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.

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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 07 07

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