University Of Kalyani
Syllabus for three-year B.Sc.(Honours) Course in Computer Science
(May be effective from the 2016-2017 academic sessions)

Year	Type/ Marks	Group	Title	Period
Part- I	Theory 50 Paper - I	A B	Computer Fundamentals Introduction to Basic Electronics	45 30
	Theory 50 Paper - II	A B	Digital System Design Programming through C Language	30 45
	Practical 100 Paper - III	A B	Software Operating System P.C. Software C Language Hardware	
Part- II	Theoretical 50 Paper - IV	A B	Computer Organization – I Microprocessor	45 35
	Theoretical 50 Paper - V	A B	Data Structures Object-Oriented Programming	45 30
	Practical 100 Paper - VI	A B	Hardware Microprocessor Programming & I/O interfacing Object Oriented Programming	
Part- III	Theoretical 80 Paper - VII	A B C D	Graph Theory Discrete Mathematical Structures Numerical Optimization Techniques Formal Language & Automata Theory	30 45 45 30
	Theoretical 80 Paper - VIII	A B C	Graphics Computer Organization – II Data Communication & Computer Network, Internet Technologies	30 40 75
	Theoretical 80 Paper - IX	A B C	Software Engineering Database Management System System Software	30 60 60
	Practical 80 Paper - X	A B	RDBMS Unix Shell Programming	
	Practical 80 Paper - XI	A	Project	

PART - I
Paper - I : 50 Marks
(Theoretical)

Group – A : Computer Fundamentals **(45 Periods)**

Introduction to Computer and Problem Solving: Information and data.
Hardware: CPU, Primary and Secondary storage, I/O devices, Bus structure.
Software: System and Application.
Generation of Computers: Super, Mainframe, Mini and Personal Computer.
Introduction to Programming language: Machine Language, Assembly Language, High Level Language.
Problem Solving: Flow Charts, Decision tables & Pseudo codes. **(12)**

Number System & Codes:
Number representation: Weighted Codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal (BCD), Conversion of bases. Complement notations, Binary Arithmetic, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC; Single Error-Detecting and Correcting Codes, Hamming Codes.

Boolean Algebra:
Fundamental of Boolean Algebra, Switches and Inverters, Functionally Complete Gates (AND, OR, NOT), NAND, NOR, Switching function and Boolean function. De Morgan's Theorem, Minterm, truth Table and minimization of switching function up to four variables, Algebric & K-Map method of Logic circuit.
Synthesis: Two level and Multi Level.

Group – B : Introduction to Basic Electronics **(30 Periods)**

Elementary Physics of semi-conductors: P-N Junction diodes, Zener diodes, FET, MOSFET. Switching characteristics of diodes and transistors, Thyristor Application of diodes in rectification & wave shapping, Amplifiers: Class A, B, C, Concept of negative and positive feedback, Oscillators: R-C Tuned Circuit, Crystal; Monostable and Astable Multivibrators, regulated power supply, Shunt and Serial, Inverters using transistors & FET, Operational Amplifiers, its offset parameters and its uses as inverting, non-inverting, differential, adder, amplifier, differentiator, integrator, Schmitt Trigger.

PART – I
Paper – II : 50 Marks
(Theoretical)

Group – A : Digital System Design **(30 Periods)**

Logical circuit design using TTL,MOS and CMOS circuits, Relative comparison.
Integrated Circuits: SSI, MSI, LSI, VLSI classification.

Combinational Circuits: Standard Gate assemblies, IC chips packaging nomenclature, Comparators, Decoders, De-multiplexers, Data selectors / Multiplexer, Encoder, Seven Segment display unit, Multiplexed display, Keyboard encoder.

Sequential Circuits: Flip-Flop (1 bit) SR, JK, D, T, Shift Register, Counter, Finite-State Model- State diagram, Synchronous and Asynchronous system illustrative counter design. Single and two phase clocks successive approximation, Basic ladder circuits, D/A and A/D converter, converter, Counter Ramp, ROM & PLA (basic idea)

Group – B : Programming through 'C' Language **(45 Periods)**

Introduction: Basic Structure, Character sets, Keywords, Identifiers, Constants, Variables, Data Types, Program structure.
Operators: Arithmetic, Relational, Logical and Assignment; Increment, Decrement and Conditional, Operator Precedence and Associations; Expressions. Expression evaluation and type conversion. Formatted input and output.
Statements: Assignment, Initialization, String handling with arrays, String handling functions, Functions – Arguments passing, Return values and there types, recursion. Enumerated data types. Structures. Arrays of structures. Arrays within structures.

Pointers: Declaration and initialization, Accessing variable through pointer arithmetic, Pointers and arrays, String, Pointer of Functions and Structures.
File Access: Opening, Closing, I/O operations.
Linked list: Concepts, Simple implementation. Dynamic Storage Allocation. Low-Level Programming.

PART – I
Paper – III : 100 Marks
(Practical)

Group – A : Software Laboratory (50 Marks)

Section – I **(Lab. Periods- 15)**

Familiarity with single user and multi user operation systems.
DOS: Internal and External commands, File name and extension, Batch file creation, Command line arguments, System Configuration.
WINDOWS: Menus, Folders, Program manager, File Creation, View and sort files.
UNIX: File and Directories, Copy, Delete, Rename directory, creation, Navigation, Editor, pipes and filters, pattern searching.
Operating Systems: Windows 7 or latest version, Linux

Section – II

Familiarity with Window based PC Software
Word Processing – Creating documents using Menus and Toolbars, Spread sheet, Document Presentation Software.
Tools: Msoffice 2007 or latest version.

Section – III

Programming through 'C' Language
Problem: Problems should cover all features of the language; Application including numerical and optimization problems,
Operating System: Linux

Distribution of Marks:

Section I & II	One question to be answered		
Section III	do		
Marks Allotment	Section I &	Section II	10 Marks
		Section III	25 Marks
		Sessional	05 Marks
		Viva voce	10 Marks

Group – B : Hardware Laboratory (50 marks)

Pre-requisites

Study of IC Data Books Lmeat and Digital Fanmhanty with breadboard. LED, Seven segment display etc. Observe the output waveform of a function generation in a CRO. Mean time period, Peak voltage, Frequency and comparison with function generation readings, Study

of basic Logic functions like AND, OR, NOT, NAND etc. Ideas of Fan in, Fan out, Norse Margin. Threshold voltage. Transfer Characteristics, Designe of a NOT gate (inverter) using transistors. Designe of a debouncing switch, Logic probe. Clock (crystal timer). Verification of NAND and NOR gates as universal gates. De Morgan's Theorem.

Analog Circuits

1. Use Diodes to design half-wave and bridge rectifier. Observe the waveform on CRO. Measure peak and rms values. Use three terminal regulator for voltage regulation Measure ripple factor and regulation. Study the use of diodes for wave shaping.
2. Design a square wave oscillator using 555 timer. Use the timer as monostable,astable multivibrator.
3. OP AMP: Close loop gains inverting and non-inverting OP AMP Measurement of input offset voltage and current, Circuit arrangement for offset null. Use of OP AMP as adder, subtracter, differentiator, integrator.
4. Study of D/A and A/D converter IC chips and associated measurements.
5. Design active filters (high pass and low pass) using OP AMP.

Digital Circuits

Combinational Circuit design

1. Implement half adder / half subtracter / full adder / full subtracter using logic gates. Realize a logic function using basic / universal gates in SOP and POS form. Study the functionalities of **7483** and design a BCD adder using **7483** of equivalent.
2. Design of two level AND-OR, NAND-NAND, NOR-NOR circuits to realize any truth table, Realize XOR in two level and multilevel.
3. Implement four logic functions AND, OR, XOR, and NOT in a single composite circuit.
4. Design a four bit Two's complement adder- subtracter unit using **7483** or equivalent and XOR gate.
5. Design a circuit to convert BCD number to corresponding Gray Code.
6. Design a **4 : 1** MUX using NAND gates, Study **74153** and **74151.** Design full adder / subtracter using MUX.
7. Design a **2 : 4** decoder using NAND gates. Study **74155** and **74138.** Design full adder / subtracter using decoder.
8. Design a priority encoder using basic gates. Study **74147** and **74148.** Design simple Keyboard encoder.
9. Design a parity generator / checker using basic gates.
10. Design magnitude comparator using basic / universal gates. Study **7485.**
11. Design seven segment display unit.

Sequential Circuits

1. Implement a serial adder using Shift register, Flip-flops and other logic gates.
2. Realize S-R, D, J-K, and T flip-flop using basic gates, (study the undefined state in S-R flip-flop)
3. Design a shift register (shift left and shift right) using flip-flops. (Study the functional characteristics of IC 74194 with emphasis on timing diagram)
4. Design asynchronous and synchronous counter. Study IC 74193.
5. Study the functional characteristics of RAM IC chip. Study of open collector and tristate output. Horizontal and vertical expansion of RAM chips by cascading. Use 74189,7489,2114 or any available chip.

Marks Allotment	Sessional	05 Marks
	Experiment	35 Marks
	Viva voce	10 Marks

PART – II
Paper – IV : 50 Marks
(Theoretical)

Group – A : Computer Organization – I **(45 Periods)**

Basic Computer Organization – IAS Computer, Von Neumann Computer, System Bus, Instruction Cycle, Data Representation, Machine instruction and Assembly Language, CPU Organization, Arithmetic and Logic Unit, Control Unit, CPU Registers, Instruction Registers, Program Counter, Stack Pointer.
Instruction: Operation Code and Operand. Zero, One, Two and Three address instruction. Instruction types. Addressing modes. Stack organization.
Memory: Type of Memory, RAM, ROM, EPROM, DRAM, SRAM, SAM. Associative memory, Memory Organization- Linear two-dimensional von Neumann Vs Harvard Architecture, Different storage technology. I/O system organization and interfacing, Bus SCSI, PCI, USB : Tri State Devices, Bus Arbitration.

Group – B : Microprocessor ***(35 Periods)***

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, interrupts, bus standards and interfacing concepts, memory interfacing, I/O interfacing and ports- Keyboard interfacing. Display interfacing, storage device interfacing. Programming a Microprocessor, Interrupt Handling, Methods of Interrupts Priority and Management Case Studies: 8085 and 8086 microprocessor. (35)

PART – II
Paper – V : 50 Marks
(Theoretical)

Group – A : Data Structures ***(45 periods)***

Definition: Concept of Data Types. Elementary structures, Data types and there interpretation.

Arrays: Types, Memory representation, Address translation, functions of single and multi dimensional arrays with examples.
Linked Structures: Single and doubly linked list (non-circular and circular).
List Manipulation with pointers: Insertion and deletion of elements.
Stacks and Queues: Definition. Representation. Uses and Applications, Infix notation to postfix notation: conversion and evaluation. Application of queues.
Recursion: Divide and conquer, elimination of recursion, when not to use recursion?
Binary Trees: Definition, Quantitative properties.
Path length: Internal and external, properties, minimum, maximum path length of a binary tree, importance.
Searching: Linear and binary search, Performance and complexity.
Hashing: Concepts, advantages and disadvantages, different types of hash functions, collision and collision resolution techniques- open addressing with probing, linear chaining. Coalesced chaining application.

Sorting: Terminology, performance evaluation, different sorting techniques (bubble, insertion, selection, quick sort, merge sort, heap, partition exchange, radix with iterative and recursive description). Complexity, advantages and disadvantages.

Group – B : Object-Oriented Programming (30 periods)

Concepts: Interference with procedure oriented programming. Data abstraction and information handling: Objects, Classes & 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.

PART – II
Paper- VI : 100 Marks
(Practical)

Group- A : Hardware: Microprocessor programming & I/O interfacing

Experiment with 8085A- based micro computing kits (50 Marks)

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. Sequential and binary search
5. Block replacement
6. Parity generator
7. Delay routines.

Interfacing

1. Use of 8255 in different modes and testing with LEDs, Seven Segment Displays.
2. Display of alphanumeric characters on seven segment displays
3. Matrix keyboard interfacing and identification of the keys.
4. Generation of square wave, rectangular wave and ramp wave using DAC.

Marks Allotment:	*Sessional*	-	*5 Marks*
	Viva-voce	-	*10 Marks*
	Experiment	-	*35 Marks*

Group – B : Object Oriented Programming (50 Marks)

Language: C++, Visual C++ Programming
Operating System: LINUX
Problems: Problem set should cover all the features of the language and implementation of different algorithms covered in theoretical papers.

Marks Allotment:	Sessional	-	5 Marks
	Viva-voce	-	10 Marks

Experiment - 35 Marks

PART – III
Paper – VII 80 Marks
(Theoretical)

Group – A : Graph Theory **(30 Periods)**

Graphs: Definition, Finite and infinite graph, directed and undirected graphs. Degree, Isolated vertex, pendant vertex, null graphs.
Walks: Paths and circuits, connected and disconnected graphs, Euler's graph. Hamiltonian path and circuits, trees, definition and basic properties, distance and contents, matrix representation of graphs, incidence, adjacency and circuit matrices, graph search: BFS, DFS, Spanning Tree, Shortest Path Problems.

Group – B : Discrete Mathematical Structures **(45 Periods)**

Logic: Propositions; Predicates and Quantifiers, Sets, Functions, Growth of Functions, relation, equivalence relation: Big O Notation, Big-omega and Big-theta notations.
Algorithms: Complexity of algorithms: Space and time. Polynomial and exponential algorithms, polynomial reducibility, P, NP – Complete. NP – hard. Satisfiability problems, cook's theorem (statement only) .
Counting, pigeon hole principle, permutations and combinations, introduction to probability.
Recurrence relation, generating function, inclusion and exclusion principle.

Group – C : Numerical and Optimization Techniques (45 periods)

System of Linier equations: Gaussian Elimination, Gauss-Jordan Elimination, Gauss-Seidel Iteration, Matrix Inversion.
Nonlinear equation: Iterative methods, Newton-Raphson.
Solution of Differential equation: Euler, Range- Kutta.
Curve Fitting, Romberg Integration.

Overview of linear programming: linear programming, simplex method.
Duality, transposition, assignment problems, integer programming, cutting plane, branch and bound, dynamic programming, PERT/CPM network.
Queuing Theory: Basic concepts, Queuing models, poisson statistics, M/M/I queue: Application.

Group – D : Formal Language and Automata Theory (30 periods)

Introduction of formal languages and grammar, finite automat, regular expressions. Deterministic and Non-deterministic finite automata and there equivalence. State minimization. Chomsky Classification of grammars. Concepts of Turing machines & Universal Turing Machines.

PART – III
Paper – VIII 80 Marks
(Theoretical)

Group – A: Computer Graphics **(30 periods)**

Introduction: Co-ordinate System, Information Handling Software, Graphics software, area of application, translation, rotation, scaling, matrix representation, homogeneous Co-ordinate

system, composite transformation, inverse transformation, computer art, animation, morphing. Projection and clipping, 2D, 3D transformations, lines, curves & their representations.

Group – B: Computer Organization-II **(40 periods)**

Fixed and floating point arithmetic: addition, subtraction, multiplication & division.
ALU- Combinational ALU, Two's compliment addition, Subtraction unit.
Memory hierarchy: CPU register, cache memory, primary memory, secondary memory & Virtual memory.
Control unit: Control structure and behaviour, hardware control and micro programmed control: basic concept, parallelism in microinstruction. I/O: Computer peripherals – VDU, Keyboard, Mouse, Printer.

Group – C: Data Communication & Computer Network, Internet Technologies
(75 Periods)

Data Communications: Transmission media; Network: Protocol and standards; Analog & Digital signals, Periodic & Non-Periodic signals. Time and Frequency domain; Multiplexing: FDM, TDM, and application, Encoding D/A and A/D encoding; Error: Different types of error & their detection. Concept of centralized and distributed computing; Advantages of networking; Layered architecture: OSI architecture, basic features, LAN, MAN, WAN; simple PC based network: Example, block diagram, mode of operation and characteristic features.

Intranet and internet ; Servers and clients; ports: Domain Name Server(DNS) accounts, internet service providers, connections dial up, ISDN, ADSN, cable, modem; E-mail: Account, sending, receiving, mailing list IRC, voice and video conferencing, WWW, Browsers.

PART – III
Paper – IX ; 80 Marks
(Theoretical)

Group – A : Software Engineering **(30 Periods)**

Software life cycle, different modes: Waterfall, Spiral, Software requirement analysis & Specification, Structure Analysis. DFD, Data Dictionary, Structure Design, Structure Charts, Software testing: White box and black box testing. Software quality assurance.

Group – B : Database Management System **(60 Periods)**

Basic concept, file management systems, advantages of DBMS, ANSI/SPARC architecture, Physical, Conceptual and External models, ER diagram, Data models: Relational, Hierarchical, Network;
File Organization: Sequential, Index sequential, Random, Inverted, Query Languages, Relational Algebra, Relational Calculus, functional dependencies, Normal forms: 1NF, 2NF, 3NF and BCNF; Structured query languages, Elementary Concepts of Security, Integrity.
Case Studies: Any commercial RDBMS package.

Group – C : System Software ***(60 Periods)***

Introduction: different system software: Assemblers, Loaders, Linkers, Interpreters, Compilers, Various phase of compilation.
Operating Systems: What is OS? Multiprogramming OS, Concept of processes, File, Shell, System Calls, Structures: Monolithic, Layered, Virtual, Client Server and Distributed model.

Concept of Synchronization: Semaphores, Critical Regions, Monitor Inter Process Communication Mechanism.

Process Management: Scheduling, Round-robin, priority queue.

I/O management: Device and device controllers, Interrupt handlers and device drives.

Memory Management: Multiprogramming, Swapping, Paging, Virtual memory, Page replacement techniques.

File Systems: Files and Directories, File Servers, Security and protection.
Dead Lock: Definition, detections and prevention.
Case Study: DOS, UNIX, LINUX,WINDOWS.

PART – III
Paper – IX ; 80 Marks
(Practical)

Group – A

(80 Marks)

RDBMS

Operating System: Windows 7 or latest version, LINUX
RDBMS: ORACLE, SQL Server
Front Ends: Visual Basic
Problems: Application Database with GUI

UNIX Shell Programming

Platform: LINUX
Problems: Problems set should cover the basic features of shell programming.

Marks Allotment:	Sessional	-	10 Marks
	Viva-voce	-	20 Marks
	Experiment	-	50 Marks

Group – A : Project Work **(80 Marks)**

Marks Allotment:	Project Report	-	10 Marks
	Presentation	-	10 Marks
	Viva-voce	-	20 Marks
	Project work	-	40 Marks

Guidelines

Each students of B.Sc. part II (Computer Science Honours) will carry out one project work under the supervision of a faculty member of the college. The project will be assigned at the beginning of Part II academic session. Students will submit a project report representing the actual work in a suitable format. The student should defend the project before the examiners. The project work will be evaluated on the basic of presentation and viva-voce examination. The

Project report should contain the following:

1. Title the Project
2. Objectives of the project
3. Analysis report in a suitable format
4. Detailed design steps
5. Circuit layout / program listing
6. Testing and analysis
7. Conclusion and future scope for development
8. Bibliography

Broad areas and tools:10

Computer networking, Network protocol, application DBMS, Multimedia, Graphics, Internet based application, software engineering tool development, simulation, any other related topics, I/O Controller, I/O interfaces, Microprocessor based system.

Language: C, C++, Assembly (8085, 8086, 8088)
Operating System Platform: Windows 7 or latest version, LINUX.
DBMS: ORACLE, SQL Server.
Tools: Visual Basic, Java

11*Recommended Books:*

1. **Kohavi : Switching and Finite Automata Theory**
2. **Milman & Halkius : Integrated Electronics**
3. **E.J. Macclusky : Logic Design Principles**
4. **Morries & Miller : Designing with TTL Integrated Circuit**
5. **Tremblay : Introduction to Computer Science**
6. **Hamachar, Vranesic & Zaky : Computer Organization**
7. **Malvino : Electronic Principles.**
8. **Brown : Fundamentals of Digital Logic**
9. **Balaguruswamy : Programming in ANSI C**
10. **Venugopal : Programming with C**
11. **Tremblay : Introduction to Data Structure**
12. **Madinick : Operating System**
13. **Rosen : Discrete Mathematics**
14. **Liu : Elements of Discrete Mathematics.**
15. **V.K. Kapoor : Operation Research**
16. **Gaonkar : Microprocessor**
17. **Rogers : Computer Graphics**
18. **Balaguruswamy : Object Oriented Programming**
19. **Jalote : Software Engineering**
20. **Korth : Data Base Management System**
21. **Majumdar : Introduction to DBMS**
22. **Deo : Graph Theory**
23. **Ash Ash : Introduction to Discrete Mathematics**
24. **Bartee : Computer Architecture & Logic Design**
25. **Mano : Digital Logic & Computer Design**
26. **Stallings : Data & Computer Communication**
27. **Faruzan : Data Communication**
28. **Kruse : Data Structure & Program Design**
29. **Horowitz & Sahani : Data Structure**
30. **G.L. Hieleman : Data Structure, Algorithms and OOP**

31. Cohoon : C++ Program Design
32. Navate : Fundamentals of Database System
33. Aho, Hofcroft, Ullman : Automata Theory.
34. Beck : System Software
35. K. Mukherjee : Numerical Analysis
36. Raj Kamal : Internet Technologies.
37. Debasish Samanta : Classic Data Structures (PHI)
38. V. Rajaraman : Computer Oriented Numerical Analyses
39. S. A. Mollah : Numical Analysis and Computational Procedures (Books and Allied Pvt. Ltd.)

16/12/2015 16/12/15 16/12/15

Signatures of Chairperson and members