UNIVERSITY OF MUMBAI

Revised Syllabus

and Scheme of Examination

For

The Second Year

(Sem III & IV)

of the

B.E. Degree Course

In Computer Engineering

(With effect from the academic year 2008-2009)

Syllabus Structure(R-2007) At

S.E. (Computer Engineering)

Semester-III

Sr. No.	Subject	Scheme of Instructions Periods per Week Each Period of 60 Min.		Scheme of Evaluation				
		Theory	Practical	Paper		TW	Practical &Oral	Total
				Hours	Marks			
1.	Applied Mathematics-III	*05	---	3	100	25	---	125
2.	Electronic Devices & Linear Circuits	04	02	3	100	25	25	150
3.	Discrete Structure & Graph Theory	03	02	3	100	25	---	125
4.	Digital Logic Design & Application	03	02	3	100	25	---	125
5.	Data Structure and Files	04	02	3	100	25	25	150
6.	Computer Organization & Architecture	03	02	3	100	25	---	125
7.	Presentation and Communication Techniques	02	02	---	---	50	---	50
		24	12	18	600	200	50	850

*After four conjugative periods test should be conducted at fifth period and the assessed papers should be considered as a part of term work.

University of Mumbai

Syllabus Structure(R-2007)

At

S.E. (Computer Engineering)

Semester

IV

Sr. No.	Subject	Scheme of Instructions Periods per Week Each Period of 60 Min.		Scheme of Evaluation				
		Theory	Practical	Paper		TW	Practical &Oral	Total
				Hours	Marks			
1.	Applied Mathematics-IV	*5	---	3	100	25	---	125
2.	Analog & Digital Communication	4	2	3	100	25	---	125
3.	Database Manag--ement System	4	2	3	100	25	25	150
4.	Computer Graphics	4	2	3	100	25	25	150
5.	Analysis of Algorithm & Design	4	2	3	100	25	25	150
6.	Operating System	4	2	3	100	25	25	150
		25	10	18	600	150	100	850

*After four conjugative periods test should be conducted at fifth period and the assessed papers should be considered as a part of term work.

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** III	
Subject: Applied Mathematics –III (Abbreviated as AM-III)			
Periods per Week (each 60 min)	Lecture	05	
	Practical	00	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical / Oral	---	---
	Oral	---	---
	Term Work	---	25
	Total	03	125

Module	Contents	Hours
1	**Laplace Transform:** • Function of bounded variation, Laplace Transform of standard functions such as 1, t^n, e^{at}, $\sin at$, $\cos at$, $\sinh at$, $\cosh at$, $erf(t)$ • Linearity property of Laplace Transform, First Shifting property, Second Shifting property, Change of Scale property of L.T. $L\{t^n f(t)\}, L\left\{\frac{f(t)}{t}\right\}, L\left\{\int_0^t f(u)du\right\}, L\{f^n(t)\}$ Heaviside Unit step function, Direct Delta function, Periodic functions and t their laplace Transform. • Inverse Laplace Transform: Linearity property, use of theorems to find inverse Laplace Transform, Partial fractions method and convolution theorem (without proof). • Applications to solve initial and boundary value problems involving ordinary differential equations with one dependent variable.	03 07 06 03
2	**Matrices(I):** • Types of matrices, Adjoint of a matrix, Inverse of a matrix, orthogonal matrix, unitary matrix, Rank of a matrix, reduction to normal form PAQ, Linear dependence and independence of rows/columns over a field. • System of homogeneous and non-homogeneous equation, their consistency and solutions.	07 04
3	**Fourier Series:** • Orthogonal and orthonormal set, Expressions of a function in a series of orthogonal functions. Dirichlet's conditions. Fourier series of periodic function in the interval $[c, c+2\pi]$, $[c, c+2l]$.	08

	• Dirichlet's theorem even and odd functions. Half range sine and cosine series, Parsevel's identities (without proof) • Complex form of Fourier series • Practical harmonic analysis	04 02 02
4	**Fourier Transform:** Introduction, Fourier integrals-Fourier sine and cosine integrals, Fourier sine and cosine transform, Linearity property, change of scale property, shifting property, convolution theorem(without proof)	06
5	**Z-transform:** Z-transform of standard functions such as $Z(a^n)$, $Z(n^p)$, Linearity property, damping rule, shifting rules, Initial & Final value theorem, convolution theorem (all without proof), idea of Inverse Z- transform.	06
6	**Use of Scilab(Computer Software) to solve integral transform.**	02

TERM WORK:

1. Based on above syllabus at least 10 tests assessed papers (10 marks)
2. One term test of 100 marks like university pattern must be conducted and scaled to 10 marks.
3. Attendance 05 marks.

Reference Books:

1 Elements of Applied mathematics, P N & J N Wartikar, Pune Vidarthi Gruha Prakashan
2 Advanced Engineering Mathematics, E Kreyszing, Wiley Eastern Limited
3 Advanced Modern Engineering Mathematics, Glyn James
4 Fourier Transform, Schuam Series
5 Higher Engineering Mathematics, B. V. Ramanna, Tata McGraw Hill

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** III	
Subject: Electronics Devices and Linear Circuits (Abbreviated as EDLC)			
Periods per Week (each 60 min)	Lecture	04	
	Practical	02	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical and Oral	02	25
	Oral	---	--
	Term Work	---	25
	Total	05	150

Module	Contents	Hours
1	Bipolar Junction Transistor: - BJT modeling, the hybrid equivalent model, Graphical determination of the H parameters. Negative feedback	07
2	Field Effect Transistor :- Construction of JFETs, Transfer characteristics, FET small signal Model , JFET configurations (Fixed bias, self bias, voltage divider, source follower and common gate) , Common source amplifier.	08
3	Operational Amplifier: Introduction, block diagram representation, Analysis of equivalent circuit, the ideal op-amp, open loop op-amp configuration	08
4	Practical op-amp – Input offset voltage , input bias current , Input offset current , Total output offset voltage , Thermal drift, effect of variation in power supply voltage on offset voltage, Common mode configuration and common mode rejection ratio .	09
5	General linear application, Comparators and Converters: - AC – DC amplifier, Summing amplifier, Instrumentation amplifier, the integrator, the differentiator, zero crossing detector, Schmitt trigger, Analog to digital and Digital to analog converter	09
6	Timer & Voltage regulator:-The IC 555 timer, monostable and astable multivibrator , PLL, voltage regulator(fixed, adjustable, switching regulator)	07

TERM WORK:

List of Experiments:-

- Study of Characteristics of FET.
- Study of RC coupled amplifier involving negative feedback
- Study of JFET amplifier
- Study of variable voltage power supply using operational amplifier.
- Study of inverting Amplifier.
- Study of Non- inverting amplifier.
- Study of Inverting adder. & subtractor.
- Study of Non- inverting & inverting comparator.
- Study of Schmitt trigger.
- Study of square wave generator.
- Study of triangular wave generator.
- Study of IC555 as Astable multivibrator / monostable multivibrator.

Note: -

- As per the pattern of university question paper, the question no. 1 which is compulsory question of 20 marks should cover all contains of syllabus
- Term work of 25 marks to be allotted as 15 marks for practical performance & attendance in theory lectures and 10 marks for unit test.

Reference Books:-

1. Electronics Devices & Circuits by Robert L. Boylestad ,Louis Nashelsky , PHI Publication
2. Electronics Devices and circuits by S Salivahanan ,N.sureshkumar,A Vallavaraj ,TATA McGraw Hill Publication
3. Circuits,Devices & Systems by Ralph J. Smith ,Richard C. Dorf , Wiley India Pvt. Ltd.
4. Electronics Laboratory Prime – a Design Approach by S. Poorna Chandra , S Chand Publication
5. Sergio Franco, 'Design with op-amp and analog integrated circuits,' Tata McGraw Hill series.
6. Op-amp and linear integrated circuits by Ramakant A. Gayakwad , PHI Publication
7. 'Semiconductor Data Manual', BPB Publications.
8. 'Data Book volume I and II', Elektor India.
9. ''TTL / CMOS Data book' , Semiconductor, Texas Instruments.

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** III	
Subject: Discrete Structure & Graph Theory (Abbreviated as DSGT)			
Periods per Week (each 60 min)	Lecture	03	
	Practical	--	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical and Oral	--	--
	Oral	---	--
	Term Work	---	25
	Total	03	125

Module	Contents	Hours
1	**Set Theory** • Sets , Venn diagrams, Operations on sets • Laws of set theory, Power set and products • Partitions of sets, The Principle of Inclusion-Exclusion 3	03
2	**Logic** • Propositions and logical operations, Truth tables • Equivalence, Implications • Laws of logic, Normal Forms • Predicates and Quantifiers • Mathematical Induction	04
3	**Relations, Diagraph and Lattices** • Relations, paths and digraphs; • Properties and types of binary relations; • Manipulation of relations, closures, Warshall's algorithm; • Equivalence and Partial ordered relations; • Posets and Hasse diagram; • Lattice.	07
4	**Functions and Pigeon Hole Principle:** • Definition and types of functions : injective, surjective and bijective; • Composition, identity and inverse; • Pigeon-hole principle.	04

5	**Graphs** • Definition; • Paths and circuits : Eulerian, Hamiltonian; • Planer graphs, Graph coloring • Isomorphism Of Graphs • Traveling salesperson problem	04
6	**Trees** • Trees, Rooted tree and path length in rooted tree • Spanning tree and minimum spanning tree • Isomorphism of trees • Weighted Trees and Prefix Codes	03
7	**Algebraic Structures** • Algebraic structures with one binary operation - semigroups, monoids and groups. • Product and quotient of algebraic structures • Isomorphism, homomorphism, automorphism; • Cyclic Groups, Normal subgroup, Codes and group codes • Algebraic structures with two binary operations - rings, integral domains and fields. • Ring Homomorphisms and Isomorphisms	07
8	**Generating Functions and Recurrence Relations.** • Series and Sequences; • Generating functions; • Recurrence relations; • Applications: Solving Differential equations, Fibonacci	04

Text Books:

1. Ralph P. Grimaldi, B. V. Ramana, " Discrete and Combinatorial Mathematics" Fifth Edision, Pearson Education.
2. Bernard Kolman, Robert C. Busby ,Sharon Cutler Ross, Nadeem-ur-Rehman, " Discrete Mathematical Structures" Pearson Education.
3. D. S. Malik and M. K. Sen , "Discrete Mathematical Structures", Thomson

Reference Books:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw-Hill.
2. Garry Haggard, John Schlipf, Sue Whitesides. "Discrete Mathematics For Computer Science", Thomson.
3. Joe Mott, Abraham Kandel and Theodore Baker, " Discrete Mathematics for Computer Scientist and Mathematicians", Second Edition PHI
4. Richard Johnsonbaugh, " Discrete Mathematics " Pearson Education
5. C. L. Liu, " Elements of Discrete Mathematics" Tata McGRAW-Hill

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** III	
Subject: Digital Logic Design and Application (Abbreviated as DLDA)			
Periods per Week (each 60 min)	Lecture	03	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical and Oral	--	--
	Oral	---	--
	Term Work	---	25
	Total	03	125

Module	Contents	Hours
1	**Number systems:** Decimal , Binary, Octal and Hexadecimal number system and conversion, Number system's application e.g. shaft encoding, Binary weighted codes, Signed number binary order, 1's and 2's complement codes, All number system's arithmetic. **Boolean Algebra:** Binary logic functions, Boolean laws, Truth Tables, Associative and distributive properties, Demorgan's Theorem, Realization of switching functions using logic gates.	07
2	**Combinational logic:** Switching equations, Canonical logic forms, Sum of product & Product of sum, karnaugh maps, two, three & four variable karnaugh graph, Simplification of expression Quine-mccluskey minimization techniques, Mixed logic combinational circuits, Multiple output functions.	06
3	**Analysis and design of combinational logic:** Introduction of combinational circuits, Multiplexer and demultiplexer,, Multiplexers as function generator, Binary adder, Substractor, BCD adder, Binary comparator with physical applications, Arithmetic and logic units, Design of combinational circuits using statements.	07
4	**Sequential Logic:** Sequential circuits, Flip flop conversions, Clocked and edge triggered flip flops timing specifications, Timing analysis, state diagrams and tables, transition tables, Excitation table and equations, Examples using flip flops.	05
5	**Sequential Circuits:** Simple synchronous and asynchronous sequential circuit analysis, Different types of counters asynchronous and synchronous, Counter Design with state equations, Registers, Different types of Shift registers, Construction of state diagram and counter design.	06
6	**Digital integrated circuits:** Digital circuit logic levels, Propagation	05

	delay times, Power dissipation, Fan out and fan in, Noise margin for popular logic families, TTL, TTL sub families, CMOS and their performance comparison(Numericals expected)	

TERM WORK

1. Term work should consist of at least 8 practical experiments duly graded (Desirable 10 experiment) and two assignments covering all the topics of the syllabus.
2. A term work test must be conducted with a weightage of 10 marks covering complete syllabus.

List of experiments:

1. Study of Basic Gates and Universal Gates.
2. Realization of logical expression using Universal Gates and Basic Gates.
3. Binary Arithmetic circuits I) Adder II) subtractor.
4. Implement certain functions using multiplexers [16:1, 8:1, 4:1]
5. Design and implement 4:1 multiplexer with strobe I/P active low using NAND & NOR Gate.
6. To design & implement any one code converter [e.g. Excess-3, BCD -- Gray] using Decoder & Demultiplexer.
7. To design & implement 4-bit parity generator/ checker using
   I) Minimum number of gates.
   II) IC 74180.
8. Design of 7-segment display using decoder [IC 7447]
9. Design of JK Flipflop using NAND gates and verification of the same flip flop using IC 7476.
10. Design of asynchronous Up & Down Counter.
11. Design of synchronous counter.
12. Design of random sequence generator.
13. Design of shift register using flip flops verification of different modes.
14. Verification of function table of universal shift register IC 74194.
15. Compare propagation delay and transfer characterstic of TTL & CMOS gates [use odd no. of gates].

Text Books:

1. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill.
2. John F. Wakerly, "Digital Design Principles and Practices", Pearson Education, Russia
3. M. Morris Mano, "Digital Logic and computer Design", PHI.

Reference Books:

1. John M. Yarbrough, "Digital Logic", Thomson Learning.
2. Samuel Lee, "Digital Circuits and Logic Design", PHI.
3. Charles H. Roth, "Fundamentals of Logic Design, (4 th Edition)", Junior Jaico Book.

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** III	
Subject: Data Structure and Files (Abbreviated as DSF)			
Periods per Week (each 60 min)	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical and Oral	02	25
	Oral	---	--
	Term Work	---	25
	Total	05	150

Pre-requisites: A Course in Object Oriented Programming Language such as (JAVA)

Module	Contents	Hours
1	**Introduction to Data Structures:** • Definition • The Abstract Data Type(ADT) • Arrays • Strings • Recursion	05
2	**File Handling:** • File Organization • Types of files • File operations	04
3	**Sorting and Searching:** **A. Sorting** • Insertion sort • Selection sort • Exchange sort (Bubble, Quick) • Merge sort • Heap sort **B. Searching:** • Linear Search • Binary Search • Hashing Technique and collision handling	07
4	**Stack:** • The Stack as an ADT • Representation	03

	• Stack Operations • Applications	
5	**Queue:** • The Queue as an ADT • Representation • Queue Operations • Circular and Priority Queues • Applications	03
6	**Linked List:** • The Linked List as an ADT • Operation on Linked List • Linked Stacks and Queues • The Linked List as a Data Structure • Array implementation of Linked List • Linked List using Dynamic variable • Comparison of Dynamic and Array implementation of Linked List • Doubly Linked List • Circular Linked List	10
7	**Trees:** • Basic tree concepts • Binary Tree Operations and Applications • Binary Tree representations • Binary Tree Traversals • Threaded Binary Tree • The Huffman Algorithm • Binary Search Tree Implementation • Expression Trees • Introduction of multiway tree (B-Tree, B+ Trees, AVL Tree)	12
8	**Graphs:** • Graph as an ADT • Graph Representation • Graph Traversal (Depth First Search, Breadth First Search)	04

TERM WORK

Term work should consist of graded answer papers of the test and 12 implementations using object oriented constructs & concepts. Students are expected to build their own classes and methods. Built-in classes are not to be used (preferably). Each student is to

appear for atleast one written test during the Term. Each implementation must consist of Problem Statement, Brief Theory, Algorithm, Flowchart and Conclusion.

Topics for Implementation

1. String functions , Recursion and Files
2. Implementations of Stack & Queues (Circular & Priority)
3. Implementation of Linked Lists (Singly & Doubly)
4. Implementation of Searching & Sorting methods
5. Implementation of Binary Tree
6. Implementation of Graph

Text Books:

1. Y. Langsam, M.J. Augenstein and A.M. Tanenbaum, "Data Structures Using Java", Pearson Education .
2. R.F. Gilberg and Behrouz A. Forouzan, "Data Structure: A Pseudocode Approach with C", Thomson Edition .
3. Michael Goodrich & Roberto Tamassia, "Data structures and algorithms in Java^{JM}", Second Edition, Wiley India Edition.

Reference Books:

1. John R. Hubbard and Hurry "Data structures with Java", Pearson Education.
2. Mark Allen Weiss, "Data Structure & Algorithm Analysis in C++", Third Edition, Pearson Education.
3. Sanjay Pahuja, "A Practical to Data Structure & Algorithms", First Edition, New Age International Publisher.
4. Alan L. Tharp "File organization and processing", Amazon Publication.

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** III	
Subject: Computer Organization and Architecture (Abbreviated as COA)			
Periods per Week (each 60 min)	Lecture	03	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical and Oral	--	--
	Oral	---	--
	Term Work	---	25
	Total	03	125

Module	Contents	Hours
1	**Basic structure of computer** Introduction of computer system and its sub modules, Basic organization of computer and block level description of the functional units. Von newmann model, Introduction to buses and connecting I/O devices to CPU and memory, Asynchronous and synchronous bus, PCI, SCSI.	04
2	**Arithmetic and Logic Unit.** Arithmetic and logical unit hardware implementation, Booth's Recoding, Booth's algorithm for signed multiplication , Restoring division and non restoring division algorithm, IEEE floating point number representation and operations.	07
3	**Central processing unit.** CPU architecture, Register organization , Instruction formats and addressing modes (Intel processor)., Basic instruction cycle, Instruction interpretation and sequencing, Control Unit operation, Hardwired control unit design methods and design examples, Multiplier control unit, Micro programmed control unit, basic concepts, Microinstruction sequencing and execution , Micro operations, concepts of nanoprogramming, Introduction to RISC and CISC architectures, design issues and examples of RISC processors.	06
4	**Memory Organization.** Characteristics of memory system and hierarchy, concepts of semiconductor memories, main memory, ROM, EPROM, RAM, SRAM, DRAM, SDRAM, RDRAM, , Flash memory, Stack Organization. High speed memories: Cache memory organization and mapping, replacement algorithms , cache coherence, Interleaved and associative memories , Virtual memory, main memory allocation , segmentation paging, Secondary storage, RAID, optical memory, CDROM, DVD.	07

5	**I/O Organization.** Input/Output systems, Programmed I/O, Interrupt driven I/O, I/O channels, DMA, Peripheral Devices, U.S.B.	03
6	**Multiprocessor Configurations.** Flynn's classifications, parallel processing concepts, Introduction to pipeline processing and pipeline hazards, design issues of pipeline architecture, Instruction pipeline, Instruction level parallelism and advanced issues.	04
7	**SPARC** Static and Dynamic data flow design, Fault tolerant computers, Interprocessor communication and synchronization, cache coherence, shared memory multiprocessor.	03
8	**Systolic Architectures** Systolic arrays and their applications, wave front arrays.	02

TERM WORK:

Based on above syllabus at least 10 experiments and one written test of 10 marks to be conducted.

Text Books:

1. Miles Murdocca, "Computer Architecture and Organization", Wiley India
2. William Stallings, "Computer Organization and Architecture: Designing and performance": Prentice-Hall India
3. Carl Hamacher, Zvonko Vranesic and Safwat Zaky "Computer Organization", McGraw Hill

Reference Books:

1. John L. Hennessy and David Patterson," Computer Architecture A Quantitative Approach", Morgan Kaufman
2. Andrew S. Tanenbaum," Structured Computer Organization", Prentice-Hall India

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** III	
Subject: Presentation and Communication Techniques(Abbreviated as PCT)			
Periods per Week (each 60 min)	Lecture	02	
	Practical	02	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory	---	---
	Practical and Oral	---	---
	Oral	---	---
	Term Work	---	50
	Total	---	50

Contents		Hours
1.	**Communication in a business organization:** Internal and external communication, Types of meetings, strategies for conducting successful business meetings, documentation (notice, agenda, minutes, resolution) of meetings. Introduction to modern communication techniques. (e-mail, internet, video-conferencing, etc.) Legal and ethical issues in communication (Intellectual property rights: patents, TRIPS, Geographical indications).	05
2	**Advanced technical writing**: Report writing: Definition and importance of reports, qualities of reports, language and style in reports, types of reports, formats (letter, memo, project-repots). Methods of compiling data for preparing report. A computer-aided presentation of a technical project report based on survey-based or reference based topic. The topics are to be assigned to a group of 8-10 students. The written report should not exceed 20 printed pages. Technical paper-writing, Writing business proposals.	07
3	**Interpersonal skills**: Introduction to emotional intelligence, motivation, Negotiation and conflict resolution, Assertiveness, team-building, decision-making, time-management, persuasion	03

4	**Presentation skills**: Elements of an effective presentation, Structure of a presentation, Presentation tools, Audience analysis, Language: Articulation, Good pronunciation, Voice quality, Modulation, Accent and Intonation.	03
5	**Career skills**: Preparing resumes and cover letters. Types of Resumes, Interview techniques: Preparing for job interviews, facing an interview, verbal and non-verbal communication during interviews, observation sessions and role-play techniques to be used to demonstrate interview strategies (mock interviews).	03
6	**Group discussion**: Group discussions as part of selection process. Structure of a group discussion, Dynamics of group behavior, techniques for effective participation, Team work and use of body language.	03

Term work:

Part-I (25 Marks): Assignments;

Two assignments on communication topics
Three assignments on report-writing
Three assignments on interpersonal skills
Two assignments on career skills
At least one class test (written)
Distribution of term work marks will be as follows:

Assignments : 10 marks
Written test : 10 marks
Attendance (Theory and Practical) : 05 marks

Part-II (25 Marks): Presentation;

Distribution of term work marks will be as follows:

Project report presentation : 15 marks
Group discussion : 10 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Text books:

1. Lesikar and Petit, *Report writing for business*, Tata McGraw Hill.
2. Raman and Sangeeta Sharma, *Technical communication*, Oxford University Press, New Delhi.

Reference Books:

1. Wallace & Masters, *Personal development for Life & work*, Thomson Lerning.
2. Heta Murphy, *Effective Business Communication*, McGraw Hill.
3. Huckin & Olsen, *Technical writing and professional communication*, McGraw Hill.
4. Fred Luthans, *Organizational behavior*, McGraw Hill.

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** IV	
Subject: Applied Mathematics IV(Abbreviated as AM-IV)			
Periods per Week (each 60 min)	Lecture	05	
	Practical	---	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical / Oral	--	---
	Oral	---	--
	Term Work	---	25
	Total	03	125

Module	Contents	Hours
1	**Matrices:** 1.1 Brief revision of vectors over a real field, inner product, norm, Linear independence and orthogonality of vectors. 1.2 Characteristic polynomial, characteristic equation, characteristic roots and characteristic vectors of a square matrix, properties of characteristic roots and vectors of different types of matrices such as orthogonal matrix, Hermitian matrix, Skew-Hermitian matrix, Diagonable matrix , Cayley Hamilton's theorem (without proof) Functions of a square matrix, Minimal polynomial and Derogatory matrix.	03 10
2	**Complex variables:** 2.1 Functions of complex variables, Analytic function, necessary and sufficient conditions for $f(z)$ to be analytic (without proof) 2.2 Milne- Thomson method to determine analytic function $f(z)$ when it's real or imaginary or its combination is given. Harmonic function, orthogonal trajectories. 2.3 Mapping: Conformal mapping, linear, bilinear mapping, cross ratio, fixed points and standard transformations such as Rotation and magnification, invertion and reflection, translation. 2.4 line integral of a function of a complex variable, Cauchy's theorem for analytic function, Cauchy's Goursat theorem (without proof), properties of line integral, Cauchy's integral formula and deductions. 2.5 Singularities and poles: Idea of Taylor's and Laurent's series development (without proof)for Residue 2.6 Residue's theorem, application to evaluate real integrals of type $\int_0^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$, & $\int_{-\infty}^{\infty} f(x)\, dx$	01 04 05 05 04 05

3	**FMathematical programming:** 3.1 Linear optimization problem, standard and canonical form of LPP, basic and feasible solutions, primal simplex method (more than two variables). 3.2 Artificial variables, Big-M method (method of penalty) 3.3 Dual problem, duality principle Dual simplex method, degeneracy andalternative optima, unbounded solution. 3.4 Nonlinear Programming, unconstrained optimization, problem with equality constraints Lagranges Multiplier Method, Problem with inequality constraints Kuhn-Tucker conditions.	06 03 7 7	

TERM WORK:

1. Based on above syllabus at least 10 tests assessed papers (10 marks)
2. One term test of 100 marks like university pattern must be conducted and scaled to 10 marks.
3. Attendance 05 marks.

Reference Books:

1. Complex Variables: Churchill, Mc-Graw Hill
2. Elements of Applied mathematics, P N & J N Wartikar, Pune Vidarthi Gruha Prakashan
3. Higher Engineering Mathematics, Dr B. S. Grewal, Khanna Publication
4. Advanced Engineering Mathematics, E Kreyszing, Wiley Eastern Limited
5. Operations Research, Kantiswearup, Manmohan, P K Gupta, S. Chand & Co.
6. Operations Research, S D Sharma, S. Chand & Co.
7. Matrices, A. R. Vasishtha, Krishna Prakashan.

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** IV	
Subject: Analog and Digital Communication(Abbreviated as ADC)			
Periods per Week (each 60 min)	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical and Oral	02	25
	Oral	---	--
	Term Work	---	25
	Total	05	150

Detailed Syllabus		
Module	**Topics**	**Hrs.**
1	**Introduction** Basics of communication systems, modulation and demodulation, analog and digital modulation, noise in communication system, various noise parameters	**04**
2	**Analog Modulation and Demodulation** Different types of analog modulation, amplitude modulators and demodulators, frequency modulators and demodulators, phase modulation and demodulation, amplitude modulation and frequency modulation receivers	**07**
3	**Pulse Analog Modulation** Sampling theorem for low-pass and band-pass filters, sampling technique principle, generation, demodulation, and spectrum, types of pulse analog modulation, generation and detection of pulse amplitude modulation (PAM), pulse width modulation (PWM) and pulse position modulation (PPM), principles of time division multiplexing (TDM) and frequency division multiplexing (FDM)	**07**
4	**Digital Modulation Techniques** Discrete messages, concept of information, average information, information rate, Shannon's theorem, channel capacity, capacity of Gaussian channel, pulse code modulation (PCM), delta modulation (DM), adaptive delta modulation (ADM) - transmission systems	**07**
5	**Base Band Modulation**	

	PCM waveform types, M-array pulse modulation, base band signal receiver, detection of binary signals in Gaussian noise, inter symbol interference (ISI) and equalization	**08**
6	**Bandpass Modulation and Demodulation** Types of bandpass modulation, phase shift keying – BPSK, DPSK, DEPSK, QPSK, M - array PSK, amplitude shifting – BASK, QAM, frequency shift keying - BFSK, M –array, FSK.	**08**
7	**Channel Coding** Types of error control, linear block codes, errors detection and correction capacity, cyclic codes, convolution codes	**07**

Topics of Experiments

1. Amplitude modulation generation and detection
2. Amplitude modulation receiver
3. Frequency modulation generation and detection
4. Frequency modulation receiver
5. Pulse width WM generation and detection
6. PPM generation and detection
7. Delta Modulation and demodulation
8. TDM
9. BPSK
10. BFSK
11. BASK
12. QPSK
13. Error detection and correction
14. Eye pattern

TERM WORK

1. Term work should consist of at least 10 experiments and 5 assignments covering all the topics (15 Marks).
2. A term work test of 100 marks like University pattern must be conducted and scaled to 10 marks.

Practical Examination

Practical Examination based on the above list should be conducted

Text Books :

1. Wayne Tomasi "Electronic Communication Systems (fundamentals through advanced)", Pearson Education, fourth Edition , 2002.
2. K.Shamugam ,"Anlog abd Digital Communciation",Wiley India.
3. Kennedy and Davis " Electronic Communication Systems", Tata McGraw Hill, third edition, 1995.
4. Taub Herbert and Schilling Donald L "Principles of Communication Systems", Tata McGraw Hill, third edition, 1999
5. Sklar Bernard "Digital Communications (fundamentals and applications)", Pearson Education , second edition, 2001.

Reference Books :

1. Couch Leon W -II, "Modern Communication Systems," Prentice Hall of India, first edition, 1995.
2. Prokies, John G, Salehi Masoud, "Communication Systems Engineering", Pearson Education , second edition, 1995.
3. Haykin Simon, "Digital Communications", John Weily and Sons, first edition, 1998.
4. Simon Haykin "Introduction to Analog and Digital Communication ",Wiley India.

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** IV	
Subject: Database Management System (Abbreviated as DBMS)			
Periods per Week (each 60 min)	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical and Oral	02	25
	Oral	---	--
	Term Work	---	25
	Total	05	150

Module	Contents	Hours
1	**1. Introduction Database Concepts :** • Introduction to data processing. Overview of file systems. • Drawbacks of file system, Concept of a database. • Comparison of Database systems and File system. • Data abstraction, 3- Layered Architecture and data independence. • Data models, Database languages. • Database users and administrators. • Database system structure	04
2	• **Entity–Relationship Model :** • Basic concepts • Constrains • Design issues, Entity–Relationship diagram • Strong - Weak entity sets • Extended ER features • Mapping an ER schema to tables.	05
3	**Relation Model :** ∗ Concept of a relation ∗ Notion of primary and secondary keys ∗ Structure relation database ∗ The relation algebra and extended algebra operations ∗ Formation of queries, Modification of database, Views.	05
4	**SQL :** • Background, Basic structure	05

	• Set operations, Aggregate function, Null values. • Nested queries, Views, Complex queries, Database modification • ∗ DDL, embedded SQL, Stored procedures and functions	
5	**Integrity and Security :** • Domain Constraints, Referential integrity • Assertions, Triggers • ∗ Security and Authorization , Authorization in SQL	04
6	**Relational–Database Design :** • First Normal form, Pitfalls in relational – database design • Function dependencies, Armstrong Axioms • 2^{nd}, 3^{rd} , BCNF , and 4^{th} normal form • Decomposition, Desirable properties of decomposition • Overall database design process.	05
7	**File structure, Indexing and Hashing:** • File organization, Organization of records in files. Data Dictionary storage. • Basic Indexing concepts, Ordered Indices, B+ Tree and B Tree Index Files • Static Hashing, Dynamic hashing • Index Definition in SQL, Multiple Key access.	05
8	**Transactions:** • Transaction concept, Transaction states • Implementation of atomicity and durability • Concurrent Executions, Serializability, Recoverability • Implementation of isolation, Transaction definition in SQL.	05
9	**Concurrency Control :** • Lock-based protocols • Timestamp-based protocols • Validation-based protocols • Deadlock handling	05
10	**Recovery System :** • Failure Classification, Storage structure • Recovery & atomicity • Log based recovery, Shadow paging • Recovering with concurrent transactions • Buffer Management.	05

TERM WORK:

1. At least 12 experiments in SQL and PL/SQL with a weightage of 10 marks
2. A term work test must be conducted with a weightage of 10 marks.
3. Attendance 05 marks

Text Books:

1. Korth, Slberchatz,Sudarshan, :"Database System Concepts", 5th Edition, McGraw – Hill
2. Peter Rob and Carlos Coronel, " Database Systems Design, Implementation and Management", Thomson Learning, 5th Edition.

Reference Books :

1. Elmasri and Navathe, " Fundamentals of Database Systems", Fourth Edition, PEARSON Education.
2. C.J. Date, A. Kannan " Introduction to Database Systems", Eighth Edition, Addison Wesley.
3. Mark L. Gillenson, Paulraj Ponniah, " Introduction to Database Management" ,WILEY
4. Raghu Ramkrishnan and Johannes Gehrke, " Database Management Systems",TMH
5. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g,Black Book, Dreamtech Press

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** IV	
Subject: Computer Graphics (Abbreviated as C.G.)			
Periods per Week (each 60 min)	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical and Oral	02	25
	Oral	---	--
	Term Work	---	25
	Total	05	150

Module	Contents	Hours
1	Basic concepts 1. Introduction to computer graphics 2. lines, line segments, vectors, pixels and frame buffers, vector generation 3. DDA and Bresenham line drawing algorithms. 4. Mid point and Bresenham's circle drawing algorithms 5. mid point ellipse drawing algorithm, 6. various styles of lines like thick lines, 7. character generation methods • Stroke Principle, • Bit map method 8. Display file structureDisplay file interpreter,	06
2	Polygons 1. Introduction, 2. representation of polygon 3. entering Polygons in display file, 4. inside-outside test 5. Polygon filling methods • Boundary fill , • Flood fill • scan line Polygon Fill • Patterns filling. Transformations 1. homogeneous coordinates 2. Translation 3. Scaling 4. Rotation 5. Rotation about an arbitrary point 6. inverse transforms 7. shear transforms 8. Reflections.	10
3	Segments	08

	1. Introduction 2. segment table 3. Operations segment • Creation • Closing • Deletion • renaming, • Visibility 4. other display-file structures 5. Image transformations 6. raster techniques. Windowing and clipping 1. Introduction 2. viewing transforms 3. 2D line clipping • Cohen-Sutherland line clipping • Midpoint subdivision algorithm • Liang-Barsky Line Clipping algorithm, • Cyrus-Beck algorithm 4. Text Clipping 5. Polygon Clipping • Sutherland-Hodgman polygon clipping algorithm • Weiler-Arthorton polygon clipping • Liang barsky polygon clipping 6. Generalized clipping.	
4	3-D Transformations 1. Introduction 2. 3-D geometry 3. 3-D display methods 4. 3-D object representation methods 5. 3-D transformations 6. Rotation about an arbitrary axis 7. Concept of parallel and perspective projections 8. 3-D clipping 9. 3-D viewing transformations	08
5	Hidden Surfaces and Lines 1. Introduction 2. Back-face removal algorithm 3. Z buffers 4. scan-line 5. Painter's algorithm 6. Warnock's algorithm 7. hidden line methods. Light, Color and Shading 1. Introduction 2. Diffuse illumination 3. Point-source illumination 4. Specular reflection 5. shading algorithms 6. transparency 7. reflections 8. shadows 9. ray tracing 10. Colour models 11. rendering pipeline.	08

6	Curves and fractals 1. Introduction 2. Curve generation • B-Splines • Bezier curves 3. Surfaces • Bezier Surfaces • B spline Surfaces 4. Fractals, fractal lines and surfaces. Animation 1. Devices for producing animation 2. Computer assisted animation 3. real time animation 4. frame-by-frame animation 5. method for controlling animation (fully explicit control, procedural)	08

Term Work –

1. Journal should consist of at least 10 Experiments based on above syllabus.

2. One written test should be conducted in the semester for the weight age of 10 Marks.

3. Suggested list of Experiments based on which practical examination should be Conducted:

1.DDA / Bresenham's line algorithm with various styles like thick, dotted etc. (Make use of Display File concept.)
2.Circle drawing using Bresenham's or Midpoint Algorithm.
3.Various 2D transformations (Scaling, Rotation,Translation etc.) implementation . Use matrices multiplications for implementation.
4.Various Polygon Filling Methods like Pattern fill , Flood fill , Boundary fill.
5.2D Curves and surfaces drawing like Bezier , B Spline.
6.Line clipping - Liang Barsky , cohen – Sutherland
7.Polygon clipping -Sutherland Hodgman.
8.3D transformations
9.Fractals
10.Character Generation.

Implementation of these experiments can be done in c/c++/java.
Practical exam of 25 marks should be based on this list of experiments.

4. Mini. Projects: journal should include 2 Mini projects as a part of term work

(Mini project is not part of practical exam).
(Concerned staff should form group of at most 3 students.)
Suggested mini project topics are

a. Graphics editor.
b. displaying given 3D object using perspective projection
c. 3D modeling of objects using OpenGL.
d. Implementing any shading algorithms using OpenGL.
e. Surface rendering using OpenGL.

5. Journal should also have at least 3 assignments based on above syllabus

Text Books

1. S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987 ISBN 0 – 07 – 100472 – 6
2. J. Foley, Van Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9
3. Leen Ammeraal ,KangZRang "Computer Graphics for Java Programming 2nd ed Wiley India

Reference Books

1. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, TATA Mc-Graw-Hill Publication, 2001, ISBN 0 – 07 – 047371 - 4
2. D. Hearn, M. Baker, "Computer Graphics – C Version", 2nd Edition, Pearson Education, 2002, ISBN 81 – 7808 – 794 – 4
3. F. Hill, "Computer Graphics: Using OpenGL", 2nd Edition, Pearson Education, 2003 ISBN 81 – 297 – 0181 – 2
4. Xiang, Plastock, "Computer Graphics", 2nd Edition, TATA Mc-Graw-Hill Publication, 2002, ISBN-0-07-049958-6

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** IV	
Subject: Analysis Of Algorithm & Design (Abbreviated as AOAD)			
Periods per Week (each 60 min)	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical and Oral	02	25
	Oral	---	--
	Term Work	---	25
	Total	05	150

Pre-requisites: Students should familiar with data structure concept, discrete structure and Programming Language such as C++ or JAVA.

Module	Contents	Hours
1	Introduction to analysis of algorithm • Design and analysis fundamentals. • Performance analysis ,space and time complexity. • Growth of function – Big-Oh, Omega, theta notation. • Mathematical background for algorithm analysis. • Randomized and recursive algorithm.	05
2	Divide and Conquer .Genaral method , Binary search, finding the min and max. .Merge sort analysis. .Quick sort, performance measurement. .Randomized version of quick sort and analysis. .Partitioned algorithm selection sort, radix sort, efficiency considerations. .Strassen's matrix multiplication.	08
3	Greedy Method .General mehod. .Knapsack problem. .Minimum cost spanning tree- kruskal and primal algo, performanance analysis. .Single source shorted path . .Job sequencing with deadlines. .Optimal storage on tapes.	08
4	Dynamic Programming . The general method . Multistage graphs, all pair shortest paths, single source shortest paths	07

	.Optimal BST ,0/1 knapsack .TSP, flow shop scheduling	
5	Backtracking .The general method. .8 queen problem ,sum of subsets. .Graph coloring,hamltonian cycles. . Knapsack problem.	07
6	Branch and Bound .The method, LC search. .15 puzzle:An example. . Bounding and FIFO branch and bound . . LC branch and bound . . 0/1 knapsack problem. .TP efficiency considerations.	07
7	Internet algorithm .Strings and patterns matching algorithm . .Tries. .Text compression. .Text similarity testing.	06

TERM WORK

Term work should consist of graded answer papers of the test and 12 implementations using c++/java. Students are expected to calculate complexities for all methods. Each student is to appear for at least one written test during the Term. Each implementation must consist of Problem Statement, Brief Theory, complexity calculation and Conclusion.

Topics for Implementation:

1. Implementation based on divide and conquer method.
2. Implementation on greedy approach .
3. Implementation on dynamic programming .
4. Implementation of backtracking methods
5. Implementation of Branch and Bound concept
6. Implementation of internet algorithm.

Text Books:

1. Ellis horowitz,Sarataj Sahni, S. Rajsekaran.”Fundamentals of computer Algorithms” University press.
2. Anany V. Levitin ”Introduction to the Design and Analysis of Algorithms” Pearson Education publication, Second Edition.
3. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to Algorithms", 2nd Edition, MIT Press/McGraw Hill, 2001
4. Michael Goodrich & Roberto Tamassia, “Algorithm design foundation,analysis and internet examples”, Second Edition, Wiley student Edition.

Reference Books:

1.S. Baase, S and A. Van Gelder, "Computer Algorithms: Introduction to Design and Analysis",3rd edition. Addison Wesley, 2000

2.Kenneth berman,Jerome Paul “Algorithm:sequential,parallel and distributed” Cengage Learning

3.Mark Allen Weiss, “Data Structure & Algorithm Analysis in C++”, Third Edition, Pearson Education.

University of Mumbai			
Class: S.E.	**Branch:** Computer Engineering	**Semester:** IV	
Subject: Operating System (Abbreviated as O.S.)			
Periods per Week (each 60 min)	Lecture	04	
	Practical	02	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory	03	100
	Practical and Oral	02	25
	Oral	---	--
	Term Work	---	25
	Total	05	150

Objective: This course is designed to introduce the most fundamental system program which control all the resources of computer and provide base upon which application programs can be written. Student will learn important resources and their management policies, algorithms used by operating systems. This fundamental will help them to study modern operating systems in subsequent semester and help them to design operating system.

Prerequisite:
Computer Organization & Architecture, Programming Language (C / C++/Java)

Detailed Syllabus

Module	Topics	Hrs.
1	**Operating System Overview :** Operating System Objectives and Functions. Evolution of Operating Systems, Characteristics of Modern Operating Systems, Basic Concepts : Processes, Files, System calls, Shell, Layered structure v/s Monolithic Structure of Operating System. Introduction to Distributed OS, RTOS, Mobile OS.	**05**
2	**Process and process scheduling :** Process description, PCB, Threads, Thread management; process and thread , Process Scheduling : Types, comparative assessment of different scheduling algorithms.	**10**
3	**Process Concurrency:** Principles of Concurrency; Mutual Exclusion- Hardware approaches; Mutual Exclusion- Software Support; Semaphores; Monitors, Message Passing; Readers/Writers Problem. Deadlock and Starvation: Principles of Deadlock, Deadlock Prevention; Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategy; Dining Philosophers Problem;	**10**

4	**Memory Management** Memory management Requirements. Memory Partitioning; Virtual memory; Paging; Segmentation; Design and implementation issues in paging and segmentation; page replacement algorithms; page fault handling; working set model	**07**
5	**I/O Management and Disk Scheduling.** I/O Devices. Organization of the I/O Function; Operating System Design Issues; I/O Buffering, Disk Scheduling and disk scheduling algorithms; RAID; Disk cache	**05**
6	**File Management.** Overview; File Organization; File Directories; File Sharing; Record Blocking; Secondary Storage Management; UNIX File system	**04**
7	**Case Studies:** Overview of Linux operating system, Process and thread management, Scheduling, concurrency control mechanisms, Memory management and I/O management in Linux. Overview of Windows operating system: Process and thread management, Scheduling, concurrency control mechanisms, Memory management and I/O management in windows.	**07**

Term Work

1. Term work shall consist of at least 9 programs based on the above topics.
2. It should also include Small routines, involving implementation of small utilities in shell programming for Unix / Linux system administration.
3. Programs that would give good exposure to Unix/Linux system calls for process control,memory management and file management.
4. Test must be conducted with a weightage of 10 marks.

Text Books:

1.William Stallings, "Operating Systems", 4th Edn, Pearson Education
2. Silberschatz A.,Galvin P., Gagne G. " Operating Systems Principles", Willey
3.Flynn Ida M., McHoes A.M., "Understanding Operating Systems", 4th Edn, Thomson

Reference Books :

1. Tannenbaum, "Modern Operating Systems", PHI
2. Milan Milenkovic, "Operating System", Tata McGraw Hill
3.Maurice J Bach, "The Design of the Unix Operating system", Prentice Hall.

Internet references:

Respective Linux Flavours Sites