**Proposed detailed syllabus of 3rd Semester B.Sc. Computer Science Honours**

**BCS-301 Computer Architecture & Organisation**

***Basic computer organization***: Accumulator based CPU, disadvantages, Improvements,

CPU registers (IR, PC, SP, MAR, MDR, AC), IAS computer, Von Neumann computer.

***Instruction***: Machine instruction, Assembly language instruction, micro instruction,

Instruction Cycle, Instruction Format, 0, 1, 2, 3-address instruction, instruction types,

instruction set completeness, Addressing modes, Numerical problems on Instruction

format.

***Stack organization***: Implementation of Stack using Shift register, Application of stack in

Organization.

***Memory***: Types of Memory (RAM, ROM, DRAM, SRAM, SAM), characteristic of

memory, Memory organization: Linear, 2D, Memory expansion (Horizontal, vertical and

mixed).

***Associative memory***: Design and application.

***Virtual memory***: Concept, Mapping (Direct, Associative and Direct –associative

mapping), Replacement algorithm (FIFO, LRU, LFU).

***Cache memory***: Concept of locality of reference, cache memory organization, Hit &

miss, Write back & Write through Cache, Mapping (Direct, Associative and Setassociative

mapping), Numerical problems on cache mapping.

***Bus Organization***: Bus structure, I/O interfacing, tri-state logic, Address decoding

(Absolute & Partial), Memory mapped I/O & I/O mapped I/O, Data transfer

(Programmed I/O, Interrupt initiated I/O, DMA), Bus contention and bus arbitration.

***ALU Design***: Functions of ALU, Bit sliced ALU, Implementation of Arithmetic

operations (Fixed point data [Addition, subtraction, multiplication and division algorithm

for signed number represented in signed magnitude and 2’s complement], Floating point

data [Addition, subtraction, multiplication and division algorithm for signed number],

BCD arithmetic, Implementation of Logical operation.

***CU Design***: Hardwired and Micro-programmed CU design and their relative advantages

& disadvantages, Horizontal and vertical microinstruction, parallelism in

Microinstruction.

**BCS-302 Formal Language**

**Introduction:** Synchronous & Asynchronous Sequential Circuit, Storage Element, Melay

and Moore Machines, Design Technique of State Machine.

**Finite State Model:** Synchronous Sequential Machine; State Successor in Sequential

Machine; Capabilities and Limitations of FSM; State Equivalence and Machine

Minimization.

**Theory Of Automata:** Definition of Automation; Description of Finite Automation;

Transition System; Properties of Transition Function; NDFA, DFA, Conversion from

NDFA to DFA, Minimization Of States (Equivalence Partition);Conversion From Moore

to Mealy machine and Vice Versa.

**Formal Languages:** Basic Definition of Grammar and Languages; Examples; Chomsky

Classification of Languages; Languages and their Relations; Operation on Languages;

Language and Automata.

**Regular Set And Regular Grammar:** Regular Expression; Finite Automata and Regular

Expression; Regular Grammars and Regular Languages; Pumping Lemma for Regular

Sets, Application of Pumping Lemma, Closure Properties of Regular Languages.

**Context-Free Languages:** Basics of CFL; Sentential Forms; Derivation Trees;

Ambiguity in CFG; Simplification of CFG; CNF And GNF;

**Pushdown Automata:** Basic Definition; Language Acceptance by PDA; Deterministic

PDA.

**Turing Machine:** Turing Machine Model; Representation of Turing Machine; Language

Acceptability by TM; Design of TM; Nondeterministic TM; Universal TM; Halting

Problem of TM, Church Turing Thesis; Unsolvable Problems about TM,NP

Completeness, Polynomial Time Reduction; Some NP Completeness Problems.

**BCS-303 Digital Logic**

***Combinational logic***: Adders (Half and Full adder, their differences, Implementation

using logic gates and universal gate), subtractor (Half and Full subtractor, their

differences, Implementation using logic gates and universal gate), Parallel Adder and its

disadvantage, Carry Look Ahead Adder, BCD Adder, Code Converter, Comparator,

Decoder: 2X4 & 3X8 Decoder, Decoder with Enable line, BCD to Decimal Decoder,

Logic circuit implementation, Expansion, Demultiplexer, Conversion of Decoder &

DEMUX, Encoder, Priority Encoder, Multiplexer: 4X1 & 2X1 MUX, Expansion, Quad

MUX, Logic circuit implementation, MUX Functionally complete, ROM, PLA and its

advantage over ROM, SSD, Multiplexed display, Key board Encoder.

***Sequential circuit***: Difference from Combinational logic, Latch: RS, D, JK, T, Latch

conversion, Flip-flop: RS, D, JK, T, Master slave, Edge trigger, Sequential circuit from

State diagram, State Reduction, Design from state equation, FSM and its Design,

Counter: Asynchronous (UP, DOWN, UP/DOWN), Synchronous ( e.g. UP, DOWN,

UP/DOWN, ODD,EVEN, PRIME, FIBONACCI), Register: SISO, SIPO, PISO, PIPO,

Universal shift register.

***A/D and D/A converter***: D/A (Weighted register, R-2R Ladder), A/D (Counter,

Successive approximation) converter, resolution, accuracy.

***Logic Families***: TTL, MOS, CMOS, Comparison, Propagation delay, Power dissipation,

Fan-In, Fan-Out, Noise margin, Open Collector type logic gates and its advantages

**BCS-304 Digital Logic Laboratory**

Combinational Circuits:

1) Implement Half Adder/Half Subtractor/Full Adder/Full Subtractor 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 or

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) Design a 4 bit 2’s complement adder – subtractor unit using 7483 or equivalent and XOR gates.

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4) Design a circuit to convert BCD numbers to corresponding gray codes.

5) Design a 4:1 MUX using NAND gates. Study of 74153 and 74151. Design Full Adder/Subtractor using MUX.

6) Design a 2:4 decoder using NAND gates. Study of 74155 and 74138. Design Full Adder/Subtractor using decoders.

7) Design a parity generator/checker using basic gates.

8) Design magnitude comparator using basic/universal gates. Study of 7485.

9) Design a seven segment display unit.

*Sequential Circuits:*

1) Realize S-R, D, J-K and T flip-flop using basic gates. (Study the undefined state in S-R flip-flop).

2) Design a shift register (shift left and shift right) using flip-flops. (Study the functional characteristic of IC 74194 with

emphasis on timing diagram).

3) Design Asynchronous and Synchronous counters. Study of IC 74193.

4) Study the functional characteristics of RAM IC chip. Study of open collector and tri-state output. Horizontal and vertical

expansion of RAM chips by cascading. Use 74189, 7489, 2114 or any available chip.

**BCS-305(i) Numerical Methods**

**Errors:** Concepts; Types of errors.

**System of Linear Equations:** properties of Set of Linear Equations -Linearly dependent

and independent, Rank, Singularity of coefficient matrix; Ill condition matrix, Gaussian

Elimination, Gauss-Jordon Elimination; iteration method and its convergence condition

and testing; Gauss-Jacobi and Gauss-Seidal iteration algorithm and its applications.

**Non-linear equation:** Iterative methods and different types of convergence; divergence

and its test condition; Bisection algorithm; Regular-falsi method, Secant and Newton-

Raphson method; Problems and its graphical significance;

**Solution of differential equations:** Euler method; Taylor method; Runge-Kutta second

and fourth order method for solving differential equations.

**Interpolation:** Newton forward and backward interpolation; Lagrange interpolation.

**Curve fitting:** Linear, Quadratic fitting.

**Integration:** Mathematical foundation for Trapezoidal and Simpson’s 1/3 rules and its

composite forms.

BCS-305(ii) Probability & Statistics

May be from Mathematics Department

BCS-306(i) Fundamentals of Information|& Communication Technology (To be prepared)

BCS-306(ii) System Analysis & Design (To be prepared)

**Syllabus 4th Semester B.Sc. Computer Science Honours**

**BCS-401 Software Engineering**

***Introduction***: S/W engineering discipline – evolution and impact, Program Vs S/W,

Emergence of S/W engineering (Introduction to Control based design, Data structure

oriented design, data flow oriented design, object oriented design).

***S/W life cycle***: Usefulness, Life cycle Model (Classical water fall model, Iterative

waterfall model, prototype model, spiral model, comparisons).

***S/W Requirement Specification***: Need, Components and characteristic of SRS, SRS

document for Simple problems.

***S/W design***: Cohesion & Coupling, S/W design Approach (Function oriented approach

[DFD, Structure chart, Transformation of DFD into Structure chart], Object oriented

approach [UML diagram, Use case model, class diagram, Interaction diagram])

***Coding***: Coding standards, Code review (Code walk through, Code Inspection, Clean

room testing).

***Testing*:** Unit Testing (Driver and Stub Module, Black box testing [Equivalence class

Partitioning and Boundary value analysis], White box testing [Statement coverage,

Edge/branch coverage, condition coverage, path coverage), Integration Testing (Big

bang, Top down, Bottom up, Mixed approach).

***Maintenance***: Characteristics, Types (corrective, adaptive and perfective), S/W

maintenance process model (Reverse engineering cycle followed by forward engineering

model).

**BCS-402 Computer Networks**

**Introduction**: Categories Of Networks; Concepts Of Protocols.

**Signals:** Analog and Digital; Periodic and aperiodic Signals; Time Frequency Domains,

Composite Signals; Concepts Of Frequency, Bandwidth , Bit Rate, Baud Rate, Channel

Capacity; Nyquist & Shannon’s Theorem; Attenuation, Distortion and Noise, concept of

modulation

**Multiplexing:** FDM (Multiplexing and Demultiplexing Process, Applications),

TDM( Time Slot and Frames, Interleaving, Bit Padding, Applications),WDM.

**Transmission Media:** Guided Media(Twisted Pair, Co-Axial Cable, Fiber Optics

Cable); Unguided Media(Radio Waves, Microwaves, Infrared, Satellite Communication);

NIC.

**Switching:** Circuit, Packet and Message Switching; Comparisons.

**Modems**: DSL, Cable Modems.

**Network Software:** OSI and TCP/IP Models.

**Data Link Layer:** Error Detection and Correction (Parity, Checksum, CRC, Humming

Code); MAC Layer; Stop-And-Wait ARQ, Sliding Window Protocol, Selective Repeat

ARQ, HDLC Protocol; ALOHA (Pure And Slotted), CMSA/CD Protocol, Polling; Token

Passing; CDMA; Ethernet, Token Bus, Token Ring, ATM.

**Network Layer:** IP Addressing and Classes of IP Address; Subnet; Static and dynamic

routing; ARP; IP; ICMP; unicast and multicast routing protocols;

**Transport layer:** process-to-process delivery; UDP; TCP; Congestion control protocols.

**Connecting Devices:** Repeaters, Hub, Bridges, Switch, Router and Gateway.

**Application Layer:** client server model; FTP, HTTP, SMTP, Telnet etc protocols;

Servers and Clients; Ports; DNS; Accounts, ISP; Email: Account, Sending, Receiving,

Mailing List, IRC, Voice and Video Conferencing, WWW, Browsers.

**Security:** Basics of cryptography; message security; digital signature;

**Miscellaneous:** Concepts of LAN, MAN and WAN; Concepts of Centralized and

Distributed Networks; Connections: Dial Up, ISDN, ADSDN; Bluetooth network

concept.

**BCS-403 Database Management System**

**Introduction:** Drawbacks of Legacy System; Advantages of DBMS; Layered

Architecture of Database, Data Independence; Data Models; Schemas And Instances;

Database Languages; Database Users, DBA; Data Dictionary; Functional Components of

a DBMS.

**ER Model:** Entity, Attributes and Relationship; Structural Constraints; Keys; ER

Diagram of Some Example Database; Weak Entity Set; Symbolic Conventions;

Specialization and Generalization; Constraints of Specialization and Generalization;

Aggregation.

**Relational Model:** Basic Concepts of Relational Model; Relational Algebra; Tuple

Relational Calculus; Domain Relational Calculus.

**Integrity Constraints:** Domain Constraints, Referential Integrity, Assertions, Triggers.

**Relational Database Design:** Problems of Un-Normalized Database; Functional

Dependencies, Derivation Rules, Closure Of FD Set, Membership Of A Dependency,

Canonical Cover; Decomposition to 1NF,2NF,3NF Or BCNF Using FD; Lossless Join

Decomposition Algorithm; Dependency Preservation.

**SQL:** Basic Structure, Data Definition, Constraints and Schema Changes; Basic SQL

Queries (Selection, Insertion, Deletion, Update); Order by Clause; Complex Queries,

Aggregate Function and Group by Clause; Nested Sub Queries; Correlated Sub Queries;

Views (Insert-Able and Updatable), Joined Relations; Set Comparisons (All, Some);

Derived Relations Etc; Grant and Revoke, Transaction in SQL.

**Record Storage and File Organization:** Fixed Length and Variable Length Records;

Concepts of Disk Blocks; Spanned and Un-Spanned Organization of Records; Primary

File Organizations and Access Structures Concepts; Unordered, Sequential, Hashed;

Concepts of Primary and Secondary Index; Dense and Sparse Index; Index Sequential

Files; Multilevel Indices.

**BCS-404 DBMS Laboratory**

Exercise related to BCS-403

**BCS-405(i) Basic Electronics**

***Energy Bands in Solids***: Charged particles, Field Intensity, Potential, energy, Nature of

atom, Atomic energy level, Electronic structure of element, Energy-Band Theory of

Crystal, Insulator, Semiconductor and metals.

***Transport Phenomena in Semiconductors***: Mobility, conductivity, Electrons and Holes

in Intrinsic semiconductor, Donor and acceptor, Electrical properties of Ge and Si, Hall

effect, Generation and Recombination of Charges, Diffusion.

***Junction Diode***: p-n junction diode, forward and reverse bias, current components in p-n

diode, volt – ampere characteristic, diode resistance, break down diodes (Zener,

avalanche), Application of diode as rectifier (Half-wave, full-wave and bridge rectifier).

***Transistor***: Junction Transistor, current components, Transistor as an amplifier, Common

base and common emitter configuration, active, cut off and saturation region.

***Operational Amplifier***: Basic OPAMP, Characteristic of Ideal OPAMP, Inverting and

Non inverting amplifier, Differential amplifier, CMRR, OPAMP as adder, Integrator,

differentiator.

**BCS-405(ii) E-Commerce (To be prepared)**

**BCS-405(iii) Management Information System (To be prepared)**

**BCS-406(i) Unix & Shell Programming (To be prepared)**

**BCS-406(ii) Web Technology (To be prepared)**

**Syllabus 5th Semester B.Sc. Computer Science Honours**

**BCS-501 Computer Graphics**

**Introduction:** VDU; Raster Scan and Random Scan Displays; Video Controller, Display

Processor;

**Output Primitives :** Points and Lines, Line Drawing Algorithms (Bresenham, DDA);

Circle Generating Algorithms ( Properties Of Circle, Midpoint Circle Algorithm);

Midpoint Ellipse Algorithms, Other Curves, Scan Line Polygon Fill Algorithms; Inside-

Outside Test; Scan Line Fill of Curved Boundary Areas; Boundary fill Algorithms, Flood

Fill Algorithm; Anti-Aliasing.

**2D Geometric Transformations:** Translation, Rotation , Scaling; Matrix

Representation, Homogeneous Coordinates; Composite Transformation(General Pivot

Point Rotation, General Fixed Point Scaling, General Scaling Directions); Reflection,

Shear; Transformations Between Coordinates Systems.

**2D Viewing:** The Viewing Pipeline; Viewing Coordinate Reference Frame; Window-To-

View port Coordinate Transformation; Point and Line Clipping, Cohen Sutherland Line

Clipping Algorithm; Polygon Clipping; Text Clipping.

**3D concepts:** Three-Dimensional Object Representations – Three-Dimensional

Geometric and Modeling Transformations – Three-Dimensional Viewing – Color models

**Back Face Detection** Projections, Algorithms(to be detailed)

**BCS-502 Object Oriented Programming with C++**

*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.

**BCS-503 C++ laboratory**

As per BCS-502

**BCS-504(i) Analysis of Algorithm**

**Growth of Functions**: Asymptotic notation, Big-O, Theta, Omega notations.

**Recurences:** Mathematical notation and recurrence, solving recurrence by substitution ,

iteration, change of variable, master method.

**Divide and Conquer Algorithm:** Binary search, Merge sort, Quick sort analysis,

Strassen’s matrix multiplication.

**Dynamic programming**: Introduction, principle of optimality**,** components, dynamic

programming solution, examples, Longest common subsequence, Warshall’s and Floyd’s

Algorithm , knapsack Problem

**Greedy algorithm**: Characteristics and features of problem solving by greedy algorithm,

basic structure, feasibility, Huffman code, Dijkstra, Spanning tree and minimum

spanning tree(Kruskal and Prim algo).

**Branch and Bound Technique**: Traveling salesman problem, Lower Bound Theory

**Pattern matching algorithm**: preliminary string matching algorithm, Rabin Karp

algorithm, string matching with Finite automation, Knuth Morris Pratt algorithm.

**Maximum flow**: max flow network, Residual network, Ford-Fulkerson algorithm.

**NP Completeness**: P, NP concepts, Description of some NP complete problems

( Boolean satisfiability problem (Sat.),N-puzzle ,Knapsack problem ,Hamiltonian path

problem ,Travelling salesman problem ,Subgraph isomorphism problem Subset sum

problem ,Clique problem ,Vertex cover problem ,Independent set problem ,Dominating

set problem ,Graph coloring problem ), Reductions

**BCS-504(ii) Advance Database Management System**

**Query Processing:** Query Processing Steps**;** Translating Different SQL Queries to

Relational Algebra; Using Heuristics in Query Optimization; General Transformation

Rules for Relational Algebra; Cost Estimation Functions of Select, Join.

**Transaction Processing:** ACID Properties; Transaction States, Concurrent Execution;

Serializability (Conflict and View), Recoverability, Test for Serializability.

**Concurrency:** Algorithms**(to be detailed)**

**Recovery**: Techniques **(to be detailed)**

**Distributed DBMS: to be detailed**

**Advanced Topic: GIS, Multimedia Database, Mobile database (to be detailed)**

**BCS-505(i) Compiler Design**

**Introduction**: Compilers & translators, the structure of a compiler (ideas of 6 phases)

**Lexical Analysis**: Need, tokens, regular expression, strings and languages, use of finite

automata, text editing.

**Parsing** : derivation and parse trees, representation of parse trees, shift reduce parsing,

handles, stack implementation of shift-reduce parsing, operator precedence parsing

(operator precedence relations, associativity and precedence, operator precedence

grammar, operator precedence parsing algorithm), top-down parsing, elimination of left

recursion, recursive descent parsing, left-factoring, Predictive parsers(FIRST , FOLLOW

rules, Construction of parsing tables, LL(1) grammars.

**LR-Parsers**: Stack model of LR parser, Parsing table, Canonical Collection of LR (0)

items (closure, goto, valid items), Construction of SLR parsing tables. Construction of

canonical LR parsing table.

Syntax Directed Translation: **(to be detailed)**

Intermediate Code generation: **(to be detailed)**

Code Optimization: **(to be detailed)**

Code Generation: **(to be detailed)**

**BCS-505(ii) Artificial Intelligence**

**(to be detailed)**

**Syllabus 5th Semester B.Sc. Computer Science Honours**

**BCS-601 Animation & Multimedia**

**Multimedia systems design** : An Introduction – Multimedia applications – Multimedia

System Architecture – Evolving technologies for Multimedia – Defining objects for

Multimedia systems – Multimedia Data interface standards – Multimedia Databases.

**Multimedia file handling** : Compression & Decompression – Data & File Format

standards – Multimedia I/O technologies - Digital voice and audio – Video image and

animation – Full motion video – Storage and retrieval Technologies.

**Hypermedia:** Multimedia Authoring & User Interface – Hypermedia messaging -

Mobile Messaging – Hypermedia message component – Creating Hypermedia message –

Integrated multimedia message standards – Integrated Document management –

Note: Further detailing necessary

**BCS-602 Microprocessor**

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, DMA, Bus Standards and types,

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.

**BCS-603 Microprocessor Laboratory**

Programs should be developed in 8085 assembly language.

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, etc.

**BCS-604 (i) Optimization Techniques**

**Introduction:** origin and development of operation research, Nature and characteristic

features, models in O.R., application of O.R.

**Linear Programming Problem:** Introduction, mathematical formulation of the problem

and graphical solution method.

**Simplex Method:** Introduction, computational procedure, artificial variable, problem of

degeneracy, application of simplex method.

**Duality:** Concept, formulation of primal – dual, duality and simplex method, Dual

Simplex method.

**Transportation Problem:** Introduction, mathematical formulation, finding initial basic

feasible solution, optimality, degeneracy, unbalanced transportation problem.

**Assignment Problem:** Introduction, mathematical formulation and solution.

**Integer Programming Problem**: Introduction, All integer programming problem, mixed

integer programming problem, Branch and Bound method.

**Queueing Theory**: Introduction, queueing system, M/M/1 queue.

**Network Scheduling:** Introduction, Critical Path Method (CPM), PERT calculation.

**Information Theory:** Introduction, Entropy and its properties, joint and conditional

entropies, Mutual information, Encoding.

**Dynamic Programming:**

**BCS-604(ii) Core Java**

To be detailed

**BCS-604(iii) Advance Computer Architecture**

To be detailed

**BCS-605(i) Cryptography & Network Security**

To be detailed

**BCS-605(ii) Internet Technology**

To be detailed

**BCS-605(iii) Soft Computing**

To be detailed