Algorithm Analysis and Design

BEG 371 CO

Year: III **Semester: I**

Teaching Schedule Hours/Week			Examination Scheme				
Theory	**Tutorial**	**Practical**	**Internal**		**Final**		**Total**
			Theory	**Practical**	**Theory**	**Practical**	
3	**1**	**--**	**20**		**80**	**-**	**100**

Course Objective:

After completion of this course, students will be able to explore techniques for designing and analyzing the algorithms.

1. Introduction **(6 hrs)**

1.1 Algorithm Definition
1.2 Algorithm Specification
1.2.1 Pseudo code Convention 1.2.2. Recursive Algorithms
1.3 Performance Analysis
1.3.1 Space Complexity
1.3.2 Time Complexity
1.3.3 Asymptotic Notation (Ὸ, Ω)
1.3.4 Practical Complexities
1.3.5 Performance Measurement

2. Divide-And- Conquer **(10 hrs)**

2.1 General Method
2.2 Binary Search
2.3 Merge Sort, Quick Sort, Selection Sort
2.4 Strassen's Matrix Multiplication
2.5 Convex Hull

3. Greedy Method **(6 hrs)**

3.1 The General Method
3.2 Knapsack Problem
3.3 Job Sequencing with Deadlines
3.4 Minimum Cost spanning Trees
3.4.1 Prim's Algorithm
3.4.2 Kruskal's Algorithm
3.5 Dijkstra's Algorithm

4. Dynamic Programming **(6 hrs)**

4.1 The General Method
4.2 Multistage Graph
4.3 All Pairs Shortest Path
4.4 0/1 Knapsack
4.5 The Travelling Salesperson Problem

5. Backtracking **(6 hrs)**

5.1 General Strategy
5.2 8-Queens Problem
5.3 Kanpsack Problem
5.4 Graph Coloring
5.5 Hamiltonian Cycles

6. Branch and Bound **(6 hrs)**

6.1 General Strategy
6.2 0/1 Knapsack
6.3 Travelling Salesperson Problem

7. Np-Hard and Np-Complete Problems **(5 hrs)**

7.1 Basic Concepts
7.2 Np-Hard Graph Problems

References

1. Horowitz, Sahani and Rajasekaran "Fundamentals of Computer Algorithms", Galgotia Publication.
2. Bressard, "Fundamental of Algorithm.", PHI

Marks Distribution:

Chapter	Marks
1	10
2	20
3	10
4	10
5	10
6	10
7	10
Total	80

* Attempt any Five Questions out of seven. One question include A and B.

Research Methodology

BEG 396 MS

Year: III **Semester: I**

Teaching Schedule Hours/Week			Examination Scheme				
Theory	**Tutorial**	**Practical**	**Internal**		**Final**		**Total**
			Theory	**Practical**	**Theory**	**Practical**	
2	**--**	**--**	**10**		**40**	**-**	**50**

Course Objective/s:

The course provides an introduction on research methods for those in the Engineering and computing disciplines. In particular, the course deals with the different research questions rising in Engineering and computing, the research approaches used and the analysis and evaluation methodologies followed by research projects. As part of the course, students would be encouraged to look for additional reading materials independently and prepare research proposal.

1. Introduction of Research (5 hrs)

1.1 Definition of Research
1.2 Rigor and Relevance in Research
1.3 The 6Ps of Research (Purpose, Products, Process, Participants, Paradigm, Presentation)
1.4 Reasons for Doing Research (Purpose)
1.5 Possible Products (Outcomes of Research)
1.6 Sources of research ideas
1.7 Evaluating the Purpose and Products of Research
1.8 Overview of the Research Process
1.9 A Model of the Research Process
1.10 Alternative Models of the Research Process
1.11 Evaluating the Research Process

2. Fundamental Concept on Research (5 hrs)

2.1 Hypothesis
2.2 Sampling, its characteristics, types, benefits and problems
2.3 Field work
2.4 Validity
2.5 Reliability

3. Research Design (5 hrs)

3.1 Definition of Research Design
3.2 Types of research Design
3.3 Finding and Choosing Research Topics
3.4 Preparing Research Proposal

4. Data Collection (3 hrs)

4.1 Meaning of Data Collection
4.2 Importance of Data Collection
4.3 Types of Data
4.4 Source of Data Collection

5. Data Collection Techniques and Classification (5 hrs)

5.1 Survey
5.2 Interview
5.3 Questionnaire
5.4 Case Study
5.5 Observation

5.6 Analysis and presentation of data

6. Mean, Median and Standard Deviation (2 hrs)

6.1 Definition
6.2 Different methods of calculation of mean, median and standard deviation

7. Report writing (3 hrs)

7.1 Definition
7.2 Organization of Report
7.3 Presentation of Diagram
7.4 Construction of tables

8. Presentation Techniques (2 hrs)

8.1 Presentation and its importance
8.2 Essentials of presentation
8.3 Techniques of presentation

References

1. Best, John W.: "Research in Education, Prentice hall of India", New Delhi
2. Wolf Howard K. and Prem R. Panta: "Social Science Research and Thesis Writing" Research Division TU, Kirtipur, 1975
3. Goode William J. and Paul K. Hatt: "Methods in Social Research" Megraw Hall Kogakusha Ltd., 1952
4. Tika Bhattarai, "Research Methodology"
5. C. R. Kothari, “Research Methodology: Methods and Techniques”, New Age International, 2009
6. Briony J. Oates, “Researching Information Systems and Computing”, SAGE Publications, London. Thousand Oaks, New Delhi. 2006.
7. Keith F. Punch,”Introduction to Social Research: Quantitative and Qualitative Approaches”, Second Edition. SAGE Publications, London, Thousand Oaks, New Delhi. 2005
8. John W. Creswell,”Research Design: Qualitative, Quantitative and Mixed Methods Approaches”, Second Edition, SAGE Publications, London. Thousand Oaks, New Delhi. 2003.

Marks Distribution:

Chapter	Marks
1	7
2	7
3	7
4	4
5	7
6	2
7	4
8	2
Total	40

Project

BEG374CO

Year: III **Semester: I**

Teaching Schedule Hours/Week			Examination Scheme				
Theory	**Tutorial**	**Practical**	**Internal**		**Final**		**Total**
			Theory	**Practical**	**Theory**	**Practical**	
0	**0**	**2**		**20**		**30**	**50**

Course Objective/s:

After completion this course, students will be able to apply the concept of system design, Database and Programming language required for developing a computer information system for real life situation.

Contents:

Students will work individually or in group on a project of their choice, mostly related to development of a computer information system for life industrial situation.

In some cases students will be asked to visit software development firms/Company where they will involve themselves in using system analysis and design and Free Open Source Programming tools required during software development process.

At the end of the semester they will be required to document their reports, which will be individually, assessed by their advisors.

Every student will have to appear for a viva-voce at the end of the semester.

Operating System

BEG 373CO

Year: III **Semester: I**

Teaching Schedule Hours/Week			Examination Scheme				
Theory	**Tutorial**	**Practical**	**Internal**		**Final**		**Total**
3	**1**	**2**	**Theory**	**Practical**	**Theory**	**Practical**	**150**
			20	**50**	**80**	**-**	

Course Objective:

After completion of this course, the students will acquire the concepts of Operating Systems and Design and Implement them.

1. Operating System Overview (3 hrs)

OS objectives and functions

1.1.1 OS as a user/computer interface
1.1.2 OS as Resource Manager
1.2 Evolution of Operating Systems
1.2.1 Serial Processing
1.2.2 Simple Batch Systems
1.2.3 Multi-programmed Batch Systems
1.2.4 Time-Sharing Systems

2. Process (17 hrs)

2.1 Introduction to Process
2.1.1 The process Model
2.1.2 Implementation of Process
2.1.3 Threads
2.2. Inter Process Communication (IPC)
2.2.1 Race Conditions
2.2.2 Critical Sections
2.2.3 Mutual Exclusion with Busy Waiting
2.2.4 Sleep and Wakeup
2.2.5 Semaphores
2.2.6 Monitors
2.2.7 Message Passing
2.3 Classical IPC problems
2.4 Process scheduling
2.4.1 Preemptive Vs. Non Preemptive Scheduling
2.4.2 Round Robin Scheduling
2.4.3 Priority Scheduling
2.4.4 Multiple Queues
2.4.5 Shortest Job First
2.4.6 Real time Scheduling
2.4.7 Two-Level Scheduling

3. Input/Output (3 hrs)

3.1 Principles of I/O Hardware
3.2 Principles of I/O Software
3.3 Disks
3.4 Clocks
3.5 Terminals

4. Deadlocks (4 hrs)

4.1 Resources of Deadlock
4.2 Principles of Deadlock
4.3 Deadlock Detection and algorithm
4.4 Deadlock Avoidance

5. Memory Management (5 hrs)

5.1 Fixed and Variable partition systems
5.2 Bit maps
5.3 Memory management with linked list (First fit, best fit, next fit, quick fit and buddy system)
5.4 Multiprogramming memory management techniques
5.5 Virtual Memory
    5.5.1 Paging and Segmentation
    5.5.2 Swapping and page replacement

6. Real Time Operating System (2 hrs)

6.1 Introduction and Example
6.2 Real Time Terminologies
    6.2.1 Soft Real Time
    6.2.2 Hard Real Time
    6.2.3 Real Real Time
    6.2.4 Firm Real Time

7. Distributed Operating System (3 hrs)

7.1 Introduction
7.2 Communication and Synchronization
7.3 Process and Processor in Distributed OS

8. File Systems (3 hrs)

8.1 Files and Directories
8.2 File System Implementation
8.3 File Sharing and Locking

9. Case Studies: Aspect of Different OS (5 hrs)

(Linux, Windows, Mac, iOS, Android OS)

Laboratory:

There shall be laboratories exercises covering following topics;

i. Implementation of Process (Creation of process, Parent process, Child Process)
ii. Interprocess Communication(Race Condition, Mutual Exclusion, Semaphores, Monitors, Message Passing)
iii. Process Scheduling(Round Robin, Priority, Shortest Job first)
iv. Implementation of Deadlocks
v. Memory Management

Reference:

1. Operating Systems: Design and Implementation

   - Tanenbaum A.S. , Woodhull A.S. (Prentice-Hall)

2. Operating System: Internals and Design Principles

   - Stallings, William (prentice-Hall)

3. Operating System Concepts

- Silberschatz A., Galvin P.B. (Addison- Wesley)

4. Mark Donovan: System Programming.

Marks Distribution:

Chapter	Marks
1	6
2	26
3	6
4	8
5	10
6,7	8
8,9	16
Total	80

Numerical Method

BEG370C0

Year: III **Semester: I**

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal		Final		Total
3	1	3	Theory	Practical	Theory	Practical	150
			80	50	20	0	

Course Objective:

After completion of this course, the students will be able to solve the engineering problems by using the theory of numerical Computational procedures

1. Introduction (4 hrs)

1.1. Numerical computing process 1.2.New trends in Numerical Computing
1.2. Application in Numerical Computing 1.4. Taxonomy of errors in numerical method
1.3. Absolute Relative & percentage errors

2. Solution of non – Linear equation (7 hrs)

2.1. Iterative methods and stopping criteria
2.2. Bisection method & its Convergence
2.3. Horner's method
2.4. Newton- Raphson method and its convergence
2.5. Secant method and its convergence
2.6. Evaluation of polynomials using Horner's Rule

3. Curve Fitting (8 hrs)

3.1 Interpolation
- 3.1.1 Linear interpolation
- 3.1.2 Lagrange interpolation
- 3.1.3 Newton interpolation
- 3.1.4 Newton Divided Different interpolation
- 3.1.5 Spine interpolation: cubic spines
- 3.1.6 Control Interpolation (Gauss Forward/ Backward Formulae)

3.2. Regression
- 3.2.1 Least squares Regression
- 3.2.2 Fitting Transcendental Equations.
- 3.2.3 Fitting a polynomial function

4. Numerical Different & integration (7 hrs)

4.1 Differentiating continuous functio
- 4.1.1 Forward Difference Quotient
- 4.1.2 Backward Difference Quotient
- 4.1.3 Central Difference quotient

4.2 Newton cotes methods of integration
- 4.2.1 Trapezoidal rule and composite trapezoidal rule
- 4.2.2 Simpson's 1/3 rule & its composite
- 4.2.3 Simpson's 3/8 rule.
- 4.2.4 Boole 's Rule

4.3 Romberg integration 4.4. Gaussian integration

5. Linear Algebraic Equations (10 hrs)

5.1 Elimination Approach
- 5.1.1 Basic Gauss Elimination
- 5.1.2 Gauss Elimination with partial pivoting
- 5.1.3 Gauss Jordon method
- 5.1.4 LU decomposition methods
  - 5.1.4.1 Do Little Algorithm
  - 5.1.4.2 Crout Algorithm
- 5.1.5 Matrix Inversion Method
- 5.1.6 Cholesky Method

5.2 Iterative method
- 5.2.1 Iconic method
- 5.2.2 Gauss- seidal method
- 5.2.3 Eigen values and eigen vectors using power method & inverse power method

6. Solution of ordinary differential equations
(6 hrs)

6.1 Euler's method . 6.2 Heun's method (predictor – Corrector method)
6.3 Fourth order Runge-kutta method 6.4 Systems of differential equations using Heun's method
6.5 Higher order differential equations using Heun's method

7. Solutions of partial differential equations (3 hrs)

7.1 Elliptic equations
7.1.1 Poisson's equations 7.1.2 Laplace's equations
7.2 Parabolic Equations 7.3 Hyperbolic Equations

Laboratories:

1. Review of properties of programming language
2. Bisection method
3. Newton-raphson method
4. Secant method & Horner's rule
5. Lagrange interpolation
6. Linear Regression
7. Basic gauss elimination method
8. Gauss seidal method
9. Matrix inversion method
10. Trapezoidal rule
11. Simpson's 1/3 rule
12. Simpson's 3/8 rule
13. Solution of differential equation using Euler's method
14. Solution of differential equation using Runge-Kutta method

References

1. E. Balagurusamy " Numencal Methods ' Tatal Mc Graw Hill
2. S.Yakwitz and F. szidarouszky '' An Introduction to Numerical Computations "2nd Edition Macmillan Publishing co ', New York .
3. W. Cdhency and D kixaid " Numerical Mathematics 4 computing "2nd Editior, Brooks /Cole publishing
4. C.F Gerald and P.o. Wheatley " Applied Numerical Analysis "4th Editim Addipon wesley publishing co. New york .
5. W. It presss, B p. Flannery et . al "Numerical Recises Inc", 1st Edition, Cambridge press 1988

Marking scheme:

Group-A (attempt any six) 6*10=60

Chapter number	Chapter topic	Final marks
1	Introduction	10
2	Solution of non-linear equation	10
3	Curve fitting	10
4	Numerical differentiation and integration	10
5	Linear algebraic equation	10
6	Solution of ordinary differential equation	10
7	Solution of partial differential equation	10

Group-B (attempt any two) 2*10=20

There may be three or four question related to program or algorithm.

*Note: There may be minor variation in marks distribution according to credit hour allocated.

Computer Graphics
BEG372CO

Year: III **Semester: I**

Teaching Schedule Hours/Week			Examination Scheme				
Theory	**Tutorial**	**Practical**	**Internal**		**Final**		**Total**
			Theory	**Practical**	**Theory**	**Practical**	
3	**1**	**3**	**20**	**50**	**80**	**-**	**150**

Course Objective:

To be familiar with the basic techniques used in computer graphics system

1. Introduction (2 hrs)

1.1. History of Computer graphics 1.2 Application of computer graphics

2. Graphics Hardware (8 hrs)

2.1. Keyboard, Mouse (mechanical & optical), Light pen, Touch screen, Tablet input hardware, joystick
2.2. Raster and Vector display architecture
2.3. Architecture of simple non-graphical display terminals
2.4. Architecture of graphical display terminals including frame buffer and color manipulation techniques RGB, CMYK
2.5. Advanced raster graphic architecture

3. Two-dimensional Algorithms and Transformations (10 hrs)

3.1. Direct and incremental line drawing algorithms
3.2. Bresenham algorithms line drawing for m>1 and m<1 (mid-point circle drawing and mid-point ellipse-drawing algorithms)
3.3. Two-dimensional translation, scaling (standard and directive), rotation, reflection, and shear
3.4. Recent transform concept and advantages 3.5. Windows-to-viewport transformation

4. Windows and Clipping (8 hrs)

4.1. Introduction 4.2. The viewing transformation
4.2. Viewing transformation implementation 4.4. Clipping
4.3. The Cohen-Sutherland line-clipping algorithm 4.6 The Sutherland-Hodgman algorithm(Polygon Clipping)

5. Three-dimensional Graphics (7 hrs)

5.1. Extension of two-dimensional transforms to three-dimensions
5.2. Three-dimensional object to screen viewing projection
5.3. Methods of generating non-planar surfaces (Bezier, Spline)
5.4. Hidden line and hidden surface removal techniques(Object and Image space method including A buffer)
5.5. Specialized and future three-dimensional display architectures

6. Light ,Color and shading (5 hrs)

6.1. Introduction
6.2. Need for shading in engineering data visualization
6.3. Algorithms to simulate ambient, diffuse, and specular reflections
6.4. Constants, Gouraud, and Phong shading models

7. Graphical Languages (4 hrs)

7.1. Need for machine independent graphical languages(PHIGS,GKS)
7.2. Discussion of available languages and file formats (Graphical file format)

8. Introduction to Animation (1 hr)

8.1. Open GL (Introduction only)

Lab:

1. Introductin to graphics primitives and graphics drivers
2. Implementation of line Drawing Algorithms.
   2.1 DDA 2.2. Breselhem's Algorithm 2.3. Breselhem's general Algorithm
3. Implementation of mid point circle Algorithm
4. Implementation of mid point ellipse Algorithm
5. Implemetation of basic 2D and 3D transformation
6. Implementation of windows to view port transformation
7. Implementation of line clipping process

References:

1. D. Harn and M. P. Baker, "Computer Graphics", PHI Edition
2. T. I. James, D. Foley, A. Van Dam, S. K. Feiner, and J. F. Hughes, "Computer Graphics, Principles,and Practice", PHI Edition

Marks Distribution:

Chapter	Marks
1,2	18
3	18
4	15
5	14
6,7,8	15
Total	80