

**CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)**

**Scheme of Teaching & Examination**

**M.E. Computer Technology & Applications**

**II Semester**

S. No.	Board of Study	Subject Code	Subject	Periods per Week			Scheme of Examination			Total Marks	Credit L+(T+P)/2
				L	T	P	Theory / Practical				
							ESE	CT	TA		
1	Computer Science & Engg.	549211 (22)	Object Oriented Analysis & Design	3	1	-	100	20	20	140	4
2	Computer Science & Engg.	549212 (22)	Data Base Engineering	3	1	-	100	20	20	140	4
3	Computer Science & Engg.	549213 (22)	Multimedia Technology	3	1	-	100	20	20	140	4
4	Computer Science & Engg.	549214 (22)	Operating System & Linux Internals	3	1	-	100	20	20	140	4
5	Refer Table –II		Elective -II	3	1	-	100	20	20	140	4
6	Computer Science & Engg.	549221(22)	Computer Software Lab –2	-	-	3	75	-	75	150	2
7	Computer Science & Engg.	549222(22)	Computer Hardware Lab – 2	-	-	3	75	-	75	150	2
<b>Total</b>				<b>15</b>	<b>5</b>	<b>6</b>	<b>650</b>	<b>100</b>	<b>250</b>	<b>1000</b>	<b>24</b>

L- Lecture

T- Tutorial

P- Practical ,

ESE- End Semester Exam

CT- Class Test

TA- Teacher's Assessment

**Table-II**

<b>ELECTIVE II</b>			
S.No.	Board of Study	Subject Code	Subject
1	Computer Science & Engg.	549231 (22)	Enterprise Resource Planning
2	Computer Science & Engg.	549232 (22)	Digital Image Processing & Computer Vision
3	Computer Science & Engg.	549233 (22)	System Performance & Evaluation

**Note (1) –** 1/4<sup>th</sup> of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a Particular academic session.

**Note (2) –** Choice of elective course once made for an examination cannot be changed in future examinations.

# CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M. E. II**  
Subject: **Object Oriented Analysis and Design**  
Total Theory Periods: **40**  
Total Marks in End Semester Exam. : **100**  
Minimum number of class to be conducted: **02**

Branch: **Computer Science & Engg.**  
Code: **549211 (22)**  
Total Tutorial Periods: **12**

## **UNIT 1: Introduction to Object Orientation**

Real-world Domains, Object oriented approach and technology, Objects Instances and Concepts. Objects and Classes of Objects Generalized Object-Oriented Software Development Cycle, Object oriented Programming language. Object-Oriented Analysis of a Real-World Domain Object Model. The Notion of Encapsulation and Information Hiding, Object Identity: Entity and Attributes, Data and Knowledge: The Notion of Inheritance, Relationships between Objects: Association, Generalization / Specialization, Aggregation , Objects and States. Dynamic Behavior of Objects

## **UNIT 2: Object oriented Analysis**

OO Analysis an introduction, Techniques for information Gathering for RA, Use case - Driven OO Analysis, OO concepts and principles. Identifying the elements of an Object model. Management of OO software projects. Object oriented analysis, domain analysis, generic components of OO analysis model, object behavior model

## **UNIT 3: Object-Oriented System Design**

OO Design Introduction, System Design Concepts and the Object-Oriented Approach Conventional Vs OO approaches, Design issues, the generic components of the OO design model, the system design process, the object design process, OOD landscape, Useful design Patterns, OO Design Process, Design patterns. UML and the System Design Introduction to the Unified Modeling Language (UML), The unified Approach, Unified Modeling Language, Static Class diagram, Use case Diagram, Behavior Diagram Relationships, Identifying Attributes and Methods

## **UNIT 4: Object oriented testing**

Testing OOA and OOD models, Object oriented testing strategies, Test case design for OO software, testing methods applicable at the class level, Interclass test case design. Technical metrics for object oriented systems: The intent of OO metrics, the distinguishing characteristics, metrics for the OO design model, class oriented metrics, operation oriented metrics, metrics for object oriented testing, metrics for object oriented projects.

## **UNIT 5: Object-Oriented Programming Paradigm**

Object-Oriented Support of Software Qualities Data Abstraction and Encapsulation. Data Type and Abstract Data Type Object-Oriented Program Structure More about Inheritance Reusability and Support for Reuse Class Design Guidelines Morphism and Polymorphism. Binding, Overloading, Overriding Object-Life Cycle. Persistent Objects Introduction to Object-Oriented Databases Object-Oriented Programming Environments. Comparison between C++, Java and C#.

### **Text Books**

1. J. Rumbaugh, M. Blaha, W. Premeriani, F. Eddy, W. Lorensen, "Object-Oriented Modeling and Design", Prentice-Hall, 1991.
2. Jacobson, M. Christerson, P. Jousson, G. Overgaard: " Object-Oriented Software Engineering ". A Use Case Driven Approach, Addison-Wesley, 1992.

### **Reference Books**

1. Roger S Pressman, "Software Engineering - A Practitioner's Approach", The McGraw Hill Publications V Edition

2. Waman S Jawadekar, "Software Engineering Principles and Practice", TMH, 2004.  
**CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,  
BHILAI (C.G.)**

Semester: **M. E. II**

Subject: **Data Base Engineering**

Total Theory Periods: 40

Total Marks in End Semester Exam. : **100**

Minimum number of class to be conducted: 02

Branch: **Computer Science & Engg.**

Code: 549212 (22)

Total Tutorial Periods: **12**

**UNIT 1: Introduction Data Modeling**

DBMS Database system concepts and architecture

ER Model: Concepts of ER model , An example of database application, specialization, generalization, aggregation, Conceptual object modeling using UML class, Ternary degree

Relational Model: Concepts of relational model, relational constraints, relational database schemas, algebra operations, additional operations, update, relational database design using ER to relational mapping, Database design theory & methodology: Functional dependencies, Normalization for relational databases (up to 5<sup>th</sup> NF), Tuple & Domain relational calculus, examples of relational database management systems: oracle & Microsoft access

SQL: DDL, DML, DCL statements,

**UNIT 2: Concepts of Object Oriented Databases**

Object identity, object structure & type constructors, encapsulation and operations, methods & persistence, Type hierarchy & inheritance, Complex object

**UNIT 3: System Implementation Techniques**

Introduction to transaction processing, Transaction & system concepts, properties of transaction schedules & recoverability, serializability of schedules, locking techniques for concurrency control, concurrency control based on timestamp ordering, multiversion concurrency control techniques, validation (optimization) concurrency control techniques, granularity of data items & multiple granularity locking , database recovery techniques, database security and authorization

**UNIT 4: Data ware housing & Data mining**

Data warehousing: terminology & definition, characteristics, characteristics of data warehouses, data modeling for data warehouses, functionality of data warehouses, Data mining: overview, association rules, application of data mining, state of art of commercial data mining tools

**UNIT 5: Database System Architecture**

Centralized and client server architecture, server system architecture, parallel system, distributed system, Distributed database: Homogeneous and heterogeneous databases, distributed data storage, distributed transaction, Commit protocol (Two phases commit, Handling of failures.

Concurrency in distributed database: Locking protocol (single lock-manager approach, distributed lock manager), time stamping, deadlock handling, Parallel databases: introduction, I/O parallelism

**Text books:**

1. Fundamentals of database system, 3<sup>rd</sup> edition, pearson education, Elmasri & Navathe
2. Database system concepts, 4<sup>th</sup> edition, McGraw Hill, Silberschatz-Korth-Sudarshan

**Reference books:**

1. An introduction to database system, Asian tudents association  
a. editon , Galgotia publication , Bipin C. Desai
2. Principals of database systems, 2<sup>nd</sup> edition galgotia publication, Ullman
3. Database management system, C.J. Date

# CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M. E. II**

Subject : **Multimedia Technology**

Total Theory Periods: **40**

Total Marks in End Semester Exam. : **100**

Minimum number of class to be conducted: **02**

Branch: **Computer Science & Engg.**

Code: **549213 (22)**

Total Tutorial Periods: **12**

## **UNIT 1: Introduction**

Applications of computer graphics, Elements of pictures created in computer graphics, Graphics display devices, Device-independent programming and OpenGL. Basic raster graphics algorithms for drawing 2D primitives: Midpoint line & circle algorithm, Scan-line polygon filling algorithm. Antialiasing. 2D geometric transformations and 2D viewing: Basic transformations, Matrix representations and homogeneous coordinates, Composite transformations, The viewing pipeline, window-to-viewport coordinate transformation, clipping operations - Cohen-Sutherland line clipping, Liang-Barsky line clipping & Sutherland-Hodgeman polygon clipping,.

## **UNIT 2: 3D and Viewing Transformations**

3D concepts & 3D object representations: Polygon surfaces, Curved lines and surfaces, Quadric surfaces, Spline representations, Bezier curves and surfaces, B-spline curves and surfaces. 3D geometric transformations and 3D viewing: Translation, Rotation, Scaling, Viewing pipeline, Viewing coordinates, Parallel projections & Perspective projections. Visible-surface detection methods: Classification, Back-face detection, Depth-buffer method, Scan-line method, Depth-sorting method, BSP-tree method & Area-subdivision method, Visible-surface ray tracing

## **UNIT 3: Introduction and Components of multimedia**

Concept of Multimedia, media & data stream, Main properties of multimedia system, Data stream characteristics & for continuous media multimedia Applications, Hardware software requirements, Multimedia Products & its evolution. Text, Basic sound concepts, MIDI, Speech, Basic concept of Images, Graphics format, Overview of image processing, Basic concepts of Video & animation, Conventional system, Transmission, Enhanced system, High Definition system, Computer based animation, Design & authoring Tools, Categories of Authority Tools, Types of products

## **UNIT 4: Data Compression and Optical Storage Media**

Coding requirement, Source, entropy, hybrid coding, JPEG, MPEG, Text compression using static Huffman technique, Dynamic Huffman Technique, Statistical coding techniques. Videodisk and other WORMS, Compact Disk digital audio, Advantage of CD-DA Frames tracks blocks of CD-DA, CD-ROM, and Further CD-Rom based developments, Principles of CDWO, Prospects of CD technologies.

## **UNIT 5: Virtual Reality**

Introduction to Virtual reality & Virtual reality Systems, Related Technologies: Tele-operation & augmented reality system VRML Programming, Domain Dependent Application like Medical, Visualisation Visibility computation Time Critical rendering

### **Text Books**

1. Computer Graphics, C Version, Second Edition, Donald Hearn & M. Pauline Baker, Pearson Education.
2. Steinmetz "Multimedia Computing Communication and Application" Pearson Edn.

### **Reference Books**

1. Schaum's Outline of Computer Graphics, Second Edition, Roy A. Plastock & Zhigang Xiang, Tata McGraw-Hill.
2. John Vince "Virtual Reality Systems" Pearson Education.
3. Nigel Chapman & Jenny Chapman, "Digital Multimedia", Wiley Publications,

4. David Hillman, "Multimedia Technology & Application", Galgotia Publications.

**CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,  
BHILAI (C.G.)**

Semester: **M. E. II**

Subject: **Operating system and Linux Internals**

Total Theory Periods: **40**

Total Marks in End Semester Exam. : **100**

Minimum number of class to be conducted: **02**

Branch: **Computer Science & Engg.**

Code: **549214 (22)**

Total Tutorial Periods: **12**

**UNIT 1: INTRODUCTION**

Computers and Software, Operating System Strategies, Programmer's Abstract Machine, Resources, Processes and Threads, Writing Concurrent Programs, Objects, Basic Functions, General Implementation Considerations, Contemporary OS Kernels.

**UNIT 2: DEVICE MANAGEMENT**

The I/O System, I/O Strategies, Device Manager Design, Buffering, Device Class Characteristics. IMPLEMENTING PROCESSES, THREADS, AND RESOURCES :The Task at Hand, The Hardware Process, The Abstract Machine Interface, The Process Abstraction, The Thread Abstraction, State Diagrams, Resource Managers, Generalizing Process Management Policies. SCHEDULING Overview, Scheduling Mechanisms, Strategy Selection, Non-preemptive Strategies, Preemptive Strategies, Implementing the Scheduler.

**UNIT 3: BASIC SYNCHRONIZATION PRINCIPLES**

Cooperating Processes, Evolving from the Classic Solution, Semaphores, Synchronization in Shared Memory Multiprocessors. HIGH-LEVEL SYNCHRONIZATION AND INTERPROCESS COMM:Alternative Synchronization Primitives, Monitors, Interprocess Communication. DEADLOCK: Background, Prevention, Avoidance, Detection and Recovery.

**UNIT-4 MEMORY MANAGEMENT**

The Basics, The Address Space Abstraction, Memory Allocation, Dynamic Address Space Binding, Modern Memory Manager Strategies. VIRTUAL MEMORY :The Task at Hand, Address Translation, Paging, Static Paging Algorithms, Dynamic Paging Algorithms, Segmentation, Memory-mapped Files.

FILE MANAGEMENT :The Task at Hand, Files, Low-level File Implementations, Supporting High-level File Abstractions, Directories, Implementing Directories, File Systems

**UNIT 5: CASE STUDY- LINUX**

LINUX: The Operating System; Compiling the kernel; Introduction to the kernel: Important Data Structures, Main algorithms, Implementing System Calls; Memory Management: Architecture-independent memory model, Virtual Address Space of a Process, Block Device Caching, Pages under Linux. INTERPROCESS COMMUNICATION, FILE SYSTEM, DEVICE DRIVERS: IPC: Synchronization in the Kernel, Communication via Files, Pipes, Debugging using ptrace, System V IPC, IPS with sockets; File system: Basic Principles, Representation of File System in the Kernel, The Proc File System, The Ext2 File System; Device Drivers: Character and Block Devices, Polling, Interrupts and Waiting Queues, Implementing a Driver, Dynamic and Static Drivers.

**Text Books**

Operating Systems: Gary Nutt, 3<sup>rd</sup> Edition, Pearson Education, 2005.

LINUX Kernel Programming: M Beck etal, 3<sup>rd</sup> Edition, Pearson Education, 2002.

**Reference Books**

Operating Systems: Deitel, Deitel and Choffnes, 3<sup>rd</sup> Edition, Pearson Education, 2004.

Operating System Concepts: Silberschatz, 6<sup>th</sup> Edition, John Wiley and Sons, 2003.

The LINUX Kernel Book: Remy Card etal, John Wiley, 1998.

**CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,  
BHILAI (C.G.)**

Semester: **M. E. II**

Subject: **Enterprise Resources Planning**

Total Theory Periods: 40

Total Marks in End Semester Exam. : **100**

Minimum number of class to be conducted: 02

Branch: **Computer Science & Engg.**

Code: 549231 (22)

Total Tutorial Periods: **12**

**UNIT 1: Overview of Business functions & Information system**

Business function in an organization, material management, scheduling, shop floor control, forecasting, accounting & finance, human resources, productivity management.

**UNIT 2: Typical Business process**

Core process, product control, sales order processing, purchase, administrative process, human resource, finance support processes, marketing, strategic planning, research & development. Problem in traditional functional view. Need for integrated process view, information as a resources, motivation for ERP. Case studies.

**UNIT 3: Evolution of information system**

EDP (Electronic Data Processing) system, management information system (MIS), executive information systems, information needs of organization, ERP as an integrated of information needs at various levels, decision making involved at the above level. Supply Chain Management system, Customer Relationship Management, Case studies.

**UNIT 4: VERP models/functionality:**

Sales order processing, MRP-I, MRP-II, scheduling, forecasting, maintenance, distribution, finance, features of each of the model, description of data flow across each module, overview of the supporting data base, technologies required for ERP. Case Studies.

**UNIT 5: Implementation of ERP & their domain:**

Pre implementation issues, financial justification of ERP, evaluation of commercial software during Implementation issues, reengineering of various business, education & training, project management, post implementation issue, performance measurement. SAP R/3 application, Oracle applications, Baan , PeopleSoft , J D Edwards. Case studies to support implementation.

**Text Books**

1. V.K. GARG & N.K. VENKATKRISHNAN: ERP, Concept & Practice, PHI
2. Laudon & Laudon : Management Information System, Pearson Education

**Reference:**

1. V. RAJARAMAN: Analysis & Design of Information System. PHIK.M.Hussain & D. Hussein: Information systems, Analysis, Design & Implementation, TMH.
2. Monk & Brady: Concepts in ERP, Vikas pub, Thomson
3. J. Kanter : Managing with information , PHI
4. ERP an Overview by Leon & Leon

# CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M. E. II**

Subject: **Digital Image Processing & Computer Vision**

Total Theory Periods: 40

Total Marks in End Semester Exam. : **100**

Minimum number of class to be conducted: **02**

Branch: **Computer Science & Engg.**

Code: **549232 (22)**

Total Tutorial Periods: **12**

## **UNIT 1: Digital Image Fundamentals**

Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image analysis and computer vision, spatial feature extraction, transform features, Edge detection, gradient operators, compass operators, stochastic gradients, line and spot detection. Elements of Visual Perception, A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations

## **UNIT 2: Image Enhancement**

Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods

Frequency Domain: Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering

## **UNIT 3: Image Restoration**

A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering

## **UNIT 4: Image Compression & Segmentation**

Fundamentals, Image Compression Models, Error-Free Compression, Lossy Compression, Image Compression Standards, Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation

## **UNIT 5: Image Analysis & Computer Vision**

Spatial feature extraction - transform features. Edge Detection- gradient operators- compass operators, stochastic gradients, line and spot detection

## **Text Books**

1. Rafael C Gonzalez and Richard E. Woods, "Digital Image Processing", PHI 2<sup>nd</sup> Edition 2005
2. Scott.E.Umbaugh, "Computer Vision and Image Processing", Prentice Hall, 1997

**CHHATISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY,  
BHILAI (C.G.)**

Semester: **M. E. II**  
Subject: **System Performance & Evaluation**  
Total Theory Periods: 40  
Total Marks in End Semester Exam. : **100**  
Minimum number of class to be conducted: **02**

Branch: **Computer Science & Engg.**  
Code: **549233 (22)**  
Total Tutorial Periods: **12**

**UNIT-1**

Performance evaluation methods, Analytical versus simulation modelling, Performance measurement and Benchmarking. Workload modelling, Random variables.

**UNIT-2**

Commonly used distributions. Stochastic processes, Markov chain models of computer systems, Steady-state and Transient analyses, Queuing models.

**UNIT-3**

Single server and multi-server queues, Open and closed queuing networks. Discrete event simulation, Simulation Languages.

**UNIT-4**

Random number generation and testing, model verification and validation, Analysis of simulation results, Confidence interval Variance reduction techniques.

**UNIT-5**

Case studies of analytical and simulation studies of computer systems.

***Text Books***

1. Raj Jain, " The Art of Computer Systems Performance Analysis ", John Wiley and Sons, New York, USA, 1991
2. Trivedi, KS, Probability and Statistics with Reliability, Queueing and computer science Applications Prentice Hall of India Reprinted in 1990
3. Law, A M, and Kelton, W.D, " Simulation Modeling and Analysis ", McGraw Hill, New York, USA, 1991

# Chhattisgarh Swami Vivekanand Technical University BHILAI (C.G.)

Semester: II  
Subject **Computer Software Lab-2**  
Total Practical Period : **40**  
Total Marks in end Semester Exam: **75**

Branch : **Computer Science & Engg.**  
Code: 549221 (22)

## List of Experiments for M.E. (CTA) first semester

1	Evoke VHDL system and be familiar with the environment.
2	Study of a variable, signal, constant Array, and VHDL operators, functions and procedures.
3	Study of compilation and simulation of VHDL code.
4	Give VHDL modeling of flip-flop.
5	Give VHDL simulation of Multiplexer circuit.
6	Design a serial adder with accumulator.
7	Give VHDL simulation of ROM.
8	Give VHDL codes for PLA/PAL system.
9	Design of 4 bit fully synchronous counter (both TTL/CMOS logic) i.e. IC 74163.
10	Give a state graph of signed number multiplication & give VHDL codes.
11	Design a Divider control circuit.
12	Design a keypad scanner using VHDL, give solution of key bouncing/denouncing.
13	Give VHDL codes for UART transmitter as well as receiver.
14	Give VHDL codes for BAUD rate generator for compute communication.
15	Give simple VHDL model static RAM along with control signals.
16	Study of MAT LAB environment for computing application.
17	Practice on matrix manipulations using MATLAB.
18	Study of various transformations method using MATLAB.
<b><i>Students have to perform at least 10 experiments out of 15.</i></b>	

### List of equipments:

1: Pentium computer with latest configuration, like Pentium IV having 256 MB RAM and appropriate backup memory system.

2: Electronic simulation software, VHDL/ Active HDL etc. MATLAB / SIMULINK preferable on network environment. Capable for designing, simulation and analysis.

### Recommended books:

- 1: " Digital System Design using VHDL" by Charles H Roth. Jr. Thomson Publication.
- 2: MATLAB reference manual.

# Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Semester: II  
Subject: **Computer Hardware Lab-2**  
Total Practical Period: **40**  
Total Marks in end Semester Exam: **75**

Branch: **Computer Science & Engg.**  
Code: **549222(22)**

## List of Practical

1. Write a program implement clipping operation as Cohen-Sutherland line clipping and Sutherland-Hodgeman Polygon Clipping.
2. Write a program to implement Benzier Curves and B-Spline curves.
3. Write a program implement for text compression using static Huffman Techniques
4. Write a program to implement for Image Compression using JPEG Techniques.
5. The branch manager has decided to mark all those accounts as inactive (I) on which there are no transactions performed in last one year. Whenever such updates takes place a record for the same is maintained in the **INACTIVE\_ACCT\_MASR** table comprising of account number, the opening date & the type of account. Write PL/SQLblock to do the same
6. Write an SQL coded block that raises a user defined exception when business rule is violated. The business rule for **Client\_master** table specifies when the vale of **Bal\_due** is less than 0, handle the exception.
7. Write an update trigger on **CLIENT\_MASTER** table. The system should keep track of records that are being updated. The old values of the updated record should be added in the **AUDIT\_TRIAL table**.
8. Create class instance & aggregation using multiplicity.
9. Write a program in Java to avoid deadlock condition.
10. Write a program to create a form for creating a new user for any application.
11. Write a program to create server socket application.
12. Write a program to simula te memory allocation policy like first fit, best fit and worst fit. Algorithm.
13. Write a program to simulate and study behavior of page replacement policy like FIFO replacement and optimal replacement.
14. Write a program for Zooming and Shrinking Digital Images.
15. Write a program for Smoothing Spatial Filters and Sharpening Spatial Filters.

## List of equipments:

1. Pentium computer with latest configuration, like Pentium IV having 256 MB RAM and appropriate backup memory system.
2. RDBMS Based software, MATLAB for Image processing, C/C++ for developing Graphics Algorithms

## Recommended books:

1. MATLAB reference manual
2. Rafel C Gonzalez and Richard E. Woods, "Digital Image Processing", PHI 2<sup>nd</sup> Edition 2005
3. Ivan Byross, "PI/SQL"