FACULTY OF ENGINEERING & TECHNOLOGY

SYLLABUS

FOR

MASTER OF COMPUTER APPLICATIONS
(5 YEARS & 6 MONTHS INTEGRATED PROGRAMME)

(Course Code: CSC1)
(SEMESTER: I – XI)
(Under Credit Based Continuous Evaluation Grading System)
Session: 2015-16

GURU NANAK DEV UNIVERSITY
AMRITSAR

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester System
(Under Credit Based Continuous Evaluation Grading System)

SCHEME

Semester-I					
			Credits		
Sr. No.	***Sub Code***	***Subject***	**L**	**T**	**P**
1.	CSL110	Programming Language-I	3	1	0
2.	CSL111	Personal Computing – Operating Systems & Software	3	1	0
3.	CSL112	Computer Organization and Architecture	3	1	0
4.	CSP113	Programming Lab-I	0	0	2
5.	ECL191	Electronics Fundamentals	3	1	0
6.	ENL101	Communicative English	2	0	0
7.	MTL111	Mathematics-I	3	1	0
8.		Elective-I	2	0	0
		Sub Total:	**19**	**5**	**2**
		Grand Total:	**26**		
		List of Electives-I			
1.	PBL 121	Punjabi Compulsory **OR**	2	0	0
2.	PBL 122	Basic Punjabi (Mudhli Punjabi)	2	0	0

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – I
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CSL110: PROGRAMMING LANGUAGE-I

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Introduction to Computer Programming.
Development life cycle and environment.
Algorithms, Flow chart & pseudopodia
Introduction to C language.

UNIT-II

Standard data types, Expressions & assignment. Console I/O statements, Pointers & arrays, Structured programming elements & interactive constructs using flow chart
Control statements and standard constructs.

UNIT-III

Functions and parameter passing. Structures, Creating & manipulating simple data structure in C. File I/O Introduction to C++ I/O statements, Reference variables.

References:

1. R.S. Salaria: Applications Programming in C, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. Byron Gotterfied: Programming in C, Tata McGraw Hill Publishing Company Ltd., Delhi.
3. Yashvant Kanetkar: Let Us C, BPB Publications, Delhi.

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CSL111: PERSONAL COMPUTING–OPERATING SYSTEMS & SOFTWARE

Credits		
L	**T**	**P**
3	1	0

UNIT-I

DISK OPERATING SYSTEM:
The basic fundamentals of DOS, Disk organization, understanding DOS prompt and Shell Screen using keyboard & mouse, Internal commands, Batch files, Using the screen editor, Printing images, ASCII files, Indirect Printing and spooling, Communicating with other devices, Parallel vs Serial communication, Optimizing DOS, CONFIG.SYS & AUTOEXEC.BAT files, Freeing up memory at boot time, Managing Extended and Expended memory, RAM Disk, Disk Caching, Defragmentation.

UNIT-II

WINDOWS:
Window Fundamental: Types of windows, anatomy of windows, Windows Explorer, customizing windows, installing a printer, using clipboard, using paintbrush, Control Panel, Taskbar Setting.

MS-WORD:
Fundamentals of MS-Word, Menus, Toolbars, Ruler, Scroll Bars, Status Bar, Creating, Saving, Importing, Exporting and Inserting files, Formation, Indents / Outdents, Lists, Tabs, Styles, Working with Frames, Columns, Pictures, Chart Graphs, Forms, Tools, Equations and Macros.

UNIT-III

MS-EXCEL:
Worksheet overview, Row, Columns, Cell, Menus, Creating worksheets, opening and saving worksheets, Formatting, Printing, Charts, Window, Establishing worksheet links, Macros, Database, Tables, Using files with other programs.

MS-POWERPOINT:
Disk Management Tools: PC Tools, Norton Utilities, Norton Disk Doctor, Virus detection, prevention and cure utilities.

References:

1. Robbins Judd: Mastering DOS 6.0 & 6.2, BPB Publications, 1994.
2. DOS Quick Ref. Manual Vol. II, BPB Publications.
3. Gurvinder Singh & Rachhpal Singh, Window Based Computer Courses, Kalyani Publishers.
4. Crawford & Russel: Getting Ready for Windows 95, BPB Publications.
5. Russel A. Stuluz. Learn Excel for Windows in a Day, BPB Publications.
6. Russel A. Stuluz. MS Word 6.0 for Windows in a Day, BPB Publications.
7. Mansfield: Mastering Word 6.0 for Windows, BPB Publications.

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CSL112: COMPUTER ORGANIZATION AND ARCHITECTURE

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Digital Fundamentals: Digital Logic Circuits: Digital Computers, Logic gates, Boolean Algebra, Map Simplification, Combinational Circuits, Sequential Circuits.

Digital Components – Decoders, Encoders, Multiplexers, Register, Shift registers, Binary counters, Memory Unit.

Data Representation – Data types, complements, Fixed-point representation, Floating pt. Representation, Error detection codes.

UNIT-II

Basic Computer Organization - Design, Register Transfer Language & Operations, Various Arithmetic, Logic & Shift micro-operations, instruction codes, computer registers, instructions, timing & control, instruction cycle, design of a complete basic computer & its working.

Programming & controlling the basic computer – Machine & Assembly Language.

UNIT-III

CPU Architecture – General register & stack organization, instruction formats and addressing modes, RISC & CISC.

Memory Organization – Memory hierarchy, Main auxiliary, Cache memory, Virtual memory, Paging and Segmentation.

Reference:

1. Morris Mano: Computer System Architecture, PHI
2. Hayes, J.P.: Computer Architecture & Organization, McGraw Hill.
3. Stone: Introduction to Computer Architecture, Galgotia
4. Tanenbaum: Structured Computer Organization, PHI

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CSP113: PROGRAMMING LAB-I

Credits		
L	**T**	**P**
0	0	2

Programming exercises on courses in the semester.

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ECL191: ELECTRONICS FUNDAMENTALS

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Elementary electrical circuit theory: Ideal voltage and current sources. Resistance and Ohm's law. Series and parallel resistance. Kirchoff's law and solution of simple resistive networks. Maximum power transfers condition for a battery. Theyenin's theorem and simple application. Norton's theorem-statement only. Functions and use of a multimeter. Capacitor and its properties. Charging a capacitor with constant current. Characteristics of an RC circuit (qualitative only, no differential equation). Time constant of an RC circuit. Properties of a pure inductor (10pds).

Periodic waves. Use oscilloscope to view periodic waveforms (concept only). Concept of phase frequency and amplitude. Alternating current. Impedance of resistor, capacitor and inductor in series (algebraic expression only). Resonance in an LC series circuit, frequency response. Resonance in LC parallel circuit frequency response

UNIT-II

Diode & Triode. Properties and limitations of a real semiconductor diode and triode. Rectification by diode bridge filtering concepts. Components and function of an unregulated DC power supply. Zener diode and its use 5 MPS. Concept of transistor, IC, VLSI etc.

Amplifier Concepts: Ideal Voltage and Current amplifier. Amplifiers in cascade. Voltage and power gain Gain dB Feed back concept Operational amplifier in summing amplifier configuration. Voltage follower. An AF amplifier using operational amplifier. Frequency response of an audio amplifier

UNIT-III

Electronic components and assembly using a printed circuit board. Elementary concept of Integrated circuits. Typical characteristics and use of an IC power amplifier.

Principles of Radio, FM & AM. Concept of tuning. Block diagram of a Radio. Frequency Bands used for Radio, TV and satellite communication

Principles of Ups, Inverters, Grounding.

Reference:

1. S.S. Bhatti, Electronics (Basic Book)

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – I
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Subject Code: ENL–101 Duration of Examination: 3 Hrs
Course Title: **Communicative English** Credits: 02 (L=2,T=0,U=0)

Objective: To introduce students to the skills and strategies of reading and writing by identifying organizational patterns, spotting classification systems and understanding associations between ideas. This course will prepare students to read a variety of texts and also to communicate more effectively through writing. The course will also pay special attention to vocabulary building.

Prescribed Text books:

1. *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.
2. *The Written Word* by Vandana R. Singh, Oxford University Press, New Delhi.

Course Contents:

1. Reading and Comprehension Skills:

Students will be required to read and comprehend the essays in Unit 1 and 2 of the book *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition. They will be required to answer the questions given after each essay.

2. Developing Vocabulary and using it in the Right Context:

The students will be required to master "Word List" and "Correct Usage of Commonly Used Words and Phrases" from the Chapter "Vocabulary" in the book *The Written Word.*

3. Writing Skills

Students will be required to learn "Report Writing" and "Letter Writing" as in the book *The Written Word.*

Students will be required to write long essays based on the prescribed text book *Making Connections: A Strategic Approach to Academic Reading.*

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Minor 1:

Syllabus to be covered:

1. Unit 1 from *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.
2. Report Writing from *TheWritten Word.*

Suggested Paper Pattern:

1. Report Writing (8 Marks)
2. Short answer type questions from Unit 1 of *Making Connections: A Strategic Approach to Academic Reading* (6 Marks)
3. Essay type question from Unit 1 of *Making Connections: A Strategic Approach to Academic Reading* (6 Marks)

Minor 2:

Syllabus to be covered:

1. "Word List" from the Chapter "Vocabulary" in the book *The Written Word.*
2. Unit-2 from the book *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.

Suggested Paper Pattern:

1. Word List from the Chapter "Vocabulary" in the book *The Written Word* (8 Marks)
2. Short answer type questions from Unit 2 of *Making Connections: A Strategic Approach to Academic Reading* (6 Marks)
3. Essay type question from Unit 2 of *Making Connections: A Strategic Approach to Academic Reading* (6 Marks)

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Suggested Paper Pattern for Major Exam:

1. Letter Writing as prescribed in *The Written Word* /1 out of 2 (10 Marks)
2. Short answer type questions from Unit 1,2 of *Making Connections: A Strategic Approach to Academic Reading* (14 Marks)
3. "Word List" and "Correct Usage of Commonly Used Words and Phrases" from the Chapter "Vocabulary" present in the book *The Written Word.* (10 Marks)
4. Essay type question from Unit 1,2 of *Making Connections: A Strategic Approach to Academic Reading* 1 out of 2 (8 Marks)
5. Report Writing from *The Written Word* (8 Marks)

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MTL111: MATHEMATICS – I

Credits		
L	**T**	**P**
3	1	0

CALCULUS

UNIT-I

Limit and Continuity on Real Line: Real line, intervals, lub and glb. The lub property of real numbers. Order properties of real number. Absolute values and related inequalities. Extended real number system. Limits of real-valued functions of a real variable. Algebra of limits, one sided limits. Continuous functions and their continuity. Sign of a function in a neighbourerhood of a point of continuity. Statements and applications of intermediate-value theorems.

UNIT-II

Applications of Derivatives and Curve Tracing: Maxima and minima. Continuity of inverse functions defined on intervals. Leibnitz theorem. Mean value theorems. Taylor's formula. Taylor series. Approximations, Increasing and decreasing functions. Indeterminate forms. Convexity, concavity, asymptotes and curve tracing.. Tracing parametric curves. Curvature of a parametric curve. derivatives of inverse functions. Hyperbolic and inverse hyperbolic functions and their derivatives.

UNIT-III

Indefinite and Definite Integrals: Reduction formulae for integrands of the type: $x^m(\log x)^n$, $x^m \cos^n x$, $x^m \sin^n x$, $\sin^m x \cos^n x$. Integrals involving inverse trigonometric and hyperbolic functions. Definite integrals (Cartesian, parametric). lengths of arc, area bounded between curves, numerical integrations: Trapezodial Rule and Simpson's Rule.

Books Recommended:

1. Kreyszig Erwin: Advanced Engineering Mathematics
2. B.S.Grewal: Higher Engineering Mathematics

CSC1: MCA (5 Years & 6 Months Integrated Programme) Electives – I
(Under Credit Based Continuous Evaluation Grading System)

PBL121: pj`bl l`zml – **I**

p`T-km Eq p`T-psqk-

Credits: 2–0–0

(I) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kh`xlk`r :

(a) grmK isG ms`iPr : gt`r
(E) sj`n isG : pT`x dl Dl
(e) krq`r isG dgl : acl Efl v`ll grg`bl
(kh`xl-s`r, ivS`-vsq, kh`xl-kl`, kh`xlk`r)

2. grmKl ErQgr`Pl dl jgq, (plql; mh`rnl; ibdl, itpl q EDk); ivr`m icn, Sbd jV (SD-ESD)

(II) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kh`xlk`r :

(a) sqK isG Dlr : s-Jl kD
(E) klvq isG ivrk : aj`V
(e) mihdr isG srn` : jQd`r mkd isG
(kh`xl-s`r, ivS`-vsq, kh`xl-kl`, kh`xlk`r)

2. lK rcn` (jlvnl-prk, sm`jk Eq clq iviSE- aq):
10 lK ilKv`ax (kl`s ivc Eq Gr lel EiBE`s)

(III) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kh`xlk`r :

(a) pm pk`S : m`V` bd`
(E) glz`r isG sD : klCx
(e) mhn Bf`rl : Gtx`
(s) virE`m isG sD : dldl
(kh`xl-s`r, ivS`-vsq, kh`xl-kl`, kh`xlk`r)

2. pr` pV k pSn- d aqr dx`
(E`qm En`qm psqk d kh`xl B`g ivcl 15 pirE- d EiBE`s krv`ax)

CSC1: MCA (5 Years & 6 Months Integrated Programme) Electives – I
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PBL-122: ਮੁੱਢਲੀ ਪੰਜਾਬੀ

(In lieu of Punjabi Compulsory)

2–0–0

ਪਾਠ–ਕ੍ਰਮ

1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ,
   ਗੁਰਮੁਖੀ ਲਿਪੀ
   ਗੁਰਮੁਖੀ ਲਿਪੀ : ਬਣਤਰ ਅਤੇ ਤਰਤੀਬ

2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ
   ਸੁਰ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ
   ਵਿਅੰਜਨ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ

3. ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ
   ਸਾਧਾਰਨ ਸ਼ਬਦ
   ਇਕ ਉਚਾਰਖੰਡੀ ਸ਼ਬਦ

ਯੂਨਿਟ ਅਤੇ ਥੀਮ

1. ਪੰਜਾਬੀ ਭਾਸ਼ਾ : ਨਾਮਕਰਣ ਅਤੇ ਸੰਖੇਪ ਜਾਣ ਪਛਾਣ, ਗੁਰਮੁਖੀ ਲਿਪੀ : ਨਾਮਕਰਣ, ਗੁਰਮੁਖੀ ਵਰਣਮਾਲਾ; ਪੈਂਤੀ ਅੱਖਰੀ, ਅੱਖਰ ਕ੍ਰਮ, ਸੁਰ ਵਾਹਕ (ਓ ਅ ਏ), ਲਗਾਂ ਮਾਤਰਾਂ, ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣ, ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣ, ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ।

2. ਗੁਰਮੁਖੀ ਆਰਥੋਗ੍ਰਾਫੀ ਅਤੇ ਉਚਾਰਨ; ਸੁਰਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ (ਲਘੂ–ਦੀਰਘ ਸੁਰ); ਸੁਰ ਅਤੇ ਲਗਾਂ ਮਾਤਰਾਂ; ਵਿਅੰਜਨਾਂ ਦੀ ਬਣਤਰ ਅਤੇ ਉਚਾਰਨ; ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਣਾਂ (ਹ, ਰ, ਵ) ਦਾ ਉਚਾਰਨ ; ਲ ਅਤੇ ਲ਼ ਦਾ ਉਚਾਰਨ; ਭ, ਧ, ਢ, ਝ, ਘ ਦਾ ਉਚਾਰਨ; ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਣਾਂ ਦਾ ਉਚਾਰਨ।

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3. ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ : ਸਾਧਾਰਨ ਸ਼ਬਦ; ਇਕੱਲਾ ਸੁਰ (ਜਿਵੇਂ ਆ); ਸੁਰ ਅਤੇ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਆਰ); ਵਿਅੰਜਨ ਅਤੇ ਸੁਰ (ਜਿਵੇਂ ਪਾ); ਵਿਅੰਜਨ ਸੁਰ ਵਿਅੰਜਨ (ਜਿਵੇਂ ਪਾਰ); ਕੋਸ਼ਗਤ ਸ਼ਬਦ (ਜਿਵੇਂ ਘਰ, ਪੀ); ਵਿਆਕਰਣਕ ਸ਼ਬਦ (ਜਿਵੇਂ ਨੂੰ, ਨੇ); ਪੰਜਾਬੀ ਸ਼ਬਦ ਰਚਨਾ–1; ਲਿੰਗ-ਪੁਲਿੰਗ, ਇਕ ਵਚਨ-ਬਹੁ ਵਚਨ; ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ–1: ਖਾਣ-ਪੀਣ, ਸਾਕਾਦਾਰੀ, ਰੁੱਤਾਂ, ਮਹੀਨਿਆਂ, ਗਿਣਤੀ, ਮੌਸਮ ਆਦਿ ਨਾਲ ਸੰਬੰਧਿਤ।

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SCHEME

Semester-II					
1.	CSL121	Numerical Methods	3	1	0
2.	CSL122	Data Base Management System	3	1	0
3.	CSL123	Data Structure & File Processing	3	1	0
4.	CSL124	Object Oriented Programming C++	3	1	0
5.	CSP120	Programming Lab-II	0	0	2
6.	ENL151	Communicative English	2	0	0
7.	MTL112	Mathematics-II	3	1	0
8.		Elective-II	2	0	0
		Sub Total:	**19**	**5**	**2**
		Grand Total:	**26**		
		List of Electives-II			
1.	PBL 131	Punjabi Compulsory OR	2	0	0
2.	PBL 132	Basic Punjabi (Mudhli Punjabi)	2	0	0

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CSL121: NUMERICAL METHODS

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Introduction

1. Numerical Methods, Numerical methods versus numerical analysis, Errors and Measures of Errors.
2. Non-linear Equations, Iterative Solutions, Multiple roots and other difficulties, Interpolation methods, Methods of Bi-section, False position method, Newton Raphson-method.

UNIT-II

3. Simultaneous solution of equations, Gauss Elimination Method Gauss Jordan Method, Gauss Seidel Method.
4. Interpolation and Curve Fitting, Lagrangian Polynomials, Newton's Method: Forward Difference Method, Backward Difference Method Divided Difference Method.

UNIT-III

5. Numerical Integration and Different Trapezoidal Rule, Simpson's '3 Rule Simplson's 3/8 Rule.
6. Numerical differentiation by Polynomial Fit.

Reference:

1. R.S. Salaria: Computer Oriented Numerical Methods, Khanna Publishing Company (P) Ltd., New Delhi.
2. V. Rajaraman: Computer Oriented Numerical Methods, Prentice Hall of India Pvt. Ltd., New Delhi.

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CSL122: DATA BASE MANAGEMENT SYSTEM

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Overview: Database, Database Management System, Advantages and disadvantages of DBMS, DDL, DML, Data Dictionary, Database System Structure, DBA, responsibilities of DBA.
Three level ANSI-SPARC Architecture, Schemas, Mapping, instances and Database Independence.

UNIT-II

Entity-Relationship model, Relational Model, Keys, Integrated constraints.
Relational Algebra, Relational Calculus, Introduction to SQL, Normalization: 1NF, 2NF, 3NF, BCNF.

UNIT-III

Concurrency Control and its management, security and recovery of database.
Basic concepts of object-oriented DBMS, Comparison of RDBMS and OODBMS.

References:

1. Silberschatz, Korth, Sudershan "Database System Concepts" 4th Ed. McGraw Hill
2. Connolly & Begg "Database Systems – A practical approach to design, Implementation and Management, 3rd Ed. Pearson Education.
3. Parteek Bhatia and Gurvinder Singh, "Simplified Approach to DBMS", Kalyani Publishers.
4. Elmarsi & Navathe "Fundamentals of Database Systems" 4th Ed. Pearson Education.
5. C.J.Date "Introduction to database system".

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CSL123: DATA STRUCTURE AND FILE PROCESSING

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Basic Data Structures
Introduction to elementary Data Organization and operations complexity of Algorithms and Time space trade off, string processing Arrays, Stacks, Linked Lists.
Searching Techniques
Linear and Binary Search

UNIT-II

Queues, Trees (Binary Trees & Binary Search Trees), Graphs and Algorithms to manipulate them.
Sorting Techniques
Bubble Sort, selection sort, insertion sort, quick sort, merge sort, heap sort.

UNIT-III

File Organization
Concept of field, record, file, blocking and compaction.
File Organization Techniques
Sequential indexed, indexed sequential, Direct, Hashing, Concept of master and transaction files.

Text / References:

1. Data Structure – Seymour Lipschutz, Schaum Outline Series.
2. File Structures & Data Structures by E.Loomis
3. Data Structures by Trabley & Soreuson.

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CSL124: OBJECT ORIENTED PROGRAMMING C++

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Getting Started:
Introduction. A brief history of C++, Variable, Constant, Expression, Statements, Comments and keywords of C++,
Operator: Arithmetic, Relational, Logical, Assignment, Increment/Decrement, Conditional, Precedence of Operators, Data type, Type conversion, library function.
Input/Output Statements: Inputting using in and outputting using cout statements, Preprocessor directives
Basic Program construction.A complete C++ program: invoking Turbo C++, naming your program, using the editor, saving your program, compiling and linking, running the program
Errors: Compiler, linker and runtime.
Other IDE features: Compiling and linking shortcut existing from IDE, examining files, opening an existing file, DOS shell.
Decision Making and Looping statement:
If statement, if.....else statement, nesting of if statement, switch statement, conditional operator statement. While loop, do loop, for loop, nesting of loops, break and continue statement, go to statement.
Arrays:
Defining an array, array type, array elements, Accessing and averaging array elements, initializing array, Programming of C++ with array, String handling, array of strings

UNIT-II

Functions:
What is a function?Declaring and defining function, Local, global variables, execution of function, Passing argument to function, Return values, Reference arguments, Overloading functions, Inline function and default parameter, Variable and storage classes.
Object Oriented Programming:
Objects & Classes, Constructor & Destructor
Operator Overloading: Overloading unary operators, Overloading binary operators, Data conversion, Pitfalls operator overloading and conversion
Inheritance: Derived class and Base Class, Derived Class Constructors, Overriding member functions, Inheritance in English distances class, class hierarchies, Public & Private inheritance, Level of inheritance
Polymorphism: Problems with single inheritance, Multiple inheritance.

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UNIT-III

Structures: A simple structure, specifying the structure, defining a structure variable Accessing Structure member

Other structure features, Structure within structure, Structure and classes, Arrays of structure

Pointers: Addresses and pointers, Pointers and Arrays, Pointers and Functions, Pointers and Strings, Pointer to objects, Pointer to pointers.

Files & Streams: Overview of streams, String I/O, character I/O, Object I/O, I/O with multiple objects, File Pointers, Disk I/O with member functions, Redirections, Error handling, Command-line Argument

Books:

1. C++ & Graphics by Vijay Mukhi's
2. Turbo C++ by Robert Lafore
3. Mastering C++
4. C++ Programming language by Saucham's outline series

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CSP120: PROGRAMMING LABORATORY – II

Credits		
L	**T**	**P**
0	0	2

Based on C++ Programming language, Based on numerical methods and statistical techniques

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – II
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Subject Code: ENL–151	Duration of Examination : 3 Hrs
Course Title: **Communicative English**	Credits : 02 (L=2,T=0,U=0)

Objectives: To equip students with the skill of reading and writing dexterously. By the end of the course the students will be skilled in the art of expressing their ideas in short and long compositions, noting information effectively and summarizing and abstracting more efficiently.

Prescribed Text books:
1. *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.
2. *The Written Word* by Vandana R. Singh, Oxford University Press, New Delhi.

Course Contents:

1. Reading and Comprehension Skills:

Students will be required to read and comprehend the essays in Unit 3 and 4 of the book *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition. They will be required to answer the questions given after each essay.

2. Writing Skills

Students will be required to learn Paragraph and Essay Writing and Note Making, Summarizing and Abstracting as in the book *The Written Word* by Vandana R. Singh, Oxford University Press, New Delhi.

Minor 1:

Syllabus to be covered:
1. Unit 3 from *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.
2. ABC of Good notes, Sub dividing your Notes and Summarizing and abstracting included in the Chapter "Note Making, Summarizing and Abstracting" from *The Written Word.*

Suggested Paper Pattern:
1. Theoretical questions based on ABC of Good notes, Sub dividing your Notes and Summarizing and abstracting included in the Chapter "Note Making, Summarizing and Abstracting" *The Written Word* (8 marks).
2. Short answer type questions from Unit 3 of *Making Connections: A Strategic Approach to Academic Reading* (6 marks).
3. Essay type question from Unit 3 of *Making Connections: A Strategic Approach to Academic Reading* (6 marks).

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Minor 2:

Syllabus to be covered:

1. Abbreviations and Symbols and Note making in practice from the chapter "Note-Making, Summarizing and Abstracting in the book *The Written Word*

2. Unit-4 from the book *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.

Suggested Paper Pattern:

1. A practical question on Note making in practice "Note-Making, Summarizing and Abstracting" from the chapter the book *The Written Word* (8 marks)

2. Short answer type questions from Unit 4 of *Making Connections: A Strategic Approach to Academic Reading* (6 marks)

3. Essay type question from Unit 2 of *Making Connections: A Strategic Approach to Academic Reading* (6 marks)

Suggested Paper Pattern for Major Exam:

1. Practical Question on Paragraph and Essay Writing as prescribed in *The Written Word* / 1 out of 2 (10 Marks)
2. Short answer type questions from Unit 3,4 of *Making Connections: A Strategic Approach to Academic Reading* (16 Marks)
3. Essay type question from Unit 3,4 of *Making Connections: A Strategic Approach to Academic Reading* 1 out of 2 (10 Marks)
4. Practical Question on Note Making from *The Written Word* (8 Marks)
5. Theoretical Question(s) based on the two chapters from the book *The Written Word* (6 Marks)

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MTL112: MATHEMATICS – II

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Matrices and Determinants: Introduction and defination of metrics, types of matrices, matrix addition and scaler multiplication transpose and inverse of matrix, solution of system of linear equations, definition and properties of determinants (statements only), characteristics polynomial, eigen values, nature of eigen values, certain types of matrices, Cayley-Hamilton theorem. Canonical forms of matrices.

UNIT-II

Logic, Lattice and Boolean Algebra: Logic operators like AND, OR, NOT, etc. truth tables, logical identities, theory of inference and deduction, mathematical induction, predicate calculus predicates and quantifiers. Lattice as a partial ordered set, properties of lattice, Boolean algebra, representation and minimization of Boolean algebra, finite state machine.

UNIT-III

Probability and Statistics: Mathematical and statistical probability, axiomatic approach to probability, law of addition of probability, dependence of events, Baye's theorem. Origin and development of statistics, definition of statistics and scope of statistics, frequency distribution, graphical representation of frequency distribution, measures of central tendency, requisites for an ideal measure of central tendency, measure of dispersion, coefficient of dispersion, moments, skewness, kurtosis. Coefficient of co-relation, effect of change of origin in scale, rank co-relation coefficient, lines of regression, curve of regression, angle between the lines of regression.

Books Recommended:

1. Trembley, J.P. and Manohar R.P., Discrete Mathematical Statistics with Application to Computer Science.
2. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics.
3. Allan Doerr: Applied Discrete Structures for Computer Science.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Electives – II
(Under Credit Based Continuous Evaluation Grading System)

PBL-131: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ–II

p`T-km Eq p`T psqk-

Credits: 2-0-0

(I) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT- ilK kvl :

(a) B`el vlr isG
(E) p: prn isG
(e) p: mhn isG
(kivq`-s`r, ivS`–vsq, k`iv-kl`, kvl)

2. pj`bl Sbd bxqr : D`q/ml, vDqr (Egqr, ipCqr, ivalqpq Eq rp-qrl), sm`s |

(II) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kvl :

a. Eimq` plqm
(E) f`. hrBjn isG
(e) iSv km`r bt`lvl
(kivq`-s`r, ivS`-vsq, k`iv-kl`, kvl)

2. pr` rcn` : kl`s ivc 10 iviSE- (siBE`c`rk, D`rimk Eq r`jnlqk) q pr` rcn` d EiBE`s krv`ax |

(III) 1. E`qm En`qm (sp. virE`m isG sD Eq f`. sihdrblr isG, gr n`nk dv wnlvristl, Eimqsr) ivcl hT ilK kvl :

(a) f`. jsvq isG nkl
(E) f`. jgq`r
(e) f`. srjlq p`qr
(s) p`S
(kivq`-s`r, ivS`-vsq, k`iv-kl`, kvl)

2. mh`vr q EK`x (EK`x q mh`vr` kS ivc) 200 mh`virE- Eq 100 EK`x- n v`k- ivc vrqx d EiBE`s krv`ax (kl`s ivc q Gr lel) |

CSC1: MCA (5 Years & 6 Months Integrated Programme) Electives – II
(Under Credit Based Continuous Evaluation Grading System)

PBL-132: ਮੁੱਢਲੀ ਪੰਜਾਬੀ

(In lieu of Punjabi Compulsory)

2–0–0

ਪਾਠ–ਕ੍ਰਮ

1. ਪੰਜਾਬੀ ਸ਼ਬਦ–ਬਣਤਰ
   ਸੰਯੁਕਤ ਅਤੇ ਮਿਸ਼ਰਤ ਸ਼ਬਦ
   ਬਹੁ–ਉਚਾਰਖੰਡੀ ਸ਼ਬਦ

2. ਪੰਜਾਬੀ ਵਾਕ–ਬਣਤਰ
   ਸਾਧਾਰਨ–ਵਾਕ : ਕਿਸਮਾਂ
   ਸੰਯੁਕਤ–ਵਾਕ : ਕਿਸਮਾਂ
   ਮਿਸ਼ਰਤ–ਵਾਕ : ਕਿਸਮਾਂ

3. ਪ੍ਰਕਾਰਜੀ ਪੰਜਾਬੀ
   ਚਿੱਠੀ ਪੱਤਰ
   ਪੈਰ੍ਹਾ ਰਚਨਾ
   ਸੰਖੇਪ ਰਚਨਾ
   ਅਖਾਣ ਅਤੇ ਮੁਹਾਵਰੇ

ਯੂਨਿਟ ਅਤੇ ਥੀਮ

1. ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ : ਸੰਯੁਕਤ ਸ਼ਬਦ; ਸਮਾਸੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਲੋਕ ਸਭਾ); ਦੋਜਾਤੀ ਸ਼ਬਦ (ਜਿਵੇਂ ਕਾਲਾ ਸਿਆਹ); ਦੋਹਰੇ ਸ਼ਬਦ/ਦੁਹਰਰੁਕਤੀ (ਜਿਵੇਂ ਧੂੜ੍ਹ ਧਾੜ੍ਹ/ਭਰ ਭਰ), ਮਿਸ਼ਰਤ ਸ਼ਬਦਾਂ ਦੀ ਬਣਤਰ/ਸਿਰਜਨਾ; ਅਗੇਤਰਾਂ ਰਾਹੀਂ (ਜਿਵੇਂ ਉਪ ਭਾਸ਼ਾ), ਪਿਛੇਤਰਾਂ ਰਾਹੀਂ (ਜਿਵੇਂ ਰੰਗਲਾ), ਪੰਜਾਬੀ ਸ਼ਬਦ ਰਚਨਾ–2: ਪੜਨਾਵੀਂ ਰੂਪ, ਕਿਰਿਆ/ਸਹਾਇਕ ਕਿਰਿਆ ਦੇ ਰੂਪ; ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ–2: ਮਾਰਕੀਟ/ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਧੰਦਿਆਂ ਨਾਲ ਸੰਬੰਧਿਤ।

CSC1: MCA (5 Years & 6 Months Integrated Programme) Electives – II
(Under Credit Based Continuous Evaluation Grading System)

2. ਪੰਜਾਬੀ ਵਾਕ-ਬਣਤਰ : ਕਰਤਾ ਕਰਮ ਕਿਰਿਆ; ਸਾਧਾਰਨ ਵਾਕ, ਬਿਆਨੀਆ, ਪ੍ਰਸ਼ਨਵਾਚਕ, ਆਗਿਆਵਾਚਕ, ਸੰਯੁਕਤ ਅਤੇ ਮਿਸ਼ਰਤ ਵਾਕਾਂ ਦੀਆਂ ਕਿਸਮਾਂ; ਸੁਤੰਤਰ ਅਤੇ ਅਧੀਨ ਉਪਵਾਕ; ਸਮਾਨ (ਤੇ/ਅਤੇ) ਅਤੇ ਅਧੀਨ (ਜੋ/ਕਿ) ਯੋਜਕਾਂ ਦੀ ਵਰਤੋਂ; ਪੰਜਾਬੀ ਵਾਕਾਂ ਦੀ ਵਰਤੋਂ : ਵਿਭਿੰਨ ਸਮਾਜਕ/ਸਭਿਆਚਾਰਕ ਪ੍ਰਸਥਿਤੀਆਂ ਦੇ ਅੰਤਰਗਤ; ਘਰ ਵਿਚ, ਬਾਜ਼ਾਰ ਵਿਚ, ਮੇਲੇ ਵਿਚ, ਸ਼ੋਪਿੰਗ ਮਾਲ/ਸਿਨਮੇ ਵਿਚ, ਵਿਆਹ ਵਿਚ, ਧਾਰਮਿਕ ਸਥਾਨਾਂ ਵਿਚ, ਦੋਸਤਾਂ ਨਾਲ ਆਦਿ।

3. ਇਸ ਯੂਨਿਟ ਵਿਚ ਚਿੱਠੀ ਪੱਤਰ (ਨਿੱਜੀ/ਦਫ਼ਤਰੀ/ਵਪਾਰਕ), ਪੈਰਾ ਰਚਨਾਂ, ਸੰਖੇਪ ਰਚਨਾ ਅਤੇ ਅਖਾਣ ਮੁਹਾਵਰਿਆਂ ਦੀ ਵਰਤੋਂ ਰਾਹੀਂ ਵਿਦਿਆਰਥੀ ਦੀ ਭਾਸ਼ਾਈ ਯੋਗਤਾ ਨੂੰ ਪਰਖਿਆ ਜਾਵੇਗਾ।

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester System
(Under Credit Based Continuous Evaluation Grading System)

			Credits		
Sr. No.	***Sub Code***	***Subject***	**L**	**T**	**P**
Semester-III					
1.	CSL210	Operating System	3	1	0
2.	CSL211	Microprocessor and its Applications	3	1	0
3.	CSL212	Information Systems	3	1	0
4.	CSL213	Object Oriented Programming in Java	3	1	0
5.	CSP214	Programming Lab -III (USING JAVA)	0	0	2
6.	*ESL220	Environmental Studies (Compulsory)	3	0	0
7.		Interdisciplinary Course - I	4	0	0
8.	MTL211	Computer Based Optimization Techniques	3	1	0
		Sub Total:	**22**	**5**	**2**
		Grand Total:	**29**		

***Note: Credits will not be included in SGPA.**

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – III
(Under Credit Based Continuous Evaluation Grading System)

CSL210: OPERATING SYSTEM

Credits		
L	**T**	**P**
3	1	0

UNIT - I

Objectives
To enable the students to have understanding of the role & importance of Operating system in computing.

Course Contents:

Basic Contents:
History & evolution of operating system, OS as resource manager, Various views of OS.
Process Management:
State of Processes, Process scheduling, Race conditions, deadlocks, Bankers Algorithm, Precedence Graphs, Semaphores, Monitors.

UNIT-II

Memory Management:
Basic Memory Management Schemes, Partition Memory Management, Demand Paged Memory Management, Segmented Memory Management, Swapping, Hierarchy of Memory.
Device Management:
Dedicated Devices, Shared Devices, Virtual Devices, Channels, I/O Traffic Controller, I/O scheduler, I/O device handlers.

UNIT-III

Information Management:
Simple File System, Symbolic File System, Logical File System, Physical File System, Security of Files Systems.
Case Studies:
Networking Operating Systems, Windows NT, Windows 95, UNIX, OS/2 etc. to be discussed briefly.

References:

1. Madnick & Donovan: Operating System, McGraw Hill, 1973.
2. P.B. Henson: Architecture of concurrent programs, Prentice Hall, 1977.
3. J.L. Peterson, A.Silberchatz: Operating System Concepts, Addison Wesley, 1983.
4. A.C. Shaw: Logic Design of Operating System, Prentice Hall, 1974.
5. M.J. Bach, Design of UNIX Operating System, PHI, 1986
6. A.S.Tanenbaum: Operating System: Design and Implemenation, PHI, 1989.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – III
(Under Credit Based Continuous Evaluation Grading System)

CSL211: MICROPROCESSOR AND ITS APPLICATIONS

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Introduction:
Introduction to Microprocessor, General Architecture of Microcomputer System. Microprocessor Units, Input unit, Output unit, Memory unit and auxiliary storage unit.

Architecture of 8086/8088 Microprocessor
Description of various pins, configuring the 8086/8088 microprocessor for minimum and maximum mode systems, Internal architecture of the 8086/8088 microprocessor, system clock, Bus cycle, Instruction execution sequence.

UNIT-II

Memory Interface of 8086/8088 Microprocessor
Address space and data organization, generating memory addresses hardware organization of memory address space, memory bus status code, memory control signals, read/write bus cycles, program and data storage memory, dynamic RAM system.

UNIT-III

Input/Output Interface of the 8086/8088 Microprocessor:
I/O interface, I/O address space and data transfer, I/O instructions, I/O bus cycles, Output ports, 8255A Programmable Peripheral Interface (PPI), Serial communication interface (USART and UART) – the RS-232 C interface.
Interrupt Interface of 8086/8088 Microprocessor, Types of Interrupt, Interrupt Vector Table (IVT).

References:

1. Walter Triebel: The 8086 Microprocessor – Architecture, Software and Interfacing Techniques, PHI, Delhi.
2. Walter Triebel: The 8088 Microprocessor – Architecture, Software and Interfacing Techniques, PHI, Delhi.
3. Douglas V. Hall: Microprocessors and Interfacing – Programming and Hardware, Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Peter Abel: IBM PC Assembly Language and Programming, PHI, Delhi.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – III
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CSL212: INFORMATION SYSTEMS

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Introduction to System theory, Types of Systems, Concepts of Information, Attributes of Information, Evolution of Information Systems, Categories of Information Systems, System Development Life Cycle.
Introduction to Management Information Systems, Fundamental Types of Management Information systems,

UNIT-II

Organization and Information systems, Management decision making, Personal Information system, Workgroups Information systems, Organizational Information systems.
Decision Support Systems, Conceptual foundations of decision support systems, concepts of DSS,

UNIT-III

Introduction to Expert system and Executive support systems.
Introduction to E-commerce, Perspective of E-commerce, Conceptual framework of E-commerce, How E-commerce works, Public information, private information, Firewalls, Encryption, Secret Kay, Public key, Digital signatures.

References:

1. Kroenke: Management Information Systems, Mc-Graw Hill, 1989.
2. Mudrick R.G., Ross, J.E. & Gleggt, J.R.: Information Systems for Modern Management 3rd Edition, Prentice-Hall of India, 1987.
3. Jayashankar: Decision Support Systems, Mc-Graw Hill, 1986.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – III
(Under Credit Based Continuous Evaluation Grading System)

CSL213: OBJECT ORIENTED PROGRAMMING IN JAVA

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Evolution of Java
Importance of JAVA to Internet, Features of JAVA, Bytecode, Object Oriented Approach.
Data Types, Variables and Arrays
Data types, Declaration of Variable, Type Conversion and Casting, One Dimensional and Multidimensional arrays
Operators and Control Structures
Arithmetic, Bitwise, Relational, Boolean, Assignment Operators, Operator precedence, Selection Statements, Iteration Statements, Jump statements.

UNIT-II

Classes
Class Fundamentals, Declaring objects, introducing methods, constructors, this keyword, Overloading constructors, Recursion, Nested and Inner classes.
Inheritance
Basics, Creating Multilevel hierarchy, Method Overriding, Abstract Classes.

UNIT-III

Packages and Interface
Packages, Access Protection, Importing Packages, Interfaces, Defining, Implementing, Applying Interfaces, Extending Interfaces
Exception Handling
Fundamentals, Exception Types, uncaught exceptions, try and catch.

References:

1. Patrick Naughton & Herbert Schildt: The Complete Reference Java 2, Tata McGraw Hill Edition.
2. Balagurusamy: Programming in JAVA, Tata McGraw Hill, 2004.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – III
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CSP214: PROGRAMMING LAB-III (USING JAVA)

Credits		
L	**T**	**P**
0	0	2

Practical based on Java

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – III
(Under Credit Based Continuous Evaluation Grading System)

ESL220: ENVIRONMENTAL STUDIES (COMPULSORY)

CREDITS		
L	**T**	**P**
3	0	0

1. **The multidisciplinary nature of environmental studies:** Definition, scope & its importance, Need for public awareness.

2. **Natural resources**: Natural resources and associated problems.

   a) **Forest resources**: Use of over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

   b) **Water resources**: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

   c) **Mineral resources**: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

   d) **Food resources**: World food problems, change caused by agriculture and overgrazing, effects or modern agriculture, fertilizer-pesticide problem, salinity, case studies.

   e) **Energy resources**: Growing of energy needs, renewable and non-renewable energy resources, use of alternate energy sources, case studies.

   f) **Land recourses**: Land as a resource, land degradation, soil erosion and desertification.

   g) Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.

3. Ecosystem:

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystems:

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

4. Biodiversity and its Conservation:

Definition: Genetic, species and ecosystem diversity, Biogeographical classification of India.

Value of Biodiversity: Consumptive use; productive use, social, ethical, aesthetic and option values.

Biodiversity of global, National and local levels, India as mega-diversity nation "Hot-spots of biodiversity.

Threats to Biodiversity: Habitat loss, poaching of wild life, man wildlife conflicts

Endangered and endemic species of India.

Conservation of Biodiversity: In situ and Ex-situ conservation of biodiversity.

5. Environmental Pollution:

Definition, Causes, effects and control measures of:

a) Air Pollution
b) Water Pollution
c) Soil Pollution
d) Marine Pollution
e) Noise Pollution
f) Thermal Pollution
g) Nuclear Hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies Disaster Management: Floods, Earthquake, Cyclone and Landslides

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6. Social Issues and Environment:

* From unsustainable to sustainable development
* Urban problems related to energy
* Water conservation, rain water harvesting, watershed management
* Resettlement and rehabilitation of people; its problems and concerns. Case studies
* Environmental ethics: Issues and possible solutions.
* Climate change, global warning, acid rain, ozone layer depletion, nuclear accidents and holocause. Case studies.
* Wasteland reclamation
* Consumerism and waste products
* Environmental Protection Act
* Air (prevention and Control of Pollution) Act
* Water (prevention and Control of Pollution) Act
* Wildlife Protection Act
* Forest Conservation Act
* Issues involved in enforcement o£. environmental legislation
* Public awareness

7. Human population and the environment

* Population growth, variation among nations
* Population explosion-Family welfare programme
* Environment and human health
* Human rights
* Value education
* HIV / AIDS
* Women and child welfare
* Role of information technology in environment :and human health
* Case studies

*** Road Safety Rules & Regulations:** Use of Safety Devices while Driving, Do's and Don'ts while Driving, Role of Citizens or Public Participation, Responsibilities of Public under Motor Vehicle Act, 1988, General Traffic Signs

*** Accident & First Aid:** First Aid to Road Accident Victims, Calling Patrolling Police & Ambulance

8. Field Work: Visit to a local area to document environmental assets–river / forest / grassland / hill / mountain. Visit to a local polluted site–Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems–pond, river, hill slopes, etc. (Field work equal to 5 lecture hours)

References:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.
2. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Bharucha, E. 2004. The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad.
4. Brunner, R. C. 1989. Hazardous Waste Incineration, McGraw Hill Inc. New York.
5. Clark, R. S. 2000. Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W. P., Cooper, T. H., Gorhani, E. & Hepworth, M. T. 2001. Environmental Encyclopedia, Jaico Publications House, Mumbai.
7. De, A. K. 1989. Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment, New Delhi.
9. Hawkins, R. E. 2000. Encyclopedia of Indian Natural History, Bombay Natural History Society.
10. Heywood, V. H & Waston, R. T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.
11. Jadhav, H. & Bhosale, V. M. 1995. Environmental Protection and Laws. Himalaya Pub.
12. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
13. Kaushik, A. & Kaushik, C. P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
14. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
15. Odum, E. P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA.
16. Rajagopalan, R. 2005. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
17. Sharma, B. K. 2001. Environmental Chemistry. Geol Publishing House, Meerut.
18. Sharma, J. P. 2004. Comprehensive Environmental Studies, Laxmi Publications (P) Ltd, New Delhi.
19. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.
20. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi.
21. Survey of the Environment. 2005. The Hindu.
22. Tiwari, S. C. 2003. Concepts of Modern Ecology, Bishen Singh Mahendra Pal Singh, Dehra Dun.
23. Townsend, C., Harper, J. and Michael, B. 2001. Essentials of Ecology, Blackwell Science.
24. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex, Amritsar.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – III
(Under Credit Based Continuous Evaluation Grading System)

MTL211: COMPUTER BASED OPTIMIZATION TECHNIQUES

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Linear Programming: Mathematical formation of linear programming problem. Solution by graphical and simplex method, Two Phase & Big M- method, Revised simplex method, Dual Simplex Method. Transportation and assignment problems, Travelling Salesmen Problems Optimality, Degeneracy & unbalanced.

(15 Lectures)

UNIT-II

Integer, Dynamic and Goal Programming: Integer programming problem, Branch and found techniques, Dynamic programming: Recursive equation approach, Characteristics, Tabular Method Deterministic & Probabilistic. Goal programming: Model Formulation, Weighted goals, Graphical Method, Interpretation & Optimal modified simplex solutions.

(15 Lectures)

UNIT-III

Non-Linear Programming: General Non-LPP, Optimizing Non-Linear functions, Search & Gradient Methods, Graphical solution, Quadratic programming.

(15 Lectures)

Books Recommended:

1. Kapoor, V.K.: Operation Research, Sultan Chand & Co., New Delhi.

2. Manmohan Gupta, P.K.: Operation Research, Sultan Chand & Co., New Delhi.

3. Pronsen, Richard: Theory and Problems of Operation Research, McGraw Hill, 1983.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester System
(Under Credit Based Continuous Evaluation Grading System)

			Credits		
Sr. No.	***Sub Code***	***Subject***	**L**	**T**	**P**
Semester-IV					
1.	CSL220	Data Communications	3	1	0
2.	CSL221	Software Engineering	3	1	0
3.	CSL222	Theory of Computer Science	3	1	0
4.	CSL223	RDBMS Using ORACLE (SQL, PL/SQL)	3	1	0
5.	CSP224	Programming Lab-IV	0	0	2
6.		Interdisciplinary Course -II	4	0	0
		Sub Total:	**16**	**4**	**2**
		Grand Total:	**22**		

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – IV
(Under Credit Based Continuous Evaluation Grading System)

CSL220: DATA COMMUNICATIONS

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Introduction to computer networks, LAN, MAN, WAN and network topologies, Concepts of Layer protocols and layer interfaces, OSI reference model and TCP/IP reference model.
Transmission Media, Communication Satellites, Multiplexing,

UNIT-II

Circuit Switching and Packet Switching and Message Switching.
Data Link Layer Design Issues: Framing, Error Control and Flow control.

UNIT-III

LAN Protocols: Ethernet, Token bus, and Token ring.
Comparison of Virtual-Circuit and Datagram subnets, Concepts of routing and congestion control, Simple routing algorithms.

References:

1. Tanenbaum A.S.: Computer Networks, 4th Ed., Pearson Education.
2. Fourozan: Data communications, Tata McGraw Hill.
3. Lehnert: Internet 101, 1st Ed., Pearson Education.
4. Stevens TCP/IP Illustrated, Vol. 1, Pearson Education.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – IV
(Under Credit Based Continuous Evaluation Grading System)

CSL221: SOFTWARE ENGINEERING

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Introduction
Principles of Software Engineering, Objectives of Software Engineering, Process & Product, Software Process Models.

UNIT-II

Technical Developments
Software Design Principles, System Design Methodology, Module Cohesion & Coupling, Design documentation, Detailed design & its specification, Documentation, Software maintenance.

UNIT-III

Introduction to CASE tools

References:

1. Pressman: Software Engineering – A Practitioner's Approach, McGraw Hill, 2005.
2. Pankaj Jalote: An Integrated Approach to System Software Engineering, Narosa Publications.
3. Ghezzi, Cario: Fundamentals of Software Engineering, PHI, 1994.
4. Sommerville, Ian: Software Engineering, 4th edition, Addison Wesley, 1992.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – IV
(Under Credit Based Continuous Evaluation Grading System)

CSL222: THEORY OF COMPUTER SCIENCE

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Basic Definitions
Operations on Languages: Closure properties of Language classes, Context Free Language: Chomsky & Greibach Normal forms, Linear Grammars and Regular Language, Regular Expressions, Context Sensitive Languages

UNIT-II

The Kuroda normal Form, One sided context Sensitive Grammars
LR (k) Grammars
Unrestricted Languages: Normal form and Derivation Graph, Automata & their Languages
Finite Automata
Pushdown Automata, 2-pushdown Automata

UNIT-III

Turing machines, the equivalence of the automata and appropriate grammars, the Dyck Language.
Undecidability: Recursive and Recursively Enumerable Languages, Rice Theorem, Post's Correspondence Problem.

References:

1. A.V. Aho, J.E: Hopcroft and J.D. Ullman, Introduction to Automata Languages and Computations. Addison Wesley, 1980.
2. Mishra Kolop: Ahandrasekaran, Theory of Computer Science (Automata, Languages & Computation); PHI, 2002.
3. H.R. Lewis and C.H. Papdimitrou, Elements of the Theory of Computation, Prentice Hall Inc., 1981.
4. V.J. Rayward Smith, 'A First Course on Computability, Blackwell Scientific Publications, Oxford, 1986.
5. M.Davis and E.J. Weyuker, Computability, Complexity and Languages, Academic Press, 1982.
6. D.Gries, Science of Programming, Springer Verlag, New York, 1981.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – IV
(Under Credit Based Continuous Evaluation Grading System)

CSL223: RDBMS USING ORACLE (SQL, PL/SQL)

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Database system architecture, data independence, normalization & normal forms.

UNIT-II

Managing Databases
Creating, defining and modifying table structure, Data constants, Oracle functions, Joins, subqueries, indexes, views, sequences, Granting & revoking permissions.

UNIT-III

PL/SQL
Introduction, execution environment, syntax, block structure, Oracle transactions, Cursors-implicit and explicit, stored procedures – syntax for creating procedure, an application using procedure, stored functions – syntax, applications, Triggers – row, statement before after combination, packages.

References:

1. Programming using SQL and PL/SQL – Ivan Bayross, BPB Publications, 2006.
2. Oracle Complete reference – Herbert Schidlt, Oracle Press, 2006.
3. Database Systems – Korth, McGraw Hill, 2006.
4. Database Systems – Elmasari Navathe, Addison Wesley Publishing Company, 2006.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – IV
(Under Credit Based Continuous Evaluation Grading System)

CSP224: PROGRAMMING LAB-IV

Credits		
L	**T**	**P**
0	0	2

Practical based on RDBMS (Relational Database Management Systems)

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester System
(Under Credit Based Continuous Evaluation Grading System)

Sr. No.	***Sub Code***	***Subject***	**L**	**T**	**P**
Semester-V					
1.	CSL310	Computer Graphics	3	1	0
2.	CSL311	Artificial Intelligence	3	1	0
3.	CSL312	Compiler Design	3	1	0
4.	CSL313	Advanced Java Technologies	3	1	0
5.		Interdisciplinary Course-III	4	0	0
6.	CSP315	Programming Lab-V	0	0	2
		Sub Total:	**16**	**4**	**2**
		Grand Total:	**22**		

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – V
(Under Credit Based Continuous Evaluation Grading System)

CSL310: COMPUTER GRAPHICS

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Preliminaries:
Basics of Computer Graphics, Computer graphics Hardware and Software.

2D Primitives:
Line drawing, circle drawing and simple line clipping algorithms.

UNIT-II

2D-Transformations:
Simple 2D-Transformations and their different representations, composite 2D-Transformations.

3D-Transformations:
Simple 3D-Transformations, composite 3D-Transformations.

UNIT-III

Hidden Surfaces:
Depth comparisons, Z-buffer algorithm, Scan line algorithms.

Projections:
Parallel Projections, Perspective Projections, Oblique Projections.

References:

1. Donald Hearn & M. Pauline Baker, *'Computer Graphics'*, Printice Hall of India Private Limited, 2008.
2. Foley, A. Van Dam. S. Feiner, and J. Hughes, '*Computer Graphics: Principles and Practice*', Addison-Wesley, 2006.
3. David F. Rogers, '*Procedural Elements for Computer Graphics*', McGraw Hill Book Company, 2006.
4. Roy A. Plastick & Cordon Kalley, '*Computer Graphics*', McGraw Hill Book Company, 2007.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – V
(Under Credit Based Continuous Evaluation Grading System)

CSL311: ARTIFICIAL INTELLIGENCE

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Introduction to AI
AI concept, Importance of AI, Evolution of AI, Related Fields of AI.
Knowledge
Introduction and Importance of Knowledge, Knowledge based systems, Knowledge Representation, First Order Predicate Logic (FOPL) , Syntax and Semantics of FOPL, Knowledge Organization and Manipulation.

UNIT-II

Natural Language Processing (NLP)
Introduction ,overview of linguistics, Grammars and Languages, Basic Parsing Techniques, syntactic Processing, Semantic Analysis, Natural Language Generation , Natural Language Systems.
Pattern Recognition
Introduction, Recognition and Classification Process, Learning Classification patterns, recognizing and understanding speech.

UNIT-III

Expert System
Introduction, Rule-Based Architectures, Nonproduction system architectures, Expert System Shells, Knowledge acquisition and Validation.
Learning
Introduction, Role of Learning, Types of Learning , General Learning Model, Performance Measures.

References :

1. Dan W. Patterson, *'Introduction to Artificial Intelligence and Expert Systems'*, Prentice-Hall India Private Limited, 2006.
2. Rich Knight, *'Artificial Intelligence'*, Tata McGraw Hill, 2007.
3. P H. Winston, *'Artificial Intelligence'*, (3rd Edition), Addison Wesley, 2006.
4. E Charniak and D Mcdermott, *'Introduction to Artificial Intelligence'*, Addison Wesley, 2004

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – V
(Under Credit Based Continuous Evaluation Grading System)

CSL312: COMPILER DESIGN

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Pre-requisites
Concepts of Programming Languages and Finite Automata.

Preliminaries
Basics of Compilers, Lexical Analysis.

Syntax Analysis
Parsers, top-down parsers, bottom-up parsers.

UNIT-II

Symbol Table Handling
Symbol table contents, operations on Symbol Tables, Organizations of Symbol Tables.

Storage Management
Static Storage Management, Dynamic Storage Management.

Code Generation
Code Generator, Code generation of simple programming constructs.

UNIT-III

Code Optimization
Local optimization, global optimization, loop optimization.

Introduction to Compiler-Compilers, incremental compilers.

References:

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman: *Compiler, Principles, Techniques and Tools*, Addision Wesley, 2006.
2. Tremblay J.P., Sorenson P.G., *The Theory and Practice of Compiler Writing*, Mc-Graw Hill, 2007.
3. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman: *Principles of CompilerDesign*, Narosa Publishing House, 2007.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – V
(Under Credit Based Continuous Evaluation Grading System)

CSL313: ADVANCED JAVA TECHNOLOGIES

Credits		
L	**T**	**P**
3	1	0

UNIT-I

Multithreaded Programming
The Java Thread Model, Thread Priorities, Synchronization , Interthread communication, Suspending Resuming and Stopping Threads.

Java I/O
I/O Basics, Streams, reading Console input and writing console output, PrintWriter class , Reading & writing Files , Byte Streams , Character Streams & Serialization.

UNIT-II

Applets
Applet basics, Applet Architecture , Applet :Display , Repaint , Parameter Passing.

Event Handling
The Delegation Event Model , Event Classes , Event Listener Interfaces

UNIT-III

AWT
Window Fundamentals , Working with Frame Windows, Graphics, Color and Fonts.

Servlets
Life Cycle of a Servlet , The Servlet API , Reading Servlet Parameters, Handling HTTP Requests and Responses, Cookies & Session Tracking.

References :

1. The Complete Reference – JAVA 2 by Ptrick Naughton & Herbert Schildt TMH Publications, 2007.
2. The Java Tutorial Continued by Compione, Walrath, Huml SUN JAVA Tutorial Team .Addison Wessley, 2007.
3. Java2 Black Book Steven Holzner OT Dreamtech Press, www.idgbooksindia.com, 2007.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – V
(Under Credit Based Continuous Evaluation Grading System)

CSP315: PROGRAMMING LAB-V

Credits		
L	**T**	**P**
0	0	2

Practical based on Advanced Java

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester System
(Under Credit Based Continuous Evaluation Grading System)

Semester-VI					
1.	CSE320	Major Project-I	**0**	**0**	**22**

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – VI
(Under Credit Based Continuous Evaluation Grading System)

CSE320: MAJOR PROJECT-I

Credits		
L	**T**	**P**
0	0	22

Ist synopsis (containing mainly literature survey corresponding to the problem taken up for the project work and line of attack to solve the problem) within one month (upto 31st March) of joining the training

IInd synopsis (containing essentially the progress of work in comparative details) with in three months (upto 15th May) of joining the training.
Final report submission: upto 30th June

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester System
(Under Credit Based Continuous Evaluation Grading System)

		Semester-VII	**Credits**		
Sr. No.	***Sub Code***	***Subject***	**L**	**T**	**P**
1.	CSL450	Design and Analysis of Algorithms	4	0	0
2.	CSL451	Object Oriented Analysis and Design	4	0	0
3.	CSL452	System Software	4	0	0
4.	CSL453	System Simulation	4	0	0
5.	CSP454	Programming Lab-VII	0	0	2
6.		Interdisciplinary IV	4	0	0
		Sub Total:	**20**	**0**	**2**
		Grand Total:	**22**		

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – VII
(Under Credit Based Continuous Evaluation Grading System)

CSL-450: DESIGN AND ANALYSIS OF ALGORITHMS

CREDITS		
L	**T**	**P**
4	0	0

UNIT-I

Algorithm concepts: Algorithm analysis, design of efficient algorithms, complexity analysis, asymptotic notation.

Design Strategies: Divide-and-conquer, Dynamic Programming,

UNIT-II

Greedy Method, Back-tracking, Branch-and-bound.

Sorting & Searching: Radix sorting, heap sort, quick sort, linear and binary search algorithms.

UNIT-III

Algorithms on Graphs: Minimum spanning tree. Depth/Breadth First search. Dijkstra's algorithm, The Bellman's Ford Algorithm.

Problem Classes: P, NP, NP-Hard and NP- Complete.

References :

1. Cormen T.H., Leiserson C.E., Rivest R.L., *Introduction to Algorithms*, PHI, 2000.
2. Horowitz E., Sahni S., Rajasekaran S., *Computer Algorithms*, Galgotia Publications, 1999.
3. Aho A.V., Hopcroft J.E. Ullman J.D., *The Design and Analysis of Computer Algorithms*, Pearson Education Asia, 1998, 1974
4. Knuth D.E., *The Art of Computer Programming, Volume 1 (Fundamental Algorithms)*, Narosa Publishing House, 1973
5. Knuth D.E., *The Art of Computer Programming, Volume 3 (Sorting and Searching)*, Addison–Wesley, 1973.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – VII
(Under Credit Based Continuous Evaluation Grading System)

CSL-451: OBJECT ORIENTED ANALYSIS AND DESIGN

CREDITS		
L	**T**	**P**
4	0	0

UNIT-I

Introduction
Introduction to Object Oriented concepts, comparison of object oriented vs Procedural software development techniques. Advantages of Object Oriented Methodology.

Modeling
Modeling as a Design technique, Object modeling technique.

Object Modeling
Object & Classes, Links & Associations, Generalization & Inheritance, Aggregation, Abstract Classes, example of an Object Model.

UNIT-II

Dynamic Modeling
Events and States, Operations, Nested State Diagrams, Concurrency, example of the Dynamic Model.

Functional Modeling
Functional Models, Data Flow Diagrams, Specifying Operations & Constraints, example of a Functional Model.

UNIT-III

Analysis & Design
Overview of Analysis, Problem Statement, example of Analysis Process using Object, Dynamic & Functional Modeling on an example system. Overview of System Design, Object Design, Design Optimization.

Implementation
Implementation of the design using a Programming Language or a Database System.
Comparison of Object Oriented vs Non Object Oriented Languages.

References :

1. "Object Oriented Modeling & Design" by James Rambaugh, Michael Balaha (PHI , *EEE*)
2. "Object Oriented Software Construction" Hertfordshire PHI International 1988.
3. "Object Oriented Programming" Brad J.Cox Addison Wessley,1986.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – VII
(Under Credit Based Continuous Evaluation Grading System)

CSL-452: SYSTEM SOFTWARE

CREDITS		
L	**T**	**P**
4	0	0

UNIT-I

Introduction to System Software — Evolution of System Software, components of system software, Translators, loaders, interpreters, compiler, assemblers.

Assemblers — Overview of assembly process, design of one pass and two assemblers.

UNIT-II

Macroprocessors — Macro definition and expansion, concatenation of macro parameters, generations of unique labels, conditional macro expansion, Recursive macro expansion.

Compilers — Phases of compilation process, lexical analysis, parsing, storage management optimisation. Incremental compilers, cross compilers, P code compilers.

UNIT-III

Loaders and Linkage editors — Basic loader functions. Relocation, program linking, linkage, editors, dynamic linking, bootstrap loaders.

References :

1. Leland L. Beck: System Software, An Introduction to System Programming, Addison Wesley.
2. D.M. Dhamdhere: Introduction to System Software, Tata McGraw Hill.
3. D.M. Dhamdhere: System Software and Operating System, Tata McGraw Hill, 1992.
4. Madrich, Stuarte: Operating Systems, McGraw Hill, 1974.
5. Stern Nancy Assembler Language Programming for IBM and IBM compatible computers, John Wiley, 1991.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – VII
(Under Credit Based Continuous Evaluation Grading System)

CSL-453: SYSTEM SIMULATION

CREDITS		
L	**T**	**P**
4	0	0

UNIT-I

Introduction : Concept of a system, stochastic activities, continue and discrete system, system modeling, mathematical modeling, principle used in modeling.

Simulation of Systems : Concepts of simulation of continuous systems with the help of two examples; use of integration formulas; concepts of discrete system simulation with the help of two examples, Generation of random numbers, Generation of non-uniformly distributed numbers.

UNIT-II

Simulation of Queuing Systems : Rudiments of queuing theory, Simulation of Single-Server queue, two-server queue, general queues.

Simulation in Inventory Control and Forecasting: Elements of inventory theory, inventory models, Generation of Poisson and Erlang variants, forecasting and regression analysis.

UNIT-III

Design and Evaluation of Simulation Experiments: Experimental layout and validation.

Simulation Languages: Continuous and discrete simulation languages, Block-Structured continuous simulation languages, expression based languages, discrete system simulation languages, Simscript, GPSS, SIMULA, factors in selection of a discrete system simulation languages.

References:

1. Narsingh Deo, “System Simulation with Digital Computer”, Prentice-Hall of India Pvt. Ltd. - 1993.
2. Gordon, “System Simulation”, Prentice Hall of India Pvt. Ltd. - 1993

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – VII
(Under Credit Based Continuous Evaluation Grading System)

CSP-454: PROGRAMMING LAB-VII

CREDITS		
L	**T**	**P**
0	0	2

Practical based on Object Oriented Programming and System Software.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester System
(Under Credit Based Continuous Evaluation Grading System)

Sr. No.	***Sub Code***	***Subject***	**L**	**T**	**P**
Semester – VIII					
1.	CSL460	Distributed Processing	4	0	0
2.	CSL461	Emerging Trends in Information Technology	4	0	0
3.	CSL462	Network Operating Systems	4	0	0
4.	CSL463	Data Communication – II	4	0	0
5.		Interdisciplinary – V	4	0	0
6.	CSP464	Programming Lab – VIII	0	0	2
		Sub Total:	**20**	**0**	**2**
		Grand Total:	**22**		

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – VIII
(Under Credit Based Continuous Evaluation Grading System)

CSL-460: DISTRIBUTED PROCESSING

CREDITS		
L	**T**	**P**
4	0	0

UNIT-I

Introduction — Definition, Characteristics, Goals and applications of Distributed Computing, Basic design issues and user requirements.

Interprocess Communication — Client Server Communication, Group Communication, IPC in UNIX, Remote Procedure Calls: Design issues and implementation.

UNIT-II

Distributed Operating Systems — Introduction, The Kernel, Process and Threads, Communication.

Distributed Transactions — Simple distributed transactions and Nested transactions, Atomic Commit protocols, Concurrency control in distributed transaction,

UNIT-III

Distributed deadlocks, Transactions with replicated data.

Recovery and fault Tolerance — Transaction recovery, Fault tolerance, Hierarchical and group masking of faults.

References :

1. George Coulouris, Jean Dollimore, Tim Kindberg: Distributed Systems: Concepts and Design 2nd Edition, Addison-Wesley Publishing Company.
2. Andrew S. Tanenbaum: Distributed Systems, Pearson Education.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – VIII
(Under Credit Based Continuous Evaluation Grading System)

CSL-461: EMERGING TRENDS IN INFORMATION TECHNOLOGY

CREDITS		
L	**T**	**P**
4	0	0

UNIT-I

Introduction to Information Technology — Latest development in Computer hardware : RISC V/S CISC architecture, Intel V/S Motorola chips, Computer peripherals.

Latest developments in Software — Programming Paradigms, Software Agents, Interoperable objects.

UNIT-II

Data Management technologies — Data Ware Housing and Data Mining, Data Marts and Conceptual Foundation of ERP.

Networking Technologies — Computer Networks, LAN, WAN, MAN, topologies, Internet, ISDN, PSDN, Wireless Networks, Internet Telephony,

UNIT-III

Virtual learning environment,
Mobile communications, IP Addressing.

Audio and Video Conferencing — Technology & Applications, Application to information technology to various function areas such as education, banking, communication etc.

References:

1. William Stallings: Computer Organization & Architecture: Designing for Performance; 7th Edition: Prentice Hall, India.
2. Walter Brenner, Rüdiger Zarnekow, Hartmut Wittig, Intelligent Software Agents; 1st Edition: Springer
3. Alex Berson, Stephen J Smith: Data Warehousing, Data Mining & OLAP: Tata McGraw Hill.
4. William Stallings: Data and Computer Communications, 7th Edition: Prentice Hall India.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – VIII
(Under Credit Based Continuous Evaluation Grading System)

CSL-462: NETWORK OPERATING SYSTEMS

CREDITS		
L	**T**	**P**
4	0	0

UNIT-I

Introduction of various Network Operating Systems (Windows 9x/XP/2000, Unix, Sun Solaris)

Introduction to Windows NT server, Window NT features, Hardware requirements, planning the network, Windows NT network security model, special purpose servers, licensing.

UNIT-II

Planning storage strategies, options, working with disk administrator and backup.
Networking and Network protocols Configuration of Windows NT.

UNIT-III

Windows NT services Architecture and security Architecture, planning and managing group and user accounts File services, distributed file system, remote administration, remote access services, Internet & Intranet. Printing and supporting network clients, performance tuning.

Text / References:

1. Mcse: NT Server 4 Guide - Mathew Strebe, Charles Perkins From Bpb Publications.
2. Mastering Windows NT Server 4 - Mark Mainasi, Christa Andrerson, Elizabeth.
3. Computer Networks & Distributed Processing By Martin, PHI.
4. Internet Working With TCP/IP Vol. I, II & III By Comer & Stevens, Phi.
5. Electronic Mail: An Introduction To X 400 Message Handling Standards By Sara Redicans, Mcgraw Hill.
6. Internet The Complete Reference By Harley Hahn, Mcgraw Hill.
7. Ibm Token-Ring Networking Handbook By George.C.Saclett, Mcgraw Hill.
8. Fddi Networking : Planning, Installation And Management By Martin A. Nemzow, Mcgraw Hill.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – VIII
(Under Credit Based Continuous Evaluation Grading System)

CSL-463: DATA COMMUNICATION – II

CREDITS		
L	**T**	**P**
4	0	0

UNIT-I

Data Transmission: Analog and Digital Data Transmission.

Network Components: Repeaters, Hubs, Bridges, Switches, Routers and Gateways.

Elementary Data Link Protocols, Sliding Window Protocols, Channel Allocation Problem, Multiple Access Protocol.

UNIT-II

Bluetooth Architecture, Bluetooth Applications, The Bluetooth Protocol Stack.

Internetworking: Concatenated Virtual Circuits, Connectionless Internetworking, Tunneling, Internetwork, Routing.

Addressing Classes, IPv4, Ipv6

UNIT-III

DNS, Electronic Mail, World Wide Web.

Fundamentals of Data Compression Techniques and Cryptography.

References:

1. B.A. Forouzan, Data Communication & Networking.
2. A.S. Tanenbaum, *Computer Networks*, Prentice Hall, 1992, 4th Edition.
3. William Stallings, *Data & Computer Communication*, McMillan Publishing Co.
4. Black, *Data Networks*, PHI.
5. Fred Halsall, *Data Communications, Computer Networks*, Pearson Education.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – VIII
(Under Credit Based Continuous Evaluation Grading System)

CSP464: PROGRAMMING LAB-VIII

CREDITS		
L	**T**	**P**
0	0	2

Implementing LAN using workgroup model & windows 95, Implementing LAN using Windows NT Domain model, Using user manager for Domains in Administration, Assigning user rights and permission on different objects,

Applications related to Internet.

CSC1: MCA (5 Years & 6 Months Integrated Programme)
(Under Credit Based Continuous Evaluation Grading System)

Semester – IX					
			Credits		
Sr. No.	***Sub Code***	***Subject***	**L**	**T**	**P**
1.	CSL531	Artificial Neural Networks	4	0	0
2.	CSL532	Advanced Software Engineering	4	0	0
3.	CSL533	Data Warehousing and Data Mining	4	0	0
4.	CSL534	Symbolic Logic and Logic Programming	4	0	0
5.	CSP535	Programming Lab – IX (SYMBOLIC LOGIC & LOGIC PROGRAMMING)	0	0	2
		Sub Total:	**16**	**0**	**2**
		Grand Total:	**18**		

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – IX
(Under Credit Based Continuous Evaluation Grading System)

CSL-531: ARTIFICIAL NEURAL NETWORKS

Time: 3 Hours

CREDITS		
L	**T**	**P**
4	0	0

UNIT – I

Basics of Neural Networks : Connectionist Models and their structures, Multilayer Perception & Back Propagation Networks, Gradient Descent.
Some Representation Issues : Representing Boolean function, Distributed Representation, Representing Real - valued Functions.
Single Layer Models : Perception learning and pocket Algorithm.

UNIT – II

Autoassociators and one-shot Learning: Linear Autoassociators and the interproduct Training Rule Hopfield Model, Associative Memories.
Mean Squared Errors (MSE) Algorithms: MSE Approximation, The Widrow-Hoff Rule, ADALINE.
Un-supervised Learning: K-Means Clustering, Topology-Preserving maps, Adaptive Resonance Theory.

UNIT – III

Back Propagation: Algorithms, Derivation, Practical Considerations.
Introduction to Some Applications: NETTALK, Handwritten Character Recognition, Travelling Salesman Problem.

References:

1. Gallant Stephen I: Neural Network Learning & Extent Systems, MIT Press, 1993.
2. Aleksander & Morton: Neural Computing, Chapman & Hall, 1991.
3. Kosko: Neural Networks & Fuzzy Systems, PHI, 1991.
4. Hertz John, Krough Anders, G. Palmer: Introduction to the theory of Neural Computation, Addison-Wesley, 1991.
5. Muller B. Reinhardt J.,: Neural Networks An Introduction" , Springer Verlag, 1991.
6. Aleksander Igor, : An Introduction to Neural Computing, Chapman and Hall, 1992.
7. Caudill Maureen, Understanding Neural Networks: Computer Explorations, MIT Press, 1993.
8. Fausett Laurene: Fundamentals of Neural Networks.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – IX
(Under Credit Based Continuous Evaluation Grading System)

CSL -532: ADVANCED SOFTWARE ENGINEERING

Time: 3 Hours

CREDITS		
L	**T**	**P**
4	0	0

UNIT – I

Software Project Management:
Fundamentals of Software project planning , Conventional Software Management, Evolution of Software Economics, Improvement of Software Economics, Comparison of old and modern ways of Software Management.

UNIT – II

Software Re-engineering:
Introduction Re-engineering, Restructuring and Reverse Engineering, Re-engineering existing systems, Data Re-engineering and migration, Software Reuse and Re-engineering.

Object-Oriented (OO) Measurements:
Introduction, Why metrics ?, Classification of OO metrics, Study of Design Metrics- method size, method internals, class size, class inheritance, Method inheritance, class intervals and class externals.

UNIT – III

Object-Oriented Analysis and Design:
What is Object-Oriented Design ?, Object, Abstraction, Collaboration among Objects, Polymorphism, Classes, specifying State, Specifying Behavior, Class Relationships, Grouping, Hiding.

Software Agents:
Definition, Applications, Types and Classes, Multi-Agent systems, characteristics & Properties Agents.

References:

1. Software project management, Walker Royce, Pearson Education Inc.
2. Software Re-engineering, Robert S. Arnold IEEE Comp. Society.
3. Object Oriented Software Metrics, Lorenz and Kidd.
4. Object-Oriented Analysis and Design, Booch.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – IX
(Under Credit Based Continuous Evaluation Grading System)

CSL – 533: DATA WAREHOUSING AND DATA MINING

Time: 3 Hours

CREDITS		
L	**T**	**P**
4	0	0

UNIT – I

Data Warehousing:
Concepts of Data Warehousing, Difference between operational database systems and Data warehousing, Need of a separate Data Warehouse. Multidimensional Data Model.

UNIT – II

Data Warehousing Architecture:
Steps for Design and Construction of Data-Warehouses, Three-Tier Data Warehouse Architecture, Characteristics of Data Warehousing Data, Data Marts, Types of OLAP Servers: ROLAP, MOLAP, HOLAP; Difference between Online Transaction Processing and Online Analytical Processing

Data Warehouse Implementation:
Efficient Computation of Data Cubes, Indexing OLAP Data, Efficient Processing of OLAP Queries, Metadata Repository, Data Warehouse Back-End Tools and Utilities

UNIT – III

Data Mining:
Basic Concepts;
Data Mining Techniques: Predictive Modeling, Database Segmentation, Link Analysis, Deviation Detection in details.
Data Mining Query Languages, Applications and Trends in Data Mining.

References:

1. Han, Kamber "Data Mining: Concepts and Techniques" Morgan Kaufmann
2. Romez Elmasri, Shamkant B.Navathe, *'Fundamentals of Database Systems'* Pearson Education.
3. Silberschatz, Korth, Sudershan "Database System Concepts" 4th Ed. McGraw Hill
4. Connolly & Begg "Database Systems – A practical approach to design, Implementation and Management, 3rd Ed. Pearson Education.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – IX
(Under Credit Based Continuous Evaluation Grading System)

CSL -534: SYMBOLIC LOGIC & LOGIC PROGRAMMING

Time: 3 Hours

CREDITS		
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4	0	0

UNIT – I

Prepositional logic: Syntax and semantics: Validity and consequence. Normal forms. Representing world knowledge using prepositional logic.
First order logic: World knowledge representation and the need for quantifiers. Syntax, semantics validity consequence clause normal form.

UNIT – II

Introduction to Prolog: Syntax of Prolog, Structured data representation. Execution model Introduction to Programming in Prolog, Illustrative examples.
The connection between logic and logic programming: Interpreting logic programs in terms of Horn clauses Deduction from clause form formulas resolution for prepositional logic Ground resolution. Unification and first order resolution SLD resolution; the computation and search rules. SLD trees and interpretation of non-declarative features of Prolog.

UNIT – III

Advanced Prolog features: Programming techniques: Structural Induction and Recursion, Extra Logical features: Cut and Negation Case Studies.
Introduction to Fuzzy logic and neural networks.

Texts/References:

1. Gries, The Science of Programming, Narosa Publishers, 1985.
2. Stoll, set Theory and Logic, Dover Publishers, New York, 1963.
3. Clocksin, W.F. and Mellish, C.S., Programming in Prolog 2nd Edition, Springer - Verlag, 1984.
4. O'Keefe, R., The Craft of Prolog. The MIT Press, 1991.
5. Lloyd, J. W., Foundation of Logic Programming, Springer, 1984.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – IX
(Under Credit Based Continuous Evaluation Grading System)

CSP -535: PROGRAMMING LAB IX
(SYMBOLIC LOGIC & LOGIC PROGRAMMING)

Time: 3 Hours.

CREDITS		
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SYMBOLIC LOGIC & LOGIC PROGRAMMING LAB

Experiments in Prolog Programming, Deductive databases, Recursion and Prolog list data structures.

Experiments to understand Prolog execution strategies, Cuts and Negation. Search Algorithms. Term Projects.

Text/Reference:

1. Clocksin, W.F. and Mellish, C.S., Programming in Prolog 2nd Edition, Springer - Verlag, 1984.

CSC1: MCA (5 Years & 6 Months Integrated Programme)
(Under Credit Based Continuous Evaluation Grading System)

			Credits		
Sr. No.	***Sub Code***	***Subject***	**L**	**T**	**P**
Semester – X					
1.	CSL541	Parallel Processing	4	0	0
2.	CSL542	Advanced Computer Architecture	4	0	0
3.	CSL543	Network Protocols	4	0	0
4.	CSL544	Mobile Computing	4	0	0
5.	CSL545	Network Programming	4	0	0
6.	*CSP546*	Programming Lab – X	0	0	2
		Sub Total:	**20**	**0**	**2**
		Grand Total:	**22**		

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – X
(Under Credit Based Continuous Evaluation Grading System)

CSL- 541: PARALLEL PROCESSING

Time: 3 Hours

CREDITS		
L	**T**	**P**
4	0	0

UNIT – I

Parallel Computer Models – Multiprocessors and Multicomputers – Multi Vector and SIMD Computers – Conditions of Parallelism – Program flow Mechanisms – System Interconnect architecture – Parallel Processing Applications – Speedup Performance Laws.

UNIT – II

Processors – CISC – RISC – Super scalar and Vector Processors – VLIW architecture – Memory hierarchy – virtual Memory - Bus, Cache and Shared Memory – Pipelining – Linear Pipeline Processors and Non-Linear Pipeline Processors.
Instruction and Arithmetic Pipeline – Super scalar and Super pipeline design.

UNIT – III

Multiprocessors System Interconnects–Cache Coherence and Synchronization Mechanisms – Message Passing Mechanism

Multi vector and SIMD computers – Scalable and Multithreaded architectures – Parallel Programming Models – Parallel Languages and Compilers – Parallel Programming Environments

References:

1. Kai Hwang, Advanced Computer Architecture Parallelism Scalability Programmability, TMH (2001)
2. Joel M Crichlow, An Introduction to Distributed and Parallel Computing, PHI, 2nd Edition (1997)
3. Michael J.Quinn, Parallel Computing Theory and Practice, McGraw Hill.
4. Kai Hwang and Faye A Briggs, Computer Architecture and Parallel Processing, McGraw Hill.
5. Lakshmivarahan and Sudharshan, Analysis and Design of Parallel Algorithms, McGraw Hill, 1990.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – X
(Under Credit Based Continuous Evaluation Grading System)

CSL-542: ADVANCED COMPUTER ARCHITECTURE

Time: 3 Hours

CREDITS		
L	**T**	**P**
4	0	0

UNIT – I

Introduction to Computers: Basic Computer Organization: System Buses, Instruction Cycles
CPU Organization: Design specifications for a Simple CPU, Fetching Instructions from Memory, Decoding Instructions, Executing Instructions, Design of a Simple ALU, Designing the Control Unit Using Hardwired Control and Microprogrammed control approach.
Memory Subsystem Organization and Interfacing, Types of Memories
I/O Subsystem Organization and Interfacing
Parallelism in Uniprocessor Systems: Trends in parallel processing, Basic Uniprocessor Architecture, Parallel Processing Mechanism.
Parallel Computer Structures: Pipeline Computers, Array Computers, Multiprocessor Systems
Architectural Classification Schemes: Multiplicity of Instruction-Data Streams, Serial versus Parallel Processing, Parallelism versus Pipelining

UNIT – II

Pipelining : An overlapped Parallelism, Principles of Linear Pipelining, Classification of Pipeline Processors, General Pipelines and Reservation Tables
Principles of Designing Pipelined Processors: Instruction Prefetch and Branch Handling, Data Buffering and Busing Structures, Internal Forwarding and Register Tagging, Hazard Detection and Resolution
Superscalar and Superpipeline Design: Superscalar Pipeline Design, Superpipelined Design
Structures and Algorithms for Array Processors: SIMD Array Processors, SIMD Computer Organizations, Masking and Data Routing Mechanisms, Inter-PE Communications

UNIT – III

SIMD Interconnection Networks: Static versus Dynamic Networks, Mesh-Connected Illiac Network, Cube Interconnection Networks
System Interconnect Architectures: Network Properties and Routing, Static Connection Networks, Dynamic Connection Networks
Multiprocessor Architecture: Functional Structures: Loosely Coupled Multiprocessors, Tightly Coupled Multiprocessors
Interconnection Networks: Time Shared for Common Buses, Crossbar Switch and Multiport Memories.

References:

1. Computer Architecture and Parallel Processing, Faye A. Briggs, McGraw-Hill International Editions
2. Computer Systems Organization & Architecture, John d. Carpinelli, Addison Wesley

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – X
(Under Credit Based Continuous Evaluation Grading System)

CSL-543: NETWORK PROTOCOLS

Time: 3 Hours

CREDITS		
L	**T**	**P**
4	0	0

UNIT – I

Review of networking Technologies & Internetworking Concepts and Architectural Model

Application level and Network level Interconnection, Properties of the Internet, Internet Architecture, Interconnection through IP Routers

Internet Addresses, Mapping internet addresses to Physical addresses (ARP) & Determining an internet addresses at Startup (RARP)

Universal identifiers, three Primary classes of IP addresses, network and Broadcast Addresses, Limited Broadcast, Dotted decimal Notation, weakness in Internet addressing, Loopback addresses. Address resolution problem, two types of Physical addresses, resolution through Direct Mapping, Resolution Through Dynamic Binding. address Resolution Cache, ARP to other Protocols. Reverse address resolution protocol, timing RARP transaction, Primary and backup RARP severs.

UNIT – II

Internet Protocol Connectionless Data Gram Delivery & Internet Protocol: Routing IP Datagrams

The concepts of unreliable delivery, connectionless delivery system , purpose of the **internet protocol** . the internet datagram. Routing in an internet, direct and indirect delivery, table driven IP routing , next Hop Routing , default routes, host specific routes, The IP routing Algorithm, handling incoming datagrams, Establishing routing tables

Internet Protocol: Error and Control Message (ICMP) & Subnet and Supernet Address Extension

The internet ,control message protocols, Error reporting versus error detection. ICMP message format. Detecting and reporting various network problems through ICMP.

Transparent Router, Proxy ARP, subset addressing, implementation of subnets with masks representation, Routing in the presence of subsets, a unified algorithm.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – X
(Under Credit Based Continuous Evaluation Grading System)

UNIT – III

User Datagram Peotocol (UDP)

Format of UDP message UDP pseudo header UDP encapsulation and Protocols layering and the UDP checksum computation. UDP multiplexing, De-multiplexing and Ports.

Reliable Stream Transport service (TCP)

The Transmission control Protocol, pots, Connections and Endpoint, passive and active opens the TCP segment format. TCP implementation issues.

References:

1. Douglas E.Comer, Internetworking with TCP/IP: Principles, Protocols
2. Forouzan, TCP-IP, Protocol Suit, TMH.
3. Comer, Internetworking with TCP-IP, Vol. 3.
4. Unix Network Programming, W. Richard Stevens.
5. SNMP, Stallings, Pearson.
6. TCP-IP Network Administration, Hunt Craig.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – X
(Under Credit Based Continuous Evaluation Grading System)

CSL-544: MOBILE COMPUTING

Time: 3 Hours

CREDITS		
L	**T**	**P**
4	0	0

UNIT – I

Making the internet Mobile - Overview of the WAP – Components of WAP standard – WAP architecture – Design principles – WML – Markup Basics – events, tasks, and bindings – variables – Other contents – Controls – Document type declaration – Errors and Browser limitations. Wireless Binary Extensible Markup Language.

WML script – Language Basics – Standard Libraries – Binary WML script – Data base connectivity.

UNIT – II

J2ME – What is J2ME Platform? – J2ME Specifications – Connected Limited Device Configuration Java virtual machine – Class libraries – The Mobile Information Device Profile and Midlets – Midlet user interface.

UNIT – III

The Midlet User interface API – The canvass class – Graphics attributes - Images - Event handling – Networking and persistent storage – J2ME command line tools - J2ME Programming Environments. Mobile Agents – Introduction to Mobile Agents – Reasons for Mobile Agent – Mobile Agent Architecture- Mobile Agent Applications – Elements of Mobile Agent Systems.

References:

1. Charles Arehart et al., - The Professional WAP – Wrex Publications, 2000.
2. Dale Browk – WAP Beginners Guide – Tata McGrawHill Publications,2001.
3. Kris Jamsa – WML and WML Script A Beginners Guide – Tata McGrawHill Publications 2001.
4. Kim Topley - J2ME in a Nutshell A Desktop Quick Reference – Oreilly Publications, 2002.
5. Johnathan Knudsen – Wireless Java: Developing with J2ME – Apress Publications II Edition,2003.
6. James Keogh – J2ME Complete Reference – Osborne Publications, 2001.
7. Schiller.J – Mobile Communicatoins – Addison Wesley Publications,2003.
8. William R Cockayne and Micheal Zyda – Mobile Agents – Printice Hall PTR, 1998.
9. Danny B Lange-Programming and Deploying Java Mobile Agents with Aglets – Addison Wesley,2002.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – X
(Under Credit Based Continuous Evaluation Grading System)

CSL-545: NETWORK PROGRAMMING

Time: 3 Hours

CREDITS		
L	**T**	**P**
4	0	0

UNIT – I

Sockets and Socket Address structures, Concept of Zombies, Daemon Processes, Super servers, Concurrent versus Iterative servers, Protocol Independence, Error Handling : Wrapper functions, OSI Model, Unix standards.

UNIT – II

TCP Connection establishment & Termination, Port Numbers and Concurrent Servers, Protocol Usage by common Internet Applications.
UDP Communication Semantics, UDP Echo Server, Echo Client working, Protocol Usage by Common Internet Applications.

UNIT – III

Sockets Address Structures, Byte ordering & Manipulation Functions, TCP Socket System Calls, TCP Client-Server E.g., I/O Multiplexing, Signal Handling in Concurrent Servers.
Socket Options, Elementary Names Address Conversions, Ipv4 and Ipv6 Interoperability.

References:

1. Networking Programming, W. Richard Stevens, Pearson Education.
2. Advanced Programming in UNIX Environment, W.Richard Stevens, Pearson Education.

CSC1: MCA (5 Years & 6 Months Integrated Programme) Semester – X
(Under Credit Based Continuous Evaluation Grading System)

CSP-546: PROGRAMMING LAB X

Time: 3 Hours.

CREDITS		
L	**T**	**P**
0	0	2

Lab exercises based on Network Programming

MCA (5 Years & 6 Months Integrated Programme) Semester -XI
(Under Credit Based Continuous Evaluation Grading System)

Semester-XI					
			Credits		
Sr.No.	***Sub Code***	***Subject***	**L**	**T**	**P**
1	CSD690	Major Project	0	0	22

MCA (5 Years & 6 Months Integrated Programme) Semester -XI
(Under Credit Based Continuous Evaluation Grading System)

CSD–690: MAJOR PROJECT

Credits		
L	**T**	**P**
0	0	22

A candidate should work on the project for 5 months and 6-8 hours on each working day.

1st synopsis (containing mainly literature survey corresponding to the problem taken up for the project work and line of attack to solve the problem) within one month of joining the training is to be submitted and will be evaluated for 4 credits.

2nd synopsis (containing essentially the progress of work in comparative details) within three months of joining the training is to be evaluated will be evaluated for 4 credits.

Credits for Final Project Report & Viva Voce: 14

The evaluation shall be done as per the common ordinances for courses under Credit Based Continuous Evaluation Grading System