2019 - Dec 2019)

Se m	Course / Paper	Description	MM	AS	SP	CS	LD	DR	total
1	PHS-A-CC-1-1-TH	Mathematical Physics – I, Theory	3				1		4
	PHS-A-CC-1-1-P	Mathematical Physics – I, Lab			3				3
	PHS-A-CC-1-2-TH	Mechanics, Theory					2	2	4
	PHS-A-CC-1-2-P	Mechanics, Lab		3					3
	PHS-G-CC-1-1-TH	Mechanics, Theory	1				1	2	4
	PHS-G-CC-1-1-P	Mechanics, Lab				3		3	6
3	PHS-A-CC-3-5-TH	Mathematical Physics – II, Theory	2	2					4
	PHS-A-CC-3-5-P	Mathematical Physics – II, Lab			3				3
	PHS-A-CC-3-6-TH	Thermal Physics, Theory		2			2		4
	PHS-A-CC-3-6-P	Thermal Physics, Lab	3						3
	PHS-A-CC-3-7-TH	Digital Systems & Appl, Theory			2	2			4
	PHS-A-CC-3-7-P	Digital Systems & Appl, Lab		3					3
	PHS-A-SEC-A-TH	Programming and Scientific Word Processing			3				3
	PHS-G-CC-3-3-TH	Thermal Physics & Stat Mech, Theory				2	2		4
	PHS-G-CC-3-3-P	Thermal Physics & Stat Mech, Lab				3		3	6
	2Y	2ND YEAR							
	Hons Paper IVB	Physics Lab							0
	General Paper 2A	Physics Lab							0
	General Paper 3B	Physics Lab							0
3Y	3RD YEAR								
	Hons. Paper V	Classical & Quantum Mechs, Atomic Physics		2	2	2			6
	Hons. Paper VI	Nuclear & Particle & Solid State Physics	2	2	2				6
	Hons. Paper VIIA	Statistical Mechanics & E.M. Theory	2				2		4
	Hons. Paper VIIB	Optical and Electrical Lab	3	3					6
	Hons. Paper VIIIA	Electronics Lab			3				3
	Hons. Paper VIIIB	Computation Lab			3				3
	General Paper IVA	General Physics		2		2			4
	General Paper IVB	Electronics & Programming Lab		3	3				6
Total:			16	22	24	14	10	10	96

BANGABASI MORNING COLLEGE

Department of Physics

Synopsis of Academic Calendar for Even Semesters in Session 2019-2020 (Jan 2020 - June 2020)

c 2019)

DR	total	Se	Course / Paper	Description	MM	AS	SP	NB	CS	LD	total
	4	2	PHS-A-CC-2-3-TH	Electricity and Magnetism, Theory	3					1	4
	3		PHS-A-CC-2-3-P	Electricity and Magnetism, Lab			3				3
2	4		PHS-A-CC-2-4-TH	Waves and Optics, Theory				2		2	4
	3		PHS-A-CC-2-4-P	Waves and Optics, Lab	3						3
2	4		PHS-G-CC-2-2-TH	Electricity and Magnetism, Theory	1			2		1	4
3	6		PHS-G-CC-2-2-P	Electricity and Magnetism, Lab				3	3		6
	4	4	PHS-A-CC-4-8-TH	Mathematical Physics – III, Theory	2	2					4
	3		PHS-A-CC-4-8-P	Mathematical Physics – III, Lab			3				3
	4		PHS-A-CC-4-9-TH	Elements of Modern Physics, Theory				2		2	4
	3		PHS-A-CC-4-9-P	Elements of Modern Physics, Lab				3			3
	4		PHS-A-CC-4-10-TH	Analog Systems & Applications, Theory		2			2		4
	3		PHS-A-CC-4-10-P	Analog Systems & Applications, Lab	3						3
	3		PHS-A-SEC-B-TH	Computer Algebra System & Figure Drawing			3				3
	4		PHS-G-CC-4-4-TH	Waves and Optics, Theory					2	2	4
3	6		PHS-G-CC-4-4-P	Waves and Optics, Lab				3	3		6
		2Y	2ND YEAR								
	0		Hons Paper IVB	Physics Lab		3	3				6
	0		General Paper 2A	Physics Lab			3				3
	0		General Paper 3B	Physics Lab		3					3
		3Y	3RD YEAR								
	6		Hons. Paper V	Classical & Quantum Mechs, Atomic Physics		2		2	2		6
	6		Hons. Paper VI	Nuclear & Particle & Solid State Physics	2	2		2			6
	4		Hons. Paper VIIA	Statistical Mechanics & E.M. Theory	2					2	4
	6		Hons. Paper VIIB	Optical and Electrical Lab	3	3					6
	3		Hons. Paper VIIIA	Electronics Lab			3				3
	3		Hons. Paper VIIIB	Computation Lab			3				3
	4		General Paper IVA	General Physics		2			2		4
	6		General Paper IVB	Electronics & Programming Lab		3	3				6
		Total:			19	22	24	19	14	10	108
10	96										

MONDAY (AS, SP, NB) (CS)			1H (NB) 103 1G Lab (CS, X) 103 2H SEC (SP) 103 3H (AS) 205	1H (NB) 103 1G Lab (CS, X) 103 2H SEC (SP) 103 3H (AS) 205	1H Lab (SP, X) 103 1G Lab (CS, X) 103 2H Lab (NB, X) 407 3H Lab (AS, X) 407	1H Lab (SP, X) 103 2H Lab (NB, X) 407 3H Lab (AS, X) 407	1H Lab (SP, X) 103 2H Lab (NB, X) 407 3H Lab (AS, X) 407
TUESDAY (MM, AS, SP, NB) (CS, LD)			2H (NB) 103 2G (LD) 308 3H (MM) 205 3G Lab (AS, X) 103	2H (NB) 103 2G (CS) 308 3H (MM) 205 3G Lab (AS, X) 103	2H Lab (SP, X) 103 2YG Lab (AS) 103 3H (CS) 205 3G Lab (AS, X) 103	2H Lab (SP, X) 103 2YG Lab (AS) 103 3H (LD) 103	2H Lab (SP, X) 103 2YG Lab (AS) 103 3H (LD) 103
WEDNESDAY (MM, SP, NB) (CS)		1H (MM) 103	1H (MM) 103 1G (NB) 312		2YH Lab (SP) 103	2H (CS) 103 2YH Lab (SP) 103	2H (MM) 103 2YH Lab (SP) 103
		3H (NB) 103	3H (CS) 205 3G Lab (SP, X) 103	3H (NB) 103 3G Lab (SP, X) 103	3H Lab (MM, X) 407 3G Lab (SP, X) 103	3H Lab (MM, X) 407	3H Lab (MM, X) 407
THURSDAY (MM, AS, NB) (LD)		1G (NB) 312	1G (MM) 312 2H (LD) 103 2G Lab (NB, X) 103	2H (AS) 103 2G Lab (NB, X) 103 3H (MM) 103	2H (AS) 103 2G Lab (NB, X) 103	1H (LD) 103 2H Lab (X) 103 3H (AS) 103	1H (LD) 103 2H Lab (X) 103 3H (AS) 103
	3G (AS) 311	3H (MM) 103 3G (AS) 311					
FRIDAY (MM, AS, SP, NB) (CS, LD)			1H (LD) 103 1G Lab (NB, X) 103 2H (AS) 205 2G (CS) 308 3H Lab (SP, X) 103	1H (MM) 103 1G Lab (NB, X) 103 2H (AS) 205 2G (LD) 308 3H Lab (SP, X) 103	1H Lab (MM, X) 407 1G Lab (NB, X) 103 2YH Lab (AS) 407 3H Lab (SP, X) 103	1H Lab (MM, X) 407 2H (CS) 103 2YH Lab (AS) 407 3H (NB) 103	1H Lab (MM, X) 407 2H SEC (SP) 103 2YH Lab (AS) 407 3H (NB) 103
	3G (CS) 311	3G (CS) 311					
SATURDAY (MM, AS, SP) (CS, LD)			2H (LD) 205 2G Lab (CS, X) 103 3H Lab (SP, X) 103	1G (LD) 312 2H (MM) 205 2G Lab (CS, X) 103 3H Lab (SP, X) 103	1H Lab (X) 103 2H Lab (MM, X) 407 2G Lab (CS, X) 103 2YG Lab (SP) 3H Lab (SP, X) 103	1H Lab (X) 103 2H Lab (MM, X) 407 2YG Lab (SP)	1H Lab (X) 103 2H Lab (MM, X) 407 2YG Lab (SP)

Dt.: 06.01.2020.

Academic Calendar

Subject: Chemistry

Chemistry (Hons)

SEM-I

INORGANIC CHEMISTRY-1

Name of teacher

Extra nuclear Structure of atom (14 Lectures)

AKD

Acid-Base reactions (12 Lectures)

AD

Redox Reactions (14 Lectures)

AKD

ORGANIC CHEMISTRY-1A

Bonding and Physical Properties (18 Lectures)

AB

General Treatment of Reaction Mechanism I (02 Lectures)

AB

INORGANIC CHEMISTRY: I (1) LAB (30 Lectures)

AKD

ORGANIC CHEMISTRY: O (1A) LAB (15 Lectures)

SS

PHYSICAL CHEMISTRY-1

Kinetic Theory and Gaseous state (20 Lectures)

UP

Transport processes (08 Lectures)

UP

Chemical kinetics (12 Lectures)

UP

ORGANIC CHEMISTRY-IB

Stereochemistry I (17 Lectures)

SS

General Treatment of Reaction Mechanism II (03 Lectures)

SS

PHYSICAL CHEMISTRY: P (1) LAB (30 Lectures)

UP

ORGANIC CHEMISTRY: O (1B) LAB (15 Lectures)

SS

SEM-II

ORGANIC CHEMISTRY-2

Stereochemistry II (20 Lectures)

SS

General Treatment of Reaction Mechanism III (20 lectures)

SS

Substitution and Elimination Reactions (20 Lectures)

SS

Organic Preparations

SS

INORGANIC CHEMISTRY-2

Chemical Bonding-I (20 Lectures)

AKD

Chemical Bonding-II (30 Lectures)

AD

Radioactivity (10 Lectures)

AKD

INORGANIC CHEMISTRY: LAB (45 Lectures)

AKD

SEM-III

Chemical Thermodynamics I (10 Lectures)	UP
Chemical Thermodynamics II (20 Lectures)	UP
Applications of Thermodynamics – I (06 Lectures)	UP
ELECTROCHEMISTRY: (24 Lectures)	UP
PHYSICAL CHEMISTRY: LAB (45 Lectures)	UP

INORGANIC CHEMISTRY-3

Chemical periodicity (15 Lectures)	AKD
Chemistry of <i>s</i> and <i>p</i> Block Elements (30 Lectures)	AKD
Coordination Chemistry-I (15 Lectures)	AD

INORGANIC CHEMISTRY: LAB (45 Lectures)	AKD
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ORGANIC CHEMISTRY-3

Chemistry of alkenes and alkynes (15 Lectures)	AB
Aromatic Substitution (10 Lectures)	AB
Carbonyl and Related Compounds (30 Lectures)	AB
Organometallics(5 Lectures)	AB

ORGANIC CHEMISTRY: LAB (45 Lectures)	SS
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SEM-IV

ORGANIC CHEMISTRY-4

Nitrogen compounds(12 Lectures)	SS
Rearrangements(14 Lectures)	SS
The Logic of Organic Synthesis(14 Lectures)	SS
Organic Spectroscopy (20 Lectures)	SS
Experiment: Qualitative Analysis of Single Solid Organic Compounds (45 Lectures)	AB

PHYSICAL CHEMISTRY 3

Application of Thermodynamics – II (20 lectures)	UP
Foundation of Quantum Mechanics (25 Lectures)	UP
Crystal Structure (15 Lectures)	UP

PHYSICAL CHEMISTRY: LAB (45 Lectures)	UP
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INORGANIC CHEMISTRY-4

Coordination Chemistry-II (30 Lectures)	AD
Chemistry of d- and f- block elements (15 Lectures)	AKD
Reaction Kinetics and Mechanism (15 Lectures)	AKD
Inorganic preparations(45 Lectures)	AKD

Chemistry (Gen)

CC1/ GE 1 Theory: 60 Lectures

Kinetic Theory of Gases and Real gases	UP
Liquids	UP
Chemical Kinetics	UP
Atomic Structure	AKD
Chemical Periodicity	AKD
Acids and bases	AD
Fundamentals of Organic Chemistry	AB
Stereochemistry	AB
Nucleophilic Substitution and Elimination Reactions	AB
CC1/GE 1 Practical: 45 Lectures	AB

CC2/GE 2: Theory: 60 Lectures

Chemical Thermodynamics:	UP
Chemical Equilibrium:	UP
Solutions	UP
Phase Equilibria	UP
Solids	UP
Aliphatic Hydrocarbons	AB
Error Analysis and Computer Applications	AKD
Redox reactions	AKD
CC2/GE 2 Practical: 45 Lectures	UP

CC3/GE 3: Theory: 60 Lectures

Chemical Bonding and Molecular Structure	AD
Comparative study of p-block elements:	AKD
Transition Elements (3d series)	AKD
Coordination Chemistry	AD
ELECTROCHEMISTRY	UP
Aromatic Hydrocarbons	AB
Organometallic Compounds	AB
Aryl Halides	AB
CC3/GE 3 Practical: 45 Lectures	AKD

CC4/GE 4: Theory: 60 Lectures

Alcohols, Phenols and Ethers	AB
Carbonyl Compounds	AB
Carboxylic Acids and Their Derivatives	AB
Amines and Diazonium Salts	AB
Amino Acids and Carbohydrates	AB
Crystal Field Theory	AD
Quantum Chemistry & Spectroscopy	UP
CC4/GE 4 Practical: 45 Lectures	AB

3rd year (1+1+1)

Same as previous academic calendar

**Academic Calendar
2019-2020
Department of Zoology**

Course: B.Sc. (Honours) Zoology		
PART I: SEMESTER 1		
CORE COURSE 1. Non-Chordates I		
ZOOA-CC1-1-TH		
4 Credits	50 Hours	
Non-Chordates I: Protists to Pseudocoelomates		Full Marks 50
First Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
Unit 1: Basics of Animal Classification Definitions: Classification, Systematics and Taxonomy; Taxonomic Hierarchy, Taxonomic types Codes of Zoological Nomenclature; Principle of priority; Synonymy and Homonymy; Concept of classification – three kingdom concept of Carl Woese, 1977 and five kingdom concept of Whittaker, 1969	S. Sarkar	6
Unit 2: Protista and Metazoa Protozoa General characteristics and Classification up to phylum (according to Levine <i>et. al.</i> , 1980) Locomotion in <i>Euglena</i> , <i>Paramoecium</i> and <i>Amoeba</i> ; Conjugation in <i>Paramoecium</i> . Life cycle and pathogenicity of <i>Plasmodium vivax</i> and <i>Entamoeba histolytica</i> Metazoa Evolution of symmetry and segmentation of Metazoa	S. Sarkar	22
Unit 3: Porifera General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Canal system and spicules in sponges	S. Hansda	9

<p>Unit 4: Cnidaria General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.), Metagenesis in <i>Obelia</i>; Polymorphism in Cnidaria; Corals and coral reef diversity, Role of symbiotic algae in reef formation. Conservation of coral and coral reefs.</p>	<p>S. Biswas</p>	<p>15</p>
<p>Unit 5: Ctenophora General characteristics</p>	<p>S. Hansda</p>	<p>3</p>
<p>Unit 6: Platyhelminthes General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.) Life cycle and pathogenicity and control measures of <i>Fasciola hepatica</i> and <i>Taenia solium</i></p>	<p>A.S. Bhunia</p>	<p>9</p>
<p>Unit 7: Nematoda General characteristics and Classification up to classes (Ruppert and Barnes, 1994, 6th Ed.) Life cycle, and pathogenicity and control measures of <i>Ascaris lumbricoides</i> and <i>Wuchereria bancrofti</i> Parasitic adaptations in helminthes.</p>	<p>A.S. Bhunia</p>	<p>10</p>

CORE COURSE 2: Molecular Biology		
ZOOA-CC1-2-TH		
4 Credits	50 Hours	
Molecular Biology	Full Marks 50	
First Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
Unit 1: Nucleic Acids Salient features of DNA, Chargaff's Rule, Hypo and Hyperchromic shift. Watson and Crick Model of DNA. RNA types & Function.	S.Biswas	5
Unit 2: DNA Replication Mechanism of DNA Replication in Prokaryotes, Prove that replication is Semi-conservative, bidirectional and discontinuous, RNA priming, Replication of telomeres.	S.Sarkar	14
Unit 3: Transcription Mechanism of Transcription in prokaryotes and eukaryotes, Transcription factors, Difference between prokaryotic and eukaryotic transcription.	S.Hansda	14
Unit 4: Translation Genetic code, Degeneracy of the genetic code and Wobble Hypothesis. Mechanism of protein synthesis in prokaryotes.	A.S.Bhunia	14
Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA Capping and Poly A tail formation in mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing and RNA editing	S.Hansda	14
Unit 6: Gene Regulation Regulation of Transcription in prokaryotes: <i>lac</i> operon and <i>trp</i> operon; Regulation of Transcription in eukaryotes: Activators, enhancers, silencer, repressors, miRNA mediated gene silencing. Epigenetic Regulation: DNA Methylation, Histone Methylation & Acetylation.	A.S.Bhunia	11
Unit 7: DNA Repair Mechanisms Types of DNA repair mechanisms, RecBCD model in prokaryotes, nucleotide and base excision repair, SOS repair	S.Sarkar	3
Unit 8: Molecular Techniques PCR, Western and Southern blot, Northern Blot	S.Das	5

PART I: SEMESTER 2

CORE COURSE 3: Non-Chordates II – Coelomates

ZOOA-CC2-3-TH

4 Credits		50 hours	
Second Semester		January - June	
Topic		Name of the Teacher	No. of Lectures
Unit 1: Introduction Evolution of coelom		S.Biswas	4
Unit 2: Annelida General characteristics and Classification up to classes (Ruppert and Barnes, 1994) Excretion in Annelida through nephridia; Metamerism in Annelida.		S.Biswas	15
Unit 3: Arthropoda General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Insect Eye (Cockroach only). Respiration in Prawn and Cockroach; Metamorphosis in Lepidopteran Insects; Social life in Termite		S.Sarkar	24
Unit 4: Onychophora General characteristics and Evolutionary significance		S.Biswas	3
Unit 5: Mollusca General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Nervous system in <i>Pila sp.</i> Torsion in Gastropoda. Feeding and respiration in <i>Pila sp.</i>		S.Hansda	15
Unit 6: Echinodermata General characteristics and Classification up to classes (Ruppert and Barnes, 1994); Water vascular system in <i>Asterias</i> . Echinoderm larva and affinities with chordates		S.Sarkar	12
Unit 7: Hemichordata General characteristics of phylum Hemichordata. Relationship with non-chordates and chordates		S.Hansda	3

CORE COURSE 4: Cell Biology		
ZOOA-CC2-4-TH		
4 Credits	50 hours	
Second Semester	January - June	
Topic	Name of the Teacher	No. of Lectures
Unit 1: Plasma Membrane Ultra-structure and composition of Plasma membrane: Fluid mosaic model, Transport across membrane - Active and Passive transport, Facilitated transport, Cell junctions: Tight junctions, Gap junctions, Desmosomes	S.Biswas	11
Unit 2: Cytoplasmic organelles I Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes; Protein sorting and mechanisms of vesicular transport	A.S.Bhunia	8
Unit 3: Cytoplasmic organelles II Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemiosmotic hypothesis; Peroxisomes: Structure and Functions; Centriole (Kinetochore and centromeric DNA): Structure and Functions	S.Sarkar	11
Unit 4: Cytoskeleton Type, structure and functions of cytoskeleton; Accessory proteins of microfilament & microtubule	A.S.Bhunia	8
Unit 5: Nucleus Nuclear envelope, Nuclear pore complex, Nucleolus; Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome)	A.Ghosh	12
Unit 6: Cell Cycle Cell cycle and its regulation, Cancer (Concept of oncogenes and tumor suppressor genes with special reference to p53, Retinoblastoma and Ras. Process of Proto-oncogene activation)	A.Ghosh	15
Unit 7: Cell Signalling Cell signalling transduction pathways; Types of signalling molecules and receptors (Classification and Example only): RTK & JAK/STAT. Apoptosis	A.Ghosh	12

Course: B.Sc. (Honours) Zoology		
PART II: SEMESTER 3		
CORE COURSE 5 : Chordata		
ZOOA-CC3-5-TH		
4 Credits		50 Hours
Third Semester : July- December		
Topic	Name of the Teacher	No. of Lecture s
Unit 1: Introduction to Chordates General characteristics and outline classification of Phylum Chordata (Young, 1981)		2
Unit 2: Protochordata General characteristics and classification of sub-phylum Urochordata and Cephalochordata up to Classes (Young, 1981). Metamorphosis in <i>Ascidia</i> . Chordate Features, structure of pharynx and feeding in <i>Branchiostoma</i>		7
Unit 3: Agnatha General characteristics and classification of cyclostomes up to order (Young, 1981)		2
Unit 4: Pisces General characteristics and classification up to living sub classes (Young, 1981); Accessory		7
Unit 5: Amphibia General characteristics and classification up to living Orders (Young, 1981); Poison apparatus and Biting mechanism in Snake. Poisonous & Non-Poisonous snake.		8
Unit 6: Reptilia General characteristics and classification up to living Orders (Young, 1981); Poison apparatus and Biting mechanism in Snake. Poisonous & Non-Poisonous snake.		7
Unit 7: Aves General characteristics and classification up to living Sub-Classes (Young, 1981); Exoskeleton and migration in Birds; Principles and aerodynamics of flight		2
Unit 8: Mammals General characters and classification up to living sub classes (Young, 1981); Exoskeleton derivatives of mammals; Adaptive radiation in mammals with reference to locomotory appendages; Echolocation in Micro chiropterans.		7
Unit 9: Invertebrates General characteristics and classification up to living sub classes (Young, 1981); Accessory		8
Unit 10: Invertebrates General characteristics and classification up to living sub classes (Young, 1981); Accessory		8

respiratory organ,
Migration in fishes;
Parental care in fishes;
Swim bladder in fishes.

Unit 5: Amphibia
General characteristics
and classification up to
living Orders (Young,
1981); Metamorphosis,
Paedomorphosis,
Parental care in
Amphibia

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CORE COURSE 6: Animal Physiology: Controlling and Co-ordinating System		
ZOOA-CC3-6-TH		
4 Credits	50 Hours	
Third Semester: July- December		
Topic	Name of the Teacher	No. of Lecture s
Unit 1: Tissues Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue		4
Unit 2: Bone and Cartilage Structure and types of bones and cartilages, Ossification		4
Unit 3: Nervous System Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and non-myelinated nerve fibres; Types of synapse, Synaptic transmission and Neuromuscular junction		10
Unit 4: Muscular system Histology of different types of muscle; Ultra-structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle fibre		10
Unit 5: Reproductive System Histology of mammalian testis and ovary; physiology of mammalian reproduction – menstrual and oestrous cycle		6
Unit 6: Endocrine System Histology and function of thyroid, pancreas and adrenal. Function of pituitary Classification of hormones; Mechanism of Hormone action; Signal transduction pathways for Steroidal and Non- steroidal hormones; Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary; Placental hormones		16

CORE COURSE 7: Fundamentals of Biochemistry

ZOOA-CC3-7-TH

4 Credits

50
Hour
s

Third Semester: July- December

Topic	Name of the Teacher	No. of Lectures
<p>Unit 1: Carbohydrates Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides; Derivatives of Monosaccharides; Carbohydrate metabolism: Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis</p>		8
<p>Unit 2: Lipids Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Sphingolipid, Glycolipids, Steroids, Eicosanoids and terpinoids. Lipid metabolism: β-oxidation of fatty acids - a. Palmitic acid {saturated (C 16:0)}, b. Linoleic acid {unsaturated (C 18:2)}; Fatty acid biosynthesis</p>		7
<p>Unit 3: Proteins Amino acids: Structure, Classification, General and Electro chemical properties of α-amino acids; Physiological importance of essential and non-essential amino acids, Proteins Bonds stabilizing protein structure; Levels of organization; Protein metabolism: Transamination, Deamination, Urea cycle, Fate of C-skeleton of Glucogenic and Ketogenic amino acids</p>		10
<p>Unit 4: Nucleic Acids Structure of Purines, Pyrimidines, Nucleosides and Nucleotides; Nucleic Acid Metabolism: Catabolism of adenosine, Guanosine, cytosine and thymine.</p>		10
<p>Unit 5: Enzymes Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism</p>		13

of enzyme action; Enzyme kinetics; Derivation of Michaelis-Menten equation, Lineweaver-Burk plot; Factors affecting rate of enzyme-catalyzed reactions; Enzyme inhibition.

Unit 6: Oxidative Phosphorylation

Redox systems; Mitochondrial respiratory chain, Inhibitors and uncouplers of Electron Transport System

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PART II: SEMESTER 4		
CORE COURSE 8. Comparative Anatomy of Vertebrates		
ZOOA-CC4-8-TH		
4 Credits	50 Hour s	
Fourth Semester: January - June		
Topic	Name of the Teacher	No. of Lecture s
Unit 1: Integumentary System Structure, function and derivatives of integument in amphibian, birds and mammals		10
Unit 2: Digestive System Comparative anatomy of stomach; dentition in mammals		6
Unit 3: Respiratory System Respiratory organs in fish, birds and mammals		6
Unit 4: Circulatory System General plan of circulation, Comparative account of heart and aortic arches		7
Unit 5: Urinogenital System Succession of kidney in different vertebrate groups; evolution of urinogenital ducts		5
Unit 6: Nervous system and sense organs Comparative account of brain in vertebrates; cranial nerves; olfactory and auditory receptors in Vertebrates		8
Unit 7: Skeletal system Overview of axial and appendicular skeleton – limbs, girdles of pigeon; jaw suspension in mammals		8

CORE COURSE 9: Animal Physiology: Life Sustaining Systems**ZOOA-CC4-9-TH****4 Credits****50
Hour
s****Fourth Semester: January- June**

Topic	Name of the Teacher	No. of Lectures
Unit 1: Physiology of Digestion Structural organisation and function of gastro-intestinal tract; Mechanical and chemical digestion of food, absorption of Carbohydrates, Lipids and Proteins in Human		10
Unit 2: Physiology of Respiration Mechanism of Respiration, Respiratory volumes and capacities, transport of Oxygen and Carbon dioxide in blood, Dissociation curves and the factors influencing it, respiratory pigments; Carbon monoxide poisoning		10
Unit 3: Physiology of Circulation Structure and functions of haemoglobin; Blood clotting system; Haematopoiesis; Basic steps and its regulation; Blood groups; ABO and Rh factor		8
Unit 4: Physiology of Heart Coronary Circulation, Structure and working of conducting myocardial fibres, Origin and conduction of cardiac impulses; Cardiac Cycle and cardiac output		8
Unit 5: Thermoregulation & Osmoregulation Thermal regulation in camel and polar bear, Osmoregulation in aquatic vertebrates		6
Unit 6: Renal Physiology Structure of Kidney and its functional unit, Mechanism of urine formation, Regulation of acidbase balance		8

CORE COURSE 10: Immunology		
ZOOA-CC4-10-TH		
4 Credits	50 Hours	
Fourth Semester: January - June		
Topic	Name of the Teacher	No. of Lectures
Unit 1: Overview of Immune System Introduction – concept of health and disease; Cells and organs of the Immune system		3
Unit 2: Innate and Adaptive Immunity Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral).		9
Unit 3: Antigens Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes		6
Unit 4: Immunoglobulins Structure and functions of different classes of immunoglobulins, Antigen-antibody interactions, Immunoassays (ELISA and RIA), Monoclonal antibody production		10
Unit 5: Major Histocompatibility Complex Structure and functions of MHC molecules. Structure of T cell Receptor and its signalling, T cell development & selection		6
Unit 6: Cytokines Types, properties and functions of cytokines		3
Unit 7: Complement System Components and pathways of complement activation.		5
Unit 8: Hypersensitivity Gell and Coombs' classification and brief description of various types of hypersensitivities.		4
Unit 9: Vaccines Various types of vaccines. Active & passive immunization (Artificial and natural).		4

Skill Enhancement courses (SEC)

PART II: SEMESTER 3

SEC-1 Apiculture ZOOA-SEC(A)-3-1-TH

Third Semester: July- December

Full Marks 80

2 Credits

Topic	Name of the Teacher	No. of Lectures
Unit 1: Biology of Bees <i>Apis</i> and Non- <i>Apis</i> Bee species and their identification. General Morphology of <i>Apis</i> Honey Bees Social Organization of Bee Colony		2
Unit 2: Rearing of Bees Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth box Bee Pasturage Selection of Bee Species for Apiculture Modern Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern)		14
Unit 3: Diseases and Enemies Bee Diseases and Enemies Control and Preventive measures		6
Unit 4: Bee Economy Products of Apiculture Industry and its Uses – Honey, Bees Wax, Propolis, Pollen etc.		2
Unit 5: Entrepreneurship in Apiculture Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens		6

PART II: SEMESTER 4

**SEC-1. Aquarium Fish Keeping
ZOOA-SEC(B)-4-1-TH**

Fourth Semester: January - June

Full Marks 80

2 Credits

Topic	Name of the Teacher	No. of Lectures
Unit 1: Introduction to Aquarium Fish Keeping The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes		2
Unit 2: Biology of Aquarium Fishes Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish		10
Unit 3: Food and feeding of Aquarium fishes Use of live fish feed organisms. Preparation and composition of formulated fish feeds, Aquarium fish as larval predator		8
Unit 4: Fish Transportation Live fish transport - Fish handling, packing and forwarding techniques.		5
Unit 5: Maintenance of Aquarium General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry		5

Course: B.Sc. (Honours) Zoology

PART III

PAPER 5, UNIT I

Molecular Biology

Marks = 50

First Term: Upto November

Topic	Name of the Teacher	No. of Lectures
1. Genome analysis a. DNA sequencing: Principle of Dideoxy sequencing b. Restriction enzyme: Types and use in gene cloning c. Cloning vectors: Characteristic features, Plasmid vector (pBR322, pUC19), Cosmid, phage vector, Concept of expression and Shuttle vector d. Construction of genomic DNA and cDNA libraries e. PCR: Basic Principle. Use of Allele specific RT-PCT f. DNA fingerprinting: Principle of RFLP, mini-satellites, microsatellites, RAPD and its uses g. Blot Technique: Southern Blot and Northern Blot	S.Biswas S.Biswas S.Biswas S.Biswas S.Biswas S.Sarkar S.Sarkar	
2. Proteome Analysis: Principle and use of SDS PAGE, affinity chromatography and Gel Filtration chromatography, immuno-electrophoresis, Western blot (excluding methodology)	S.Das	
3. Regulation of gene expression: Operon concept (inducible and repressible viz. Lac and Tryptophan operon)	S.Biswas	
4. Epigenetic regulation of gene expression: DNA methylation (CpG) and histone acetylation.	S.Hansda	
5. Recombination: Homologous recombination, Holliday Model of recombination, definition and example of site specific and transpositional recombination; Gene conversion	S.Biswas	

Second Term: Upto March		
1. DNA repair mechanism: Base and nucleotide excision repair in bacteria, Mismatch repair, SOS repair	S.Sarkar	
2. Apoptosis: concept, molecular signaling (extrinsic and intrinsic) and significance	S.Sarkar	
3. Cell cycle & cancer genetics: Concept of cell cycle check points and molecular regulation, concept of normal and transformed cell, role of proto-oncogene, tumour suppressor genes. Molecular mechanism of proto-oncogene activation	S.Hansda	
4. Molecular basis and detection technique for human genetic disorders: Sickle cell Anemia, Thalassemia, Hemophilia	S.Biswas	
5. Transposable Genetic Element: Concept of transposon and retrotransposon, Characteristic features of IS element in bacteria, SINE and LINE element in mammals and their role in chromosomal aberratio	S.Hansda	
PAPER 5, UNIT II		
Parasitology, Microbiology and Immunology		
Group A: PARASITOLOGY and MICROBIOLOGY		Marks = 25
First Term: Upto November		
Topic	Name of the Teacher	No. of Lectures
1. Inter-specific associations	S.Das	2
2. Origin and evolution of parasitism with special reference to nematodes	S.Das	2
3. Host-parasite interaction, parasitic adaptations in internal parasites with special reference to protozoa and helminths	A.S.Bhunia	2
4. Life cycle of important parasites; Mechanism of host-finding; establishment in host; growth; reproduction and modes of transmission of a) <i>Plasmodium vivax</i> , b) <i>Entamoeba histolytica</i> , c) <i>Leishmania donovani</i> , d) <i>Wuchereria bancrofti</i> , e) <i>Fasciola hepatica</i> , and f) <i>Ascaris lumbricoides</i>	A.S.Bhunia	6

Second Term: Upto March

1. Concept of Vector with special reference to resurgence of malaria (bio-ecology, vector potentiality, present susceptibility status to commonly used insecticide of important rural malaria vectors of India - <i>Anopheles culicifacies</i>)	A.S.Bhunia	2
2. Characterization and classification of bacteria (on the basis of staining methods)	A.S.Bhunia	2
3. Techniques of microorganism culture (sterilization reproduction and growth, maintenance and preservation of pure cultures), Control of micro-organisms	A.S.Bhunia	2
4. Microbes in relation to common diseases of man and control (Cholera and Shigella)	A.S.Bhunia	2

Group B: IMMUNOLOGY

Marks = 25

First Term: Upto November

Topic	Name of the Teacher	No. of Lectures
1. Cells and organs associated with immune system; Innate and adaptive immunity	S.Sarkar	2
2. Antigens – characteristics, antigenic determinants, antigen processing and presentation	S.Sarkar	2
3. Antibody – structure, types, binding sites and binding mechanisms	S.Sarkar	4
4. Humoral and cell mediated immunity in man, mollusks and insects	S.Das	3

Second Term: Upto March

1. Cytokines, adjuvants – complete and incomplete	S.Sarkar	2
2. Complement proteins – pathways and activation (classical, alternative and lectin mediated pathway, MAC formation)	S.Sarkar	4
3. T-cell – structure, receptor and maturation (signal hypothesis excluded); B-cell – activation and differentiation (signal hypothesis excluded); Macrophage – types, generation and function	A.Ghosh	4
	A.Ghosh	3

4. MHC: Structure and Function. 5. Monoclonal antibody production strategy and use of monoclonal antibody	A.Ghosh	3
PAPER 6, UNIT I		
INTEGRATION BIOLOGY & HOMEOSTASIS		Marks = 50
First Term: Upto November		
Topic	Name of the Teacher	No. of Lectures
1. Neuro-endocrine integration		
a. General concept of hormone action and receptors	S.Hansda	2
b. Chemical messengers – kiromones, synomones, info-chemicals, semio-chemicals – their types, mode of action and behavior modulation	S.Hansda	3
c. Homeostasis of Ca ⁺⁺ regulation and Blood glucose regulation	S.Hansda	2
d. Insect hormones – neuro-endocrine regulation of diapauses and metamorphosis	S.Sarkar	3
e. Environmental signaling in sex reversals in fish and mollusks – role of endocrine disruption and signals	S.Biswas	2
Second Term: Upto March		
1. Neuro-endocrine integration		
a. Mechanism of hormone action (cAMP, ip3, DAG, TRK), neuro-hypophysis, adenohipophysis, hypothalamic regulatory peptides, endocrine tissues of the gastrointestinal endoderm	S.Hansda	3
b. Biosynthesis, secretion, mode of action, functional significance and regulation of T ₃ , T ₄ , Adrenalin, Nor-adrenalin, Insulin and Glucagon	S.Hansda	5
c. Endocrine regulation of estrous and menstrual cycle	A.Ghosh	3
2. Biological light production in animals		
a. Chemistry of bioluminescence in insect and its significance	S.Biswas	4
b. Electric organs in electric rays		
3. Biological rhythm – concept, types and its control by pineal and SCN	A.Ghosh	3

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PAPER 6, UNIT II		
ANIMAL BIOTECHNOLOGY & APPLIED ZOOLOGY		Marks = 50
First Term: Upto November		
Topic	Name of the Teacher	No. of Lectures
1. Transgenic animals (i) Production of transgenic animals: cloning (methodology and application) (ii) Contribution of transgenic animals to human welfare (Poultry and Dairy)	S.Hansda	5
2. Biotechnology and Applied Zoology (i) Modern techniques of fish hybridization and induced breeding in carps. (ii) Application of biotechnology in – (a) Sericulture, (b) Lac culture, (c) Api culture, (d) Pearl culture practice, (e) Prawn culture	S.Biswas	8
Second Term: Upto March		
1. Biotechnology and Applied Zoology (i) Integrated pest management and biological control of pests: principles and significance. (ii) Principle of LD ₅₀ and LC ₅₀ and their application in applied Zoology	S.Sarkar	4
2. Animal cell culture (i) Cell culture types (ii) Cell culture technology (suspended and adherent culture) (iii) Cell culture media (RPMI-1640, M-199 and its components)	A.Ghosh	4
3. Gene therapy: Principle: Ex-vivo & In-vivo gene therapy. Strategies, Viral and non-viral vectors, antisense therapy.	S.Hansda	4

Course: B.Sc. (General) Zoology		
PART I: SEMESTER 1		
CORE COURSE 1. Animal Diversity		
ZOOG-CC1-1-TH		
Full Marks 50	4 Credits	50 Hours
First Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
Unit 1: Kingdom Protista General characters and classification up to phyla (Levine et. al., 1980); Locomotory Organelles and locomotion in <i>Amoeba</i> and <i>Paramecium</i>	S. Sarkar	3
Unit 2: Phylum Porifera General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Canal System in <i>Sycon</i>	S. Hansda	3
Unit 3: Phylum Cnidaria General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Metagenesis in <i>Obelia</i>	S. Biswas	3
Unit 4: Phylum Platyhelminthes General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Life history of <i>Taenia solium</i>	S. Biswas	3
Unit 5: Phylum Nematelminthes General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Life history of <i>Ascaris lumbricoides</i> and its adaptation	S. Biswas	3
Unit 6: Phylum Annelida General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Metamerism in Annelida	S. Hansda	6
Unit 7: Phylum Arthropoda General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Eye in Cockroach, Metamorphosis in Lepidoptera	S. Sarkar	6
Unit 8: Phylum Mollusca General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Respiration in <i>Pila</i>	S. Hansda	3
Unit 9: Phylum Echinodermata General characters and classification up to classes (Ruppert and Barnes, 1994, 6th Ed.); Watervascular system in Asteroidea	S. Sarkar	6
Unit 10: Protochordates General Characters ; Pharynx and feeding mechanism in	S. Hansda	3

	<i>Amphioxus</i>		
	Unit 11: Agnatha		
	General features of Agnatha and classification of cyclostomes up to classes (Young, 1981)	S.Sarkar	3
	Unit 12: Pisces		
	General features and Classification up to subclass (Young, 1981); Osmoregulation in Fishes	S.Biswas	6
	Unit 13: Amphibia		
	General features and Classification up to subclass (Young, 1981); Parental care	S.Biswas	6
	Unit 14: Reptiles		
	General features and Classification up to subclass (Young, 1981); Poisonous and non-poisonous snakes, Biting mechanism	S.Hansda	6
No. of lectures	Unit 15: Aves		
3	General features and Classification up to subclass (Young, 1981); Flight adaptations in birds	S.Hansda	6
	Unit 17: Mammals		
3	Classification up to subclass (Young, 1981); Hair, Horn & Antler, Nail & claw	S.Sarkar	6
3			
3			
3			
6			
6			
3			
6			
3			

PART I: SEMESTER 2
CORE COURSE 2. Comparative Anatomy & Developmental Biology

ZOOG-CC2-2-TH

Full Marks 50

4 Credits

50 Hours

Second Semester: January- June

Topic	Name of the Teacher	No. of Lectures
Unit 1: Integumentary System Derivatives of integument with respect to glands in Birds & Mammals	S.Biswas	6
Unit 2: Digestive System Stomach and Dentition	S.Biswas	6
Unit 3: Respiratory System Brief account of Gills, lungs, air sacs and swim bladder	S.Hansda	9
Unit 4: Circulatory System Evolution of heart and aortic arches	S.Hansda	9
Unit 5: Urino-genital System Succession of kidney, Evolution of urino-genital ducts	S.Hansda	9
Unit 6: Early Embryonic Development Gametogenesis: Spermatogenesis and oogenesis with respect to mammals. Fertilization: Sea-Urchin; Early development of frog; structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula; types of morphogenetic movements; Fate of germ layers	S.Sarkar	21
Unit 7: Late Embryonic Development Placenta types and function; Metamorphic events in frog life cycle and its hormonal regulation	S.Sarkar	15

Course: B.Sc. (General) Zoology

PART II SEMESTER 3.

CORE COURSE 3. PHYSIOLOGY AND BIOCHEMISTRY

ZOOG-CC3-3-TH

Third Semester : July - December

Full Marks 50

4 Credits

Topic

Name of the
Teacher

No. of
Lectures

Unit 1: Nerve and muscle

Structure of a neuron, resting membrane potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction

8

Unit 2: Digestion

Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids

6

Unit 3: Respiration

Pulmonary ventilation, Transport of Oxygen and carbon

6

Unit 4: Cardio-vascular system

Composition of blood, Structure of Heart, Origin and conduction of the cardiac impulse, cardiac cycle

6

Unit 5: Excretion

Structure of nephron, Mechanism of Urine formation; Counter-current Mechanism

6

Unit 6: Reproduction and Endocrine Glands

Physiology of male reproduction: Histology of testis, hormonal control of spermatogenesis; Physiology of female, reproduction: Histology of ovary, hormonal control of menstrual cycle. Structure and function of pituitary, thyroid, pancreas and adrenal.

10

Unit 7: Carbohydrate Metabolism

Glycolysis, Krebs's cycle, Glycogenesis, Electron Transport Chain.

4

Unit 8: Lipid metabolism

Beta oxidation of Palmitic acid {saturated (C 16:0)} and

4

Linoleic acid {unsaturated (C 18:2)}		
Unit 9: Protein Metabolism Transamination, Deamination, Urea cycle		4
Unit 10. Enzyme Enzyme Classification, factors affecting enzyme action, Inhibition.		2

PART II: SEMESTER 4.
CORE-COURSE 4.Genetics & Evolutionary Biology

ZOOG-CC4-4-TH

Fourth Semester: January - June

Full Marks 50	4 Credits	
Topic	Name of the Teacher	No. of Lectures
Unit 1: Mendelian Genetics and its Extension Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and codominance, Multiple alleles, lethal alleles, sex linked inheritance in <i>Drosophila</i> (White eye locus) & Human (Thalassemia).		10
Unit 2: Linkage, Crossing Over Linkage and crossing over, Complete & Incomplete Linkage, Recombination frequency as a measure of linkage intensity. Holiday Model		8
Unit 3: Mutation Chromosomal mutation, Deletion, duplication, inversion, translocation, aneuploidy, gene mutation, induced mutation, types & example		8
Unit 4: Sex determination Genic Balance theory and dosage compensation in <i>Drosophila</i> .		8
Unit 5: Origin of Life Chemical Origin of life		2
Unit 6: Evolutionary Theories Lamarckism, Darwinism, Neo-Darwinism.		6
Unit 7: Process of Evolutionary changes Isolating mechanism, Natural Selection.		4
Unit 8: Speciation Sympatric, Allopatric, Parapatric		

Skill Enhancement Elective Courses (SEC)

SEMESTER -3 SEC-A

APICULTURE; ZOOG-SEC-A-3-1-TH

Third Semester : July - December

Full Marks 50	4 Credits	
Topic	Name of the Teacher	No. of Lectures
Unit 1: Biology of Bees Classification and Biology of Honey Bees Social Organization of Bee Colony		2
Unit 2: Rearing of Bees Artificial Bee rearing; Apiary, Beehives - Newton and Langstroth, Bee Pasturage; Selection of Bee Species for Apiculture; Bee Keeping Equipment; Methods of Extraction of Honey; Indigenous and Modern		14
Unit 3: Diseases and Enemies Bee Diseases and Enemies Control and Preventive measures		6
Unit 4: Bee Economy Products of Apiculture Industry and its Uses ;Honey, Bees Wax, Propolis, Pollen etc		2
Unit 5: Entrepreneurship in Apiculture Bee Keeping Industry - Recent Efforts, Modern Methods in employing artificial Beehives for cross		6

Course: B.Sc. (General) Zoology

PART III

Paper IV Group A.

(Course No ZG-8): Applied Zoology

Full Marks -30

First Term: Upto November

Topic	Name of the Teacher	No. of Lectures
1.Sericulture: Life history and rearing of <i>Bombyx mori</i> ,	S.Hansda	6

	harvesting & processing of cocoon, reeling and extraction of silk, diseases of worms of <i>Bombyx mori</i> and control measures.	S.Biswas	8
	2. Aquaculture: Principles, definition and scope. Exotic fishes- their merits and demerits. Basic principles of different aquaculture system (Polyculture and integrated farming); culture of prawn	S.Sarkar	6
	3. Pest and Management: a) Definition and types of pests with examples. Life history, behaviour, ecology, damage and control of the following pests: i) Paddy <i>Scirpophaga</i> (Syn. <i>Tryporyza</i>) <i>incertulas</i> , ii) Stores grain- <i>Sitophilus oryzae</i> , iii) Mammalian pest (<i>Bandicota bengalensis</i>).		
No. of Lectures	Second Term: Upto March		
2			
14	4. Apiculture: Development of Apiary in India. Types of honey bees, modern methods of apiary management, products and its uses. Problems and prospects.	S.Biswas	5
	5. Poultry: fowl - Types of breeds, rearing and disease management.	S.Biswas	5
6			
2			
6			
Marks -30			
No. of Lectures			
6			

Paper IV Gr. B.
 (Course No ZG-09) Parasitology & Immunology
 First Term: Upto November

Full Marks -20

Topic	Name of the Teacher	No. of Lectures
1.Parasitism (definition and types) and other inter-specific interactions (symbiosis, commensalism and mutualism).	S.Hansda	6
2. Life history, Pathogenecity and clinical features of (i) <i>Entamoeba histolytica</i> , (ii) <i>Plasmodium vivax</i> , (iii) <i>Ascaris</i>	S.Sarkar	6

Second Term: Upto March

1.Outline structure and classification of immunoglobulin, antigen-antibody reaction	S.Sarkar	8
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Paper IV Group - C.
 (Course No ZG-10): Evolutionary Biology

Full Marks -20

First Term: Upto November

Topic	Name of the Teacher	No. of Lectures
1.Definition of systematics & taxonomy	S.Sarkar	6
2. Chemical basis of origin of life	S.Hansda	6

Second Term: Upto March

1. Species as a unit of evolution (definition and types: biological, sibling and polytypic species)	S.Biswas	4
2. Anatomical and Physiological adaptations: Aquatic (fish), Desert (Camel) and Volant (Pigeon) animals.	S.Hansda	4
3. Zoogeographical realms (Wallace scheme) with characteristic mammalian fauna.	S.Sarkar	4

Duration	Topics	Name of Teacher
January to June	<p>HUMAN GENETICS AND POPULATION VARIATION</p> <p>a. Definition and application of knowledge of genetics b. Gametogenesis: Spermatogenesis and Oogenesis, stages, and differences c. Normal chromosomal constitution of man. Brief outline of Karyotype and Denver system of human chromosome classification d. Basic structure of DNA and RNA with comparison e. Brief concepts of aneuploidy and polyploidy, numerical chromosomal aberrations in man. Causes and manifestation (Down's syndrome, Turner's syndrome and Klinefelter's syndrome) f. Mendelian principles g. Mendelian inheritance in man-autosomal dominant (PTC), autosomal recessive (albinism), sex chromosomal –dominant (vitamin D resistant rickets), recessive (colour blindness) i. Multiple allele and polymorphic character in man (ABO blood group system).</p> <p>UNIT II. Peoples/Population of World</p> <p>a. Concept of race b. UNESCO statement of race c. Geographical distribution and features of major races; Caucasoid, Mongoloid and Negroid d. Racial concept-Garn-Geographical, local and micro races e. Criteria for racial classification (skin colour, scalp hair, and ABO blood groups) f. Racial/ethnic composition of the population of undivided India by H.H. Risley, B.S. Guha and S.S. Sarkar g. Human adaptation: Hit, cold, altitude, infectious disease and stress.</p> <p>Ecology and Culture in the Past</p> <p>Unit I. Development of prehistoric cultures from earliest evidences up to the beginning of historical times; Africa and Europe</p> <p>1. Earliest Pleistocene cultures of Africa and their subsequent development with special emphasis on</p>	<p>A. Majumder</p> <p>Dr. P. Sarkar</p> <p>A. Majumder</p>

	<p>east Africa Lake Turkana basin (Olduvai Gorge, Omo, Hadar, Laetoli, Koobi-fora, Ologesaile). Relevant brief sketches</p> <p>2. Earliest Pleistocene cultures of Europe with special emphasis on western Europe. Justification of Lower, middle and upper Palaeolithic, Mesolithic and Neolithic Classifications and nomenclatures including evidences, dates, cultural life, associated with fossil finds.</p> <p>SOCIAL CULTURAL ANTHROPOLOGY FAMILY AND MARRIAGE: Concept, definition, Is marriage universal? Incest taboo, types, and variations of marriage system, regulations of marriage, preferential marriage, transactions, dowry, bride price, emerging of marriage. The family, nuclear, extended family</p> <p>MARITAL RESIDENCE, KINSHIP AND ASSOCIATION Patterns of marital residence, kinship, structure, bilateral, unilateral, ambilineal kinship, classification of kin, terminology, Non kin associations (group based on age, sex).</p> <p>SOME IMPORTANT AREAS Medical anthropology, Urban Anthropology, Development and Anthropology, Applied Anthropology, Cognitive Anthropology, Visual Anthropology,</p> <p>Economic Anthropology (subsistence strategies: Hunting and gathering, Horticulture, Pastoralism, Shifting cultivation, production, distribution, and redistribution, Agriculture and peasants, Informal economy, poverty, sustainable livelihood, and sustainable development: exchange, consumption of goods and services in complex societies.)</p>	<p>C.Sherpa</p> <p>Dr. P. Sarkar</p>
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UNIT III: Microlithic cultures of India; brief outlines; a) Eastern India b) Central India c) Western India d) South India. With special focus to regional variability, available dates, environmental adaptability.

C.Sherpa

SOCIAL CULTURAL ANTHROPOLOGY II

Political anthropology, The major theoretical approaches, anthropology of power and politics, political processes, style of leadership, political rituals, comparative study of political institutions in simple and complex cultures, race, regional/linguistic groups, state/nationhood, religions and ethnicity and (inter) ethnic relations, social movements.

Anthropology and contemporary social issues: population growth, poverty, inequality and justice, gender issues and sexuality, warfare (nuclear, biological, imperial) and peace, terror, marginalization and exclusion, epidemic diseases, and disaster.

Regional anthropology: South Asia:

- a. Religion, functions, animism, animatism, nature worship, regionalism, nationalism in India
- b. Varna, *Jati*/caste, caste system in India, *Jajmani* system, caste system and inequalities in India.
- c. Peasant village: Feature, habitation, economy and changes.

Duration	Topics	Name of teacher
January to June	<p>Biological anthropology:</p> <p>a. Forensic anthropology: Personal Identification from blood groups and skeleton. Paternity diagnosis</p> <p>b. Genetic Counselling: Definition, aim and methods, Genetic counselling for autosomal (Thalassemia) and X chromosomal (haemophilia) inheritance</p> <p>c. Birth defects: Teratogens, Cocaine, Alcohol, Cigar, Occupational hazards</p> <p>d. Bio-statistics: Measurement of central tendency-mean, median, mode, standard deviation, standard error of mean</p> <p>Archaeological Anthropology II :</p> <p>UNIT I: Neolithic cultures of India; brief outlines on regional cultures, a) eastern India b) central India c) western India d) southern India e) north India f) north-east India. Emphasis to be given on regional feature and variability.</p> <p>UNIT II: Earliest civilizations; concepts/features of civilization according to Braidwood and Childe. Mesopotamian, Egyptian civilizations- brief ideas, Harappan, civilizations to be studied in details Chalcolithic India- Classification and characters.</p> <p>Social and Cultural Anthropology: III</p> <p>Anthropology of Religion</p> <p>Indigenous religions: concept and definition, myth, ritual, sorcery, witchcraft, and divination, animism, animatism, totem and taboo, magic, shamanism, sacrifice, spirit possession, initiation rituals, witchcraft and other institutionalized principal of the world.</p>	<p>Dr. P. Sarkar</p> <p>A. Majumder</p> <p>C. Sherpa</p>
	Backward Communities in India and Development	Dr. P. Sarkar

		<p>valley, Western India-Nevasa</p> <p>Social and Cultural Anthropology: (Anthropology of Religion)</p> <p>Indigenous religions: concept and definition, myth, ritual, sorcery, witchcraft, and divination, animism, animatism, totem and taboo, magic, shamanism, sacrifice, spirit possession, initiation rituals, etc.</p>	C.Sherpa
Name of teacher	December to April	<p>Backward Communities in India and Development</p> <p>Indian Tribes: an outline of anthropological studies, distribution according to linguistic groups, economy, geographical region, sectors, problems, plans and agencies, of development, welfare of tribes, S.C. and OBC in India. Constitutional provisions and safeguards of the S.C, S.T., and OBC.</p> <p>Microlithic Cultures of India: Brief outlines, of the following regional cultures: a) eastern India, b) western India, c) central India, d) southern India, with reference to regional variability, environmental adaptability, along with available dates.</p> <p>Neolithic Cultures of India: Brief outlines, of the following regional cultures: a) eastern India, b) central India, c) western India, d) southern India e) northern India, f) north-east India, with emphasis on regional features and variability, concepts of acculturation and influence of neighbouring areas on the Neolithic artefacts and way of life of the people.</p>	<p>Dr. P. Sarkar</p> <p>A. Majumder</p>
P. Sarkar			
A. Majumder			

**Academic Calendar
2019-2020
Department of Botany**

Course: B.Sc. (Honours) Botany		
PART I: SEMESTER 1		
CORE COURSE 1. Phycology and Microbiology		
BOTA-CC1-1-TH		
4 Credits		
Phycology and Microbiology	Full Marks 50	
First Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
PHYCOLOGY		
1. General account : 1.1. Thallus organization, Structure of algal cell, 1.2. Ultrastructure of Plastids and Flagella, 1.3. Origin and evolution of sex, 1.4. Life cycle patterns, 1.5. Significant contributions of important phycologists (Fritsch, Smith, R. N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar)	R. Bar	5
2. Classification: 2.1. Criteria and basis of Fritsch's classification 2.2. Classification by Lee (2008) upto phylum with examples 2.3. Salient features of Cyanobacteria, Rhodophyta, Chlorophyta , Charophyta, Bacillariophyta, Xanthophyta, Phaeophyta, Heterokantophyta.	R. Bar	5
3. Cyanobacteria: 3.1. Ultrastructure of cell, 3.2. Heterocyst - structure and function.	R. Bar	4
4. Bacillariophyta: 4.1. Cell structure, 4.2. Cell division, 4.3. Auxospore formation in Centrales and Pennales.	R. Bar	6
5. Life History: 5.1. Chlamydomonas, 5.2. Oedogonium, 5.3. Chara, 5.4. Ectocarpus, 5.5. Polysiphonia, 5.6. Evolutionary significance of Prochloron.	R. Bar	10
MICROBIOLOGY		
1. Virus:	P. Saha	10

<p>1.1. Discovery, 1.2. Plant virus- types, 1.3. Transmission and translocation of Plant virus, 1.4. TMV- Physicochemical characteristics and Multiplication, 1.5. One step growth curve, 1.6. Lytic cycle (T4 phage) and Lysogenic cycle (Lambda phage), Significance of lysogeny, 1.7. Viroids and Prions.</p> <p>2. Bacteria: 2.1. Discovery, 2.2. Distinguishing features of Archaea and Bacteria, 2.3. Characteristics of some major groups: Proteobacteria (Enterobacteria), Firmicutes, Mollicutes, Actinobacteria, Spirochaetes, Chlamydiae, 2.4. Bacterial growth curve and generation time, 2.5. Flagella (ultrastructure) & Pili, 2.6. Cell wall – chemical structure and differences between Gram +ve & Gram – ve bacteria, 2.7. Bacterial genome and plasmid, 2.8. Endospore - formation, structure and function, 2.9. Genetic Recombination (a) Transformation – with special emphasis on Natural and Induced competence and DNA uptake, (b) Conjugation– F- factor, F+ X F–, Hfr X F–, concept of F', chromosome mobilization, (c) Transduction– Generalised and specialized.</p>	<p>P. Saha</p>	<p>20</p>
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BOTA-CC1-1-P

2 Credits

Phycology and Microbiology

Full Marks 30

First Semester: July- December

Topic	Name of the Teacher	No. of Lectures
<p>ALGAE 1. Work out of the following algae with reproductive structure (Free hand drawing and drawing under drawing prism with magnification): Oedogonium, Chara, Ectocarpus.</p>	<p>R. Bar</p>	<p>9</p>
<p>2. Study of (a) Permanent slides : Gloeotrichia, Volvox, Vaucheria, Coleochaete, Polysiphonia, Centric and Pennate diatom; (b) Macroscopic specimens : Laminaria, Sargassum.</p>	<p>R. Bar</p>	<p>9</p>
<p>MICROBIOLOGY 1. Preparation of bacterial media – (a) Nutrient agar and nutrient broth, (b) Preparation of slants and pouring Petri-plates. 2. Sub-culturing of bacterial culture. 3. Gram staining from bacterial culture. 4. Microscopic examination of bacteria</p>	<p>R. Bar</p>	<p>24</p>

from natural habitat (curd) by simple staining.		
FIELD WORK At least one local excursion to be conducted for study and collection of algae (only 5 from natural habitat) and another local excursion should be conducted to give an introductory idea about plant diversity (Collection not required).	P. Saha R. Bar S. Sengupta P. Chatterjee	2days

CORE COURSE 2: Mycology and Phyto-Pathology

BOTA-CC1-2-TH

4 Credits

Mycology and Phyto-Pathology

Full Marks 50

First Semester: July- December

Topic	Name of the Teacher	No. of Lectures
MYCOLOGY		
1. General Account: 1.1. Hyphal forms, 1.2. Fungal spore forms and mode of liberation, 1.3. Sexual reproduction and degeneration of sex, 1.4. Parasexuality and sexual compatibility, 1.5. Life cycle patterns.	S. Sengupta	6
2. Classification: 2.1. Classification of Fungi (Ainsworth, 1973) upto sub-division with diagnostic characters and examples. 2.2. General characteristics of Myxomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota, Deuteromycota.	S. Sengupta	6
3. Life history: 3.1. Synchronytrium, 3.2. Rhizopus, 3.3. Ascobolus, 3.4. Agaricus.	S. Sengupta	10
4. Mycorrhiza: 4.1. Types with salient features, 4.2. Role in Agriculture & Forestry.	T. Biswas	4
5. Lichen: 5.1. Types, 6.2. Reproduction, 6.3. Economic and ecological importance	T. Biswas	4
PHYTO-PATHOLOGY		
1. Terms and Definitions: 1.1. Disease concept, 1.2. Symptoms, 1.3. Etiology & causal complex, 1.4. Primary and secondary inocula, 1.5. Infection,	P. Chatterjee	6

FIELD WORK At least one local excursion to be conducted for study and collection of macrofungi (only 5).	All	1 day
PART I: SEMESTER 2		
CORE COURSE 3: PLANT ANATOMY		
BOTA-CC2-3-TH		
4 Credits		
Second Semester : January - June		
Topic	Name of the Teacher	No. of Lectures
ANATOMY		
1. Cell wall: 1.1. Ultrastructure & Chemical constituents, 1.2. Plasmodesmata- ultrastructure, 1.3. Concept of Apoplast and Symplast, 1.4. Growth and Thickening of cell wall.	S. Sengupta	8
2. Stomata: 2.1. Types (Metcalf and Chalk, Stebbins and Khush).	S. Sengupta	4
3. Stele: 3.1 Leaf-trace and leaf-gap, 3.2. Stellar types & evolution	S. Sengupta	4
4. Primary structure of stem and root- Monocot and Dicot. Leaf- dorsiventral and isobilateral.	R. Bar	8
5. Secondary growth: 5.1. Normal (intra- & extra-stelar), 5.2. Anomalous (stem of <i>Bignonia</i> , <i>Boerhavia</i> , <i>Tecoma</i> , <i>Dracaena</i> and root of <i>Tinospora</i>).	R. Bar	12
6. Mechanical tissues and the Principles governing their distribution in plants.	R. Bar	8
7. Developmental Anatomy: 7.1. Organisation of shoot apex (Tunica–Corpus) and Root apex (Korper-Kappe), 7.2. Plastochrone.	R. Bar	8
8. Ecological Anatomy: Adaptive anatomical features of 8.1. Hydrophytes, 8.2.	R. Bar	4

day	Xerophytes.	S. Sengupta	4
	9. Scope of plant anatomy: application in systematics, forensics and pharmacognosy.		
	BOTA-CC2-3-P		
	2 Credits		
	Plant Anatomy	Full Marks 30	
	Second Semester : January - June		
	Topic	Name of the Teacher	No. of Lectures
	PLANT ANATOMY		
	1. Microscopic studies on: Types of stomata, sclereids, raphides (<i>Colocasia</i>), cystolith (<i>Ficus</i> leaf) starch grains, aleurone grains, laticiferous ducts, oil glands.	R. Bar	6
no. of lectures	2. Study of anatomical details through permanent slides/ temporary stained mounts- a) Root-Monocot and dicot, b) Stem- Monocot and dicot, c) Leaf-Monocot and dicot.		6
8	3. Study of anomalous secondary structure in stem of <i>Bignonia</i> , <i>Boerhaavia</i> , <i>Tecoma</i> , <i>Dracaena</i> and root of <i>Tinospora</i>		5
	4. Study of adaptive anatomical features: Hydrophytes (<i>Nymphaea</i> – petiole) and Xerophytes (<i>Nerium</i> –leaf).		2
4	CORE COURSE 4: ARCHAEGONIATE		
4	BOTA-CC2-4-TH		
8	4 Credits		
	Second Semester : January - June		
12	Topic	Name of the Teacher	No. of Lectures
	BRYOPHYTES		
8	1. General Account : 1.1. General characteristics and adaptations to land habit, 1.2. Classification (Strotler and Crandle Strotler, 2009) upto class with diagnostic characters and examples.	T. Biswas	4
8	2. Life History: Gametophyte structure and Reproduction, Development and Structure of sporophyte, Spore dispersal in: 2.1. <i>Marchantia</i> , 2.2. <i>Anthoceros</i> , 2.3. <i>Funaria</i> .	T. Biswas	6
4			

<p>3. Phylogeny: 3.1. Unifying features of archaegoneates; transition to land habit, 3.2. Origin of Alternation of Generations (Homologous and Antithetic theory), 3.3. Evolution of Sporophytes (Progressive and Regressive concept), 3.4. Origin of Bryophytes.</p>	P. Chatterjee	4
<p>4. Importance : Role of bryophytes in: 4.1. Plant succession, 4.2. Pollution Monitoring, 4.3. Economic importance of bryophytes with special reference to <i>Sphagnum</i>.</p>	P. Chatterjee	2
PTERIDOPHYTES		
<p>1. General Account: 1.1. Colonisation and rise of early land plants, 1.2. Classification of vascular plants by Gifford & Foster (1989) upto division (Rhyniophyta to Filicophyta) with diagnostic characters and examples.</p>	P. Saha	4
<p>2. Life History: Sporophyte structure, Reproduction and Structure of gametophyte in 2.1. <i>Psilotum</i>, 2.2. <i>Selaginella</i>, 2.3. <i>Equisetum</i>, 2.4. <i>Pteris</i>.</p>	P. Saha P. Saha Guest Teacher	8
<p>3. Telome concept and its significance in the origin of different groups of Pteridophytes.</p>	Guest Teacher	4
<p>4. Heterospory and Origin of Seed habit.</p>	Guest Teacher	4
<p>5. Economic importance as food, medicine and Agriculture.</p>	Guest Teacher	2
GYMNOSPERMS		
<p>1. Classification of vascular plants by Gifford & Foster (1989) upto division (Progymnospermophyta to Gnetophyta) with diagnostic characters and examples.</p>	Guest Teacher	4
<p>2. Progymnosperms : Diagnostic characters of the group, 2.2. Vegetative and reproductive features of Archeopteris, 2.3. Phylogenetic importance.</p>	Guest Teacher	6
<p>3. Life History : Distribution in India; Vegetative and Reproductive structure of sporophyte, Development of gametophyte in : 3.1. <i>Cycas</i> , 3.2. <i>Pinus</i> and 3.3. <i>Gnetum</i>.</p>	Guest Teacher	8

4. Economic Importance with reference to Wood, Resins, Essential oils, and Drugs.	P. Saha	4
BOTA-CC2-3-P		
2 Credits		
ARCHAEGONIATE	Full Marks 30	
Second Semester : January - June		
Topic	Name of the Teacher	No. of Lectures
BRYOPHYTES	P. Saha T. Biswas	
1. Morphological study of the plant body: Genera as mentioned in theoretical syllabus and <i>Riccia</i> , <i>Porella</i> .		6
2. Study from permanent slides : <i>Riccia</i> (V.S. of thallus with sporophyte), <i>Marchantia</i> (L.S. through gemma cup, antheridiophore , archegoniophore) , <i>Anthoceros</i> (L.S. of sporophyte) , <i>Funaria</i> (L.S. of capsule).		3
PTERIDOPHYTES	P. Saha T. Biswas	
1. Morphological study of the sporophytic plant body: Genera as mentioned in the theoretical syllabus and <i>Lycopodium</i> , <i>Ophioglossum</i> and <i>Marsilea</i> .		6
2. Workout of the reproductive structures: <i>Selaginella</i> , <i>Equisetum</i> , <i>Pteris</i> .		9
3. Study from permanent slides: <i>Psilotum</i> (T.S. of synangium), <i>Lycopodium</i> (L.S. of strobilus), <i>Ophioglossum</i> (L.S. of spike), <i>Dryopteris</i> (gametophyte), <i>Marsilea</i> (L.S. of sporocarp).		3
GYMNOSPERMS	P. Saha T. Biswas	
1. Morphological study: <i>Cycas</i> (microsporophyll and megasporophyll), <i>Pinus</i> (female and male cone), <i>Gnetum</i> (female and male cone).		6
2. Study from permanent slides: <i>Cycas</i> (L.S. of ovule), <i>Pinus</i> (L.S. of male and female cone), <i>Ginkgo</i> (L.S. of female strobilus), <i>Gnetum</i> (L.S. of male cone and ovule).		
FIELD STUDY	P. Saha T. Biswas S. Sengupta P. Chatterjee	
Botanical excursion to familiarize the students with the natural habitats of these groups is desirable. No individual collection should be allowed. Students should submit only photographs in their field report.		5 days

PART II: SEMESTER 3		
CORE COURSE 5. PALAEOBOTANY AND PALYNOLOGY		
BOT-A-CC-3-5-TH		
4 Credits		
Palaeobotany and Palynology	Full Marks 50	
Third Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
PALAEOBOTANY & PALYNOLOGY		
1. Geological time scale with dominant plant groups through ages.	T. Biswas	4
2. Plant Fossil: 2.1. Types: Body fossil (Micro- and Megafossils), Trace fossil, Chemical fossil, Index fossil, 2.2. Different modes of preservation (Schopf, 1975), 2.3. Conditions favouring fossilization, 2.4. Nomenclature and Reconstruction, 2.5. Principle of fossil dating (a brief idea), 2.6.Importance of fossil study.	P. Chatterjee	12
3. Fossil Pteridophytes: Structural features, Geological distribution and Evolutionary significance of 3.1. Rhynia, 3.2. Lepidodendron (Reconstructed), 3.3. Calamites (Reconstructed).	P. Chatterjee	10
4. Fossil gymnosperms: Structural features and Geological distribution of reconstructed genera: 4.1. Lyginopteris, 4.2. Williamsonia, 4.3.Cordaites.	T. Biswas	10
5. Indian Gondwana System - Three fold division with major megafossil assemblages.	T. Biswas	6
6. Palynology: 6.1. Spore and Pollen, 6.2. Pollen aperture types, 6.3. NPC classification (Erdtman). 6.4. Pollen wallSporopollenin, Stratification and Ornamentation (sculpturing).	P. Chatterjee	10
7. Applied Palynology: Basic concepts of: 7.1. Palaeopalynology, 7.2. Aeropalynology, 7.3. Forensic palynology, 7.4. Melissopalynology.	P. Chatterjee	8

BOT-A-CC-3-5-P		
2 Credits		
Palaeobotany and Palynology		Full Marks 30
Third Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
PALAEOBOTANY AND PALYNOLOGY		
1. Morphological study: Ptilophyllum and Glossopteris leaf fossils.	P. Saha	6
2. Study from permanent slides: T.S. of stem of Rhynia, Lepidodendron, Calamites, Lyginopteris, Cordaites.		9
3. Study of Pollen types (colpate, porate and colporate) from permanent slides. Slides may be prepared from specimens: Colpate (Leonurus sibiricus/ Brassica sp.), Porate (Hibiscus rosa-sinensis), Colporate (Cassia sophera/ C. tora).		3
CORE COURSE- 6: REPRODUCTIVE BIOLOGY OF ANGIOSPERMS		
BOT-A-CC-3-6-TH		
4 Credits		
Reproductive Biology of Angiosperms		Full Marks 50
Third Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
MORPHOLOGY OF ANGIOSPERMS		
1. Inflorescence types with examples.	T. Biswas	8
2. Flower, induction of flowering, flower development- genetic and molecular aspects.		
3. Fruits and seeds - types with examples.		
EMBRYOLOGY		
1. Pre-fertilisation changes: 1.1. Microsporogenesis and Microgametogenesis, 1.2. Megasporeogenesis and Megagametogenesis (monosporic, bisporic and tetrasporic).	P. Saha	6
2. Fertilisation: 2.1. Pollen germination, 2.2. Pollen tube-growth, entry into ovule and discharge, 2.3. Double fertilization.	P. saha	6

3. Post-fertilization changes : 3.1. Embryogenesis in Capsella, 3.2. Development of Endosperm (3 types).	P. Saha	10
4. Apomixis & Polyembryony: 4.1. Apomixis- Apospory and Apogamy, 4.2. Polyembryony- different types.	P. Saha	8
BOT-A-CC-3-6-P		
2 Credits		
Reproductive Biology of Angiosperms		Full Marks 30
Third Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
REPRODUCTIVE BIOLOGY OF ANGIOSPERMS	P. Saha	12
1. Inflorescence types- study from fresh/ preserved specimens		
2. Flowers- study of different types from fresh/ preserved specimens		
3. Fruits- study from different types from fresh/preserved specimens		
4. Study of ovules (permanent slides/ specimens/photographs)- types (anatropous, orthotropous, amphitropous and campylotropous)		
5. Field study desirable		
6. A project supported along with photographs taken during field study to be submitted giving comprehensive idea about different types of inflorescence, flowers and fruits.	All	5 days
CORE COURSE- 7 PLANT SYSTEMATICS		
BOT-A-CC-3-7-TH		
4 Credits		
Plant Systematics		Full Marks 50
Third Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
TAXONOMY OF ANGIOSPERMS	S. Sengupta	6
1. Introduction: 1.1. Components of Systematic:		

<p>Nomenclature, Identification, Classification; 1.2. Taxonomy and its phases - Pioneer, Consolidation, Biosystematic and Encyclopaedic; alpha- and omega- taxonomy.</p>		
<p>2. Nomenclature: Type method, Publication, Rank of taxa, Rules of priority, Retention and rejection of names, Author Citation, Effective and valid publication, Elementary knowledge of ICN- Principles.</p>	<p>S. Sengupta</p>	<p>6</p>
<p>3. Systems of classification: Broad outline of Bentham & Hooker (1862-1883), Cronquist (1988), Takhtajan (1991) - system of classification with merits and demerits. Brief reference of angiosperm phylogeny group (APG III) classification. 3.1. Systematics in Practice: Herbaria and Botanical Gardens – their role in teaching and research; important Herbaria and Botanical Gardens of India and world (3 each); 3.2. Dichotomous keys – indented and bracketed.</p>	<p>Guest Teacher</p>	<p>20</p>
<p>4. Phenetics and Cladistics: Brief idea on Phenetics, Numerical taxonomy- methods and significance; Cladistics- construction of dendrogram and primary analysis; Monophyletic, polyphyletic and paraphyletic groups; Plesiomorphy and apomorphy.</p>	<p>S. Sengupta</p>	<p>8</p>
<p>5. Data sources in Taxonomy: Supportive evidences from: 5.1. Phytochemistry, 5.2. Cytology, 5.3. Palynology and 5.4. Molecular biology data (Protein and Nucleic acid homology).</p>	<p>S. Sengupta</p>	<p>8</p>
<p>6. Diagnostic features, Systematic position (Bentham & Hooker and Cronquist), Economically important plants (parts used and uses) of the following families: 6.1. Monocotyledons: Alismataceae, Gramineae (Poaceae), Cyperaceae, Palmae (Arecaceae), Liliaceae, Musaceae, Zingiberaceae, Cannaceae, Orchidaceae. 6.2. Dicotyledons: Nymphaeaceae, Magnoliaceae, Leguminosae (subfamilies), Polygonaceae, Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae).</p>	<p>R. Bar</p>	<p>12</p>

BOT-A-CC-3-7-P		
2 Credits		
Plant Systematics	Full Marks 30	
First Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
ANGIOSPERMS	R. Bar & S. Sengupta	24
1. Work out, description, preparation of floral formula and floral diagram, identification up to genus with the help of suitable literature of wild plants and systematic position according to Bentham Hooker system of classification from the following families: Malvaceae, Fabaceae (Papilionaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Labiatae (Lamiaceae), Rubiaceae.		
2. Spot identification (Binomial, Family) of common wild plants from families included in the theoretical syllabus (list to be provided).		6
FIELD WORK	P. Saha R. Bar S. Sengupta P. Chatterjee	2days
At least three excursions including one excursion to Acharya Jagadish Chandra Bose Indian Botanic Garden (Shibpur, Howrah) and Central National Herbarium (CNH).		
SKILL ENHANCEMENT COURSE- ELECTIVE		
(SEC) SEC-A APPLIED PHYCOLOGY, MYCOLOGY AND MICROBIOLOGY		
BOT-A-SEC-A-3-1		
2 Credits		
Applied Phycology, Mycology and Microbiology	Full Marks 80	
Third Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
APPLIED PHYCOLOGY	R. Bar	10
1. Algae as food and source of phycocolloid (Agar-agar, Algin, Carrageenan), 2. Diatomite, 3. Algal toxin, 4. Algal Biotechnology – potential of microalgae for SCP, β -carotene, Biodiesel, bioplastics from algae.		
APPLIED MYCOLOGY	T. Biswas	10
1. Fungi as food, 2. Cheese and Ethanol- Industrial production (brief outline), 3. Fungal sources and uses of Enzyme (Cellulase), Amino acid (Tryptophan), Vitamin (Riboflavin), Antibiotic (Griseofulvin), Pharmaceuticals (Cyclosporin-A). 4.		

Aflatoxin		
APPLIED MICROBIOLOGY 1. Industrial Production of Vinegar and Streptomycin (brief outline), 2. Microbial sources and uses of Enzyme (Amylase, Protease), Amino acid (Glutamic acid, Lysine), Polysaccharides (Dextran), 3. Use of microbes as Biofertilizer and Biopesticides, 3.4. Use of microbes in mineral processing.	P. Saha	10
PART II: SEMESTER 4		
CORE COURSE 8. PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION		
BOT-A-CC-4-8-TH		
4 Credits		
Plant Geography, Ecology and Evolution	Full Marks 50	
Fourth Semester: January-June		
Topic	Name of the Teacher	No. of Lectures
PLANT GEOGRAPHY 1. Phytogeographical regions: 1.1. Phytogeographical regions of India (Chatterjee 1960); 1.2. Dominant flora of Eastern Himalaya, Western Himalaya and Sunderban.	P. Chatterjee	8
2. Endemism: 2.1 Endemic types and Factors; 2.2. Age & Area hypothesis and Epibiotic theory; 2.3. Endemism in Indian flora.		6
ECOLOGY 1. Preliminary idea on: 1.1. Habitat and Niche, 1.2. Ecotone and edge-effect, 1.3. Microclimate, 1.4. Ecads, ecotype and ecoclines, 1.5. Carrying capacity.	P. Chatterjee	4
2. Community ecology: 2.1. Community- Characteristics and diversity, 2.2. Ecological succession -Primary and secondary, Seral stages (with reference to Hydrosere), autogenic and allogenic succession.		6
3.1. Plant indicators (metallophytes); 3.2. Phytoremediation.		4
4. Conservation of Biodiversity: 4.1. Level of Biodiversity: genetic, species & ecosystem diversity, 4.2. Biodiversity hot spots- criteria, 21 Indian hotspots, 4.3. In- situ and ex-situ conservation, 4.4. Seed-banks, 4.5. Cryopreservation		16
EVOLUTION 1.1 Introduction, 1.2. Theories of evolution: Natural selection, Group selection, Neutral theory of molecular evolution, 1.3.	S. Sengupta	6

Phyletic gradualism, Punctuated equilibrium and Stasis		
2.1 Brief idea on: Stabilizing directional, disruptive and sexual selection; Speciation: Sympatric and allopatric speciation; Coevolution, Adaptive radiation, Reproductive isolation		4
3.1. Simplified phylogeny of bacteria, algae, fungi, bryophyte, pteridophyte and gymnosperm, 3.2. Phylogenetic tree.		6
BOT-A-CC-4-8-P		
2 Credits		
Plant geography, Ecology and Evolution		Full Marks 30
Fourth Semester: January-June		
Topic	Name of the Teacher	No. of Lectures
PLANT GEOGRAPHY 1. Field visit- at least one long excursion at different phytogeographical region of India. 2. Study of local flora and submission of a project report highlighting phytogeographical characteristics of the region.	All	5 Days
ECOLOGY 1. Study of community structure by quadrat method and determination of (i) Minimal size of the quadrat, (ii) Frequency, density and abundance of components (to be done during excursion/ field visit).	All	1 day
2. Comparative anatomical studies of leaves form polluted and less polluted areas.	S. Sengupta	3
3. Measurement of dissolved O ₂ by azide modification of Winkler's method.		3
4. Comparison of free CO ₂ from different sources.		3

CORE COURSE- 9 ECONOMIC BOTANY

BOT-A-CC-4-9-TH

4 Credits

Economic Botany

Full Marks 50

Fourth Semester: January-June

Topic	Name of the Teacher	No. of Lectures
1. Origin of cultivated crops: Concepts of centre of origin, their importance with reference to Vavilov's work. Examples of major plant introductions; crop domestication and loss of genetic diversity; evolution of new crops/ varieties, importance of germplasm diversity.	R. Bar	6
2. Cereals: Rice and wheat (origin, morphology, processing and uses).		6
3. Legumes: Origin, morphology and uses of gram and mung bean. Importance to man and environment.		6
4. Sugar and starches: Morphology and processing of sugarcane, products and byproducts of sugarcane industry. Potato- morphology, propagation and uses.		5
5. Spices: Listing of important spices, their family and part used.		6
6. Beverages: Tea (morphology, processing and uses).		5
7. Oil and fats: General description, classification, extraction, their uses and health implications of mustard, soybean, coconut (Botanical name, family and uses). Essential oils- general account, extraction methods, comparison with fatty oils and their uses.	Guest Teacher	10
8. Drug-yielding plants: Therapeutic and habit forming drugs with special reference to Cinchona, Digitalis, Papavar, Cannabis and Tobacco (morphology, processing, uses and health hazards).		8
9. Timber: general account with special reference to Sal and Teak.		4

10. Fibers: Cotton and Jute (Morphology, extraction and uses).		4
BOT-A-CC-4-9-P		
2 Credits		
Economic Botany	Full Marks 30	
Fourth Semester: January-June		
Topic	Name of the Teacher	No. of Lectures
ECONOMIC BOTANY		
1. Cereals: Wheat (habit sketch, L.S./T.S. of grain, starch grains, micro-chemical tests); rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests)	R. Bar	3
2. Legume: Soybean, ground nut (habit, fruit, seed structure, micro-chemical tests)		3
3. Source of sugars and starches: Sugarcane (habit sketch; cane juice- micro-chemical tests); potato (habit sketch, tuber morphology, T.S. of tuber to show localization of starch grains, W.M. of starch grains, micro-chemical tests.		6
4. Tea- tea leaves, tests for tannin		3
5. Mustard- plant specimen, seeds, tests for fat in crushed seeds		3
6. Habit sketch of Digitalis, Papaver and Cannabis.		3
7. Sal, Teak- section of young stem.		3
8. Jute- specimen, transverse section of stem, tests for lignin on T.S. of stem and study of fibre following maceration technique.		3
8. Field visit desirable to give an idea about cultivation of any crop (viz. rice, jute, mustard, tea, potato)	All	1 day

CORE COURSE 10 GENETICS		
BOT-A-CC-4-10-TH		
4 Credits		
Genetics	Full Marks 50	
Fourth Semester: January-June		
Topic	Name of the Teacher	No. of Lectures
1. Introduction: Mendelian genetics and its extension	T. Biswas	6
2. Linkage, Crossing over and Gene Mapping: 2.1. Complete and incomplete linkage (example), linked gene does not assort independently (example), linkage group, 2.2. Crossing over, crossing over produces recombination (example), detection of crossing over (McClintock's experiment), and 2.3. Molecular mechanism of crossing over (Holliday model), 2.4. Gene mapping with three point test cross, detection of middle gene in three point test cross, calculation of recombination frequencies, 2.5. Co-efficient of coincidence and interference, mapping function, 2.6. Problems on gene mapping, 2.7. Molecular mapping – ISH, FISH (brief idea).		16
3. Epistasis and Polygenic inheritance in plants.		4
4. Aneuploidy and Polyploidy: Types, examples, meiotic behaviour and importance of: 4.1. Aneuploidy, 4.2. Polyploidy, 4.3. Speciation and evolution through polyploidy.	P. Saha	8
5. Chromosomal aberration: Types and meiotic behaviour of: 5.1. Deletion, 5.2. Duplication, 5.3. Translocation, and 5.4. Inversion.		6
6. Mutation : 6.1. Point mutation-Transition, Transversion and Frame shift mutation, 6.2. Molecular mechanisms (tautomerisation, alkylation, deamination, base analogue incorporation, dimerisation), 6.3. DNA repair (brief idea).		8
7. Structural organisation of Gene: 7.1. One Gene–one polypeptide concept, 7.2. Split gene, 7.3. Overlapping gene, 7.4. Repetitive DNA tandem and interspersed, 7.5. Transposon (Ac-Ds system), 7.6. Homoeotic gene in plants (ABCE Quartet model of flowering).		12

BOT-A-CC-4-10-P		
2 Credits		
Genetics	Full Marks 30	
Fourth Semester: January-June		
Topic	Name of the Teacher	No. of Lectures
GENETICS	P. Saha	
1. Introduction to chromosome preparation: Pre-treatment, Fixation, Staining, Squash and Smear preparation, Preparation of permanent slides.		3
2. Determination of mitotic index and frequency of different mitotic stages in pre-fixed root tips of <i>Allium cepa</i> .		3
3. Study of mitotic chromosome: Metaphase chromosome preparation, free hand drawing under high power objective, drawing with drawing prism under oil immersion lens, determination of 2n number, and comment on chromosome morphology of the following specimens from root tips: <i>Allium cepa</i> , <i>Aloe vera</i> , <i>Lens esculenta</i> .		9
4. Study of chromosomal aberrations developed due to exposure to any two pollutants/ pesticides etc.		6
5. Study of meiotic chromosome: Smear preparation of meiotic cells, identification of different stages and free hand drawing of the following specimens from flower buds: <i>Allium cepa</i> and <i>Setcreasea</i> sp.		9
6. Identification from permanent slides : Meiosis – (i) normal stages (ii) abnormal stages – laggard, anaphase bridge, ring chromosome (<i>Rhoeo discolor</i>); Mitosis – (i) normal stages, (ii) abnormal stages- early separation, late separation, multipolarity, sticky bridge, laggard, fragmentation, (ii) pollen mitosis.		6

**SKILL ENHANCEMENT COURSE- ELECTIVE
(SEC) SEC-B MUSHROOM CULTURE TECHNOLOGY**

BOT-A-SEC-B-4-4

2 Credits

Mushroom Culture Technology

Full Marks 80

Fourth Semester: January-June

Topic	Name of the Teacher	No. of Lectures
1. Introduction, nutritional and medicinal value of edible mushrooms; poisonous mushrooms, types of edible mushrooms available in India- Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus.	S. Sengupta	5
2. Cultivation technology: infrastructure: substrates (locally available), polythene bags, vessels, inoculation hook, inoculation loop, low cost stoves, sieves, culture racks, mushroom unit (thatched house), water sprayer, tray, small polythene bag. Pure culture: medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation- paddy straw, sugarcane trash, maize straw, banana leaves,. Factors affecting the mushroom bed preparation- low cost technology, composting technology in mushroom production.		12
3. Storage and nutrition: short term storage (Refrigeration- upto 24 hours), long term storage (canning, pickels, papads), drying, storage in salt solutions. Nutrition- proteins- amino acids, mineral elements nutrition- carbohydrates, crude fibre content- vitamins.	Guest Teacher	8
4. Food preparation: type of foods prepared from mushroom. Research centres- National level and regional level. Cost benefit ratio- marketing in India and abroad. Export value.		5

Course: B.Sc. (Honours) Botany		
PART III (1+1+1 system), Full Marks-400		
PAPER 5 (Theoretical), Marks 100		
Module IX		Marks = 50
First Term: Upto November		
Topic	Name of the Teacher	No. of Lectures
BIOCHEMISTRY	P. Chatterjee	
1. Biochemical Foundations		5
2. Molecules of life		10
3. Energy flow and enzymology		12
4. Cell membrane and Biosignalling		4
5. Phosphorylation	3	
PHARMACOGNOSY	R. Bar	
1. General account		4
2. Secondary metabolites		9
3. Pharmacologically active constituents	2	
Module X		Marks = 50
*First Term: Upto November & #Second Term: Upto April		
Topic	Name of the Teacher	No. of Lectures
PLANT PHYSIOLOGY	S. Sengupta	
1. Plant-water relations *		4
2. Organic Translocation *		3
3. Photosynthesis *		7
4. Respiration *		7
5. Nitrogen Metabolism *		2
6. Plant Growth Regulations *		8
7. Photomorphogenesis *		3
8. Seed dormancy #		2
9. Physiology of Senescence and Ageing #		2
10. Stress Physiology #	4	

PAPER 6 (Theoretical), Marks 100

Module XI

Marks = 50

***First Term: Upto November & #Second Term: Upto April**

Topic	Name of the Teacher	No. of Lectures
CELL BIOLOGY * 1. Origin and Evolution of Cells 2. Nucleus and Chromosome 3. Cell cycle and regulation	Guest Teacher	6 8 8
PLANT BREEDING & BIOMETRY 1. Plant Breeding 2. Biometry #	P. Chatterjee	7 8
PLANT BIOTECHNOLOGY 1. Plant tissue culture-Introduction * 2. Callus culture * 3. Micropropagation * 4. Haploid Culture # Protoplast Culture # Plant Genetic Engineering #	T. Biswas	2 3 4 3 3 3

Module XII

Marks = 50

***First Term: Upto November & #Second Term: Upto April**

Topic	Name of the Teacher	No. of Lectures
GENETICS & MOLECULAR BIOLOGY 1. Linkage, Crossing over and Gene Mapping * 2. Epistasis and Polygenic inheritance in plants * 3. Aneuploidy and Polyploidy * 4. Chromosomal aberration 5. Mutation * 6. Structure organization of gene * 7. DNA replication. Transcription and Translation * 8. Gene regulation # 9. Genetic code # 10. Recombinant DNA Technology # 11. Bioinformatics #	P. Saha & T. Biswas	7 2 2 2 3 4 8 6 2 5 4

PAPER 7 (Practical), 100 Marks		
Module XIII		Marks = 50
*First Term: Upto November & #Second Term: Upto April		
Topic	Name of the Teacher	No. of Lectures
1. PLANT BIOCHEMISTRY *	P. Chatterjee	51
2. PHARMACOGNOSY *	R. Bar	24
Module XIV		Marks = 50
*First Term: Upto November & #Second Term: Upto April		
Topic	Name of the Teacher	No. of Lectures
1. PLANT PHYSIOLOGY*	S. Sengupta	33
2. ANATOMY#	R. Bar	27
Paper 8 (Practical), 100 Marks		
Module XV		Marks = 50
*First Term: Upto November & #Second Term: Upto April		
Topic	Name of the Teacher	No. of Lectures
P. CELL BIOLOGY AND GENETICS *	P. Saha	54
Module XVI		Marks = 50
*First Term: Upto November & #Second Term: Upto April		
Topic	Name of the Teacher	No. of Lectures
1. BIOMETRY #	T. Biswas	30
2. MICROBIOLOGY #	T. Biswas	15
3. PLANT PATHOLOGY #	P. Saha	18

Course: B.Sc. (General) Botany		
PART I: SEMESTER 1		
CORE COURSE 1. Plant Diversity I (PHYCOLOGY, MYCOLOGY, PHYTOPATHOLOGY, BRYOPHYTES AND ANATOMY)		
BOTG-CC1-1-TH		
Full Marks 50	4 credits	
First Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
1. Introduction to different plant groups	R. Bar	2
2. Phycology 2.1. Diagnostic characters and examples of Cyanophyceae, Rhodophyceae, Chlorophyceae, Charophyceae and Phaeophyceae, 2.2 Classification: Criteria and system of Fritsch, 2.3. Life histories of Chlamydomonas, Chara and Ectocarpus, 2.4. Role of algae in the environment, agriculture, biotechnology and industry.	R. Bar	14
3. Mycology 3.1 Diagnostic characters and examples of Oomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina (Ainsworth, 1973). 3.2 Life histories of Rhizopus and Ascobolus, 3.3. Economic importance of fungi, 3.4 Fungal symbioses: Mycorrhiza, Lichen and their importance.	S. Sengupta	12
4. Phytopathology 4.1 Symptoms - necrotic, hypoplastic and hyperplastic, 4.2 Koch's postulates, 4.3 Biotrophs and Necrotrophs, 4.4 Disease triangle, 4.5 Pathotoxins and phytoalexins (brief concept), 4.6 Symptoms, causal organism, disease cycle and control measures of plant diseases (Late blight of potato, Brown spot of Rice, Stem rot of jute).	P. Chatterjee	10
5. Bryophytes 5.1 Unifying features of archaeogoniates and transition to land habit, 5.2 Amphibian nature of bryophytes, 5.3 Diagnostic characters and examples of Hepaticopsida, Anthocerotopsida and Bryopsida (Proskauer 1957), 5.4 Life histories of Marchantia and Funaria, 5.5 Ecological and economic importance.	T. Biswas	10

6. Anatomy 6.1 Stomata - Types (Metcalfe & Chalk), 6.2 Anatomy of root, stem and leaf of monocots and dicots, 6.3 Stellar types and evolution, 6.4 Secondary growth – normal in dicot stem and anomaly in stem of Tecoma & Dracaena.	P. Saha	12
BOTG-CC1-1-P		
Full marks 30	2 credits	
First Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
1. Work out: Microscopic preparation, drawing and labeling of Chlamydomonas, Chara, Ectocarpus, Rhizopus and Ascobolus	T. Biswas & S. Sengupta	15
2. Anatomical studies (following double staining method) of: 2a. Stem-Cucurbita, sunflower and maize. 2b. Root- Colocassia, gram and orchid. 2c. Leaf- Nerium	T. Biswas & S. Sengupta	21
3. Identification with reasons: 3a. Cryptogamic specimens (macroscopic/microscopic as prescribed in the theoretical syllabus. 3b. Pathological specimens (herbarium sheets) of Late blight of potato, Brown spot of rice and stem rot of jute.	T. Biswas & S. Sengupta	6
4. Atleast one local excursion to be conducted to give an idea of plant diversity, habitat of algae and fungi	All	1 day
PART I: SEMESTER 2		
CORE COURSE 2. PLANT DIVERSITY II (PTERIDOPHYTES, GYMNOSPERMS, PALAEOBOTANY, MORPHOLOGY AND TAXONOMY)		
BOTG-CC2-2-TH		
Full Marks 50	4 Credits	
Second Semester: January- June		
Topic	Name of the Teacher	No. of Lectures
1. Pteridophytes 1.1 Diagnostic characters and examples of Psilophyta, Lycophyta, Sphenophyta & Filicophyta (Gifford & Foster 1989). 1.2 Life histories of Selaginella and Pteris, 1.3 Economic importance.	T. Biswas	12

<p>2. Gymnosperms 2.1 Progymnosperms (brief idea), 2.2 Diagnostic characters and examples of Cycadophyta, Coniferophyta and Gnetophyta (Gifford & Foster 1989), 2.3 Life histories of Cycas and Pinus, 2.4 Williamsonia (reconstructed), 2.5 Economic importance of Gymnosperms.</p>	<p>P. Chatterjee</p>	<p>12</p>
<p>3. Paleobotany & Palynology 3.1 Fossil, fossilization process and factors of fossilization, 3.2 Importance of fossil study. 3.3 Geological time scale, 3.4 Palynology - Definition, spore & pollen (brief idea), Applications.</p>	<p>Guest Teacher</p>	<p>10</p>
<p>4. Angiosperm Morphology 4.1 Inflorescence types with examples, 4.2 Flower, 4.3 Fruits and seeds- type and examples.</p>	<p>P. Saha</p>	<p>12</p>
<p>5. Taxonomy of Angiosperms 5.1 Artificial, Natural and Phylogenetic systems of classification with one example each, 5.2 Diagnostic features of following families- Malvaceae, Leguminosae (Fabaceae), Cucurbitaceae, Rubiaceae, Compositae (Asteraceae), Solanaceae, Acanthaceae, Labiateae (Lamiaceae), Orchidaceae, Gramineae (Poaceae).</p>	<p>R. Bar & S. Sengupta</p>	<p>14</p>
<p>BOTG-CC2-2-P</p>		
<p>Full marks 30</p>	<p>2 credits</p>	
<p>Second Semester: January- June</p>		
<p>Topic</p>	<p>Name of the Teacher</p>	<p>No. of Lectures</p>
<p>1. Dissection, drawing and labelling, description of angiospermic plants and floral parts, floral formula and floral diagram, identification (family) from the following families: Leguminosae (Fabaceae), Malvaceae, Solanaceae, Labiateae (Lamiaceae), Acanthaceae.</p>	<p>T. Biswas & S. Sengupta</p>	<p>15</p>
<p>2. Identification with reasons: Macroscopic specimens of Selaginella and Pteris, male and female strobilus of Cycas and Pinus, Anatomical slides (stellar types, transfusion tissue, sieve tube, sunken stomata, lenticels), inflorescence types.</p>		<p>6</p>
<p>3. Spot identification of the following Angiospermic plants (scientific names and families): Sida rhombifolia (Malvaceae),</p>		<p>9</p>

<p>Abutilon indicum (Malvaceae), Cassia sophera (Fabaceae), Tephrosia halimtonii (Fabaceae), Crotonaria palida (Fabaceae), Coccinia grandis (Cucurbitaceae), Solanum indicum (Solanaceae), Nicotiana plumbagenifolia (Solanaceae), Leucas aspera (Lamiaceae), Leonurus sibiricus (Lamiaceae), Parthenium hysterophorus (Asteraceae), Tridax procumbense (Asteraceae), Eclipta prostrate (Asteraceae), Eragrostis tenella (Poaceae), Chrysopogon aciculatus (Poaceae), Eleusine indica (Poaceae), Vanda taesellata (Orchidaceae).</p> <p>4. Field excursion: Local Excursions (at least two including one to Acharya Jagadish Chandra Bose Botanic Garden, Shibpur, Howrah)</p>	All	2 days
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PART II: SEMESTER 3

CORE COURSE 3. CELL BIOLOGY, GENETICS AND MICROBIOLOGY

BOT-G-CC-3-3-TH

Full Marks 50

4 credits

Third Semester: July- December

Topic	Name of the Teacher	No. of Lectures
1. Cell Biology and Genetics		
1.1 Ultrastructure of nuclear envelope, nucleolus and their functions, 1.2 Molecular organisation of metaphase chromosome (Nucleosome concept).	P. Chatterjee	6
2. Chromosomal aberrations- 2.1 deletion, duplication, inversion & translocation, 2.2 Aneuploidy & Polyploidy-types, importance and role in evolution.	P. Chatterjee	6
3. Central Dogma, 3.1 Transcription and Translation.	P. Chatterjee	10
4. Genetic Code- properties.	Guest teacher	4
5. Linkage group and Genetic map (three-point test cross).	T. Biswas	6
6. Mutation – 6.1 Point mutation (tautomerisation; transition, transversion and frame shift), 6.2 Mutagen-physical and chemical.	T. Biswas	8

7. Brief concept of Split gene, Transposons.	S. Sengupta	4
2. Microbes 2.1 Viruses- Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; 2.2 Bacteria- discovery, general characteristics and cell structure; reproduction- vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.	I. Khatua P. Saha	16
BOT-G-CC-3-3-P		
Full marks 30	2 credits	
Third Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
1. Cell Biology: Staining (Aceto-orcein) and squash preparation of onion root tip: study of mitotic stages. Determination of mitotic index (from onion root tip).	P. Saha & P. Chatterjee	6
2. Microbiology: Workout gram staining (curd/any natural source)		3
3. Identification with reasons: Cytological slides of different mitotic and meiotic stages. Different forms of bacteria (Coccus, Bacillus, Spiral)		6
SEC A BIOFERTILIZERS		
BOT-G-SEC-A-3/5-2		
2 Credits		
Biofertilizers	Full Marks 80	
Third Semester: July- December		
Topic	Name of the Teacher	No. of Lectures
1. Biofertilizers: General account about microbes used as biofertilisers; Rhizobium- identification, mass multiplication. Actinorrhizal symbiosis.	R. Bar	4
2. Azospirillum- identification, mass multiplication, associative effect of different microorganisms. Azotobacter and crop		6

response to Azotobacter inoculums.		6
3. Cyanobacteria, Azolla, Anabaena and Azolla association, blue green algae and Azolla in rice cultivation.		6
4. Mycorrhizal association: 4.1 Types of Mycorrhizal association- Brief idea, 4.2 Its influence on growth and yield of crop plants.	I. Khatua	6
5. Organic farming: 5.1 Green manuring and organic fertilizers, 5.2 Biocompost and vermicompost- making methods and field applications. 5.3 Recycling of biodegradable municipal, industrial and agricultural wastes.	S. Sengupta	8

PART II: SEMESTER 4

CORE COURSE 4 PLANT PHYSIOLOGY AND METABOLISM

BOT-G-CC-4-4-TH

Full Marks 50

4 Credits

Fourth Semester: January- June

Topic	Name of the Teacher	No. of Lectures
1. Proteins 1.1 Primary, secondary and tertiary structure, 1.2 Nucleic acid- DNA structure, RNA types, 1.3 Enzyme-Classifications with examples (IUBMB), Mechanism of action.	P. Chatterjee	8
2. Transport in plants 2.1 Ascent of sap and Xylem cavitation , 2.2 Phloem transport and source-sink relation.	I. Khatua	4
3. Transpiration 3.1 Mechanism of stomatal movement, significance.	I. Khatua	4
4. Photosynthesis 4.1 Pigments, Action spectra and Enhancement effect, 4.2 Electron transport system and Photophosphorylation, 4.3 C3 and C4 photosynthesis, CAM-Reaction and Significance.	S. Sengupta	12
5. Respiration 5.1 Glycolysis & Krebs cycle— Reactions and Significance, 5.2 ETS and oxidative phosphorylation.	S. Sengupta	8
6. Nitrogen metabolism 6.1 Biological dinitrogen fixation, 6.2 Amino acid synthesis (reductive amination and	P. Chatterjee	6

transamination).		
7. Plant Growth regulators 7.1 Physiological roles of Auxin, Gibberellin, Cytokinin, Ethylene, ABA.	P. Saha	10
8. Photoperiodism (Plant types, Role of phytochrome and GA in flowering) and Vernalization.	S. Biswas	6
9. Senescence (brief idea).	T. Biswas	2

BOT-G-CC-4-4-P

Full marks 30

2 credits

Fourth Semester: January-June

Topic	Name of the Teacher	No. of Lectures
Plant Physiology: i) Experiment on Plasmolysis. ii) Measurement of leaf area (graphical method) and determination of transpiration rate per unit area by weighing method. iii) Imbibition of water by dry seeds - proteinaceous and fatty seeds. iv) Evolution of O ₂ during photosynthesis (using graduated tube). v) Evolution of CO ₂ during aerobic respiration and measurement of volume.	P. Saha & P. Chatterjee	15

SEC B MUSHROOM CULTURE TECHNOLOGY

BOT-G-SEC-D-4/6-4

2 Credits

Mushroom Culture Technology

Full Marks 80

Fourth Semester: January - June

Topic	Name of the Teacher	No. of Lectures
1. Mushroom- nutritional and medicinal value of mushrooms. Poisonous mushrooms.	R. Bar	4
2. Cultivation techniques/ technology of edible mushrooms in India: Volvarealla volvacea, Pleuretus citrinopyrineatus, Agaricus bisporus.		12

3. Storage- short term and long term, storage, drying.	Guest Teacher	6
4. Food preparation- types of foods prepared from mushroom. Cost and benefit ratio.		6
5. Research centres- national and regional.		2

Course: B.Sc. (General) Botany		
PART III (1+1+1 system), Full Marks-100		
Paper 4A (Theoretical)		
Module VII	Full Marks -70	
*First Term: Upto November & #Second Term: Upto April		
Topic	Name of the Teacher	No. of Lectures
1. Biofertilizer *	R. Bar	6
2. Mushroom *	R. Bar	3
3. Plant disease control *	P. Chatterjee	4
4. Plant Breeding #	P. Chatterjee	6
5. Biometry *	P. Saha	6
6. Plant tissue culture #	T. Biswas	6
7. Recombinant DNA Technology #	P. Saha	8
8. Pharmacognosy *	I. Khatua	6
Paper 4B (Practical)		
Module VIII	Full Marks -30	
*First Term: Upto November & #Second Term: Upto April		
Topic	Name of the Teacher	No. of Lectures
1. Acquaintance with laboratory instrument *	T. Biswas	8
2. Sterilization technique by Autoclave *	P. Saha	2

3. Preparation of PDA medium *	P. Saha	2
4. Bacteria staining by simple method (methylene blue/crystal violet) from curd #	P. Saha	4
5. Acquaintance with common medical plants and their useful parts *	T. Biswas	7
6. Determination of Goodness of fit of normal monohybrid ratios (3:1 and 1:1) by Chi-square analysis #	P. Saha	8
7. Visit to a Medicinal Plant Garden #	All	1 day