Semester VII

Purbanchal University
BE (Computer Engineering) 7th semester
(Ashad, 2071)

Year: IV

Semester: VII

S.N.	Course Code	Course Description	Credits	Lecture (Hrs)	Tutorial (Hrs)	Practical (Hrs)	Total (Hrs)
1	BEG490MS	Entrepreneurship	3	3	2	-	5
2	BEG471CO	Artificial Intelligence	3	3	1	2	6
3	BEG472CO	Software Engineering	3	3	2	-	5
4	BEG473CO	Simulation and Modeling	3	3	1	2	6
5	BEG474CO	Project	2		1	2	3
6	BEG475CO	Elective-I	3	3	1	2	6
		Total	17	15	8	8	31

Electives

1. **Compiler Design** BEG475CD
2. **Visual Basic . Net, C#** BEG475VB
3. **Image Processing and Pattern recognition** BEG475IP
4. **System Administration** BEG475SA
5. **Information Security** BEG475IS
6. **E-governance** BEG475EG
7. **Geographic Information System** BEG475GI
8. **JAVA programming** BEG475JP
9. **Database Programming** 475DB
10. Mobile Computing BEG475MC
11. E- commerce BEG475EC
12. Distributed Processing BEG475DP

Entrepreneurship
BEG490MS

Year IV   **Semester: VII**

Teaching Schedule Hours/Week			Examination Scheme				Total
Theory	Tutorial	Practical	Internal Assessment		Final		
			Theory	Practical*	Theory**	Practical	100
3	2	-	20	-	80	-	

Course Objective: To develop entrepreneurship skills and leadership in practical fields

UNIT 1: The foundation of Entrepreneurship: [4 Hrs]
    1.1 The World of Entrepreneur
    1.2 What is an Entrepreneur?
    1.3 The Benefits of Entrepreneurship
    1.4 The Potential Drawbacks of Entrepreneurship
    1.5 Behind the Boom: What's Feeding the Entrepreneurial Fire?
    1.6 The Cultural Diversity of Entrepreneurship
    1.7 The Power of Small Business
    1.8 The Ten Deadly Mistakes of Entrepreneurship
    1.9 Putting Failure into Perspective
    1.10 How to Avoid the Pitfalls

UNIT 2: Inside the Entrepreneurial Mind: Form Ideas to reality   [4 Hrs]
    2.1 Creativity, Innovation, and Entrepreneurship
    2.2 Creativity – A Necessity for Survival
    2.3 Creative Thinking
    2.4 Barriers to Creativity
    2.5 How to Enhance Creativity
    2.6 The Creative Process
    2.7 Techniques for Improving the Creative Process
    2.8 Intellectual Property: Protecting Your Ideas

UNIT 3: Designing a Competitive Business Model and Building a Solid Strategic Plan [3 Hrs]
    3.1 Building a Competitive Business Model and Building a Solid Strategic Plan
    3.2 The Strategic Management Process

UNIT 4: Conducting a Feasibility Analysis and Crafting a Winning Business Plan [4 hrs]
    4.1 Conducting a Feasibility Analysis
    4.2 Why Develop a Business Plan?
    4.3 The Elements of Business Plan
    4.4 What Lenders and Investors Look for in Business Plan
    4.5 Making the Business Plan Presentation
    4.6 Business Plan Format

UNIT 5: Forms of Business Ownership   [2 hrs]
    5.1 Brief Introduction to Various Forms of Ownership

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UNIT 6: Building a Powerful Marketing Plan [5 hrs]

6.1 Building a Guerilla Marketing Plan
6.2 Pinpointing the Target Market
6.3 Determining Customer Needs and Wants through Market Research
6.4 Plotting a Guerilla Marketing Strategy: How to Build a Competitive Edge
6.5 Marketing on the World Wide Web
6.6 The Marketing Mix

UNIT 7: Pricing Strategies [5 hrs]

7.1 Three Potent Forces: Image, Competition and Value
7.2 Pricing Strategies and Tactics
7.3 Pricing Strategies and Methods for Retailers
7.4 Pricing Concepts for Manufacturers
7.5 Pricing Strategies and Methods for Service Firms
7.6 The Impact of Credit on Pricing

UNIT 8: Creating a Successful Financial Plan [4 hrs]

8.1 Basic Financial Statements
8.2 Creating Projected Financial Statements
8.3 Ratio Analysis
8.4 Interpreting Business Ratios
8.5 Break-Even Analysis

UNIT 9: Managing Cash Flow [5 hrs]

9.1 Cash Management
9.2 Cash and Profits Are Not the Same
9.3 The Cash Budget
9.4 Preparing a Cash Budget
9.5 The 'Big Three' of Cash Management
9.6 Avoiding the Cash Crunch

UNIT 10: Sources of Financing: Debt and Equity [4hrs]

10.1 Planning for Capital Needs
10.2 Equity Capital versus Debt Capital
10.3 Sources of Equity Financing
10.4 The Nature of Debt Financing

UNIT 11: Choosing the Right Location and Layout [5 hrs]

11.1 Location: A Source of Competitive Advantage
11.2 Location Criteria for Retail and Service Businesses
11.3 Location Options for Retail and Service Businesses
11.4 The Location Decision for Manufacturers
11.5 Layout and Design Considerations
11.6 Layout: Maximizing Revenues, Increasing Efficiency, or Reducing Costs

Text Book:

Essentials of Entrepreneurship and Small Business Management, 5th Edition ,Thomas W. Zimmerer and Norman M. Scarborough

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Artificial Intelligence
BEG471CO

Year IV | Semester: VII

Teaching Schedule Hours/Week			Examination Scheme				Total
Theory	Tutorial	Practical	Internal Assessment		Final		
			Theory	Practical*	Theory**	Practical	
3	1	2	20	25	80	-	125

Course Objective:
- To provide basic knowledge of Artificial Intelligence
- To proved the knowledge of Machine Learning, Natural Language, Expert Systems and Neural Network
- To develop entrepreneurship skills and leadership in practical fields

UNIT 1: Introduction   [2 Hrs]
1.1 Definitions
1.2 Goals of AI
1.3 Challenges of AI
1.4 AI approaches
1.5 AI techniques
1.6 Applications of AI

UNIT 2: Agents   [5 Hrs]
2.1 Introduction to agents
2.2 Agent's performance
2.3 Example of Agents
2.4 Rationality and omniscience
2.5 Types of agent environment
2.6 Agent architecture
2.7 PEAS (vaccum cleaner agent, human agent, robotic agent, taxi driving agent, 8-queen problem etc)
2.8 Types of agent (simple reflex, goal based, model based, utility agent, learning agent)

UNIT 3: Problem solving using searching   [8 Hrs]
3.1 Uninformed Search
    3.1.1 Problem solving agents
    3.1.2 Problem types
    3.1.3 Problem formulation
    3.1.4 Example problems
    3.1.5 Basic search algorithms (BFS, DFS, Depth limited search, uniform cost search, iterative deepening, bidirectional search)

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3.1.6 Comparative study of all uninformed search strategies (completeness, optimality, time complexity and space complexity)

3.2 Informed Search
    3.2.1 Best first (greedy) search
    3.2.2 A* Search
    3.2.3 Heuristic function
    3.2.4 Hill Climbing and problems
    3.2.5 Comparative Study of each type of searching
    3.2.6 Simulated annealing
    3.2.7 Genetic Algorithm

UNIT 4: Adversial Search and Constraint satisfaction problem   **[5 Hrs]**
4.1 Games
4.2 Perfect games
4.3 Game tree and formal definition
4.4 Min Max problem
4.5 Alpha beta pruning algorithm
4.6 CSP Problem and examples
4.7 Crypto arithmetic problems and solutions

UNIT 5: Knowledge Representations   **[8 Hrs]**
5.1 Knowledge and its types
5.2 Logic
5.3 Semantic Nets
5.4 Propositional logic vs FOPL
5.5 Resolution in FOPL
5.6 Frames

UNIT 6: Learning System   **[4 Hrs]**
6.1 Rote learning
6.2 Learning from example: inductive learning methods
6.3 Decision trees
6.4 Explanation based learning
6.5 Reinforcement learning

UNIT 7: Reasoning   **[4 Hrs]**
7.1 Monotonic Reasoning
7.2 Statistical Reasoning (Bayesian Network)
7.3 Uncertainty in reasoning
7.4 Case based reasoning

UNIT 8: Expert System   **[4 Hrs]**
8.1 Human Expert vs expert system
8.2 Expert System Structure
8.3 Expert system example

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8.4 Characteristics of expert system

8.5 Knowledge acquisition

8.6 Knowledge base

8.7 Inference engine

8.8 Forward chaining and backward chaining

8.9 Design of expert system

UNIT 9: Artificial Neural networks [3 hrs]

9.1 Research history

9.2 Model of artificial neuron

9.3 Neural networks architectures

9.4 Learning methods in neural networks

9.5 Perceptron Network, Multi-layered feed forward network, Hopfield networks

9.6 Application of neural networks

UNIT 10: Natural language processing [2 Hrs]

10.1 introduction

10.2 components of natural language processing

10.3 natural language understanding

10.4 natural language generation

10.5 steps in language understanding and generation

Laboratory:

Students must do labs on prolog, C or java to cover following topics

- solving family relation problem
- GCD in prolog
- Tower of Hanoi
- Wumpus world
- Using prolog to understand (variable, rules, input output, arithematic operations, recursion in prolog)

Students must do case study on expert system or natural language processing also.

References:

1. E. Rich & K. Knight, "*Artificial Intelligence*", McGraw-Hill, 1991

2. Haykin "Neural Networks: *A Comprehensive Fundamentals*", Macmillan, 1994

3. E. Turban, "*Decision Support and Expert Systems*" , Macmillan, 1993

4. R. Shingal, "*Formal Concepts in Artificial Intelligence*" , Chapman & Hall, 1992

5. G. Gazadar & C. Mellish, "*Natural Language Processing in Prolog: and introduction to computational linguistics*", Addison-Wesley, 1989

6. D. Crookes, "*Introduction to Programming in Prolog*", Prentice Hall, 1988.

7. P. H. Winston, "*Artificial Intelligence* ", Addison-Wesley, 1984

9. Hecht-Neilson "*Neurocomputing*", Addison-Wesley, 1990

10. G. F. Luger & W. A Stubblefield, "*Artificial Intelligence*" , Benjamin Cummings, 1993

Software Engineering
BEG 472CO

Year IV   **Semester: VII**

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
			Theory	Practical*	Theory**	Practical	
3	2	-	20		80	-	100

Course Objective: This course is intended to provide an introduction to SE concepts and practices focusing on industrial software development characteristics and processes, development models, and the software life cycle for mid-scale system.

- Provide students a comprehensive introduction to software engineering.
- provide the students the kinds of activities that are necessary for developing a software system
- Study the important phases of software development

UNIT 1: Introduction to Software Engineering: [2Hrs]
  1.1 Definition of Software engineering
  1.2 The evolving role of software
  1.3 Changing Nature of Software
  1.4 Characteristics of Software
  1.5 A Generic view of software Engineering
  1.6 Software engineering- layered technology.

UNIT 2: Process models: [4Hrs]
  2.1 The waterfall model
  2.2 Prototyping Model
  2.3 RAD Model
  2.4 Spiral Model.

UNIT 3: Software Project Management: [5Hrs]
  3.1 Meaning of **People, Product, Process, Project** in Software Project Management
  3.2 Activities of Project Plannin
  3.3 Project Estimation techniques
  3.4 COCOMO
  3.5 Risk Management
  3.6 Project Scheduling
  3.7 Staffing
  3.8 Software Configuration Management (SCM)

UNIT 4: Software Requirements and Specification   [8Hrs]
  4.1 Functional and non-functional requirements
  4.2 Requirements engineering process(Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management)
  4.3 Data Modeling and flow diagram
  4.4 Software Prototyping Techniques
  4.5 Requirement definition and specification.

UNIT 5: Software Design   [7Hrs]

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5.1 Introduction to Software Design
5.2 Characteristics of a good Software Design
5.3 Design Principal
5.4 Design concepts
5.5 Design Strategy
5.6 Design process and Design quality
5.7 Software Architecture and its types   [7Hrs]

UNIT 6: Software Testing
6.1 Software testing Process
6.2 Principal of Testing
6.3 Test Case design
6.4 Black-Box Testing(Boundary Value Analysis,Equivalence class Partitioning)
6.5 White-Box testing(Statement Coverage,Path coverage,Cyclomatic complexity)
6.6 Software Verification and Validation.

UNIT 7: Metrics for Process and Products   [7Hrs]
7.1 Software Measurement
7.2 Metrics for software quality
7.3 Software Quality Assurance
7.4 Software reliability
7.5 The ISO 9000 quality standards.

UNIT 8: Introduction to Engineering Software Trends and Technolog   [5Hrs]
8.1 Agile Development
8.2 Extreme Programming
8.3 Cloud Computing and Grid Computing
8.4 Enterprise Mobility
8.5 Business Intelligent and Approaches
    8.5.1 ERP, Supply Chain Management, Service Oriented Architecture and web services
    8.5.2 Enterprise Portals and Content Management
8.6 Introduction to OOSE

Case Studies
Students are encouraged to perform the case study to implement concepts of above-mentioned topics.

References:
1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition.McGrawHill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson education.2004
3. Software Engineering (*Latest Edition*), Udit Agrawal
4. Fundamentals of Software Engineering (*Latest Edition*), Rajib Malla
5. Software Engineering – A precise Approach (*Latest Edition*), Pankaj Jalote

Question Pattern

Type	Number of Questions	Total Marks	Chapters
Long Questions	2 Questions out of 3	2X12=24	All Chapters
Short Questions	7 Questions out of 9	7X 8 =56	All Chapters

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Simulation And Modeling
BEG473CO

Semester: VII

Year IV							
Teaching Schedule Hours/Week			Examination Scheme				Total
			Internal Assessment		Final		
Theory	Tutorial	Practical	Theory	Practical*	Theory**	Practical	125
3	1	2	20	25	80	-	

Course Objective: This course provides the discrete and continuous system, generation of random variables, and analysis of simulation output and simulation languages.

UNIT 1: Concept of simulation   [6 Hrs]
1.1 Introduction
1.2 The system
1.3 Continuous and discrete systems
1.4 System simulation
1.5 Real time simulation
1.6 When to use simulation
1.7 Types of simulation model
1.8 Steps in simulation study
1.9 Phases of simulation study
1.10 Advantages of simulation
1.11 Limitations of the simulation Technique
1.12 Areas of applications

UNIT 2: Monte Carlo Method   [4 Hrs]
2.1 Monte Carlo Method
2.2 Normally distribution random number
2.3 Monte Carlo Method V/S stochastic Simulation

UNIT 3: Simulation of Continuous systems   [5 Hrs]
3.1 A pure Pursuit Problem
3.2 Continuous system models
3.3 Analog Computer
3.4 Analog Methods
3.5 Hybrid Simulation
3.6 Feedback Systems
3.7 Differential and Partial Differential Equations and its Engineering Purpose

UNIT 4: Queuing System   [5 Hrs]
4.1 Elements of Queuing System
4.2 Characteristics of Queuing System
4.3 Types of Queuing System
4.4 Queuing Notation
4.5 Measurement of System Performance
4.6 Application of Queuing System
4.7 Markov Chain

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UNIT 5: Verification & Validation of Simulation Models [5 Hrs]
      5.1 Model building
      5.2 Verification & Validation
      5.3 Verification of Simulation Models
      5.4 Calibration & Validation of Models

UNIT 6: Random Number [8 Hrs]
      6.1 Random Numbers
      6.2 Random Number Tables
      6.3 Pseudo Random Numbers
      6.4 Generation of Random Numbers
      6.5 Mid square Random Number generator
      6.6 Qualities of an efficient Random Number generator
      6.7 Testing Numbers for Randomness
      6.8 Uniformity Test
      6.9 Chi-square Test
      6.10 Testing for auto correlation
      6.11 Poker Test

UNIT 7: Analysis of simulation Output [5 Hrs]
      7.1 Estimation Methods
      7.2 Simulation run statistics
      7.3 Replication of runs
      7.4 Elimination of internal bias

UNIT 8: Simulation Language [7 Hrs]
      8.1 Basic concept of Simulation tool
      8.2 CSSLs, GPSS
      8.3 Discrete systems modeling and simulation
      8.4 Continuous systems modeling and simulation
      8.5 Structural, data and control statements hybrid simulation
      8.6 Feedback systems: typical application

Laboratories

Laboratory exercises using simulation and modeling package, at the end of this course last student must do a project on simulation using simulation and modeling package.

Recommended Books
1. G. Gordan, "System Simulation", Prentice Hall of India.
2. M. Law and R.F. Perry, "Simulation: A problem solving approach", Addison Wesley publishing company.
3. M. Law and W.D. Kelton,"Simulation Modeling and Analysis", Mc Graw Hill, 1991.
4. Jerry Banks, John S.Carson II, Barry L. Nelson, Devid M. Nicol, P.Shahabudden: Discrete –Event System Simulation
5. R.Y. Rubinstein, B. Melamed: Modern Simulation And Modelling

Project
BEG 474CO

Year IV   **Semester: VII**

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
			Theory	Practical*	Theory**	Practical	
	1	2		20		80	100

Course Objective:

- To develop practical knowledge in emerging computer science and technologies.
- To implement academic knowledge in practical fields

Guidelines of Project Work

Students are required to submit project on any one of the emerging technology. Project should be application based reflecting real time scenarios.

Following activities must be followed during project.
1. Proposal submission
2. Proposal defense
3. Midterm defense
4. Final defense
5. Project documentation

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Compiler Design

BEG475CD

Year: IV   Semester: I/II

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal		Final		Total
			Theory	Practical	Theory	Practical	
3	1	2	20	25	80	-	125

Course Objective:

1. Describe the steps and algorithms used by language translators.
2. Recognize the underlying formal models such as finite state automata, push-down automata and their connection to language definition through regular expressions and grammars.
3. Discuss the effectiveness of optimization.
4. Explain the impact of a separate compilation facility and the existence of program libraries on the compilation process.

1. Introduction to Compilers   [6 Hrs]

1.1 Compilers and translators
1.2 Need of translators, Comparison of Compilers and Interpreters
1.3 Structure of compiler
1.4 Different Phases of Compilers
1.5 Compiler construction

2. Lexical Analysis   [10 Hrs]

2.1 Role of lexical analyzer
2.2 Design of lexical analyzer, Regular expressions
2.3 Specification and recognition of tokens, input buffering
2.4 A language specifying lexical analyzer
2.5 Finite automata, conversion from regular expression to finite automata, and vice versa, minimizing number of states of DFA
2.6 Implementation of lexical analyzer.

3. Basic Parsing Techniques   [6 Hrs]

3.1 Parsers, Shift reduce parsing, operator precedence parsing, top down Parsing, predictive parsers
3.2 Automatic Construction of efficient Parsers
    3.2.1 LR parsers, the canonical Collection of LR(0) items
    3.2.2 constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing table
    3.2.3 Using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables

4. Syntax-directed Translation   [6 Hrs]

4.1 Syntax-directed Translation schemes, Implementation of Syntax directed Translators
4.2 Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements
4.3 Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser
4.4 Array references in arithmetic expressions, procedures call, declarations and case statements.

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5. Symbol Tables [6 Hrs]
   5.1 Data structure for symbols tables, representing scope information8-Queens Problem

   5.2 Run-Time Administration
      5.2.1 Implementation of simple stack allocation scheme
      5.2.2 storage allocation in block structured language

   5.3 Error Detection & Recovery
      5.3.1 Lexical Phase errors
      5.3.2 syntactic phase errors semantic errors

6. Code Generation [6 Hrs]
   6.1 Design Issues, the Target Language
   6.2 Addresses in the Target Code
   6.3 Basic Blocks and Flow Graphs
   6.4 Optimization of Basic Blocks
   6.5 Code Generator

7. Code optimization [5 Hrs]
   7.1 Machine-Independent Optimizations
   7.2 Loop optimization
   7.3 DAG representation of basic blocks, value numbers and algebraic laws
   7.4 Global Data-Flow analysis

Laboratory:

There shall be laboratories exercises covering following topics;

  i. Practice of LEX/YACC of compiler writing
  ii. Program to check whether a string belong to the grammar or not, program to
  iii. generate a parse tree, program to find leading terminals, program to find trailing terminals, program to compute FIRST of non-terminal, program to compute FOLLOW of non-terminal, program to check whether a grammar is left Recursion and remove left Recursion, program to remove left factoring, program to check whether a grammar is operator precedent
  iv. show all the operations of a stack
  v. show various operations i.e. read, write and modify in a text file

References
1. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education
2. Kenneth Louden," Compiler Construction", Cengage Learning
3. Charles N. Fischer, Richard J. leBlanc, Jr.- Crafting a Compiler with C, Pearson Education, 2008
4. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman- Compilers- Principles, Techniques and Tools, 2nd edition, Addison-Wesley, 2007

VB.NET, C# (Elective)
BEG475VB

Year: IV

Teaching Schedule Hours/Week			Examination Scheme				Total
			Internal		Final		
Theory	Tutorial	Practical	Theory	Practical	Theory	Practical	
3		2	20	25	80	-	125

Objectives:
- To understand and develop web based applications using Microsoft .NET framework
- To provide theoretical knowledge and practical expertise on DOT NET Technology.
- To gain a basic practical understanding of dot net concepts, technical issues, and applications.

1. **Overview of VB .NET and C# .NET Language** [4 Hrs]
   1.1. Introduction to .NET Framework
   1.2. Introduction to C# and VB
   1.3. Feature of object oriented programming
   1.4. Scope of .NET technology

2. **Language Basics** [5 Hrs]
   2.1. Variables and Data Types
   2.2. String & String Builder.
   2.3. Boxing and Unboxing
   2.4. Operators
   2.5. Control Statements
   2.6. Arrays and Strings
   2.7. Procedures and Functions

3. **Developing Console Application** [4 Hrs]
   3.1. Entry point method - Main.
   3.2. Command Line Parameters
   3.3. Compiling and Building Projects

4. **Essentials of Object-Oriented Programming** [6 Hrs]
   4.1. Object and Class definition and working
   4.2. Understanding Identity, State, and Behavior
   4.3. Using encapsulation to combine methods and data in a single class
   4.4. Inheritance and Polymorphism with interface

5. **WinForms** [12 Hrs]
   5.1. Introduction .
   5.2. Basic controls
   5.3. Menus and Context Menus
   5.4. Menu Strip, Toolbar Strip
   5.5. Graphics and GDI
   5.6. SDI and MDI Applications
   5.7. Dialog box (Modal and Modeless)
   5.8. Form Inheritance
   5.9. Developing Custom, Composite controls
   5.10. Field validator control
   5.11. Events – types and handling
   5.12. Exception handling

6. **Data Access using ADO.NET** [8 Hrs]
   6.1. Comparison between ADO and ADO.NET
   6.2. ADO.NET Concepts and Overview
   6.3. Working with Connection, Command, DataReader

6.4. Working with DataSet
6.5. Adding, Deleting and Modifying records in a Dataset
6.6. Data Tables, Data Columns and DataRows , Constraints
6.7. Using DataView
6.8. Working with DataGridView

7. Web Application [6 Hrs]
7.1. Basic concept
7.2. Building web application

Laboratory:
Lab work should cover at least 12 labs and should include

1. Introduction to IDE
2. Web Forms
3. Events and Event handling
4. Controls and its validation
5. Web application development
6. Database connectivity
7. Error handling

References:
8. Jose Mojica, C# & VB.Net Conversion Pocket Reference, O'Really media
9. Evangelospetroutsos, Mastering Visual Basic.Net, BPB Publication

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Image Processing & Pattern Recognition (Elective)
BEG475IP

Semester: VII

Year: IV

Teaching Schedule Hours/Week			Examination Scheme				Total
			Internal Assessment		Final		125
Theory	Tutorial	Practical	Theory	Practical*	Theory**	Practical	
3	-	3	20	25	80	-	

Objectives:
- To be familiar with image processing tools and techniques
- To be familiar with pattern recognition and its application

1. Introduction [4 Hrs]
- 1.1 Introduction to Digital Image Processing
- 1.2 Application of DIP
- 1.3 Elements of visual perception
- 1.4 Image representation
- 1.5 Fidelity Criteria
- 1.6 Relationship between Pixels (Neighbors, Path, Connectivity, Adjacency, Distances)
- 1.7 Types of Images (Color Image, grayscale Image)

2. Image Enhancement & Restoration [10 Hrs]
- 2.1 Purposes of Image Enhancement
- 2.2 Image Enhancement Techniques
- 2.3 Filtering using frequency domain
- 2.4 Point Processing (Negative, log transform, power transform, thesholding, intensity level slicing, bit plane slicing)
- 2.5 Spatial Processing
- 2.6 Image Enhancement Filters (Smoothing, Sharpening, Unsharpening filters)
- 2.7 Low Pass , High Pass & Band Pass filters
- 2.8 Mean Filter, Media Filters
- 2.9 First order and second orderDifferential filters (Laplace, Robert &Sobel Filter)
- 2.10 Histogram Modeling, Histogram equalization, Histogram matching
- 2.11 Image enhancement using Histogram statistics
- 2.12 Noise modeling
- 2.13 Types of noise (White noise, salt & pepper noise, Impulse noise, Gaussian noise, Rayleigh noise)
- 2.14 Image restoration using degradation models
- 2.15 Image Zooming (Replication& Interpolation techniques)
- 2.16 Image Enhancement using arithmetic operation

3. Transform operation in image [5 Hrs]
- 3.1 Fourier Transform
- 3.2 Properties of Fourier Transform
- 3.3 Fast Fourier Transform
- 3.4 Discrete Cosine Transform
- 3.5 Discrete Sine Transform

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7. **Pattern recognition &classification techniques** [6 Hrs]
   7.1 Introduction to Digital pattern recognition
   7.2 General steps of Pattern recognition
   7.3 Feature extraction
   7.4 Training &Learning techniques
      7.4.1 Supervised learning
      7.4.2 Unsupervised learning
      7.4.3 Reinforcement learning
   7.5 Different types of classifier& classification techniques
      7.5.1 Discriminator based classifiers
      7.5.2 Probability based classifiers
      7.5.3 Matching based classifier
      7.5.4 ANN based classifiers
      7.5.5 Clustering
      7.5.6 Similarity measurement & correlation

8. **Application of Artificial Neural Network in Pattern recognition** [3 Hrs]
   8.1 Principles of Neuro Computing
   8.2 Brain & Traditional Computers
   8.3 Biological Neuron
   8.4 Artificial Neuron
   8.5 Perceptron Neurons
   8.6 Back Propagation network
   8.7 Hopfield Network
   8.8 Self organizing map

Laboratory:

At least 12 labs should be done on image processing and pattern recognition procedures.

Text Book:

1. A.K. Jain , Introduction to Digital Image Processing
2. R. C. Gonzalez, R. E. Woods, *Digital Image Processing,* Addison Wesley, 1993, ISBN 0-201-50803-6

System Administration (Elective)
BEG475SA

Year: IV

<div align="right">Semester : I/II</div>

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
			Theory	Practical	Theory	Practical	
3	1	2	20	25	80	-	125

1. **Network Architecture and Networking software** [2 Hrs]
   1.1 Mainframe Architecture
   1.2 Client/server Architecture
       1.2.1   Different Client/server models
   1.3 File server Architecture
   1.4 Upsizing
   1.5 Downsizing
   1.6 Integration

2. **Introduction to Server Hardware and OS** [4 Hrs]
   2.1 Investigating Different Types of Servers
       2.1.1   Tower Server
       2.1.2   Rack Server
       2.1.3   Blade Server
   2.2 Overview of Network OS
       2.2.1   Linux Server
       2.2.2   Windows Server
       2.2.3   Solaris
   2.3 Emerging Server Hardware Technologies
   2.4 Installation of Linux/Unix OS

3. **Data Storing, fault-tolerance techniques and Storage Area Network (SAN)** [7 Hrs]
   3.1 File system Management
       3.1.1   Overview of File Systems
           3.1.1.1 FAT
           3.1.1.2 NTFS
           3.1.1.3 EXT3/4
           3.1.1.4 ZFS
       3.1.2   Making EXT3/FAT file system
       3.1.3   Making Swap Disk
       3.1.4   Mounting file system
   3.2 Managing different file system in network (NFS,CIFS/Samba)
       3.2.1   Overview of NFS
       3.2.2   Configuration of NFS in Unix
       3.2.3   Overview of CIFS/Samba
       3.2.4   Installation and Configuration of CIFS/Samba in Unix
   3.3 Disk Technologies

6.1 Overview of Network Monitoring and Management
6.2 Network monitoring architecture
6.3 Account Monitoring and control
6.4 Security control
6.5 User Environment configuration and protocol
6.6 Fault monitoring
6.7 Installation and Configuration of SNMP daemon in Unix System
6.8 Installation and configuration Open Source Network Monitoring Tools
(MRTG and Nagios or any other open source tools)

7. **System Startup, Automation and Scheduling jobs**   [3 Hrs]
7.1 Configuration of services in startup
7.2 Scheduling jobs with cron and at commands in Unix
7.3 Shell Scripting
    7.3.1   Overview of variables and environmental variables
    7.3.2   Basic structure
    7.3.3   Control statement
    7.3.4   Control statement and loops
    7.3.5   Functions
    7.3.6   Sample of Real work scripts

8. **Disaster Recovery**   [3 Hrs]
8.1 Disaster recovery Plan
8.2 Backup Plan
    8.2.1   Overview
    8.2.2   Consideration of backup media
    8.2.3   Types of backup (full, incremental, differential)
    8.2.4   Installation and Configuration of backup and recovery in Unix
8.3 Concepts of Disaster Recovery sites
8.4 Concepts of Disaster recovery with the help of Virtualization and Cloud
environment

9. **Virtualization and Cloud Infrastructure**   [4 Hrs]
9.1 Virtualization
    9.1.1   Overview
    9.1.2   Advantages
    9.1.3   Types of virtualization
    9.1.4   Managing Virtual Machine with KVM/Xen
9.2 Cloud Infrastructure
    9.2.1   Overview
    9.2.2   Types of Cloud
    9.2.3   Private Cloud vs Public Cloud
    9.2.4   Introduction of OpenStack
        9.2.4.1 Basic installation and configuration with packstack
        9.2.4.2 Configuration of Virtual machine with Web interface (Horizon)
    9.2.5   Overview of public cloud

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10. **Network Security** [5 Hrs]
    10.1   Attack Services and Mechanisms and counter measures
        10.1.1 SQL Injection
        10.1.2 Cross site scripting
        10.1.3 IP and ARP spoofing
        10.1.4 DOS and DDOS Attack
        10.1.5 Man in the Middle attack
        10.1.6 Hijacking
        10.1.7 Virus, Worms, Trojans
    10.2   Cryptography
        10.2.1 Conventional encryption and message confidential
        10.2.2 Public-key cryptography and message authentication
        10.2.3 Configuration of Private Key and public key cryptography in Unix
    10.3   Network security application
        10.3.1 Overview of Kerberos
        10.3.2 Pretty good privacy assignment
    10.4   IP Security
        10.4.1 Firewalls
            10.4.1.1   Overview
            10.4.1.2   Types of Firewalls
            10.4.1.3   basic configuration of firewall with iptables (in Linux)
        10.4.2 Virtual Private Network
            10.4.2.1   Overview
            10.4.2.2   Types of VPN

Note: Installation and Configuration part in each chapter are for the proof of concept only so question directly related to installation and configuration should not be asked in Examination.

Laboratory:
There shall be lab exercises covering all features of above chapters.

References:

1. Essential System Administration, 2nd Edition by By Æleen Frisch, Publisher: O'Reilly Media
2. Principles of Network and System Administration by Mark Burgess
3. Backup and Recovery, W. Curtis Preston, O'Reilly Media
4. Network Security with OpenSSL by JohnViega, Matt Messier and Pravir Chandra, O'Reilly Media
5. LDAP System Administration by Gerald Carter, O'Reilly Media
6. Unix and Linux System Adminisration handbook (4th Edition) by Evi Nemeth, Garth Snyder, Trent R. Hein.
7. Comptia Security+ Study Guide by Emmett Dulany, Sybex.

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Information Security (Elective)
BEG475IS

Year: IV

Semester: VII

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal		Final		Total
			Theory	Practical	Theory	Practical	
3	1	2	20	25	80	-	125

Course Objective:

The aim of this course is to provide attendees with a thorough understanding of the issues associated with the design, provision and management of security services for modern communication and information systems. Moreover this course aims to provide the concepts, properties, and functions of computer/information systems security and controls.

1. **Introduction** [2 Hrs]
   - 1.1. Meaning of Information Security, Attacks, Computer Crime
   - 1.2. Methods of Defense
   - 1.3. Encryption
   - 1.4. Recent cyber threats overview

2. **Cryptography** [10 Hrs]
   - 2.1. Crypto Basic, Classic Cryptography
   - 2.2. Symmetric Key Cryptography:Stream Ciphers, A5/1, RC4, Block Ciphers, Feistel Cipher, DES, Triple DES, AES
   - 2.3. Public Key Cryptography: Kanpsack, RSA, Defiie-Hellman, use of public key crypto- Signature and Non-repudiation, Confidentiality and Non-repudiation, Public Key Infrastructure
   - 2.4. Hash Function: The Birthday Problem, MD5, SHA-1, Tiger Hash, Use of Hash Function

3. **Viruses and Malicious Code** [3 Hrs]
   - 3.1. Program security
   - 3.2. Control Against Program Threats
   - 3.3. Malicious software (Viruses, trojans, rootkits, worms, botnets)

4. **Operating Systems Security** [8 Hrs]
   - 4.1. Access Contro
   - 4.2. File Protection
   - 4.3. User Authentication
   - 4.4. Security Policies
   - 4.5. Models of Security

5. **Database Security** [5 Hrs]
   - 5.1. Security requirements
   - 5.2. Reliability and Integrity
   - 5.3. Protecting sensitive data
   - 5.4. Multilevel security

6. **Security in Networks** [8 Hrs]
   - 6.1. Network security basics, TCP/IP Model and Port No., Protocol flaws
   - 6.2. Enterprise wide network Design and Vulnerabilities
   - 6.3. Reconnaissance of network, Packet sniffing, Session Hijacking, Web site and web server vulnerabilities

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6.4. Denial of Service, SSL and IPSec protocol, Firewall
6.5. Intrusion Detection System, and Honey pots, Email Security

7. **Administered Security**   [4 Hrs]
   7.1. Planning
   7.2. Risk Analysis
   7.3. Organizational Policies
   7.4. Physical Security

8. **Legal and Ethical Issues**   [5 Hrs]
   8.1. Protection of data and Information Laws
   8.2. Employees rights
   8.3. Software failure
   8.4. Computer Crime
   8.5. Privacy
   8.6. Ethics

Lab:

1. Block Cipher such as Feistel, DES or AES
2. Public Key Cryptography (RSA)
3. Conventional Cryptography
4. Authentication Methods such as password or Kerberos.
5. Software Flaw Frauding tools such as flaw finders, ITS, PScan, RATS
6. Analysis of Network port scanner tool such as NMAP
7. Analysis of Sniffer program such as Ethernet
8. Transport Security using firewall
9. Application level security such as email by using PHP
10. Implementation of IDS

References:

1. Mark Stamp, "Information security Principles and Practice" Wiley
2. Charles P. Pfleeger, "Security in Computing", Pearson Education
3. Michael E. Whitman and Herbert J. Mattord, Principles of Information Security, Thomson/Course Technology, ISBN 0-619-21625-5, Fourth Edition, 2012
4. Computer Security: Art and Science, Matt Bishop, Addison- Wesley

e-Governance (Elective)
BEG475EG

Year: IV

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

Course Objective: This course provides the implementation and management of e-Government from the technicalities of data flows and process mapping to the policies of e-government and also provides the case studies of different countries.

Course Contents:

1. **Introduction** [3 Hrs]
   1.1. e-Government and e-Governance.
   1.2. e-Government as information system.
   1.3. Benefits of e-Government.
   1.4. e-Government stages of development.
   1.5. Online service delivery and electronic service delivery.

2. **Public-Private Partnership for e-Government** [4 Hrs]
   2.1. PPP Forms
   2.2. Issues in PPP for e-Government
   2.3. Citizen-centric approach to e-Government.

3. **ICT Infrastructure for e-Government** [3 Hrs]
   1.1. Network infrastructure.
   1.2. Computing Infrastructure.
   1.3. Data centers
   1.4. e-Government architecture.
   1.5. Interoperability framework.

4. **e-Government Readiness** [4 Hrs]
   1.1. e-Readiness framework
   1.2. Steps to e-Government readiness.
   1.3. Issues in e-Government readiness.

5. **Security for e-Government** [5 Hrs]
   1.1. Challenges of e-government security.
   1.2. An approach to security for e-Government.
   1.3. Security management model.
   1.4. e-Government security architecture.
   1.5. Security standards.

6. **Managing e-Government** [8 Hrs]
   1.1. Approaches to management of e-Government systems.

1.2. e-Government strategy
1.3. Managing public data
1.4. Managing issues for e-Government
1.5. Emerging management issues for e-Government.

7. **Implementing e-Government** [8 Hrs]
1.1. e-Government system life cycle and project assessment
1.2. Analysis of current reality
1.3. Design of new e-Government system.
1.4. e-Government risk assessment and mitigation.
1.5. e-Government system construction.
1.6. Implementation and beyond
1.7. Developing e-Government hybrids.

8. **Case Studies and Applications of e-government system** [10 Hrs]
8.1 Nepal: Cyber Laws, ICT development project, Government Integrated Data Center (GIDC), e-Government master plan, Human resource management software.
8.2 India: Community information centers, e-Procurement in the government of Andhra Pradesh, e-Suvida.
8.3 Other Countries: E-Government development in South Korea, e-Government in China, e-Government in Brazil, Sri Lanka, Singapore, USA.

Reference Books:
1. Implementing & Managing e-Government, Richard Heeks
2. e-Governance: Concepts & Case Studies, C. S. R. Prabhu, Prentice Hall of India
3. e-Government, J. Satyanarayana, Prentice Hall of India

Question Pattern:
Group-A: Long Answer-Type Questions: (Attempt 2 out of 3)   [2×12=24]
Group-B: Short Answer-Type Questions: (Attempt 7 out of 8)   [7×8=56]

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Geographic Information System (Elective)
BEG475GI

Year IV

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
			Theory	Practical	Theory	Practical	
3	1	2	20	25	80	-	125

Course Objectives: To gain a basic practical understanding of GIS concepts, technical issues, and applications using Arc View GIS.

Course Details:

1. **Introduction and Overview of Geographic Information Systems**   [2 Hrs]
   1.1 Definition
   1.2 Importance
   1.3 Application and Components
   1.4 Spatial and non-spatial data
   1.5 Spatial data handling

2. **The Real World and Representation of GIS**   [3 Hrs]
   2.1 Maps
   2.2 Map design
   2.3 Map elements
   2.4 Geographic phenomena and types
   2.5 Geographic fields and objects
   2.6 Boundaries and surfaces

3. **Computer Representation of Geo-information**   [5 Hrs]
   3.1 Concept of data model
        3.1.1 Raster data model
        3.1.2 Vector data model
        3.1.3 TIN data model
   3.2 Data conversion from raster to vector format

4. **Data Processing System**   [2 Hrs]
   4.1 Hardware and software trends
   4.2 Digitizers, plotters and scanners
   4.3 GIS software

5. **Database Concepts**   [3 Hrs]
   5.1 Using a DBMS
   5.2 Database management alternatives

5.3 Using GIS and DBMS together

6. Data Sources, Data Input and Data Quality [7 Hrs]
    6.1 Major data sources
    6.2 Data input and methods
    6.3 GPS and its working
    6.4 Remote Sensing and its components
    6.5 Digitizing (Manual and Scanning)
    6.6 Data Quality and Components
    6.7 Errors in source data
    6.8 Digitizing errors and recovery

7. Spatial Referencing and Map Projection [7 Hrs]
    7.1 Introduction to spatial referencing
    7.2 Introduction and needs of map projection
    7.3 Types of map projection
    7.4 Aspects of map projection
    7.5 UTM

8. Spatial Data Analysis [5 Hrs]
    8.1 Re-classification
    8.2 Query analysis
    8.3 Overlay functions
    8.4 Vector overlay
    8.5 Raster overlay
    8.6 Neighborhood functions
    8.7 Network analysis

9. Data Visualization [2 Hrs]
    9.1 GIS and Maps
    9.2 Visualization process and strategies
    9.3 Cartographic tools

10. Spatial Data Infrastructure [6 Hrs]
    10.1 Introduction and components of SDI
    10.2 Metadata
    10.3 Clearing house

11. Overview of GIS Implementation [3 Hrs]
    11.1 Planning of a GIS project
    11.2 Barriers to implementation
    11.3 Successful key factors to implementation
    11.4 Future of GIS

Laboratories: There will be several lab exercises regarding to different concepts in GIS.

Reference Books:
1. *"Principles of Geographic Information System"*, ITC Education Textbook Series
2. Kang Tsung, *"An Introduction to Geographic Information Systems"*, Tata McGraw Hill

Java Programming (Elective)
BEG475JP

Year: IV

Semester: VII

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
			Theory	Practical	Theory	Practical	
3	1	2	20	25	80	-	125

1. Introduction to Java (12 Hours)

1.1 Overview of Object oriented Programming in Java
1.2 JVM, Java environment, Java tools
1.3 Features of Java
1.4 Control Statements
1.5 Looping
1.6 Array
1.7 String and StringBuffer
1.8 Vector
1.9 Class and Objects
1.10 Inheritance
1.11 Polymorphism
1.12 Working with Collections
1.13 Interface and Packages
1.14 Exception Handling(try,catch,throw,throws,User defined exception)
1.15 Multi threaded Programming(life cycle, thread creation, thread synchronization)

2. Applet Programming (2 hours)

2.1 Introduction to Applet
2.2 Standard Applet Methods
2.3 Putting an Applet on a Web Page
2.4 Passing parameter to Applets
2.5 Comparison between Applet and Application

3. GUI Programming (7 hours)

3.1 AWT Vs. Swing
3.2 Using Swing Components
3.3 Using Automic Components (JLabel, JButton etc)
3.4 Using JFrame, JPanal, JTree and JTable
3.5 Event handling(Mouse driven, Keyboard driven and other)

4. Java IO (5 hours)

4.1 Working with Input/output APIs
4.2 Working with scanner class
4.3 Working with Files
4.4 Working with Object Serialization

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5. JDBC (4 hours)

5.1 JDBC Basic
5.2 Different Types of Drivers
5.3 Setting up a database
5.4 Setting up a Connection
5.5 Retrieving Values from Result Sets
5.6 Deleting/Updating tables
5.7 Working with Statement and PreparedStatement

6. Socket Programming (6 hours)

6.1 Overview of Socket Programming
6.2 Introduction of APIs related to Socket Programming
6.3 Server Side Programming (TCP and UDP)
6.4 Client Side Programming (TCP and UDP)
6.5 A Sample Program

7. Distributed Application (5 hours)

7.1 Introduction to Distributed Objects
7.2 Overview of RMI
7.3 Rmi Architecture
7.4 Creating Distributed Application using RMI

8. Overview of Servlet and JSP (4 Hours)

8.1 Introduction to Servlet and JSP and its Architecture
8.2 Configuring Apache Tomcat to host Servlet/JSP files
8.3 Sample program of Servlet and JSP.

Laboratory:

There shall be lab exercises covering all features of above chapters.

Books Reference

1. Cay S. Horstman, "*Core Java Volume I & II*", PHI
2. Bruce Eckel, "*Thinking in Java*", PHI
3. Herbert Schildt, "Java: *The Complete Reference*", McGraw Hill
4. Java 2.0 by "Ivan Bayross"
5. Programming with java by: "E. BALAGURUSAMY" latest edition.

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Database Programming (Elective)
BEG475DB

Year IV

Semester II

Teaching Schedule Hours/Week			Examination Scheme				
Theory	Tutorial	Practical	Internal Assessment		Final		Total
			Theory	Practical	Theory	Practical	
3	1	2	20	25	80	-	125

1. Introduction
1.1 Overview of data, database, DBMS,RDBMS,ORDBMS   **(5hrs)**
1.2 Importance and needs of DBMS
1.3 Database administrator and other database users
1.4 Relationship among data(one to one, many to one, many to many)
1.5 Database Models (Hierarchical, Network, Relational)
1.6 Codd's Rule of relational database management System

2. SQL
2.1 Introduction to SQL
2.2 SQL Commands (DDL,DML,DCL,TCL)   **(10 hrs)**
2.3 Creating database and Users
2.4 Categories of SQL Statements
2.5 Oracle Data types
2.6 The CREATE, DROP, ALTER Statement
2.7 Integrity Constraints (Entity, Domain, Referential Constraints)
2.8 DML Statements (Select ,Insert, delete, Update)
2.9 Transaction Control Statements(Commit, Rollback, Save point)
2.10 Data Control Statements(Grant, Revoke)
2.11 Comparison Operators, IN and NOT IN Operators, BETWEEN Operator
2.12 The LIKE Operator, Logical Operators, IS NULL and IS NOT NULL,
2.13 set operators, Union, Union all, Intersect, Minus, GROUP BY Clause,
2.14 HAVING Clause, The DISTINCT Keyword, Miscellaneous Functions,
2.15 Mathematical Functions, String Functions, Date Functions, Conversion Functions

3. Joining Tables
3.1 Joins, Cartesian Product ,Inner Joins, Equi-Join, Outer Joins, Right Outer Join,   **(4 hrs)**
Left Outer Join, Full Outer Join

4. Locks and Partition of Tables
4.1 Introduction   **(4 Hrs)**
4.2 Row level and table level lock
4.3 Table partitions
4.3 Maintaining Partitions

5. **Database Objects**
   5.1 Synonyms
   5.2 Views
   5.3 Index
   5.4 Sequences
   5.5 Abstract data type
   5.6 Nested tables

6. **PL/SQL**
   6.1 SQL vs. PL/SQL, A Few Simple Examples
   6.2 Saving Procedures
   6.3 Simple Exception Handling
   6.4 Advantages of PL/SQL
   6.5 Standard Data Types
   6.6 Initialization
   6.7 Variable Names
   6.8 Specialized Data Types - %TYPE, %ROWTYPE
   6.9 Decision Making Statements
   6.10 Simple Loops, Loops – for, while, Cursors, Cursor Manipulation, Using the
        Cursor, For Loops Cursors, Cursor Attributes, Cursor Parameters

7. **Functions ,Procedures and Triggers**
   7.1 Creating a Procedure, Example Procedure, Using Parameters
   7.2 Functions
   7.3 Procedures and Exceptions
   7.4 Triggers, Simple Example of Triggers

8. **Oracle Forms and Reports**
   8.1 Introduction to Forms and Reports
   8.2 Building applications using Forms
   8.3 Various types of reports
   8.4 Designing reports
   8.5 Building Menu

Laboratory:
There shall be lab exercises covering all features of above chapters.

References:
1. Commercial Application Development using Oracle developer 2000
   Ivan Bayros.

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