Annexure C

Parvatibai Chowgule College of Arts and Science (Autonomous)

Accredited by NAAC with Grade 'A+'
Best Affiliated College-Goa University Silver Jubilee Year Award

DEPARTMENT OF COMPUTER SCIENCE

SYLLABUS FOR PROGRAMME IN M.Sc [Information Technology]

(Implemented from the Academic Year 2023-2024 onwards) COURSE STRUCTURE

Semester I (20 credits)

Course Code	Course Type	Course Title	Credits	Contact hours/week	
				L	P
PGMP-IT-DSC-401	DSC	Advanced Data Structures and Algorithms	4	4	0
PGMP-IT-DSC-402	DSC	Operating Systems and Networks	4	4	0
PGMP-IT-DSC-403	DSC	Machine Learning	4	4	0
PGMP-IT-DSC-404	DSC	Advanced Data Structures and Algorithms Lab	2	0	4
PGMP-IT-DSC-405	DSC	Operating Systems and Networks Lab	2	0	4
	Total Credits for Discipline Specific Core (DSC) subjects		**16**		
	DSE	Discipline Specific Elective I	4	4	0
	Total Minimum Credits for Discipline Specific Elective (DSE) subjects		**4**		
	List of Discipline Specific Elective I:				
PGMP-IT-DSE-401	Cloud Computing		4	4	0
PGMP-IT-DSE-402	Software Quality Assurance and Testing		4	4	0
PGMP-IT-DSE-403	Computer Graphics		4	4	0

PGMP-IT-DSE-404	Compiler Design	4	4	0

Semester II (20 credits)

Course Code	**Course Type**	**Course Title**	**Credits**	**Contact hours/week**	
				L	**P**
PGMP-IT-DSC-406	DSC	Design and Analysis of Algorithms	4	4	0
PGMP-IT-DSC-407	DSC	Advanced Database Management Systems	4	4	0
PGMP-IT-DSC-408	DSC	Software Architecture, Design Patterns andFrameworks	2	2	0
PGMP-IT-DSC-409	DSC	Design and Analysis of Algorithms Lab	2	0	4
PGMP-IT-DSC-410	DSC	Advanced Database Management System Lab	2	0	4
PGMP-IT-DSC-411	DSC	Software Architecture, Design Patterns and Frameworks Lab	2	0	4
	Total Credits for Discipline Specific Core (DSC) subjects		**16**		
	DSE	Discipline Specific Elective II	4	2	4
	Total Credits for Discipline Specific Elective (DSE) subjects		**4**		
	List of Discipline Specific Elective II: (2 Theory + 2 Practical)				
PGMP-IT-DSE-405	Web Development Frameworks		4 (2T+2P)	2	4
PGMP-IT-DSE-406	Mobile Application Development		4 (2T+2P)	2	4
PGMP-IT-DSE-407	Agile Methodology and DevOps		4 (2T+2P)	2	4
PGMP-IT-DSE-408	Cryptography and Network Security		4 (2T+2P)	2	4

Semester III (24 credits)

Course Code	**Course Type**	**Course Title**	**Credits**	**Contact hours/week**	
				L	**P**
	DSE	Discipline Specific Elective III	4	4	0
	DSE	Discipline Specific Elective IV	4	4	0

	Total Minimum Credits for Discipline Specific Elective (DSE) subjects		**8**		
	DSRE	Research Specific Elective-I	6 (4T+2P)	4	4
	DSRE	Research Specific Elective-II	6 (4T+2P)	4	4
	Total Minimum Credits for Discipline Specific Research (DSRE) Elective subjects		**12**		
	GE	Generic Elective I	4	4	0
	Total Minimum Credits for Generic Elective (GE) subjects		**4**		
	List of Discipline Specific Electives III & IV:				
			Credits	**L**	**P**
PGMP-IT-DSE-501	Data Mining		4	4	0
PGMP-IT-DSE-502	Information Retrieval		4	4	0
PGMP-IT-DSE-503	Information Security		4	4	0
PGMP-IT-DSE-504	Parallel and Distributed Computing		4	4	0
PGMP-IT-DSE-505	Soft Computing		4	4	0
PGMP-IT-DSE-506	Digital Image Processing		4	4	0
	List of Discipline Specific Research Electives I & II				
PGMP-IT-DSRE-501	Research Methodology		6 (4T+2P)	4	4
PGMP-IT-DSRE-502	Data Analytics		6 (4T+2P)	4	4
PGMP-IT-DSRE-503	Modeling and Simulation		6 (4T+2P)	4	4
PGMP-IT-DSRE-504	Blockchain Technologies		6 (4T+2P)	4	4
PGMP-IT-DSRE-505	Natural Language Processing		6 (4T+2P)	4	4
PGMP-IT-DSRE-506	Neural Networks and Deep Learning		6 (4T+2P)	4	4
PGMP-IT-DSRE-507	Educational Technology		6 (4T+2P)	4	4
	List of Generic Electives for Students of other PG Programmes				
PGMP-IT-GE-501	Programming using Python		4	4	0
PGMP-IT-GE-502	Introduction to Web Designing		4	4	0
PGMP-IT-GE-502	Content Management System		4	4	0

Semester IV(16Credits)

Course Code	**Course**	**Course Title**	**Credits**	**Contact**

	Type			**hours/week**	
				L	**P**
PGMP-IT-DSI-501	Internship	Industrial Internship	16	0	0
PGMP-IT-DSR-501	Dissertation	Research Project in Academic or Research Institutes	16	0	0

SYLLABUS

DISCIPLINE SPECIFIC CORE (DSC) COURSES

Course Title: Advanced Data Structures and Algorithms
Course Code: PGMP-IT-DSC-401
Credits: 4
Marks: 100
Duration: 60 Hrs

Course Prerequisites:
Familiarity with basic data structures like Stacks, Queues, Linked Lists and Binary Trees.

Course Objectives:
The objective of the course is to understand the real-life applications of data structures and be familiar with writing recursive and iterative methods using data structures.

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Design an algorithm for the use case.
CLO2: Choose efficient data structures and apply them to solve problems.
CLO3: Design and analyze the time and space efficiency of the data structure.
CLO4: Formulate new solutions for programing problems or improve existing code using learned algorithms and data structures,

Syllabus:

Unit I:
[15 Hrs]
Overview of Linear Data Structures
ADT, Sparse matrices, Linked Lists: Doubly linked list, Circular linked list, Doubly Circular linked lists, Operations on Linked Lists. Stack and Queues: Need and justification of the study, Multiple stacks and queues, Dequeues, Circular Queues, Priority Queues, Implementation of recursion using stack, Application of stacks, queues and linked lists.

Unit II: **[15 Hrs]**
Non Linear Data Structures
Trees: Definitions, terminologies and properties, Binary tree representation and traversals , Skewed Trees, Binary Search Trees: AVL Trees, Red Black Tree, suffix

trees, Segment Tree, Splay trees ,M-way Search Trees, B-trees, B+-trees.
Graphs: Definitions, terminologies and properties, Graph representations: Graph Traversals , Maximum Flow, Eulerian Graphs , Hamiltonian Graphs. Heap Structures.

Unit III:
[15 Hrs]
Complexity of Sorting and Searching Algorithms
Mathematical Background, Big-O notation and computational Analysis of functions, Running Time computation, Radix Sort, Heap Sort, Quick Sort, Merge Sort ,Insertion Sort, Shell Sort, Counting Sort, Interpolation search, Symbol Tables.

Unit IV:
[15 Hrs]
File Organization and Processing
Dynamic memory management. Sequential files, Hashing techniques: Approaches to collision problem, Indexed sequential files: organization, Creation, Update and Maintenance, Multi-key files,Inverted file, Multi-list file, Tries: Standard Tries, Compressed Tries, Suffix Tries, Huffman Algorithm.

REFERENCES:

Mandatory:
1. R. Venkatesan , S. Lovelyn Rose (2019) "Data structures" (2nd Ed) Wiley.
2. Prof Peter Brass (2014) "AdvancedData Structures ",(1st Ed), Cambridge University Press.

Supplementary:
1. Alfred V. Aho, John E Hoproft, Jeffrey D. Ullman, "Data structures and algorithms",(2nd Ed)
Pearson Education India Delhi,
2. Jean-Paul Tremblay, Paul Sorenson (2017), An Introduction to Data Structures with
Application, (2 nd Ed), McGraw Hill Education.

Web References:
1: http://www.cs.cmu.edu/~ab/15-121N11/
2: https://www.cse.iitb.ac.in/~ranade/cs213/
3: http://cse.iitrpr.ac.in/ckn/courses/f2015/csl201/w4.pdf
4: https://www.cpp.edu/~ftang/courses/CS241/notes/b-tree.html
5: https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

Course Title:Operating Systems and Networks
Course Code: PGMP-IT-DSC-402
Credits:4
Marks: 100
Duration: 60 Hrs

Course Pre-Requisites:

● Basics of Operating Systems and Networks

Course Objectives:
● To understand Real time operating systems
● To gain understanding in specific areas of networking such as the design and maintenance of individual networks.

Course Learning Outcomes:

At the end of the course students will be able to:

CLO1: Understand file systemstructure, processes, threads and memory management.
CLO2: Analyse various resource management and fault tolerance techniques for real time systems.
CLO3: Discuss the fundamentals of IP addressing.
CLO4: Apply subnet masking concepts to allocate space for host in subnet.

Syllabus:

Unit I:
[20 Hrs]

Introduction to Processes, Process states, Process Control Block, Process Scheduling Queues, Short-term, Long-term and Medium-term schedulers, Context Switch

Introduction to threads, Benefits of multithreaded programming, User and Kernel threads, Multithreading models

Basic concepts of CPU Scheduling, Scheduling criteria, Scheduling Algorithms

Cooperating processes and Race Conditions, The critical-section problem, Peterson's solution, mutex locks, Synchronization Hardware, Semaphores and their Implementation, Classic problems of synchronization.

System Model, Deadlock characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock

Unit II
[20 Hrs]

Memory Management background**,** Swapping , Contiguous Memory Allocation, Paging, Segmentation

Introduction to Virtual-Memory, Demand Paging, Process creation, Page replacement, Allocation of frames, Thrashing

File Concept, Access Methods, Directory Structure, File-system mounting, File sharing, Protection.

Basic model of real time systems, Characteristics, Applications of real time systems, Real time task scheduling, handling resource sharing, Micro kernel design, Processes and Threads, Memory Management, File system. Failure Recovery and Fault Tolerance, Approaches of fault tolerance

Unit III:
[10 Hrs]

Introduction to TCP/IP, Benefits of using TCP/IP,IP addressing, IP Network and Host addressing, Classfull and classless IP addresses, IPV6, Subnet mask, Subnetting and supernetting

Switch fundamentals (Bridges vs. Switches) – Spanning Tree Protocol, Rapid Spanning Tree protocol.

Unit IV
[10Hrs]

VLAN- concepts, broadcast domains with VLANs and routers, preventing broadcast storms. VLAN Trunking Protocol, VTP modes of operation, Routing between VLANs, Inter-VLAN routing issues.

Static V/s Dynamic routes, Adding and deleting static routes, Routing protocol, RIP, OSPF, IGP, Secure IP routing.

References:

Mandatory:

1. Silberschatz ,Galvin and Gagne , Operating systems Principles – 8th edition Wiley Asia Student Edition.
2. Singhal, M. &Shivaratri, N.G (2000), *Advanced concepts in operating systems.* Delhi, India: McGraw-Hill.

2. Beasley, J S. &Nilkaew, P. (2015), *A practical guide to advanced networking*, Chennai, India: Pearson.

Supplementary:

1. Stallings, W.(2009), *Wireless communications and networks*, (2nd Ed), New Delhi, India: Prentice Hall of India.
2. Deitel H.M., "An Introduction to Operating Systems", Addison Wesley Publishers Company,
Second Edition, 1990.
3. Milenkovic M., "Operating Systems : Concepts and Design", McGraw Hill International Edition Computer Science series ; Second Edition, 2001.
4. Tanenbaum A. S., Modern Operating Systems", Prentice Hall of India Pvt. Ltd.,Third Edition, 2015.

Web Resources:

1. https://swayam.gov.in/nd1_noc20_cs16/preview
2. https://swayam.gov.in/nd1_noc20_cs23/preview
3. http://study-ccna.com/

Course Title: Machine Learning
Course Code: PGMP-IT-DSC-403
Credits: 4
Marks: 100
Duration: 60 Hrs

Course Pre-Requisites:
- Familiarity with Probability & Statistics.

Course Objectives:
- Provide a broad introduction to artificial intelligence and machine learning techniques.

Course LearningOutcomes:
At the end of the course students will be able to:

CLO1: Design and Implement Machine Learning solutions to real-world problems.
CLO2: Evaluate and interpret the result of Machine Learning Algorithms.
CLO3: Recognize various ways of selecting suitable model parameters for different machine learning techniques.
CLO4: Perform experiments in Machine Learning using real-world data.

Syllabus:

Unit I Introduction
[15 Hrs]

What is Artificial Intelligence, Machine Learning & Deep Learning, Problems spaces & search, Heuristic search techniques, Knowledge Representation Issues, Predicate Logic, Representing knowledge using Rules.

Unit II Supervised Learning
[15Hrs]
Supervised learning setup, LMS, Logistic regression, Decision Trees, Version space, Artificial Neural Networks, Perceptron, Back propagation neural network, Exponential family, Generative learning algorithms, Gaussian discriminant analysis. Naive Bayes, Support vector machines, Model selection and feature selection, Ensemble methods: Bagging, boosting, Evaluating and debugging learning algorithms.

Unit III Unsupervised Learning
[15 Hrs]
Clustering. K-means, Hierarchical clustering, EM. Mixture of Gaussians, Factor analysis, Anomaly detection, PCA (Principal components analysis), ICA

(Independent components analysis), Self-organizing map(SOM).

Unit IV Reinforcement Learning
[15 Hrs]

Introduction, Upper Confidence Bound Bandit Algorithm, Probably Approximately Correct Bandit Algorithm, Median Elimination, Policy Gradient, Full RL and MDPs. Bellman equations, Value iteration and policy iteration, Dynamic Programming and Temporal Difference Methods

References:

Mandatory:

1. Alpaydin E (2015), *Introduction to Machine Learning* (3rd Ed), New Delhi, India: PHI Learning Pvt. Ltd.

Supplementary:

1. Mitchell T (2017), *Machine Learning* (1st Ed), New Delhi, India: McGraw HillEducation.
2. Duda R, Hart P & Stork D (2012), *Pattern Classification* (2nd Ed), New Delhi, India:Wiley
3. Rich E, Knight K & Nair S (2017), *Artificial Intelligence* (3rd Ed), New Delhi, India: McGraw-HillEducation.
4. R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press.

Web References:

1. https://nptel.ac.in/courses/106106139/
2. https://nptel.ac.in/courses/106/106/106106202/
3. https://nptel.ac.in/courses/106/106/106106198/
4. https://nptel.ac.in/courses/106106143/
5.https://www.coursera.org/learn/machine-learning

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Course Title: AdvancedData Structures and Algorithms Lab
Course Code: PGMP-IT-DSC-404
Credits: 2
Marks: 50
Duration: 60 Hrs

Course Prerequisites:
Theoretical Knowledge of Data Structures

Course Objective:
● Introduce students to a number of highly efficient algorithms and data structures for
fundamental computational problems across a variety of areas.
● Analyze a problem and determine the appropriate data structure for the problem.
● Analyze the asymptotic performance of algorithms .

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Select algorithm design approaches in a problem specific manner.
CLO2: Become proficient in applying knowledge from the theory of Data Structures to various
application areas.
CLO3: Design Algorithms to solve the problems.
CLO4: Discuss different Data Structures to represent real world problems.

List of suggested assignments:
1. Implementation of Linear Data Structure such as Stack, Queue, Linked List etc**.**
[6 Hrs]
2. Implementation of Binary Tree and its Traversals.
[6 Hrs]
3. Implementation of AVL Tree.
[6 Hrs]
4. Implementation of Red Black tree.
[6 Hrs]
5. Implementation of Heap Structure
[6 Hrs]
6. Implementation of Graph Traversal Techniques (BFS and DFS).
[6 Hrs]
7. Implementation of Sorting Techniques (Quick Sort and Merge Sort)
[6 Hrs]
8. Implementation of Hashing: linear probing, quadratic hashing and Double hashing. **[8 Hrs]**
9. Implementation of Simple Trie.

[6 Hrs]

10. Implementation of Huffman Algorithm.

[4 Hrs]

***Mini Project on Application of Data Structures**

Course Title: Operating Systems and Networks Lab
Course Code: PGMP-IT-DSC-405
Credits: 2
Marks: 50
Duration: 60 Hrs.

Course Pre-Requisites:
- Theoretical Knowledge of operating systems and networks.

Course Objectives:
- To provide practical base in operating system and networks.

Course LearningOutcomes:
At the end of the course students will be able to:

CLO1: Manage processes, memory and file system using system calls.
CLO2: Illustrate socket communication involving sender process and receiver process using TCP and UDP.
CLO3: Analyse network traffic by using network analyser tool.
CLO4: Design and demonstrate VLANs by using simulation tool.

Syllabus:

1. Linux File System, File & Directory Management.
   [12 Hrs]
2. Filters
   [**6 Hrs]**
3. Process Management
   [4Hrs]
4. Shell Scripting
   [6 Hrs]
5. TCP client and server application
   [4Hrs]
6. UDP client and server application
   [4Hrs]
7. Using nmap for port scanning and vulnerability detection.
   [4Hrs]
8. Configuration of a Firewall.
   [4Hrs]
9. Using ethereal or tcp dump to analyse network traffic.
   [4Hrs]
10. Creating subnets and supernets using simulation tools.
   [4Hrs]
11. Configuring static and dynamic route using routing tools.

[4Hrs]

12. Configuring VLANs.
[4Hrs]

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Course Title: Design and Analysis of Algorithms
Course Code: PGMP-IT-DSC-406
Credits: 4
Marks: 100
Duration: 60 Hrs

Course Pre-Requisites: Understanding of basic Data Structures, Recursion, Matrix operations, Proof byInduction

Course Objectives:
- Understand the basic concepts related tothe design and analysis of algorithms
- Understand classical algorithms and their complexity
- Apply the algorithms to real-world problems

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Analyze the running time of various algorithms.
CLO2: Apply the algorithms and techniques to solve various problems.
CLO3: Analyze the complexities of various problems in different domains.
CLO4: Design their own algorithmic strategies to solve problems and analyze their correctness.

Syllabus:

Unit I: Foundations for Design and Analysis of Algorithms
[20 Hrs]

Introduction: The Role of Algorithm in computing, Framework for design and analysis of algorithms,Growth of functions: asymptotic notation; Recurrences: substitution method, recursion-tree method,master method; Probabilistic analysis and randomized algorithms, indicator random variables.

Dynamic programming: Rod-cutting problem.Assembly line scheduling, matrix-chain multiplication, elements of DP, longestcommon subsequence, Optimal BST.

Unit II: Advanced Design and Analysis Techniques
[15 Hrs]

Greedy algorithms: Elements of greedy strategy, Huffman codes, Optimal storage on tapes,Minimumcost spanning tree- Kruskal and Prim's algorithms, performance analysis.

Backtracking: The general method,8 Queens problem , sum of subsets,Graph coloring.

Branch-and-Bound: The method, 0/1 Knapsack problem
Amortized analysis: Aggregate analysis, accounting method, potential method, dynamic tables.

Unit III: Graph and Text Processing Algorithms
[15 Hrs]

Graph Algorithms: Elementary graph algorithms- Minimum spanning tree: growing a spanning tree,
Single-source shortest paths: Bellman-ford algorithm, Djikstra's algorithm. All pairs shortest paths:shortest paths and matrix multiplication, Floyd-Warshall algorithm.

Text Processing Algorithms: Strings and patterns matching algorithms, Naive Brute Force, Rabin-Karp,KMP Algorithms,Tries, Text compression. Textsimilarity testing.

Unit IV: NP Completeness and Approximation Algorithms
[10 Hrs]

NP-Completeness: Polynomial time, polynomial time verification, NP-completeness and reducibility.

Approximation algorithms: The vertex cover problem, Traveling salesman problem, the set coveringproblem.

References

Mandatory:
1. Cormen, T. H., Leisorson, C. E., Rivest, R. L.& Stein, C., (2010), Introduction toalgorithms, (3rd ed), New Delhi, India: PHI, Eastern Economy Edition

Supplementary:
1. Knuth, D. E. (2011), The art of computer programming Vol I, II, III, Boston, United States: AddisonWesley
2. Horowitz, E., Sahni, S., Rajasekaran, S. (2008), Fundamentals of computer algorithm (2nd ed), NewDelhi, India: Galgotia Publications
3. Aho, A., Hopcroft, J., Ullman, J. (2004),The design and analysis of computer algorithms, New Delhi,India: Pearson Education, LPE
4. Gilberg, R., Forouzan, B. (2004).Data Structure: a pseudo code approach with C, USA: ThomasLearning Inc.

Web Resources:
1. https://nptel.ac.in/courses/106106131/
2. https://www.geeksforgeeks.org/fundamentals-of-algorithms/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/

4. https://www.udemy.com/course/introduction-to-algorithms-and-data-structures-in-c

Course Title: Advanced Database Management Systems
Course Code: PGMP-IT-DSC-407
Credits: 4
Marks: 100
Duration: 60 Hrs

Course Prerequisites:
Fundamental knowledge of Database Management Systems

Course Objectives:
● Understand the concept of a database transaction and related database facilities.
● Introduce research development ability in databases through technical survey and Presentation.

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Understand methods of storing, managing and interrogating complex data with cost estimation on execution of query based on DB statistics.
CLO2: Analyze the background processes involved in optimizing queries and transactions.
CLO3: Develop a high-level understanding of major Distributed DBMS components and their function.
CLO4: Define, compare and use the two types of NoSQL Databases (Document-oriented, Graph).

Syllabus:

Unit I:
[15 Hrs]
Database Design and Query Processing
Database Schemas, SQL Commands, Constraints, Keys in ADBMS, SQL Queries: Simple, Complex, Nested queries and its functions. Advanced SQL Queries: Overview of Assertions, Triggers, Comparisons, Views as Virtual Tables, Roles and Privileges, Stored Procedures.

Database Design Theory, Functional Dependencies, Normalisation Design, Decomposition of relational schemes, Normal forms for Relations, schemas, Multivalued and other forms of Dependencies. Basic algorithms for executing query operations, Query Processing and Optimisation, Basic optimization strategies, Algebraic manipulations, External Sorting, optimization of selections in system.

Unit II:
[15 Hrs]
Database Concurrency and Recovery Techniques

Simple transaction model, serializability, lock based protocols, Timestamp based protocol, Concurrency Control, Deadlock handling (Wait-die, wound-wait, no waiting, cautious waiting), optimistic concurrency control. Recovery Concepts, NO-UNDO/REDO Recovery Based on deferred update, Recovery technique based on immediate update, Comparisons, shadow paging, ARIES Recovery Algorithm.

Unit III:
[15 Hrs]

Distributed Database and Security

Principles of Distributed Databases, Fragmentation: Correctness rule of Fragmentation, Horizontal Fragmentation, Vertical Fragmentation, Hybrid Fragmentation, Framework for distribution, translation of global queries into fragment queries, query optimization and management of distributed transaction, concurrency control and reliability in distributed databases.
Database Security: Types of Security, Threats, Control Measures, SQL Injection, its risks and Protection techniques

Unit IV: Emerging Technologies
[15 Hrs]

Emerging Technologies
XML Databases: XML-Related Technologies-XML Schema- XML Query Languages, Geographic Information Systems, Cloud Based Databases: Data Storage Systems on the Cloud , Introduction to Big Data-Storage-Analysis. Introduction of NoSQL databases: Document Database (MongoDb), GraphStores: Neo4j

References:

Mandatory:

1. Elmasri & Navathe(2016), Fundamentals of Database Systems,(7th Ed),Pearson Arlington.
2. Abraham Silberschatz, Henry F. Korth(2016), Database System Concepts,(6th Ed), McGraw Hill Pennsylvania.

Supplementary:

1. Rini Chakrabarti ,Shilbhadra Dasgupta(2011), Advanced Database Management System,
2 nd Ed) DreamtechPress,Kolkota India
2. S.Ceri and G.Relagatti(2017), Distributed Databases,(1st Ed),McGraw Hill Education India Private Limited New Delhi,

Web References:

1: https://link.springer.com/10.1007%2F978-0-387-39940-9_712
2:
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.71.1311&rep=rep1&type=pdf
3: https://rubygarage.org/blog/neo4j-database-guide-with-use-cases

4: http://datasys.cs.iit.edu/events/ScienceCloud2013/p02.pdf

Course Title: Software Architecture, Design Patterns and Frameworks
Course Code: PGMP-IT-DSC-408
Credits: 2
Marks: 50
Duration: 30 Hrs.

Course Pre-Requisites:

- Familiarity with requirement elicitation techniques and knowledge of basics of software design, programming and testing

Course Objectives:

- Learning Software Development using good OO Design and Architecture
- Understanding of Design and Architectural patterns and Frameworks.

Course Learning Outcomes:

At the end of the course students will be able to:

CLO1: Apply various concepts of Object-Oriented Analysis and Design while solving problems.
CLO2: Analyze a problem scenario and prepare various models of the solution.
CLO3: Analyze a given problem and study the applicability of Design Patterns to the problem.
CLO4: Generate code skeletons in an OO programming language from UML class diagrams.

Syllabus:

Unit I
[15 Hrs]

Encapsulation, Abstraction, Implementation Hiding, Inheritance, Dynamic binding, Polymorphism, Overriding and Overloading, SOLID Principles of Object-Oriented Design. Scenarios, Actors & Use Cases, The include and extend relationships, Use Case Generalization, Writing Use Cases formally, Choosing System Boundary, Finding Actors and Use cases, Using use cases for Verification and Validation, Use-Case Realization Classes, Objects, Attributes and Operations, Visibility of attributes and operations, Class-Scope Attributes, Attributes with default values, Association, Multiplicity, Role-Name, Qualified Association, Association Class**,** Ternary Association, Recursive Association, Multiple Association between two classes, Composite and Shared Aggregation, Generalization and sub-class partitioning, Generalization Set, Interfaces and their realization, Packages and Grouping of classes into Packages , Parameterized Classes. Modelling object interaction using Interaction Diagrams.

Unit II
[15 Hrs]

Modelling the behaviour of reactive objects using State chart diagrams; Modelling systems workflows or operations using Activity diagram. “GoF” patterns & AntiPatterns, Software Architecture & its importance, System Quality attributes discernible at runtime, Business Qualities, Architecture Qualities, Data Flow Architecture, Virtual machine Architecture, Call & Return Architecture, Independent Component Architecture. MVC & Broker, Component and Deployment Diagrams.

References:

Mandatory:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software, Pearson Education, First Edition.

Supplementary:

1. Bass L, Clements P & Kazman R (2019), *Software Architecture in Practice* (3rd Ed),Westford, USA: PearsonEducation.
2. Buchmann F, Munier R,RohnertH, Sommerland P & Stahl M (2008), *Pattern Oriented Software Architecture-I* (First Ed),Wiley.

Web References:

1. https://www.coursera.org/learn/object-oriented-design
2. https://cosmolearning.org/courses/software-architecture-design/video-lectures/
3. https://swayam.gov.in/nd1_noc19_cs69/

Course Title: Design and Analysis of Algorithms Lab
Course Code: PGMP-IT-DSC-409
Credit : 2
Marks: 50
Duration: 60 Hours

Course Pre-Requisites: Theoretical knowledge of Design and Analysis of Algorithms

Course Objectives: Understand the various algorithm design approach

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Implement various algorithms using dynamic programming approach.
CLO2: Implement various Internet algorithms.
CLO3: Implement various graph Algorithms.
CLO4: Implement algorithms for real life problems

List of suggested assignments:

1. **Implementation of Elementary Data Structures**
   [10 Hrs]
   a. Stacks, Queues Linked List applications
   b. Hashing
   c. AVL Trees
   d. Red Black Trees

2. **Implementation of various Graph algorithms.**
   [08 Hrs]

a. Djikstra's Algorithm
b. Bellman Ford Algorithm
c. Floyd Warshall Algorithm

3. Implementation of various Text Processing Algorithms
[10 Hrs]
a. Tries
b. Text Compression
c. Pattern Matcher

4. Implementation of algorithms using Dynamic Approach
[08 Hrs]
a. Matrix Chain Multiplication
b. Longest Common Subsequence

5. Implementation of algorithms using Greedy Approach
[08 Hrs]
a. Optimal Storage on Tapes

b. Minimum Cost Spanning Tree

6. Implementation of Backtracking approach for various problems. [08 Hrs]

a. 8-Queen's Problem

b. Graph Coloring

7. Implementation of Text Processing Algorithms [08 Hrs]

a. Rabin-Karp Algorithm

b. KMP Algorithm

Course Title: Advanced Database Management Systems Lab
Course Code: PGMP-IT-DSC-410
Credits:2
Marks: 50
Duration: 60 Hrs

Course Prerequisites:
Theoretical knowledge of Advanced Database Management Systems

Course Objectives:
● Understand the concept of a database transaction
● To understand Schema representation methods in Relational and NO SQL Databases

Course Outcomes:
At the end of the course students will be able to:

CLO1: Populate and query a database using SQL,DML/DDL commands.
CLO2: Execute various advance SQL queries related to Transaction Processing & Locking using concept of Concurrency control, assertions, triggers and stored procedures.
CLO3: Execute CRUD and various other queries operations using NOSQL database: MongoDB
CLO4: Represent the database GraphStore database.

List of suggested Assignments:
1: SQL Queries : Simple, Complex and Nested Queries
[09 Hrs]
2: Views, Roles and Grants
[09 Hrs]
3: Advanced SQL- Joins and Triggers
[06 Hrs]
4: Advanced SQL- Stored Procedures
[06 Hrs]
5: Introduction to NO SQL database and Installation: MongoDB
[03 Hrs]
6: Creating Documents, Collection, inserting records, embedding documents
[06 Hrs]
7: Querying the documents and Linking
[09 Hrs]
8: Aggregation Framework and Map Reduce
[09 Hrs]
9: Installation and Introduction to GraphStore : Neo4j
[03 Hrs]

Course Title: Software Architecture, Design Patterns and Frameworks Lab
Course Code: PGMP-IT-DSC-411
Credits: 2
Marks: 50
Duration: 60 Hrs.

Course Pre-Requisites: Theoretical knowledge of Object-oriented concepts, design patterns and frameworks

Course Objectives:

- Implement the various concepts of Object Orientation.
- Implement the various Design Patterns.
- Usage of a framework.

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Implement the various concepts of Object-Oriented Programming.
CLO2: Illustrate Creational, Structural and Behavioural Design Patterns.
CLO3: Analyze a given problem and apply Design Patterns to it solve problems by using a framework.
CLO4: Work with a framework.

1. Implementation of different concepts of Object Orientation i.e. Encapsulation, Abstraction, Implementation Hiding, Inheritance, Dynamic binding, Method Overriding and Method Overloading, Polymorphism
   [6 Hrs]
2. Implementation of S.O.L.I.D principles of Object-Orientation
   [6 Hrs]
3. Implementation of the Singleton and Factory patterns
   [4 Hrs]
4. Implementation of Abstract Factory, Builder and Prototype patterns
   [6 Hrs]
5. Implementation of Adapter, Bridge and Composite patterns
   [6 Hrs]
6. Implementation of Decorator and Proxy patterns
   [4 Hrs]
7. Implementation of Strategy, State and Observer patterns
   [5 Hrs]
8. Demonstration of Visitor, Chain of Responsibility and Memento Patterns
   [5 Hrs]
9. Experiments on Object-Relational Mapping framework to generate tables from classes, save objects and retrieve persisted objects
   [6 Hrs]

10. Experiments on Object-Relational Mapping framework to demonstrate saving of embedded objects, configuring columns of embedded objects, saving multiple embedded objects, saving collection of objects

[6 Hrs]

11. Experiments on Object-Relational Mapping framework to demonstrate mappings, single table inheritance, table per class inheritance, table per subclass inheritance and CRUD operations.

[6 Hrs]

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DISCIPLINE SPECIFIC ELECTIVES (DSE) - I

Course Title: Cloud Computing
Course Code: PGMP-IT-DSE-401
Credits: 4
Marks: 100
Duration: 60 Hrs

Course Prerequisite:
Computer Networks

Course Objectives:

- To understand the concepts of Cloud Computing.
- To learn Taxonomy of Virtualization Techniques.
- To learn Cloud Computing Architecture.
- To acquire knowledge on Aneka Cloud Application Platform.
- To learn Industry Cloud Platforms.

Course Learning Outcomes:
At the end of the course, student will be able to :

CLO1: Know the fundamentals of cloud, cloud Architectures and types of services in cloud.
CLO2: Understand the concept of virtualization and various technological drivers and how this has enabled the development of Cloud Computing
CLO3: Understand scaling in software and network development, cloud security and disaster management
CLO4: Design different Applications in cloud and explore some important cloud computing driven commercial systems

Syllabus

Unit 1
[15 hours]

Introduction to Cloud: Cloud Computing at a Glance, the Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model. Characteristics and Benefits, Challenges Ahead, Historical Developments.
Cloud Computing Fundamentals : Introduction, Definition and Motivation for Cloud Computing, 5-4-3 Principles of Cloud Computing, Cloud Ecosystem, Requirements for cloud services, Cloud Applications, Benefits and Drawbacks.
Cloud Computing Architecture : Introduction, Cloud Reference Model, Architecture, Network Connectivity in Cloud Computing, Managing the cloud, Migrating applications to the cloud, Cloud Deployment Models – Private cloud, Public cloud, community cloud, Hybrid cloud, comparisons on basis of characteristics, suitability, Issues, Benefits and drawbacks. Cloud Service Models –

Introduction, Infrastructure as a Service, Platform as a Service, Software as a Service, other cloud service models.

Unit II [15 Hrs]

Technological Drivers for Cloud Computing :

***Introduction to SOA and cloud* –** benefits, technologies, similarities and differences.

***Virtualisation* –** Approaches, Hypervisor and its role, Types of Virtualisation. Memory and Storage technologies, Network technologies.

***Web 3.0* –** Components, characteristics, convergence of cloud and web 3.0, Example – Connecting information : Facebook, Search Optimisation and Web Commerce : BestBuy.

***Software Process Models for Cloud* –** Agile SDLC for Cloud Computing, How Cloud Meets Agile Process?, Advantages.

***Operating Systems for Cloud* –** Role of OS in cloud computing, Features of Cloud OS, Cloud OS Requirements, Cloud Based OS.

***Application Environment* –** Need for ADE, Application Development Methodologies, Overview of Cloud Application Development Platforms – Windows Azure, Google App Engine, Force.com . Cloud Computing APIs – Rackspace, IBM, Intel.

Unit III [15 Hrs]

Software Development in Cloud : Introduction, Different Perspectives on Saas Development, New Challenges, CAS development using Paas Development

Network Development in Cloud : Overview of Data Center Environment, Networking and Transport Layer Issues in Data Centers,

Security in Cloud : Introduction, Security Aspects, Platform Related Security, Audit and Compliance

Unit IV

[15 Hrs]

Industrial Platforms and New Developments

Cloud Platforms in Industry – Amazon Web Services, Google App Engine, Microsoft Azure.

Advanced Concepts – InterCloud, Mobile Cloud, Media Cloud, Green Cloud, Cloud Analytics.

REFERENCES :

Mandatory

1. K.ChandraSekaran, “Essentials of Cloud Computing, CRC Press”
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi: “Mastering Cloud Computing, Foundations and Applications Programming”

Supplementary

1. George Reese, " Cloud Application Architectures, First Edition, O"Reilly"
2. Cloud Computing – web based Applications that change the way you work and collaborate Online – Micheal Miller.Pearson Education.

Web References :

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2. https://nptel.ac.in/courses/106105167
3. https://in.coursera.org/specializations/cloud-computing
4. https://www.javatpoint.com/web-services-in-cloud-computing

Course Title: Software Quality Assurance and Testing
Course Code:PGMP-IT-DSE-402
Credits: 4
Marks: 100
Duration:60 Hrs

Course Pre-Requisites:
Knowledge of analysis, design and programming

Course Objectives:
To provide a detailed study of testing software and automated tools.

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Apply Software Testing process in relation to Software Development and Project Management.
CLO2: Create Test Strategies and plans, design test cases, prioritize and execute them.
CLO3: Identify the needs of software test automation, and define and develop a test tool to support testautomation.
CLO4: Use software testing methods and modern software testing tools for their testing projects.

SYLLABUS:

Unit I:
[15 Hrs]
Testing fundamentals Software testing, Levels of software testing, Test activities, Testing Life Cycle, TestOrganization, White Box testing, Basis Path Testing, Control Structure testing, Black BoxTesting,Equivalence Class Partitioning, Boundary Value Analysis, Cause-effect Graphing, Special cases.

Unit II:
[15 Hrs]
Functional Testing Performance Testing, Stress testing, Configuration Testing, Security Testing, RecoveryTesting, Integration Testing, Regression Testing, Acceptance Testing.
Object oriented testing methods
Testing Methods at Class level – Interclass test case design- Testing for Specific Environment, architecture,and application - Testing patterns

Unit III:
[15 Hrs]
Testing Processes Comparison of different techniques- Test Plan – Test case Design ProcedureSpecification – Test Case Execution and Analysis - Test Documentation -

Reporting test results - Final testreport Test Driven Development & Refactoring.

Unit IV:
[15 Hrs]

Testing Web Application Testing concepts for web apps, Content Testing, User Interface Testing ,Component Level Testing, Navigation Testing, Configuration Testing , Security Testing – PerformanceTesting. Testing Tools Need for automated testing tools - Selection of testing tool – Tools used at variousphases.

References

Mandatory:

1. Desikan S., Gopalswamy R. (2006). Software Testing : Principles and Practices, India:Pearson Education.

Supplementary:

1.Kit E. Software Testing in the Real World, United States: Addison-Wesley Publishing Co. 2.William E.Software Testing and Continuous Quality Improvement, Auerbach Publications.

Web References :

1. www.guru99.com/software-testing.html
2. 2. https://www.tutorialspoint.com/software_testing/index.htm
3. 3. https://www.javatpoint.com/software-testing-tutorial

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Course Title: Computer Graphics
Course Code: PGMP-IT-DSE-403
Credits: 4
Marks: 100
Duration: 60 Hrs

Course Prerequisites:
Knowledge of Data Structures and Algorithms

Course Objectives:
To understand the concepts of Graphic Algorithms, Geometrical transformations and Modeling

Course Learning Outcomes:
At the end of the course students will be able to :

CLO1: Comprehend and analyze the fundamentals of animation, underlying principles, and
applications.
CLO2: Apply 3D Transformation on the object.
CLO3: Develop familiarity with key algorithms for modelling and rendering graphical data.
CLO4: Design interactive computer graphics programs using Babylon JS.

Syllabus:

Unit I:
[15 Hrs]
Introduction to Computer Graphics and Graphics Transformation
History of Computer Graphics, graphics primitives, scan conversion. 2D Transformations, compositetransformation, viewing transformation, clipping algorithms.

Unit II:
[15 Hrs]
3D Transformation and Representation of Curve
Viewing pipeline, Parallel and Perspective projections, view volumes, clipping ,Parametric,
curves, continuity conditions, cubic splines, Hermite interpolation, Bezier curves and surfaces,
B-spline Curves, Fractals.

Unit III:
[15 Hrs]
Visible Surface Detection and Rendering Algorithm
Regularized Boolean operators, Sweep methods, Boundary Methods Constructive

solid geometry methods,representation through quad trees and Octrees. Issues in Visible surface determination Coherence, backfaceculling, Z-Buffer and A-Buffer Algorithms, use of Binary Space Partitioning trees, Boolean operations onOctrees, Visible surface ray tracing. Diffuse andSpecular illumination model, reflection vector computation, Shading models for polygons –polygon mesh shading, Gouraud and Phong Shading, problems with interpolated shading,
Transparency, shadows, Ray tracing.

Unit IV:
[15 Hours]
Animation
Perception, Animation production, use in film and videos, orientation representation andInterpolation, Motion along a curve –computing are length, speed control – sine interpolation, rigid bodysimulation, collision detection, Particle systems – particle generation, modeling water, fire, explosions.

References:

Mandatory:
1. Foley, Van Dam, Feiner, Hughes(2013), Computer Graphics – Principles and Practices (3 rd
Ed), Pearson Education India New Delhi.

Supplementary:
1. Rick Parent(2012), “Computer Animation: Algorithms and Techniques(3rd Ed), Morgan-
Kaufman California.
2. Hearn &Baker(2010), Computer Graphics with OpenGL(4th Ed), Prentice Hall of India Delhi.

Web References:
1: https://nptel.ac.in/courses/106106090/
2: http://cs.wellesley.edu/~cs110/lectures/M01-color/graphics.pdf
3: http://gamma.cs.unc.edu/graphicscourse/solid_modeling.pdf
4: https://link.springer.com/chapter/10.1007%2F978-3-642-77263-4_20

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Course Title: Compiler Design
Course Code: PGMP-IT-DSE-404
Credits: 4
Marks: 100
Duration: 60 Hrs
Course Pre-Requisites: None

Course Objectives:
To enable the student to understand compiler construction and equip them with skills towrite a compiler for a programming language.

Course Learning Outcomes:
At the end of the course students will be able to:

CLO1: Convert a NFA to DFA and minimize the DFA.
CLO2: Perform Lexical Analysis using tools such as Lex and YACC.
CLO3: Apply the concepts of Register allocation.
CLO4: Design and code a simple compiler for a programming language.

Syllabus:
Unit I. Introduction and ContextFreeGrammars
[15 Hrs]
Lexical analysis, Regular Expressions, Finite automata. N.F.A., N.F.A. to D.F.A. conversion,
D.F.A., minimization of D.F.A., Lex tool, Derivations & Parse trees, Syntax analysis: Parsing,
Top Down Parser, Recursive descent Parser, Predictive parsing, LL(1) Parsing table, Bottom UpParsing, Shift Reduce parsing, Operator precedence parsing, LR Parsing methods, SLR, LRDL,LALR, YACC tool.

Unit II Syntax Directed Translation, Error DetectionandRecovery
[15 Hrs]
Syntax directed translation schemes, Implementation of syntax directed translation schemes,
Intermediate codes, Post fix notation parse trees &syntax trees, three address codes, quadruples,
triples, Translation of assignment statements, Boolean expression, statements that after flow of
control, Post fix translation, Translation with Up down parsing. Errors, lexical phase errors,
Syntactic phase errors, semantic errors.

Unit III Code Optimization and DataFlowAnalysis [15 Hrs]
Loop optimization, DAG representation of basic block, value numbers & algebraic laws, Globaldata flow analysis, Dominators, Reducible flow graph, Depth first

search, Loop invariantcomputation, Induction variable elimination, Reaching definition, Available Expression, copypropagation, Backward flow problems, Very busy, expression & code hoistingcode.

Unit IV Code Generation andRegisterAllocation
[15 Hrs]

A simple code generation, code generation from DAG & labeled trees, Coloring by implication,
coalescing, graph coloring implementation, Register allocation for Trees.

References:

Mandatory:

1. Aho A, Ullman J, Lam M &Sethi R (2006), Compilers - Principles, Techniques, and
Tools (2nd Ed), New Delhi, India: Pearson Education.

Supplementary:

1. Tremblay J & Sorenson P (2014), Theory& Practice of Compiler Writing (4th Ed), New Delhi,
India: B. S.Publication

Web References:

- https://nptel.ac.in/courses/106105190/
- https://www.tutorialspoint.com/compiler_design/index.htm
- https://www.geeksforgeeks.org/compiler-design-tutorials/
- https://www.javatpoint.com/compiler-tutorial

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DISCIPLINE SPECIFIC ELECTIVES (DSE) - II

Course Title: Web Development Frameworks
Course Code: PGMP-IT-DSE-405
Credits: 2
Marks: 50
Duration: 30 Hours

Course Prerequisite: Object Oriented Paradigm, Basics of Web , PHP

Course Objectives:
Use Web Frameworks and Libraries to develop interactive web applications using both front end and back-end frameworks

Course Learning Outcomes:
At the end of the course, student will be able to :

CLO1: Build a web application using Laravel framework
CLO2: Use ReactJS to build rich and interactive front end applications.
CLO3: Use NodeJS to develop back end application to accept POST,GET,PUT,DELETE requests
CLO4: Develop REST API's using NodeJS and non blocking and blocking JS code.

Syllabus

Unit 1
[15 Hrs]
Laravel
Introduction to Laravel, Routing in Laravel, MVC in Laravel, Caching in Laravel, Event subscribers in Laravel, Package Development, Templates, Creating an Application, Testing in Laravel, Database Configuration, Helpers in Laravel, Laravel Pagination, Laravel Security, Authentication Facade, Validation in Laravel, Eloquent ORM, Artisan Command Line Interface, Deploy Application using Laravel.

ReactJS
History of front end libraries, Motivation for using React, Thinking in React, One way binding, JSX+ CSS modules, Virtual DOM, ES6
ReactJS:components
Component lifecycle, Component API, Render functions, State, Props, Mixins

Unit II [15 Hrs]
ReactJS:Interaction between components
Passing data from parent to child, Passing data from child to parent, Passing data

between 2
components at the same level, Forms, Refs, React-Router, API integration
NodeJS: Express framework
Set up a web server, Implementing API routing, Implementing middle-ware, Implementing URL parameters.
NodeJS: MySQL module
Setting up a database and connect it to a NodeJS server, Storing and retrieving data from the
database.
MERN STACK AND GIT
Introduction to MERN Stack and GIT.

Practical : 2 Credits
(60 Hours)
Maximum Marks: 50

List of Lab Assignments:
1: Study of Laravel Framework:
[12 Hrs]
a. Migrations in Laravel
b. Using Forms and Gathering Input in Laravel
c. Creating a registration & user login form in Laravel
d. Using Controllers and Routes for URLs and APIs in Laravel
e. Eloquent ORM in Laravel
f. Creating and Using Composer Packages
g. Security & Session
2: Creating a simple web server and connect to MYSQL database.
[06 Hrs]
3: CRUD using MySQL database API's.
[08 Hrs]
a. Fetch data from a form, validate and insert in the database.
b. Delete data in the database.
c. Update data in the database
d. Display data from the database.
4: Uploading files, Login Functionality using sessions
[04hrs]
5: Using Cookies to store website data
[04 Hrs]
6: Create an unique app with react.js and node.js
[08 Hrs]
7: Using sessions and OAuth to authorize and authenticate users in Node.js apps
[09 Hrs]
8: Building Node.js REST API Servers with Express.js
[09 Hrs]

Mini Project Mandatory where students will develop a web based or app based or

web app based projects covering all the aspects of Web development frameworks covered in the syllabus

REFERENCES :

Mandatory

1. Stauffer, M. (2019). Laravel: Up & Running: A Framework for Building Modern PHP
Apps. O'Reilly Media.
2. Brett McLaughlin (2011). What Is Node ? (1st ed) O'Reilly Media \
3. Alex Banks (2017). Learning React. (1st ed) Shroff / O'Reilly

Supplementary

1. Brinzarea, B., & Hendrix, A. (2009). Ajax and PHP: Building modern Web applications. Packt Publishing Ltd.
2. Mario Casciaro (2016). Node.js Design Patterns (2nd ed) Packt Publishing Limited

Web References :

1: https://laravel.com/docs/6.x
2: https://www.tutorialspoint.com/laravel/index.htm
3: https://nodejs.org/en/docs
4: https://legacy.reactjs.org/tutorial/tutorial.html
5: https://www.youtube.com/watch?v=Ke90Tje7VS0

Course Title: Mobile Application Development
Course Code: PGMP-IT-DSE-406
Credits: 2
Marks: 50
Duration: 30 Hours

Course Prerequisite: Basics of Javascript

Course Objectives:
- To facilitate students to understand android SDK
- To help students to gain a basic understanding of iOS application development

Course Learning Outcomes:

CLO1: Critique mobile applications on their design pros and cons
CLO2: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces
CLO3: Program mobile applications for the Android and iOS operating system that use basic and advanced phone features
CLO4: Deploy applications to the marketplace for distribution.

Syllabus

Unit 1:
[15 Hrs]
A brief history of Mobile, Types of mobile phone generations, The Mobile Ecosystem, Types of Mobile Applications, Mobile Information Architecture Android Versions, Features of Android, Android Architecture, Installing Android SDK Tools, Configuring Android in Eclipse IDE, Android Development Tools (ADT), Creating Android Virtual Devices (AVD)

Introduction to React Native: Advantages of using React Native, Differences between React Native and React, Setting up the development environment

Introduction to Node.js and NPM: Installing Expo CLI, Setting up Android/iOS development environment, Creating a React Native app
Understanding basic components like View, Text, Image, etc. Inline styles and stylesheets. Handling user input.

Unit 2:
[15 Hrs]
Using text input fields, Handling touch events, Navigation in React Native

Understanding navigation concepts, Using React Navigation library, Working with APIs

Handling responses and errors, Parsing JSON data, Integrating third-party libraries

Popular libraries: React Native Elements, Redux, etc.Using native modules with React Native
Debugging and testing

Using Chrome DevTools for debugging, Using React Native Debugger, Writing and running tests with Jest and Enzyme
Publishing the app, Preparing the app for release, Generating app bundles, Submitting the app to Google Play Store and Apple App Store

Practical : 2 Credits
(60 Hours)
Maximum Marks: 50

List of suggested practicals

1. Setting up the Android/iOS development environment, Installing Node.js and NPM Installing Expo CLI [8 Hrs]
2. Creating a React Native app, Running the app on a simulator/emulator [8 Hrs]
3. Creating custom components, Styling components, Handling touch events [8 Hrs]
4. Creating navigation screens and stack, Working with APIs [8 Hrs]
5. HTTP requests using fetch API, Integrating third-party libraries [8 Hrs]
6. Installing and using React Native Elements, Redux, [8 Hrs]
7. Using Chrome DevTools for debugging, running tests with Jest and Enzyme [6 Hrs]
8. Publishing the app, Submitting to Google Play Store and Apple App Store [6 Hrs]

References:

Mandatory:

1. P. Akshat, N. Abhishek, React Native for Mobile Development: Harness the Power of React Native to Create Stunning iOS and Android Applications, Apress, 2019

Supplementary:

2. Reto Meier, Professional Android 4 Application Development, Wiley India, (Wrox), 2012
3. James C Sheusi, Android Application Development for Java Programmers, Cengage Learning, 2013

Web References

https://developer.apple.com/tutorials/app-dev-training/
https://designcode.io/tutorials/
https://reactnative.dev/docs/more-resources
https://reactnative.dev/docs/getting-started

Course Title: Agile Methodologies and DevOps
Course Code: PGMP-IT-DSE-407
Credits: 2
Marks: 50
Duration: 30 Hours

Course Pre-Requisites:

- Knowledge of programming

Course Objectives:

- Provide students with a theoretical as well as practical understanding of agilesoftware development practices
- Apply these practices in teams to create high-quality software.
- Provide an introduction to DevOps

Course Learning Outcomes:

At the end of the course students will be able to:

CLO1: Understand, appreciate and apply Agile practices for Software development
CLO2: Apply Software Configuration Management concepts to change requests
CLO3: Perform Test-Driven Development while solving real-world software problems
CLO4: Integrate and automate the work of software development and IT operations

Syllabus:

Unit I
[15 Hrs]
Understanding how traditional software development works and its problems, Role of Agile practices in the world of software development & Tools used, Requirement Analysis, Estimation techniques, Iteration, planning, Introduction to development practices: Test Driven Development & Pair Programming, Introduction to QA Practices: Fail Fast & Automated functional testing,
Introduction to Continuous Integration

Unit II
[15 Hrs]
Practicing TDD and pair programming as alternative to traditional documentation; Configuring Continuous Integration tools; Automated function testing in detail, Source Control, Iterative and incremental software development, Automated and scripted deployment strategies, Handling change requests.
What Is Devops , History of Devops, Devops definition, DevOps Main Objectives, DevOps and Software Development Life Cycle, Waterfall Model versus Agile

Model

Practical : 2 Credits
(60 Hours)
Maximum Marks: 50

List of Suggested Practicals

1. Installing and configuring MAVEN with Eclipse
   [4 Hrs]
2. Experiment using MAVEN to simplify build process.
   [6 Hrs]
3. Experiment using MAVEN to provide uniform build system
   [6 Hrs]
4. Install Jenkins and perform Unit tests
   [6 Hrs]
5. Demonstration of Automated testing using Jenkins
   [6 Hrs]
6. Demonstration of Code Analysis and Automated Deployment using Jenkins
   [8 Hrs]
7. Demonstration of and reporting using Jenkins
   [6 Hrs]
8. Demonstration of distributed builds using Jenkins
   [6 Hrs]
9. Demonstration of Version Control using GIT.
   [6 Hrs]
10. Usage of GIT on remote repository platform
    [6 Hrs]

References:

Mandatory:

1. Ken Schwaber & Mike Beedle Agile Software Development with Scrum, Prentice Hall, 2002.

Supplementary:

1. Mike Cohn, Agile Estimating and Planning, Prentice Hall, Professional Technical Reference, 2006.

Web References:

1. https://www.javatpoint.com/devops
2. https://www.guru99.com/devops-tutorial.html
3. https://www.tutorialspoint.com/devops_tutorials.htm

Course Title: Cryptography and Network Security
Course Code: PGMP-IT-DSE-408
Credits: 2
Marks: 100
Duration: 30 Hours

Course Prerequisite:
Computer Networks

Course Objectives:
To understand the principles of encryption algorithms, conventional and public key cryptography. To have a detailed knowledge about authentication, hash functions and application level security mechanisms.

Course Learning Outcomes:
At the end of the course, student will be able to :

CLO1: To know the methods of conventional encryption and concepts of Number theory
CLO2: To understand various authentication and hash functions in practice
CLO3: Understand and analyse various network security tools and applications
CLO4: Analyse the different system level security issues

Syllabus

Unit 1
[15 Hrs]
Symmetric Ciphers
Introduction, Services, mechanisms and attacks, The OSI Security Architecture, Security Attacks, Services, Security Mechanism, Model for Network Security.
Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.
Block Ciphers and Data Encryption Standard : Simplified DES, Example, Strength of DES, Block Cipher Principles, The Data Encryption Standard, Multiple Encryption and Triple DES.

Public Key Encryption and Hash Functions
Introduction to Number Theory: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, Euclid's Algorithm, Modular Arithematic, Chinese Remainder Theorem, Discrete Algorithms.
Public Key Cryptography and RSA: Principles of Public Key Cryptosystems, The RSA Algorithm
Advanced Encryption Standard: AES Structure, Functions, Key Expansion
Key Management : Key Management, Deffie-Hellman Key Exchange, Elgamal Cryptographic System.

Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes (MAC).
Hash Algorithms : Hash Functions , Requirements and Security, Secure Hash Algorithm, SHA – 3

Unit II
[15 Hrs]

Data Integrity and Network Security

Digital Signatures and Authentication Protocols: Digital Signatures, Elgamal Digital Signature Scheme, Schnorr Digital Signature Scheme.
Key Management and Distribution : Symmetric key distribution using Symmetric Encryption, Symmetric key distribution using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure.
Network Access Control and Cloud Security: Network Access Control, Cloud Security, Risks and its countermeasures, Data Protection in the cloud

Internet Security

IP Security :Overview, Policy, Security Payload, Internet key exchange, Cryptographic suites.
Electronic Mail Security : Architecture, Formats, Threats and Security, S/MIME, PGP, Domain Based Message Authentication, Reporting and Conformance.
System Security : Intruders, Intrusion Detection , Password Management, Malicious Software : Viruses and related threats Virus counter measures, Firewalls: Firewall Design Principles , Trusted Systems.

Practical : 2 Credits
(60 Hours)
Maximum Marks: 50

List of suggested Assignments:

1: Implementation of Classical Encryption Techniques as Substitution techniques:
[12 Hrs]
   a. Caesar Cipher
   b. Monoalphabetic Cipher
   c. Playfair Cipher
   d. Hill Cipher
   e. Polyalphabetic cipher techniques
   f. One Time Pad
2: Implementation of Classical Encryption Techniques as Transposition techniques
[05 Hrs]
3: Implementation of Simplified DES (S- DES) Algorithm
[06 Hrs]
4: Implementation of Multiple Encryption on DES:
[06 Hrs]
   a. Double DES

b. Triple DES

5: Perform Encryption and Decryption using RSA Algorithm **[08 Hrs]**

6: Perform Encryption and Decryption using AES Algorithm **[08 Hrs]**

7: Implement the Diffie-Hellman Key Exchange mechanism using HTML and JS **[09 Hrs]**

8: Configure IP security and firewalls **[06 Hrs]**

Mini Project Mandatory where students will develop projects based on encryption and decryption methodologies with using proper HTML, JS and other web based applications

REFERENCES :

Mandatory

1. Cryptography and Network security 7th ed. William Stallings PEA.
2. Internet Cryptography by Richard E Smith, Pearson Education Asia, ISBN:81-297-0351- 3

Supplementary

1.Building Internet Firewalls by Chapman D., E. Zwicky, O'Reilly 1995, ISBN:81-7366- 101-4
2. Network Security Essential: Applications and Standards by William Stallings, PEA, ISBN:81-7808-307-8
3. Network Security, Private Communication in a Public World by Charlie Kaufman, Radia Perlman, Mike Speciner PTR Prentice Hall, 1995, ISBN:978-81-203-2213-4

Web References :

1: https://nptel.ac.in/courses/106/105/106105031/
2: https://engineering.purdue.edu/kak/compsec/NewLectures/Lecture8.pdf
3: https://www.us-cert.gov/ncas/tips/ST04-018
4: http://www.iet.unipi.it/g.dini/Teaching/sanna/lecturenotes/applied-cryptography-digital-signature.pdf
5: http://www.cs.man.ac.uk/~banach/COMP61411.Info/CourseSlides/Wk4.2.MAC.pdf