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PREAMBLE

This three years Master of Computer Applications (MCA) course aims to prepare candidates for the IT industry. It will provide the necessary theoretical foundation and the skills to make the successful candidates proficient in software development, paving the way for self-employment. Core focus of the course is on Database, Application Programming, System Level Programming and Network and Internet Technologies. Adequate emphasis is given for the Open Source Software platform and emerging technologies. The need for continuity in the electives offered in the fourth and fifth semesters, leading to desired specialisation, has been given due attention. The Audit courses included in the syllabus, one per year, would give the candidates soft skills necessary for the employment market.

Eligibility

This course is open to graduates of Arts, Science and Commerce streams. It does not presuppose that the applicant has had prior exposure to Computer Science. However, a good academic record and an aptitude for analytical thinking would be an essential requirement. The candidate should have passed mathematics or equivalent at the Plus Two or Under Graduate level. Admission will be on the basis of the marks secured at the qualifying examination (50% weightage) and an entrance test (50% weightage). Candidates having passed Computer Science or Computer Applications Honours at the degree level will have the additional benefit of 5% of their Honours marks.

Duration

The Duration of the course is three academic years consisting of six semesters. Each semester should have a minimum of 14 teaching weeks.

Examination

This professional course is based on the credit system of marking.. For theory papers, one credit is assigned for every one hour of class per week. For practical papers, one credit is assigned for every two hours of class per week.

The question papers of the external examination will follow the general guidelines below. The examination of the theory papers having 3 or more credits will be of 3 hours duration and will have a maximum of 75 marks. Other theory examinations will be of 2 hours duration and have a maximum of 50 marks. Examinations of the Practical papers of 2 or more credits will have duration of 3 hours and will have a maximum of 75 marks. Other practical examinations will have duration of 2 hours and a maximum of 40 marks. However, the marks scored will be converted to grades according to the scheme given below.

Marks Obtained (%)	Grade	Grade Points
90 and above	O	10
80 to 89	A+	9
70 to 79	A	8
60 to 69	B	7
50 to 59	C	6
40 to 49	D	5
Below 40	F (**Fail**)	
Absent	AB	

A student has to complete at least 140 credits for the award of the Degree

Calculation of SGPA and CGPA and Conversion of CGPA to percentage
From the grade obtained by a student in each paper, the SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average) will be calculated.

$$\mathbf{SGPA} \equiv \frac{\sum_{1}^{n} \mathbf{GP_i} \times \mathbf{NC_i}}{\sum_{1}^{n} \mathbf{NC_i}}$$

GP_i = Grade Points earned in the i^{th} paper
NC_i = Number of Credits for the i^{th} paper
n = Number of papers in the semester

$$\mathbf{CGPA} \equiv \frac{\sum_{1}^{n} \mathbf{SGPA_i} \times \mathbf{NSC_i}}{\sum_{1}^{n} \mathbf{NSC_i}}$$

$SGPA_i$ = Semester Grade Point Average of the i^{th} semester
NSC_i = Number of Credits in the i^{th} semester
n = Number of semesters

Percentage = CGPA x 10 – 5

Requirements for Passing

For all subjects the passing requirement shall be that the candidate secures minimum 40 percent (Grade D) in the Internal Assessment as well as in the Semester Examinations. Only the candidates passing in Internal Assessment may be allowed to appear for the Semester Examination.

Classification of Successful Candidates

The successful candidates will be given marksheets that will contain the grades they have scored in each paper, as well as the SGPA and CGPA.

Candidates shall have to pass all the Papers within a period of 5 years from the date of admission to the First Semester to qualify for the award of the Master's Degree.

Course Structure for MCA

Code	Paper	Credits			Hours per Week
		Theory/ Tutorial	Practical/ Assignment	Total	
SEMESTER 1: 23 Credits					
101	Digital Logic Design	4	-	4	4
102	Programming & Problem Solving through C	4	2	6	8
103	Organisational Behaviour	4	-	4	4
104	Accounting and Financial Management	4	-	4	4
105	Discrete Mathematics and Probability Theory	5	-	5	5
SEMESTER 2: 25 Credits					
201	Theory of Computation	3	-	3	3
202	Data Structures Using C ++	4	2	6	8
203	Object Oriented Programming and Design	4	2	6	8
204	Computer Graphics	3	2	5	7
205	Computer Organisation and Architecture	5	-	5	5
SEMESTER 3: 25 Credits					
301	Database Management System - I	4	-	4	4
302	Data Communication and Networks – I	4	-	4	4
303	Operating System	4	2	6	8
304	Design and Analysis of Algorithms	4	1	5	6
305	GUI Programming Using VB.NET	4	2	6	8
SEMESTER 4: 26 Credits					
401	Software Engineering	4	-	4	4
402	Data Communication and Networks – II &Network Programming using Linux	4	2	6	8
403	Oracle	1	3	4	7
404	Database Management System - II	4	-	4	4
405	Internet Technology and Applications	1	3	4	7
406	**Elective I			4	4
SEMESTER 5: 26 Credits					
501	Compiler Design	3	2	5	7
502	Programming Through Java	4	2	6	8
503	System Programming	4	2	6	8
504	***Elective II			5	5
505	Minor Project	-	4	4	8
SEMESTER 6: 15 Credits					
601	Major Project	-	15	15	30
Audit Course					
	Communication Skills	1st Year			
	Ethics	2nd Year			
	Entrepreneurship	3rd Year			
****Elective I**					
406.1	Operations Research	3	2	5	7
406.2	Microprocessors and Their Interfacing	5	-	5	5
406.3	Computer Oriented Numerical Methods	4	-	4	4
406.4	Advanced Linux Programming	3	2	5	7
406.5	Artificial Intelligence	4	-	4	4
406.6	Network Security	4	-	4	4
406.7	Digital Image Processing	4	2	6	8
*****Elective II**					
504.1	Simulation and Modeling	3	2	5	7
504.2	Parallel and Distributed Processing	4	2	6	8
504.3	Multimedia Technology and Applications	3	2	5	7
504.4	Enterprise Resource Planning	5	-	5	5
504.5	E-Commerce	4	2	6	8
504.6	Natural Language Processing	4	2	6	8
504.7	Data Mining	4	1	5	6
504.8	Embedded and Real Time Systems	3	2	5	7
Total Credits for the Course (Minimum)				**140**	

101: Digital Logic Design

Objective:

The topics below cover some of the basic understanding of a digital computer. The aim is to give an overview of the computer and it's functions, with specific references to some of its parts. The student will also get an understanding of the application of Boolean Algebra in computer science and applications.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
56	3	4	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	Introduction to organization of a digital computer	12	15
II	Memory Unit	12	15
III	Boolean Algebra and Simplification of Boolean functions	12	15
IV	Combinational Logic and Sequential Logic	20	30
TOTAL		**56**	**75**

Detailed Syllabus

Unit 1: Introduction to organization of digital computer **12 Hours**

Block diagram of a computer: Input Unit, Output Unit, Storage Unit, CPU. Control Unit, Arithmetic Logic Unit. System bus. Stored program concept. Number systems. Binary Arithmetic, Floating point number representation, Fixed point number representation, Signed-magnitude representation, overflow, underflow, Computer codes; Error detection and correction codes, parity, parity generator, parity checker.

Unit 2: Memory Unit **12 Hours**

Memory Hierarchy, Main Memory, Memory Address Map. Semiconductor Memory, Different types of semiconductor memory; Different types of Cache Memory: Levels of Cache, Locality of reference, hit, miss, hit ratio, Magnetic Memory; Different types Optical Memory, Different types of magnetic memory.

Unit 3: Boolean Algebra and Simplification of Boolean Functions **12 Hours**

Boolean Algebra: Various Boolean operations; Postulates, Theorems, Duality, Boolean functions, Canonical forms, Representation of Boolean expressions using truth tables, logic gates. Boolean expressions, Karnaugh map, Don't Care Conditions- problems using Don't care conditions, benefit of using Don't care conditions. Tabulation method/Quine- Mc Kluskey method, prime implicants.

Unit 4: Combinational Logic and Sequential Logic **20 Hours**

Brief introduction to Microprocessor, Integrated circuits, SSI, MSI, LSI, VLSI, IC Digital logic families- TTL, ECL, MOS, CMOS and I^2L.

Positive and negative logic. Characteristic of IC logic families- fanout, power dissipation, propagation delay, noise margin.

Digital devices: Logic gates, wired-logic, 8 non-degenerate forms of NOR and NAND, multilevel NAND and NOR gates (Boolean function implementation using block diagram method, analysis procedure, deviation of Boolean function by algebraic manipulation, derivation of truth table, block diagram transformation), buffer, 3-state buffer, high impedance state, Realization of other logic functions using NAND/NOR gates. Drawing logic diagrams for different types of Boolean expression derived from truth tables; A brief introduction to Combinational and sequential circuits. Difference between Combinational and sequential circuits; Arithmetic circuits: Half-adder, Full-adder, Binary Adder, Binary Parallel Adder, BCD Adder, Binary Adder-Subtractor, Half-subtractor, Half-subtractor , Binary Incrementer, carry propagation, look ahead carry, carry generator, magnitude comparator.; Encoders, Decoders, Multiplexers, Demultiplexers

Code conversion, BCD-to-Excess3 Code converter. Analysis of Combinational circuits.

Flip-flops: Different types of flip-flops, Flip-flop excitation tables, characteristic equations, truth tables, Triggering of Flip-flops.

Registers: Registers (Register with Parallel Load), Shift registers(serial transfer, Bi-directional Shift Registers With Parallel Load, serial adder, Serial Register);

Counters: Asynchronous counters, Synchronous counters; Binary Counter with Parallel Load, binary Ripple Counter, BCD ripple counter, synchronous binary counter, binary count-up-down counter, BCD synchronous counter, Decade Counter, Mod 6 counter. Timing sequences- word-time generation, timing signals, Johnson counter. Designing of counters using excitation tables of flip flops. Designing of counters using state equations.

Instructions for Paper Setter:

Unit	Questions	
	To be Set	**To be Answered**
I	2	1
II	2	1
III	2	1
IV	3	2
Total	**9**	**5**

Recommended Books

1. **Mano, M. M.,** *Digital Logic and Computer Design***,** New Delhi: Prentice-Hall India, 1994
2. **Floyd, T. L.,** *Digital Fundamentals(*Fifth Edition), New Delhi: Pearson Education, 2002

Further readings

1. **Hamacher, V. C.; Z. G. Vranesic; S. G. Zaky,** *Computer Organization(*Fourth Edition), New Delhi: Tata McGraw-Hill, 1996

102: Programming & Problem Solving through C

Objective:

The objective of the course is to introduce the fundamentals of C programming language and develop the skills for solving problems using computers. After completion of this course, a student will be able to

- Understand and use the process of abstraction using a programming language such as 'C'
- Analyse step by step and develop a program to solve real world problems
- Understand the basics of system programming, graphics programming and design user interface

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks					
						External		Internal		Total	
Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr
56	56	3	3	4	2	75	75	25	25	100	100

Unit	Topic	Minimum Class Hours		Marks	
		Th	Pr	Th	Pr
I	C Fundamentals	14	14	18	30
II	Functions, arrays and pointers	12	12	17	
III	Structure and Union, Data files	14	14	18	25
IV	VDU and Keyboard Basics	8	8	10	20
V	Graphics and Mouse programming	8	8	12	
TOTAL		56	56	75	75

Detailed Syllabus

Unit I: C fundamentals **14 Hours**

C Fundamentals**,** I/O functions, Control statements, The C Preprocessor

Unit II: Functions, Arrays and Pointer **12 Hours**

Functions: Overview, defining a function, accessing a function, function prototypes, call by value, call by reference, recursion, Storage classes, String functions, Other functions (sqrt(), exit(), malloc(), free())

Arrays and Pointers: Defining an array, array initialization, processing an array, passing array to a function, multidimensional arrays, arrays and strings, pointer declarations, passing pointer to a function, pointers and one dimensional arrays, Operation on pointers, pointers and multidimensional arrays, array of pointers, functions returning pointers, Command-line parameters

Unit III: Structure and Union, Data files **14 Hours**

Structures and Unions: Defining a structure, processing a structure, user defined data types, structures and arrays, structures and pointers, passing structures to a function, self referential structures, bit fields in structures, Union, Union of structures, Enumerated data type

Data files: Standard File opening modes, character I/O, String I/O, Formatted console I/O, text mode versus binary mode, Unformatted console I/O functions - record I/O, Data Record operations

Unit IV: VDU & Keyboard Basics **8 Hours**

VDU Basics: Screen memory accessing, memory segments, far pointers, writing to VDU memory, text mode, color attribute, Interrupts, interrupt vector table, WORD register, BYTE register, DOS interrupts, BIOS interrupts, int86() functions(controlling cursor size, position of cursor, visibility) and intdos() functions(make, remove, change directory and delete file)

Keyboard basics: operation on keyboard, Shift and Toggle keys

Unit V: Graphics and Mouse programming **8 Hours**

Graphics Programming: Library file- graphics.h, 2-D Coordinate system, Simple Graphics Functions(initgraph(), line(), circle(), arc(), rectangle(), ellipse(), drawpoly(), closegraph(), restorecrtmode(), setfillstyle(), putpixel(), getmaxx(), getmaxy(), outtextxy(), setcolor(), fillcolor(), settextstyle(), moveto(), lineto(), moverel(), linerel()) Pallete and color, Animation functions(imagesize(),getimage(),putimage())

Mouse Programming: GUI and mouse, dos.h, mouse initialization, show and hide mouse pointer, restrict mouse movement, Cursor Position and button status

Instructions for Paper Setters

Unit	Theory Questions		Practical Questions	
	To be set	To be answered	To be set	To be answered
I	2	1	2	1
II	2	1		
III	2	1	2	1
IV	2	1	2	1
V	2	1		

Recommended Books

1. **Kanetkar, Y.,** *Let us C* (Third Edition) **,**New Delhi: BPB Publications,1999
2. **Gottfried, B. S.,** *Theory and Problems of Programming with C***,** New Delhi: Tata McGraw-Hill Publication, 1997
3. **Balaguruswamy, E.** *Programming in ANSI C* (Second Edition)**,** New Delhi: Tata McGraw-Hill Publication, 1992

103 : Organizational Behaviour

Objective:

The objective of this paper is to provide the student an insight into the principles of organizational behaviour and its relation to other activities in an organization, and to introduce the student to the techniques of organisational behaviour used as a management tool.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
56	3	4	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	Introduction to Organizational Behaviour	6	12
II	Cognitive processes of organizational behaviour	10	16
III	Group Dynamics	14	16
IV	Communication and Decision Making	12	14
V	Organizational Culture and Work Stress	14	17
TOTAL		**56**	**75**

Detailed Syllabus

Unit I : Introduction to Organizational Behaviour **6 Hours**

Defining Organisational Behaviour, historical background: the Hawthorne Studies; early development, conceptual development; theoretical frameworks; explaining and predicting behaviour; OB in the global context.

Unit II : Cognitive processes of organizational behaviour **10 Hours**

Perception: Nature, importance and attribution; perception and individual decision making; values, nature and dimensions of attitudes and job satisfaction; personality; aptitude; interests; learning; intelligence, motivation - theories of motivation.

Unit III : Group Dynamics **14 Hours**

Groups: Group dynamics, types of groups, group goals, group cohesiveness, group norms, group pressure, teamwork; group structure - formal leadership, roles and norms; group member resources - abilities, personality, characteristics, stages in group development.

Leadership : Theories - trait, behavioural, contingency, attributional, charismatic, transactional vs. transformational.

Power and leadership: Contrasting leadership and power; power in groups; power tactics; politics-power in action.

Unit IV: Communication and Decision Making **12 Hours**

Role of communication; Communication media and technology, communication networks - formal vs. informal; barriers to effective communication; communication skills; feedback information; persuasion in communication; active listening; participative decision making techniques; groups vs. the individual; group think and group shift; the decision making process

Unit V : Organizational culture and Work Stress **14 Hours**

Definition of organizational culture and its typologies; formation of cultures; functions of culture; organizational culture vs. national culture.

Stress: Potential sources of stress - environmental factors, organizational factors; individual differences -perception, job experience, social support, locus of control, hostility; Stress –the emergence of stress, causes of stress; stress consequences - physiological symptoms, psychological symptoms, behavioural symptoms, stress management strategies - individual approaches, organizational approaches.

Conflict and negotiation: Definition of conflict; the conflict process; conflict in intergroup relations; creating functional conflicts; bargaining strategies; role of personality traits on negotiation; third party negotiations; intergroup relations and factors affecting intergroup relations.

Instructions for Paper Setter

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1
Total	**10**	**5**

Recommmended Books :

1. **Luthans, F.,** *Organisational Behaviour* (Tenth Edition), New Delhi: Tata McGraw-Hill India, 2005
2. **Robbins, S. P.,** *Organizational Behaviour* (Eleventh Edition), New Delhi: Prentice-Hall India, 2004

Further readings:

1. **Gilmer**, *Industrial Psychology***,** New Delhi: Tata McGraw-Hill
2. **Ghiselle; Brown**, *Personnel and Industrial Psychology*, New Delhi: Tata McGraw-Hill
3. **Davis; Keith**, *Human Relations at Work***,** New Delhi: Tata McGraw-Hill
4. **Leavitt**, *Managerial Psychology*, University of Chicago Press
5. **Bass, B. M.**, *Leadership Psychology and Organizational Behaviour*, Harper International
6. **Litterer,** *Analysis of Organizations***,** New York: John Wiley

104: Accounting And Financial Management

Objective:

The objective of this paper is to make the students familiar with the basic accounting and financial management concepts. This takes into account the knowledge of accounting that a student may require when faced with the task of developing or maintaining any package for any business/financial institutions as well as for non profit organisations

Outline of the Course

Minimum Class Hours	Credits	Exam Time (Hours)	Marks		
			External	Internal	Total
56	4	3	75	25	100

Unit	Topics	Minimum Class Hours	Marks
I	Introduction to Accounting	12	12
II	Final Accounts and Statements	15	20
III	Techniques of costing	8	14
IV	Financial management	13	15
V	Budget	8	14
TOTAL		**56**	**75**

Detailed Syllabus

Unit 1: Introduction to Accounting **12 Hours**

Utility of Accounting in business enterprises, Double entry system of accounting, accounting equation, accounting principle concepts and conventions, journal, ledger, trial balance, cash book (single, double and triple column.

Unit 2: Final Accounts and Statements **15 Hours**

Distinction between capital and revenue expenditure, construction of trading, profit and loss accounts and balance sheet of sole proprietorship concerns with adjustments, manufacturing account, simple problems on final accounts of companies.

Preparation of Income and Expenditure account and balance sheet (from receipts and payments account) with common adjustments for non trading institutions.

Unit 3: Techniques of costing **8 Hours**

Definition of costing and cost accounting, classification of cost, Marginal costing – Basic concepts, break-even analysis, construction of break-even chart, problems on marginal costing, application of marginal costing in decision-making.

Unit 4: Financial management **13 Hours**

Financial Statement Analysis- Ratio Analysis – Meaning, Advantages, limitations and types of ratios and their usefulness, simple problems on ratio analysis. Fund Flow Analysis- preparation of statement of changes in working capital, preparation of fund flow statement.

Unit 5: Budget **8 Hours**

Budget – Different types of budget, Theoretical concept, preparation of flexible budgets and cash budgets.

Instructions for Paper Setter:

The number of questions to be set from each unit and the number of questions that the student has to answer are specified in the table below.

Unit	To be set	To be answered
1	2	1
2	2	1
3	2	1
4	2	1
5	2	1
Total	**10**	**5**

Recommended books

1. **Lal, J.,** *Accounting for Management,* Mumbai: Himalaya Publishing House
2. **Juneja, C. M.; R. C. Chawla; K. K. Saksena,** *Double Entry Book Keeping*(Sixth Edition)**,** Ludhiana: Kalyani Publishers, 1994
3. **Jain, S.P.; K. L. Narang,** *Cost Accounting* (Thirteen Edition), Ludhiana: Kalayani Publishers, 1995

Further Readings

1. **Shukla; Grewal; Gupta,** *Advanced Accounts,* New Delhi: S. Chand & Sons, 2005
2. **Jain; Narang,** *Advanced Accountancy,* Ludhiana: Kalyani Publishers, 1995

105: Discrete Mathematics and Probability Theory

Objective:

The objective of this course is to introduce the student of Computer Applications to the principles of Discrete Mathematics and Probability Theory which have applications in Computer Science and the development of logical thinking. Discrete Mathematics exposes the student to algebraic structures, combinatorial mathematics and graph theory. The necessary abstract mathematical content is to be dealt with and explained in the context of its application to computer science to present to the students the foundations of many basic computer related concepts. Probability Theory is an essential input to facilitate the study of many other topics such as Operations Research.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
70	3	5	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	Sets, Relations and Functions	9	10
II	Algebraic Structures	12	15
III	Combinatorics, Recurrence Relations and Introduction to Graph Theory	25	20
IV	Introduction to Probability Theory	12	15
V	Random Variables and Probability Distributions	12	15
TOTAL		**70**	**75**

Unit I: Sets, Relations and Functions **9 Hours**

Sets, set operations; binary relations, types of relations, partitions; partial order relations, Hasse and lattice diagrams for posets; functions, types of functions, composition of functions.

Unit II: Algebraic Structures **12 Hours**

Semi groups, products and quotients of semi groups; groups, cosets, normal subgroups, quotient groups, Lagrange's Theorem, products of groups; use of groups in coding of binary information and error detection, decoding and error correction.

Unit III: Combinatorics, Recurrence Relations and Introduction to Graph Theory 25 Hours

Combinatorics : Permutation and combination, principles of counting and enumeration; recurrence relations, the Fibbonacci sequence, solutions of recurrence relations by substitution and generating functions, solution of non-recurrence relations by conversion to linear recurrence relations.

Graph Theory : Introduction to graphs, representation of graphs, graph isomorphisms, subgraphs, directed and undirected graphs; Euclidean paths and circuits; Hamiltonian paths and circuits; colouring graphs.

Unit IV: Introduction to Probability Theory **12 Hours**

Sample space and events, probabilities of events and combinations of events, conditional probability and stochastic independence. Introduction to the Random Walk and Ruin problems, introduction to Markov chains.

Unit V: Random Variables and Probability Distributions **12 Hours**

Random variables, expectation, mean and variance of random variables.

Probability distributions, binomial and Poisson distributions, properties and occurrence; normal distribution, properties, examples, relation to Poisson approximation.

Instructions for Paper Setter

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1
Total	**10**	**5**

Recommended Books

1. **Kolman, B.; R. C. Busby; S. C. Ross,** *Discrete Mathematical Structures*, New Delhi: Prentice-Hall India, 2002
2. **Trembly, J. P.; P. Manohar,** *Discrete Mathematical Structures With Applications to Computer Science*, New Delhi: Tata McGraw-Hill, 1997
3. **Feller, W.,** *An Introduction to Probability Theory and its Applications*, Vol 1, New Delhi: Wiley Eastern, 1972
4. **Taha, H. A.,** *Operations Research, An Introduction*, New Delhi: Prentice-Hall India, 2004

Further readings

1. **Mott, J. L.; A. Kandel; T. P. Baker**, *Discrete Mathematics for Computer Scientists and Mathematicians*, New Delhi: Prentice-Hall India, 2004
2. **Somasundaran, R.,** *Discrete Mathematical Structures*, New Delhi: Prentice-Hall India, 2003
3. **Parzen, E.,** *Modern Probability Theory and Its Applications*, California: Wiley Eastern University Edition, 1960
4. **Papoulis, A.,** *Probability and Statistics*, New Delhi: Prentice-Hall India, 1990

201: Theory Of Computation

Objective:
The objective of the theory of computing is to introduce and study abstract, mathematical models of computation (such as finite state, push down & Turing machines), and to use the abstract machines models to study the ability to solve computational problems. At the complete course students will be able to use regular expression effectively and appropriately, construct derivations and parse trees, write simple programs for a Turing machine, understand the equivalence of grammars, languages & automata and translate between grammars, languages & automata

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
42	3	3	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	Theory of Automata	10	16
II	Formal Languages, Regular Sets & Regular Grammars	10	16
III	Context-free Languages	10	18
IV	Pushdown Automata Turing Machines and Linear Bounded Automata	12	25
TOTAL		**42**	**75**

Detailed Syllabus

Unit I: Theory of Automata **10 Hours**

Definition of an Automaton, Description of a Finite Automaton, Transition Systems, Properties of Transition Functions, Acceptability of a String by a Finite Automaton, Nondeterministic Finite State Machines, The Equivalence of DFA and NDFA, Mealy and Moore Models, Minimization of Finite Automata.

Unit II: Formal Languages, Regular Sets & Regular Grammars. **10 Hours**

Definition of formal languages, Chomsky Classification of Languages, Languages and Their Relation, Recursive and Recursively Enumerable Sets, Operations on Languages, Languages and Automata; Regular Expressions, Finite Automata and Regular Expressions, Pumping Lemma for Regular Sets, Application of Pumping Lemma, Regular Sets and Regular Grammars Exercises.

Unit III: Context-free Languages **10 Hours**

Context-free Languages and Derivation tree, Ambiguity in Context-free Grammars, Simplification of Context-free Grammars, Normal Forms for Context-free Grammars, Pumping Lemma for Context-free Languages, Decision Algorithms for Context-free Languages Exercises

Unit IV: Pushdown Automata Turing Machines and Linear Bounded Automata **12 Hours**

Basic Definitions, Acceptance by pda, Pushdown Automata and Context-free Languages, Parsing and Pushdown Automata; Turing machine Model, Representation of Turing Machine, Language Acceptability by Turing Machines, Design of Turing Machines, Universal Turing

Machine and Other Modification, The Model of Linear Bounded Automaton, Turing Machines and Type 0 Grammars, Linear Bounded Automata and Languages, Halting Problem of Turing Machines, NP-Completeness.

Instructions for Paper Setter

Unit	Questions	
	To be Set	**To be Answered**
I	2	1
II	2	1
III	2	1
IV	2	1
Total	**8**	**4**

Recommended Books

1. **Mishra, K. L. P.; N. Chandrasekaran,** *Theory of Computer Science* (Second Edition)**,** New Delhi: BPB Publications, Prentice-Hall of India, 1998
2. **Lewis, H. R.; C. H. Papadimitriou,** *Elements of the Theory of Computation* (Second Edition), New Delhi: Prentice-Hall India, 2003
3. **Hopcraft, H. E.; J. D. Ullman,** *Introduction to Automata Theory, Languages and Computation,* New Delhi: Narosa Publications, 2001

Further readings

1. **Martin, J. C.,** *Introduction to Languages and the Theory of Automata,* New Delhi: Tata McGraw-Hill
2. **Papadimitriou, C. H.,** *Computation Complexity,* New Delhi: Addison Wesley

202 : Data Structures Using C++

Objective

The objective of the course is to learn how to create data structures in a computer language, such as C++, to represent a collection of similar data, and how to process these data most efficiently for solving problems. After completion of this course, a student will be able to

1. Understand and use the process of abstraction using a programming language such as 'C++'
2. Implement various data structures viz. Stacks, Queues, Linked Lists, Trees and Graphs
3. Understand various searching and sorting techniques.
4. It is expected that the student has adequate knowledge of C++ language basics, functions, arrays, structures, pointers and dynamic memory allocation.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks					
						External		Internal		Total	
Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr
56	56	3	3	4	2	75	75	25	25	100	100

Unit	Topic	Minimum Class Hours		Marks	
		Th	Pr	Th	Pr
I	Arrays and Lists	16	16	22	30
II	Stacks and Queues	12	12	15	
III	Trees and Graphs	16	16	22	25
IV	Searching and Sorting	12	12	16	20
Total		**56**	**56**	**75**	**75**

Detailed Syllabus

Unit I : Arrays and Lists **16 Hours**

Data Type, Abstract Data Type, Data Structure, Fundamental and Derived Data Types

Array as a data structure, Representation of arrays: single and multidimensional, Address calculation using column and row major ordering; insertion and deletion in arrays; use of arrays for matrix representation and manipulation (addition, multiplication), use of arrays for large integer representation and their addition.

Linked List as a data structure; operations on lists; singly linked list (with one or two external pointers), doubly linked list, circular list; use of linked lists for polynomial representation and manipulation (addition and multiplication), and sparse matrix representation and manipulation (inputting, adding, and displaying in matrix form)

Unit II : Stacks and Queues **12 Hours**

Stacks and Queues as data structures; implementation of stacks and queues using arrays and linked lists; Circular Queue, Priority Queue; Application of stacks : Conversion of infix(containing arithmetic operators including exponential operator, and parenthesis) to postfix and prefix expressions; evaluation of postfix expression

Unit III : Trees and Graphs **16 Hours**

Binary Trees and General Trees, Representation of trees using linked lists, Binary tree traversal methods, recursive and non-recursive algorithms for traversal methods, Binary search trees (creation, insertion and deletion of a node), threaded binary trees (construct and traverse a right in-threaded binary tree); Height balanced (AVL) binary trees (construct and traverse an AVL tree), multi-way search trees (construction and traversal); B-tree (construction and traversal of a B-tree of given order)

Introducing Graphs; Graph representation : Adjacency matrix, adjacency lists, incidence matrix; Traversal schemes : Depth first search, Breadth first search (Recursive and non-recursive algorithms); Shortest Path algorithm (Dijkstra's), Spanning tree, Minimal spanning tree algorithm (Kruskal's algorithm)

Unit IV : Searching and Sorting **12 Hours**

Linear and binary search, Indexed search; Hashing, Hash Functions (division method, mid square method, folding), Analysis of ideal hash function; Conflict resolution (linear and quadratic probe, double hashing, separate chaining, coalesced chaining); Analysis of collision resolution techniques; Sorting algorithms(Insertion, Selection, Bubble, Quick, Merge, Radix, Heap)

Instructions for Paper Setter

Unit	Theory Questions		Practical Questions	
	To be set	To be answered	To be set	To be answered
I	2	1	2	1
II	2	1		
III	2	1	2	1
IV	2	1	2	1

Recommended Books

1. **Langsam, Y.; M. J. Augenstein; A. M. Tenenbaum,** *Data Structures Using C and C++***,** (Second Edition), New Delhi: Prentice-Hall India, 2000
2. **Chattopadhyay, S.; D. G. Dastidar; M. Chattopdhyay**, *Data Structures Through C Languag**e**,* New Delhi: BPB Publications, 2001

Further readings

1. **Horowitz, E.; Sahni, D. Mehta,** *Fundamentals of Data Structures in C++*, New Delhi: Galgotia Publications, 2002
2. **Lipschutz, S.,** *Theory and Problems of Data Sturctures* (International Edition)*,* Schaum's Outline Series, New Delhi: Tata McGraw-Hill, 1986
3. **Wirth, N.,** ***Algorithms + Data Structures = Programs,*** New Delhi: Prentice-Hall India, 1998
4. **Kanetkar, Y. P.,** *Data Structures Through C Language,* New Delhi: BPB Publications, 2002

203: Object Oriented Programming and Design

Objective

The Main aim of this paper is to give the students a broad understanding of the object oriented approach to problem solving through C++. It provides a practical, productive way to develop software for most applications. It also includes an introduction to object-oriented design, which can promote a better understanding of the requirements, cleaner designs, and more maintainable systems**.**

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks					
						External		Internal		Total	
Th	**Pr**	**Th**	**Pr**	**Th**	**Pr**	**Th**	**Pr**	**Th**	**Pr**	**Th**	**Pr**
56	56	3	3	4	2	75	75	25	25	100	100

Unit	Topic	Minimum Class Hours		Marks	
		Th	**Pr**	**Th**	**Pr**
I	Introduction to object-orientation concepts and programming	14	16	20	25
II	Templates and Exception handling	12	18	15	25
III	Inheritance, Virtual functions and Polymorphism	15	22	20	25
IV	Object oriented design	15		20	
TOTAL		**56**	**56**	**75**	**75**

Detailed Syllabus

UNIT I: Introduction To Object-Orientation Concepts And OOP **14 Hours**

Introduction to Object-Oriented Programming: Basic concepts of OOP (Abstraction, Encapsulation, Inheritance, Polymorphism), comparison of procedural programming and OOP; code reusability, creating new data types. C++ Language basics**,** *cin* and *cout,* << and >> operators, *setw* and *endl,* Control statements, differences between C and C++.

Classes and Objects: C++ extension to structures, member access operators static members, arrays of objects, returning objects from functions, Friend functions, Pointers to members, Friend classes, stack class.

Constructors: Default constructors, overloaded constructors, constructors with default arguments default constructor, copy constructor, dynamic constructor, destructors.

UNIT II: Templates and Exception Handling **12 Hours**

Templates: string template, instantiation, template parameters, type-checking, function templates, template argument deduction, specifying template arguments, function template overloading, default template arguments, specialisation, conversions.

Exception handling: Error handling, grouping of exceptions, catching exceptions, catch all, re-throw, resource management, auto ptr, exceptions and new, resource exhaustion, exceptions in constructors, exceptions in destructors, uncaught exception, standard exceptions.

Unit III: Inheritance, Virtual Functions And Polymorphism **15 Hours**

Overloading: Defining operator overloading, *operator* function as member function and friend function, overloading unary and binary operators, type conversions, function overloading.

Inheritance: Types of inheritance, Defining derived class, Access specifiers: public, private and protected; public and private inheritance, accessing base class members, ambiguity in multiple

inheritance, virtual base classes, abstract classes, Derived class constructor with arguments, Initialization lists in constructors, classes within classes.

Virtual functions and polymorphism: Virtual functions, pure virtual functions, abstract classes, implementation of virtual functions (virtual pointers and virtual tables in classes with virtual functions), *this* pointer, static and dynamic binding, virtual functions in derived classes, object slicing, virtual functions and constructors, calling virtual functions from constructors, destructors and virtual destructors, calling virtual functions from destructors, virtual base classes, Rules for virtual functions.

Unit IV: Object Oriented Design **15 Hours**

Overview of object design, Steps of object design, design algorithms (choosing algorithms, choosing data structures, defining internal classes and operations, assigning responsibility for operations), design optimization (adding redundant associations for efficient access, rearranging execution order for efficiency, saving derived attributes to avoid recomputation), implementation of control (state as location within a program, state machine engine, control as concurrent tasks), adjustment of inheritance (rearranging classes and operations, abstracting out common behavior, use delegation to share implementation), design of associations(analyzing associations traversal, one-way association, two-way association, link attributes), object representation, physical packaging (information hiding coherence of entities, constructing modules), documenting design decisions.

Instructions for Paper Setter:

Unit	Theory Questions		Practical Questions	
	To be set	To be answered	To be set	To be answered
I	2	1	2	1
II	2	1	2	1
III	2	1	2	1
IV	2	1		
Total	8	4	6	3

Recommended Books:

1. **Balagurusamy, E.,** *Object-Oriented Programming with C++,* New Delhi: Tata McGraw-Hill, 1995
2. **Barkakati, N.,** *Object-Oriented programming in C++,* New Delhi: Prentice-Hall India, 2005
3. **Rumbaugh, J.; M. Blaha; W. Premerlani; F. Eddy; W. Loorenson,** *Object-Oriented Modeling and Design,* New Delhi: Prentice-Hall India, 2005

Further readings:

1. **Stroustrup, B.,** *The C++ Programming Language* (Special Edition), New Delhi: Pearson Education
2. **Parsons, D.,** *Object-Oriented Programming with C++,* New Delhi: BPB Publications, 1995
3. **Booch, G.,** *Object-Oriented Analysis and Design with Applications* (Second Edition), Addison Wesley , 1994
4. **Qualline, S.,** *Practical C++ Programming* (Second Edition), New Delhi: Shroff Publishers

204: Computer Graphics

Objective

Computer graphics is one of the most exciting and rapidly growing computer field. It has got numerous areas of applications such as user interface, data visualization, television commercials, motion pictures etc. This paper is meant to give the students knowledge of hardware, graphics concept and algorithms to implement the concepts.

Outline of the Course

Minimum Class Hours		Exam Time(Hours)		Credit		Marks					
						External		Internal		Total	
Th	As	Th	As	Th	As	Th	As	Th	As	Th	As
42	56	3	Viva 15 mins	3	2	75	25	25	75	100	100

Unit	Topic	Minimum Class hours		Marks
		Th	AS	Th
I	Overview of Graphics Systems	5		5
II	Output Primitives	10	56	20
III	Two- Dimensional Geometric Transformations	10		20
IV	Two- Dimensional Viewing	10		20
V	Three Dimensional Concept and Some Object Representation	7		10
Total		**42**	**56**	**75**

Detailed Syllabus

Unit I **5 Hours**

Overview of Graphics Systems : Video Display Devices, Refresh cathode-ray Tubes, Raster Scan Display, Random Scan Display Color CRT Monitor, Direct View Storage Tubes, Flat panel Display, Three Dimensional Viewing Devices, Stereoscopic and Virtual-Reality Systems, Raster Scan Systems Video Controller, Raster Scan Display Processor, Random-Scan Systems, Graphics Monitors and Workstations, Input Devices, Hard Copy Devices, Graphics Software, Coordinate Representations,Graphics Functions, Software Standards, PHIGS Workstations.

Unit II **10 Hours**

Output Primitives: Points and Lines, Line Drawing Algorithms, Loading the Frame Buffer, Line Functions, Circle –generating Algorithms, Ellipse-generating Algorithms, Other Curves, Conic Sections, Polynomial and Spline Curves, Parallel Curve Algorithms, Curve Functions, Pixel Address and Object Geometry Screen Grid Coordinate, Maintaining Geometric Properties of Displayed Objects, Filled-Area Primitives, Scan-line polygon Fill Algorithm, Inside Outside Test, Scan –Line Fill of Curved Boundary Areas, Boundary Fill Algorithm, Flood Fill Algorithm, Fill-Area Functions, Cell Array, Character Generations.

Unit III **10 Hours**

Two- Dimensional Geometric Transformations : Basic Transformations: Translations, Rotations, Scaling; Matrix Representations and Homogeneous Coordinates, Composite Transformations: Translations, Rotations, Scaling, General Pivot Point Rotations, General Fixed Point Scaling, General Scaling Directions, Concatenation Properties, General Composite

Transformations and Computational Efficiency, Other Transformations: Reflections, Shear; Transformations Between Coordinate Systems, Affine Transformations, Transformation Functions, Raster Method for Transformations.

Unit IV **10 Hours**

Two- Dimensional Viewing : The Viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-Viewport Coordinate Transformations. Two -Dimensional Viewing Functions, Clipping Operations, Point Clipping, Line Clipping: Cohen-Sutherland Line Clipping, Liang-Barsky Line Clipping, Nicholl-Lee-Nicholl Line Clipping; Polygon Clipping: Sutherland-Hodgeman Polygon Clipping, Weiler-Atherton Polygon Clipping; Curve Clipping, Text Clipping, Exterior Clipping.

Unit V **7 Hours.**

Three Dimensional Concept and Some Object Representation: Three-Dimensional Display Methods, Parallel Projections, Perspective Projections, Depth Cueing, Visible Line and Surface, Identification, Surface Rendering, Exploded and Cutway Views, Three-dimensional and Stereoscopic Views, Three Dimensional Graphic Packages, Polygon Surfaces, Polygon Tables, Place Equations, Polygon Meshes, Curved Line and Surfaces, Quadric Surfaces: Sphere, Ellipsoid, Torus, Superquadrics, Superellipse, Superellipsoid, Blobby Objects, Spline Representations, Interpolations and Approximations Splines, Parametric Continuity Conditions, Geometric Continuty Conditions, Spline Specifications, Cubic Spline Intepolation Methods, Natural Cubic Splines, Hermite Interpolations, Cardinal Splines, Kochanek-Bartels Splines, Bezier Curves, Properties of Bezier Curves, Design Technique Using Bezier Curves, CubicBezier Curves, Bezier Surfaces.

Assignments

1. Algorithms discussed in the previous units should be implemented using C/C++.
2. Graphics using OPEN GL: Introduction to OPEN GL, Drawing lines, Drawing polylines, Drawing polygons, Drawing aligned rectangles, clipping a line, Drawing arcs, Drawing circles, Drawing 3D curves, Circles rolling around a circle.
3. GUI using X-Windows: X Windows, Xaw-an X Toolkit, Introduction to Motif.

Instructions for Paper Setter (Theory):

Units	To be set	To be answered
I	1	1
II	2	1
III	2	1
IV	2	1
V	1	1
Total	**8**	**5**

Recommended Books

1. **Hearn, D.; M. P. Baker,** *Computer Graphics (*Second Edition)**,** New Delhi: Prentice-Hall India., 1994
2. **Hill, F. S.,** *Computer Graphics Using Open GL* (Second Edition), New Delhi: Prentice-Hall India, 2005
3. **Rao, R. M.; G. L. *Prasad,*** *Graphical User Interface(GUI) with X-Wndows and Motif***,** New Delhi: Wiley Eastern, 1994

Further readings

1. **Plastock, R.; G. Kalley,** *Theory and Problems of Computer Graphics* (Second Edition), Schaum's Series, New Delhi: Tata McGraw-Hill
2. **Foley, l. J.; A. V. Dam; S. Feiner; J. Huges,** *Computer Graphics : Principles and Practice,* New Delhi: Addison Wesley, 1996
3. **Rogers, D.; J. Adams,** *Mathematical Elements for Computer Graphics* (Second Edition), New Delhi: Tata McGraw-Hill

205: Computer Organization and Architecture

Objective

The objective of the course aims to provide the student with a basic knowledge necessary to understand the organization and architecture.

Outline of the Course

Minimum Class Hours	Exam Time Hours	Credits	Marks		
			External	Internal	Total
70	3	5	75	25	100

Unit	Topic	Minimum Class Hours	Marks
	Arithmetic Logic Unit	14	15
II	Control Unit	14	15
III	Parallel Processing, Multiprocessors	14	15
IV	Memory Organization	14	15
V	Input-Output Organization	14	15
Total		**70**	**75**

Detailed Syllabus

Unit I: Arithmetic Logic Unit **14 Hours**

Addition and Subtraction (Addition and Subtraction with Signed-Magnitude Data, Hardware Implementation, Addition and Subtraction with Signed-2's Complement Data); Booth's Multiplication Algorithm; Division Algorithm; Floating-Point Arithmetic Operations (Addition, Subtraction, Multiplication, Division).

Unit II: Control Unit **14 Hours**

Major Components of a CPU; General Register Organization; Stack Organization (Register Stack, Memory Stack, Reverse Polish Notation); Subroutine Call and Return; Fetch Routine; Types of Interrupts; Characteristics of Complex Instruction Set Computer (CISC) and Reduced Instruction Set Computer(RISC)

Microoperations, Control Function, Role of Three-State Bus Buffers in Memory Transfers; Arithmetic Microoperations, Logic Microoperations, Shift Microoperations; Microprogrammed Control and Hardwired Control; Control Memory, Control Word, Microinstruction, Microprogram, Mapping of Instructions; Instruction Formats(Three-Address Instructions, Two-Address Instructions and Zero-Address Instructions); Addressing modes.

Unit III: Parallel Processing and Multiprocessors **14 Hours**

Parallel Processing: Flynn's Classification of computers; Pipelining, Data Dependency, Handling of Branch Instructions, Delayed Load, Delayed Branch; Vector Processing, Supercomputers; Array Processors.

Multiprocessors: Tightly Coupled, Loosely Coupled; Interconnection Structures (Time-Shared Common Bus, Multiport Memory, Crossbar Switch, Multistage Switching Network, Hypercube Interconnection); Interprocessor Arbitration (Serial Arbitration Procedure, Parallel Arbitration Logic, Rotating Daisy-Chain); Interprocessor Communication and Synchronization, Mutual Exclusion with a Semaphore.

Unit IV: Memory Organization **14 Hours**

Hardware Organization for Associative Memory; Mapping methods for Cache Memory (Associative Mapping, Direct Mapping, Set-Associative Mapping), Write Through, Write Back, Cache Initialization, Cache Coherence; Virtual Memory, Memory management hardware.

Unit V: Input-Output Organization **14 Hours**

Input Output Interface, I/O Bus, Memory Bus, Isolated I/O, Memory-Mapped I/O; Asynchronous Data Transfer, Strobe Control, Handshaking; Modes of Transfer- viz. Direct Memory Access, Programmed I/O, and Interrupt-Initiated I/O; Priority Interrupt (Daisy-Chain Priority, Parallel Priority Interrupt, Priority Encoder); Input-Output Processor; Serial Communication(Character-Oriented Protocol and Bit-Oriented Protocol).

Instructions for Paper Setter:

Unit	Questions	
	To be set	To be answered
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1
Total	**10**	**5**

Recommended Books

1. **Mano, M. M.,** *Computer System Architecture* (Third Edition), New Delhi: Prentice-Hall India, 2002
2. **Hamacher, V. C.; Z. G. Vranesic; S. G. Zaky,** *Computer Organization* (Fourth Edition), New Delhi: Tata McGraw-Hill, 1996

Further readings

1. **Stallings, W.,** *Computer Organization and Architecture* (Sixth Edition), New Delhi: Prentice-Hall India , 2002

301: Database Management System - I

Objective

The objective of this paper is to introduce to the students the fundamental concepts necessary for designing, using and implementing database systems and applications. The paper stresses on database modeling and design, physical file storage techniques and language facilities provided by database management systems.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
56	3	4	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	Introduction and Conceptual Data Modeling	20	20
II	Relational Data Model and SQL	20	25
III	Functional Dependencies and Normalization	10	15
IV	File Organization	16	15
Total		**56**	**75**

Detailed Syllabus

Unit I: Introduction and Conceptual Data modeling **20 Hours**

Introduction: Introduction to databases, characteristics of the database approach, database users and designers, role of a DBA, advantages of using a DBMS, data models, schemas, instances, DBMS architecture (Three-Schema Architecture), Database systems- Network, Hierarchical, Relational, Data Independence

Conceptual Data Modeling: Phases of database design, entity type, entity set, attributes, keys, value sets, relationships, relationship types, relationship sets, relationship instances, relationship degree, role names, recursive relationships, constraints on relationship types, attributes of relationship types, weak entity types, ER Diagram, naming conventions and design issues, EER concepts.

Unit II: Relational Data Model and Structured Query Language **20 Hours**

Relational model concepts: Domain, attribute, tuple, relation, characteristics of relations, relational databases, relational database schemas, relational constraints (Domain constraint, constraints on null), entity integrity, referential integrity, foreign keys. ER to Relational mapping algorithm, Case study.

Relational Algebra: basic relational algebra operations-SELECT, PROJECT, UNION, INTERSECTION, SET DIFFERENCE, Cartesian PRODUCT, JOIN, Aggregate functions

Relational Calculus: Tuple Relational Calculus, Domain Relational Calculus

SQL: Characteristics of SQL, Data types in SQL, Types of SQL commands

Data Definition Commands: CREATE SCHEMA, CREATE TABLE, DROP TABLE, ALTER TABLE .

Single table query commands: SELECT, SELECT with WHERE, SELECT with ORDER BY, SELECT with GROUP BY, SELECT with GROUP BY and HAVING, SQL built-in functions - SUM, MIN, MAX, COUNT, AVG.

Multi-table query commands: Retrieval using sub-query, JOIN, EXIST and NOT EXIST

Special operators: IS NULL, IS NOT NULL, BETWEEN..AND, IN, LIKE, ANY, ALL

Data changing commands: INSERT, DELETE, UPDATE

Unit III: Functional Dependencies and Normalization **10 Hours**

Functional Dependencies, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Multivalued Dependencies, Join Dependencies, Fourth Normal Form, Fifth Normal Form, Denormalization

Unit IV: File Organization **16 Hours**

Introduction to storage hierarchies, hardware descriptions of disk devices, Magnetic Tape Storage Devices, RAID technology, Organization of file records on disk (record and record types, Fixed- length records, variable-length records, record blocking, spanned and unspanned records, allocating file blocks on disk, file headers), Operations on Files (Open, Reset, Find, Read, Delete, Modify, Insert, Close), primary methods of file organization -Heap Files, Sorted Files, Hashed Files.Types of Single-level Ordered Indexes (Primary Indexes, Clustering Indexes, Secondary Indexes), Multilevel Indexes: Basic technique, Multilevel indexing using B tree and B+ tree,Indexing on multiple keys

Instructions for Paper Setter

Unit	Questions	
	To be set	To be answered
I	2	1
II	2	1
III	2	1
IV	2	1
Total	8	4

Recommended Book

1. **Elmasri, R.; S. B. Navathe**, *Fundamentals of Database Systems* (Third Edition)**,** New Delhi: Addison Wesley, 2000

Further readings

1. **Silberschatz, A.; H. F Korth; S Sudarshan**, *Database System Concepts,* New Delhi: Tata McGraw-Hill, 1997
2. **Desai, B.,** *An Introduction to Database Systems*, New Delhi: Galgotia Publications, 1991
3. **Kroenke, D. M.,** *Database Processing: Fundamentals, Design and Implementation* (Eighth Edition), New Delhi: Prentice-Hall of India, 2002
4. **Hansen, G. W.; J. V. Hansen**, *Database Management and Design* (Second Edition) Prentice-Hall of India, 2001
5. **Connolly, T. M.; C. E. Begg,** *Database Systems, A Practical Approach to Design, Implementation and Management*, New Delhi: Addison Wesley, 1999

302:Data Communications & Networks - I

Objective

Data communications and networking may be the fastest growing technologies in our culture today. One of the ramifications of that growth is a dramatic increase in the number of professionals where an understanding of these technologies is essential for success. This paper deals with the introduction and the first two layers of the OSI model. The students, at the end of this course, will have a more than elementary idea about the technologies/protocols involved in the physical and data link layer, including the medium access control sublayer of the later.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
56	3	4	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	Introduction to Computer Networks	5	15
II	Physical Layer	17	20
III	Data Link Layer	17	20
IV	Medium Access Control Sublayer	17	20
Total		**56**	**75**

Detailed Syllabus

Unit I: Introduction To Computer Networks **5 Hours**

Uses of Computer Networks; Wired and wireless Networks; Types of networks – LAN, MAN, WAN; Network Topology; OSI Reference Model – Outline, Protocol hierarchies, Design considerations; TCP-IP Reference Model; ATM Reference Model; Comparison among these reference models; Examples- Internet, X.25, Frame Relay, ATM

Unit II: Physical Layer **17 Hours**

Fourier Analysis (Qualitative), Maximum data rate of a Channel, Bit rate and Baud; Baseband and Broadband; Guided Transmission Media- Magnetic, Twisted pair, Coaxial cable, Fibre Optics; Wireless transmission – Electromagnetic Spectrum, Radio transmission, Microwave Transmission, Infrared transmission; Comparison among the different transmission media – guided and unguided; Communication Satellite – LEO, MEO and GEO Satellite; Amplitude, Phase and Frequency modulation – QPSK, QAM, Frequency Division and Time Division Multiplexing – PCM, Delta Modulation, SONET; Circuit, Message and Packet Switching; Outline of PSTN, ADSL, WLL, AMPS, D-AMPS, GSM, CDMA

Unit III: Data Link Layer **17 Hours**

Design Issues - Services provided to the higher layer, Framing, Error Control, Flow Control; Error Detection and Correction – Error Correcting Codes, Error-Detecting Codes; Elementary Data Link Protocols – Unrestricted simplex protocol, Simplex stop-and-wait protocol, Protocol for Noisy Channel; Sliding Window protocols – One bit sliding window, Go Back n protocol, Protocol using Selective Repeat; Examples – HDLC, Data Link Layer in the Internet, PPP

Unit IV: Medium Access Control Sublayer **17 Hours**

Channel Allocation Problem – Static and Dynamic channel allocation; Multiple access – Aloha, Slotted Aloha, CSMA; Collision free protocols; Limited Contention Protocols; Wireless LAN protocols – MACA, MACAW; IEEE Standard 802.3 – Ethernet, Cabling, Encoding, MAC Sublayer, Switched Ethernet, Fast Ethernet Gigabit Ethernet; IEEE Standard 802.11 – Protocol Stack, Physical Layer, MAC Sublayer, Frame Structure; IEEE Standard 802.16 – Protocol Stack, Physical Layer, MAC Sublayer, Frame Structure; Bluetooth- Architecture, Application, Protocol Stack, Radio Layer, Baseband layer, Frame Structure; Bridges – Spanning tree bridges, Remote bridges

Instructions for Paper Setter

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
Total	**8**	**4**

Recommended Book

1. **Tenenbaum, A. S.**, *Computer Networks* (Fourth Edition), New Delhi: Prentice-Hall India, 2002

Further readings

1. **Forouzan B. A.**, *Data Communication and Networking* (Second Edition), New Delhi: Tata McGraw-Hill, 2000
2. **Stallings, W.,** *Data and Computer Communications* (Sixth Edition), New Delhi: Prentice-Hall India, 2000
3. **Halsall, F.**, *Data Communication, Computer Networks and Opens Systems* (Fourth Edition), New Delhi: Pearson Education, 2000

303: Operating System (Theory)

Objective:

The main objective of this paper is to introduce the students to a layer of software called the Operating Systems, whose job is to manage all the devices of a computer system and provide user programs with a simple interface to the hardware. This paper will familiarize the students with the concepts of processes, memory management, file management, Input/Output management and the potential problem of deadlocks. The students will also learn about the Linux operating system, which is a full-blown Unix clone and is fast gaining popularity worldwide.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
56	3	4	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	Concepts, Processes and Threads	13	15
II	Deadlocks and Memory Management	13	20
III	Input/Output and File Systems	15	20
IV	Introduction To Linux	15	20
Total		**56**	**75**

Detailed Syllabus

Unit I: Concepts, Processes and Threads **13 Hours**

Operating system as an Extended Machine and as a Resource Manager, Operating system concepts (Files, Deadlocks, Memory Management, Input/Output, Processes, The Shell, Security), The evolution of Operating Systems (Serial Processing, Simple Batch Systems, Multiprogrammed Batch Systems, Mainframe Operating Systems, Server Operating Systems, Time Sharing Systems, Multiprocessor Operating Systems, Real-Time Systems, Embedded Operating Systems, Smart Card Operating), System Calls (Process Management, File Management, Directory management), Introduction to Processes (The Process Model, Process Creation, Process Termination, Process Hierarchies, Process States, Implementation of Processes, Process Control Block), Threads (The Thread Model, Thread Usage, Implementing Threads(In User Space and Kernel), Scheduler Activation, Pop Up Threads, Interprocess Communication (Race conditions, Critical Sections, Mutual Exclusion with Busy Waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message Passing), Classical IPC problems (The Dining Philosophers Problem, The Sleeping Barber Problem), Process Scheduling (Scheduling in Batch Systems, Scheduling in Batch Systems, Scheduling in Interactive Systems, Scheduling in Real-Time Systems, Thread Scheduling)

Unit II: Deadlocks and Memory Management **13 Hours**

Resources, Deadlock (Conditions for Deadlock, Deadlock modeling), Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention

Memory management without swapping or paging (Monoprogramming without swapping or paging, Multiprogramming with fixed partitions, Relocation and Protection), Swapping, Virtual Memory (Paging, Page Tables), Page Replacement Algorithms (Not-recently-used, First in first out, Second Chance page replacement algorithm, The Clock Page Replacement Algorithm, Least Recently used page replacement algorithm, The Working Set Page Replacement Algorithm, Modeling Paging Algorithms (Belady's Anomaly, Stack Algorithms, Predicting page

fault rates), Design issues for Paging Systems, Implementation issues, Segmentation (Implementation of pure segmentation, Segmentation with Paging: MULTICS)

Unit III: Input/Output and File Systems **15 Hours**

Principles of I/O hardware (I/O devices, Device Controllers, Direct memory access), Principles of I/O software, I/O Software Layers, Disks (Disk hardware, disk formatting, disk arm scheduling algorithms, Error handling, Track-at-a-time caching, RAM disks) Clocks (Clock hardware, Clock software), Terminals (Terminal hardware, Input software, Output software)

Files (File Naming, File structure, File types, File access, File attributes, File operations, Memory mapped files), Directories, File System layout (Implementing files, Implementing directories, Shared files), Security (The security environment, Generic Security Attacks, Design Principles For Security, User Authentication), Protection mechanisms (Protection Domains, Access Control Lists, Capabilities, Multilevel Security, Covert Channels), Type of File Systems (FAT, VFAT, FAT32, NTFS)

Unit IV: Introduction to Linux OS design –Case study **15 Hours**

Overview of Unix, Processes in Unix (Fundamental Concepts, Process Management System Calls in Unix, Implementation of Processes in Unix), Memory Management in Unix, Input/Output in Unix, The Unix File System, Security in Unix

Instructions for Paper Setter

Unit	Questions	
	To be set	To be answered
I	2	1
II	2	1
III	2	1
IV	2	1
Total	8	4

Recommended Book

1. **Tenenbaum, A. S.**, *Modern Operating Systems* (Second Edition), New Delhi: Prentice-Hall India, 2002

Further readings

1. **Stallings, W.**, *Operating Systems* (Fourth Edition), New Delhi: Prentice-Hall India, 2003
2. **Silberschatz; Galvin**, *Operating System Concepts* (Fifth Edition), New York: John Wiley and Sons, 2000
3. **Deitel, H. M.,** *Operating Systems* (Second Edition), New Delhi: Pearson Education
4. **Bhatt P. C. P.,** *An Introduction to Operating Systems Concept*, New Delhi: Prentice-Hall India
5. **Bach, M. J.,** *The Design of the Unix Operating System,* New Delhi: Prentice-Hall India, 1992
6. **Kernighan; Pike**, *The Unix Programming Environment*, New Delhi: New Delhi: Prentice-Hall India

303:Operating System (Practical)

Objective:

This paper aim in providing an opportunity to develop programs that normally is handled by the Operating System. The students will learn how processes are managed, how multiuser capability of an Operating System like Linux is achieved and how deadlocks are resolved.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
56	3	2	75	25	100

Detailed Syllabus

Unit I : Introduction to Linux

File System (Types of file, Filename, parent-child relationship, absolute and relative pathname, file and directory permissions) Introduction to vi editor (start vi, the three modes, create, save and open a text file, positioning by character, positioning by line, positioning by word, positioning in the word, positioning on a numbered line, inserting text, deleting text), Simple Linux commands, Shell Programming

Semaphores, Shared Memory and Message Queues: Semaphore (Binary semaphore, Linux Semaphore Facilities, Using Semaphores), Shared Memory, Message Queues

Unit II : Processes and Signals

Process Structure, Starting a new Process, Replacing a Process Image, Duplicating a Process Image, Waiting for a process, Zombie Processes, Terminating a Process, Signals (Signal handling, Sending signals, Signal interface, Signals sets).

POSIX Threads : Creating threads, Simultaneous execution of threads, Synchronization and Critical sections, Synchronization with Semaphores, Synchronization with Mutexes, Thread Attributes, Canceling a thread.

Inter-Process Communication: Pipes, Process Pipes, The Pipe Call, Parent and Child processes, FIFOs (Accessing a FIFO, Opening a FIFO, Reading and Writing FIFO).

Instructions for Paper Setter:

This paper is to be evaluated only through Practical Examination. Questions are to be set involving the above mentioned topics.

Unit	Questions		Marks	
	To be set	To be answered	Each question	Total
I	2	1	25	25
II	3	2	25	50

Recommended Books

1. **Das, S.,** *Unix Concepts and Applications* (Third Edition)**,** New Delhi: Tata McGraw-Hill 1998
2. **Matthew, N.; R. Stones,** *Beginning Linux Programming* (Third Edition),New Delhi: Wrox, Wiley, 2004

Further readings:

1. **Mitchell, M.; J. Oldham; A. Samuel**, *Advanced Linux Programming,* New Delhi: New Riders Techmedia, 2001
2. **Stevens, W. R.,** *Unix Network Programming Interprocess Communications - Vol 1* (Second Edition), New Delhi: Prentice-Hall India, 2002
3. **Stutz, M.,** *The Linux Cookbook* (Second Edition), New Delhi: Shroff Publishers, 2004

304: Design and Analysis of Algorithms

Objective:

The study of algorithms is at the heart of computer science. In recent years, a number of advances have been made in the field of designing of the algorithms. This paper is meant to give the students an in-depth knowledge to analyze and design a better algorithm before its actual implementation.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks					
						External		Internal		Total	
Th	As	Th	As	Th	As	Th	As	Th	As	Th	As
56	28	3	Viva 15 mins	4	1	75	10	25	40	100	50

Unit	Topic	Minimum Class hours		Marks
		Th	As	Th
I	Models of Computations, Analysis, Design	15	28*	30
II	Sorting, Data Structures	8		10
III	Graphs and Matrix	13		15
IV	NP Complete, Intractable problems	10		10
V	Data structures, Memory management	10		10
Total		56	28	75

DETAILED SYLLABUS

Unit I **15 Hours**

Models of Computations: Algorithms and their complexity, Random access machines, Computational complexity of RAM programs, A stored program model, Abstraction of RAM, A primitive model of computation: Turing machine, Relationship between Turing machine and RAM model.

Algorithms Analysis Techniques: Efficiency of algorithms, Analysis of recursive programs, Solving recurrence equations, A General solution for large class of recurrences.

Algorithms Design Techniques: Data structures: List, queues and stacks; Set representations, Graphs, Trees, Divide and Conquer algorithms, Dynamic programming, Greedy algorithms, Backtracking, Local search algorithms, Balancing .

Analysis of some AI Algorithms: A algorithm, A* algorithm, AO* algorithm, AND-OR algorithm, Hill climbing algorithm.

Unit II **8 Hours**

Sorting and Order Statistics: The sorting problem, Radix sorting, Sorting by comparison, Heapsort- an $O(n \log n)$ comparison sort, Quicksort- an $O(n \log n)$ expected time sort, Order statistics, Expected time of order statistics.

Data Structures for Set Manipulation Problems: Fundamental operations on set, Hashing, Binary search, Binary search trees, Optimal binary search trees, A simple-disjoint-set union algorithm, Tree structures for UNION-FIND problem, Application and extensions of the UNION-FIND algorithm, Balanced tree schemes, Dictionaries and priority queues, Mergeable heaps, Concatanable queues, Partitioning.

Unit III **13 Hours**

Algorithms on Graphs: Minimum-cost spanning trees, Depth-first search, Biconnectivity, Depth-first search of a directed graph, Strong connectivity, Path-finding problems, A transitive closure algorithm, A shortest-path algorithm, Path problems and matrix multiplication, Single –source problems, Dominators in a directed acyclic graph.

Matrix Multiplications and Related Operations: Basics, Strassen's matrix-multiplication algorithm, Inversion of matrices, LUP decomposition of matrices, Application of LUP decomposition, Boolean matrix multiplication.

Unit IV **10 Hours**

NP-Complete Problems: Nondeterministic Turing machine, The classes *P* and *NP,* Languages and problems*,* NP-completeness of the satsifiability problem, Additional NP-complete problem, Polynomial space-bound problems.

Some Provably Intractable Problems: Complexity hierarchies, The space hierarchy for deterministic Turing machine., A problem requiring exponential time and space, A non-elementary problem.

Unit V **10 Hours**

Data Structures and Algorithms for External Storage: A model for External computation, External sorting, Storing information in files, External search trees.

Memory Management: The issues in memory management, Managing equal-sized blocks, Garbage collection algorithms for equal-sized blocks, Storage allocation for objects with mixed sizes, Buddy systems, Storage compaction.

***Assignments should be based on the units I, II and III, and be done using C/C++.**

Instructions for Paper Setter (Theory):

Unit	To be set	To be answered
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1
Total	**10**	**5**

Recommended Books

1. **Aho, A. V.; J. E. Hopcroft; J. D. Ullman,** *The Design and Analysis of Computer Algorithms,* New Delhi: Addison Wesley, 2001.
2. **Aho, A. V.; J. E. Hopcroft; J. D. Ullman,** *Data Structures and Algorithms,* New Delhi: Addison Wesley, 2000.
3. **Cormen, T. H.; C. E. Leiserson; R. L. Rivest; C. Stein,** *Introduction to Algorithms* (Second Edition), New Delhi: Prentice-Hall India, 2004

Further readings

1. **Manbar, V.,** *Introduction to Algorithms- A Creative Approach.* New Delhi: Addison Wesley, 2000
2. **Harwitz, E.; S. Sahani,** *Fundamentals of Computer Algorithms,* Computer Science Press, 2000
3. **Linz, P.,** *An Introduction to Formal Languages and Automata,* New Delhi: Narosa Publishing House, 2001

305: GUI Programming using VB.NET

Objective

NET is the new strategy from Microsoft for building applications for the next decade and VB.NET is probably the most widely used languages in this new strategy. This paper will give the students an in-depth knowledge to design and develop programs for Desktop as well as Web using VB.NET. This paper will also give the students a clear concept of the many new technologies such as ADO.NET, ASP.NET, Web Services etc., which are very useful for developing robust applications for almost any environment**.**

Outline of the Course

Minimum Class Hours		Exam Time Hours		Credits		Marks					
						External		Internal		Total	
Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr
56	56	3	3	4	2	75	75	25	25	100	100

Unit	Topic	Minimum Class hours		Marks	
		Th	Pr	Th	Pr
I	Getting Starated, Visual Basic Project, Language.	10	10	10	40
II	Procedures, Forms, Controls	13	13	20	
III	Custom Class, Windows Controls, Debugging	13	13	20	
IV	Building Database Application, Programming ADO.NET	10	10	15	20
V	VB.NET, Accessing Data in Web, XML Web Services	10	10	10	15
Total		**56**	**56**	**75**	**75**

DETAILED SYLLABUS

Unit I **10 Hours**

Getting Started : The Integrated Development : The Start Page, Project Types; Your First VB Application, The IDE Components : IDE Menu, ToolBox Window, Solution Explorer, Properties Window, Output Window, Command Window, Task List Window; Environment Options, A few Common Properties, A Few Common Events , A Few Common Methods, Building a Console Application

Visual Basic Projects: Building A loan Calculator, Building a Math Calculator, Taking the LoanCalculator to the Web, Working with Multiple Forms: Working with Multiple Projects, Executable Files; Distributing An Application: Creating a Window Installer, Running the Window Installer, Verifying the Installation;

Visual Basic: The Language : Variables: Declaring Variables, Types of Variables, Converting Variable Types, User-Defined Data Types, Examining Variable Types, A Variable's Scope, The Lifetime of a Variable; Constants, Arrays: Declaring Arrays, Initializing Arrays, Array Limits, Multidimensional Arrays, Dynamic Arrays, Array of Arrays; Variables as Object: What's an Object, Formatting Numbers, Formatting Dates; Flow Control Statements: Test Structures, Loop Structures, Nested Control Structures, The Exit Statement.

Unit II **13 Hours**

Using Procedures: Modular Coding : Subroutines, Functions, Calling Functions and Subroutines, Arguments: Argument Passing Mechanisms, Event-handler Arguments, Passing and Unknown Number of Arguments, Named Arguments, Overloading Functions.

Working with Forms: The Appearance: Properties of form Controls, Placing Control on the Forms, Setting the Tab Order, The Contracts Projects, Anchoring and Docking, The Form's Events; Loading and Showing Forms : The Startup Form, Controlling One Form from within Another, Forms Vs Dialog Boxes, The Multiple Forms Projects; Designing Menus, Building Dynamic Forms at Runtime.

Windows Controls : Basic Windows Controls : The TextBox , ListBox, CheckBox, ComboBox, Scroll Bars and TaskBars Controls;

More Windows Controls: The Common Dialog Controls: Using Common Dialog Controls, Color Dialog Box, Font Dialog Box, Open and Save Dialog Box, Print Dialog Box. Rich TextBox: RTF Language, Rich TextBox Properties, Methods, Advanced Editing Features, Cutting and Pasting, Searching, Formatting URLs, RTFPad Project.

Unit III **13 Hours**

Building Custom Classes: Building the Manual Class: Adding Code, Property Procedures, Customizing Default Members, Custom Enumerations, Using SimpleClass in Other Objects, Featuring Events, Shared Properties. A "Real" Class : Passing a Filename String, Reusing the String Tools Class, The ClassContract Project, Encapsulation and Abstraction. Inheritance, Polymorphism, Parent Class Keywords, Derived Class Keywords, Parent Class Member Keywords, Derived Class Member Keywords, MyBase and MyClass, The Matrix Class

Building Custom Windows Controls: Designing Windows Controls, Enhancing Existing windows Controls, Building Compound Controls, Building User-Drawn Controls, Designing Irregular Shaped Controls, Building Owner-Drawn Controls, Using ActiveX Controls.

Error Handling and Debugging: Types of error, Exception and Structured Exception Handling: Studying an Exception, Getting a Handle, Finally, Customizing Exception Throwing your Own Excerption. Debugging Breakpoints, Stepping Through, The Local and Watch Window.

Unit IV: **10 Hours**

Building Database Application with ADO.NET : Architecture of ADO.NET, Creating a DataSet, Data Binding, Programming the DataAdapter Object, The Command Object, The Command and DataReader Objects.

Programming The ADO.NET Objects : Structure of DataSet: Navigating the Tables, Updating DataSets. DataForm Wizards, Handing Identity Fields, Transactions. Performing Update Operations: A DataRow's Versions, DataRow's States, Building and Using Custom DataSets.

Unit V: **10 Hours**

VB.NET and Web: Building a Web Application: Interacting with Application, Maintaining State, The Web Controls. ASP.NET Objects: Page Object, Response Object, Request and Server Object. Using Cookies, Handling Multiple Forms in Web Application.

Accessing Data on the Web: Data-Bound Web Controls: Simple Data Binding, Binding to DataSets, Getting Orders on the Web, A Master/Detail Page: Customizing the Appearance of the DataGrid Control, Programming the Selection Button.

XML Web Services : How to serve the Web, Building a Web Service, Consuming the Web Service, ASP.NET Web Service Project, A Data-driven Web Service, Consuming the Products Web Service in VB.

Instructions for Paper Setter:

Units	Theory Questions		Practical Questions	
	To be set	To be answered	To be set	To be answered
I	2	1	3	2
II	2	1		
III	2	1		
IV	2	1	2	1
V	2	1		
Total	**10**	**5**	**5**	**3**

Recommended Books

1. **Petroutsos, E.**, *Mastering Visual Basic.NET,* New Delhi: BPB Publications, 2004

Further readings

1. **Evgen, B.; J. Beres et. al,** Visual *Basic.NET Programming Bible***,** IDG Books India, 2002
2. **Riordan,** *Microsoft ADO.NET Step By Step,* New Delhi: Prentice-Hall India, 2004
3. **Halvorson,** *Microsoft Visual Basic.NET Step by Step,* New Delhi: Prentice-Hall India, 2004
4. **Duthie,** *Microsoft ASP.NET Step By Step,* New Delhi: Prentice-Hall India, 2004

401:Software Engineering

Objective:

The field of software engineering aims to find answers to the many problems that software development project is likely to meet when constructing large software systems. The objective of this paper is to make students aware of the problems incurred by large-scale software development and the solutions proposed. It covers a framework for studying and evaluating software tools, and stresses the importance of theory in the development of software.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
56	3	4	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	The Product and The Process, Software Projects' Process, Metrics and Planning	10	15
II	Software Projects Risks, Quality Assurance and Configuration Management	10	15
III	Analysis and Design	14	15
IV	Software Testing	08	10
V	Object Oriented Software Engineering, Advanced Topics In Software Engineering	14	20
TOTAL		**56**	**75**

Detailed Syllabus

Unit I **10 Hours**

The Product and The Process: *The Product* - Evolving Role of Software, Software (Characteristics, Components and Applications;

The Process – Software Engineering A Layered Technology, The Software Process, Software Process Models, The Linear Sequential Model, The Prototyping Model, The RAD Model, Evolutionary Process Models (The Incremental Model, The Spiral Model, The Component Assembly Model, The Concurrent Development Model), The Formal Methods Model, Fourth Generation Techniques;

Software Projects' Process, Metrics and Planning: *Project Management Concepts* – The Management Spectrum (People, The Problem, The Process and The Project);

Software Process and Project Metrics – Measures, Metrics and Indicators, Metrics in the Process and Project Domains, Software Measurement, Reconciling Different Metrics Approaches, Metrics for Software Quality;

Software Project Planning – Observation on Estimating, Project Planning Objectives, Software Scope, Resources, Project Estimation Technique – Empirical estimation techniques (Expert Judgement Technique, Delphi Cost Estimation), Heuristic estimation techniques (COCOMO Model), Halstead Software Science (An Analytical Technique), The Make-Buy Decision;

Unit II **10 Hours**

Software Projects Risks, Quality Assurance and Configuration Management: *Risk Management*- Reactive Vs. Proactive Risk Strategies, Software Risk, Risk Identification, Risk Projection, Risk (Mitigation, Monitoring and Management), Safety Risks and Hazards, The RMMM Plan;

Project Scheduling and Tracking- Basic Concepts, The Relationship between People and Effort, Defining a Task set for the Software Project, Selecting Software Engineering Tasks, Defining a Task Network, Scheduling, The Project Plan;

Software Quality Assurance- Quality Concepts, The Quality Movement, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Statistical Quality Assurance, Software Reliability, The SQA Plan, The ISO 9000 Quality Standards;

Software Configuration Management- Software Configuration Management, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting;

System Engineering- Computerised Based Systems, Product Engineering;

Unit III **14 Hours**

Analysis and Design: *Analysis Concepts and Principles*- Requirements Analysis, Communication Techniques, Analysis Principles, Software Prototyping, Specification, Specification Review;

Analysis Modeling- The Elements of the Analysis Model, Data Modeling, Functional Modeling and Information Flow, Behavioral Modeling, The Mechanics of Structured Analysis, The Data Dictionary;

Design Concepts and Principles- Software Design And Software Engineering, The Design Process, Design Principles, Design Concepts, Effective Modular Design, Design Heuristic for Effective Modularity, The Design Model, Design Documentation;

Design Methods- Data Design, Architectural Design, The Architectural Design Process, Architectural Design Optimization, Interface Design, Human-Computer Interface Design, Interface Design Guidelines, Procedural Design;

Design For Real Time systems- Real Time Systems;

Unit IV **8 Hours**

Software Testing: *Software Testing Methods*- Software Testing Fundamentals, Test Case Design, White Box Testing, Basis Path Testing, Control Structure Testing, Black Box Testing, Testing for Specialized Environments;

Software Testing Strategies- A Strategic Approach to Software Testing, Strategic Issues, Unit Testing, Integration Testing, Validation Testing, System Testing, The Art of Debugging;

Technical Metrics For Software- Software Quality, A Framework For Technical Software Metrics, Metrics for the Analysis Model, Metrics for the Design Model, Metrics for Source Code, Metrics for Testing, Metrics for Maintenance;

Unit V **14 Hours**

Object Oriented Software Engineering: *Object Oriented Concepts and Principles*- The Object Oriented Paradigm, Object Oriented Concepts, Identifying the Elements of an Object Model, Management of Object Oriented Software Projects;

Object Oriented Analysis- Object Oriented Analysis, Domain Analysis, Generic Components of the Object Oriented Analysis Model, The OOA Process, The Object Relationship Model, The Object Behavior Model;

Object Oriented Design- Design for Object Oriented Systems, The Generic Components of the OO Design Model, The Systems Design Process, The Object Design Process, Design Patterns, Object Oriented Programming;

Advanced Topics In Software Engineering: *Cleanroom Software Engineering*- The Cleanroom Approach, Functional Specification, Design Refinement and Verification, Cleanroom Testing;

Software Reuse- *Management Issues, The Reuse Process, Domain Engineering, Building Reusable Components, Classifying and Retrieving Components, Economics of Software Reuse;*

Reengineering- Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering, The Economics of Reengineering;

Computer Aided Software Engineering- Case Definition, Building Blocks of Case, Taxonomy Of Case Tools, Integrated Case Environments, The Integration Architecture, The Case Repository;

Instructions for Paper Setter:

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1
Total	**10**	**5**

Recommended Books

1. **Pressman, R. S.,** *Software Engineering A Practitioner's Approach* (Sixth Edition), New Delhi: Tata McGraw-Hill, 2005
2. **Mall, R.,** *Fundamentals of Software Engineering* (Second Edition), New Delhi: Prentice-Hall India

Further readings

1. **Sommerville, I.,** *Software Engineering* (Sixth Edition), New Delhi: Addison Wesley
2. **Ghezzi, C.; M. Jazayeri; D. Mandrioli**, *Fundamentals Of Software Engineering* (Second Edition), New Delhi: Prentice-Hall India, 2002
3. **Hoffer, J. A.; J. F. George; J. S. Valacich,** *Modern Systems Analysis and Design* (Second Edition), New Delhi: Pearson Education, 2000
4. **Fairley, R. E.,** *Software Engineering Concepts*, New Delhi: Tata McGraw-Hill, 1997
5. **Vilet, H. V.,** *Software Engineering Principles and Practice* (Second Edition), New York: John Wiley and Sons

402:Data Communications & Networks - II & Network Programming Using Linux (Theory)

Objective

This paper, being the continuation from the previous semester, builds on the concepts of data communications and computer network. It deals with the remaining three main layers – the Network layer, the Transport layer and the Application Layer. This paper also introduces the students to network security and cryptography. While the aforesaid topics are dealt for the theory part of this paper, the practical section deals with network programming.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
56	3	4	75	25	100

Unit	Topic	Minimum Class Hours	Marks
		Th	Th
I	Network Layer	16	25
II	Transport Layer	16	20
III	Application Layer	8	10
IV	Network Security	16	20
Total		**56**	**75**

Detailed Syllabus

Unit I: Network Layer **16 Hours**

Design Issues – Store and forward packet switching, Services provided to higher layer, Connection Oriented and Connectionless services, Virtual Circuits and Datagram subnets; Routing Algorithms – Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts, Routing in Adhoc networks; Congestion Control Algorithms – General Principles, Congestion Prevention Policies, Congestion control in Virtual Circuit and Datagram Subnets, Load shedding, Jitter control, QoS, Leaky Bucket Algorithm, Token Bucket Algorithm, RSVP; Internetworking – Tunneling, Fragmentation; Internet Protocol – IP addresses, Subnets, CIDR, Network address translation,; Internet Control Protocol – ICMP, ARP, RARP, BOOTP, DHCP; Mobile IP – Routing

Unit II: Transport Layer **16 Hours**

Design Issues, Services presented to higher layers; Transport Service Primitives; Berkeley Sockets; Transport protocols – Addressing, Connection Establishment and Release, Flow Control and Buffering, Multiplexing, Crash Recovery; Internet Transport Protocols: UDP – Remote Procedure Call, Real-time transport Protocol; TCP – Service Model, Protocol, Header, Connection Establishment and Release, Connection Management, Transmission Policy, Congestion Control, Timer Management

Unit III: Application Layer **8 Hours**

Domain Name System – name space, resource records, name servers; Electronic Mail-architecture and services, user agent, Message formats – MIME, Message Transfer - SMTP, Message Delivery – POP3 and IMAP, Web mail

Unit IV: Network Security **16 Hours**

Cryptography, Substitution Ciphers, Transposition Ciphers, One time pads, Quantum Cryptography, Cryptographic principles; Symmetric Key Algorithms – Data Encryption Standard,

Advanced Encryption Standard, Cipher Modes; Public Key Algorithms – RSA; Digital Signatures – Symmetric Key, Public Key, Message Digest, Birthday Attack; Communication Security - IPSec, Firewalls, Virtual Private Networks; Wireless Security – 802.11 Security, WAP Security; Authentication Protocols – Based on shared secret key, Deffie-Hellman Key Exchange, Key Distribution Center, Kerberos, Public Key

Instructions for Paper Setter:

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
Total	**8**	**4**

Recommended Book

1. **Tenenbaum, A. S.,** *Computer Networks* (Fourth Edition), New Delhi: Prentice-Hall India, 2002

Further readings

1. **Stevens, W. R.,** *UNIX Network Programming – Volume I* (Second Edtion), New Delhi: Prentice-Hall India, 2002
2. **Stallings, W.,** *Data and Computer Communications* (Sixth Edition), New Delhi: Prentice-Hall India, 2000
3. **Halsall, F.,** *Data Communication, Computer Networks and Opens Systems,* (Fourth Edition), New Delhi: Pearson Education, 2000
4. **Stallings, W.,** *Cryptography and Networking Security - Principles and Practice,* New Delhi: Pearson Education, 2000

402:Data Communications & Networks - II & Network Programming Using Linux (Practical)

Objective

Network programming involves writing programs that communicate with other programs across a computer network. Most operating systems provide pre-compiled programs that communicate across a network. This course envisages providing an introduction to such networking programming, whereby students will learn to write their own network programs. At the end of this course in network programming, the students are expected to have elementary ideas about the Barkeley sockets and their usage in setting up TCP and UDP communications.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
Pr	Pr	Pr	Pr	Pr	Pr
56	3	2	75	25	100

Detailed Syllabus

Unit I

Introduction to Network Programming

Introduction to Sockets; Address Structure – IPv4, IPv6; Value-Result Arguments; Byte Order Functions; Byte Manipulation Functions; `inet_aton, inet_addr, inet_ntoa, inet_pton, inet_ntop, readn, written, readline, isfdtype` functions

Elementary TCP Sockets

Introduction; socket, connect, bind, listen, accept, fork, exec, close, getsockname, getpeername functions; TCP Client Server example; signal, sigaction, wait, waitpid functions; Connection Termination; SIGPIPE signal

I/O Multiplexing

I/O models; `select` function; Batch input; `shutdown, pselect, poll` functions; Example – TCP Echo Server.

Socket Options

`getsockopt, setsockopt, fcult, ioclt` functions; Socket status – generic socket options

Elementary UDP Sockets

Introduction; `recvfrom, sendto` functions; UDP Examples; `connect` function with UDP; UDP socket receive buffer; Example – UDP Echo Server

Unit II

Elementary Name and Address Conversion

Introduction; gethostbyname function; RES_USE_INET6 resolver option; gethostbyaddr, uname, gethostname, getservbyname, getservbyport functions.

IPv4 and IPv6 Interoperability
Introduction; IPv4 Client - IPv6 Server, IPv6 Client – IPv4 Server; IPv6 Address Testing Macros, IPV6_ADDRFORM.

Advanced Name and Address Conversions
Introduction; getaddrinfo, gai_strerror, freeaddrinfo, getnameinfo functions; Reentrant functions.

Daemon Processes
Introduction; `syslogd` daemon; `syslog`, `daemon_init` functions; `inetd` daemon; `daemon_inetd` function.

Instructions for Paper Setter:

Unit	Questions	
	To be Set	To be Answered
I	3	2
II	2	1
Total	**5**	**3**

This part of the course is to be evaluated only through Practical Examination. Five questions of 25 marks each are to be set involving the above-mentioned topics, out of which three are to be answered by the examinees using Linux platform.

Recommended Book

1. **Stevens, W. R.,** *UNIX Network Programming – Volume I* (Second Edition), New Delhi: Prentice-Hall India, 2002

Further readings

1. **Comer, D. E.,** *Internetworking with TCP/IP: Principles, Protocols, and Architectures – Volume I* (Fourth Edition), New Delhi: Prentice-Hall India, 2002
2. **Comer, D. E.; D. L. Stevens,** *Internetworking with TCP/IP: Design, Implementation, and Internals – Volume II* (Third Edition), New Delhi: Prentice-Hall India, 2000
3. **Comer, D. E.; D. L. Stevens,** *Internetworking with TCP/IP: Client Server Programming and Applications – Volume III* (Second Edition), New Delhi: Prentice-Hall India, 2000

403: Oracle (Theory)

Objective

The objective of this paper is to train the students in the most widely used database in the world, Oracle. The main focus of the theory paper is to explain some important concepts of creating and managing databases in Oracle and also programming using PL/SQL. The topics in the first units are to be discussed only in brief as these has already been discussed in the paper Database Management Systems

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
14	2	1	40	10	50

Unit	Topic	Minimum Class Hours	Marks
I	Introduction to Oracle	3	10
II	PL/SQL Programming	8	15
III	Advanced Oracle Topics	3	15
Total		**14**	**40**

Detailed Syllabus

Unit I: Introduction **3 Hours**

Introduction to the Oracle Environment, Creating tables (CREATE TABLE), adding data (INSERT), modifying data (UPDATE), removing data (DELETE), rollback and commit, retrieval of data (SELECT), Joins in Multi-table queries, Views

Unit II: PL/SQL Programming **8 Hours**

Language fundamentals- PL/SQL block structure, character set, identifiers, literals, delimiters, comments, data types in PL/SQL

Program Structure- Conditional constructs, Iterative constructs, Exception handling

SQL in PL/SQL- DML and Transaction Management (Commit and Rollback), Data Retrieval, Cursors (Explicit and Implicit), error handling with Cursors

Procedures, Functions, packages, Triggers- creating and managing functions, procedures, packages and triggers

Built-in functions- String functions (ascii, chr, concat, greatest, instr, least, length, lower, lpad, ltrim, replace, rpad, rtrim, substr, trim, upper) Numeric functions (bitand, ceil, exp, floor, ln, mod, power, round, sign, sqrt, trunk) , Date and time functions (add_months, current_date, current_timestamp, last_day, months_between, next_day, round, sysdate, systimestamp, trunk) Conversion functions (to_number, to_char, cast, to_date, to_timestamp)

Unit III: Advanced Oracle Topics **3 Hours**

Database Administration – Users, Roles and privileges, Tablespaces in Oracle, Creating and managing user accounts, Password management- changing password, enforcing password expiry, enforcing password reuse limitation, Different roles- Connect, resource and DBA, creating roles, granting and revoking privileges to a role, granting a role to another role, adding and removing password to a role, enabling and disabling roles, dropping a role, granting and revoking privileges by the DBA and the User, Creating Synonym, passing on privileges

Oracle support for parallel and distributed databases- parallel database servers, distributed database servers, database names and links, public and private links, shared database links, interacting with remote database tables, location transparency using synonyms, materialized views (introduction)

Instructions for Paper Setter

Unit	Questions	
	To be set	**To be answered**
I	2	1
II	2	1
III	2	1
Total	**6**	**3**

Recommended Books

1. **Rosenzweig, B.; E. Silverstrova,** *Oracle PL/SQL By Example* (Third Edition), New Delhi: Pearson Education, 2004
2. **Abbey, M.; M. Corey; I. Abramson,** *Oracle 9I, A Beginner's Guide,* New Delhi: Tata McGraw-Hill, 2002
3. **Feuerstein, S.,** *Oracle PL/SQL Programming* (Third Edition), New Delhi: O'Reilly, 2002

403: Oracle (Practical)

Objective

The objective of this paper is to apply the concepts learnt in the theory paper to model real-life problems. The paper also deals with application designers and builders to design and develop database applications using Developer 2000 as the front-end and Oracle as the back-end.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	External	Internal
84	3	3	75	25

Detailed Syllabus

Unit I: PL/SQL Programming **26 Hours**

Language fundamentals- PL/SQL block structure, character set, identifiers, literals, delimiters, comments, data types in PL/SQL

Program Structure- Conditional constructs, Iterative constructs, Exception handling

SQL in PL/SQL- DML and Transaction Management (Commit and Rollback), Data Retrieval, Cursors (Explicit and Implicit), error handling with Cursors

Procedures, Functions, packages, Triggers- creating and managing functions, procedures, packages and triggers

Built-in functions- String functions (ascii, chr, concat, greatest, instr, least, length, lower, lpad, ltrim, replace, rpad, rtrim, substr, trim, upper) Numeric functions (bitand, ceil, exp, floor, ln, mod, power, round, sign, sqrt, trunk) , Date and time functions (add_months, current_date, current_timestamp, last_day, months_between, next_day, round, sysdate, systimestamp, trunk) Conversion functions (to_number, to_char, cast, to_date, to_timestamp)

Unit II: Forms Builder **20 Hours**

Components of application development in Oracle Forms (Form modules, menus, PL/SQL libraries, Object libraries, Database objects), components of a form module, creating single table forms, creating tabular forms, changing attributes of form objects, validations, triggers, adding PL/SQL codes to triggers, creating master-details form, PL/SQL libraries, creating and adding library to modules, creating multi-canvas forms, error handling, creating multi-form applications, creating menus, adding PL/SQL code to menu items, adding libraries to a menu module, attaching menu to a form, properties of menus, creating iconic toolbar, creating master-details iconic toolbar menu

Unit III: Reports Builder and Graphics Builder **10 Hours**

Features of the Report Builder, defining a data model for a report, specifying the layout of the report, specifying a runtime parameter form for a report, using the Oracle reports interface, using the Reports Wizard, changing report attributes, creating manual reports, creating master-detail reports, creating parameterized reports, running a report from a form, working with charts, tools available in the Graphics Builder, creating Graphs, embedding charts in forms and reports

Instructions for Paper Setter:

Unit	Questions	
	To be set	To be answered
I	2	1
II	2	1
III	2	1
Total	**6**	**3**

Recommended Books

1. **Bayross, I.,** *Commercial Application Development Using Oracle Developer 2000 Forms 6I* (Second Revised Edition), New Delhi: BPB Publications, 2005
2. **Day, J.; C. V. Slyke,** *Starting out with Oracle,* New Delhi: Dreamtech Press, 2004
3. **Feuerstein, S.,** *Oracle PL/SQL Programming,* New Delhi: O'Reilly, 2002

404:Database Management System - II

Objective

The objective of this paper is to present to the students some advanced database management concepts like query procession and transaction processing. Also, an introduction to some emerging database management technologies like data mining, data warehousing, multimedia databases etc. is also included.

Outline of the Course

Minimum Class Hours	Credits	Exam Time (Hours)	Marks		
			External	Internal	Total
56	4	3	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	Query Processing and Optimization	10	10
II	Transaction Processing and Concurrency Control	20	25
III	Recovery and Security	16	25
IV	Database System Architectures and New Applications (Introduction)	10	15
Total		**56**	**75**

Detailed Syllabus

Unit I: Query Processing and Optimization **10 Hours**

Query Processing: Overview of query processing, translation of SQL queries into relational algebra, Algorithms for SELECT, JOIN, PROJECT and SET operations, pipelining of operations, heuristics, selectivity and cost estimates in query optimization

Unit II: Transaction Processing and Concurrency Control **20 Hours**

Transaction Processing: Transaction, ACID properties of transaction, transaction states, schedules, serializability, tests for serializability, recoverability, transaction definition in SQL.

Concurrency Control: Concurrent execution of transaction, Lock-based techniques for concurrency control, Graph-based protocol, Timestamp based protocol, Deadlock, Deadlock prevention methods, Deadlock detection Deadlock recovery

Unit III: Recovery and Security **16 Hours**

Recovery system: Types of failure, types of storage, recovery and Atomicity, Log-based recovery, shadow paging, recovery with concurrent transactions, buffer management, logical undo logging, transaction rollback, checkpoints, restart recovery, fuzzy checkpointing

Security: Security and Integrity-security violations, authorization and views, granting of privileges, security specifications in SQL, encryption, and statistical databases.

Unit IV: Database System Architectures and New Applications (Introduction) 10 Hours

Centralized Systems, Client-Server Systems, Parallel Systems, Distributed Systems, Decision-Support Systems, Data Mining Concepts- Association Rules, Clasification, Clustering, Applications of Data Mining, Commercial Data Mining Tools, Other Database Technologies (introduction)-Data Analysis, Data Warehousing, Spatial and Geographical Databases, Multimedia Databases, Mobility and Personal Database.

Instructions for Paper Setter:

Unit	Questions	
	To be set	To be answered
I	2	1
II	2	1
III	2	1
IV	2	1
Total	**8**	**4**

Recommended Books

1. **Silberschatz; H. F. Korth; S. Sudarshan**, *Database System Concepts* (Third Edition), New Delhi: Tata McGraw-Hill, 1997
2. **Elmasri, R.; S. B. Navathe**, *Fundamentals of Database Systems* (Third Edition), New Delhi: Addison Wesley, 2000

Further readings

1. **Kroenke, D. M.,** *Database Processing: Fundamentals, Design and Implementation* (Eighth Edition), New Delhi: Prentice-Hall of India, 2002
2. **Hansen, G. W.; J. V. Hansen**, *Database Management and Design* (Second Edition) Prentice-Hall of India, 2001
3. **Connolly, T. M.; C. E. Begg,** *Database Systems, A Practical Approach to Design, Implementation and Management*, New Delhi: Addison Wesley, 1999

405: Internet Technology and Applications (Theory)

Objective:

The objective of the course is to familiarize the students with a discussion on Internet and its growth. It also provides the students a study on the basic services provided by the Internet. A familiarization on the markup languages, scripting languages and web application development are also being discussed to make the student competent to design websites. It has been taken into consideration that this paper assumes that the students must know well in advance about the various protocols of the Internet and the knowledge of HTML and databases.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
14	2	1	40	10	50

Unit	Topic	Minimum Class Hours	Marks
I	Introduction to Internet	3	10
II	Internet Markup Languages	4	10
III	Web Servers, Databases and Scripting Languages	3	10
IV	Web Application Development using PHP	4	10
Total		**14**	**40**

Detailed Syllabus

Unit I: Introduction to Internet **3 Hours**

History of the Internet; History of the World Wide Web; W3C (World Wide Web Consortium); Levels of Internet Connectivity (Dial-up, Leased Line, DSL, VSAT); Requirements for Internet connectivity; Use of Browsers; Different types of browsers (IE, Opera, Netscape); Search engines; FTP; Electronic Mail; Instant Messaging; DHCP; DNS; HTTP; URL; Proxy Servers.

Unit II: Internet Markup Languages **4 Hours**

XHTML: Introduction; Components of XHTML; Elements of XHTML (Headers, Linking, Images, Special Characters, Lists, Tables, Forms, Framesets)

Cascading Style Sheets: Inline Styles; Embedded Style; Conflicting Style; Linking External Styles; W3C CSS Validation Service; Use of CSS (Positioning Elements, Backgrounds, Text flow)

XML: Introduction; Structuring Data; XML Namespaces; Document Type Definitions and Schemas; XML Vocabularies; Document Object Model (DOM and its methods); Extensible StyleSheet Language (XSL)

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Unit III: Web servers, Databases and Scripting Languages **3 Hours**

Web servers: Introduction; HTTP Request Types; System Architecture of a Web server; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Microsoft Internet Information Services (IIS); Apache Web Server.

Databases: Introduction to each one of the following: SQL, MYSQL, DBI

Scripting Languages: Javascript: Operators, Data Types, Control Structures, Functions, Arrays, String Manipulation. VBScript (Topics same as Javascript). Introduction to Perl and CGI

(Common Gateway Interface). ASP: Working of ASP; Setup; ASP Objects. JSP: Introduction; JSP Overview; Scripting; Standard Actions; Directives

Unit IV: Web Application Development Using PHP **4 Hours**

Web Site Design Considerations: Using Logical Design: Planning website, drawing a map, using a top-down approach, flexibility, other web design metaphors. Creating templates. Creating a Compatible Design: Designing for different color depths, resolutions, different browser considerations, accommodating limited bandwidth. Validating.

PHP: Introduction to PHP; Data Types; Control Structures; Functions; Strings; Arrays; Querying Web Databases using PHP; Writing to Web Databases; Errors, Debugging and Deployment; Reporting in PHP; Validation Techniques in PHP.

Instructions for Paper Setter

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
Total	**8**	**4**

Recommended books

1. **Deitel, H. M.; P. J. Deitel,** *Internet and World Wide Web: How to Program* (Second Edition), New Delhi: Prentice-Hall India, 2002
2. **Williams, H. E.; D. Lane,** *PHP and MySQL* (Second Edition), New Delhi: O'Reilly

Further readings

3. **Brown, T.; S. Bonnelli,** *Internet Complete* (Second Edition), New Delhi: BPB Publications, 2000
4. **Comer, D. E.,** *The Internet Book: Everything you need to know about Computer Networking and how the Internet works* (Third Edition), New Delhi: Prentice-Hall India, 1997

405: Internet Technology and Applications (Practical)

Objective:

The objective of this paper is to apply the concepts learnt in the theory paper. The paper deals with the website development and web-based databas applications with PHP, MySQL. The paper also deals with how to handle scripting languages.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
84	3	3	75	25	100

Detailed Syllabus

Unit I: **40 Hours**

XHTML: Components of XHTML; Elements of XHTML (Headers, Linking, Images, Special Characters, Lists, Tables, Forms, Framesets)

Cascading Style Sheets: Inline Styles; Embedded Style; Conflicting Style; Linking External Styles; W3C CSS Validation Service; Use of CSS (Positioning Elements, Backgrounds, Text flow)

XML: Structuring Data; XML Namespaces; Document Type Definitions and Schemas; XML Vocabularies; Document Object Model (DOM and its methods); Extensible StyleSheet Language (XSL)

Unit II: **46 Hours**

Web servers: HTTP Request Types; System Architecture of a Web server; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Microsoft Internet Information Services (IIS); Apache Web Server.

Databases: Introduction to each one of the following: SQL, MYSQL, DBI

Scripting Languages: Javascript: Operators, Data Types, Control Structures, Functions, Arrays, String Manipulation. VBScript (Topics same as Javascript). Introduction to Perl and CGI (Common Gateway Interface). ASP: Setup; ASP Objects. JSP: Introduction; JSP Overview; Scripting; Standard Actions; Directives

Web Site Design Considerations: Using Logical Design: Planning website, drawing a map, using a top-down approach, flexibility, other web design metaphors. Creating templates. Creating a Compatible Design: Designing for different color depths, resolutions, different browser considerations, accommodating limited bandwidth. Validating.

PHP: Introduction to PHP; Data Types; Control Structures; Functions; Strings; Arrays; Querying Web Databases using PHP; Writing to Web Databases; Errors, Debugging and Deployment; Reporting in PHP; Validation Techniques in PHP.

Instructions for Paper Setter:

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	3	2
Total	**5**	**3**

Recommended books

1. **Deitel, H. M.; P. J. Deitel,** *Internet and World Wide Web: How to Program* (Second Edition), New Delhi: Prentice-Hall India, 2002
2. **Williams, H. E.; D. Lane,** *PHP and MySQL* (Second Edition), New Delhi: O'Reilly
3. **Brown, T.; S. Bonnelli,** *Internet Complete* (Second Edition), New Delhi: BPB Publications, 2000
4. **Comer, D. E.,** *The Internet Book: Everything you need to know about Computer Networking and how the Internet works* (Third Edition), New Delhi: Prentice-Hall India, 1997

501: Compiler Design

Objective:

Compilers and interpreters are among the most widely used tools in software development. It is important for a computer student to understand the process by which programs written in high-level languages are translated and executed. Among other things, this will help you to write better programs, and enable you to make more effective use of available compiler technology. The main objective of this course is to gain an in-depth understanding of the compilation process.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks					
						External		Internal		Total	
Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr
42	56	3	3	3	2	75	75	25	25	100	100

Unit	Topic	Minimum Class Hours		Marks	
		Th	Pr	Th	Pr
I	Introduction to Compilers & Programming Languages	8	56	14	100
II	Finite Automata, Lexical Analysis & Syntactic-specification of Programming Languages	8		14	
III	Basic Parsing Techniques & Constructions	8		14	
IV	Syntax-directed Translation , Symbol Tables & Run-time Storage	10		19	
V	Codes Optimization & Generation	8		14	
Total		**42**	**56**	**75**	**100**

Detailed Syllabus

Unit I: Introduction to Compilers & Programming Languages **8 Hours**

Compilers & translators, Phases of a compiler, compiler-writing tools; High-level programming languages, Definition of programming languages, Lexical & syntactic structure of a language, Data elements, Data structure, Operators, Assignment, Statements, Program units, Data environments, Parameter transmission, Storage management.

Unit II: Finite Automata, Lexical Analysis & Syntactic-specification of Programming Languages **8 Hours**

The role of the lexical analyzer, a Simple approach to the design of lexical analyzers, Regular expression, Finite automata; Context-free grammars, Derivations & parse trees, Capabilities of context-free grammars;

Unit III: Basic Parsing Techniques & Constructions **8 Hours**

Parsers, Shift-reduce parsing, operator-precedence parsing, Top-down parsing, Predictive parsers; LL(1), LL(K) Grammar, Construct LR, SLR & LALR parsers.

Unit IV: Syntax-directed Translation , Symbol Tables & Run-time Storage 10 Hours

Syntax-directed translation schemes, Implementation of syntax-directed translators, Intermediate code, Postfix notation, Parse trees and Syntax trees, Three-address code, quadruples and triples, Boolean translations, Case statements; The contents of a symbol table, Data structure for symbol tables, Representing scope information; Implementation of a simple stack allocation scheme; Lexical & Syntactic-phase errors, Semantic errors;

Unit V: Codes Optimization & Generation 8 Hours

The principal sources of optimization, loop optimization, the DAG representation of basic blocks, value numbers and algebraic laws, Global data-flow analysis; Issue in the design of a code generator (input to the code generator, Target programs, Memory management, Instruction selection, Register allocation.)

Instructions for Paper Setter:

Unit	Theory Questions		Practical Questions	
	To be Set	To be Answered	To be Set	To be Answered
I	2	1	2	1
II	2	1		
III	2	1		
IV	2	1		
Total	**8**	**4**	**2**	**1**

Recommended Books

1. **Aho, A. V.; J. D. Ullman,** *Principles of Compiler Designs* (First Edition), New Delhi: BPB Publications, 2003
2. **Aho, A. V.; R. Sethi; J. D. Ullman,** *Compilers principles, techniques and tools*, New Delhi: Addison Wesley, 1999
3. **Levine, J. R.,** *Lex & Yacc***,** O'Reilly Publications, 2005

502 : Programming Through Java

Objective

The course is designed to impart knowledge and skill required to solve the real world problem using object-oriented approach utilizing Java language constructs. This course covers the two main part of Java i.e. Java Language and Java Library (JDK 5)

- After completion of the course, a student is expected to be able to
- Do Object Oriented Programming using Java
- Implement Exception handling and Multithreading in Java.
- Create Java I/O Applications and Applets.
- Setting up a GUI using Swing components
- Do Network Programming in Java.
- Access relational databases from Java program and use Java Beans and Servlets.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks					
						External		Internal		Total	
Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr
56	56	3	3	4	2	75	75	25	25	100	100

Unit	Topic	Minimum Class Hours		Marks	
		Th	Pr	Th	Pr
I	Core Java Programming	12	12	15	30
II	Inheritance, Exception handling, Multithread and Applets	10	10	15	
III	String handling, Utility classes, java.lang & java.io	12	12	15	45
IV	Networking, Images, Applet class and Swing	12	12	15	
V	Java Beans, JDBC, Java Servlets	10	10	15	
Total		**56**	**56**	**75**	**75**

Detailed Syllabus

Unit I: Core Java Programming **12 Hours**

Java Overview: Genesis, Java Philosophy, Java & Internet, Object-Oriented Programming features, Java Applet and Application, Java Environment and Java Development Kit (JDK) & Java Standard Library (JSL),

Java language fundamentals, The scope and lifetime of variable, Type conversion and casting, Control statements, Arrays

classes and objects: The *this* keyword, Garbage collection, Overloading constructor, Using object as parameters, Argument passing, Returning objects, Recursion, Introducing Access control (public, private and protected), *static***,** *final*, nested classes, String class, Command-line argument

Unit II: Inheritance, Exception handling, Multithread and Applets **10 Hours**

Inheritance: Member access and inheritance, method overriding, dynamic method dispatch, using abstract classes, using *final* with inheritance, the Object class; Packages, Interface, classpath, *Exception handling:* Fundamentals, Exception types, Java's built-in exceptions, user defined exceptions

Multithreaded Programming: The Java thread model (thread priorities, synchronization and inter-thread communication); Deadlock, ThreadGroup

I/O Basics : (Streams, The stream classes, The predefined streams, Reading console input, writing console output, The transient and volatile modifiers, using instance of native methods

Unit III: String handling, Utility classes, java.lang and java.io **12 Hours**

String handling: **S**tring constructors, methods for character extraction, string searching & comparison, data conversion using valueof (), StringBuffer

*Exploring java.lang***:** Simple type wrappers, System class, class Class, Math functions

The utility classes: Vector, Stack , HashTable, StringTokenizer, Bitset, Date, Calendar, GregorianCalendar, Random, Observable

Input/Output-Exploring java.io: The java.io classes and interface, File class and methods for creating, renaming, listing and deleting files and directories, I/O stream classes (FileInputSream, FileOutputStream, BufferedInputStream, BufferedOutputStream, PushBackInputStream, InputStreamReader, BufferedReader, BufferedWriter, PrintStream, RandomAccessFile)

Unit IV: Networking, Images, Applet class and Swing **12 Hours**

Networking: Socket overview, Stream Sockets, Datagram sockets, Manipulating URLs, Establishing a simple Server/Client using Stream Sockets, Connectionless Client/Server Interaction with Datagrams

Images: File formats, image fundamentals, creating, loading and displaying images, ImageObserver, MediaTracker

The Applet class: applet architecture, passing parameters to applets, getDocumentBase, getCodeBase, and showDocument, AppletContext and AudioClip interfaces, Graphics class and methods for drawing lines, rectangles, polygons and ovals

Swing: Component and Container classes, Layout managers (FlowLayout, GridLayout, BorderLayout), Handling events, Adapter classes, Anonymous inner classes

Swing GUI components *(*JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JScrollBar, JScrollPane, JToolTip, JPanel, JFrame)

Menus: JmenuBar, JMenu, JMenuItem, JSeparator

Unit V: Java Beans, JDBC, Java Servlets **10 Hours**

Java Beans: Introducing JavaBeans Concepts and Bean Development Kit (BDK), Using the Bean Box, Writing a simple Bean, Bean Properties (simple properties), Manipulating events in the Bean Box

Java database connectivity (JDBC): Introduction to JDBC, type of JDBC connectivity, Establishing database connections, Accessing relational database from Java programs

Java Servlets: Servlet overview and architecture, Servlet Interface and Servlet life cycle, HttpServlet Class, HttpServletRequest Interface, HttpServletResponse Interface, Handling HTTP *get* Requests, Setting up the Apache Tomcat Server, Deploying a web application, Handling HTTP *get* requests containing data, Handling HTTP *post* requests

Instructions for Paper Setter:

	Theory Questions		**Practical Questions**	
Unit	**To be set**	**To be Answered**	**To be set**	**To be Answered**
I	2	1	2	1
II	2	1		
III	2	1	3	2
IV	2	1		
V	2	1		
Total	**10**	**5**	**5**	**3**

Recommended Books

1. **Deitel, H. M.; P. J. Deitel,** *Java : How To Program* (Sixth Edition), New Delhi: Prentice-Hall India, 2005

Further readings

1. **Schildt, H.,** *The Complete Reference Java 2* (Fifth Edition), New Delhi: Tata McGraw-Hill, 2005
2. **Moss, K.,** *Java Servlets* (Second Edition), New Delhi: Tata McGraw-Hill
3. **Russel**, *Java Programming for the absolute Beginner* **,** New Delhi: Prentice-Hall India
4. **Hanagan D.**, *Java Examples in a Nutshell* (Third Edition), New Delhi: O' Reilly, 2001

503: System Programming

Objective:

The objective of this course is to introduces the fundamental models of the processing of a High-level-language program for execution on a computer system, it deal with different kinds of software processors, viz. Assemblers, compilers, interpreters and loaders.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks					
						External		Internal		Total	
Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr
56	56	3	3	4	2	75	75	25	25	100	100

Unit	Topic	Minimum Class Hours		Marks	
		Th	Pr	Th	Pr
I	Language Processors, Data structure for language processing & Scanning, Parsing	12	56	15	100
II	Assemblers	12		15	
III	Macros, Macro Processors, Compiler & Interpreters	12		15	
IV	Linkers & Software Tools	20		20	
TOTAL		**56**	**56**	**75**	**100**

Detailed Syllabus

Unit 1: Language Processors, Data structure for language processing & Scanning, Parsing **12 Hours**

Introduction, Language Processing Activities, Fundamental of Language Processing & Specification; Search & Allocation Data Structures; Scanning, Parsing.

Unit 2: Assemblers **12 Hours**

Elements of Assembly Language Programming, A Simple Assembly Scheme, Pass Struture of Assembler, Designing of a Two Pass Assembler, A Simple Pass Assembler for IBM PC.

Unit 3: Macros, Macro Processors, Compiler & Interpreters **12 Hours**

Macro Definition, Call & Expansion, Nested Macro Calls, Advance Macro Facilities, Design of a Macro Preprocessor; Aspects of Compilation, Memory Allocation, Compilation of Expressions, Compilation of control structures, Code Optimization, Interpreters .

Unit 4: Linkers & Software Tools. **20 Hours**

Relocation and Linking Concepts, Design of a Linker, Self-Relocating Programs, A Linker for MS DOS, Linking for Overlays, Loaders; Software Tools for Program Development, Editors, Debug Monitors, Programming Environments, User Interface.

Perl Programming: Introduction to Perl – Variables, Data Structures, Conditional Statements, Looping Statements, Using Perl to access shell, command line switches, Administrative tasks using Perl - sending mails, purging logs

Instructions for Paper Setter:

Unit	Theory Questions		Practical Questions	
	To be Set	To be Answered	To be Set	To be Answered
I	2	1	2	1
II	2	1		
III	2	1		
IV	2	1		
Total	**8**	**4**	**2**	**1**

Recommended Books

1. **Dhamdhere, D.M.,** *Systems Programming And Operating Systems* (Second Edition), New Delhi: Tata McGraw-Hill
2. **Hermann ,** *Mastering Perl 5,* New Delhi: BPB Publications, 2005
3. **Pitts, D.; B. Ball et al,** *Red Hat Linux Unleashed,* New Delhi: BPB Publications

Further Reading

1. **Schwartz, R. L. ; Poenix,** *Learning Perl* (Third Edition), New Delhi: O'Reilly, 2005

505: Minor Project

Specifications for Minor Project are given in the appendix.

Outline of the course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
112	Viva 15 mins	4	25	75	100

601: Major Project

Specifications for Major Project are given in the appendix.

Outline of the course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
420	Viva 20 mins	15	25	75	100

Audit Course: Communication Skills

Objective:

The objective of this course is to assist the student in developing self-confidence and in acquiring the skills that are so necessary to present oneself and one's ideas to others, whether it be to an interview board or a wider audience.

Course Content

1. **Introduction to communication skills**: identifying strengths and weaknesses in this area, goal setting exercises. **3 Hours**
2. **Personality, Self-confidence, Self-image and Leadership** and their role in development of communication skills. Theoretical inputs and role-play exercises **3 Hours**
3. **Communication Skills** Theoretical inputs with Role Play Exercises **3 Hours**
4. **Public Speaking** Public speaking techniques: different types of speeches, techniques to be used for each, pitfalls to be avoided – theoretical inputs
   Extempore speech – exercise.
   Public speaking exercises (prepared speech) **8 Hours**
5. **Group Discussion**
   The purpose of a group discussion
   techniques to take part in a GD effectively
   Practice and Video Recording
   Evaluation **6 Hours**
6. **Resume Development** **2 Hours**
7. **Interview techniques** and practice sessions **5 Hours**
8. **Self-evaluation and Feedback**: Assessment of targets set in the first session, Conclusion **3 Hours**

Audit Course : Ethics

Objective:

The objective(s) of this course is to serve as a catalyst for stimulating thinking and research on ethical behaviour and business ethics initiatives. It attempts to deal with some issues and questions related to decision making as an individual, organization or as a society. It will force the student to confront the nature and importance of business ethics and provide challenges for further ethical initiatives.

Outline of the Course

This course will be spread out across 14 classes of one hour duration for the whole semester.

1. Ethics and Business: Nature of business ethics, Moral reasoning and ethical theories **2 Hours**
2. Ethical Principles in Business: Professional rights and professional responsibilities **2 Hours**
3. Social attitudes, Beliefs and values **2 Hours**
4. Ethics and the environment : Dimension of pollution and resource utilization **2 Hours**
5. The ethics of consumer production and marketing, advertising ethics and privacy **2 Hours**
6. The ethics of job discrimination **2 Hours**
7. Code of ethics, Solving ethical conflicts, ethical judgement **2 Hours**

Suggested case studies that can be discussed:

1. Case on Napster's Revolution
2. Philip Morris' Troubles
3. AIDS and Needles

The course instructor may also suggest appropriate cases that will help positive discussion on various ethical issues.

Recommended Books:

1. **Velasquez, M. G.,** *Business Ethics (Concepts and Cases)* (Fifth Edition), New Delhi: Prentice-Hall India , 2005
2. **Govindarajan, M.; S. Natarajan; V. S. Senthilkumar,** *Engineering Ethics* (First Edition), New Delhi: Prentice-Hall India, 2004

Audit Course: Entrepreneurship

Objective:

The objective of this course is to assist the student to better understand the entrepreneurial process. It explains the nature of entrepreneurship and provides models for new venture creation and gives pointers that are essential for success.

Course Content

1. Defining entrepreneurship, perspective on small business and corporate entrepreneurship, entrepreneurship in practice, opportunities through change. Creativity as a prerequisite to innovation, success factors for entrepreneurs, ideas generation methods, measuring the entrepreneurial quotient. **2 Hours**

2. The concept of a planning paradigm, the four stage growth model, fundamentals of a feasibility plan, creative problem solving, product concept and commercial opportunities, the product development process, use of PERT/CPM for implementation **2 hours**

3. Product Protection: Patents, Types of patents, The Patent process; Trademarks, Copyrights, trade secrets, Licensing, Insurance, Registering software as Intellectual Property, Implication for entrepreneurs. **2 Hours**

4. Marketing Research for new ventures, Profiling customers, markets, competitors. **1 Hour**

5. Marketing – Functions and strategies **2 Hours**

6. The changing international environment and its implications on entrepreneurs. **1 Hour**

7. Organising and financing the New Venture, Composition of the organization, legal forms of business entities, financial resources for new ventures. **2 Hours**

8. Managing growth and transition, strategies for growth, time management. **2 Hours**

Suggested readings

1. **Holt, D. H,** *Entrepreneurship: New Venture Creation*, New Delhi: Prentice-Hall India, 2005
2. **Coulter, M.,** *Entrepreneurship in Action* (Second Edition) ,New Delhi: Prentice-Hall India, 2005
3. **Mohanty, S. K.,** *Fundamentals of Entrepreneurship,* New Delhi: Prentice-Hall India, 2005

406.1: Operations Research

Objective:

Operations Research is the application of Scientific methods to complex problems arising in the direction and management of large systems of men, machines, materials and money in industry, business and government. It is a field that offers rich scope for the application of the skills of a student of computer applications. The objective of this paper on Operations Research is to introduce the student of computer applications to this vast area where computer skills may be very appropriately used for facilitating executive decision making.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks					
						External		Internal		Total	
Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr
42	56	3	3	3	2	75	75	25	25	100	100

Unit	Topic	Minimum Class Hours		Marks	
		Th	Pr*	Th	Pr*
I	Operations Research, Linear Programming	14	56	25	25
II	Non Linear Programming, Network Models and Project Management	18		30	30
III	Decision Making and Probabilistic Inventory Models	10		20	20
TOTAL		**42**	**56**	**75**	**75**

Detailed Syllabus

Unit I : Introduction to Operations Research and Linear Programming 14 Hours

Operations research, its scope, methods and applications. Models and modeling concepts.

Linear Programming – Linear programming models; linear programming methods-simplex and dual simplex methods; duality and sensitivity analysis.

Assignment problem – the zero-one programming model for assignment problem, types of assignment problem, Hungerian method and Branch and bound technique for the solution of the assignment problem.

Unit II : Non Linear Programming, Network Models and Project Management 18 Hours

Introduction to Non Linear Programming: Non-linear optimization, affine and convex sets, operations that preserve convexity, generalized inequality, separating and supporting hyperplanes, dual cones and generalized inequalities, Convex functions: basic properties, conjugate and quasiconvex functions, log-concave and log-convex functions, basic norm approximation problem

Network Models – shortest route model, minimum spanning tree problem and maximum flow model.

Project Management – phases of project management, Critical Path Method (CPM), Project Evaluation and Review Technique (PERT), crashing of project network and project scheduling with constrained resources.

Unit III : Decision Making and Probabilistic Inventory Models **10 Hours**

Decision Making – Decision making under certainty, analytical Hierarchy Process; decision making under risk and its study using probability distributions.

Probabilistic Inventory Models – continuous review models, single period model and multiperiod model.

PRACTICAL

Numerical problems arising from each of the units to be solved using Excel Spreadsheets and / or some dedicated software package such as the TORA Optimization System.

Instructions for Paper Setter:

Unit	Theory Questions		Practical Questions	
	To be Set	To be Answered	To be Set	To be Answered
I	2	1	2	1
II	3	2	2	1
III	2	1	2	1
Total	**7**	**4**	**6**	**3**

Recommended Books

1. **Panneerselvam, R.,** *Operations Research*, New Delhi: Prentice-Hall India, 2004
2. **Taha, H. A.,** *Operations Research*, *An Introduction*, New Delhi: Prentice-Hall India, 2004
3. **Stephen B.; L. Vandenberghe,** *Convex Optimization*, Cambridge: Cambridge University Press, 2004

Further readings

1. **Swarup, K.; P. K. Gupta; M. Mohan**, *Operations Research*, New Delhi: S. Chand and Sons, 2003
2. **Budnick, F. S.; D. McLeary; R. Mojena,** *Principles of Operations Research for Management*, Illinois: Richard D Irwin Inc., 1988
3. **Ackoff, R. L.; M. W. Sasieni,** *Fundamentals of Operations Research*, New York: John Wiley and Sons Inc., 1968
4. **Feller, W.**, *An Introduction to Probability Theory and Its Applications*, *Vol. 1,* New Delhi: Wiley Eastern , 1971

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406.2: Microprocessors and Their Interfacing

Objective:

The Objective of this paper is to familiarise the student with the Instruction Set of 8085 Microprocessor, and its interfacing with various peripheral devices using Assembly Language.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
70	3	5	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	Introduction to Microprocessor & Assembly Language Programming	14	15
II	Assembly Language Programming	14	15
III	Interrupts and Signal Converters	14	15
IV	Programmable Devices	14	15
V	Serial I/O	14	15
Total		**70**	**75**

Unit I: Introduction to Microprocessor & Assembly Language Programming 14 Hours

Microprocessor Architecture and its operations – The 8085 MPU – Memory Interfacing – Data Transfer Operations – Arithmetic Operations – Logic Operations – Branch Operations – Writing Assembly Language programs – Debugging a Program.

Unit II: Assembly Language Programming 14 Hours

Programming Techniques: Looping, Counting, and Indexing – Additional Data Transfer and 16-bit Arithmetic Instructions – Arithmetic Operations related to Memory – Logic Operations: Rotate, Compare – Stack – Subroutine.

Unit III: Interrupts and Signal Converters 14 Hours

The 8085 interupt – vectored interrupts - Restart as software Instructions – Additional I/O Concepts and Processes. Digital to Analog(D/A) Converters – Analog tp digital (A/D) Converters

Unit IV: Programmable Devices 14 Hours

Basic concepts in Programmable Devices – 8279 Keyboard/ display Interface – 8255A programmable peripheral Interface – Programmable Interrupt Controller-8259A - Direct Memory Access (DMA) and the 8237 DMA Controller.

Unit V: Serial I/O 14 Hours

Basic Concepts in Serial I/O –Software-Controlled Asynchronous Serial I/O – The 8085 Serial I/O Lines: SOD and SID – Hardware Controlled Serial I/O Using Programmable Chips.

Instructions for Paper Setter:

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1
Total	**10**	**5**

Recommended Book

1. **Goankar, R.,** *Microprocessor Architecture, Programming, and Applications with the 8085* (Fifth Edition), Mumbai: Penram International Publishing India, 1989

Further readings

1. **Hall, D. V.,** *Microprocessors and Interfacing programming and Hardware* (Second Edition), New Delhi: Tata McGraw-Hill, 1999
2. **Leventhal, L. A.**, *Introduction to Microprocessors: Software, Hardware, Programming* New Delhi: Prentice-Hall of India, 1991
3. **Brey, B. B.,** *The Intel Microprocessors Architecture, Programming, and Interfacing* (Sixth Edition), New Delhi: Prentice-Hall of India, 2004
4. **Singh, B. P.,** *Microprocessors and Microcontrollers,* New Delhi: Galgotia Publications, 2001

406.3: Computer Oriented Numerical Methods

Objective:

The widespread use of digital computers in recent years in engineering design and scientific research has made the study of numerical methods very demanding. This paper introduces the basic computing concepts and discusses the importance of algorithms and error analysis. Emphasis should be given on algorithms and their applications rather on the theoretical derivation. A student opting for this paper should have prior knowledge to the basics of ordinary and partial differential equations.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
56	3	4	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	Computational Basics and Iterative Methods	12	17
II	Solution of Algebraic and Differential Equations	12	16
III	Interpolation and Curve Fitting	12	16
IV	Numerical Differentiation and Integration	10	13
V	Partial differential equations	10	13
Total		**56**	**75**

Detailed Syllabus

Unit I: Computational Basics and Iterative Methods **12 Hours**

Computational Basics: Floating-point representation of numbers, normalization and its consequences, arithmetic operations with normalized floating-point numbers, types of errors and its measurements, Absolute and Relative error.

Iterative Methods for the solution of a Single Equation: Method of Successive Bisection, Method of False Position, Newton-Raphson Method, Secant Method.

Unit II: Solution of Algebraic and Dfferential Equations **12 Hours**

Solution of sets of Algebraic Equations: Gaussian Elimination Method, Gauss-Jordan Elimination Method, Jacobi's Method, Pivoting, Ill-conditioned Equations, Refinement of Solution obtained by Gaussian Elimination; Gauss-Seidel Iterative Method.

Solution of Differential Equations: Euler's Method, Taylor Series Method, Runge-Kutta 2^{nd} and 4^{th} Order Methods, Predictor-Corrector Method.

Unit III: Interpolation and Curve Fitting **12 Hours**

Interpolation: Finite Difference Operations, Newton's Forward and Backward Interpolation Formulae, Lagrange's Interpolation Formula, Divided Difference, Newton's Divided Difference Formula.

Curve Fitting: Method of Group Averages, Least Squares Method, Fitting a Straight Line, Fitting a Parabola, Fitting a curve of the form $y=ax^b$, Fitting an Exponential Curve, method of Moments.

Unit IV: Numerical Differentiation and Integration **10 Hours**

Numerical Differentiation: Differentiation using Difference Operations, Differentiation using Interpolation.

Numerical Integration: Numerical Integration, Newton-Cotes Integration Formulae, Trapezoidal Rule, Simpson's 1/3rd Rule, Simpson's 3/8th Rule, Gaussian Quadrature Formulae.

Unit V: Partial Differential Equations **10 Hours**

Parabolic Partial Differential Equations: Schmidt Explicit Method, Dumfort-Frankel Explicit Method, Classical Implicit Method, Crank-Nicolson Implicit Method, Weighted Average Implicit Method, Explicit and Implicit Methods for Two-Dimensional Equations.

Elliptical Partial Differential Equations: Derivation of Finite Difference Approximations, Iterative Methods, Laplace Equation in Polar Coordinates.

Instructions for Paper Setter:

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1
Total	**10**	**5**

Recommended Books

1. **Rajaraman, V.,** *Computer Oriented Numerical Analysis* (Third Edition), New Delhi: Prentice-Hall India, 1994
2. **Rao, K. S.,** *Numerical Methods for Scientists and Engineers* (Second Edition), New Delhi: Prentice-Hall India, 2004

Further readings

1. **Sastry, S. S.,** *Introductory Methods of Numerical Analysis* (Third Edition), New Delhi: Prentice-Hall India, 2004
2. **Krishnamurthy, E.V.; S. K. Sen,** *Computer Based Numerical Algorithms*, East West Press
3. **Sankara, K.; E. Balagurusamy,** *Computer Oriented Statistical and Numerical Analysis* (Third Edition), New Delhi: Prentice-Hall India

406.4 Advanced Linux Programming

Objective:

Linux is becoming an essential freeware platform in many aspects of computing whether in the software development, educational purpose and research sectors. This paper will give the students an in-depth knowledge to design and develop programs using the technologies such as device drivers, CORBA, GNOME, X programming, database, etc., which are very useful for developing industry standard versatile applications and kernel development concepts.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credit		Marks					
Th	Pr	Th	Pr	Th	Pr	External		Internal		Total	
						Th	Pr	Th	Pr	Th	Pr
42	56	3	3	3	2	75	75	25	25	100	100

Unit	Topic	Minimum Class hours		Marks	
		Th	Pr	Th	Pr
I	UNIX environment, files and terminals	6	10	10	20
II	Development Tools and Data Management	6		10	
III	Device Driver	10	16	25	20
IV	GNOME and X Window	10	15	10	35
V	CORBA	10	15	20	
Total		**42**	**56**	**75**	**75**

Detailed Syllabus

Unit I: UNIX environment, files and terminals **6 Hours**

Working with files: Unix File Structure- Directories, Files and Devices, System Calls and Device drivers, Library functions, Low-level file access, Standard I/O library, Formatted Input and Output, Stream functions, Streams and File descriptors, File and directory maintenance, Scanning directories, Errors

The UNIX environment: Program arguments, Environment variables, time and date, temporary files, User information, host information, logging, Resources and limits

Terminals: Reading from and writing to the terminal, terminal driver and terminal interface, terminal output, detecting keystrokes

Review of Kernel, sockets, process, signal, system call, LDAP, RAID

Unit II: Development Tools and Data Management **6 Hours**

Curses: Compiling with curses, Concepts, Initialization and termination, output to the screen, reading from screen, clearing the screen, moving the cursor, character attributes, the Keyboard, Windows, Subwindows, the keypad, color, pads

Development tools: problems of multiple source files, make command and Makefiles, Source code control (RCS, SCCS, CVS), writing a manual page, Distributing software

Debugging: Types of error, general debugging techniques, debugging with gdb, more debugging tools, assertions, memory debugging

Data management: Managing memory, file locking, databases and application, accessing MySQL data from C, connection routines, error handling, executing SQL statements

Unit III: Device Driver **10 Hours**

Device drivers: Devices, character devices, Debugging, enhanced char driver operations, time and Jiffies, memory management, hardware management, I/O ports, interrupt handling, block devices, MMAP and DMA, network drivers, portability, peripheral buses, PCI devices and drivers

Unit IV: GNOME and X Window **10 Hours**

Programming for X**:** X and X window manager, X programming model, Fast track X programming, Tk toolkit, Tk's built-in dialogs, color schemes, fonts, bindings, BindTags, Geometry management, Focus and navigation, option databases, inter-application communication, selection, clipboard, window manager, dynamic/static loading, Sage Tk, Mega-Widget, application using the Tree Mega-Widget, Tk process log viewer

Programming GNOME using GTK+**:** The GNOME architecture, GNOME desktop, GTK+ GNOME libraries, glib, GTK+, GNOME basics, GTK+ widgets and functions, GNOME source tree, programming in GNOME using GTK+, Sample application using GNOME

Unit V: CORBA **10 Hours**

CORBA**:** Interface Definition Language (IDL), Object Request Broker (ORB), Interoperable Object Reference (IOR), Object Adapter, Servers, Naming and trading services, Evaluating CORBA, CORBA and RPC, CORBA and Sockets, System similar to CORBA, IDL-Defining interfaces, Language mappings, A simple messaging system

Instructions for Paper Setter:

Units	Theory Questions		Practical Questions	
	To be set	To be answered	To be set	To be answered
I	2	1	2	1
II	2	1		
III	2	1	2	1
IV	2	1	2	1
V	2	1		
Total	**10**	**5**	**6**	**3**

Recommended Books

1. **Mathew, N.; R. Stones et al.,** *Beginning Linux Programming* (Third Edition), Mumbai: Wrox Publication, 2004.
2. **Mathew, N.; R. Stones et al.,** *Professional Linux Programming*, Mumbai: Wrox Publication, 2004
3. **Rubini, A.; J. Corbet,** *Linux Device Drivers,* Mumbai: Shroff Publishers and Distributors, 2001

Further readings

1. **Johnson, M. K.; E. W. Troam,** *Linux Application Development* (First Edition), New Delhi: Pearson Education, 2000
2. **Bach, M. J.,** *The Design of Unix operating System,* New Delhi: Prentice-Hall India, 2000
3. **Stevens,** *Unix Network Programming. Vol I & II*, New Delhi: Prentice-Hall India, 2000
4. **Bonet, D. P.; M. Cesati,** *Understanding the Linux Kernel* (Second Edition), Mumbai: Shroff Publishers and Distributors, 2001
5. **Harlow**, *Developing Linux Applications with GTK+ and GDK,* New Delhi: BPB Publications, 1999

406.5: Artificial Intelligence

Objective

Artificial Intelligence has embraced the larger scientific goal of constructing an information-processing theory of intelligence. If such a science of intelligence could be developed, it could guide the design of intelligent machines as well as explicate intelligent behaviour as it occurs in humans and other animals. This paper describes the fundamental AI ideas that underly many of the AI applications and provides a base for understanding natural intelligence.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
56	3	4	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	General Issues and Overview of AI	10	15
II	Search Strategies for AI Production Systems	16	20
III	Knowledge representation	16	20
IV	Advanced AI	14	20
Total		**56**	**75**

Detailed Syllabus

Unit I: General Issues and Overview of AI **10 Hours**

Introduction to AI: The AI Problems, The Underlying Assumption, AI Techniques, The Level of the Model, Criteria for Success, AI Applications.

Problem solving, Search and Control Strategies: Defining the Problem as a State Space Search, Production Systems, Control Strategies, Breadth-First Search, Depth-First Search, Problem Characteristics, Production System Characteristics, Issues in the design of Search Programs.

Unit II: Search Strategies for AI Production Systems **16 Hours**

Heuristic Search Techniques: Generate-and-Test, Hill Climbing, Simple Hill Climbing, Steepest-Ascent Hill Climbing, Simulated Annealing, Best-First Search, OR-Graphs, the A* Algorithm, Problem Reduction, AND-OR Graphs, The AO* Algorithm, Constraint Satisfaction, Means-End Analysis.

Game Playing: Overview, The Minimax Search Procedure, Adding Alpha-Beta Cutoffs, Additional Refinements, Iterative Deepening.

Unit III: Knowledge Representation **16 Hours**

Knowledge Representation Issues: Representations and Mappings, Representing Simple Facts in Logic, Knowledge Representation Attributes, Computable Functions and Predicates, Resolution, Conversion to Clause Form, the Basics of Resolution, Resolution in Propositional Logic, Procedural vs. Declarative Knowledge, Logic Programming, Forward vs. Backward Reasoning, Matching, Control Knowledge.

Statistical Reasoning: probability and bayes' theorem, Certainty factors and Rule-Based Systems, Bayesian Networks, Dempster-Shafer Theory, Basic Notions and Concepts of Fuzzy Sets, Fuzzy Set Operations, Information - Based Characterization of Fuzzy Sets, Fuzzy Relations and their Calculus

Unit IV: Advanced AI **14 Hours**

Natural Language Processing: Overview, Morphological Analysis, Syntactic Analysis, Semantic Analysis, Discourse Integration, Pragmatic Analysis, Parsing Techniques, Top-Down Parsing, Bottom-Up Parsing, Augmented Transition Networks (ATN).

Learning: Rote Learning, Learning by Taking Advice, Learning by Induction, Explanation-Based Learning.

Expert System: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

Instructions for Paper Setter:

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
Total	**8**	**4**

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Recommended Books

1. **Rich, E.; K. Knight,** *Artificial Intelligence,* (Second Edition), New Delhi: Tata McGraw-Hill, 1997
2. **Nilson, N. J.,** *Principles of Artificial Intelligence***,** New Delhi: Narosa Publishing House, 2002
3. **Pedrycz, W.; F. Gomide,** *An Introduction to Fuzzy Sets: Analysis and Design,* New Delhi: Prentice-Hall India, 2004

Further readings:

1. **Winston, P. H.,** *Artificial Intelligence,* New Delhi: Pearson Education Asia, 2002
2. **Charniak, E.; D. McDermott,** *Introduction to Artificial Intelligence,* New Delhi: Pearson Education, 2002
3. **Russell, S.; P. Norvig,** *Artificial Intelligence: A Modern Approach* (Second Edition), New Jersey: Prentice-Hall, 2003

406.6: Network Security

Objective:

With expanding use of computer networks in general and the Internet in particular in financial and business transactions, the issue of security of such networks has come to the forefront. This course provides the fundamental concepts, theory and techniques of Cryptography and Network Security. Various security issues in computer communications and applications will also be introduced.

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
56	3	4	75	25	100

Unit	Topic	Minimum Class Hours	Marks
I	Overview and Classical Encryption Techniques	10	15
II	Data Encryption and Symmetric Ciphers	14	20
III	Public Key Encryption and Hash Functions	14	20
IV	Digital Signatures and Network Security Applications	18	20
Total		**56**	**75**

Detailed Syllabus

Unit I: Overview and Classical Encryption Techniques **10 Hours**

Overview: Services, mechanisms and attacks; Security architecture – security services, authentication, data confidentially, data integrity, nonrepudiation, availability; Security Mechanisms-attacks; Security network model.

Classical Encryption techniques: Symmetric cipher model, Cryptography, Cryptanalysis; Substitution techniques – Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Transposition techniques

Unit II: Data Encryption and Symmetric Ciphers **14 Hours**

Data Encryption: Simplified DES, DES; Differential and Linear Cryptanalysis; Block Cipher - Stream and Block Ciphers, Feistel Cipher, Design Principles, Modes of operation.

Symmetric Ciphers - Double DES, Triple DES, Blowfish; Confidentiality – Placement of functions, Traffic Confidentiality, Key Distribution

Unit III: Public Key Encryption and Hash Functions **14 Hours**

Public Key Encryption: Public Key Cryptosystems, Applications, Requirements, Cryptanalysis; RSA Algorithm; Public Key Distribution; Deffie-Hellman Key Exchange.

Hash Functions: Authentication Requirements, Message authentication codes; Hash functions – Requirements, Simple hash functions, Birthday attack, Block chaining, Brute Force attack, Cryptanalysis

Unit IV: Digital Signatures and Network Security Applications **18 Hours**

Digital Signatures: Requirements, Direct and Arbitrated Digital Signatures; Mutual Authentication, One-way Authentication; DSS

Network Security Applications: Kerberos- Versions 4 and 5; PGP – Operation, Cryptographic Keys; S/MIME; IP Security – IPSec, IPSec Services, Security Associations, Transport and Tunnel Modes, Authentication Header, Security Payload Encapsulation, SSL Architecture; SET; Intrusion Detection – Audit records, Anomaly Detection; Base Rate Fallacy, Distributed intrusion detection, Honeypots; Password Management; Firewalls – Characteristics, Types

Instructions for Paper Setter:

Unit	Questions	
	To be Set	**To be Answered**
I	2	1
II	2	1
III	2	1
IV	2	1
Total	**8**	**4**

Recommended Books

1. **Stallings, W.,** *Cryptography and Network Security: Principles and Practice, Third Edition,* New Delhi: Prentice-Hall India, 2003

Further reading

1. **Pfleeger, C. P.; S. L. Pfleeger,** *Security in Computing* (Third Edition), New Delhi: Prentice-Hall of India, 2003
2. **Kaufman, C.; R. Perlman; M. Speciner,** *Network Security – Private Communication in a Public World* (Second Edition), New Delhi: Prentice-Hall of India, 2002
3. **Garrett, P.,** *Making and Breaking Codes. An Introduction to Cryptology,* New Delhi: Prentice-Hall, 2001
4. **Schneier, B.,** *Applied Cryptography* (*Second Edition),* New York: John Wiley & Sons, 1996
5. **Menezes, A.; P. V. Oorshot; S. Vanstone,** *Handbook of Applied Cryptography,* CRC Press, 1997
6. **Tilborg, H. V.,** *Fundamentals of Cryptology,* Kluwer Academic Publishers, 2000
7. **Cheswick, W.; S. Bellovin,** *Firewalls and Internet Security. Repelling the Wiley Hacker,* (Second Edition), New Delhi: Addison-Wesley, 1998
8. Related publications in Journals/Conferences.

406.7: Digital Image Processing

Objective:

The Field of digital image processing is continually evolving. The principle objectives of this paper is to provide an introduction to basic concepts and methodologies for digital image processing, and to develop a foundation that can be used as the basis for further study and research in this field.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks (Th)					
						External		Internal		Total	
Th	As	Th	As	Th	As	Th	As	Th	As	Th	As
56	56	3	Viva 15 mins	4	2	75	25	25	75	100	100

Unit	Topic	Minimum Class Hours	Marks
I	Introduction and Fundamentals of Digital Image Processing	12	15
II	Image Transformation	8	10
III	Image Enhancement and Restoration	14	20
IV	Image Compression and Segmentation	12	15
V	Image Compression and Segmentation	10	15
TOTAL		**56**	**75**

Detailed Syllabus

Unit I: Introduction and Fundamentals of Digital Image Processing **12 Hours**

Introduction: Digital Image representation, fundamental steps in image processing, and elements of digital image processing systems (Image acquisition, storage, processing, communication, and display).

Fundamentals: A simple image model, sampling and quantization (uniform sampling and quantization, non uniform sampling and quantization), some basic relationships between pixels (neighbors of pixels, connectivity, labeling of connected components, relations, equivalence, transitive closure, distance measures, arithmetic/logical operations), Image geometry (basic transformation, perspective transformations).

Unit II: Image Transformation **8 Hours**

Image transformation: Introduction to the Fourier transform, discrete Fourier transform, some properties of the two-dimensional Fourier transform (separability, translation, periodicity and conjugate symmetry, rotation, distributivity and scaling, average value, laplacian, convolution and correlation, sampling), The Fast Fourier Transform (FFT Algorithm, The inverse FFT), Walsh transform.

Unit III: Image Enhancement and Restoration **14 Hours**

Image enhancement: spatial domain methods, frequency domain method, enhancement by point processing (Some simple intensity transformations, histogram processing, image

subtraction, image averaging), spatial Filtering (background, smoothing filters, sharpening filters), highpass filtering, color image processing (color fundamentals, color models, Pseudo-color image processing, full-color image processing).

Image restoration: degradation model (definitions, degradation model for continuous functions, discrete formulation), circulant matrices, block-circulant matrices, algebraic approach to restoration (unconstraint restoration, constraint restoration), inverse filtering (formulation, removal of blur caused by uniform linear motion), least mean square (wiener) filter, constraint least squares restoration, interactive restoration, restoration in the spatial domain.

Unit IV: Image Compression and Segmentation **12 Hours**

Image compression: Fundamentals (coding redundancy, interpixel redundancy, pyschovisual redundancy), image compression models (source encoder and decoder, channel encoder and decoder), error-free compression (variable-length coding, bit-plane coding, lossless predictive coding), lossy compression (lossy predictive coding, transform coding), Image compression standard (Bilevel (binary) image compression standards, continuous tone image compression standard.

Image segmentation: Detection of discontinuities (point detection, line detection, edge detection, combined detection), edge linking and boundary detection (local processing, global processing via the hough transform, threshold (foundation, the role of illumination, simple global thresholding, optimal thresholding, threshold selection based on boundary characteristics, thresholds based on several variables, region-oriented segmentation (basic formulation, region growing by pixel aggregation, region splitting and merging.

Unit V: Representation and Recognition **10 Hours**

Representation and description: representation schemes (chain codes, polygonal approximations, signatures, boundary segments, skeleton of a region), boundary descriptors (simple descriptors, shape numbers, Fourier descriptors, moments), regional descriptors (simple descriptors, topological descriptors, texture, moments), morphology (dilation and erosion, opening and closing, hit-or-miss transform, some basic morphological algorithms).

Recognition and interpretation: Elements of image analysis, patterns and pattern classes, decision-theoretic methods (matching, optimum statistical classifiers, neural networks), structural methods (matching shape numbers, string matching, syntactic methods), interpretation (types of knowledge, logical systems, semantic networks, production system).

Instructions for Paper Setter:

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1
Total	**10**	**5**

Recommended Book:

1. **Gonzalez, R. C.; R. E. Woods,** *Digital Image Processing*, New Delhi: Addison Wesley, 2000

Further readings:

1. **Jain, A. K**, *Fundamentals of Digital Image Processing*, New Delhi: Prentice-Hall India, 2004
2. **Chanda; Majumdar,** *Digital Image Processing and Analysis*, New Delhi: Prentice-Hall India

504.1 : Simulation and Modeling

Objective:

The application of simulation continues to expand both in terms of the extent to which simulation is used and the range of applications. The objective of the paper is to introduce the students to the topics and techniques of system simulation. The paper will give the students the knowledge of continuous and discrete system simulation so as to enable the students to solve the industrial and socio-economic problems.

Outline of the Syllabus

Minimum Class Hours		Exam Time(hours)		Credit		Marks					
						External		Internal		Total	
Th	As	Th	As	Th	As	Th	As	Th	As	Th	As
42	56	3	Viva 15 mins	3	2	75	25	25	75	100	100

Unit	Topic	Minimum Class hours		Marks
		Th	As*	Th
I	System Models, System Studies	6		10
II	System Simulation ,Continuous System Simulation	8	56	15
III	System Dynamics, Probability Concepts	9		15
IV	Arrival Pattern, Discrete System Simulation.	9		15
V	GPSS, Analysis of a Simulation Output	10		20
Total		**42**	**56**	**75**

Detailed Syllabus

Unit I **6 Hours**

System Models : The Concept of a system, System Environment, Stochastic Activities, Continuous and Discrete Systems, System Modeling, Types of Models, Static Physical Models, Static Mathematical Models, Dynamic Mathematical Models, Principle Used in Modeling.

System Studies : Subsystems**,** A Corporate Model, Environment Segment, Production Segment, Management Segment, The Full Corporate Model, Types of System Study, System Analysis , System Design, System Postulation.

Unit II **8 Hours**

System Simulation: The Techniques of Simulation, The Monte Carlo Method, Comparison of Simulation and Analytical Methods, Experimental Nature of Simulation, Types of System Simulation, Numerical Computation Techniques for Continuous Model, Numerical Computation Techniques for Discrete Models. Distributed Lag Models, Cobweb Models, Progress of Simulation Study.

Continuous System Simulation : Continuous Systems Models, Differential Equations, Analog Computers, Analog Methods, Hybrid Computers, Digital-Analog Simulators, Continuous System Simulation Languages(CSSL).

Unit III **9 Hours**

System Dynamics : Historical background, Exponential Growth Models, Exponential Decay Models. Modified Exponential Growth Models, Logistics Curves, Generalization of Growth Models, System Dynamic Diagrams, Simple System Dynamic Diagrams, Multi-Segment Models, Representation of Time Delays, Feedback in Socio-Economic Systems, A Biological Example, World Models, The DYNAMO Language.

Probability Concept in Simulation : Stochastic Variables, Discrete Probability Functions, Continuous Probability Functions, Measure of Probability Functions, Numerical Evaluation of Continuous Probability Functions. Continuous Uniformly Distributed Random Numbers, Computer Generations of Random Numbers, A Uniform Random Number Generator, Generating Discrete Distribution, Non-Uniform Continuous Random Numbers, The Rejection Method.

Unit IV **9 Hours**

Arrival Pattern and Service Times : Congestion of Systems, Arrival Patterns, Poisson Arrival Patterns, Exponential Distribution, Coefficient of Variations, Erlang Distribution, The Hyper-Exponential Distribution, Service-Time, The Normal Distribution, Queuing Discipline, Measures of Queues, Mathematical Solution of Queuing Problems, Utilization as a Design Factor, Grade of Service.

Discrete System Simulation: Discrete Events, Representation of Time, Generation of Arrival Patterns, Simulation of a Telephone System, Delayed Calls, Simulation Programming Task, Gathering Statistics, Counters and Summery Statistics, Measuring Utilization and Occupancy, Recording Distribution and Transit Times, Discrete Simulation Languages.

Unit V **10 Hours**

Introduction to GPSS : GPSS Programs, General Description, Action Times, Succession of Events, Choice of Paths, Simulation of a Manufacturing Shop, Facilities and Storage, Gathering Statistics, Conditional Transfers, Program Control Statements.

GPSS Examples: Priorities and Parameters, Standard Numerical Attributes, Functions, Simulation of Super Market, Transfer Modes, Logic Switches, Testing Conditions, GPSS Model of a Simple Telephone System, Set Operations.

Analysis of a Simulation Output: Nature of the Problem, Estimation Methods, Simulation Run Statistics, Replication of Runs, Elimination of Initial Bias, Batch Means, Regenerative Techniques, Time Series Analysis, Spectral Analysis, Autoregressive Process.

*** Assignments should be based on the algorithms in the units II through V and be done using C/GPSS**

Instructions for Paper Setter (Theory):

Units	To be set	To be answered
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1
Total	**10**	**5**

Recommended Books

1. **Gordon, G.,** *System Simulation* (Second Edition), New Delhi: Prentice-Hall India, 1998

Further readings

1. **Banks, J.; S. Carson; B. L. Nelson,** *Discrete-Event System Simulation* (Second Edition), New Delhi: Prentice-Hall India, 1996
2. **Deo, N.,** *System Simulation with Digital Computers,* New Delhi: Prentice-Hall India, 1979
3. **Law, A. M.; W. D. Kelton,** *Simulation Modeling and Analysis* (Second Edition), New York: McGraw-Hill, 1991

504.2: Parallel and Distributed Processing

Objective:

As the computing power available increases the quest for more and more power also keeps increasing. There are always applications waiting for more powerful machines. Much of the effort in meeting this requirement has so far been focussed on by making the existing computer architecture faster and faster. Parallel computing is a different but related approach to obtain faster machines. Parallel processing is by no means easier than conventional sequential programming. Distributed computing systems will be the key to exploiting the astonishingly high performance, pervasive technology. The basic principles underlying state-of-the-art distributed computing has been pulled together in a form intended to be approachable by advanced undergraduate and graduate students in this paper.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks					
						External		Internal		Total	
Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr
56	56	3	3	4	2	75	75	25	25	100	100

Unit	Topic	Minimum Class Hours		Marks	
		Th	Pr	Th	Pr
I	Introduction to computing and computer organization	10		15	
II	Communication and Computer Network	10		15	
III	Client-server Systems	10	20	15	30
IV	Distributed Systems	13	16	15	15
V	Parallel algorithms and programming	13	20	15	30
TOTAL		**56**	**56**	**75**	**75**

Detailed Syllabus

Unit 1: Introduction to computing and computer organization **10 Hours**

Introduction: Parallel and distributed computing (Computer organization, Operating systems, computer networks, client-server, distributed database, parallel algorithms),

Data dependency analysis: Introduction, types of dependencies, loop and array dependence, loop dependence analysis, solving Diophantine equations, program transformation

Computer organization for parallel and distributed computing: Pipeline and vector processors, multicomputers and computer networks, multiprocessors, massively parallel architecture, Non-von Neumann-type computers, cache architectures in multiprocessors,

Unit 2: Communication and computer network **10 Hours**

Communication: Essentials of communication and computer network, Wireless computing,

Operating Systems for distributed and parallel computing: Network operating systems, Distributed operating systems, Operating systems for parallel computing, Distributed and parallel system modeling,

Multicomputer Sytems: Multicomputer hardware, low-level communication software, user-level communication software, remote procedure call, distributed-shared memory, Multicomputer scheduling, load balancing

Unit 3: Client-server System and Shared memory programming **10 Hours**

Client-Server model: File servers, Name and directory servers, Printer servers, and Electronic mail servers

File services: Introduction, File service components, design issues, interfaces, implementation techniques,

Shared data and transactions: Introduction, Conversations between and client and server, fault tolerance and recovery, transactions, nested transactions

Share memory programming: General model of shared memory programming, process model under UNIX

Unit 4: Distributed Systems **13 Hours**

Distributed Systems: Key characteristics, Network Hardware, Network services and protocols, document-based middleware, file system-based middleware, shared object-based middleware, coordination-based middleware

Distributed database systems: Introduction, distribution case and pattern, queries and updates in DDBS, Failures, and Case study examples

Distributed transactions: Introduction, simple distributed transactions and nested transactions, atomic commit protocols, concurrency control in distributed transactions, distributed deadlocks, transactions with replicated data

Distributed computing: Message passing model, General model, Programming model, parameter passing, locating server, semantics in the presence of failures, security, Java RMI, DCE, developing applications in DCE

Unit 5: Parallel algorithm and programming **13 Hours**

Algorithms for Parallel Machines: Speedup, complexity, and cost, histogram computation, parallel reduction, quadrature problem, matrix multiplication, parallel sorting algorithms, solving linear systems, probabilistic algorithms

Parallel programming languages and algorithms: Parallel language and algorithm design for the array processor, Von Neumann-type languages (Concurrent Pascal, Communicating Sequential Processes –CSP and Occam, Distributed Processors, Programming language in the Sky-PLITS, Ada, Synchronizing Resources –SR, Linda), C, C++ and Parallel C++, Non von Neumann type languages- (Functional Programming-FP, Lisp and Multilisp, CAJOLE, PARLOG),

Instructions for Paper Setter:

Unit	Theory Questions		Practical Questions	
	To be Set	To be Answered	To be Set	To be Answered
I	2	1	-	-
II	2	1	-	-
III	2	1	2	1
IV	2	1	2	1
V	2	1	2	1
Total	**10**	**5**	**6**	**3**

Recommended Books:

1. **Coulouris, G.; J. Dollimore; T. Kindberg,** *Distributed Systems – Concepts and Design* (Second Edition), New Delhi: Pearson Education, 2000
2. **Joel; M. Crichlow,** *An introduction to distributed and parallel computing* (Second Edition), , New Delhi: Prentice-Hall India, 2004
3. **Sasikumar, M.; D. Shikhare; P. R. Prakash,** *Introduction to Parallel processing*, New Delhi: Prentice-Hall India, 2005

Further readings

1. **Tenenbaum, A. S.,** *Modern Operating Systems* (Second Edition),New Delhi: Prentice-Hall India, 2004
2. **Silverschatz, Korth, Sudarsan,** *Database System Concepts* (Fourth Edition), New Delhi: Tata McGraw-Hill Pub, 2004
3. **Ceri, S.; G. Pelagatti,** *Distributed Databases-principles and systems,* New Delhi: Tata McGraw-Hill, 1985
4. **Mullender, S.J.,** *Principles of Distributed Operating System Design,* Amsterdam: Mathematisch Centrum
5. **Quinn, M.J.,** *Parallel Computing: Theory and practice,* New York: McGraw-Hill, 1994
6. **Hwang, K.,** *Advanced Computer Architecture: Parallelism, scalability and programmability,* New York: McGraw Hill, 1993
7. **Brawner, S.,** *Introduction to parallel programming,* New York: Academic Press, 1989
8. **Ken, A.,** *Java Programming Language* (Second Edition), New Delhi: Addison Wesley, 1998
9. **Johnson, M. K.; E. W. Troam,** *Linux Application Development* (First Edition), New Delhi: Pearson Education, 2000

Area of practical and assignments:

The programming can be from shared memory abstraction or distributed memory abstraction The problems are taken from various domains, but locating useful references for detailed problem descriptions such as sequential algorithm and formative effective strategies for solving these problems on parallel machines, and implement them. It is useful to try different variations (such as loop splitting vs. self-scheduling for parallelising loops). Practical may be carried out on the topics such as General matrix manipulation package, Sparse matrix multiplication package, linked list manager, Convex hull computation, Z-buffer algorithm, Distributed ray tracing, Histogram equalization, DBMS server, Polynomial manipulation package, Word reference, Parallel grep, Graph algorithms, Simple client server model, Mandelbrot Fractal

504.3: Multimedia Technology and Applications

Objective:

The topic below brings the student to the introduction of what multimedia are, the various forms of multimedia and so on. It also dealt with the technologies employed in multimedia. It also dealt with the issues related to the architectural design of multimedia application. It also brings a discussion on multimedia on the network.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks					
Th	As	Th	As	Th	As	Internal		External		Total	
						Th	As	Th	As	Th	As
42	56	3	Viva 15 mins	3	2	25	75	75	25	100	100

Unit	Topic	Minimum Class Hours	Marks
		Th	Th
I	Introduction to multimedia and multimedia systems	8	10
II	Technologies employed in Multimedia	12	30
III	Architectural and Multimedia Application Design Issues	12	15
IV	Multimedia and networks	10	15
TOTAL		**42**	**75**

Detailed Syllabus

Unit 1: Introduction to Multimedia and Multimedia systems **8 Hours**

Terminology, Multimedia Data Elements, Multimedia Applications, Multimedia Systems Architecture, Evolving Technologies for Multimedia Systems, Defining objects for Multimedia Systems, Multimedia Data Interface Standards, The Need for Data Compression, Multimedia Databases.

Unit 2: Technologies employed in Multimedia **12 Hours**

Compression and Decompression techniques: Types of compression, Binary image compression scheme, Color, Gray Scale and Still-video Image Compression, Video Image Compression, Audio Compression, Fractal Compression.

Data and File Format Standards: Rich Text Format, TIFF File format, Resource Interchange File Format (RIFF), MIDI File Format, JPEG DIB File Format for Still and Motion Images, AVI Indeo File Format, MPEG Standards, TWAIN.

Multimedia Input/ Output Technologies: Key Technology Issues, Pen Input, Video and Image Display Systems, Print Output Technologies, Image Scanners, Digital Voice and Audio, Digital Camera, Video Images and Animation, Full-Motion Video.

Storage and Retrieval Technologies: Magnetic Media Technology, Optical Media, Hierarchical Storage Management, Cache Management for Storage Systems.

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Unit 3: Architectural and Multimedia Application Design Issues **12 Hours**

Architectural and Telecommunications Considerations: Specialized Computational Processors, Memory Systems, Multimedia Boards Solutions, LAN/WAN connectivity, Distributed Object Models.

Multimedia Application Design: Multimedia Application Classes, Types of Multimedia Systems, Virtual Reality Design, Components of Multimedia Systems, Organizing Multimedia Databases, Application Workflow Design Issues, and Distributed Application Design Issues.

Multimedia Authoring and User Interface**: Multimedia Authoring Systems, Hypermedia Authoring Design Considerations, User Interface Design, Information Access, Object Display/Playback Issues.**

Hypermedia Messaging: Mobile Messaging, Hypermedia Message Components, Hypermedia Linking and Embedding, Creating Hypermedia Messages, Integrated Multimedia Message Standards, Integrated Document Management.

Distributed Multimedia Systems: Components of a Distributed Multimedia System, Distributed Client-Server Operation, Multimedia Object Servers, Multiserver Network Topologies, Distributed Multimedia Databases, and Managing Distributed Objects.

Unit 4: Multimedia and networks **10 Hours**

Multimedia technology used on networks: Streaming audio (Music on demand), Internet Radio, Voice over IP (Internet Telephony), H.23 architectural model for Internet telephony, SIP(Session Initiation Protocol) for Internet Telephony. Difference between H.23 and SIP.

Video on demand: What is video on demand?; How it works?; Video Servers and its architecture; The Distribution network; The Mbone(The Multicast Backbone) : An overview of what it is and how it works on the Internet.

Instructions for Paper Setter:

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
Total	**8**	**4**

Recommended Books

1. **Andleigh, P. K.; K. Thakrar,** *Multimedia Systems Design***,** New Delhi: Prentice-Hall India, 2005
2. **Chapman, N.; J. Chapman,** *Digital Multimedia* (Second Edition)**,** New Delhi: Wiley Dreamtech India, 2004

Further readings

1. **Jeffcoate, J.,** *Multimedia Practice: Technology and Applications*, New Delhi: Prentice-Hall India, 1995,
2. **Tenenbaum, A. S.,** *Computer networks* (Fourth Edition)**,** New Delhi: Prentice-Hall India

504.4 : Enterprise Resource Planning

Objective:

To help the student understand the conceptual elements of ERP and its theory and implementation. This is especially poignant in view of large number of organizations implementing ERP applications in recent years. The student will appreciate the impact that ERP brings into the daily operations of firms with respect to their productivity, integration, communication, etc..

Outline of the Course

Minimum Class Hours	Exam Time (Hours)	Credits	Marks		
			External	Internal	Total
Th	Th	Th	Th	Th	Th
70	3	5	75	25	100

Unit	Topic	Minimum Class Hours	Marks
		Th	Th
I	ERP Basics	15	12
II	ERP Modules	15	18
III	Profiling ERP Vendors	15	15
IV	ERP implementation lifecycle	10	15
V	Best practices in ERP	15	15
TOTAL		**70**	**75**

Detailed Syllabus

Unit I : ERP Basics: **15 Hours**

Evolution and structure of ERP, ERP concepts, growth of the ERP market, conceptual model of ERP, 2-tier & 3-tier architecture, elements in ERP architecture, advantages/benefits of ERP, overview of an enterprise, integrated management information, business modeling, integrated data model

ERP and related technologies: Business Process Reengineering (BPR), Management Information Systems (MIS), Decision Support Systems (DSS), Data Warehousing, Data Mining, Online Analytical Processing (OLAP), Supply Chain Management.

Unit II: ERP Modules: **15 Hours**

Item types in ERP, Manufacturing, distribution and Financial requirements, item control module in ERP, Finance module, Manufacturing and Production Planning module, Sales and Distribution module, Plant Maintenance module, Quality Management module, Materials Management module, Capital Requirement Planning module, Purchase Control module, Human Resources modules; concept of Bill of materials, concept of formula management.

Unit III: Profiling ERP Vendors: **15 Hours**

SAP AG : R/3 –, overview of R/3 system, R/3 modules, R/3 and the internet

BAAN : Baan ERP modules, BaanERP Tools

Oracle : Oracle modules – Financials, Human Resources, Projects, Manufacturing, Supply chain.

PeopleSoft : Accounting and control, Treasury Management, Performance Management, Sales and Logistics, Procurement.

Unit IV : ERP Implementation Lifecycle: **10 Hours**

Elements of implementation methodology, Pre-evaluation Screening, Package evaluation, project planning phase, Gap Analysis, Business Process Reengineering, configuration, Implementation team training, testing, product migration and support, Problems in ERP implementation, cost of ERP.

Unit V: Best Practices in ERP: **15 Hours**

Concept of Best Practices, concept of Customer Order Decoupling Point(CODP), Demand Management – Sales & Operations Planning, ERP scenario in India, future directions in ERP.

Case studies should also be introduced to highlight situations where ERP projects are implemented, and the success stories/benefits/difficulties of these implementations.

Instructions for Paper Setter:

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1
Total	**10**	**5**

Recommended Readings

1. **O'Leary; E. Daniel,** *Enterprise Resource Planning Systems : systems, lifecycle, electronic commerce and risk*, Cambridge University Press
2. **Leon, A.,** *Enterprise Resource Planning,* New Delhi: Tata McGraw-Hill, 2005

Further readings

1. **Altekar, R. V.,** *Enterprise Resource Planning (Theory and Practice),* New Delhi: Prentice-Hall India, 2004
2. **Leon, A.,** *ERP Demystified*, New Delhi: Tata McGraw-Hill, 2000
3. **Sandoe, K.**, *Enterprise Integration***,** New York: John Wiley & Sons
4. **Garg; Venkitakrishnan**, *Enterprise Resource Planning : Concepts and Practice* (Second Edition), New Delhi: Prentice-Hall India
5. **Garg; Venkitakrishnan**, *ERPWARE : ERP Implementation Framework*, New Delhi: Prentice-Hall India
6. *ERP – Concepts and Cases***,** ICFAI University Press, 2004

** It will also be more meaningful if the student(s) is/are actually given exposure to at least one of the various ERP products during the course of the semester.

504.5: E-Commerce

Objective:

E-Commerce is becoming the future of business. This paper is intended to give an in depth knowledge of the various aspects of E-Commerce. The paper takes for granted that the student is familiar with Networks, Internet, Security, Java, ASP, and other Internet programming languages and packages.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks					
Th	As	Th	As	Th	As	Internal		External		Total	
						Th	As	Th	As	Th	As
56	56	3	Viva 15 min	4	2	25	75	75	25	100	100

Unit	Topics	Minimum Class Hours	Marks
I	E Commerce & Launching a Business	10	15
II	Designing Web Sites, Evaluation and Usability Tests, & Hosting the site	12	15
III	Marketing on the Internet, Implementation and Maintenance	10	15
IV	Electronic Payment System	12	15
V	E Security	12	15
Total		**56**	**75**

Unit 1 **10 Hours**

E-Commerce Framework – E-Commerce and Media convergence – The anatomy of E-Commerce Applications - E-Commerce Consumer Applications – E-Commerce organization applications

Launching a Business

The Life Cycle Approach – the Business planning and Strategizing Phase – Hardware, Software, Security and Setup Phase – The Design Phase – The Marketing Phase – The Fulfilment Phase – The Maintenance and Enhancement Phase.

Unit II **12 Hours**

Designing Web Sites

Web Sites – The Life Cycle of Site Building from Page to Stage – How to Build a Web Site – Web Navigation Design – Design Criteria

Web Site Evaluation and Usability Testing

Anatomy of a Site – Cookies – Usability of a Web Site – Web Site Content and Traffic Management.

Hosting the Web Site

Internet Service Providers (ISP) – Choosing an ISP – Choosing and Registering the Domain Name.

Unit III **10 Hours**

Marketing on the Internet

Pros and cons of online shopping – Internet marketing techniques – The E-cycle of Internet Marketing - Marketing your Presence – Attracting Customers – Tracking customers – Advertising on the Internet.

Implementation and Maintenance: Implementation strategies – Maintenance strategies

Unit IV **12 Hours**

Electronic Payment Systems

Types of Electronic Payment Systems – Digital Token Based Electronic Payment Systems – Smart Cards and Electronic Payment Systems – Credit Card Based Electronic Payment Systems - Risk and Electronic Payment Systems – Designing Electronic Payment Systems – Electronic Data Interchange (EDI) – EDI Application in Business.

Unit V **12 Hours**

E- Security

Security in Cyberspace – Designing for Security – How much Risk can you afford? – The Viruses – Security Protection and Recovery – Encryption – The Basic Algorithm System – Authentication and Trust – Key management – Internet security Protocols and Standards - Other Encryption Issues

Legal and Ethical Issues: Ethical Issues – Legal Issues

Instructions for Paper Setter:

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1
Total	**10**	**5**

Recommeded Books

1. **Awad, E. M.**, *Electronic Commerce From Vision to Fulfilment*, New Delhi: Prentice-Hall India, 2002
2. **Kalakota, R.; A. B. Whinston,** *Frontiers of Electronic Commerce*, New Delhi: Addison Wesley, 2000

Further readings

1. **Amor, D.,** *The E-business (R)evolution*, New Delhi: Prentice-Hall India, 2000

504.6: Natural Language Processing

Objective:

Language is the means of transferring the information and knowledge from generation to generation through which humankind have survived and benefited. This paper aims to introduce and explain Linguistics, computational linguistics and processing of natural languages. It introduces the fundamental algorithms of different parts of language study, whether originally proposed for spoken and written language, whether logical or statistical in origin and attempts to tie together the descriptions of algorithms from different domains. Brief coverage of applications like spell checking, information retrieval and extraction as well as areas like machine translation have been included to highlight the core of NLP.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credits		Marks					
						External		Internal		Total	
Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr	Th	Pr
56	56	3	3	4	2	75	75	25	25	100	100

Unit	Topic	Minimum Class Hours		Marks	
		Th	Pr	Th	Pr
I	Introduction to NLP, Regular Expressions and automata, Morphology and Finite-State Transducers	10	18	15	25
II	Probabilistic Models of Spelling, N-grams, Word Classes and Part of Speech Tagging	10		15	
III	Context Free Grammar for English, Parsing with Context Free Grammar, Lexicalized and Probabilistic Parsing	13		15	
IV	Semantic Analysis,Lexical Semantics, Word Sense Disambiguation and Information Retrieval	10	18	15	25
V	Machine Translation, Discourse and Generation	13	20	15	25
TOTAL		**56**	**56**	**75**	**75**

Detailed Syllabus

Unit I: Introduction to NLP, Regular expression and automata, Morphology and Finite-State Transducers 10 Hours

Introduction, Multidisciplinary allied subjects (artificial intelligence, computational linguistics, cognitive science, speech processing etc), Knowledge in Speech and Language Processing, Ambiguity, Models and Algorithms, Language, Thought, and Understanding, The state of the art and the near-term future, brief history

Regular expressions, basic regular expression patterns, disjunction, grouping and precedence, a simple and complex examples, advanced operators, regular expression substitution, memory, Finite State Automata, formal languages and examples, non-deterministic FSAs, Using an NFSA

to accept Strings, recognition as search, relating deterministic and non-deterministic automata, regular languages and FSAs

Survey of English Morphology-inflectional, derivational, Finite state morphological parsing, the lexicon and morphotactics, morphological parsing with finite-state transducers, Orthographic rules and finite state transducers, Combining FST lexicon and rules, lexicon-free FSTs: The Porter Stemmer. Human Morphological Processing

Unit II: N-grams, Word classes and Parts-of Speech Tagging, Probabilistic Models of Pronunciation and Spelling 10 Hours

Counting Words in Corpora, Simple (Unsmoothed) N-grams, N-grams and their sensitivity to the training corpus, Smoothing – Add-one Smoothing, Witten-Bell discounting, Good-Turing discounting, Backoff, Deleted interpolation, N-grams for spelling and pronunciation, context sensitive spelling error correction.

English word classes, tagsets for English, parts-of speech tagging, Rule based part-of speech tagging, Stochastic part-of-speech tagging and example, Actual algorithm for HMM tagging, Transformation based tagging, how TBL rules are applied and learned.

Dealing with spelling errors. Spelling error patterns, Detecting Non-word Errors, Probabilistic Models, Applying the Bayesian Method to Spelling, Minimum Edit Distance.

Unit III: Context-Free Grammars for English, Parsing with Context-free grammars, Lexicalized and Probabilistic Parsing 13 Hours

Constituency, Context-free rules and trees, Sentence level constructions, the noun phrase before the head noun, after the noun. Coordination, agreement, the verb phrase and sub categorization, auxiliaries, grammar equivalence and normal form, finite state and context-free grammars, grammars and human processing

Parsing as search, Top-down, bottom-up parsing and their comparision, A basic top-down parser, adding bottom-up filtering, problems with the basic top-down parser, left-recursion, ambiguity, repeated parsing of subtree. The Earley Algorithm, Finite-state Parsing methods

Probabilistic context –free grammars, probabilistic CYK parsing of PCFGs, Learning PCFG probabilities, problems with PCFGs, Probabilistic Lexicalized CFGs, Dependency Grammars, Categorical Grammar, Human Parsing

Unit IV: Semantic Analysis, Lexical Semantics, Word Sense Disambiguation and Information Retrieval 10 Hours

Syntax driven semantic analysis, Semantic Augmentation to context free grammar rules, quantifier scoping and the translation of complex-terms, attachments for a fragment of English-sentences, noun phrases, verb phrases, prepositional phrases, Integrating semantic analysis into the Earley parser, Idioms and Compositionality, Robust Semantic Analysis- semantic grammars, information extraction.

Relations among lexemes and their senses, homonymy, polysemy, synonymy, hyponymy. WordNet: A database of lexical relations, the internal structure of words- thematic roles, selectional restrictions, primitive decomposition, semantic fields, creativity and the lexicon, metaphor, metonymy, computational approaches to metaphor and metonymy

Selectional restriction-based disambiguation, limitations of selectional restrictions, robust word sense disambiguation, machine learning approaches, dictionary-based approaches. Information

retrieval, the vector space model, term weighting, term selection and creation, homonymy, polysemy, and synonymy, improving user queries, Other Information retrieval tasks

Unit V: Machine Translation , Discourse and Generation **13 Hours**

Language Similarities and differences, The transfer metaphor, syntactic, Lexical transfer. The Interlingua idea: Using Meaning, Direct Translation, using Statistical techniques, quantifying fluency, quantifying faithfulness, search, usability, and system development

Reference resolution, reference phenomena, syntactic and semantic constraints on coreference, preferences in pronoun interpretation, an algorithm for pronoun resolution. Text coherence, the phenomenon

Introduction to language generation, and architecture for generation, surface realization, systemic grammar

Instructions for Paper Setter:

Unit	Theory Questions		Practical Questions	
	To be Set	To be Answered	To be Set	To be Answered
I	2	1	2	1
II	2	1		
III	2	1		
IV	2	1	2	1
V	2	1	2	1
Total	**10**	**5**	**6**	**3**

Recommended Books:

1. **Jurafsky, D.; J. H. Martin,** *Speech and language Processing,* New Delhi: Pearson Education, 2003
2. **Allen, J.,** *Understanding Natural Language Processing* (Second Edition), New Delhi: Pearson Education, 2004
3. **Bharti, A.; Chaitainya; Sanghal,** *Natural Language Processsing- a paninian perspective* (Second Edition), New Delhi: Prentice-Hall India, 2000

Further readings

1. **Aho. A.V.; J. D. Ullman,** *The theory of parsing, translation and compiling, Vol I,* Massuchussettes: Addison Wesley
2. **Bybee J.L.**, *Morphology: A study of the relation between meaning and form***,** Amsterdam: John Benjamins, 1985
3. **Dorr, B.**, *Machine Translation***,** Cambridge: MIT Press, 1993

504.7 : Data Mining

Objective:

Capabilities of both generating and collecting data have been increasing rapidly in the last several decades due to the use of bar codes, computerisations of many products, advances of data collection tools etc. This growth in stored data has generated an urgent need of the subject like Data Mining. The paper aims to give the concept and various techniques of data mining to the students. Students will also learn the feasibility, usefulness, efficiency and the scalability of the techniques for discovery of patterns hidden in large databases. The paper will also familiarize the students with some advance topics in data mining such as Text mining, WWW mining, Spatial database mining etc. Another purpose of the paper is to introduce the students with some popular data mining systems such as DBMiner etc.

Outline of the Course

Minimum Class Hours		Exam Time (Hours)		Credit		Marks					
						External		Internal		Total	
Th	As	Th	As	Th	As	Th	As	Th	As	Th	As
56	28	3	Viva 15 mins	4	1	75	10	25	40	100	50

Unit	Topic	Minimum Class hours		Marks
		Th	As	Th
Unit I	Introduction, Data Warehouse	10		10
Unit II	Data Processing, Data Mining Primitives, Concept Description	11		15
Unit III	Mining Association Rules, Classification and Prediction , Cluster Analysis,	20	22	30
Unit IV	Mining Complex Types of Data.	10		15
Unit V	An introduction to OLEDB for Data Mining, An introduction to DBMiner	5	6	5
Total		**56**	**28**	**75**

Detailed Syllabus

Unit I **10 Hours**

Introduction: What motivated data mining? Why is it important? What is data mining? Data Mining: Relational databases, Data warehouses, Transactional databases and advanced database system. Data mining functionalities: Concept and class description, Association analysis, Classification and prediction, Cluster analysis, Outlier analysis, Evolution analysis. Are all patterns interesting? Classification of data mining systems. Major issues in data mining.

Data Warehouse and OLAP Technology for Data Mining: What is data warehouse: Differences between operational database systems and data warehouses, Why have a separate data warehouse? A multidimensional data model: From tables and spreadsheets to data cubes, Stars, snowflakes and fact constellations, Examples for defining star, snowflake and fact constellation schemas, Measures: Their categorization and computation, Introducing concept hierarchies, OLAP operations in the multidimensional data model, A starnet query model for querying multidimensional databases. Data warehouse architecture: Steps for design and construction of data warehouses, A three-tier data warehouse architecture, Types of OLAP

servers- ROLAP, MOLAP and HOLAP. Date warehouse implementation: Efficient computation of data cubes, Indexing OLAP data, Efficient processing of OLAP queries, Metadata repository, Data warehouse backend tools and utilities. Further development of data cube technology: Discovery-driven exploration of data cubes, Complex aggregation at multiple granularities: multifeature cubes, Other developments. From data warehousing to data mining: Data warehouse usage, From on-line analytical processing to online analytical mining.

Unit II **11 Hours**

Data Processing: Why process the data? Data cleaning: Missing values, Noisy data, Inconsistent data. Data Integration: Data integration, Data transformation. Data reduction: Data cube aggregation, Dimensionality reduction, Data compression, Numerosity reduction. Discretization: discretization and concept hierarchy generation for numeric data, Concept hierarchy generation for categorical data.

Data mining primitives, Languages and system architecture: Data mining primitives : Task relevant data, the kind of knowledge to be mined, Background knowledge, Interestingness measures, Presentation and visualization of discovered pattern. A data mining query languages: Syntax for task relevant data specification, syntax for specifying the kind of knowledge to be mined, syntax for concept hierarchies specification, Syntax for interestingness measure, Syntax for pattern presentation, Putting all together, Other data mining languages. Architecture of data mining systems.

Concept Description: What is concept description?, Data generalization and summarization-based characterization: Attribute-Oriented induction, Efficient implementation of attribute-oriented induction ,Presentation of the derived generalization. Analytical characterization: Why perform attribute-relevance analysis, Methods of attribute relevance analysis, Analytical characterization: An example. Mining class comparisons: Class comparison methods and implementation, Presentation of class comparison descriptions, Class description. Mining descriptive statistical measures in large databases: Measuring the central tendency, Measuring the dispersion of data, Graph displays of basic statistical class description.

Unit III **20 Hours**

Mining Association Rules in Large Databases: Association rule mining : Market basket analysis, Basic concepts, Association rule mining-a road map. Mining single-dimensional boolean association rules from transactional databases : The Apriori algorithm, Generating association rules from frequent itemsets, Improving the efficiency of Apriori, Mining frequent itemsets without candidate generation, Iceberg queries. Mining multilevel association rules from transaction databases : Multilevel association rules, Approaches to mining multilevel association rules, Checking for redundant multilevel association rules. Mining multilevel association rules from relational databases and data warehouses : Multidimensional association rules, Mining multidimensional association rules using static discretization of quantitative attributes, Mining quantitative association rules, Mining distanced-based association rules. From association mining to correlation analysis: Strong rules are not necessary interesting, From association analysis to correlation analysis. Constraint-based association mining : Metarule-guided mining association rules, Mining guided by additional rule constraints.

Classification and Prediction: What is classification and what is prediction? Issues regarding classification and prediction : Preparing the data, Comparing the classification methods. Classification by decision tree Induction : Decision tree induction, Tree pruning, Extracting classification rules, Enhancements to basic decision tree induction, Scalability and decision tree induction, Integrating data warehousing techniques and decision tree induction. Bayesian Classification : Bays theorm, Naïve Bayesian calssification, Bayesian Belief network, Training Bayesian belief network. Classification based on concepts from association rule mining. Other classification methods: k-Nearest neighbor classifiers, cased-based reasoning, Genetic algorithms, Rough set approach, fuzzy set approach. Prediction : Linear and multiple

regression, Nonlinear regression, Other regression models. Classifier accuracy : Estimating classifier accuracy, Increasing classifier accuracy, Is accuracy enough to judge a classifier?

Cluster Analysis : What is cluster analysis?, Types of data in cluster analysis: Interval-scaled variables, Binary variables, Nominal, Ordinal, and Ratio-scaled variables, Variables of mixed types. A categorization of major clustering methods. Partitioning methods : Classical partitioning methods, Partitioning methods in large databases. Hierarchical methods : Agglomerative and divisive hierarchical clustering, BIRCH, CURE, Chamenlon. Density-based methods: DBSCAN, OPTICS, DENCLUE. Grid-based methods: STING, Wave-Cluster, CLIQUE. Model-based clustering methods: Statistical approach, Neural network approach. Outlier analysis : Statistical based outlier detection, Distance-based outlier detection, Deviation-based outlier detection.

Unit IV **10 Hours**

Mining Complex Types of Data : Multidimensional analysis: Generalization of structured data, Aggregation and approximation in spatial and multimedia data generalization, Generalization of object identifiers and class/subclass hierarchies, Generalization of class composition hierarchies, Construction of mining and object cubes, Generalization-based mining of plan databases by divide and conquer. Mining spatial databases : Spatial data cube construction and spatial OLAP, Spatial association analysis, Spatial clustering methods, Spatial classification and spatial trend analysis, Mining raster databases. Mining multimedia databases: Similarity search in multimedia data, Multidimensional analysis of multimedia, Classification and prediction analysis of multimedia data, Mining associations in multimedia data. Mining time-series and sequence data : Trend analysis, Similarity search, Sequential pattern mining, Periodicity analysis. Mining Text databases: Text data analysis and information retrieval, Text mining. Mining World Wide Web : Mining the web link structures, Automatic classification of Web document, Construction of a multi-layered Web information base, Web usage mining.

Applications and Trends: Data mining for biomedical and DNA analysis, Data mining for financial data analysis, Data mining for retail industry, Data mining for telecommunication industry. Trends in data mining.

Unit V **5 Hours**

An introduction to Microsoft's OLEDB for data mining : Creating a DMM object, Inserting training data into the model and training the model, Using the model.

An introduction to DBMiner : System architecture, Input and outut, Data mining and tasks suported by the system, Support for the task and method selection, Support of the KDD process, Main applications.

***Assignments: Implementation of the algorithms discussed in the unit III, using OLEDB for data mining.**

Instructions for Paper Setter:

Units	To be set	To be answered
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1
Total	**10**	**5**

Recommended Books

1. **Han, J.; M. Kamber ,** *Data Mining: Concepts and Techniques*, San Fransisco: Morgan Kaufman Publisher, 2001

Further readings

1. **Hand, D.; H. Mannila; P. Smyth,** *Principles of Data Mining,* New Delhi: Prentice-Hall India, 2005

2. **Pujari, A. K.,** *Data Mining Techniques,* Hyderabad: Univeristy Press, 2002

504.8: Embedded and Real Time Systems

Objective:

Embedded system tools and products are evolving rapidly, This course deals with the concepts and various approaches to building embedded systems. It introduces unified view of hardware and software. The aim of this course is to make the students aware of the various applications of embedded systems through some of the case studies which the students will take them as their assignments.

Outline of the course

Minimum Class Hours		Exam Time (Hours)		Credit		Marks					
Th	As	Th	As	Th	As	External		Internal		Total	
						Th	As	Th	As	Th	As
42	56	3	Viva 15 min	3	2	75	25	25	75	100	100

Unit	Topic	Minimum Class Hours		External Marks
		Theory	Assignment	
I	Introduction to Embedded System and its Architecture and Programming	8	10	15
II	Embedded System Development Cycle, Hardware Platforms and Communication Interfaces issues	12		20
III	Concepts and Overview of Embedded/Real-Time Operating Systems.	12		30
IV	Case Studies of Embedded Systems and Introduction to DSP-based Embedded System	10	18	10
TOTAL		**42**	**28**	**75**

Detailed Syllabus

Unit I: Introduction to Embedded System and its Architecture and Programming 8 Hours

Introduction: Terminology, Application Areas, Categories of Embedded Systems, Overview of Embedded System Architecture, Specialties of Embedded Systems, Recent Trends.

Architecture: Hardware Architecture, Software Architecture, Application Software, Communication Software, and Process of Generating Executable Image, Development and Testing Tools.

Programming : Bit Manipulation using C, Memory Management, Timing of Programs, Device Drivers, Productivity Tools, and Code Optimization.

Unit II: Embedded System Development Cycle, Hardware Platforms and Communication Interfaces issues 14 Hours

Embedded System Development Cycle: Development Process, Requirements Engineering, Design, Implementation, Integration and Testing, Packaging Configuration Management, Managing Embedded System Development Projects, Embedded System Fiascoes.

Hardware Platforms: Types of Hardware Platforms, Study of 89C51 Micro-controller Development Board and ACR Micro-controller Development Board.

Communication Interfaces: Need for Communication Interfaces, Studies of following interfaces: RS232/UART, RS422/RS485, US, Infrared, IEEE 1394 Firewire, Ethernet, IEEE 802.11, Bluetooth.

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Unit III: Concepts and Overview of Embedded/Real-Time Operating Systems. 14 Hours

Concepts: Architecture of Kernel, Tasks and Task Scheduler, Interrupt Service Routines, Semaphores, Mutex, Mailboxes, Message Queues, Event Registers, Pipes, Signals, Timers, Memory Management, Priority Inversion Problem.

Overview: Off-the-shelf Operating Systems, Embedded Operating Systems, Real-time Operating Systems, and Hand-held Operating Systems.

Representative Embedded Systems**: Digital Thermometer, Handheld Computer, Navigation System, IP Phone, Software-defined Radio, Smart Cards and RF tags.**

Unit IV: Case Studies of Embedded Systems and Introduction to DSP-based Embedded System 18 Hours

Case Studies: Overview of RTLinux, Appliance Control by RTLinux System, Navigation System, Protocol Converter, Embedded Database Application, Mobile Java Applications.

Introduction to RFID systems, Application Development using RFID.

DSP-based Embedded System: Need of such system, Overview of Digital Signal Processing, Application of DSP, Digital Signal Processor Architecture, DSP-based Embedded System Design Process.

Instruction to Paper Setter:

Unit	Questions	
	To be Set	To be Answered
I	2	1
II	3	2
III	3	2
IV	2	1
Total	**10**	**6**

Recommended Books

1. **Prasad, K. V. K. K.,** *Embedded/ Real-Time Systems: Concepts, Design and Programming*, New Delhi: Dreamtech Press, 2005

Appendix

Guidelines for Project

Objective

The objective of the project is to consolidate the concepts and practices that were learned during the course and to serve as a record of competence. It should enable a student to apply concretely in a small package the concepts gained from Software Engineering.

Guidelines

- **Overview:** Every student should do a project individually and not in a group. The selected project can be either of type Model 1 or Model 2 described below.
- **Platform:** The project can be in any platform e.g., DOS, WINDOWS, UNIX, LINUX, Mac OS, etc.
- **Language and package:** The project can be done using any language or package learned within or outside the course such as C, C++, Java, VB, C#, Director, tcl, VC++, Visual FoxPro, Flash, etc.
- **Venue:** The project can be done in the College itself or in a reputed organization.
- **Guides:** Internal Guides from within the college should be assigned to each student. If the project is to be done in a reputed organization, an External Guide from that organization is also required as Co-Guide.
- **Monitoring of Projects:** The progress of the project should be monitored through seminars, and each of the seminars should be evaluated, a record of which should be maintained. The number of seminars should not be less than three (e.g. Analysis, Design, Implementation).
- **Final Examination:** For the final external evaluation a brief summary of the project should be submitted to the university at least one week prior to the date of the examination for the benefit of the external examiner(s).

Types of Project:

Model 1

1. The topic for the project can be any subsystem of a system software or tool or any scientific or a fairly complex algorithmic situation.

2. The aim of this type is to highlight the abilities of algorithmic formulation, program and data flow representation, modular programming or object oriented programming, optimized code preparation, systematic documentation and other associated aspects of software engineering.

3. The assessment would be through the Project Report, Viva and the following criteria for this model:
    - Programming style, structured design, minimum coupling and high cohesion, abstraction, encapsulation, inheritance and polymorphism, as relevant.
    - Good commenting and annotating of the code and flow of representation, such that meaningful code, with good readability and ease of maintenance, results.
    - Design specifications, depicting the method adopted and giving a simple data dictionary for each data, to cover name, type and validity aspects.
    - Test case samples, enough in number, to adequately cover the possible chances of common errors

Model 2

1. This model can be of a typical business application. The aim of this type is to highlight the stages involved in a typical business oriented project development, though on a miniature scale, in a real or simulated environment. The appropriate use of RDBMS towards any business application, along with adequate system analysis and structured design and

development of specific tools/products, would be the underlying activity in preparing this project.

2. The emphasis should be on selecting a system/subsystem that shows the RDBMS and System Analysis aspects to a greater degree. Any small and simple business system may be selected, although candidates are advised to use their knowledge and creativity, to select typical and intelligent applications, rather than run-of-the-mill themes, such as simple Pay roll calculation or Issue-Return portion of an inventory scheme. The Evaluation stage would give due weightage for theme selection, problem analysis, fact finding techniques and initial design, which is as close to real-life business situations as possible.

3. The code can be generated out of 4 GL Interface, like Screen Builder and Report Generator, Application Generator/Program Code Generators, or can be totally hand-coded or a combination of both. The documentation need not contain the code generated by these applications, but only that written by the candidate.

4. The assessment would be through the Project Report, Viva and the following criteria for this model:

    - Requirements leading to the project, those which were the result of System Analysis
    - The design aspect of RDBMS oriented documentation which describes the structure and organization of the database, well annotated source code, supplemental documentation, which can serve as Data Analysis and Data Flow description
    - A simple Data Dictionary of the elements which form the structure
    - Details about I/O Screens and facilities for on-screen querying, print oriented Reports and built in house-keeping routines which help disk management and file integrity, are to be included to the extent possible.
    - Details of Acceptance Tests which, should be in adequate number and should include error messages

Content of the Project Report:

1) Acknowledgement
2) Certificate, stating it to be a bonafide work of the student, and that it has not been submitted for any other examination, and counter-signed by the project guide(s).
3) Synopsis of the project
4) Description of the existing system
5) Proposed system
6) User requirements
7) Hardware and software requirements
8) Costs and benefits estimation
9) System Flow Charts, Algorithms
10) DFD, Decision Tables, Decision Trees
11) Data Dictionary
12) Module Design
13) Database Design
14) Source Code
15) Input and Output Screen Design
16) Testing used and Test Results
17) Need for review : deficiencies and future enhancements
18) User/Operational Manual (including menu design, security aspects, access rights, backup, controls etc.)

Data Dictionary

a) This should give a catalogue of the data elements used in the system/subsystem developed.
b) The following are the details required. Write NA where NOT applicable
    - Data Name
    - Aliases, if any
    - Length (size)

- Type (Numeric, alpha, binary, etc)
- Validity criterion (Minimum, maximum, etc)
- Default value, if any
- Whether related to other data items
- Where used in the program: Reference to data structure/file/procedures/modules

Viva-Voce:

The viva-voce will be conducted by external examiner(s) appointed by the University and internal examiner(s). Other members of the faculty and students may be present. It will be of duration of about 15 to 20 minutes. The analysis, design aspects and quality of implementation of the project would be the main subject matter for the viva. However, the general proficiency of the candidate in the selected software platform should also be tested.

Distribution of Marks

Topics	Marks
Analysis	10
Design	15
Implementation	20
Internal	25
Project Report	20
Viva	10
Total	**100**