



**ST ALOYSIUS COLLEGE (AUTONOMOUS)**  
**MANGALURU**

**RE-ACCREDITED BY NAAC "A" GRADE**

**COURSE STRUCTURE AND SYLLABUS**  
**OF**  
**Master of Computer Application**  
**(M.C.A)**

**CHOICE BASED CREDIT SYSTEM**

**(2020 -21 ONWARDS)**

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**Re-accredited by NAAC with 'A' Grade - CGPA 3.62**  
**Recognised by UGC as "College with Potential for Excellence"**  
**College with 'STAR STATUS' conferred by DBT, Government of India**  
**3<sup>rd</sup> Rank in "Swacch Campus" Scheme, by MHRD, Govt of India**

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Date: 25-06-2020

### **NOTIFICATION**

Sub: Syllabus of **Master of Computer Applications** under Choice Based Credit Scheme.

Ref: 1. Decision of the Academic Council meeting held on 09-06-2020 vide Agenda No: 5(2020-21)  
2. Office Notification dated 25-06-2020

Pursuant to the above, the Syllabus of **Master of Computer Applications** under Choice Based Credit Scheme which was approved by the Academic Council at its meeting held on 09-06-2020 is hereby notified for implementation with effect from the academic year **2020-21**.

**PRINCIPAL**

**REGISTRAR**

To:

1. The Chairman/Dean/HOD.
2. The Registrar Office
3. Library
4. PG Office

# PEO

Program Educational Objective (PEO) is what the programme is preparing graduates for in their career and professional life. Our current PEOs are as follow:

PE01	Excel in professional career and/or higher education by acquiring knowledge in various sub-domains related to the field of computer science and applications
PE02	Analyze real life problems, design computing systems appropriate to its solutions that are technically sound, economically feasible and socially acceptable
PE03	To develop the abilities to face the changing trends and career opportunities in computer application
PE04	Exhibit professionalism, ethical attitude, communication skills, team work in their profession and adapt to current trends by engaging in life long learning

## PROGRAMME OUTCOMES (PO's)

P01	<b>Computational Knowledge:</b> Apply knowledge of mathematics, computing fundamentals, data analytics, software engineering concepts and application development knowledge appropriate for the computing specialization
P02	<b>Problem Analysis:</b> Identify, formulate, design and develop applications to analyze and solve computer science related problems
P03	<b>Design /Development of Solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
P04	<b>Conduct investigations of complex Computing problems:</b> Use appropriate review literatures, research methodologies, techniques and tools, design, conduct experiments, analyze and make inferences from the resulting data.
P05	<b>Modern Tool Usage:</b>

	Create, Select, Integrate and apply efficiently appropriate techniques, resources, and modern computing tools to solve complex problem, with an understanding of the limitations.
P06	<b>Professional Ethics:</b> Understand and work with a professional context pertaining to ethics with appropriate societal and cyber regulations in a global economic environment
P07	<b>Life-long Learning:</b> Recognize and develop the passion for a continued career development and progress as a computer professional
P08	<b>Project management and finance:</b> Apply the principles of management with computing knowledge to manage the projects effectively both as a team leader and team member on multidisciplinary environments
P09	<b>Communication Efficacy:</b> Communicate effectively with the computing community as well as society by being able to make effective presentations and design documentation with respect to appropriate standards.
P010	<b>Societal and Environmental Concern:</b> Ability to utilize the computing knowledge efficiently in projects to analyze the global and local impact of business solutions for societal, environmental, and cultural aspects
P011	<b>Individual and Team Work:</b> Develop the ability to act as a member or leader for the fulfillment of diverse teams in multidisciplinary environments.
P012	<b>Innovation and Entrepreneurship:</b> Develop and design innovative methodologies to create value as a successful entrepreneur and wealth for betterment of individual and society at large.

## Scheme of Examination

### I Semester

Sl No	Subject Code	Subject Title	Type	Credits	Theory Exam duration (hours)	Practical Exam duration (hours)	Max Marks for Internal Assessment	Max. Marks for Term End Exam	Total Marks
1	PH 601.1 (E1)	Database Management Systems	HC	4	3	---	30	70	100
	PH 601.1 (E2)	Database Design and Implementation							
	PH 601.1 (E3)	NoSQL with MongoDB							
2	PH 602.1 (E1)	Data Structures & Analysis of Algorithms	HC	4	3	---	30	70	100
	PH 602.1 (E2)	Data Structures & Graph Theory							
	PH 602.1 (E3)	Advanced Data Structures and Algorithms							
3	PH 603.1 (E1)	Object Oriented Programming with Java	HC	4	3	---	30	70	100
	PH 603.1 (E2)	Enterprise Computing with Advanced Java							
	PH 603.1 (E3)	Enterprise Computing : Java EE Frameworks							
4	PH 604.1 (E1)	Web Design with HTML5, CSS, Java Script	HC	4	3	---	30	70	100
	PH 604.1 (E2)	Web Programming with PHP & MySQL							
	PH 604.1 (E3)	Web Application Development using Python							
5	PH 605.1 P	DBMS and Data Structures Lab	HCL	2	---	3	30	70	100
6	PS 606.1 (E1)	Statistical Techniques for computing	SC	3	3	---	30	70	100
	PS 606.1 (E2)	Probability and Stochastic Processes							
	PS 606.1 (E3)	Operations Research							
7	PS 607. 1 P	Java & Web Development Lab	SCL	2	---	3	30	70	100
8	PS 608.1	Business Communication/Entrepreneurship	SCP	3	----	---	50	50	100
		<b>Total</b>		<b>26</b>			<b>260</b>	<b>540</b>	<b>800</b>

\* HC – Hard Core    SC – Soft Core    HCL – Hard Core Lab    SCL – Soft Core Lab    SCP – Soft Core Project

## II Semester

Sl No	Subject Code	Subject Title	Type	Credits	Total no of hours	Lecture Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Self Study Hrs / week
1	PH 601.2 (E1)	Cloud Computing with Amazon Web Services	HC	4	3	---	30	70	100
	PH 601.2 (E2)	Grid and Cluster Computing							
	PH 601.2 (E3)	High Performance Computing							
2	PH 602.2 (E1)	Software Engineering and UML	HC	4	3	---	30	70	100
	PH 602.2 (E2)	Object Oriented Software Engineering							
	PH 602.2 (E3)	Agile Software Development							
3	PH 603.2 (E1)	Mobile Application Development using Android	HC	4	3	---	30	70	100
	PH 603.2 (E2)	Cross Mobile App Development using React Native							
	PH 603.2 (E3)	Mobile App Development for iOS with Swift							
4	PH 604.2 P	Cloud Computing and Mobile App Development Lab	HCL	2	----	3	30	70	100
5	PS 605.2 (E1)	Natural Language Processing	SC	3	3	---	30	70	100
	PS 605.2 (E2)	Image Processing & Pattern Recognition							
	PS 605.2 (E3)	Bioinformatics Algorithms, Databases and Tools							
6	PS 606.2 (E1)	Data Warehousing & Data Mining	SC	3	3	---	30	70	100
	PS 606.2 (E2)	Business Intelligence and Advanced Data Mining							
	PS 606.2 (E3)	Data Science and Analytics							
7	PS 607. 2 P	Advanced Computing and Data Mining Lab	SCL	2	---	3	30	70	100
8	PS 608.2	Mini Project & Advanced Entrepreneurship	SCP	4	---	---	50	100	150
9	PS 609.2	Seminar & Technical Communication – I	---	1	----	---	50	---	50
		<b>Total</b>		<b>27</b>			<b>310</b>	<b>590</b>	<b>900</b>

\* HC – Hard Core SC – Soft Core HCL – Hard Core Lab SCL – Soft Core Lab SCP – Soft Core Project

### III Semester

Sl No	Subject Code	Subject Title	Type	Credits	Total No of Hours	Lecture Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Self Study Hrs / week
1	PH 601.3 (E1)	Functional Programming Paradigm	HC	4	3	---	30	70	100
	PH 601.3 (E2)	Internet of Things and Applications Development							
	PH 601.3 (E3)	Augmented and Virtual Reality							
	PH 601.3 (E4)	Mobile Communication							
2	PH 602.3 (E1)	Web Development with Angular, Node.js	HC	4	3	---	30	70	100
	PH 602.3 (E2)	Content Management with Joomla and WordPress							
	PH 602.3 (E3)	Blockchain Technology with Ethereum							
3	PH 603.3 (E1)	Computing with C# and .NET Framework	HC	4	3	---	30	70	100
	PH 603.3 (E2)	Web Technologies & .NET Framework							
	PH 603.3 (E3)	Cross-Platform Development using .NET Core							
4	PH 604.3 P	Web Application Development & .NET Lab	HCL	2	----	3	30	70	100
5	PS 605.3 (E1)	Cognitive Computing and Artificial Intelligence	SC	3	3	---	30	70	100
	PS 605.3 (E2)	Computational Intelligence and Machine Learning							
	PS 605.3 (E3)	Deep Learning and Neural Networks							
6	PS 606.3 (E1)	Big Data Analytics with MapReduce and Hadoop	SC	3	3	---	30	70	100
	PS 606.3 (E2)	Big Data Analytics with Scala and Spark							
	PS 606.3 (E3)	Big Data Visualization using Tableau							
7	PS 607.3 P	Machine Learning & Big Data Lab	SCL	2	---	3	30	70	100
8	PH 608.3	Business Consultancy Project	SCP	4	---	---	50	100	150
9	PS 609.3	Seminar & Technical Communication – II	---	1	----	---	50	---	50
		<b>Total</b>		<b>27</b>			<b>310</b>	<b>590</b>	<b>900</b>

\* HC – Hard Core SC – Soft Core HCL – Hard Core Lab SCL – Soft Core Lab HCP – Hard Core Project



## IV Semester

Sl. No.	Subject Code	Subject Title	Credits	Max. Marks
1.	PH 601.4	Project Work/ Dissertation	20	500
		<b>TOTAL</b>	<b>20</b>	<b>500</b>

## Scheme of Teaching

I Semester									
Sl No	Subject Code	Subject Title	Type	Credits	Total No of Hours	Lecture Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Self Study Hrs / week
1	PH 601.1 (E1)	Database Management Systems	HC	4	45	3	2	--	2
	PH 601.1 (E2)	Database Design and Implementation							
	PH 601.1 (E3)	NoSQL with MongoDB							
2	PH 602.1 (E1)	Data Structures & Analysis of Algorithms	HC	4	45	3	2	--	2
	PH 602.1 (E2)	Data Structures & Graph Theory							
	PH 602.1 (E3)	Advanced Data Structures and Algorithms							
3	PH 603.1 (E1)	Object Oriented Programming with Java	HC	4	45	3	2	--	2
	PH 603.1 (E2)	Enterprise Computing with Advanced Java							
	PH 603.1 (E3)	Enterprise Computing : Java EE Frameworks							
4	PH 604.1 (E1)	Web Design with HTML5, CSS, Java Script	HC	4	45	3	2	--	2
	PH 604.1 (E2)	Web Programming with PHP & MySQL							



4	PH 604.2 P	Cloud Computing and Mobile App Development Lab	HCL	2	90	--	(1 x 2) 2	(3 x 2) 6	--
5	PS 605.2 (E1)	Natural Language Processing	SC	3	45	3	2	--	2
	PS 605.2 (E2)	Image Processing & Pattern Recognition							
	PS 605.2 (E3)	Bioinformatics Algorithms, Databases and Tools							
6	PS 606.2 (E1)	Data Warehousing & Data Mining	SC	3	45	3	2	--	2
	PS 606.2 (E2)	Business Intelligence and Advanced Data Mining							
	PS 606.2 (E3)	Data Science and Analytics							
7	PS 607. 2 P	Advanced Computing and Data Mining Lab	SCL	2	90	--	(1 x 2) 2	(3 x 2) 6	--
8	PS 608.2	Mini Project & Advanced Entrepreneurship	SCP	4	---	---	----	----	90
9	PS 609.2	Seminar & Technical Communication – I	PA	1	30	2	2	--	4
		<b>Total</b>		<b>27</b>		<b>17</b>	<b>16</b>	<b>12</b>	<b>14</b>

\* HC – Hard Core SC – Soft Core HCL – Hard Core Lab SCL – Soft Core Lab SCP – Soft Core

Project

### III Semester

Sl No	Subject Code	Subject Title	Type	Credits	Total No of Hours	Lecture Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Self Study Hrs / week
1	PH 601.3 (E1)	Functional Programming Paradigm	HC	4	45	3	2	--	2
	PH 601.3 (E2)	Internet of Things and Applications Development							
	PH 601.3 (E3)	Augmented and Virtual Reality							
	PH 601.3 (E4)	Mobile Communication							
2	PH 602.3 (E1)	Web Development with Angular, Node.js	HC	4	45	3	2	--	2
	PH 602.3 (E2)	Content Management with Joomla and WordPress							
	PH 602.3 (E3)	Blockchain Technology with Ethereum							
3	PH 603.3 (E1)	Computing with C# and .NET Framework	HC	4	45	3	2	--	2

	PH 603.3 (E2)	Web Technologies & .NET Framework							
	PH 603.3 (E3)	Cross-Platform Development using .NET Core							
4	PH 604.3 P	Web Application Development & .NET Lab	HCL	2	90	--	(1 x 2) 2	(3 x 2) 6	--
5	PS 605.3 (E1)	Cognitive Computing and Artificial Intelligence	SC	3	45	3	2	--	2
	PS 605.3 (E2)	Computational Intelligence and Machine Learning							
	PS 605.3 (E3)	Deep Learning and Neural Networks							
6	PS 606.3 (E1)	Big Data Analytics : MapReduce and Hadoop	SC	3	45	3	2	--	2
	PS 606.3 (E2)	Big Data Analytics with Scala and Spark							
	PS 606.3 (E3)	Big Data Visualization using Tableau							
7	PS 607.3 P	Machine Learning & Big Data Lab	SCL	2	90	--	(1 x 2) 2	(3 x 2) 6	--
8	PS 608.3	Business Consultancy Project	HCP	4	---	---	----	----	90
9	PS 609.3	Seminar & Technical Communication – II	---	1	30	2	2	--	4
		<b>Total</b>		<b>27</b>		<b>17</b>	<b>16</b>	<b>12</b>	<b>14</b>

\* HC – Hard Core SC – Soft Core HCL – Hard Core Lab SCL – Soft Core Lab HCP – Hard Core Project

#### IV Semester

Sl. No.	Subject Code	Subject Title	CIE Marks	SEE Marks		Total
				Record Evaluation	Viva-Voce	
2.	PH 602.4	Project Work/ Dissertation	200	150	150	500

## **I Semester**

### **PH 601.1 [E1] : DATABASE MANAGEMENT SYSTEMS**

<b>Total No. of Lectures : 48</b>	<b>Total Marks : 100</b>	<b>[ L - T - P - S ]</b>
<b>No. of Lectures / Week : 4</b>	<b>Credits : 4</b>	<b>[ 3 - 1 - 0 - 2 ]</b>

#### **Course Objectives**

1. Introduction to the basic terminologies related to database domain and database management systems
2. Understanding various data models. Designing ER model, identifying the foundation of Relational Model, Relational Algebra operations.
3. Using Structured Query Language and also understanding components of SQL.
4. Introducing database security, database performance, Knowledge on File Structure, Indexing and Query processing.
5. Knowledge on Transaction and Database architecture and also data recovery concepts

**Course Outcomes:** After you have finished this course, you should have

1. Very good understanding about data and database systems.
2. Describe the fundamental elements of relational database management systems
3. Understand the design of relational databases through the use of Entity-Relationship Diagrams and Normalization procedures
4. Develop basic skills in the use of SQL in defining and creating a database, inserting and modifying entries in a table, creating views and other data objects
5. Effective way of manipulating the database to produce useful decision making information for management & analytics. Using data in the distributed environment

## Unit I

**Overview of Database Systems:** Historical Perspective, Levels of Data Abstraction, File Systems, Limitations of File system, Files Vs Database, Characteristics of Database System, Concept of Database Management, Advantages of DBMS, Users of Database, Database Administration

**Database Architecture :** Database Schema, Three schema architecture, Data Independence, Database Tools and Languages. Centralized database system and Client/server DBMS

**(10 hrs)**

## Unit II

**Data Modeling:** Concept of Data Model, Purpose/importance of Data model, Types of data model : Hierarchical and Network model : concept, features and uses

**Database design and ER Model :** Entities, Attributes, Relationship, Types of relationships, Keys, Cardinality, Degrees, ER-Diagram notations

**Overview of ER Model :** ER-Diagrams, ERDIssues, Extended E-R Features, ERD for Company and Student Admission system

**Relational database model-** Introduction to Relational model, Relational Algebra : Set oriented operations : Union, Intersection, Difference and Cartesian Products, Relation oriented operations: Selection, Projection, Join and Division, **Constraints :** Concept of Constraints, types of constraints, Data Integrity, Business rules, Implementing constraints and business rules.

**(10 hrs)**

## Unit III

**Normalization:** Concept of Normalization, Benefits of normalization : function dependency and determinants, normalization theory- **Normal forms:** 1 NF, 2NF, 3NF and BCNF,

**Structured query language-** Characteristics of SQL, types of SQL, **components of SQL:** DDL,DML,DCL and DQL, basic queries in SQL, adding constraints, altering and dropping constraints, adding business rules. single-table and multi-table retrievals, Joins : Outer joins, Inner Joins and Cross Joins

**Nested Queries :** Concept of subquery, features of subquery, creating subquery

**(10 hrs)**

## Unit IV

**Views :** Definition, purpose, types of views, Advantages and disadvantages of views, creating views in SQL, Altering and dropping views

**Functions:** Scalar and aggregate functions, types of scalar functions, **Conversion functions:** TO\_CHAR, TO\_NUMBER, TO\_DATE , Aggregate Functions, Using SET operators : UNION, INTERSECT, MINUS

**Indexes:** Concept of index, advantages and disadvantages of indexes, types of indexes, creating indexes in SQL

**(9 hrs)**

Query processing and optimization: Concept, purpose, Translating queries into relational algebra operator, Query Trees and Heuristics for query optimization Limitations of SQL, Concept of PL/SQL, writing a simple program in PL/SQL (9 hrs)

### **Unit V**

**Transaction management and Concurrency control** : Transaction, states of transaction, ACID properties, serializability, Concurrent transaction: Lost Update, dirty read, Inconsistent summary, unrepeatable read, Concurrency control mechanism : database lock, types of locks, Locking protocol (2PL), Deadlocks, Time stamping methods, deadlock prevention algorithms : wait die and wound wait, optimistic methods

**Failure in Database/Transaction** : Transaction failure, recovery of transactions, 2 PC protocol, database backup.

**Distributed database:** Components, distribution transparencies, **Issues in DDBMS:** Fragmentation, Replication and Allocation, DDBMS architecture: SP2D, SPMD, MPMD **(10 HRS)**

### **TEXT BOOKS**

1. Raghurama Krishnan, Johannes Gehrke ,Data base Management Systems, 3rd Edition, 2014, Mc Graw Hill Education,
2. A.Silberschatz, H.F. Korth, S.Sudarshan, Data base System Concepts, VI edition, 2006, McGraw Hill,

### **References**

3. Peter Rob, Carlos Coronel, Database System Concepts, 5<sup>th</sup> Edition, 2015, Cengage Learning
4. Ashima Bhatnagar Bhatia, Vaibhav Bansal, Database Management System, First Edition 2015, Narosa Publishing House Pvt. Ltd
5. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7<sup>th</sup> Edition, 2018, Pearson India Education Services Pvt. Ltd,
6. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, 2014, McGrawHill Education,
7. Arun Majumdar & Pritimoy Bhattacharya, DATABASE MANAGEMENT SYSTEMS , 2007, TMH.
8. Gerald V. Post, DATABASE MANAGEMENT SYSTEMS 3rd edition, TMH.

### **PH 601.1 [E2] : DATABASE DESIGN AND IMPLEMENTATION**

**Total No. of Lectures : 48**

**Total Marks : 100**

**[ L - T - P - S ]**

**No. of Lectures / Week : 4**

**Credits : 4**

**[ 3 - 1 - 0 - 2 ]**

#### **Course objectives**

1. Enabling students to achieve a comprehensive understanding of data, information and knowledge.
2. To make aware that how an efficient management system, helps to create database. Design tables, manipulate data values, maintaining integrity constraints and so on
3. Learning the technique of writing queries to generate different reports, how to optimize queries, creating views and cursors.
4. Preparing the students to understand the power Query languages and also writing stored procedure and triggers at the back end.
5. Introducing the concept of Big data domain and Schema-less storage

#### **Course Outcomes**

Upon successful completion of this course, students should be able to:

1. Understand the limitations of traditional file management systems, different data models
2. Understand the need for an efficient management system to administer the data repository of any organization, designing relational database systems with normalization concept
3. Identify the importance of data consistency and also how data integrity ignorance affects any business organization



4. Providing data security through different means (such as Views)
5. Identifying the power of Query language - generating flexible and customized reports
6. Providing complex integrity constraints through the use of Triggers
7. Know the Power of procedural SQL, writing Stored procedures, functions and packages
8. Gain knowledge about the emerging trends in database technology and also schema less database

## **UNIT-I**

**Introduction-Database System Applications:** Purpose of Database Systems, View of Data – Data, Data Abstraction, Three Schema Architecture, Data Independence, Database Users and Administrators, Data Models : Hierarchical, Network, ER

**Introduction to Data base design :**ER model : Entities, Attributes and Entity sets, relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises. **(10 hrs)**

## **Unit II**

**Relational Model :** Foundations of Relational model, Basics of Relational Algebra and Calculus, **Relational algebra:** Introduction, Basic Operations : Union , Intersection, Cartesian Product , Difference, **Relational Algebraic Operations :** Projection, Join, Selection and Division, Relational model constraints : Domain constraints, Key constraints, Entity integrity, referential integrity

**SQL :** Components of SQL : Data Definition Language, Data Manipulation Language, Data Control Language, Data Query Language, Creating Tables, Altering Tables and Schema, Manipulation of Data, Querying Single Table and Multiple Tables, Adding./Altering Constraints and Business Rules, Sorting, Join Operation, Data Dictionary, Integrity Rules, Constraints and Business Rules, Implementation of Constraints and Business Rules

**(10 hrs)**

## **UNIT III**

**Normalization :** Concept of normalization, Need for Normalization, Anomalies in DB, Normalization Process, Functional Dependency, Full Functional Dependency, Partial Dependency, 2NF, 3NF, BCNF, Join and Multivalued Dependency. Denormalization, Database design with Normal forms

**Views :** Concept, purpose of views, types of views, Advantages and disadvantages of views, Implementing views in SQL, Altering Views

Nested queries : Features of sub query, Rules , types of sub-query

Set operators in SQL : Using Union, Union All, Intersect and Minus

**Functions :** Scalar and aggregate functions, types of scalar functions, Aggregate functions : MIN, MAX, AVG, SUM and COUNT, using HAVING, **Conversion functions :** TO\_CHAR, TO\_NUMBER, TO\_DATE  
(10 hrs)

#### UNIT IV

**File Organization :** Heap Files, Sequential Access Methods, Indexed Sequential Access method, Indexes: Purpose Index, Types of Indexes, Advantages and Disadvantages of creating Indexes, Multi-level indexes, Creating Indexes in SQL, purpose of Index, types of indexes, Implementing Indexes in SQL, Sequences

**Transactions:** Concept of Transaction, States of Transaction, ACID properties, Concurrent Transaction : Lost update, Dirty Read, Unrepeatable Read, Inconsistent summary, Concurrency control Mechanism: Data base Lock, 2 PL : Basic 2 PL, Strict 2 PL, Rigorous 2 PL, Time stamp: Dead lock, deadlock prevention algorithms : Wait-Die and Wound-Wait

Failures in DB/Transaction: Reasons for Database failures, Catastrophic failure, Transaction Log, Backup, transaction Failure, Deferred update, Immediate update, Log based recovery

**PL/SQL:** A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types, Assignment operation – Bind variables, Conditional statement, Branching and Looping,

**Transaction Control statements,** DCL : Commit and Rollback (09 hrs)

#### UNIT- V

**PL/SQL Cursors and Exceptions:** Cursors – Implicit & Explicit Cursors and Attributes – Cursor FOR loops, Cursor with Parameters – Cursor Variables – Exceptions – Types of Exceptions. Stored Procedures and Triggers

**Distributed Database Systems:** Components, Advantages over centralized database system, Transparencies in DDB, Issues in DDB: Fragmentation, Replication and Allocation, DDB architecture : SP2DC, MP2DC, MP2MD, Distributed query processing, 3-phase commit protocol

**Big data :** Concept of Big Data, 4 V's of Big Data, ACID vs BASE, NoSQL, Types of NoSQL Data

(09 hrs)

#### Text Books

- [1]. R. Elmasri and S.B. Navathe: "Fundamentals of Database System", Pearson, 7<sup>th</sup> Edition, 2018
- [2]. Raghurama Krishnan, Johannes Gehrke, Data base Management Systems, 3rd Edition, 2014, McGrawHill Education,

#### Reference Books:

1. Alexis Leon, Mathew Leon, "Database Management System", Vikas Publishers
2. Peter Rob, Carlos Cornel, "Database Systems: Design & Management", Cengage
3. J A Hoffer, Mary B Prescott, H Topi, "Modern Database Management Systems", Pearson

4. Saeed K Rahimi, Frank S Haug, "Distributed Database Management Sytem: A Practical Approach", Wiley India Publishers
5. Bipin C. Desai, "Introduction to Database Systems", Galgotia Publications.
6. Date, C. J. , "An introduction to database systems", 3<sup>rd</sup> Edition, Narosa publishing house.
7. Hansen & Hansen, "Database Management and Design", Prentice Hall of India Ltd.
8. Ullman, J. D., "Principals of Database systems", Galgotia publications
9. Narang, "Database Management System", Prentice Hall of India Ltd
10. Nilesh Shah, "Database Systems using ORACLE: A simplified guide to SQL, and PL/SQL", 2<sup>nd</sup> Edition, Prentice Hall of India Ltd.
11. Ivan Bayross "SQL, PL/SQL : The programming language of Oracle", BPB Publications

#### **PH 601.1 [E3] : NoSQL with MongoDB**

<b>Total No. of Lectures : 48</b>	<b>Total Marks : 100</b>	<b>[ L – T – P – S ]</b>
<b>No. of Lectures / Week : 4</b>	<b>Credits : 4</b>	<b>[ 3 – 1 - 0 - 2 ]</b>

#### **Course Objectives**

1. Introducing schema less, big data and highlighting the limitations of relational data base systems
2. Concept of big data and unstructured data storage,/handling data, when data is not in the form of table and data which has no strict schema.
3. Introducing NoSQL, Storage of unstructured and semi structured data and its manipulations.
4. Exposing to NoSQL environment using MongoDB as the NoSQL Tool
5. Application of commands pertaining to NoSQL using MongoDB such as CRUD Operations, Schema Design and Data Modeling, Scalability etc.

#### **Course Outcomes**

After successful completion of the course students should be able to

1. Understand that data need not be structured for storage, retrieval and manipulation
2. Define, compare and use the four types of NoSQL Databases (Document-oriented, Key Value Pairs, Column-oriented and Graph).
3. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.

4. Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.
5. Using NoSQL tools efficiently in the academic projects
6. Understands different types of Indexing/sharding and marinating NoSQL data.  
Comparing the power of different NoSQL tools

### UNIT I

Relational Data modeling , Normalization, ACID properties, Data storage and retrieval challenges with Relational data. Types of Data : Structured, semi structured and unstructured data, Data storage and retrieval challenges, Schema and Schema less Databases, Definition of NOSQL, History of NoSQL and Different NOSQL products, CAP and BASE Theorem, Types of NoSQL: Key-value store, Wide-Column store, Document Database and Graph Databases **(10 hrs)**

### UNIT II

**Replication and sharding**:, Concept of Sharding, purpose, Distribution Models, Single Server, Sharding, Purpose of replication, **Types of replication** : Master-Slave Replication, Peer-to-Peer Replication, Combining Shading and Replication, MapReduce on databases.

The Value of Relational Databases, Getting at Persistent Data, Concurrency, Principles of schema design, Nested documents, Collections and capped collections, The Emergence of NoSQL, Popular NoSQL tools **(10 hrs)**

### UNIT III

**MongoDB** : Overview of MongoDB, basic terms used : Database, Collection, Document, Field, Comparison with RDBMS, Advantages of MongoDB over RDBMS, MongoDB Application Areas, MongoDB Environment, Principles of Designing schema, MongoDB Data Modeling, **Basic commands** : Create Database,, **use Command, dropDatabase () Method**, Create Collection, **createCollection() Method**, Drop Collection, creating capped collections

Create Database and Collections, Dropping Databases and Collections, Data types, Insert, Update, Querying document, Relational operators, Logical Operators, **(10 hrs)**

### UNIT IV

MongoDB Data types, insert() Method, find() Method, pretty() Method, Logical operators AND, OR, NOT, Using AND and OR together, Update() method, Save() Method, Delete Document, remove() Method, Remove only one, Remove All documents, **MongoDB Projection** :The find() Method, Limit Records, The Limit() Method, Skip() Method, Sort Documents: The sort() Method,

Indexing, The ensureIndex() Method, Aggregation , aggregate() Method, Group functions, string functions : Sconcat, \$strcasecmp, \$substr, \$toLower, \$toUpper, set operators: \$setEquals, \$setIntersection, \$setDifference, \$setUnion,\$setIsSubset **(9 hrs)**

## **UNIT V**

**Indexing and Query Optimization**, Indexing rules, Simple index, compound index, single-key indexes, compound-key indexes, **Indexing types** : unique indexes, sparse indexes, multi-key indexes, hashed indexes, creating and deleting indexes

Query optimization, text search and pattern matching, Sharding :overview, purpose of sharding, distributing databases to shards, sharding within collections, MongoDB Replication, Creating backup and Restoring data, Comparing MongoDB with other NoSQL. **(9 hrs)**

### **Text Books**

1. Rick Copeland.. MongoDB Applied Design Patterns, , First Edition, 2013, OREILLY
2. Kyle Banker, Peter Bakkum, Shaun Verch, Douglas Garrett, Tim Hawkins, MongoDB in Action, Second Edition, , 2016 dreamtech press

### **References**

1. Samse Pub1 , NoSQL with MongoDB in 24 Hours, 1st Edition, Kindle Edition
2. Amol Nayak, MongoDB Cookbook Paperback – 2014, Publisher: Packt Publishing
3. Doug Bierer,, MongoDB 4 Quick Start Guide, First Edition, 2018, Packt Publishing,
4. Shannon Bradshaw, Eoin Brazil & Christina Chodorow, MongoDB The Definitive Guide,3<sup>RD</sup> Edn, 2019, , O'REILLY
5. Subhashini Chellappan, MongoDB Recipes, 1<sup>st</sup> Edition, 2015

### **PH 602.1 [E1] DATA STRUCTURES AND ANALYSIS OF ALGORITHMS**

<b>Total No. of Lectures: 48</b>	<b>Total Marks: 100</b>	<b>[L – T – P – S]</b>
<b>No. of Lectures/Week: 4</b>	<b>Credits: 4</b>	<b>[3 – 1 – 0 – 2]</b>

#### **Course Objectives:**

1. Learn basic concepts such as Abstract Data Types, Linear and Non Linear Data structures and algorithms and time and space complexity.
2. Learn the basic data structures stack and queue and its variants
3. Learn the different linked list concepts
4. Learn the tree data structure and its applications
5. Learn search and sorting methods

#### **Course Outcomes:**

1. Ability to understand and implement algorithms and are able to calculate the time and space complexities.
2. Able to implement and apply stack and queue data structure in different applications.
3. Ability to implement linked list and concepts and apply list concepts to solve different problems.
4. Ability to implement tree data structure and tree data structure to solve expressions
5. Ability to implement and apply different searching and sorting methods.

#### **UNIT - I**

**Introduction:** Notion of algorithm: - Properties of algorithm, Issues in writing algorithm, how to write an algorithm, what kinds of problem solved by algorithms. Designing algorithm. Analysis of algorithm – Space complexity, Time complexity, Measuring an input Size, Measuring running time, Order of growth, Best, Worst and Average Case analysis. Growth of Functions – Big Oh, Omega, Theta Notation. Complexity Analysis Examples.

Structures, Functions, Pointers, new and delete operators, class and object, access specifiers, constructors and destructor.

Single, two dimensional arrays, sparse matrices-array,

Introduction to Data structure types - Linear and Non Linear, Static and Dynamic data structures, primitive and Non primitive data structures. **(10 HRS)**

## **UNIT - II**

Stack Data structure, Stack using array, Stack applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue - definition, array and linked Implementations, Circular queues-Insertion and deletion operations, Double Ended Queue using array, Priority Queue using array. **(9 HRS)**

## **UNIT - III**

Singly Linked Lists- Operations-Insertion, Deletion, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations- Insertion, Deletion.

Polynomial addition using linked list, Ordered list, Stack using list, Queue using List. **(9 HRS)**

## **UNIT - IV**

Trees – definition, terminology, Binary trees-definition, Properties of Binary Trees, representation of Binary Trees-array and linked representations, Binary Tree traversals, Representation of expressions using tree, Threaded binary trees – Right in threaded binary tree .

**(10 HRS)**

## **UNIT - V**

Searching - Linear Search, Binary Search, Hashing-Introduction, hash tables, hash functions, Overflow Handling, Comparison of Searching methods.

Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Merge sort.

**(10 HRS)**

### **TEXT BOOKS:**

1. Data structures, using C and C++, 2nd Edition, Yedidyah Langsam, Aaron M. Tenenbaum. Pearson
2. **Design and Analysis of Algorithms** By A.A.Puntambekar Technical Publications, 2010

### **REFERENCE BOOKS:**

1. Data structures with C++, J. Hubbard, Schaum's outlines, TMH.

2. Data structures and Algorithms in C++, M.T. Goodrich, R. Tamassia and D. Mount, Wiley India.
3. Data structures and Algorithm Analysis in C++, 3rd edition, M. A. Weiss, Pearson.
4. Classic Data Structures, D. Samanta, 2nd edition, PHI.

### **PH 602.1 (E2) DATA STRUCTURES AND GRAPH THEORY**

<b>Total No. of Lectures: 48</b>	<b>Total Marks: 100</b>	<b>[L – T – P – S]</b>
<b>No. of Lectures/Week: 4</b>	<b>Credits: 4</b>	<b>[3 – 1 – 0 – 2]</b>

#### **Course Objectives:**

1. Learn basic concepts such as structures, function pointers, classes and objects.
2. Learn the data structures stack, queues and list
3. Learn the different tree data structures and the concept of tree traversal
4. Learn the important searching and sorting methods with the help of array
5. Learn the basic graph algorithms and different searching methods.

#### **Course Outcomes:**

1. Ability to program using structures, function pointers, classes and objects.
2. Ability to implement and apply stack, queue and list data structures in different applications.
3. Ability to implement and apply tree data structure in different applications
4. Ability to program different searching and sorting methods and how to apply these in different applications
5. Ability to implement and apply different graph methods in different applications

### **UNIT I**

**Introduction:** Introduction to structures, functions, Pointers, Classes and Objects, Memory Allocation - New and Delete. Introduction to one dimensional array, two dimensional array, character array – string operations, sparse matrix and its operations

What is data structure, different types of data structures, Application of data structures?

**(10 HRS)**

### **UNIT II**

Stack: stack as an ADT, Representing Stack using C++, Stack Applications – infix to postfix, postfix evaluation, Decimal to binary conversion, Recursion



Queue: Queue as an ADT, Queue implementation using C++, Queue Applications, Queue Types – Circular Queue, Double Ended Queue, Priority Queue – Implementation using array.

Lists: Introduction to lists, Types of linked list, Node Structure, list operations – insert and delete, circular linked list – insert and delete operations, Double ended and double ended circular queue – insert and delete operations.

**(10 HRS)**

### **UNIT III**

Representation of Exponential equation and addition of exponential equations. Ordered singly linked list.

Trees: Introduction to trees, Binary trees – Operations on binary trees, Applications of Binary trees – duplicate value deletion, expression representation and traversal. Binary tree representation – Node Representation of binary trees, implicit array representation of binary trees, binary tree traversals, Threaded binary trees. Binary Search trees. Self-balancing trees -AVL trees.

**(10 HRS)**

### **UNIT IV**

Searching – Linear Search, Binary Search, Hashing – insertion and searching using hashing.

Sorting – Bubble sort, insertion sort, selection sort, radix sort, merge sort, quick sort, heap sort, address calculation sort.

**(09 HRS)**

### **UNIT V**

Graphs–Definitions, Graph Representations- Adjacency matrix, Adjacency lists, warshall's algorithm, shortest path algorithm, Graph traversal methods – Depth First Search and Breadth First Search, Graph spanning tree – prims algorithm and kruskal's algorithm.

**(09 HRS)**

### **TEXT BOOKS:**

1. Data structures, using C and C++, 2nd Edition, Yedidyah Langsam, Aaron M. Tenenbaum. Pearson
2. **Design and Analysis of Algorithms** By A.A.Puntambekar Technical Publications, 2010

### **REFERENCE BOOKS:**

1. DATA STRUCTURES THROUGH C IN DEPTH by S. K. srivastava and Deepali Srivastav BPB Publications.
2. Data Structures – R Venkateshan, S. Lovelyn rose – Second Edition – Wiley

3. DATA STRUCTURES AND ALGORITHMS MADE EASY by Narasimha Karumanchi - Careermonk Publications; 5th ed. edition (2016)
4. Data structures and Algorithms in C++, M.T. Goodrich, R. Tamassia and D. Mount, Wiley India.

### **PH 602.1 (E3) ADVANCED DATA STRUCTURES AND ALGORITHMS**

**Total No. of Lectures: 48**  
**No. of Lectures/Week: 4**

**Total Marks: 100**  
**Credits: 4**

**[L - T - P - S]**  
**[3 - 1 - 0 - 2]**

#### **Course Objectives:**

1. Learn what is data structures, structures, functions, pointer and memory allocation functions and sparse matrix
2. Learn stack and Queue ADT, also they study list data structure and its types.
3. Learn different tree data structure and how to traverse
4. Learn what is searching and sorting and different algorithms to perform to searching and sorting
5. Learn what is graphs, how searching is done in graphs and different algorithms to find the shortest path.

#### **Course Outcomes:**

1. Understand what is data structure and able to implement different programs using structures, functions, pointer and memory allocation functions
2. Skill to program stack, queue using array and apply these algorithms to different applications.
3. Ability to program binary tree, binary search tree, AVL tree and other tree data structures and traverse and represent expressions using tree data structure.
4. Ability to program different searching and sorting algorithms using cpp programming language.
5. Ability to create graph using array and using linked list. Ability to find shortest path in graph, able to traverse the graph

### **UNIT I**

**Introduction:** Introduction to structures, functions, Pointers, Classes and Objects, Memory Allocation - New and Delete. Introduction to one dimensional array, two dimensional array, character array – string operations, sparse matrix and its operations

What is data structure, different types of data structures, Application of data structures.

**(10 HRS)**

## **UNIT II**

Stack: stack as an ADT, Representing Stack using C++, Stack Applications – infix to postfix, postfix evaluation, Decimal to binary conversion, Recursion

Queue: Queue as an ADT, Queue implementation using C++, Queue Applications, Queue Types – Circular Queue, Double Ended Queue, Priority Queue – Implementation using array.

Lists: Introduction to lists, Types of linked list, Node Structure, list operations – insert and delete, circular linked list – insert and delete operations, Double ended and double ended circular queue – insert and delete operations.

Representation of Exponential equation and addition of exponential equations. Ordered singly linked list.

**(10 HRS)**

## **UNIT III**

Trees: Introduction to trees, Binary trees – Operations on binary trees, Applications of Binary trees – duplicate value deletion, expression representation and traversal. Binary tree representation – Node Representation of binary trees, implicit array representation of binary trees, binary tree traversals, Threaded binary trees. Binary Search trees.

**(10 HRS)**

## **UNIT IV**

Self-balancing trees -AVL trees, B trees, splay trees, KD tree, Huffman Coding, Quad tree, 2-3 tree, Red Black trees, Knapsack problem.

Searching – Linear Search, Binary Search, Hashing

Sorting – Bubble sort, insertion sort, selection sort, radix sort, merge sort, quick sort, heap sort, address calculation sort.

**(09 HRS)**

## **UNIT V**

Graphs–Definitions, Graph Representations- Adjacency matrix, Adjacency lists, warshall's algorithm, shortest path algorithm, Graph traversal methods – Depth First Search and Breadth First Search, Graph spanning tree – prims algorithm and kruskal's algorithm.

**(09 HRS)**

### **TEXT BOOKS:**

1. Data structures, using C and C++, 2nd Edition, Yedidyah Langsam, Aaron M. Tenenbaum. Pearson
2. M. A. Weiss, "Data Structures and Algorithm Analysis in C", 2nd ed, Pearson Education Asia.

### **REFERENCE BOOKS:**

1. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures – A Pseudocode Approach with C", Thomson Brooks / COLE.
2. Aho, J. E. Hopcroft and J. D. Ullman, "Data Structures and Algorithms", Pearson education Asia. Data structures and Algorithms in C++, M.T. Goodrich, R. Tamassia and D. Mount, Wiley India.
3. Data structures and Algorithm Analysis in C++, 3rd edition, M. A. Weiss, Pearson.
4. Classic Data Structures, D. Samanta, 2nd edition, PHI.

### **PH 603.1 [E1]: OBJECT ORIENTED PROGRAMMING WITH JAVA**

**Total No. of Lectures: 48                      Total Marks: 100                      [ L – T – P – S ]**

**No. of Lectures / Week: 4                      Credits : 4                      [ 3 – 1 – 0 – 2 ]**

#### **Course Objectives:**

1. Understand differences between procedure oriented programming and Object Oriented programming. To study the features and control structures in Java.
2. Understand how to create new data types using Classes. Learn the different ways to create objects. Ability to understand polymorphism. Learn multidimensional arrays.
3. Learn how to reuse classes using Inheritance concept. Understand dynamic polymorphism. Learn to use interfaces and packages.
4. Understand the exception handling features of Java. Learn about multithreaded programs and how to synchronize threads.
5. Understand reading from and writing to files. Learn the importance of generic classes.

#### **Course Outcomes:**

1. Develop simple Java applications using control structures
2. Design user defined classes and create instances for them. Learn to invoke methods on those objects. Create programs to execute various methods of String and StringBuffer classes.
3. Develop applications to illustrate simple inheritance and multilevel inheritance. Simulate multiple inheritance with the help of interfaces.
4. Develop programs to illustrate synchronization between multiple threads. Also to handle exceptions caused by them.
5. Students will be able to build Java applications where they can read from and write to files. Design generic classes and test them.

## UNIT-I

**Principles of Object Oriented Programming:** A look at procedure oriented programming – characteristics, Object Oriented programming paradigm, Basic concepts of OOP, Benefits and application of OOP.

**Java Programming Fundamentals:** Features of Java, The Java Keywords, Identifiers in Java, The Java's Primitive Types, The Scope and Lifetime of Variables, Operators, Type conversion, Control structures – if, if – else and nested if, The if-else-if Ladder, The Switch Statement, Looping structures - for Loop, while Loop, The do-while Loop, Use of break and continue statements, Nested Loops and labelled loops. **(9 HRS)**

## UNIT -II

**Classes, Objects and Methods:** Class Fundamentals, Creating Objects – the new operator, Reference Variables and Assignment, Methods, Getters and Setters, Using Parameters – this Keyword.

**Constructors** – default, Parameterized Constructors, Garbage Collection and Finalize method. Controlling Access to Class Members, Passing Objects to Methods, Returning Objects, and Method Overloading, Overloaded Constructors, Static members, Introducing Nested and Inner Classes.

**Arrays and Strings:** Arrays in Java, Multidimensional Arrays, Using the Length Member, the For-Each Style for Loop. String class Fundamentals, The String Constructors, String class methods, StringBuffer and StringBuilder classes. **(10 HRS)**

## UNIT -III

**Inheritance:** Inheritance Basics, Member Access and Inheritance, Constructors and Inheritance, using super under different contexts, Different types of inheritance, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final keyword.

**Interfaces:** Interface Fundamentals, creating an Interface, implementing an Interface, Using Interface References, Implementing Multiple Interfaces. Package Fundamentals, Packages and Member Access, Importing Packages **(10 HRS)**

## UNIT -IV

**Exception Handling:** Exception Handling Fundamentals, try...catch block, using Multiple catch clauses, Nested try blocks, throwing an Exception, Throwable class, using throw, throws, finally, creating user defined exceptions and its use.

**Multithreaded Programming:** Multithreading fundamentals, Thread life cycle, creating a Thread - Thread Class and Runnable Interface, Creating Multiple Threads, Thread Priorities, Synchronization. **(9 HRS)**

## UNIT -V

**File Input/Output:** - Byte Streams and Character Streams, Reading and Writing Files, BufferedInputStream, BufferedOutputStream, ObjectOutputStream, ObjectInputStream

**Generics:** Introduction, defining a Generic class – general form, type parameters, generic method, bounded wildcards, Generics Inheritance, and Subtypes **(10 HRS)**

**Text Book:**

1. Herbert Schildt, “Java: The Complete Reference”, 8<sup>th</sup> Edition, Indian Edition, Oracle Press, McGraw- Hill.
2. Paul Deitel, Harvey Deitel, “Java How to Program”, 8<sup>th</sup> Edition, PHI

**Reference books:**

1. Cay Horstman, Gary Cornel, “Core Java: Fundamentals”, 8<sup>th</sup> Edition, 2010, Pearson Asia.
2. Jana, Debashish, “Java and Object Oriented Programming Paradigm”, PHI Learning
3. Joyce Farrell, “Java For Beginners”, Cengage Learning India
4. Rashmi Kanta Das, “Core Java for Beginners”, Vikas Publishing House Pvt. Ltd.
5. Khalid A. Mughal, Rolf W. Rasmussen, “A Programmer’s Guide to Java SCJP Certification”, 3<sup>rd</sup> Edition, Pearson
6. Walter Savitch, “Java An Introduction to Problem Solving and Programming”, Pearson
7. “Java 7 Programming Black Book”, Kogent Learning Solutions Inc., Dreamtech Press.

**PH 603.1 [E2] : ENTERPRISE COMPUTING WITH ADVANCED JAVA**

**Total No. of Lectures: 48**

**Total Marks: 100**

**[ L – T – P – S ]**

**No. of Lectures / Week: 4**

**Credits : 4**

**[ 3 – 1 – 0 – 2 ]**

**Course Objectives:**

1. To understand about EE platform, distributed multitier applications, web-business components, JEE clients and JEE containers.
2. To understand MVC Architecture, Learn Servlet
3. To learn JSP, differentiate between JSP and Servlets.
4. To learn about JDBC drivers, connect to a database and perform SQL queries.
5. To learn about EJB Container and Server, Differences between CMP and BMP

**Course Outcomes:**

1. To analyze various JEE components. To understand about distributed applications
2. To Develop server side programs using Servlets
3. To Develop server side web applications using JSP

4. Update and retrieve the data from the databases using Apache Derby
5. Create session and entity beans using EJB

### **UNIT - I**

**Overview of Java EE Architecture:** Java EE platform highlights, Java EE Application model, Distributed Multitier applications, Java EE components, Java EE Clients, Web Components, Business Components, Java EE containers, Web Services support. **(9HRS)**

### **UNIT - II**

**Servlets:** MVC Architecture, Introduction to Servlet, Features of Java Servlets, Servlet tasks, Servlet package, Life Cycle of Servlet, Get() and Post() methods, Reading form parameters, Client HTTP Request, Server HTTP Response, Cookies handling, Session Tracking **(9HRS)**

### **UNIT - III**

**Java Server Pages (JSP):** Java Server Pages (JSP) Introduction, Advantages of JSP, Differences between JSP and Servlets; JSP Architecture, JSP Page life cycle; Elements of JSP, JSP Directives, JSP Actions elements, JSP Form processing- GET() and POST() methods, JSP Cookies handling and Session tracking **(10 HRS)**

### **UNIT - IV**

**JDBC - JDBC Architecture-**Types of JDBC Drivers, The Connectivity Model, The java.sql package, Navigating the ResultSet object's contents, Manipulating records of a ResultSet object through User Interface, The JDBC Exception classes, Database Connectivity, Data Manipulation, Data navigation. **(10 HRS)**

### **UNIT V**

**EJB – EJB architecture and concepts, Responsibilities of EJB Container and Server, Classification of EJB, Anatomy of Session and Entity beans, Differences between CMP and BMP, Annotations, Dependency Injection** **(10 hrs)**

#### **Text books:**

- [1] Antonio Gonsalvis, "Beginning Java EE 7", Apress
- [2] Kogent Solutions Inc, "Java Server Programming Java EE 7 Black Book", Dreamtech Press

#### **Reference books:**

- [1] Joe Wigglesworth, Paula McMillan, "Java Programming: Advanced Topics", 3<sup>rd</sup> Edition, 2011, Cengage
- [2] Santhosh Kumar, "JDBC, Servlets, JSP Black Book", 2008, Wiley Dreamtech
- [3] George Reese, "Database Programming with JDBC and Java", 2<sup>nd</sup> Edition, O'Reilly
- [4] Subrahmanyam Allamaraju, Cedric Buest and others, "Professional Java Server Programming J2EE 1.3 Edition", APress
- [5] K Somasundaram, "Advanced Programming in Java2: Updated To J2SE6 with Swing, Servlet and RMI", Jaico Publishing House

### **PH 603.1 [E3]: ENTERPRISE COMPUTING: JAVA EE Frameworks**

<b>Total No. of Lectures: 48</b>	<b>Total Marks : 100</b>	<b>[ L – T – P – S ]</b>
<b>No. of Lectures / Week: 4</b>	<b>Credits : 4</b>	<b>[ 3 – 1 – 0 – 2 ]</b>

#### **Course Objectives:**

1. To understand about EE platform, MVC Architecture, Learn Servlet and JSP
2. To learn about different Tag Libraries in JSTL, about JDBC drivers, connect to a database and perform SQL queries.
3. To learn about EJB Container and Server, differences between CMP and BMP, learn about the features of JSF
4. To learn about Object-Relational Mapping (ORM) and features of Hibernate

#### **Course Outcomes:**

1. Developing server side web applications using Servlet, JSP,
2. Update and retrieve the data from the databases using Apache Derby. Develop web applications using various JSTL tags
3. Develop enterprise applications using EJB
4. Create simple web applications using JSF framework
5. Map Java classes to database tables using Hibernate

### **UNIT - I**

**Java EE:** Overview of Java EE Architecture; Framework and their advantages; MVC Framework Methodologies;



**Servlets:** Introduction to Servlet, Features of Java Servlets, Servlet tasks, Servlet package, Life Cycle of Servlet, Get() and Post() methods, Reading form parameters, Client HTTP Request, Server HTTP Response,

**Java Server Pages(JSP):** Java Server Pages (JSP) Introduction, Advantages of JSP, Differences between JSP and Servlets; JSP Architecture, JSP Page life cycle; Elements of JSP, JSP Directives, JSP Action Elements, JSP Form processing- GET() and POST() methods

**(10 hrs)**

## **UNIT - II**

**JSP Standard Tag Library (JSTL):** Expression language syntax, Core tag library, XML tag library, Formatting tag library, SQL Library

**JDBC:** Architecture, Driver types, Connections, Statement, ResultSet, Transactions, Exceptions, Batch Processing, CRUD operations using Servlets, JSP and JSTL

**(10 hrs)**

## **UNIT - III**

**EJB –** EJB architecture and concepts, Responsibilities of EJB Container and Server, Classification of EJB, Anatomy of Session and Entity beans, Differences between CMP and BMP, Annotations, Dependency Injection

**(9 hrs)**

## **UNIT - IV**

**JSF:** Overview, Benefits, JSF UI Component model, JSF Life Cycle, JSF Managed Beans, Page Navigation, Basic Tags, Facelet tags, Converter tags, Validator tags, Data tables and various operations

**(9 hrs)**

## **UNIT - V**

**Hibernate:** Origins of Hibernate and Object-Relational Mapping, Architecture of Hibernate, Hibernate Sessions, Persistent class, Mapping Files, Mapping Types, Hibernate annotations, Querying in Hibernate: HQL, Criteria Queries, Native SQL, Hibernate Caching. Batch Processing, Hibernate Interceptors

**(10 hrs)**

### **Text books:**

1. Joe Wigglesworth, Paula McMillan, "Java Programming: Advanced Topics", 3<sup>rd</sup> Edition, Cengage Learning International
2. Kogent Solutions Inc, "Java Server Programming Java EE 7 Black Book", 1<sup>st</sup> Edition, Dreamtech Press

**Reference books:**

- [1] Richard Reese, "EJB 3.1 Cookbook", 1<sup>st</sup> Edition, 2013, SPD/ Packt Publishers
- [2] Santhosh Kumar, "JDBC, Servlets and JSP Black Book", New Edition, Dreamtech
- [3] Antonio Gonsalvis, "Beginning Java EE 7", 1<sup>st</sup> Edition, Wiley Apress
- [4] Subrahmanyam Allamaraju, Cedric Buest and others, "Professional Java Server Programming J2EE 1.3 Edition", Apress
- [5] Dave Minter, Jeff Linwood "Beginning Hibernate From Novice to Professional", Apress

**PH 604.1 [E1]: WEB DESIGN with HTML 5, CSS, Java Script**

<b>Total No. of Lectures : 48</b>	<b>Total Marks : 100</b>	<b>[ L – T – P – S ]</b>
<b>No. of Lectures / Week : 4</b>	<b>Credits : 4</b>	<b>[ 3 – 1 – 0 – 2 ]</b>

**Learning Objectives:**

- Students will learn to develop web pages using HTML
- They will apply styles to the web pages using CSS
- They can bring dynamic behavior to the web pages using JavaScript

**Learning Outcomes:** At the end of the course, the

- Students will be able to develop websites and web based projects.
- Students can be employed on entry-level jobs of web development in software industry.
- Students will be able to develop interactive and dynamic webpages

**Unit – I**

HTML – Introduction, elements, attributes, headings, paragraphs, styles, formatting, quotations, comments, colors, links, images, image maps, tables, lists, blocks, classes, id, iframes.

HTML – Layout elements, computercode, entities, symbols

**(10 hrs)**

**Unit – II**

Html Form – form element, input types, input attributes, Html Canvas – draw line, circle, draw text, stroke text. HTML SVG – draw circle, rectangle, star. Play audio and video in Html.

**(9 hrs)**

### **Unit – III**

CSS – syntax, selectors, ways to insert CSS, backgrounds, borders, margins, padding, width, height, box-model, outline, fonts, links, lists, tables, display, position, overflow, float, inline-block.

**(10 hrs)**

### **Unit – IV**

CSS – navigation bars, dropdowns, forms. JavaScript – introduction, syntax, variables, operators, data types, functions, events, string manipulation, handling numbers, Arrays

**(10 hrs)**

### **Unit – V**

JavaScript – Date, switch, loops, break, continue, type conversion, regular expressions, this, classes, form validation.

**(9 hrs)**

#### **Text Books:**

- [1]. Jon Duckett, “Beginning HTML, XHTML, CSS, and JavaScript”, Wiley INDIA Edition
- [2]. Elizabeth Castro, Bruce Hyslop, “HTML and CSS”, 8<sup>th</sup> Edition, Pearson

#### **References:**

- [1]. Scott Duffy, “JavaScript A Beginners Guide”, Dreamtech Press
- [2]. Ian Pouncey, Richard York, “Beginning CSS Cascading Style Sheets for Web Design”, Wiley
- [3]. Chris Bates, “Web Programming Building Internet Applications”, 2<sup>nd</sup> Edition
- [4]. Rachel Andrew, “The CSS3 Anthology Take your sites to new Heights”, SPD
- [5]. Elizabeth Castro, “HTML for the World Wide Web”, 5<sup>th</sup> Edition, Peachpit Press
- [6]. Marco Casario & others, “HTML5 Solutions Essential Techniques for HTML5 Developers”
- [7]. Ben Frain, “Responsive Web Design with HTML5 & CSS3”, 2<sup>nd</sup> Edition, Packt Publishing
- [8]. Zak Ruvalcaba, Anne Boehm, “HTML5 and CSS3”, SPD

**PH 604.1[E2]: WEB PROGRAMMING WITH PHP and MYSQL**

<b>Total No. of Lectures: 48</b>	<b>Total Marks: 100</b>	<b>[L - T - P - S]</b>
<b>No. of Lectures / Week: 4</b>	<b>Credits: 4</b>	<b>[3 - 1 - 0 - 2]</b>

**Course Objectives:**

1. Students will learn to develop web pages using HTML
2. Learn to design HTML Forms. Understand CANVAS, SVG and how to play audio and video in web pages
3. Learn to apply styles to web pages using CSS.
4. Learn to use navigation bars, dropdowns in CSS. Understand the syntax of JavaScript
5. Understand the control structures in JavaScript. Learn classes and form validation

**Course Outcomes:**

1. Students will be able to develop static webpages using HTML elements
2. Students will be able to design HTML forms. Perform graphics design using CANVAS, SVG. They will be able to play audio and video in web pages
3. Ability to style HTML pages using CSS
4. Develop simple JavaScript programs
5. Ability to develop interactive web pages using JavaScript

**Unit I**

**HTML 5:** Internet and its applications, Browsers and web servers, Hyper Text Transfer Protocol (HTTP), Difference between HTML and HTML5, HTML tags and Formatting elements, HTML Lists – Ordered and Unordered, Creating Hyperlink and Anchor. HTML Page layout and Navigation – Tables and forms and media.

**CSS:** Introduction to CSS, CSS Rules, Pseudo classes and pseudo elements, Selectors, Precedence of Selectors; Cascading; Creating an Embedded Style Sheet; Creating an External Style Sheet; Adding Inline Styles; Using CSS box model for spacing, borders, and backgrounds; Using CSS for page layout; Dealing with fonts, text, images and hyperlinks; Using Lists as Hierarchical Navigation. Styling Forms with CSS. **(10 HRS)**

### **Unit II**

**Java Script:** Syntax, Client side v/s server side java scripting, Native objects, security. Operators – assignment, bitwise, string, ternary, unary and comma. Statements – control, looping, Debugger, Function, Var, Throw and try-catch-finally.

**Super Global Objects** - \$\_GET, \$\_POST, \$\_REQUEST, \$\_FILES, \$\_SESSION, \$\_COOKIE, \$\_SERVER and \$\_ENV. **(9 HRS)**

### **Unit III**

**Java Script Objects:** Methods to create Objects and defining methods, Array, String, Date, Math and Number. JS Browser objects – Windows, History, Navigator and Screen. Document Objects. JS form Validation. JS Cookies and Events.

**jQuery UI:** Overview of jQuery; Using jQuery Selectors and Filters; Selecting Single and Multiple Elements. Operating on Wrapped Sets; Method Chaining; Accessing Attributes of an Element; Adding and Removing Elements; Setting up JQueryUI; JQueryUI -Interactions, Widgets and Effects.

**(10 HRS)**

### **Unit IV**

**PHP Basics:** Introduction, Principles, Embedding PHP code inside HTML; Types and operators; Integer division, Generating Random numbers; Comparing values with the Spaceship operator; Condition and Looping statements; Arrays and Multi-dimensional arrays; Strings and String functions; Regular Expressions; Date and Time function; Mathematical functions; User-Defined Functions; Return type declarations with compound Types; Scalar Type Hinting; Scalar Parameter and Return Type declarations;

**Working with web forms;** PHP POST & GET form elements; Validating form data; Understanding magic quotes; Setting default values in forms; Handling Errors, Throwing and Catching Exceptions. Logging exceptions. **(10 hrs)**

### **Unit V**

**PHP Intermediate:** Classes and Objects Constructors and Destructors Access Specifiers, Static and final modifiers Inheritance and its types Polymorphism, Abstract and Final classes. Anonymous Classes, Generator Return expressions, Generator Delegation.

**Using MySQL:** Database Basics, Configuring PHP for Database Support, Managing Database Connections, PHP's Database & SQL APIs, Performing Queries, Processing Result Sets, PDO. PHP

cookie handling; PHP session handling; Reading & writing; files with PHP; Processing uploaded files; Retrieving uploaded files; Mail functions. **(9 hrs)**

**Textbook:**

1. Robin Nixon, "Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5", 5<sup>th</sup> Ed, 2018, O'Reilly Publishers.
2. Christopher Murphey, R Clark, "Beginning HTML 5 and CSS 3", 1<sup>st</sup> Ed, 2015, Wiley Apress.

**Reference Books:**

1. Steve Prettyman, "Learn PHP 7: Object Oriented Modular Programming using HTML5, CSS3, JavaScript, XML, JSON, and MySQL", 2016, Apress.
2. Vaibhav Vinayak, Hiren Jayantilal, Rajendra Patil, "Web programming with HTML5, JavaScript and PHP", 2017, SPD Pvt. Ltd.
3. Simon Sarris, "HTML5 Unleashed", 2014, Pearson Education.
4. Piotr Sikora, "Professional CSS3", 2016, Packt Publishing.
5. Joel Murach, Ray Harris, "Murach's PHP and MySQL", 2<sup>nd</sup> Ed, 2014, Mike Murach & Associates
6. Anirudh Prabhu, "Beginning CSS Preprocessors: With SASS and Less", 2015, Apress.
7. Eric Sarrion, "jQuery UI", 2014, Oreilly Publishers.

**PH 604.1[E3] WEB APPLICATION DEVELOPMENT USING PYTHON**

**Total No. of Lectures : 45                      Total Marks : 100                      [ L - T - P - S ]**

**No. of Lectures / Week : 3                      Credits : 4                      [ 3 - 0 - 2 - 2 ]**

**Course Objectives:** The objectives of the course is to

1. Describe the semantics of Python programming language and basic programming concepts
2. Discover the need for working with String and the process of structuring the data using List and Dictionary, to handle files and explore Object Oriented Programming along with the use of regular expressions
3. Handle Exceptions in Python and do CRUD operations.
4. Gain knowledge about various Libraries in Python and install and configure Django Framework
5. Learn to build web applications using Django framework

**Course Outcomes:**

At the end of this course students will be able

1. To define the structure and components of a Python program and to design and program Python applications.
2. To learn how to use lists, tuples, dictionaries in Python programs, to read and write files in Python, to design object oriented programs with Python classes.
3. To learn how to use exception handling in Python applications for error handling and do CRUD operations.
4. To use various libraries in Python and successfully configure and install Django framework
5. To develop a secure and robust web applications using Django framework

**Unit I**

**Introduction to Python:** Installation and Working with Python, Understanding Python variables, basic operators, blocks. Declaring and using Numeric data types: int, float, complex, using string data type and string operations, defining list and list slicing, Use of Tuple data type.

**Program Flow Control & Functions:** Conditional blocks using if, else and elif, for loops in, for loop using ranges, use of while loops in python, Loop manipulation using pass, continue, break and else. Organizing python codes using functions, organizing python projects into modules, importing own module as well as external modules, Understanding Packages.

**(10 hrs)**

## **Unit II**

**String, List, Dictionary & File handling:** Understanding in-built string methods, List manipulation, Dictionary manipulation. Programming using string, list and dictionary in-built functions. Reading files in python, writing files in python, Understanding read and write functions, manipulating file pointer using seek, Programming using file operations.

**OO Programming & Regular Expressions:** Concept of class, object and instances, constructor, class attributes and destructors, Inheritance, overlapping and overloading operators, Adding and retrieving dynamic attributes of classes. Pattern matching and searching, Power of pattern searching using regex in python, Pattern finding programs using regular expression.

**(10 hrs)**

## **Unit III**

**Exception Handling & Database Interaction:** Avoiding code break using exception handling, Safe guarding file operation using exception handling, Handling and helping developer with error code. SQL Database connection using python, Creating and searching tables, Reading, storing and updating information on database.

**(10 hrs)**

## **Unit IV**

**Web development using Python and Django Framework:** Introduction to Python Web Development, Libraries, Various Python Frameworks for Web Development and their features, Introduction to Django Framework, Django installation and configuration, Django project structure

**(9 Hrs)**

## **Unit V**

**Django Models and HTML forms:** Django Models , Registering the models with the admin site, generic class-based views, adding session framework, user authentication and permissions, Working with HTML forms in Django

**(9 hrs)**

**TEXT BOOK**

1. R. Nageswara Rao, "Core Python Programming", 2<sup>nd</sup> Edition, Dreamtech Press
2. Michel Anders, "Python 3 Web Development Beginner's Guide", Packt Publishing

#### REFERENCE BOOKS:

1. Eric Matthes, "Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming", No Starch Press; 2 edition
2. Zed A. Shaw, "Learn Python 3 the Hard Way", Addison Wesley, 2017
3. John M Zelle, "Python Programming: An Introduction to Computer Science", Ingram short title
4. Jeff Forcier, Paul Bissex, Wesley J Chun "Python Web Development with Django"
5. Sanjeev Jaiswal, Ratan Kumar "Learning Django Web Development", PACKT publishing

#### PH 605.1 P DBMS and Data Structures Lab

**Total No. of Practicals : 90**

**Total Marks : 100**

**[ L - T - P - S ]**

**No. of Labs / Week : 3**

**Credits : 2**

**[ 0 - 1 - 3 - 0 ]**

**Course Objectives:** The Lab will help to understand more on Data Structures and its implementation with C++ / Java. Data Structures provide the knowledge of how to store the data items effectively, which is the better storage structure in terms of time complexity & Space complexity. The Analysis of Algorithms, which is a part of this Lab mainly focus on the fact that how effective analysis of algorithms can be done

**DBMSE :** To develop database handling, data manipulation and data processing skills through SQL & PL/SQL, which will help students to develop data centric computer applications.

**Course Outcomes:** At the end of the course, the candidate will be able to learn

- To implement the data structures at the systems level
- Manage the Time and Space Complexity of the programmes
- Comprehend the art of programming and, the structure and meaning of basic Java programs,
- Design and build programs using problem-solving techniques such as top-down design,
- Modify, compile, debug, and execute Java programs,
- Understand how to create graphical interfaces and Java applets for a Web page
- Create databases using popular database management system products
- Solve problems by constructing database queries using the Structured Query Language
- Develop insights into future data management tool and technique trends
- Recommend and justify strategies for managing data security, privacy, audit/control, fraud detection, backup and recovery



**Data Structure Lab :**

- [1]. Write a C++ / Java program Implement Stack using array
- [2]. Write a C++ / Java program to implement Linear queue using array
- [3]. Write a C++ / Java program to implement circular queue using array
- [4]. Write a C++ /Java program Implement Stack using array
- [5]. Write a C++ / Java program to implement Linear queue using array
- [6]. Write a C++ / Java program to implement circular queue using array
- [7]. Write a C++ / Java program to convert infix to postfix using stack data structure
- [8]. Write a C++ / Java program to evaluate postfix string using stack data structure
- [9]. Write a C++ / Java program Implement single linear linked list
- [10]. Write a C++ / Java program to Implement Stack using linked list
- [11]. Write a C++ / Java program to Implement Queue using linked list
- [12]. Write a C++ / Java program to Implement circular single linked list
- [13]. Write a C++ / Java program to reverse the linked list
- [14]. Write a C++ / Java program to Program to add two polynomials using linked list
- [15]. Write a C++ / Java program to Implement double linear linked list
- [16]. Write a C++ / Java program to implement double circular linked list
- [17]. Create a binary search tree recursively and traverse through it using  
Inorder  
Preorder  
Postorder traversals
- [18]. Write a C++ / Java program to search an element in Binary Search tree
- [19]. Write a C++ / Java program to implement Merge Sort
- [20]. Write a C++ program to implement Heap Sort
- [21]. Write a C++ / Java program to implement Quick Sort
- [22]. Write a C++ / Java program to implement functions of Dictionary using Hashing.
- [23]. Write Java program to perform various operations, insertions and deletions on AVL trees
  
- [24]. Write Java program to perform various operations, insertions and deletions on 2-3 trees.
- [25]. Write a Java program to implement operations on binary heap.
- [26]. Write a Java program to implement Depth First Search for a graph nonrecursively.
- [27]. Write Java program to implement Breadth First Search for a graph nonrecursively.
- [28]. Write Java program to implement Prim's algorithm to generate a min-cost spanning tree.
- [29]. Write Java program implement Krushkal's algorithm to generate min-cost spanning tree.
- [30]. Write a Java program to implement Dijkstra's algorithm to find shortest path in graph.
- [31]. Write a Java program implement pattern matching using Boyer-Moore algorithm.
- [32]. Write a Java program implement Knuth-Morris-Pratt algorithm for pattern matching.

**Analysis of Algorithms Lab :**

- [33]. Write a program in "C/C++ language" for Prim's algorithm . Interpret your result
- [34]. Write a program in "C/C++ language" for Kruskal's algorithm. Interpret your result
- [35]. Write a program in "C/C++ language" for depth and breadth first search in graphs?  
Interpret your result.
- [36]. Write a program in "C/C++ language" for KANPSACK problem using dynamic programming and Interpret your result.

- [37]. Write a program in “C/C++ language” for KANPSACK problem using greedy programming and Interpret your result.
- [38]. Write a program in “C/C++ language” for finding maximum and minimum numbers .use divide and conquer and Interpret your result.
- [39]. Write a program in “C/C++ language” for sorting numbers using quick sort .use divide and conquer and Interpret your result.
- [40]. Write a program in “C/C++ language” for sorting numbers using merge sort. Use divide and conquer and Interpret your result.
- [41]. Write a program in “C/C++ language” for multiply two matrixes using strassens matrix multiplication , use divide and conquer and Interpret your result.
- [42]. Write a program in “C/C++ language” for single source shortest problem using greedy method..

#### **DBMS Lab Exercises**

- [1]. Overview of RDBMS, Introduction to Postgre SQL
- [2]. Start, stop and restart PostgreSQL database
- [3]. Introduction of SQL- DDL, DML, DTL, Basic Data Types
- [4]. Create Database, Select Database, Drop Database
- [5]. Create Table, Drop Table, Insert Query, Select Query
- [6]. Operators, Expressions, Where Clause, AND & OR Clauses
- [7]. Update Query, Delete Query, Like Clause, Limit Clause
- [8]. Order By, Group By, With Clause, Having Clause, Distinct Keyword
- [9]. Constraints, Joins, Unions Clause, NULL Values, Alias Syntax
- [10]. Alter Command, Truncate Table, Transactions Locks, Sub Queries, Autoincrement, Privileges
- [11]. Functions: Date & Time,String Functions, Aggregate Functions
- [12]. Postgre SQL Interface: C/C++ / Java/PHP/Python
- [13]. Synonym – introduction, Create, synonym as alias for table & view, drop
- [14]. Sequence- Introduction, alter sequence, drop
- [15]. View- Introduction, types,alter , drop
- [16]. Index - Introduction,types, alter, drop
- [17]. Primary introduction to DBA-User create, alter User,Grant,Revoke
- [18]. Report writer using SQL Title, Btitle, skip, pause, column, SQL, Break on, computer sum
- [19]. PL/SQL - Introduction of PL/SQL,Advantages of PL/SQL,Support of SQL, Executing PL/SQL
- [20]. PL/SQL character set & Data Types
- [21]. PL/SQL blocks Attribute % type, %rowtype, operators
- [22]. Control structure Condition – if Interactive- loop, for, while Sequential – goto
- [23]. Procedures- Definition, creating, Parameter
- [24]. Function-Definition, creating, Parameter
- [25]. Cursor- types
- [26]. Database Triggers- Definition, syntax, parts of triggers ,Types of triggers, enabling &disabling triggers

### **PS 606.1 [E1] STATISTICAL TECHNIQUES FOR COMPUTING**

**Total no of lectures: 48**

**Total marks : 100**

**[L – T – P –S]**

**No of lectures / week: 4**

**Credits: 3**

**[3 - 1 - 1 - 1]**

**Course Objectives:**

1. To learn the basic of data presentation with appropriate visualization to have a better perspective of the data.
2. To understand the purposes of measures of central tendency, how to calculate and interpret them.
3. To determine the reliability of an average and compare the variability of two or more series.
4. To help understand and explain relationships among variables; they can also be used to predict actual outcomes and learn how to derive multiple linear regression models.
5. To identify the strength and direction of a linear relationship between two variables and using regression to predict how much a dependent variable changes based on adjustments to an independent variable

**Course outcomes:** On completion of the course the students will be able to

1. Select appropriate statistical techniques for summarizing and displaying data
2. Analyze and draw inferences from data using appropriate statistical methods.
3. Analyze the dispersion in the data and draw inference.
4. Understand the concept of a frequency distribution for sample data, and be able to summarize the distribution by diagrams and statistics.
5. Understand correlation and regression, and be able to make predictions and understand their limitations.

**UNIT I**

**Classification, tabulation and graphical representation of data:** types of data, measurement of data, Classification of data, preparation of tables, presentation of data, Data summarization, frequency distribution, Relative frequency, cumulative frequency,

**Data Visualization:** Tables, Graphs, Charts, Histograms: when do we use them and the interpretation, bar charts: need and importance, simple bar, composite bar, double bar charts, Pie charts, stem and leaf display, scatter plot and Storytelling with Data.

**10hrs.**

**UNIT II**

**Measure of central tendency:** need, importance and Characteristics, Mean: Arithmetic mean, Geometric mean, Harmonic mean, Weighted mean, Combined mean, Median, Mode of grouped and ungrouped data, quartiles, deciles, percentiles, merits and demerits, properties and applications.

**10hrs.**

**UNIT III**

**Measure of Dispersion:** need, importance and properties, range, interquartile deviation, quartile deviation, mean deviation, variance, standard deviation, coefficient of variation, combined variance of grouped and ungrouped data, Identifying outliers: boxplot, merits and demerits.

**9hrs.**

#### **UNIT IV**

**Regression:** scatter diagram and interpretation, Simple linear regression model definition and assumptions, regression line  $x$  on  $y$  and  $y$  on  $x$ , regression coefficients, method of least squares to fit a regression line, properties of regression coefficient, multiple regression (2 independent variables), applications.

**9hrs.**

#### **UNIT V**

**Correlation:** Graphical representation and interpretation, correlation coefficient, correlation of bivariate data, relationship between correlation coefficient and regression coefficients, rank correlation, and problem of tied observations.

**Analysis of categorical data:** two-way Contingency table, odd's ratio, measure of association: types of association, Yule's Coefficient of Association, Coefficient of Colligation, test of independence: Chi Square test.

**10hrs.**

#### **Text books:**

1. Mathematical Statistics and data Analysis, Rice, John A, Cengage learning, 2014
2. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, John Wiley & Sons, Inc, 2011

#### **Reference books:**

1. Probability & Statistics for Engineers & Scientists, N Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, 9<sup>th</sup> edition, Prentice Hall, 2011.
2. A Modern Introduction to Probability and Statistics Understanding Why and How, F.M. Dekking C. Kraaikamp H.P. Lopuhaa, L.E. Meester, Springer, 2005.
3. Introduction to the Statistical Analysis of Categorical Data, Erling B. Andersen, Springer, 1997.

## PS 606.1 [E2] PROBABILITY AND STOCHASTIC PROCESS

Total no of lectures: 48

Total marks: 100

[L – T – P –S]

No of lectures / week : 4

Credits: 4

[3 – 1 – 1 – 1]

### Course Objectives:

1. Introduce the basic concepts of probability and their importance.
2. Understand the principles of probability and the various concept related to inverse probability.
3. To be gain knowledge of random variables and their use.
4. To understand the difference between discrete and continuous distributions like Binomial, Poisson, Geometric, Normal and Exponential probability distributions and their applications.
5. Understand the concept of Markov chains and be able to classify the Markov chains.

**Course outcomes:** On completion of the course the students will be able to

1. Calculate the probabilities and identify the various types.
2. Apply inverse probability concepts and solve problems.
3. express the features of discrete random variables and formulate the *distribution* functions.
4. Identify the various distributions and apply them.
5. Classify a stochastic process according to whether it operates in continuous or discrete time and whether it has a continuous or a discrete state space. To Understand the concept of Markov chains and study the transition diagram.

### UNIT I

**Introduction to basic concepts:** Elements of set theory: subset, proper subset, Cartesian product and its properties, Venn diagram and operation on sets, permutations and combinations. Trial, random experiment, sample space, random sampling with and without replacement, Event- types, independent events, dependent events, mutually exclusive events, equally likely events, Birthday paradox

**9hrs**

### UNIT II

**Probability:** Mathematical, statistical and axiomatic definition, addition theorem of probability, multiplicative(compound) theorem of probability, odds in favor and odds against, conditional probability, De-Morgan's law, Results of probability and their proofs, Bayes' theorem, Applications.

**9hrs**

### UNIT III

**Random variables:** one Dimensional random variables, discrete and continuous, probability mass function, probability density functions, distribution function. Expectation: properties, mean, variance. Two dimensional random variable: joint density and mass function, joint distribution

function, marginal distribution, conditional distribution, independence of random variables.

**9hrs**

#### **UNIT IV**

**Probability distributions:** Discrete distribution and their properties, Bernoulli, Binomial: mean, variance, approximation to Poisson distribution, fitting of binomial distribution. Poisson: mean and variance, approximation to Normal distribution, fitting of Poisson distribution. Geometric: mean and variance, memory less property and its application, Continuous distribution: exponential mean, variance distribution function, fitting of exponential distribution, Normal: mean, variance distribution function, fitting of normal distribution.

**11hrs**

#### **UNIT V**

**Stochastic process:** introduction, classification of stochastic process based on state and parameter space, Markov chains, transition probability and matrix, Gambler ruin, Brand switching, Chapman –Kolmogorov equations, Period of a state, classification of states and chains: transient and persistent, positive recurrent and null recurrent, reducible and irreducible, ergodic, regular and stationary distribution.

**10hrs**

#### **Text books:**

1. Probability and Statistics for Computer Scientists, Michael Baron, CRC press, 2014.
2. Applied Probability and Stochastic Processes, Frank Beichelt, CRC press, 2016.
3. Fundamentals of Probability with Stochastic processes, Saeed Ghahramani, CRC press, 2015.

#### **Reference books:**

1. Probability and statistics, Degroot, Morris H;Schervish, Mark J, Pearson Education,2017.
2. Probability and statistics, Kumar, Mukesh; Singh, A P; Kumar, Ashok; Chauhan, Anand, 2018
3. Probability and statistics with reliability queuing and computer science applications, Trivedi, Kishor S, Wiley India Pvt Ltd, 2014.

## PS 606.1 [E3] OPERATIONS RESERACH

**Total no of lectures: 48**

**Total marks: 100**

**[L – T – P –S]**

**No of lectures / week: 4**

**Credits: 4**

**[3 – 1 – 0 – 1]**

### **Course Objectives:**

1. Introduce the basic concepts of probability and their importance.
2. Understand the principles of probability and the various concept related to inverse probability.
3. To be gain knowledge of random variables and their use.
4. To understand the difference between discrete and continuous distributions like Binomial, Poisson, Geometric, Normal and Exponential probability distributions and their applications.
5. Understand the concept of Markov chains and be able to classify the Markov chains.

### **Course outcomes:**

On completion of the course the students will be able to

1. Calculate the probabilities and identify the various types.
2. Apply inverse probability concepts and solve problems.
3. express the features of discrete random variables and formulate the *distribution* functions.
4. Identify the various distributions and apply them.
5. Classify a stochastic process according to whether it operates in continuous or discrete time and whether it has a continuous or a discrete state space.
6. To Understand the concept of Markov chains and study the transition diagram.

## **UNIT I**

**Introduction:** Nature and Significance of OR in Decision Making, definitions, phases of operations research, Scientific Methods in Operations Research, Models in Operations Research, Application Areas of OR in Management.

**Linear programming:** Formulation, Assumptions, Standard and matrix form, Graphical solution, Simplex method (Maximization case) – unique solution, multiple solution and unbounded solution, Use of case studies for Illustration.

**10hrs**

## UNIT II

**Transportation Problem:** Concepts, Formulation of Transportation Problem, Mathematical form, LPP form, Balanced and Unbalanced Problems, Minimization and Maximization Problems, North -West Corner Rule, matrix minima method, row minima method, column minima method, Vogel's Approximation method (VAM) initial solution, MODI method for optimality, unique solution, multiple solutions, unbalanced problems, prohibited routes, degeneracy – initial and intermediate stage, maximization.

**10hrs**

## UNIT III

**Assignment Problem:** Concepts, Mathematical Formulation of an Assignment Problem Mathematical form, LPP form, special case of Transportation problem, The Assignment Algorithm Hungarian method – unique solution, multiple solutions, Balanced and Unbalanced Assignment Problems, restricted assignment problems, case of maximization. Travelling Salesman problem as an Assignment Problem

**10hrs**

## UNIT IV

**Decision theory:** Decision making process, types of decision making, One stage decision making problems, payoff and regret tables. Decision making under uncertainty – Laplace principle, maximin or Minimax principle, Maximax or Minimin principle, Hurwicz Principle. Decision making under risk –expected monetary value, expected monetary loss, expected value of perfect information, posterior probabilities and Bayesian analysis. Multistage decision making problems- decision tree, Illustrations.

**9hrs**

## UNIT V

**Job sequencing:** Sequencing problem, Johnson's Algorithm for processing n jobs through 2 machines, Algorithm for processing n jobs through 3 or more machines, Processing n jobs through m machines.

**Queuing theory:** Introduction, components, structure, characteristics, measures of performance, Kendall 's notation, classification of queuing models: MM1: FCFS /  $\infty$  /  $\infty$ , M/M/1: FCFS/N/ $\infty$ , MMC: FCFS/ $\infty$ / $\infty$ , Applications to real life problems.

**9hrs**

### Text books:

1. Operations research, Mote, Vasant Lakshman; Madhavan, T, Wiley Pvt Ltd, 2016
2. Operations research an introduction, Handy A Taha ,Pearson education, 10<sup>th</sup> edition, 2019.

### Reference Books:



- 1) Operations Research Theory and Applications, J K Sharma, Macmillan publishers, 5<sup>th</sup> edition, 2013.
- 2) Optimization techniques in operations research, Gupta C B, I K international publishing house,
- 3) Operations Research, Prem Kumar Gupta, D S Hira , S. Chand Publishing, Year: 2014.

### **PS 607. 1 P Java & Web Development Lab**

#### **Course Objectives:**

- ☐Implement Strings, Vectors, Interfaces, Packages and Threads Handling in Java.
- ☐Implement Java Applets, AWT, Swings, Servlet.
- ☐Learn and Understand the Implementation of GUI Application, Web Applications, N-Tier Architecture.
- ☐Develop the Understandings of File Handling, Database Connectivity, Java Servlets and Web Application in Java.
- ☐Learn and Understand the Implementation of GUI Application, Web Applications, N-Tier Architecture.

#### **Course Outcomes**

1. Use the Java SDK & JRE Environment to Create, Debug and Run Simple Java Programs.
2. Analyze the Problem, Identify the Requirements & Features of Applications and Utilities
3. Implement Object Oriented Concepts for Solving Real Problem.
4. Develop Small Applications, Utilities, and Web Applications Using AWT, Event and Layout Manager

#### **Program list**

1. Write a Program in Java to Calculate the Simple Interest.
2. Write a Program in Java to Calculate Sum of Two Numbers Input from Command Line Argument.
3. Write a Program in Java to Calculate Area of Circle Using Scanner Class.
4. Write a Program in Java to Calculate Square Root of a Number.
5. Write a Program in Java to Display Name, Age, Calendar and Salary of a Person Input from the Keyboard.

6. Write a Program in Java to Display Grading of Student When His Percentage is Input from Keyboard.
7. Write a Program in Java to Display Odd Number from 1 to 100.
9. write a java program to add 2 vectors
- 10 Write a Program in Java to Calculate the Factorial of a Number.
- 11 Write a Program in Java to Calculate nPr.
- 12 Write a Program in Java to Calculate the Factorial of a Number.
13. Write a Program in Java to Determine Whether a Number Input from Keyboard is Prime Number Or Not.
14. Write a Program in Java to Display the Prime Numbers from 1 to 500 Using Function.
15. Write a Program in Java to Show Accessing Class Members and use a Dot(.).
16. Write a Program in Java to Show Multilevel Inheritance.
17. Write a Program in Java to Show Single Inheritance.
18. Write a Program in Java to Concatenate Two Strings Without Using Library Function.
19. Write a Program in Java to Make First Alphabet Capital of Each Word in a String.
20. Write a Program in Java to Get the Last Index of Any Given Character in a String.
21. Write a Program in Java to Reverse Words of a String.
22. Write a Program in Java to Find Occurrences of Each Character in a String. 23. Java Program to Get String and Count Number of Words in Provided String. 24. Write a Program in Java to Check Given String is Palindrome String Or Not in Java.
25. Write a Program in Java to Reverse Each Word of Given String. 26. Write a Program in Java to Get Sub String from a Given String.
27. Java Program to Convert String to Lowercase and Uppercase.
28. Create a Java Applet and Show the use of Drawstring() Function.
29. Create a Java Applet to Show How to use Various Methods of Applet Class and Graphics Class in a Java Applet.
30. Write a Program in Java to Show the use of Interface.
31. Create a Java GUI Application Using Labels and Textfields.
- 32 Create a Java GUI Application Using Radiobuttons.
33. Create a Java GUI Application Using Checkboxes.
34. Create a Java GUI Application Using Comboboxes.

35. Create a Java GUI Application Using Listboxes.
36. Create Two Html Pages with Links to Navigate from One Page to Other Page.
37. Write a Servlet to Display Current Date and Time of Server on Client : Date Servlet
38. Write a Servlet to Display Natural Numbers from 1 to 100 : Numberservlet
39. Create a JSP to Display Natural Numbers from 1 to 50 :Number.Jsp and Write Down the Process of Running It Step by Step.
40. Create a JSP to Display Current Date and Time of Server onClient :Date.JSP and Write Down the Process of Running it Step by Step

### **PS 608.1 Business Communication/Entrepreneurship**

<b>Total no of lectures: 36</b>	<b>Total marks: 100</b>	<b>[L – T – P –S]</b>
<b>No of lectures / week: 4</b>	<b>Credits: 3</b>	<b>[3 – 1 – 0 – 1]</b>

**About the Course:** This course is the first of a two-part entrepreneurship development curriculum from Wadhwani Foundation. It is aimed at empowering you with an entrepreneurial mindset and business skills to enhance your job prospects, help you develop intrapreneurship skills, and get you started on the entrepreneurship journey. You will also learn about the risks and rewards in choosing entrepreneurship as a career option.

This is not a theoretical course – you will actually start your venture and build it as you progress through this course. The course follows the “Watch – Think – Do – Explore – Collaborate” pedagogy in a highly experiential learning format. Every lesson has one or more videos/animations to help you understand and master key entrepreneurship concepts. The videos have been interspersed with knowledge check questions at strategic points – these will help you reflect on the concepts presented, and internalize them. You also get to experience entrepreneurship through the activities and assignments provided throughout the course. Additionally, if you want to dig deeper and learn more, read through the reference materials provided.

You will start this course by discovering yourself and your entrepreneurial style. You will then identify a problem “worth” solving, delve into the problem to understand it better through Design Thinking principles, generate ideas to solve that problem using Brainstorming, and go on to develop your Business Model.

1. **Self-Discovery :** Finding your flow, Effectuation, Principles of Effectuation, Class Activity – Take stock of your means; Case Study on Effectuation, Entrepreneurial Style –

Entrepreneurial Style Introduction, Different Entrepreneurial Styles, Class Activity – Entrepreneurial Style Quiz; Master Class – Team Formation, Student Handout – Form Teams and Assign Roles – Process Flow, Form Teams and assign roles – Framework. Case Study – Entrepreneurial Journey

2. **Opportunity Discovery** – Identify Problems worth Solving, Class Activity – Identifying Problems worth Solving; Design Thinking – Introduction to Design Thinking, Value of Design Thinking, Design Thinking Process, Student Activity – Applying Design Thinking, Case studies; Look for Solutions – Brainstorming Concept, Class Activity – Brain Storming. Case Studies
3. **Customer and Solution** – Customers and Markets; Customer Vs Consumer, Types of Start ups, Class Activity – Customer Vs Consumer; Market Types; Identify your Customer Segments and Niche – Segmentation and Targeting, Identify your customer segment, Niche Marketing, Class Activity – Find your Niche; Identify Jobs, Pains and Gains and Early Adopters – Value Proposition Design, Introduction and Concept; Customer Segment Concept and Example; Class Activity – Customer Jobs, Pains and Gains; Identify your Early adopters, Creating Personas. Craft your Value Proposition – Value Proposition and assessing Fit, Value Proposition Examples, Student Activity – Craft my value proposition; Outcome driven innovation – Class activity on Outcome driven Innovation; Present your value proposition Canvas (VPC). Case studies.
4. **Business Model** – Business Models, Tesla Case study, Lean Approach, Identifying the problem, solution and Customer segments to the venture; Observe / Research Business Models; Capture your Business Model; Business Models, Sketching the Lean Canvas; Lean Canvas Template, Case Studies – Airbnb, Facebook, Starbucks; Risks and Assumptions, Tips to prioritize the Risks and Assumptions, Identifying the Riskiest Assumptions; Pitch your Business Model; Case Studies.
5. **Validation** – Blue Ocean Strategy, Blue Ocean Strategy Example; Plot the strategy Canvas, Build your Solution Demo and conduct Solution Interviews; Class Activity – Build your Solution Demo Mock ups; Problem Solution Fit; Building an MVP -MVP How to build a start up, Difference between Solution Demo and MVP, Class Activity – Identify your MVP and Build it; Tips for prototyping and MVP, Class Activity – Compile your results from MVP interviews; Present your MVP
6. **Money** – Cost Structure, Basic Financial Template, Class Activity – Estimate your Costs; Pricing; Revenue Streams; Class Activity – Identify your Secondary Revenue Stream, Estimate your revenue and Price; Profitability Checks; Bootstrapping – Sources and Uses of Funds; Case Studies on Bootstrap Finance; Student activity – Identify Sources and use of

- funds; Practice Pitching; Case Studies – How to Bootstrap and get initial funding for the company; Best Practices for pitching with investors.
7. **Team** - Shared Leadership, Adopting Shared Leadership Student Activity – Adopting Shared Leadership, Shared Leadership and Team Building; Hiring & Fitment, Team Role and Responsibilities – Identifying Co-Founders and Hiring a Team; Student Activity – Identify Job roles for Hiring. Practice Pitching; Collaboration Tools and Techniques.
  8. **Marketing Sales** - Positioning and Branding – What is Branding, Create Brand Strategy, Creating your Positioning statement; Channels, Selecting your Channels, Sales Planning – Why Customers won't Buy? -Introduction, Switching Costs, Psychological Biases, How Customers Buy – Patterns; Customer Acquisition, Make your Sales Plan and Sales Pitch; Selling Skills – One to One Selling Skills,
  9. **Support** – Project Management, Project Tracking, List of Required Registrations, Compliance Checklist, Interviewing Entrepreneurs and Business Owners; Why Compliance; Types of Organizations and setting up; Business Structures and Legal Entities; Different Legal Entities- A comparative note; Getting Started with your Venture – How to get help to get started. Case Studies

#### **TextBook:**

- [1]. Robert D. Hisrich, Mathew J. Manimala, Michael P. Peters, Dean A. Shepherd, "Entrepreneurship, 6<sup>th</sup> Edition, 2013, Tata McGraw Hill Publishers
- [2]. Rajeev Roy, "Entrepreneurship", 2<sup>nd</sup> Edition, 2011, Oxford University Press
- [3]. C B Gupta, N P Srinivasan, "Entrepreneurship Development in India", 1<sup>st</sup> Ed, 2013, Sultan Chand

#### **Reference Books:**

- [1]. Bruce R Barrianger, "Entrepreneurship: Successfully Launching New Ventures", 3<sup>rd</sup> Ed, 2011, Pearson
- [2]. Arya Kumar, "Entrepreneurship: Creating and Leading an Entrepreneurial Organization", 2012, Pearson
- [3]. D F Kuratko, Rao, "Entrepreneurship: A South Asian Perspective", 1<sup>st</sup> Ed, 2012, Cengage Learning
- [4]. N V R Naidu, T Krishana Rao, "Management and Entrepreneurship", 1<sup>st</sup> Ed, 2008, IK International
- [5]. Jack m Kaplan, "Patterns of Entrepreneurship", 1<sup>st</sup> Edition, 2007, Wiley India
- [6]. Madhurima Lal, shikha Shai, "Entrepreneurship", 2<sup>nd</sup> Ed, 2008, Excel books

## **II Semester**

### **PH 601.2 [E1] CLOUD COMPUTING WITH AMAZON WEB SERVICES**

**Total No. of Lectures : 48                      Total Marks : 100                      [ L – T – P – S ]**

**No. of Lectures / Week : 4                      Credits : 4                      [ 3 – 1 – 0 – 2 ]**

#### **Course Objectives**

The objective of this course is to:

1. To introduce the broad perceptive of cloud architecture and model
2. To understand the design of cloud Services and the trusted cloud Computing system
3. To understand applications of cloud
4. To know how to design cloud applications
5. To know how to use AWS services in cloud applications

#### **COURSE OUTCOMES:**

On the successful completion of the course, students will be able to

1. Describe the key technologies, architecture, strengths, limitations and applications of cloud computing
2. Explain the types and service models of cloud.
3. Understand security implications in cloud computing
4. Design Cloud Services and Set a private cloud
5. Create and automate infrastructure to design cost-effective, highly available applications
6. Integrate AWS services with your application to meet and exceed non-functional requirements

#### **Unit 1**

Introduction ,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, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies.

Virtualization : Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology **(10 hrs)**

### **Unit II**

Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects, Principles of Parallel and Distributed Computing- Elements of parallel computing, Elements of distributed computing, Technologies for distributed computing **(10 hrs)**

### **Unit III**

Energy efficiency in clouds . Energy-efficient and green cloud computing architecture, Market-based management of clouds, Market-oriented cloud computing, Reference model, A reference model for MOCC , Technologies and initiatives supporting MOCC , Federated clouds/InterCloud-Characterization, Cloud federation stack, Aspects of interest, Technologies for cloud federations, Third-party cloud services. Cloud Applications- Scientific applications(Healthcare, Biology, Geoscience), Business and consumer applications **(10 hrs)**

### **Unit IV**

Designing Cloud Applications: Introducing cloud-based multitier architecture , Designing for multi-tenancy , Understanding cloud applications design principles Understanding emerging cloud-based application architectures , Estimating your cloud computing costs , A typical e-commerce web application, AWS Components, Managing costs on AWS Cloud, Application development environments **(9 hrs)**

### **Unit V**

Scalability: Objectives, Designing scalable application architecture, Leveraging AWS infrastructure services for scalability, architecture –increasing loads, Event handling at scale . High Availability: Objectives, Nature of failures, AWS High availability architecture, Security – Security objectives, Best practices in implementing AWS security **(9 hrs)**

### **Text Books**

- [1]. Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, “Mastering Cloud Computing”, 1<sup>st</sup> Edition, 2015, Tata Mcgraw Hill Publishing Co Ltd
- [2]. Aurobindo Sarkar, Amith Shah “Learning AWS” Second edition 2018, Packt Publishing Ltd

### **Reference Books**

- [1]. Atul V. Mistry ,”Expert AWS Development”, Packt Publishing Ltd ,First edition 2018
- [2]. Kris Jamsa, “Cloud Computing”, 1<sup>st</sup> Edition, 2013, Jones & Bartlett Publishers
- [3]. Anthony T Velte, “Cloud Computing: A practical Approach”, 1<sup>st</sup> Ed, 2010, Tata McGraw Hill.

- [4]. Fern Halper, Kaufman, Bloor Robin, Hurwit, "Cloud Computing for Dummies", 1<sup>st</sup> Ed, 2010, Wiley
- [5]. Joshy Joseph , Craig Fellenstein, "Grid Computing", 4<sup>th</sup> Ed, 2013, PearsonAsia
- [6]. Ahmar Abbas, "Grid Computing: A Practical Guide to technology and Applications", 2010, CRC Press
- [7]. Kaittwang Geoffrey C.Fox, Jack J Dongrra, "Distributed and Cloud Computing", 1<sup>st</sup> Ed, 2012, Elsevier

### **PH 601.2 [E2] Grid and Cluster Computing**

<b>Total No. of Lectures : 48</b>	<b>Total Marks : 100</b>	<b>[ L – T – P – S ]</b>
<b>No. of Lectures / Week : 4</b>	<b>Credits : 4</b>	<b>[ 3 – 1 – 0 – 2 ]</b>

#### **Course objectives:**

1. To learn the characteristics of cluster and grid computing.
2. To learn the design principles of grid computing ;
3. To learn security mechanisms in grid computing applications
4. To learn *Job scheduling and resource management*
5. To understand data management in grid computing applications

#### **Course Outcomes:**

At the end of the course students are able to

1. understand fundamentals of cluster computing and Environments
2. To enable resource sharing across networks.
3. To integrate heterogeneous computing systems and data resources with the aim of providing a global computing space.
4. To manage and schedule the resources in grid environments.
5. To know the standards and protocols used.
6. To Know the middleware in grid computing.
7. To understand the latest advances in the field of computation to optimize the utilization of resources.

### **UNIT 1**



Overview of Cluster Computing, Cluster Computer and its Architecture, Clusters Classifications, Components for Clusters, Cluster Middleware and SSI, Resource Management and Scheduling, Programming, Environments and Tools, Cluster Applications, Cluster Systems

**(9 hrs)**

## **UNIT II**

Introduction to grid computing, cluster computing, parallel computing and high performance computing. **Types of grids** :: departmental grids, enterprise grids, extraprise grids, global grids, compute grids, data grids and utility grids. **Grid environment** : standard environment, local implementation, remote implementation, **Layered grid architecture**, **OGSA** : service instance semantics, service data semantics, OGSA porttypes future discussion on OGSA, **WSRF**:: Introduction to WSRF, the WS-Resource concept, the implied WS-Resource pattern, Grid computing challenges, Grid applications characteristics

**(10 Hrs)**

## **UNIT III**

**Grid Monitoring Architecture (GMA)** :: consumer – consumer steps, the directory service – functions supported by directory service, producers – producer steps and monitoring data- time related data, information flow data and monitoring categories

### **An Overview of Grid Monitoring Systems – GridICE –**

overview, general architecture, scalability and fault tolerance, monitoring and extensibility, data request and presentation, searching and standards, security, software implementation

**JAMM** –overview, general architecture, scalability and fault tolerance, monitoring and extensibility, data request and presentation, searching and standards, security, software implementation

**MDS3** – overview, general architecture, scalability and fault tolerance, monitoring and extensibility, data request and presentation, searching and standards, security, software implementation

**Network Weather Service** –overview, general architecture, scalability and fault tolerance, monitoring and extensibility, data request and presentation, searching and standards, security, software implementation

**R GMA** – overview, general architecture, scalability and fault tolerance, monitoring and extensibility, data request and presentation, searching and standards, security, software implementation

**Ganglia and GridMon**: overview, general architecture, scalability and fault tolerance, monitoring and extensibility, data request and presentation, searching and standards, security, software implementation

**Hawkeye:** overview, general architecture, scalability and fault tolerance, monitoring and extensibility, data request and presentation, searching and standards, security , software implementation

**Network weather service:** overview, general architecture, scalability and fault tolerance, monitoring and extensibility, data request and presentation, searching and standards, security, software implementation **(10 Hrs)**

#### UNIT IV

**Security primer,** - confidentiality, integrity, availability, authentication, authorization, assurance, non repudiation, auditability , trust , reliability and privacy  
cryptography :: introduction, symmetric cryptosystems, asymmetric cryptosystems, digital signatures, public key certificate, certification authority , firewalls,

##### **Grid security**

The grid security infrastructure (GSI) – Gsi, introduction, mutual authentication through digital certificates , credential delegation and single sign on

Authentication modes in GSI:: Server side authorization, client side authorization

**Job scheduling and resource management:** Scheduling Paradigms - centralized scheduling, Distributed scheduling and Hierarchical scheduling. How scheduling works – Resource discovery , resource selection, schedule generation, job execution

**Job scheduling and resource management:** A review of condor, Condor platforms, the architecture of condor pool, Daemons in a condor pool, job life cycle in condor, security management in condor , job management in condor , resource management in condor, job scheduling policy in condor , resource matching in condor, condor support in globus. Condor G review of SunGridEngine.;The SGE architecture, Daemons in an cluster, job management in SGE, job runtime environments in SGE, jonb selection and resource matching in SGE

Review of The Portable Batch System: The PBS architecture, Daemons in PBS, job selection and resource matching in PBS

**Job scheduling and resource management:** Grid scheduling with QOS :: apples, scheduling in GrADS, Nimrod/G, scheduling with heuristics **(10 Hrs)**

#### UNIT V

**Data Management** –Categories and Origins of structured Data, Data management Challenges, Architectural Approaches – Collective Data Management Services- Federation Services

List of globally available grid Middlewares – Case Studies-Current version of Globus

Toolkit and gLite - Architecture, Components and Features. **(09 Hrs)**

**Text Book:**

[1] Maozhen Li , Mark Baker ,The grid core technologies , 1<sup>st</sup> edition, 2005Wiley-India edition

[2] Laurence T.Yang, Minyi Guo – High Performance Computing Paradigm and Infrastructure John Wiley

**Reference Books:**

1. www.globus.org
2. Joshy Joseph , Craig Fellenstein Grid Computing ,Pearson Education
3. Grid computing : a practical guide to technology and applications , AHMAR ABBAS
4. Distributed data bases principles and systems by Ceri & Pelagatti (McGraw Hill Publications)
5. A.D. Kshemkalyani, M. Singhal, [Distributed Computing: Principles, Algorithms, and Systems.](#) Cambridge University Press
6. Joshy Joseph and Craig Fellenstein , “Grid Computing” Pearson Education, 2004. 4.Ian Foster, et al., “The Open Grid Services Architecture”, Version 1.5 (GFD.80). Open Grid Forum, 2006.

**PH 601. 2 [E3] HIGH PERFORMANCE COMPUTING**

**Total No. of Lectures : 48**

**Total Marks : 100**

**[ L – T – P – S ]**

**No. of Lectures / Week : 4**

**Credits : 4**

**[ 3 – 1 – 0 – 2 ]**

**Course Objective :**

1. To understand Computational Science and Engineering Applications
2. To understand High-End Computer Systems
3. To learn about Parallel Computing and Programming
4. To learn about Parallel Algorithm Design
5. To learn about parallel Sorting and graph algorithms

**Course Outcomes:**

At the end of the course, the candidate will be able to

1. To Study various computing technology architecture.
2. To know Emerging trends in computing technology.
3. To highlight the advantage of deploying computing technology.
4. demonstrate understanding of learned concepts of parallel algorithm design, performance evaluation, communication operators by writing algorithms and programs exploiting parallel architecture
5. analyze the efficiency of parallel algorithms designed for matrix, graph and sorting operations

## UNIT I

Introduction: Computational Science and Engineering: Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multi- scale, multi-discipline applications) **(10 hrs)**

## UNIT II

High-End Computer Systems : Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built. **(10 hrs)**

## Unit III

**Introduction to Parallel Computing and Programming:** Motivating Parallelism, Scope of Parallel Computing, Implicit Parallelism, Limitations of Memory system performance, Dictionary of Parallel Computing Platforms Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process – Processor Mapping and Mapping Techniques. **(10 hrs)**

## Unit IV

**Principles of Parallel Algorithm Design:** Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for containing Interaction Overloads, Parallel Algorithm Models. **(09 hrs)**

## Unit V

**Sorting and graph algorithms:** Matrix Vector Multiplication, Matrix – Matrix Multiplication, Issues in sorting on Parallel Computers, Sorting Networks, Bubble Sort and its variants, Quick Sort, **Graph Algorithms:** Definitions and Representation, Minimum Spanning Tree, Prim's Algorithm, Single Source shortest path : Dijkstra's Algorithms All-pairs shortest paths, Transitive closure, Connected Components. **(09 hrs)**

### Text Book:

- 1) A Grama et.al – Introduction to Parallel Computing, 2<sup>nd</sup> ed. Pearson Education, New Delhi

2003.

- 2) Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, 2007

**Reference Books:**

- 1) M.J. Quinn – Parallel Computing : Theory and Practice, 2nd ed., McGraw Hill, New York, 1994.
- 2) Peter S Pacheco, An Introduction to Parallel Programming, Morgan Kaufmann, 2011.
- 3) DE Culler, A Gupta and JP Singh, Parallel Computer Architecture: A Hardware/Software Approach Morgan-Kaufmann, 1998.
- 4) Marc Snir, Steve W. Otto, Steven Huss-Lederman, David W. Walker and Jack Dongarra, MPI - The Complete Reference, Second Edition, Volume 1, The MPI Core.
- 5) L Hennessy and DA Patterson, Computer Architecture: A Quantitative Approach, 4th Ed., Morgan Kaufmann/Els India, 2006.

**PH 602.2 E1: SOFTWARE ENGINEERING and UML**

**Total No. of Lectures: 48**

**Total Marks: 100**

**[L – T – P – S]**

**No. of Lectures/Week: 4**

**Credits: 4**

**[3 – 1 – 0 – 2]**

**Course Objectives:**

1. To understand the Knowledge of basic SW engineering methods and practices, and their appropriate application.
2. To learn fundamentals of software engineering including requirement specifications and software process.
3. To understand the Software Design Process, Coding Methodology and software testing approaches.
4. To learn Software project maintenance, quality control and to ensure good quality software.
5. To learn software measures, project scheduling and cost estimation.

**Course Outcomes:** Upon completion of this course, students should be able to:

1. Plan and deliver an effective software engineering process, based on development lifecycle models.
2. Employ group working skills including general organization, planning and time management and negotiation.
3. Apply software engineering principles and techniques.
4. Understand the principles of large scale software systems, and the processes that are used to build them

5. Analyze a problem, and identify and define the computing requirements appropriate to its solution.
6. Design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.

### **Unit – I**

**Introduction:** Software, Software Engineering - Definition; Phases in the Software Engineering; Key Challenges in Software Engineering; Software Engineering Life Cycle.

**Basics of Software Engineering:** Software process models; Software Engineering Terminologies, software cost estimation.

**Software Requirements:** Software Requirements, Feasibility Study, Requirements Elicitation; Requirement Analysis, Analysis Patterns, Requirement Specification - SRS, Requirement Validation, Requirement Management, Requirement Engineering Tools. **(9 Hrs)**

### **Unit – II**

**Software Process:** Process and Process Models, Component software process, Process Specification, Characteristics of Software process, Predictability, Process Improvements and Feedback, Comparison of Process Models.

**Software Requirements Analysis and Specification:** Software Requirements, Need for SRS, Requirement Process, Problem Analysis – Informal Approach, Data Flow Modeling; Data Flow Diagrams and Data Dictionary; The Structured Analysis Method, Object-Oriented Model.

**Requirement Specification:** Characteristics of an SRS, Components of an SRS – Functional Requirements, Performance Requirements, Design Constraints, External Interface Requirements; Specification Language. UML Diagrams with Notation. **(10 Hrs)**

### **Unit – III**

**Software Design:** Software Design Process, Software Design Documents (SDD), Design Methodology – Top-Down Design, Bottom-Up Design, Hybrid Design; Software Design Approaches- Structured Design approach, Object-Oriented Design Approach; Design Notations; Software Implementation;

**Software Coding:** Features of a Software Code; Coding Guidelines, Coding Methodology; Programming Practice; Software Programming, Programming Paradigm; Code Verification Techniques, Coding Tools, Code Documentation;

**Software Testing:** Basics, Testing Terms, Testing Process, Testing Methods, Test Plan, Test Case Design, Levels of Testing, Testing Strategies, Testing Techniques, Testing Tools, Test Reports, Case Studies. **(10 Hrs)**

### **Unit – IV**

**Software Maintenance:** Software Maintenance; Types of Software Maintenance; Life Cycle; Models; Techniques; Tools; Activities; Technology Change Management(TCM); Software Maintenance Documentation.

**Software Project Management:** Project Management Process – Planning, Organizing, Monitoring, Adjusting; Project Management Techniques – COCOMO, Function Point, Simple technique for Object Oriented; Task scheduling; Project Monitoring;

**Software Quality:** Quality Concepts; Quality Assurance Group; SQA Activities; Software Reviews; Quality Evaluation; CMM; TQM **(10 Hrs)**

#### **Unit – V**

**Software Metrics:** Software Measurement; Software Metrics; Designing Software Metrics; Classification of Software Metrics – Process, Product, Project; Measuring Software Quality;

**Software Scheduling:** Project scheduling; Project staffing; People Capability Maturity Model; Risk Management;

**Software Cost Estimation:** Basics of Cost Estimation; Estimation Process; Decomposition Techniques; Estimation Models; Case Studies; **(9 Hrs)**

#### **Text Books:**

1. R. S. Pressman, “Software Engineering – A Practitioner’s approach”, 7<sup>th</sup> Ed, 2012, McGraw Hill Int. Ed.,.
2. Ian Sommerville, “Software Engineering”, 10<sup>th</sup> Edition, 2013, Pearson Education. Published by Dorling Kindersley (India) Pvt. Ltd.

#### **Reference:**

1. Frank Tsui, Orlando Karam and Barbara Bernal, “Essentials of Software Engineering”, Third Edition, 2015, Jones and Bartlett India Pvt. Ltd.
2. Kelkar, “Software Engineering”, 1<sup>st</sup> Edition, 2010, Prentice Hall of India Ltd.
3. K.K. Aggarwal and Yogesh Singh, “Software Engineering”, 3<sup>rd</sup> Edition, New Age International.
4. James Peter, W Pedrycz, “Software Engineering”, 4<sup>th</sup> Edition, 2011, Wiley India.
5. Rohith Kurana, “Software Engineering Principles and Practices”, 3<sup>rd</sup> Edition, 2011, Vikas

### **PH 602.2 E2: OBJECT ORIENTED SOFTWARE ENGINEERING**

**Total No. of Lectures: 48**

**Total Marks: 100**

**[L – T – P – S]**

**No. of Lectures/Week: 4**

**Credits: 4**

**[3 – 1 – 0 – 2]**

#### **Course Objectives:**

1. To learn Object-Oriented Software Development.
2. To understand how to use the OO technology efficiently in software design and development process
3. To learn System design and basic modeling behaviors.
4. To learn techniques at each stage of development, including use cases, UML, Analysis and Design, and Testing.
5. To understand various quality assurance techniques, including metrics and OOD quality, and automated analysis tools.

**Course outcomes:** Upon completion of this course, students should be able to:

1. Display understanding and the ability to apply object-oriented programming principles.
2. Have detailed knowledge of the software development lifecycle.

3. Apply skills relevant for academic progression and career development within the sector.
4. Explore and analyze different analysis and design models, such as OO Models, Structured Analysis and Design Models, etc.
5. Show an ability to use the graphical UML representation using tools.
6. Apply software engineering perspective through software design and construction, requirements analysis, verification, and validation, to develop solutions to modern problems such as security, data science, and systems engineering.

### **Unit – I**

**Software Engineering:** Introduction; Software Life Cycle Models; Object Oriented Concepts and Modeling - Introduction to Class, Object, Inheritance, Polymorphism; Overview of System Analysis and Design.

**Requirement Analysis:** Introduction to software specification, its needs and importance, formal specification methods, **SRS:** attributes of good SRS and organization of SRS document.

Introduction to Unified Modelling Language (UML); Diagrams - Notations; **(9 Hrs)**

### **Unit – II**

**Object Methodology & Requirement Elicitation:** Introduction to Object Oriented Methodology, Overview of Requirements Elicitation, Requirements Elicitation Activities, Managing Requirements Elicitation.

**Requirement Engineering:** Introduction; Requirement Engineering Tasks and Process; Analysis - An Overview of Analysis, Analysis Object Models and Dynamic Models; Process Models and Design Models;

**Software Engineering Models:** Basic structural Modeling - Classes, Relationships, Common mechanisms, Diagrams, Class diagrams; Advanced Structural Modeling - Interfaces, types and Roles Object diagrams, packages. **(10 Hrs)**

### **Unit – III**

**System Design:** An Overview of System Design, System Design Activities; Identifying Design Goals; Documenting System Design and Reviewing System Design.

**Basic Behavioral Modeling:** Use cases, use case diagrams, Interaction diagram, Activity diagrams, state chart diagrams, component diagrams, deployment diagrams, Sequence Diagram, patterns and frame works.

**A Case Study:** (Example: - ATM, Trading System, Banking System, Library Information System, Student Information System etc.). **(10 Hrs)**

### **Unit – IV**

**Object Oriented Analysis and Design:** Analysis and design tools - E-R analysis, Decision tree and decision tables, DFD (physical and logical), Data dictionary-definition, component, advantages; Input and output design; Components of OO Analysis Models; OOA Process; System Design and Object Design Process;

**Software Testing:** Testing Fundamentals, White Box Testing, Black Box Testing, software testing strategies, verification and Validation, System Testing, Unit testing, Integration testing and



Debugging. Software Maintenance – Maintenance Tasks, Characteristics of a good quality software.

**Object Oriented Testing:** View of Testing; Testing OOA and OOD Models; OOT Strategies; Test case design for OO Software; Testing Method; Inter class test case design; **(10 Hrs)**

#### **Unit – V**

**Metrics and Quality:** Introduction; Software Quality; Metrics - project based metrics and design based metrics, Process, Products, Resources; Measuring quality ; GQM;

**Quality of OOD:** Principles of OOD - General Principles, Cohesion Principles, Coupling Principles. Metrics for OO Design - Metrics Design Model, MOOD Metrics Model; Evaluation of OO Metrics;

**Quality Management:** Process and Product Quality; Quality Assurance and Standards; Quality Planning; Quality Control; Software Measurement and Metrics; **(9 Hrs)**

#### **Text Books:**

- [1] Bernd Bruegge and Allen H. Dutoit, “Object-Oriented Software Engineering”, 2<sup>nd</sup> Edition, Pearson.
- [2] Ali Bahrami, “Object Oriented Systems Development”, 2<sup>nd</sup> Edition, 2012, McGraw Hill Publishers.

#### **References:**

- [1] Hans Van Vliet, “Software Engineering – Principles and Practice”, Second Edition, Vrije Universiteit, Amsterdam.
- [2] Waman S. Jawadekar, “Software Engineering – Principles and Practice”, Computer Engineering Series, Tata McGraw-Hill Publishing Company Limited.
- [3] Pankaj Jalote, “An Integrated Approach to Software Engineering”, third Edition, Narosa Publishing House.
- [4] Stephen Schach, “Classical Object Oriented Software Engineering with UML and Java”, 2008, McGraw-Hill.
- [5] Graddy Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language”, 3<sup>rd</sup> Edition, 2009, Pearson.

### **PH 602.2 E3: AGILE SOFTWARE DEVELOPMENT**

**Total No. of Lectures: 48**

**Total Marks: 100**

**[L – T – P – S]**

**No. of Lectures/Week: 4**

**Credits: 4**

**[3 – 1 – 0 – 2]**

#### **Course Objectives:**

1. To understand the principles and practices of Agile Project Management.
2. To learn Agile and its Significance, Roles for Agile Requirements Engineering.
3. To estimate in an incremental and iterative fashion using practical techniques.
4. To apply agile principles to a range of decision possibilities.
5. To compare and contrast the differences between Agile and other project management methodologies.

**Course outcomes:** Upon completion of this course, students are expected to achieve the following learning outcomes:

1. Understand concept of agile software engineering and its advantages in software development.
2. Recognize various agile methods.
3. Understand the principles behind the agile approach to software development
4. Deconstruct user stories into tasks and ideal day estimates.
5. Differentiate between the testing role in agile projects compared with the role of testers in non-agile projects.

### **Unit – I**

**Introduction:** Why Agile? Agile core terminology; Agile Principles; Development in Agile; Advantages; Disadvantages; Agile methods - Rational Unified Process, Scrum, Crystal Clear, Extreme Programming, Adaptive Software Development, Feature Driven Development, and Dynamic Systems Development Method (DSDM); Benefits of Agile;

**Software Development:** Product Development; Iterative Development; Iterative Planning – Risk Driven and Client Driven; DSDM - Requirements, principles; Extreme Programming(XP) - supporting practices, Feature Driven Development (FDD) - basic activities; **(10 Hrs)**

### **Unit – II**

**Agile and Its Significance:** The Agile Manifesto and Principles; Agile software development; incremental model; iteration planning; iterative model; Agile software development approaches; Attributes of Agile Requirements; Quality of Agile Requirements; Requirements Engineering in Agile Software Development - Success Factors, Risk Factors;

**Roles for Agile Requirements Engineering:** The Stakeholders, Product Owner, Development Team, Scrum Master, Project Stakeholder, Requirements Manager, Scrum Master, System Stakeholder, Team Member - Common Agile Roles; **(10 Hrs)**

### **Unit – III**

**Agile Methodology:** Method overview; Lifecycle – Work products, Roles and Practices values, common mistakes and misunderstanding; Adaptive Software Development – Principle, lifecycle phases, Characteristics; Comparison of agile methods; Sample projects, Process Mixtures;

**Agile Project Planning:** Gathering User Documents; Estimation; Agile Planning; Iteration Management; Creating an Agile Communication Plan; Visual Workspace; **(10 Hrs)**

#### **Unit – IV**

**Creating Agile Software:** Time – Time related problems in Software Projects, Time Management of Agile Project – Time Measurements, Prioritizing Development Tasks, Planning Activities; Measures – Measure Definition, Measure Illustration, Case study – Monitoring a Large-Scale Project by measures; Quality – The Agile approach to Quality Assurance, Process Quality, Product Quality, Test-Driven development;

**Agile Testing:** Test Plan for Agile, Agile Testing Strategies, The Agile Testing Quadrant, QA challenges with agile software development, Risk of Automation in Agile Process, Advantages of Agile Testing, Disadvantages of Agile Testing, Principles of Agile Testing; **(9 Hrs)**

#### **Unit – V**

**Agile Practicing and Testing:** Project Management, Environment, Requirements, Test, The agile alliances, The Manifesto, Supporting the Values, Agile Testing, Nine Principles and Six concrete practices for testing on agile teams. **(9 Hrs)**

#### **Text Books:**

- [1] Craig Larman, “Agile and Iterative Development - A Manager’s Guide”, Pearson Education.
- [2] Lisa Crispin, Janet Gregory, Mike Cohn, Brain Marick, “Agile Testing: A Practical guide for Testers and Agile Teams”, Addison-wesley publication.

#### **References:**

- [1] Jonathan Rasmusson, “The Agile Samurai – How Agile Masters Deliver Great Software”, Shroff publishers and distributors Pvt. Ltd. July 2016.
- [2] Hazzan and Dubinsky, “Agile Software Engineering, Series: Topics in Computer Science” Springer 2009.
- [3] Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, 1<sup>st</sup> edition, PHI.
- [4] Alistair, “Agile Software Development Series”, Cockburn Publishers International.
- [5] Kevin C. Desouza, “Agile information systems: Conceptualization, Construction and Management”, Butterworth-Heinemann Publishers.

#### **PH 603.2 (E1): Mobile Application Development using Android**

<b>Total No. of Lectures : 48</b>	<b>Total Marks : 100</b>	<b>[ L – T – P – S ]</b>
<b>No. of Lectures / Week: 4</b>	<b>Credits : 4</b>	<b>[ 3 – 1 – 0 – 2 ]</b>

**Course Objectives:**

1. To understand the development environments, Architectures and programming paradigms of Android devices.
2. To design and develop an Android App with various controls that provide interactivity and handle user inputs.
3. To understand the various building blocks of Android and implement Broadcast Receiving, Services, Content Providers etc.
4. To understand how various types of data is stored in an Android Based device and also perform read and write operations on the same.
5. Implement and understand how various advanced features of Android such as Sensors, Accelerometer, GPS, etc.

**Course Outcomes:** Students must be able to

1. Understand the architecture, working and environmental setup of Android
2. Design and Implement simple GUI based Android Apps that handle user input and provide information
3. Implement Android apps that are able to receive broadcasted messages, act as content provider or receiver and run background services.
4. Create Android Apps that can manipulate data from various data stores such as internal, external memory and also SQLite as a Database.
5. Design and Work with advanced sensors of the phone and manipulate Telephony and SMS in an Android Phone.

**Unit - I**

Introduction to Android - Architecture - Features of Android SDK - Introducing the Development Framework, Developing for Android- Android Development Tools- The Android Virtual Device Manager - Android SDK Manager - The Android Emulator - The Dalvik Debug Monitor Service - The Android Debug Bridge. Installing and Configuring Android SDK, ADT and AVD - Android Software Stack, Dalvik Virtual Machine. **(9 hrs)**

**Unit - II**

**Creating Android Applications:** Working of Android Application: Android Application Life Cycle; Building User Interfaces - Introducing Activities, Various Layouts, Fragments, and Adapters. Intents, Intent Filters, Controls, Dialogs, Toasts and Notifications: Displaying Pictures and Menus with Views; Adding Interactivity and Handling UI events. **(10 hrs)**

**Unit - III**

**Building Blocks of Android:** Activities: Life Cycle and Working; Broadcast Receivers: Creating, Registering and unregistering a Broadcast Receiver. Content Providers: Concept of Content Resolver, Creating and using Content Providers. Services: Bound Services and Unbound Services, Life Cycle of services **(9 hrs)**

#### **Unit - IV**

**Data Access in Android:** Creating, Saving and Retrieving Shared Preferences; Introducing the Preference Framework and the Preference Activity; Including Static Files as Resources; Working with the File System. Introducing Android Databases; Introducing SQLite; Content Values and Cursors; Working with SQLite Databases; Creating and Using Content Providers; Using Native Android Content Providers. **10 hrs**

#### **Unit - V**

Advanced Android: Introducing Services, Using Background Threads, Using Alarms; Controlling Device Vibration; Introducing Android Text-to-Speech; Using Sensors and the Sensor Manager; Using Accelerometer, Compass and GPS; Audio, Video and Using the Camera; Using Telephony and SMS. **10 hrs**

#### **TEXT BOOKS:**

1. Reto Meier, Ian Lake, "Professional Android", 4<sup>th</sup> edition, Wiley Wrox Publications, 2018
2. Dawn Griffiths, David Griffiths, "Head First Android Development", 2<sup>nd</sup> Edition, O'Reilly Media, 2017

#### **REFERENCE BOOKS:**

1. Bill Phillips, Chris Stewart, Kristin Marsicano, "Android Programming: The Big Nerd Ranch Guide", Big Nerd Ranch Guides; 3<sup>rd</sup> edition 2017
2. John Horton, "Android Programming for Beginners", Ingram short title; 2<sup>nd</sup> edition, 2018

#### **PH 603.2 (E2): Cross Mobile App Development using React Native**

**Total No. of Lectures : 48**

**Total Marks: 100**

**[ L - T - P - S ]**

**No. of Lectures / Week: 4**

**Credits : 4**

**[ 3 - 1 - 0 - 2 ]**

#### **Course Objectives:**

1. To Revisit how JavaScript works and understand the syntax and working of JavaScript
2. To understand how ReactJS helps to develop User Interfaces and UI Components
3. To develop an understanding of how to design, implement, and debug apps with React Native

4. To exploit the many capabilities of React Native libraries to produce creative solutions to everyday challenges.
5. Develop advanced applications that effectively run in any Phone running iOS or Android.

**Course Outcomes:** Students must be able to

1. Write JavaScript code for any particular scenario and also be familiar with the syntax of JavaScript
2. Create simple React JS based User Interfaces and UI Components
3. Create React Native apps that simultaneously work in Android and iOS
4. To Use Widgets and components to create professional mobile applications
5. To Create Cross Platform apps that makes use of all the advanced features that React Native has to offer.

### **Unit - I**

Revisiting JavaScript: Javascript: Overview, Syntax, Variables, Operators, Conditionals, Looping, Functions, Events, Page Redirect, Dialog Boxes, Void Keyword, Page Printing, Objects- Number, Boolean, Strings, Arrays, Date, Math. RegExp, HTML DOM, Error Handling, Validations and Debugging.

**9 hrs**

### **Unit - II**

**ReactJS:** Overview, Environment Setup, JSX, Components, State, Props Overview, Props Validation, Component API, Component Life Cycle, Forms, Events, Refs, Keys, Router, Flux concept, Using Flux, Animations, Higher order, Components.

**9 hrs**

### **Unit - III**

**Introduction to React Native:** Introduction, Environment Setup, First App, React Native View, React Native State, React Native Props, React Native Style, Height and Width, React Native Button, Layout and Flexbox, Positioning Element with Flex, React Native ScrollView, React Native ListView, React Native FlatList, React Native SectionList.

**10 hrs**

### **Unit - IV**

Components and APIs in React Native: React Native Touchables, React Native TextInput, ActivityIndicator, React Native Picker, React Native StatusBar, React Native Switch, React Native WebView, ProgressBar, React Native Animation, React Native Image, APIs, React Native AlertReact Native Geolocation

10 hrs

#### Unit - V

Advanced React Native: React Native Navigation, Configuring Header Bar, Moving Between Screens, Passing Value b/w Screens, Tab Navigation, Adding Icons at Bottom of Tab Navigation, Create Material Top & Bottom Tab Navigator, Drawer Navigation, Storage, AsyncStorage, AsyncStorage Methods, React Native, Google Maps, React Native Modal, React Native Vector Icons, React Native Splash Screen.

10 hrs

#### TEXT BOOKS:

- [1] Kirupa Chinnathambi, "Learning React: A hands-on guide to building web applications using React and Redux", Addison-Wesley Professional; 2<sup>nd</sup> edition, 2018.
- [2] Akshat Paul, Abhishek Nalwaya, "React Native for Mobile Development", Apress; 2<sup>nd</sup> edition 2019

#### REFERENCE BOOKS:

- [1] Eric Freeman, Elisabeth Robson, "Head First JavaScript Programming: A Brain-Friendly Guide", O'Reilly Media, 2014
- [2] Adam Boduch, "React and React Native: Complete guide to web and native mobile development with React, 2nd Edition", Packt Publishing, 2018.

#### PH 603.2 (E3): Mobile App Development for iOS with Swift

**Total No. of Lectures : 48**

**Total Marks: 100**

**[ L – T – P – S ]**

**No. of Lectures / Week: 4**

**Credits : 4**

**[ 3 – 1 – 0 – 2 ]**

#### Course Objectives:

1. To understand the development environment, Architecture and programming paradigm of all Mobile Development Platforms.
2. To Learn a new Programming Language, Swift and solve problems in it.
3. To exploit the many capabilities of Swift to produce creative solutions to everyday challenges.
4. To Learn developing iOS apps using Swift in XCode
5. Develop applications that effectively combine mobile device capabilities such as communication, computing, and particularly sensing.

#### Course Outcomes: Students must be able to

1. Understand the working of mobile devices compared to the various architectures available

2. Do programming with the Swift Language
3. Use advanced concepts of Swift to solve complex problems
4. Use Widgets and components to create professional iOS applications
5. Develop iOS apps to perform the various advanced tasks like Database handling.

### **Unit -1**

**Overview of Mobile Devices:** Mobile devices vs. desktop devices - ARM and Intel architectures - Development environments; XCode & Android Studio - Native vs. Web Applications. Comparing and Contrasting architectures of – Android and iOS - Underlying OS (Darwin vs. Linux) - Kernel structure and native level programming - Runtime (Objective-C vs. Dalvik) **9 hrs**

### **Unit – II**

**Basics of Swift:** Overview, Environment, Basic Syntax, Data Types, Variables, Optionals, Tuples, Constants, Literals, Operators, Decision Making, Loops, Strings, Characters, Arrays, Sets, Dictionaries. **10 hrs**

### **Unit – III**

**Advanced Swift:** Functions, Closures, Enumerations, Structures, Classes, Properties, Methods, Subscripts, Inheritance, Initialization, Deinitialization, ARC Overview, Optional Chaining, Type Casting, Extensions, Protocols, Generics, Access Control.

**10 hrs**

### **Unit - IV**

**Introduction to iOS:** Basics and Overview of iOS, Environment Setup - Overview of Mac, XCode and Apple Developer Account, Understanding the XCode IDE and its functionalities, iPhone Simulator, First iPhone Application, Introduction to Actions and Outlets, Delegates, Understanding Basic UI Elements, Autorotation and Auto sizing. **9**

**hrs**



## Unit – V

**Advanced iOS Concepts: Accelerometer, Universal Applications, Camera Management, Location Handling, SQLite Database, Sending Email, Audio & Video, File Handling, Accessing Maps, In-App Purchase, iAd Integration, Storyboards, Auto Layouts, Twitter & Facebook, Memory Management, Application Debugging.**

**10 hrs**

### TEXT BOOKS:

1. Greg Lim, "Beginning iOS 13 & Swift App Development", 2019
2. Ahmad Sahar, Craig Clayton, "iOS 13 Programming for Beginners", Packt Publishing Limited; 4<sup>th</sup> Revised edition, 2020.

### REFERENCE BOOKS:

1. Abhishek Mishra, "Swift iOS 24-Hour Trainer", Wiley Publications, 2016
2. Wallace Wang, "Beginning iPhone Development with Swift 5: Exploring the iOS SDK", Apress; 5<sup>th</sup> edition, 2019.

### PH 604.2 P Cloud Computing and Mobile App Development Lab

**Total No. of Practicals : 90**

**Total Marks : 100**

**[ L – T – P – S ]**

**No. of Labs / Week : 3**

**Credits : 2**

**[ 0 – 1 – 3 – 0 ]**

**Course Objectives:** The course gives a practical introduction to modern distributed computing. It describes in detail two methods of accessing computing resource across the internet: Grid computing and Cloud computing. For each of these, a working software system is described (UNICORE for Grid, Amazon Web Services for Cloud).

The course will also explain the relevance of these forms of computing to business models for enterprises that require large amounts of computation but do not necessarily wish to purchase and maintain large amounts of specialist computing systems.

**Course Outcome :** At the completion of this unit, students will:

- Understand the business models that underlie Cloud Computing
- Understand the importance of protocols and standards in computing.
- Understand the issues involved in distributed computing
- Ability to deploy applications using the Unicore Grid middleware
- Ability to programme using the APIs of Cloud Computing
- Ability to create Virtual Machine images and to deploy them on a Cloud.

### **Cloud Resource Provisioning.**

- [1] DOT: a matrix model for analyzing, optimizing and deploying software for big data analytics in distributed systems
- [2] No One (cluster) Size Fits All: Automatic Cluster Sizing for Data-intensive Analytics
- [3] Mesos: a platform for fine-grained resource sharing in the data center
- [4] Data confidentiality in storage-intensive cloud applications
- [5] CryptDB: protecting confidentiality with encrypted query processing
- [6] Data Markets in the Cloud: An Opportunity for the Database Community
- [7] CloudViews: Communal Data Sharing in Public Clouds
- [8] Policy expressivity in the Anzere personal cloud
- [9] Orleans: cloud computing for everyone
- [10] Exploring information leakage in third-party compute clouds
- [11] FAWN: a fast array of wimpy nodes

### **Cloud Data Storage**

- [12] Google File System
- [13] Bigtable: A Distributed Storage System for Structured Data
- [14] Megastore: Providing Scalable, Highly Available Storage for Interactive Services
- [15] Windows Azure Storage: a highly available cloud storage service with strong consistency
- [16] The Case for RAM Clouds: Scalable High-Performance Storage Entirely in DRAM
- [17] Resilient Distributed Datasets: A Fault-Tolerant Abstraction for In-Memory Cluster Computing
- [18] Dynamo: Amazon's Highly Available Key-value Store

### **DBs in the cloud and moving stuff**

- [19] Relational Cloud: The Case for a Database Service
- [20] Database scalability, elasticity, and autonomy in the cloud
- [21] Hive: a warehousing solution over a map-reduce framework
- [22] PNUTS: Yahoo!'s Hosted Data Serving Platform
- [23] SCADS: Scale-Independent Storage for Social Computing Applications
- [24] Managing data transfers in computer clusters with orchestra
- [25] c-Through: part-time optics in data centers

### **Case Studies**

- [26] Finding a needle in Haystack: facebook's photo storage
- [27] Volley: Automated Data Placement for Geo-Distributed Cloud Services
- [28] Scaling the mobile millennium system in the cloud

### **Mobile Application Development**

- [1]. Developing Simple Applications for Android.
- [2]. Creating Applications with Multiple Activities and a Simple Menu using List View.
- [3]. Creating Activities for Menu Items and Parsing XML Files.
- [4]. Writing Multi-Threaded Applications in Android.
- [5]. Create an Android app Using Web View and Using the Network.
- [6]. Create an app that demonstrates the Audio Functions in Android
- [7]. Create an app that demonstrates Graphics Support in Android
- [8]. Create an app that demonstrates Preferences and Content Providers in Android.
- [9]. Create an app that demonstrates Location Services and Google Maps in Android.
- [10]. Create an app that demonstrates Simulating Sensors in Android.

- [11]. Create an app demonstrates how to access contacts and display the details by using data binding.
- [12]. Create a an app to call and process data from a web service for weather forecast.
- [13]. Create an app that shows how to use & store relational data in a local database that resides in app's storage container.
- [14]. Create an app that demonstrates how to use the Web Browser control
- [15]. Create an app that demonstrates how to send a raw notification to a phone.
- [16]. Create an app that demonstrates how to use Isolated Storage.
- [17]. Create an app that demonstrates different methods you can use for passing data from one XAML page to another page.
- [18]. Create an app to dynamically create ,display and remove images at run time

### **PS 605.2 [E1]: NATURAL LANGUAGE PROCESSING**

<b>Total No. of Lectures : 48</b>	<b>Total Marks: 100</b>	<b>[L – T – P – S]</b>
<b>No. of Lectures / Week: 4</b>	<b>Credits : 3</b>	<b>[3 – 2 - 0 - 2]</b>

#### **Course Objectives:**

1. To introduce basic methods used in NLP applications to formulate computational solutions. Use NLP technologies to explore and gain a broad understanding of text data.
2. To Understand how key concepts from NLP are used to describe and analyze language; and implement various language Models
3. Will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
4. To get acquainted with the basic concepts and algorithmic description of the semantics,
5. Understanding pragmatics of English language for processing.

#### **Course Outcomes:**

The students will able:

1. Understand natural language processing and to learn how to apply basic algorithms in this field.
2. Understand POS tagging and context free grammar for English language
3. Learn how model linguistic phenomena with formal grammars; and to design, implement and test algorithms for NLP problems

4. Understand the mathematical and linguistic foundations underlying approaches to the various areas in NLP
5. Apply NLP techniques to design real world NLP applications such as machine translation, text categorization, text summarization, information extraction

### **Unit - I**

**Introduction:** History of NLP, Generic NLP system, levels of NLP, Knowledge in language processing, Ambiguity in Natural language, stages in NLP, challenges of NLP, Applications of NLP. Evaluation of NLP System. Speech Processing,

**Basic English Concepts:** Various Grammar- based Language Models, Sentence, Active and Passive voice, Dictionary Features. **(8hrs)**

### **Unit - II**

**Word Level Analysis:** Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST) , Morphological parsing with FST , Lexicon free FST Porter stemmer. N –Grams- N-gram language model, N-gram for spelling correction.

**Syntax Analysis :** Part-Of-Speech tagging( POS)- Tag set for English ( Penn Treebank ) , Rule based POS tagging, Stochastic POS tagging, Issues –Multiple tags & words, Unknown words. Introduction to CFG, Sequence labeling: Hidden Markov Model (HMM), Maximum Entropy, and Conditional Random Field (CRF). **(10hrs)**

### **Unit - III**

**Parsing Techniques & Grammar:** Parsing Process, Algorithm, Efficient Parsing, Types of Parsing Techniques, Transition networks, Human Parsing, Feature Grammar, Parsing with Unification constraints, Parsing Integration and Unification, Prolog Grammar Parser Generator.

**(10hrs)**

### **Unit – IV**

**Semantic Analysis:** Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses – Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, Robust Word Sense Disambiguation (WSD) Dictionary based approach Syntax Driven Semantic Analysis Approach.

**(10hrs)**

### **Unit - V**

**Knowledge Representation for NLP:** Human Language Technology, Information Discovery, issues in Semantic Representation.

**Natural Language Generation:** Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG.

**Machine Translation:** Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages

**Pragmatics:** Discourse –reference resolution, reference phenomenon, syntactic & semantic constraints on coreference **(10hrs)**

**Text Books:**

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", 2nd Ed, 2014, Pearson Education.
2. James Allen, "Natural Language Understanding", 2nd edition. Benjamin Cummings publishing.

**Reference Books:**

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press.
2. Manning, Christopher and Heinrich, Schutze, "Foundations of Statistical Natural Language Processing", 2016, Create Space Independent Publishing Platform.
3. Jacob Eisenstein, "Introduction to Natural Language Processing", 2019, MIT Press
4. Carol Genetti, "How Languages Work: An Introduction to Language and Linguistics, 2019, Cambridge University Press.

**PS 605.2 [E2]: IMAGE PROCESSING AND PATTERN RECOGNITION**

**Total No. of Lectures : 48                      Total Marks: 100                      [L – T – P – S]**

**No. of Lectures / Week: 4                      Credits : 3                      [3 – 2 – 0 – 2]**

**Course Objectives:**

1. To understand the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement in frequency and spatial domain.
3. To understand the image segmentation and representation techniques. To understand how image are analyzed to extract features of interest.
4. To learn importance of pattern recognition in various applications and also able identify when, where and how pattern recognition can be applied.
5. To instigate the various classification and clustering techniques

## Course Outcomes:

The students will be able to:

1. Understand image formation, role of human visual system plays in perception of gray and color image data.
2. Apply image processing techniques in both the spatial and frequency (Fourier) domains. Apply different de-noising models to recover original image.
3. Design image analysis techniques, image segmentation and to evaluate the Methodologies for segmentation. Conduct independent study and analysis of feature extraction techniques.
4. Identify different pattern recognition techniques and apply them in real world problems.
5. Learn how to classify patterns. And build a statistical classifier and will learn how to use other classifiers.
6. Be able to write programs in Matlab language for digital manipulation of images; image acquisition; preprocessing; segmentation; Fourier domain processing.

## Unit - I

**Digital Image Processing:** Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.

**Digital Image Fundamentals:** Elements of Visual Perception, A Simple Image Formation Model, Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking, Basic Relationships Between Pixels, Linear and Nonlinear Operations.

**(9hrs)**

## Unit - II

**Image Enhancement in the Spatial Domain:** Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Combining Spatial Enhancement Methods.

**Image Enhancement in the Frequency Domain:** Introduction to the Fourier Transform and the Frequency Domain, Frequency-Domain Filters, Homomorphic Filtering.

**Image Restoration:** Image degradation/Restoration process, Noise Models, Restoration in, Periodic Noise Reduction, Degradations, Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Least Square Filtering, Geometric Mean Filter.

**(10hrs)**

## Unit - III

**Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

**Image Feature Extraction:** Image Features and Extraction–Image Features– Types of Features– Feature Extraction–SIFT, SURF and Texture–Feature Reduction Algorithms

**Image Representation:** Representation, Boundary Descriptors, Regional Descriptors

**(10hrs)**

#### **Unit – IV**

**Introduction to Pattern Recognition :** Elements of Image Analysis, Introduction to pattern classification Feature selection and extraction, Supervised and Unsupervised Parameter estimation Basic concepts- Structure of a typical pattern recognition system Feature vectors , Feature spaces , Pattern classification by distance functions - Minimum distance classification - Cluster algorithms

**(10 hrs)**

#### **Unit - V**

**Pattern Classification:** Pattern classification using Statistical classifiers and Bayes' classifier Classification performance measures - Risk and error probabilities. Fuzzy classification - Fuzzy clustering - Fuzzy pattern recognition - Syntactic pattern recognition. Application of pattern recognition

**(9hrs)**

#### **Text Books:**

- [1] Rafael C Gonzalez and Richard E. Woods: "Digital Image Processing", 4<sup>th</sup> Edition, 2018, Pearson Publication.
- [2] Sergios Theodoridis, Konstantinos Koutroumbas, "Pattern Recognition", 5<sup>th</sup> Edition, 2018, Academic Press.

#### **Reference Books:**

1. Scott. E. Umbaugh, "Digital Image Processing and Analysis", 3<sup>rd</sup> Edition, 2017, CRC Press
2. M. Sonka Milan, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis and Machine Vision", 4<sup>th</sup> Edition, 2014, Cengage Learning
3. Rafael C. Gonzalez, Richard Eugene Woods, "Digital Image Processing Using MATLAB", 2<sup>nd</sup> Edition, 2013. Tata McGraw Hill Ed.
4. Chris Solomon, Toby Breckon, "Fundamentals of Digital Image Processing: A Practical Approach with Examples".
5. W. K. Pratt, Introduction to "Digital Image Processing", 2014, CRC Press.
6. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", 2<sup>nd</sup> Ed, 2012, John Wiley & sons
7. Christopher M. Bishop, "Pattern Recognition and Machine Learning", 2016, Springer.

#### **PS 605.2 [E3] : Bioinformatics Algorithms, Databases and Tools**

**Total No. of Lectures : 48**

**Total Marks : 100**

**[ L – T – P – S ]**

**No. of Lectures / Week : 4**

**Credits : 3**

**[ 3 – 1 – 0 – 2 ]**

**Learning Objective:** The subject aims to introduce students to

1. Understand fundamentals concepts of cells, genes, DNA and protein; have a fundamental understanding of the fundamentals of bioinformatics and its databases
2. Have an overview of the different primary and secondary databases
3. Appreciate the need for methods to be accurate and efficient to implement some of the algorithms; understanding the difference between biological and computer algorithms
4. Understand the concept of sequence alignment, approaches to gene prediction
5. Understanding the protein sequencing problem; learn the concepts of HMM and its usage in bioinformatics

**Learning Outcome:** Upon completion of the subject, students shall be able to

1. Gain a knowledge of simple biology and Bioinformatics
2. Gain knowledge of database and tools with respect to Genomics and Proteomics; usage of different biological databases for understanding protein domains and families
3. Understand the algorithmic complexity of Biological algorithms; application of algorithms to find motifs in proteins
4. Usage of gene prediction algorithms and its statistical approaches
5. Usage of HMM for Profiling; applying graph algorithm for protein sequencing

### Unit – I

**The Origin and Evolution of Cells:** The First Cell, The Evolution of Metabolism, Eukaryotic Cells, The Origin of Eukaryotes, The Development of Multicellular Organisms, **Molecules of Cells:** Carbohydrates, Lipids, Nucleic Acids, Proteins, **Heredity, Genes, and DNA:** Genes and Chromosomes, Identification of DNA as the Genetic Material, The Structure of DNA, **Protein Synthesis:** Transfer RNAs, The Ribosome, The Organization of mRNAs and the Initiation of Translation, The Process of Translation, Regulation of Translation

**Introduction to Bioinformatics:** What Is Bioinformatics? , Goal, Applications, Limitations, **Biological Databases:** What Is a Database?, Types of Databases, Biological Databases, Pitfalls of Biological Databases, Information Retrieval from Biological Databases **(10 hrs)**

### Unit – II

**Genome Information Resources-** Introduction, DNA Sequence databases, Specialised genomic databases

**Protein Information Resources:** Introduction, Biological databases, Primary Sequence Databases, Composite Sequence Databases, Secondary Databases – Prosite, PRINTS, BLOCKS, Profiles, Pfam, Identify Composite Protein pattern databases – SCOP, CATH, PDBsum (9 hrs)

### Unit – III

**Algorithms and Complexity:** Biological Algorithms versus Computer Algorithms, The Change Problem, Correct versus Incorrect Algorithms, Recursive Algorithms, Iterative versus Recursive



Algorithms, Fast versus Slow Algorithms, Big-O Notation, Algorithm Design Techniques, Tractable versus Intractable Problems

**Exhaustive Search:** Impractical Restriction Mapping Algorithms, A Practical Restriction Mapping Algorithm, The Motif Finding Problem, Search Trees, Finding Motifs **(9 hrs)**

#### **Unit – IV**

**Dynamic Programming Algorithms:** The Power of DNA Sequence Comparison, The Change Problem Revisited, The Manhattan Tourist Problem, Global Sequence Alignment, Local Sequence Alignment, Multiple Alignment, Gene Prediction, Statistical Approaches to Gene Prediction

**Divide-and-Conquer Algorithms:** Divide-and-Conquer Approach to Sorting, Space-Efficient Sequence Alignment, Block Alignment and the Four-Russians Speedup **(10 hrs)**

#### **Unit – V**

**Graph Algorithms:** Graphs, Graphs and Genetics, DNA Sequencing, Shortest Superstring Problem, DNA Arrays as an Alternative Sequencing Technique, Sequencing by Hybridization, SBH as a Hamiltonian Path Problem, SBH as an Eulerian Path Problem, Protein Sequencing and Identification, The Peptide Sequencing Problem

**Hidden Markov Models:** CG-Islands and the “Fair Bet Casino”, The Fair Bet Casino and Hidden Markov Models, Decoding Algorithm, HMM Parameter Estimation, Profile HMM Alignment **(10 hrs)**

#### **Text Books :**

1. Geoffrey M. Cooper,, “ The Cell, A Molecular Approach”, 8<sup>th</sup> Edition, Oxford University Press
2. Jin Xiong, “Essential Bioinformatics”, Cambridge University Press
3. `Teresa K Attwood and David J. Parry-smith, “Introduction to Bioinformatics”, Prentice Hall
4. Neil C. Jones and Pavel A. Pevzner, “An Introduction to Bioinformatics Algorithms”, The MIT Press

#### **References:**

1. Anna Tramantono, ““Introduction to Bioinformatics”, 3<sup>rd</sup> Edition, 2012, CRC Press
2. Orpitha Bosu, S K Thukral, “Bioinformatics Databases, Tools, Algorithms”, 2<sup>nd</sup> Ed, 2012, Oxford University Press
3. Ion Mandoiu, A Zelinkovsky, “Bioinformatics Algorithms: Techniques and Applications”, 2012, Wiley

#### **PS 606.2 [E1] : DATA WAREHOUSING AND DATA MINING**

**Total No. of Lectures : 48**

**Total Marks: 100**

**No. of Lectures / week : 4**

**Credits : 3**

**Course Objectives:**

1. To introduce the basic concepts and techniques of data warehouse and data mining.
2. Identify the key processes of data mining, data warehousing and knowledge discovery process.
3. Understand the strength and weaknesses of various methods and implement classical models and algorithms in data warehouses and data mining.
4. Characterized the kinds of patterns that can be discovered by association rule mining, classification and prediction and clustering.
5. To develop the skills using data mining software for solving practical problems.
6. Apply data mining techniques to solve problems in other disciplines in a mathematical way.

**Course Outcomes:** After completing this course, students will be able to

1. List the definitions, concepts and architectures of data warehousing and data mining
2. Demonstrate the impact of business reporting, information visualization and dashboards
3. Explain data mining, support vector machines and text mining.
4. Define social impacts of data mining.
5. Handle classification through statistical methods used in prediction.

**Unit – I**

**Data Warehousing:** Data Warehousing Components – Building a Data Warehouse – Mapping the Data Warehouse to a Multi-Processor Architecture – ETL Process – Loading and Refreshing the Warehouse Data – Metadata – OLAP – Multidimensional Data Analysis – Report and Query Tools and Applications.

**(9 hrs)**

**Unit – II**

**Data Mining:** Data – Types of Data – Data Mining functionalities – Data Mining Task Primitives – Issues - Integration of Data Mining system with a Data Warehouse.

**Data Preprocessing:** Descriptive Data Summarization - Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation

**(9 hrs)**

**Unit – III**

**Association Rule Mining:** Scalable Frequent Itemset Mining Methods – Improving efficiency – Mining various kinds of Association Rules – Association Mining to Correlation Analysis – Constraint based Association Mining. **(10 hrs)**

#### **Unit – IV**

**Classification and Prediction:** Issues – Classification by Decision Tree Induction – Bayesian Classification – Rule Based Classification - Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures –Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Selection. **(10 hrs)**

#### **Unit – V**

**Cluster and Outlier Analysis:** Types of Data in Cluster Analysis – Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Constraint-Based Cluster Analysis – Outlier Analysis.

**Data Mining Applications:** Data mining applications - Social impacts of data mining: Ubiquitous and invisible data mining – data mining privacy and data security - Case Studies: Mining the WWW -Text mining. **(10 hrs)**

#### **Text Books:**

1. Jain Pei, Jiawei Han, Micheline Kamber, “Data Mining : Concepts and Techniques”, 3<sup>rd</sup> Ed, 2011, Elsevier
2. Alex Berson, Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, 3<sup>rd</sup> Ed, 2011, McGraw Hill
3. Witten, Frank, Hall, “Data Mining : Practical Machine Learning Tools & Techniques”, 3<sup>rd</sup> 2010, Elsevier

#### **Reference Books:**

1. Reema Theraja “Data Warehousing”, 1<sup>st</sup> Edition, 2011, Oxford University Press.
2. Paulraj Ponniah, “Data Warehousing: Fundamentals for IT Professionals”, 2<sup>nd</sup> Ed, 2012, Wiley India
3. Prabhu C.S.R., “Data Warehousing Concepts, Techniques, Products and Applications”, 3<sup>rd</sup> Edition, 2011, PHI Learning Private Limited.
4. Sam Anahory, Dennis Murray, “Data Warehousing In The Real World : A Practical Guide For Building Decision Support Systems”, 1<sup>st</sup> Edition, 2011, Pearson Asia
5. K.P. Soman, ShyamDiwakar, V. Ajay “Insight into Data mining Theory and Practice”, 2<sup>nd</sup> Ed, 2010, PHI
6. Pang-Ning Tan, Michael Steinbach, Vipin Kumar “Introduction to Data Mining”, 3<sup>rd</sup> Ed, 2011, Pearson
7. Vikram Pudi, Radhakrishna, “Data Mining”, 2<sup>nd</sup> Edition, 2011, Oxford University Press.
8. Richard Roiger, Michael Getz, “Data Mining : A Practical Based Primer”, 1<sup>st</sup> Ed, 2010, Pearson
9. Margaret Dunham, “Data Mining : Introductory & Advanced Topics”, 1<sup>st</sup> Edition, 2011, Pearson
10. Arun K Pujari, “Data Mining Techniques”, 2<sup>nd</sup> Ed, 2013, University Press
11. Peter Adrians, Rolf Zantinge, “Data Mining”, 1<sup>st</sup> Edition, 2010, Pearson Education

12. Gordon S. Linoff Michael J. A. Berry, "Mastering Data Mining: The Art And Science Of Customer Relationship Management", 1<sup>st</sup> Edition, 2013, Wiley India

**PS 606.2 [E2] : BUSINESS INTELLIGENCE & ADVANCED DATA MINING**

**Total No. of Lectures : 48**

**Total Marks : 100**

**No. of Lectures / week : 4**

**Credits : 3**

**Course Objectives:**

1. To introduce the basic concepts and techniques of business intelligence.
2. Identify the key processes of data mining, data warehousing and knowledge discovery process.
3. Characterized the kinds of patterns that can be discovered by association rule mining, classification and prediction and clustering.
4. To develop the skills using recent data mining software for solving practical problems.
5. Basic principles and algorithms used in practical data mining and understand their strengths, weaknesses
6. To study Graph and web data mining.

**Course outcomes:** After completing this course, students will be able to

1. Identify the major frameworks of business intelligence (BI).
2. List the definitions, concepts and architectures of data mining
3. Demonstrate the impact of business reporting, information visualization and dashboards
4. Handle classification through statistical methods used in prediction.
5. Explain data mining, neural networks, support vector machines, text mining, web mining and social network analysis.

**UNIT – I**

**Business Intelligence:** Road Map of Business Intelligence – Architecture – Components - Cycle of Business Intelligence Analysis – Development of a BI system – Ethics and BI -

**Data Warehousing:** Data Warehouse: Definitions, Properties and Characteristics – Data Warehouse Development approach – Components of Data Warehouse **(9 hrs)**

**UNIT – II**

**Modeling the Data Warehouse:** Choosing the Architecture – Creating the Dimensional Model

**Building Data Warehouse:**Data Extraction – Transformation – Loading – Refreshing the Warehouse – Purging and Archiving the Data – Metadata: Types - Strategy – Metadata Management Tools **(9 hrs)**

**UNIT – III**

**Classification and Prediction:** Issues – Bayesian Belief Networks – Classification by Back propagation – Support Vector Machine – Classification using Frequent Patterns – Lazy Learners – Multi Class Classification – Semi Supervised Classification – Active Learning – Transfer Learning  
(10 hrs)

#### UNIT – IV

**Advanced Pattern Mining:** Roadmap to Pattern Mining – Pattern mining in Multi-Level and Multi-Dimensional Space – Mining Quantitative Association Rules – Mining Rare and Negative Patterns – Constraint Based Pattern Mining.

**Cluster and Outlier Analysis:** Types of Data in Cluster Analysis – Requirements - Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Probabilistic Model-Based Clustering Methods – Clustering High Dimensional Data: Biclustering Methods  
(10 hrs)

#### UNIT- V

**Mining Sequential Patterns in Transactional Database** - Graph Mining – Social Network Analysis – Text Mining – Web Mining – Data Visualization - Data Mining Applications (10 hrs)

##### Text Books:

1. Delen Dursun Delen, Efraim Turban, Ramesh Sharda, "Decision Support And Business Intelligence Systems", 9<sup>th</sup> Edition, 2013, Pearson
2. R N Prasad, Seema Acharya, "Fundamentals of Business Analytics", 1<sup>st</sup> Ed, 2011, Wiley India
3. Jain Pei, Jiawei Han, Micheline Kamber, "Data Mining : Concepts and Techniques", 3<sup>rd</sup> Ed, 2011, Elsevier

##### Reference Books:

1. Reema Theraja "Data Warehousing", 1<sup>st</sup> Edition, 2011, Oxford University Press.
2. Paulraj Ponniah, "Data Warehousing: Fundamentals for IT Professionals", 2<sup>nd</sup> Ed, 2012, Wiley India
3. Alex Berson, Stephen J. Smith "Data Warehousing, Data Mining & OLAP", 3<sup>rd</sup> Ed, 2011, McGraw Hill
4. Pang-Ning Tan, Michael Steinbach, Vipin Kumar "Introduction to Data Mining", 3<sup>rd</sup> Ed, 2011, Pearson
5. Witten, Frank, Hall, "Data Mining : Practical Machine Learning Tools & Techniques", 3<sup>rd</sup> 2010, Elsevier
6. Vikram Pudi, Radhakrishna, "Data Mining", 2<sup>nd</sup> Edition, 2011, Oxford University Press.
7. Richard Roiger, Michael Getz, "Data Mining : A Practical Based Primer", 1<sup>st</sup> Ed, 2010, Pearson
8. Margaret Dunham, "Data Mining : Introductory & Advanced Topics", 1<sup>st</sup> Edition, 2011, Pearson
9. Peter Adrians, Rolf Zantinge, "Data Mining", 1<sup>st</sup> Edition, 2010, Pearson Education
10. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", 2013, Wiley.
11. Efraim Turban, Ramesh Sharda, Dursun Delen, David King, "Business Intelligence : A Managerial Approach", 1<sup>st</sup> Edition, 2012, Pearson.
12. Mark Rittman, "Oracle Business Intelligence 11G Developers Guide", 1<sup>st</sup> Ed, 2012, McGraw Hill.

13. Gert H. N. Laursen, Jesper Thorlund, "Business Analytics for Managers : Taking Business Intelligence Beyond Reporting", 1<sup>st</sup> Edition, 2013, Wiley

### **PS 606.2 [E3] : DATA SCIENCE AND ANALYTICS**

**Total No. of Lectures : 48**

**Total Marks : 100**

**No. of Lectures / week : 4**

**Credits : 3**

**Learning Objectives:** The objectives of this course are to provide with

1. data sampling/cleaning in order to get an informative, manageable data set
2. data storage and management in order to be able to access data.
3. Characterized the kinds of patterns that can be discovered by association rule mining, classification and prediction and clustering.
4. prediction based on statistical tools such as regression, classification, and clustering.
5. exploratory data analysis to generate hypotheses and intuition about the data.
6. communication of results through visualization, stories, and interpretable summaries

**Learning Outcomes :** After successful completion of this course, you will be able to...

1. Use data management techniques to store data
2. Use statistical methods and visualization to quickly explore data
3. Apply statistical and computational analysis to make predictions based on data
4. Implement data-intensive computations on cluster and cloud infrastructures.
5. Effectively communicate the outcome of data analysis using descriptive statistics and visualizations

### **UNIT- I**

**Data Science:** Data science process – roles, stages in data science project; working with data from files; working with relational databases; exploring data, managing data, cleaning and sampling for modeling and validation, introduction to NoSQL.

**Data Analytics Life Cycle:** Introduction to Big data Business Analytics; State of the practice in analytics role of data scientists; Key roles for successful analytic project; Main phases of life cycle - Developing core deliverables for stakeholders. **(9 hrs)**

### **UNIT - II**

**Data Mining:** Introduction -Data mining task. Data Preprocessing: Descriptive Data Summarization - Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization. Data visualization

**Association Rule Mining:** Basic concepts – Market basket analysis Scalable Frequent Itemset Mining Methods – Improving efficiency – Mining various kinds of Association Rules – Association Mining to Correlation Analysis – Constraint based Association Mining. **(9 hrs)**

### UNIT – III

**Classification:** Basic concepts – Decision tree induction - Bayes classification methods – Rule based classification – Support Vector Machine.

**Cluster Analysis:** Types of Data in Cluster Analysis – Categorization of Major Clustering Methods – Partitioning Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods. **(10 hrs)**

### UNIT – IV

**Predictive Analytics:** Simple linear regression: Coefficient of determination, Significance tests, Residual analysis, Confidence and Prediction intervals;  
Multiple linear regression: Coefficient of determination, Interpretation of regression coefficients, Categorical variables, outliers, Regression Model Building;  
Logistic and Multinomial Regression: Logistic function, Estimation of probability using logistic regression. **(10 hrs)**

### UNIT – V

**Hypothesis testing:** Null and alternate hypotheses; Types of errors, Level of significance, Power of a test, ANOVA; Test for goodness of fit

**Forecasting:** Moving average, Exponential smoothing, Casual Models.

**Application of predictive analytics** in retail, direct marketing, health care, financial services, insurance, supply chain, etc. **(10 hrs)**

#### Text Books:

- [1]. Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014.
- [2]. Jain Pei, Jiawei Han, Micheline Kamber, “Data Mining : Concepts and Techniques”, 3<sup>rd</sup> Ed, 2011, Elsevier
- [3]. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”, 2<sup>nd</sup> Edition, 2011, Springer Series in Statistics.
- [4]. Daniel T. Larose, Chantal D. Larose “Data Mining and Predictive Analytics”, 2<sup>nd</sup> Ed, 2016, John Wiley & Sons Inc.,

#### Reference Books:

- [1]. Ken Black, “Applied BUSINESS STATISTICS Making better business decisions”, 7<sup>th</sup> Ed, 2016, John Wiley & Sons Inc.,
- [2]. R N Prasad, Seema Acharya, “Fundamentals of Business Analytics”, 1<sup>st</sup> Ed, 2011, Wiley India
- [3]. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, “Practical Data Science Cookbook”, 1st Ed, 2014, Packt Publishing Ltd..
- [4]. Nathan Yau, “Visualize This: The Flowing Data Guide to Design, Visualization”, 2011, Wiley

- [5]. Daniel T. Larose, "Discovering Knowledge in Data: An Introduction to Data Mining", 2011, Wiley Intl
- [6]. Thomas W Miller, "Modeling Techniques in Predictive Analytics", 1<sup>st</sup> Ed, 2013, Pearson
- [7]. Peter Adrians, Rolf Zantinge, "Data Mining", 1<sup>st</sup> Edition, 2010, Pearson Education
- [8]. Vikram Pudi, Radhakrishna, "Data Mining", 2<sup>nd</sup> Edition, 2011, Oxford University Press.
- [9]. Richard Roiger, Michael Getz, "Data Mining : A Practical Based Primer", 1<sup>st</sup> Ed, 2010, Pearson
- [10]. Arun K Pujari, "Data Mining Techniques", 2<sup>nd</sup> Ed, 2013, University Press

### **PS 607. 2 P Advanced Computing and Data Mining Lab**

<b>Total No. of Practicals : 90</b>	<b>Total Marks : 100</b>	<b>[ L - T - P - S ]</b>
<b>No. of Labs / Week : 3</b>	<b>Credits : 2</b>	<b>[ 0 - 1 - 3 - 0 ]</b>

**Course Objectives:** This subject enables students to

- master the basics in business intelligence (BI), data mining (DM), and knowledge discovery in databases;
- learn the role that software tools/applications play in BI and DM, with emphasis on industrial case studies and practical applications;
- Have an overall understanding of the major issues and applications in business intelligence and data mining, including a basic grasp of the algorithm classes and best practices for building successful BI projects

**Course Outcome:** Upon completion of the subject, students will be able to

- examine the concepts of data warehousing and OLAP;
- apply the concepts of BI and DM techniques for clustering, association, and classification;
- understand the operation procedures of BI projects in an organization;
- select appropriate DM tools and methods to manipulate and achieve data;
- apply DM concepts for formulating business strategies and programs to enhance business intelligence.

### **Business Intelligence Laboratory exercises**

- [1] Experiment dealing with elementary concepts in Statistics . Calculate Probability and Conditional Probability for given data set ( with discrete attributes and continuous attributes) and vizualise them.
- [2] Gain insight for running pre- defined decision trees and explore resultsusing MS OLAP Analytics.



- [3] To Perform various PL/SQL commands in Oracle 11g
- [4] To perform multi dimensional data model using SQL queries e.g: Star, Snowflake, Fact Constellation schemas.
- [5] Using IBM OLAP Miner – Understand the use of data mining for evaluating the content of multidimensional cubes.
- [6] To perform various OLAP operations such as Slice, dice, roll up, drill up, pivot etc.
- [7] To perform Text mining on the given data warehouse.
- [8] To perform Correlation ship analysis between for the given data set.
- [9] Publish cognos cubes to a business intelligence portal. Metadata & ETL Lab: The objective of the lab exercises is to implement metadata import agents to pull metadata from leading business intelligence tools and populate a metadata repository.
- [10] Import metadata from specific business intelligence tools and populate a meta data repository.
- [11] Publish metadata stored in the repository
- [12] Load data from heterogenous sources including text files into a pre-defined warehouse schema.
- [13] Using Teradata Warehouse Miner – Create mining models that are executed in SQL
- [14] Design a data mart from scratch to store the credit history of customers of a bank. Use this credit profiling to process future loan applications.
- [15] Design and build a Data Warehouse using bottom up approach titled 'Citizen Information System'. This should be able to serve the analytical needs of the various government departments and also provide a global integrated view.
- [16] To perform attribute relevance analysis on the given data.
- [17] To perform the information gain for a particular attribute in the given data.
- [18] To perform the experiment to predict the class using the Bayesian Classification.
- [19] To find out a weight or bias updating using the Back Propagation Neural Network.
- [20] To perform various Data Mining algorithms on the given database using Clementine.
- [21] To perform data Mining using Weka tool.
- [22] Experiment with any Classification method.
- [23] To perform Data Mining using Ms-Excel Mining Tool.
- [24] Experiment with the Apriori Association Mining Algorithm
- [25] Perform Market basket analysis with a given data set.
- [26] Experiment with data set using any Clustering algorithm.
- [27] Data Analysis- Getting to know the Data(Using ORANGE,WEKA)
  - Parametric – Means, T-Test, Correlation
  - Prediction for numerical outcomes - Linear regression
  - Correlation analysis
  - Preparing data for analysis
  - Pre-processing techniques
- [28] Data Mining(Using ORANGE,WEKA or any open source data mining tool)
  - Implement clustering algorithm
  - Implement classification using
  - Decision tree
  - Back propagation
- [29] Web Analytics(Using Rapid Miner or any open source web mining tool)
  - Visualization methods

- Study of web mining tool kits
- Categorization and clustering of web data(Using CARROT)

### **PH 608.2 : MINI PROJECT AND ADVANCED ENTREPRENEURSHIP**

<b>Total No. of Lectures : 48</b>	<b>Total Marks : 150</b>	<b>[ L - T - P - S ]</b>
<b>No. of Lectures / Week : 4</b>	<b>Credits : 4</b>	<b>[ 3 - 0 - 2 - 2 ]</b>

**Objectives :** By now you are well aware that in this curriculum you learn by “doing” and that it is not a theoretical course. Here, you will actually start your venture and build it and bring it to life! You start this part of the journey with a quick recap of some fundamentals of entrepreneurship. Then you revisit your existing business model and refine it as you deem fit. Based on the updated business model, you will make your Sales plan, People plan, and Financial plan. The next step is to increase the revenue options and look at funding options for your venture for further growth.

1. **Refining the Business Model, Product and Services:** Pivoting, Class Activity – Should I Pivot, Type of Business Models, Class Activity – Research the Business Evolution for 2 Companies; Refining Business Models, Class Activity – Generate Two New Business Models for your Venture; Analyze Business Model of your Competitors, Class Activity - Analyze Business Model of your Competitors; Adding New Customer Segments, Class Activity – Add New Customer Segment to your Business Model; Product Manager – Role and Responsibilities, Class Activity – Product Management who did it right? Case Studies – Practo, Swiggy
2. **Business Planning** - Business Plan, Make a Sales Plan, Class Activity – Make a Sales Plan & Hiring Sales Team; Make a People Plan, People Plan for your venture; Introduction to Financial Plan, Class Activity – Understanding Financial Planning and Forecasting Template, Discuss Financial Plan and Revisit your Business Model, Create Procurement Plan, Negotiation Role Play; Case Study – Ninja Cart
3. **Exploring ways to increase Revenue** - Understanding Primary Revenue Source; Class Activity – Exploring Customer Life Cycle for Growing Customers; Exploring Secondary Sources of Revenue, Class Activity – Identify Secondary Revenue Resources.
4. **Funding the Growth / Scalability** - Funding Options for an Entrepreneur, Class Activity – Explore the Right Funding Options, Create your Funding Plan; Preparing a Business Pitch Deck, Case Study – Head Out

5. **Building the A Team** – Introduction to Building a A Team, Class Activity – Pitching to attract Talent; Setting your Team up for Success, Class Activity – Defining the role of a new hire; Case Study – Oyo Rooms
6. **Creating Branding and Channel Strategy** – All about Branding, Class Activity – Draw your Ventures golden circle, Define your values; All about Positioning statements, Class Activity – Create your Brand Name, Social Media Handler, and Logo; Identify your Right Channel.
7. **Leveraging Technologies and Available Platforms** – Leaping ahead with Technology; Digital Marketing for your Startup; Class Activity – Plan a Social Media Campaign; Digital Collaboration; Class Activity – Store your Documents online, Other Platforms Class activity – Make your Tech Plan and Platform wish list.
8. **Measuring your Progress** - Metrics for Customer Acquisition – CAC+CLV + ARPU; Metrics for Customer Retention and Satisfaction; Class Activity – Find your CAC, CLV, ARPU; Key Financial Metrics; How to communicate your Metrics; Class Activity – Find new Revenue Streams based on your key financial metrics
9. **Legal Matters** – Identify Professional and Legal and Compliance requirement for your venture; Conduct a Trademark Search for your Company and Trade Name. Case Study – Spring Role
10. **Mentorship and Seeking Support** – How Mentors help to create startups; Identify mentors and Advisors; Scout for Board of Directors; Final Project and Entrepreneur Case Studies

#### **References :**

- 1) Cliffton: Davis s and Fyfie, David E. "Project Feasibility Analysis". John wiley, New York
- 2) Desai, A.N. "Entrepreneur & Environment". Ashish, New Delhi.
- 3) Drucker, Peter. "Innovation and Entrepreneurship". Heinemann, London.
- 4) Jain Rajiv. "Planning a Small Scale Industry: A guide to Entrepreneurs". S.S. Book, Delhi.
- 5) Kumar S.A. "Entrepreneurship in Small Industry". Discovery, New Delhi.
- 6) McClelland, D.C. and Winter, W.G. "Motivating Economic Achievement Free Press, New York
- 7) Pareek, Udit and Venkateswara Rao, t. "Developing Entrepreneurship-A Handbook on learning system". Learning systems Delhi.

**III Semester**  
**PH 601.3 [E1] : FUNCTIONAL PROGRAMMING PARADIGM**

<b>Total No. of Lectures : 48</b>	<b>Total Marks : 100</b>	<b>[ L – T – P – S ]</b>
<b>No. of Lectures / Week : 4</b>	<b>Credits : 4</b>	<b>[ 3 – 1 - 0 - 2 ]</b>

**Course Objectives:**

1. To learn basic of Haskell programming language, types and functions.
2. To learn working of functional programming, JSON data.
3. To learn working of I/O and files processing.
4. To learn basic of Clojure programming language, types and functions.
5. To learn composite data types in Clojure programming language.

**Course Outcomes** – upon successful completion of this course, the participant will be able to:

1. Understand the basic fundamentals data types, and function structure required for Haskell programming language.
2. Implementation of functions, loops, arrays, objects, and working with JSON data.
3. Implementation of files, I/O and Buffering.
4. Understand the basic fundamentals object-oriented, Scalars, Collections and functions required for Clojure programming language.
5. Implementation of vectors, list, queues and function for Clojure programming language.

**Unit - I**

**INTRODUCTION TO HASKELL:** Haskell environment, basic interaction, command-line editing in ghci, lists, strings and characters, first steps with types.

**Types and Functions:** Haskell type system, common basic types, function application, composite data types, functions over lists and tuples, function types and purity, Haskell source files, understanding evaluation, polymorphism.

**Defining Types, Streamlining Functions:** Defining new Data type, type synonyms, algebraic data types, pattern matching, record syntax, parameterized types, recursive types, local variables, case expression.

**(10 Hrs)**

**Unit - II**

**Functional Programming:** infix functions, working with lists, think about loops, partial functions.

**Working with JSON Data:** representing JSON data in Haskell, anatomy of a Haskell module, generating a Haskell program and importing modules, printing JSON data, type inference, arrays and objects, module header, creating package.

**Using Typeclasses:** need for typeclasses, typeclass instances, built-in typeclasses. **(10 Hrs)**

### **Unit - III**

**I/O:** working with files and handles- open file, closing handles, seek and tell, standard input, output and error, deleting and renaming files, temporary files, lazy I/O, Buffering.

**Efficient file processing, regular Expressions, Filename matching:** efficient file processing, filename matching, regular expressions, writing lazy functions. **(9 Hrs)**

### **Unit - IV**

**Introduction to Clojure:** clojure way, why Lisp, functional programming, why clojure isn't especially object-oriented. Scalars, collections, functions, vars, locals, loops and blocks, quoting, interop, exceptional, namespaces.

**Data types:** on scalars- understanding precision, rational, use of keywords, symbolic resolution, regular expressions. **(9 Hrs)**

### **Unit - V**

**Composite data types:** persistence, sequence and complexity, vectors, lists, persistent queues, persistent sets, thinking in maps. Immutability, designing a persistent, laziness. Functions in all forms, closures, recursively. **(10**

**Hrs)**

### **Text Books:**

- [1]. Bryan O'Sullivan, Don Stewart, and John Georzen, "Real World Haskell", O'Reilly.
- [2]. Michael Fogus, Chris Houser, "The Joy of Clojure", Manning Publications.

### **Reference Books**

- [1]. Michael Swaine, "Functional programming a pragpub anthology", Pragmatic Bookshelf.
- [2]. Richard Bird, Philip wadler, "Introduction to functional programming", prentice hall series in computer science.
- [3]. Allen B. Tucker, Robert E. Noonam, "Programming languages principles and paradigms", McGraw Hill.
- [4]. Alex Miller, "Programming Clojure", Pragmatic Bookshelf.
- [5]. Michael Bevilacqua-Linn, "Functional programming patterns in scala and clojure", Pragmatic bookshelf.
- [6]. Graham Hutton, "Programming in Haskell", Cambridge University Press.

**PH 601.3 [E2] : INTERNET OF THINGS AND APPLICATIONS DEVELOPMENT**

**Total No. of Lectures : 48**

**Total Marks : 100**

**[ L – T – P – S ]**

**No. of Lectures / Week : 4**

**Credits : 4**

**[ 3 - 1 - 0 - 2 ]**

**Course Objectives:**

1. To learn networking core concepts and principles of IoT.
2. To learn M2M protocols, architecture, hardware constraints, model of IoT.
3. To learn data Link layer and protocols of IoT.
4. To learn connected devices technology and user experience of IoT.
5. To learn networks technology, product/service of IoT.

**Course Outcomes** – upon successful completion of this course, the participant will be able to:

1. Understand the basic networking model, internet/Web, networking equipment required for design of IoT.
2. Understand the basic IoT protocols, architecture, reference architecture, data representation, required for design of IoT.
3. Understand the basic of data link layer protocols and their feature for the design of IoT.
4. Understand the basic of user experience in design of IoT and multipurpose computer concepts, sensor for IoT design.
5. Understand the basic of networking, issues, challenges, communication patterns for the IoT design.

**Unit - I**

**The IoT Networking Core :** Technologies involved in IoT Development: Internet/Web and Networking Basics OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Introduction to Web Servers,

**Network Fundamentals:** Overview and working principle of Wired Networking equipment's – Router, Switches, Overview and working principle of Wireless Networking equipment's, Access Points.

**(10 Hrs)**

**Unit - II**

**IoT Architecture:** M2M – Machine to Machine, Web of Things, IoT protocols Applications: Remote Monitoring & Sensing, The Architecture The Layering concepts , IoT Communication Pattern

**IoT Architecture-State of the Art** – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

**(10 Hrs)**

**Unit - III**

**IoT Data Link Layer and Protocols :** PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), WirelessHART,Z-Wave,Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer- IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

(9 Hrs)

#### Unit - IV

**User Experience Design for the Internet of Things:** UX for IoT Different, Design model for IoT.  
**Things the Technology of Connected devices:** Types of connected device, multipurpose computers, bridging physical and digital: sensors and actuators, the challenge of powering devices, conserving battery life.

(9 Hrs)

#### Unit - V

**Networks the Technology of connectivity:** Networking relevant to IoT UX, networking issues that cause UX challenges for IoT, the Architecture of the IoT, types of Network, network communication patterns, internet service.

**Product/Service definition and strategy:** making good products, from innovation to mass market, tools versus products, what makes good product, services in IoT, business models.

(10 Hrs)

#### Text Books:

1. Zach Shelby, Carsten Bormann, "LoWPAN: The Wireless Embedded Internet", 1<sup>st</sup> Ed, 2010, Wiley
2. Claire Rowland, Elizabeth Goodman, Martin Charlier, " Designing connected Products UX for the consumer internet of Things", Oreilly.

#### Reference Books

1. Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning, "The Internet of Things: From RFID to the Next-Generation Pervasive Networked", 1<sup>st</sup> Edition, 2011, Wiley International
2. Vijay Madisetti , Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1<sup>st</sup> Ed, 2014, TMH
3. Hakim Cassimally, "Designing the Internet of Things , Adrian McEwen (Author)", McGraw Hill
4. Asoke K Talukder and Roopa R Yavagal, "Mobile Computing," Tata McGraw Hill, 2010.
5. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press,
6. Peter Waher, "Learning Internet of Things", 1<sup>st</sup> Edition, 2015, PACKT publishing,
7. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", 2014, Springer
8. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", 1<sup>st</sup> Edition, 2016, Willy Publications
9. Jean-Philippe Vasseur, Adam Dunkels, "Interconnecting Smart Objects with IP: The Next Internet", 2<sup>nd</sup> Edition, 2014, Morgan Kuffmann
10. Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", 1<sup>st</sup> Edition, 2013, River Publishers

#### PH 601.3 [E3] : AUGMENTED AND VIRTUAL REALITY

<b>Total No. of Lectures : 48</b>	<b>Total Marks: 100</b>	<b>[ L – T – P – S ]</b>
<b>No. of Lectures / Week: 4</b>	<b>Credits : 4</b>	<b>[ 3 – 1 – 0 – 2 ]</b>

**Course Objectives:** This subject aims to teach students are as follows:

1. To learn the basic concepts for Augment and Virtual Reality.
2. To learn the Software and Hardware concepts for Augment and Virtual Reality.
3. To learn the Wearable Computers, Augmented Reality and their challenges.
4. To learn the Input, Output interface and Applications of Virtual Reality.
5. To learn the technology, features, functionality and visualization techniques for Augment Reality. Understanding the differences in AR/VR concepts.

**Course Outcomes:** When students have successfully completed this module they should be able to:

1. Understand the basic fundamental topics to consider for the design of Augment and Virtual Reality.
2. Understand the Software and Hardware needed for Augment and Virtual Reality.
3. Knowledge on fundamentals of Wearable Computers, scope, augmented Reality and their challenges.
4. Knowledge on fundamentals of Input, Output interface required for the design of Virtual Reality.
5. Knowledge on fundamentals of technology, features and visualization techniques required for design of Augment Reality.

### **Unit - I**

**Introduction:** Creative Coding Platforms; Open Source Platforms; PIC - Arduino, Sketch, Raspberry Pi, Iterative coding methodology ; Python Programming; Mobile phones and similar devices; Arm Devices; Basic Electronics (circuit theory, measurements, parts identification)

**(9 Hrs)**

### **Unit - II**

**Software and Hardware Frameworks: Software:** openFrameworks as our IDE (C/C++) - “Arduino” Language (C/C++) – **Hardware:** Desktop / Laptop / Raspberry Pi; approach to a programming problem; Representing “reality” with computers; Digital vs. Analog circuits, audio, communication, etc. Analog to Digital Conversion (ADC) ; Digital to Analog Conversion (DAC); Microcontrollers; Communication Serial& Parallel; Hardware to Hardware Communication; I2C/IIC (Inter-Integrated Circuit); SPI (Serial Peripheral Interface) – Serial UART Communication

**(10 Hrs)**

### **Unit - III**



**Wearable Computers and Augmented Reality:** Public Policy, Theory of augmented Reality, Challenges and Future Ahead.

**Wearable Computing Challenge:** Networking, power and heat, mobile input, display, virtual reality, portable video viewers, industrial wearable systems, academic/maker systems for everyday use, consumer devices, meeting the challenge.

**(9Hrs)**

#### **Unit - IV**

**Introduction of Virtual Reality:** Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality.

**Multiple Models of Input and Output Interface in Virtual Reality:** Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices.

**Applications in Virtual Reality:** wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

**(10 Hrs)**

#### **Unit - V**

**Augmented and Mixed Reality,** Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.

**(10 Hrs)**

#### **Text Books:**

1. Woodrow Barfield, "Fundamentals of Wearable Computers and Augmented Reality", 2<sup>nd</sup>, 2015, Pearson Burdea.
2. Paul Scherzand Simon Monk, "Practical Electronics for Inventors", Third Edition, 2016, Wiley Int.

#### **Reference Books:**

1. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality", by Elsevier Science.
2. Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", 2<sup>nd</sup> Edition, 2014, Morgan Kaufmann Publishers.
3. Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications, Foundations of Effective Design", 1<sup>st</sup> Edition, 2009, Morgan Kaufmann.
4. Borko Furht, "Hanbook of Augmented Reality", Springer.
5. Intel Galileo and Intel Galileo "API Features and Arduino Projects for Linux Programmers", Ramon, Manoel 2014 (Open Access)
6. G. C. and P. Coffet. "Virtual Reality Technology", Second Edition. 2009, Wiley

7. Ravi Iyer, "Programming Interactivity", Second Edition, 2012, O'reilly Publishers
8. Joshua Noble, "Programming the Raspberry Pi: Getting Started with Python ", 2E, 2016, Apress.

## **PH 601.3 (E4) : MOBILE COMMUNICATION**

**Total No. of Lectures : 48                      Total Marks : 100                      [ L - T - P - S ]**

**No. of Lectures / Week : 4                      Credits : 4                      [ 3 - 1 - 0 - 2 ]**

### **Course Objectives:**

1. Understanding the basic principles of mobile communication systems,
2. An analysis of mobile communications with the interpretation of the call prints
3. The basic principles of the modern mobile and wireless communication systems
4. Understanding the operation of mobile communications systems and their generation divisions
5. An understanding of the concept of wireless adhoc and wireless sensor network with its major challenges

**Course Outcomes:** After completing the course, the students will be able to

**CO1:** Discuss cellular radio concepts and identify various propagation effects.

**CO2:** To have knowledge of the mobile system specifications.

**CO3:** Classify multiple access techniques in mobile communication.

**CO4:** Outline cellular mobile communication standards.

**CO5:** Learn Sensor Network fundamentals.

## **UNIT – I**

**09 Hrs.**

**Introduction to Mobile Communication:** applications, a simplified reference model, **Wireless Transmission:** frequencies of radio transmission, signals, antennas, signal propagation, multiplexing, modulation, spread spectrum, cellular system. **Media Access Control:** motivation for a specialized MAC, SDMA, FDMA, TDMA, CDMA, and Comparisons.

## UNIT - II

09 Hrs.

Telecommunications systems: GSM-Mobile services, System architecture, Radio interface, Protocol, Security, DECT- System architecture, Protocol architecture, Wireless LAN: Infrared vs. radio transmission, Infrastructure and ad-hoc networks, IEEE 802.11, HPERLAN, Bluetooth.

## UNIT - III

10 Hrs.

Mobile Network Layer: Mobile IP, Dynamic host configuration protocol, Mobile ad-hoc networks- Routing, Destination sequence distance vector, Dynamic source routing. Mobile Transport Layer: Traditional TCP, classical TCP improvements, TCP over 2.5/3G wireless networks. 4G, 5G

## UNIT - IV

10 Hrs.

Support for Mobility:File Systems, World Wide Web, Wireless Application Protocol (WAP)-Architecture, Wireless datagram protocol, transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Wireless markup language, WMLScript and WAP 2.0.

## UNIT - V

10 Hrs.

Sensor Networks, Introduction and Architecture, Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture – Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

## REFERENCE BOOKS:

1. Jochen Schiller, Mobile Communications, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, Fundamentals of Mobile Computing, PHI Learning Pvt.Ltd, New Delhi , 2012.
3. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.

4. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, Principles of Mobile Computing, Springer, 2003.
5. William.C.Y.Lee, Mobile Cellular Telecommunications, Analog and Digital Systems, Second Edition, TataMcGraw Hill Edition ,2006.
6. C.K.Toth, AdHoc Mobile Wireless Networks, First edition, Pearson Education, 2002.
7. HolgerKarl , Andreas willig, Protocol and Architecture for Wireless Sensor Networks, John wiley publication, Jan 2006.
8. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, Wireless sensor networks: a survey, computer networks, Elsevier, 2002.

### **PH 602.3 [E1] WEB DEVELOPMENT WITH ANGULAR , NODE .JS**

**Total No. of Lectures : 48      Total Marks : 100      [ L – T – P – S ]**

**No. of Lectures / Week : 4    Credits : 4      [ 3 – 1 - 0 - 2 ]**

#### **Course Objectives:**

1. To understand CSS stylesheets
2. To understand javaScript & its features
3. To Understand angular & its features
4. To Understand application of angular in web development
5. To Understand Node.js & its features
6. To Understand application of Node.js in web development

**Course outcomes:** At the end of the course, students should be able to:

1. Get introduced in the area of JavaScript's Role in recent web applications.
2. Acquire knowledge about client side java framework angular
3. Acquire knowledge about Building Applications using Angular.
4. Acquire knowledge about server side framework nodeJS

### **UNIT 1**

**Introduction to Web Development:** Revisiting HTML Page Structure, using CSS for page layout - Introduction to JavaScript: Defining variables, understanding JavaScript data types, operators, looping, creating functions, understanding variable scope using JavaScript objects, manipulating string, working with arrays, error handling  
10 hrs

## UNIT II

**Introduction to Angular,** Angular Development History, MVC,MVV, **Angular Core Concepts-** Angular Architecture and Building Blocks,Modules,Components,Templates, Directives, and Data Binding,Services and Dependency Injection,Routing,Angular Application Working,Angular Installation,Sample Angular Application 10 Hrs

## UNIT III

**Angular Component, Template and Data Binding-**Component,Component Interaction, Displaying Data,Data Binding,Templates,Dependency Injection,Lifecycle Hooks , **Angular Modules** Module Basics,NgModule Basics,Bootstrapping,Feature Modules,NgModule Metadata, NgModules and Components , **Angular Directives-**Angular Directive Basics,Component or Directives,Attribute Directives,Structural Directives,Built-in Directives,Built-in Attribute Directives,Built-in Structural Directives,**Pipes-**Angular Pipe,Using pipes,Built-in Pipes 9hrs

## Unit - IV

**Introduction to Node.js:** Asynchronous programming, Benefits of using Node.js, Setting up the environment, Introduction to REPL and NPM and usage, Modules in Node.js, Event-driven applications using Node.js, File Uploading and Email Handling.

09 hrs

## Unit - V

**Advanced Node.js:** Using Express Framework, Introduction to RESTful API using Node.js, Using Node.js with MySQL to create connection, database and tables, inserting, updating and deleting records, retrieving records to display. 09 hrs

**Text books:**

- [1]. Caleb Dayley, Brendan Dayley, Brad Dayley, “Learning Angular”, Edition 2<sup>nd</sup> 2017, Addison- Wesley Publishers
- [2]. Basarat Syed, “Beginning Node.js”, Edition 1<sup>st</sup> 2014, Wiley – Apress Publishers

**Reference books:**

- [1]. Valeri Karpov, Diego Netto, “Professional Angular”, Edition 1<sup>st</sup> 2015, Wiley Wrox
- [2]. Pawel Kozlowski, “Mastering Web Application Development with AngularJS”, Edition 1<sup>st</sup> 2013, Packt Publishing
- [3]. Pedro Teixeira, “Professional Node.js: Building Javascript Based Scalable Software”, Edition 1<sup>st</sup> 2012, Wiley
- [4]. Ethan Brown, “Web Development with Node and Express”, Edition 1<sup>st</sup> 2014, O’Reilly
- [5]. Sandro Pasquali, “Mastering Node.js”, Edition 1<sup>st</sup> 2013, Packt Publishing Limited
- [6]. Brad Dayley, “ Node.js, MongoDB, and AngularJS Web Development”, Edition 2<sup>nd</sup> 2014, Addison- Wesley

**PH 602.5 [E2] CONTENT MANAGEMENT WITH JOOMLA & WORDPRES**

<b>Total No. of Lectures : 48</b>	<b>Total Marks: 100</b>	<b>[ L – T – P – S ] No. of</b>
<b>Lectures / Week: 4</b>	<b>Credits : 4</b>	<b>[ 3 – 1 – 0 – 2 ]</b>

**Objectives:**

- Introduce learners to two most popular open source content management systems (CMS) in use on the web today, WordPress and Joomla.
- Understand the difference between a CMS website, a static website, and websites using other server-side technologies.
- Understand the benefits of working with a server-side database and the power it brings to creating and managing websites.

**Course outcomes:**

At the end of the course, students should be able to:

- Create and deploy websites using CMS, including creating and editing content, adding functionality, and creating custom templates and themes.
- Understand ongoing maintenance considerations with CMS websites.

## **UNIT I**

Introduction to Content Management Systems: Revisiting HTML Page Structure, using CSS for page layout - Introduction to CMS: Exploring CMS terminology, including open source, PHP, MySQL, server-side, client-side, static HTML website, how CMS web pages are generated.  
(10 HRS)

## **UNIT II**

Introduction to Joomla: Overview, Installing Joomla, Architecture, How Joomla works, Control Panel, Toolbars and Menus. Content creation, Content customization: images, video, audio, tags, formats, etc. Adding and displaying menus, Linking menus to articles and other features  
(10 HRS)

## **UNIT III**

Extending Joomla: Finding and adding Joomla plugins, how do Plugins Work? plugin types, examples for plugin usage, Modules in Joomla, User management and permissions. Using Templates in Joomla.  
(10 HRS)

## **UNIT IV**

Introduction to WordPress: Overview, Installing WordPress, Dashboard, Content Management using WordPress, Exploring the admin interface, WordPress Categories and Posts, Content customization: images, tags, formats, etc. WordPress themes and templates.  
(10 HRS)

## **UNIT V**

Extending WordPress: WordPress media, Using WordPress Plugins, Managing Databases in CMS, Comments and Links Management in WordPress, User management and permissions, creating a blog website using WordPress.  
(10 HRS)

**Text books**

1. Brad Williams, David Damstra, Hal Stern, Professional WordPress: Design and Development, 2<sup>nd</sup> 2013, John Wiley & Sons
2. Jennifer Marriott, The Official Joomla! Book, 2<sup>nd</sup> 2013 Addison-Wesley Professional

#### **Reference Books**

1. Matthew Macdonald , WordPress: The Missing Manual, 1<sup>st</sup> 2012, O'Reilly
2. Matthew Macdonald , WordPress: The Missing Manual, 1<sup>st</sup> 2012, O'Reilly
3. Eric Tiggeler , Joomla! 3 Beginner's Guide , 2<sup>nd</sup> 2014 Packt Publishing Limited
4. Dan Rahmel , Advanced Joomla!, 4<sup>th</sup> 2013 Apress
5. Mark Dexter, Louis Landry, Joomla! Programming, 1<sup>st</sup> 2012 Addison- Wesley

#### **PH 602.3 [E3] Blockchain Technology with Ethereum**

**Total No. of Lectures : 48    Total Marks : 100    [ L - T - P - S ]**  
**No. of Lectures / Week : 4    Credits : 4    [ 3 - 1 - 0 - 2 ]**

#### **Course Objectives:**

1. To understand how bitcoin works, from when a transaction is created to when it is considered part of the Blockchain
2. To understand private and public keys as well as addresses and how exactly they are constructed and used
3. To understand fundamental and implied differences between Ethereum and Bitcoin protocol by covering historical, conceptual and architectural distinctions
4. To Learn most prominent smart contract platform Ethereum and expose to its main programming language Solidity

#### **Course Outcomes**

On the successful completion of the course, students will be able to

1. Understand what and why of Blockchain
2. Explore the major components of Blockchain
3. Learn about Hyperledger Fabric model and its Architecture
4. Learn about Hyperledger Composer and Explorer
5. Learn about Bitcoin, Ethereum



6. Learn about Ethereum Virtual machine, The Ethereum network. Applications development on Ethereum.

### **UNIT 1**

Distributed systems :CAP theorem, Byzantine Generals problem, The history of blockchain Electronic cash. Introduction to blockchain : Various technical definitions of blockchains , Generic elements of a blockchain Features of a blockchain Applications of blockchain technology ,Tiers of blockchain technology, Types of blockchain -Public blockchains, Private blockchains ,Semi-private blockchains, Sidechains ,Permissioned ledger , Distributed ledger , Shared ledger , Fully private and proprietary blockchains , Tokenized blockchains , Tokenless blockchains, Consensus in blockchain. CAP theorem and blockchain Benefits and limitations of blockchain

**(10 HRS)**

### **UNIT II**

Blockchain and full ecosystem decentralization, Smart contracts , Decentralized Organizations , Decentralized Autonomous Organizations, Decentralized Autonomous Corporations, Decentralized Autonomous Societies, Decentralized Applications ,Platforms for decentralization Cryptography and technical foundations: cryptography, confidentiality , Integrity, Authentication, Symmetric Cryptography, Asymmetric Cryptography, RSA, Discrete logarithm problem, Cryptographic primitives, Hash Functions, Elliptic curve digital signature Algorithm(ECDSA)

**(10 HRS)**

### **UNIT III**

Bitcoin, Transactions : The Transaction life cycle, The transaction structure, Types of transaction, Blockchain : the structure of a block, the structure of a block header, the genesis block, the bitcoin network, Wallets. Bitcoin payments. Bitcoin Limitations: privacy and anonymity, Extended protocols on top of bitcoin, Development of altcoins, Namecoin, Litecoin, Primecoin. Zcash

**(10 HRS)**

### **UNIT IV**

Ethereum clients and releases, the Ethereum stack, Ethereum Blockchain: Currency, Forks,Gas, the consensus mechanism, the world state. Transactions,Contract creating transaction , Message call transaction.

Elements of the Ethereum blockchain : Ethereum virtual machine (EVM): Execution environment, Opcodes and their meaning, Accounts: Types of accounts, Block: Block header,The genesis block, Transaction receipts, Transaction validation and execution, the block validation mechanism.

Ether, Messages, Mining, Clients and wallets, Trading and Investment, The Ethereum network. Applications developed on Ethereum. **(10 HRS)**

#### **UNIT V**

Setting up a development environment: Test Net, Setting up a Private Net, Starting up the private network. Development tools and clients: Languages, Compilers, Tools and Libraries, EthereumJS. Contract development and deployment. Introducing solidity: Types: value types, Literals, Enums, Function types, Mappings, Global variables, control structures.

Introducing Web3: POST requests, The HTML and JavaScript frontend. Development framework: Truffle **(10 HRS)**

#### **Text Books:**

[1] Imran Bashir, Mastering Blockchain, 1<sup>st</sup> edition 2017, Packt publications Ltd.

#### **Reference Books**

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, 1<sup>st</sup> edition, 2016, Princeton University Press
2. Stallings W., Cryptography and Network security: Principles and Practice, 7/e, Pearson Education Asia, 2017.
3. Kevin Werbach, The Blockchain and the new architecture of Trust, MIT Press, 2018.
4. Joseph J. Bambara and Paul R. Allen, Blockchain – A practical guide to developing business, law, and technology solutions, McGraw Hill, 2018
5. Melanie Swan, Blockchain – Blueprint for a new economy, O'Reilly publishers, 2018.
6. Jai Singh Arun, Jerry Cuomo, Nitin Gaur, Blockchain for Business, Pearson publishers, 2019.

#### **PH 603.3 (E1) Computing with C# and .NET Framework**

**Total No. of Lectures : 48**

**Total Marks: 100**

**[ L – T – P – S ]**

**No. of Lectures / Week: 4**

**Credits : 4**

**[ 3 - 1 - 0 - 2 ]**

**Course Objectives:**

1. To introduce .NET Framework and its constituent components also to understand the working of a .NET Application.
2. To learn Object Oriented Programming using C#
3. To develop UWP for Windows with ease using GUI programming
4. To learn Data Access in Universal Windows App Programming
5. To give an Introduction to the .NET Core Paradigm

**Course outcomes:**

At the end of the course, students should be able to:

1. Understand what is .NET Framework and how does it work
2. Develop Programs using various C# concepts
3. Design and develop full-fledged UWP applications using C#
4. Use any DB technology and create a dynamic UWP.
5. Gain knowledge in the area of .NET Core and develop applications using .NET Core

**UNIT I**

**.NET Framework:** Architecture of .NET Framework. Working, .NET Compliant Languages - The Common Language Runtime (CLR); Common Type System (CTS); Common Language Specification (CLS); Common Intermediate Language (CIL); Types of JIT Compilers; Garbage Collection; Base Classes Framework; Assemblies and Modules.

**8 Hrs**

**UNIT II**

**Introduction to C#.NET:** Overview, Environment, Program Structure, Basic Syntax, Data Types, Variables, Constants, Modifiers, Statements, Operators, Decision Making, Loops, Strings, Date & Time, Arrays, Collections, Object Oriented Programming with C#.NET; Classes and Objects, Inheritance, Polymorphism, Encapsulation.

**10 Hrs**

**UNIT III**

**Universal Windows App Development using C#:** Overview of the IDE to develop Metro Style Apps; Windows Store apps using C# and XAML: Blank, Grid and Split App; Overview of XAML for

Design; Syntax, Features and working of XAML; Manage app life cycle and state; Navigation, layout, and views; File access and pickers using C#.

**10 Hrs**

#### **UNIT IV**

**Data Access:** The ADO.NET Object Model; Managed Providers; Working with Connected and Disconnected Architectures; Connection, Command, DataReader, DataAdapter, DataSet and Transaction objects; Using Data Controls – Code way; An Overview of LINQ; Using LINQ to SQL; Entity Framework: Entity Data Model, Querying Data, CRUD Operations in EF.

**10 Hrs**

#### **UNIT V**

**Introduction to .NET Core:** Overview, Working of .NET Core, Execution, Modularity, Project File References, Creating UWP using .NET Core, Portable Class Libraries, Using ASP.NET Core, Components, Web Pages Introduction to ASP.NET Core MVC.

**10 Hrs**

#### **TEXT BOOKS:**

1. Sergii Baidachnyi, "Developing Windows 10 Applications with C#", CreateSpace Independent Publishing Platform, 2016
2. Rishabh Verma, Neha Shrivastava, ".NET Core 2.0 By Example:", Packt Publishing; 1<sup>st</sup> edition 2018

#### **REFERENCE BOOKS:**

1. E Balagurusamy, "Programming in C#", McGraw Hill Education; 4<sup>th</sup> edition, 2017
2. Arthur Gittleman, "Computing with C# and the .NET Framework", Jones & Bartlett Learning, 2<sup>nd</sup> edition, 2011

### **PH 603.3 (E2): Web Technologies and .NET Framework**

**Total No. of Lectures : 48**

**Total Marks: 100**

**[ L – T – P – S ]**

**No. of Lectures / Week: 4**

**Credits : 4**

**[ 3 - 1 - 0 - 2 ]**

**Objective:** The learning objectives are -

1. To study the elements of the .NET Framework platform and its working
2. To understand what is ASP.NET and what it has to offer in Web Development
3. Understand the architecture and main classes of ADO.NET, LINQ and EF to develop Data Driven Applications
4. To Develop Web Services using ASP.NET and to understand ASP.NET AJAX and MVC
5. To Introduce ASP.NET Core MVC Programming Paradigm

**Course outcomes:**

At the end of the course, students should be able to:

6. Understand what is .NET Framework and Develop Programs using various C# concepts
7. Design and develop full-fledged Web applications using ASP.NET With C#
8. Use any DB technology such as ADO.NET, LINQ or EF to create a Dynamic application.
9. Create and Consume Web Services and Develop ASP.NET MVC based applications; Use AJAX
10. Develop web applications using ASP.NET Core

### **UNIT -I**

**.NET Framework and C#:** Architecture of .NET Framework. -.NET Compliant Languages - The Common Language Runtime (CLR); Common Type System (CTS); Common Language Specification (CLS); Common Intermediate Language (CIL); **C#:** Data types – Operators and Expressions - Statements – Decision Making – Loops – Arrays and Collections – Strings; Object Oriented Programming - Encapsulation, Polymorphism and Inheritance in C#.

**10 hrs**

### **UNIT – II**

**ASP.NET:** ASP.NET Architecture; Programming with ASP.NET Web pages, Components, Master pages and User Control; ASP.NET State Management; Caching; **ASP.NET AJAX** Components of Microsoft's AJAX Support; Partial Page Update; Script Manager; Client-Side Page Lifecycle; Update Panel Control; Update Modes; Timer.

**9 hrs**

### UNIT – III

**Data Access using ADO.NET, LINQ, Entity Framework:** The ADO.NET Object Model; Managed Providers; Working with Connected and Disconnected Architectures; Command, DataReader, DataAdapter, DataSet and Transaction objects; **LINQ**; Using Standard 'LINQ to' Technologies namely: LINQ to Object, LINQ to DataSet, LINQ to SQL, LINQ to XML; **Entity Framework**, Entity Data Model, Navigating the EF, Querying Data, CRUD Operations in EF.

**10 hrs**

### UNIT - IV

**Web Services:** Overview; Working of a Web Service; Features; Platform Elements; Creating a Web Service using ASP.NET; Consuming a Web Service. **ASP.NET MVC:** MVC Overview; Advantages of using MVC Model; ASP.NET MVC application Structure; Creating the Model; Creating a Controller; Adding a View; Razor View Engine; Razor Syntax, Variables, Loops and Logic; Specifying a Partial View; Models, Layout; Scaffolding, Databases;

**10 hrs**

### UNIT – V

ASP.NET Core: Overview, Environment Setup, Project Layout, Project.Json, Configuration, Middleware, Exceptions, Static Files, Setup MVC, MVC Design Pattern, Routing, Attribute Routes, Action Results, Views, Setup Entity Framework

**9 hrs**

#### TEXT BOOKS:

1. Mary Delamater, Anne Boehm, "Murachs ASP.NET 4.6 Web Programming with C#", Shroff Publishers & Distributors Pvt Ltd, 6<sup>th</sup> edition, 2016
2. James Chambers, David Paquette, Simon Timms, "ASP.NET Core Application Development", PHI Learning Private Limited, 2017

#### REFERENCE BOOKS:

1. E Balagurusamy, "Programming in C#", McGraw Hill Education; 4th edition, 2017
2. Imar Spaanjaars, "Beginning ASP.NET 4: in C# and VB", Wrox, 2010

### PH 603.3 (E3) Cross Platform Development using .NET Core

**Total No. of Lectures : 48**

**Total Marks: 100**

**[ L – T – P – S ]**

**No. of Lectures / Week: 4**

**Credits : 4**

**[ 3 – 1 – 0 – 2 ]**

## Course Objective -

1. To study the .NET Framework platform and the features of C# language.
2. To understand the latest version of .NET Core and its working
3. To understand Data access using LINQ etc. in NET Core applications
4. To understand developing Web Applications using ASP.NET Core with Razor View Engine
5. To Implement ASP.NET MVC Core Web Applications with Entity Framework

## Course Outcomes:

At the end of the course, students should be able to:

1. Understand what is .NET Framework and Develop Programs using various C# concepts
2. Design and develop full-fledged applications using .NET Core
3. Use DB technologies like Entity Framework and LINQ with .NET Core
4. Create and Deploy Web Applications using ASP.NET Core
5. Develop Professional Websites using ASP.NET Core, ASP.NET MVC Core and Razor View Engine

## UNIT I

**.NET Framework and C#:** Architecture of .NET Framework. -.NET Compliant Languages - The Common Language Runtime (CLR); Common Type System (CTS); Common Language Specification (CLS); Common Intermediate Language (CIL); C#: Data types – Operators and Expressions - Statements – Decision Making – Loops – Arrays and Collections – Strings; Object Oriented Programming - Encapsulation, Polymorphism and Inheritance in C#.

**8 Hrs**

## UNIT II

**Introduction to .NET Core:** Overview, Environment, Controlling Flow and Converting Types, Writing, Debugging and testing functions. Object Oriented Programming Implementing Interfaces and Inheriting Classes, Understanding and Packaging .NET Types.

**10 Hrs**

## UNIT III

**Advanced Concepts .NET Core:** Working with Files, Streams and Serialization in .NET Core. Protecting Data and Applications, Working with Databases using Entity Framework Core. Querying and Manipulating Data using LINQ. Improving performance and Scalability using Multitasking.

**10 Hrs**

#### **UNIT IV**

**ASP.NET Core:** Building Websites using ASP.NET Core: Understanding ASP.NET Core, Classic ASP.NET vs ASP.NET Core, Testing and Securing the Website. Enabling Razor Pages, Defining a Razor Page. Using shared layouts with Razor pages. Using Entity Framework Core with ASP.NET Core

**10 Hrs**

#### **UNIT V**

**Introduction to ASP.NET Core MVC Framework:** Set up MVC, Difference Between AddMvc and AddMvcCore, Dependency Injection, Model, Controllers, Views in ASP.NET Core MVC, ViewData, ViewModel, ViewBag, Strongly Typed View in ASP.NET Core MVC, Routing, Custom Routing & Attribute Routing, Layout View, Sections in Layout Page, ViewStart, ViewImports, Use Bootstrap in ASP.NET Core MVC, Tag Helpers, Navigation Menus.

**10 Hrs**

#### **TEXT BOOKS:**

1. [Mark J. Price, "C# 8.0 and .NET Core 3.0 - Modern Cross-Platform Development", Packt Publishing Limited; 4<sup>th</sup> Revised edition 2019.
2. James Chambers, David Paquette, Simon Timms, "ASP.NET Core Application Development", PHI Learning Private Limited, 2017

#### **REFERENCE BOOKS:**

1. Gabriel Baptista, Francesco Abbruzzese, "Hands-On Software Architecture with C# 8 and .NET Core 3", Packt Publishing Limited 2019
2. Ian Griffiths, "Programming C# 8.0: Build Cloud, Web, and Desktop Applications", O'Reilly Media; 1<sup>st</sup> edition 2020
3. PH 604.3 P Web Application Development & .NET Lab



### PH 604.3 P Web Application Development & .NET Lab

**Total No. of Practicals : 90**

**Total Marks : 100**

**[ L - T - P - S ]**

**No. of Labs / Week : 3**

**Credits : 2**

**[ 0 - 1 - 3 - 0 ]**

#### **Course Objectives:**

This course prepares students to build applications with a graphical user interface (GUI) for the Microsoft Windows operating system. Topics include: event-driven programming, .NET Framework, C#, GUI widgets, Model-View-Controller, Windows Presentation Foundation, Windows Store app development, and Human Computer Interaction. The course will also explain the relevance of these forms of computing to business models for enterprises that require large amounts of computation but do not necessarily wish to purchase and maintain large amounts of specialist computing systems.

**Course Outcome :** At the completion of this unit, students will:

- Identify important events and individuals in the history of human-computer interfaces.
- Design and develop Windows application using different Windows technologies that use a variety of GUI controls and classes to fulfill specific user requirements.
- Explain how event driven applications use threading to perform time-consuming operations.
- Demonstrate how to use specific features of the C# programming language to write object-oriented programs and handle run-time errors.
- Explain in a public presentation how user interfaces should be designed to accommodate human physiology and limitations.

#### **Web Technologies with .NET Lab**

- [1]. *Create a Registration form using basic web controls in ASP.NET.*
- [2]. *Create a Website to demonstrate the various States of ASP.NET Pages*
- [3]. *Create a Website with different pages to use of the following controls in each page, i) Adrotator Control ii) calendar control iii) Treeview control iv) Validation controls*
- [4]. *Create a Website that demonstrates the use of Master Pages*
- [5]. *Create a Website that demonstrates the use of various Page directives available in ASP.NET*
- [6]. *Develop a Database driven website that performs CRUD operations on a database using Connected Architecture of ADO.NET*
- [7]. *Develop a Database driven website that performs CRUD operations on a database using Disconnected Architecture of ADO.NET*
- [8]. *Create a Website in ASP.NET which uses LINQ to Query and grouping data.*
- [9]. *Develop a Database Driven Website that performs CRUD operations on a database through LINQ*
- [10]. *Develop a Database Driven Website that performs CRUD operations on a database through Entity Framework.*

- [11]. *Create a Simple Data Entry Website using ASP.NET MVC architecture*
- [12]. *Create a simple movie-listing application that supports creating, editing, and listing movies from a database using ASP.NET MVC*
- [13]. *Create a Website in ASP.NET MVC to demonstrate the concept of scaffolding.*
- [14]. *Create a Webservice to Convert Dollars to Rupees and vice-versa and create an application that consumes that web service.*
- [15]. *Create a Webservice to Convert temperature and create an application that consumes that web service.*
- [16]. *Create a Silverlight application that draws a few shapes on the canvas.*
- [17]. *Create a Silverlight application that simulates a simple mcq quiz environment.*
- [18]. *Create a Silverlight application that connects and navigates multiple pages*
- [19]. *Create a Silverlight application that can be an Out-Of-Browser Application*
- [20]. *Create a Shopping Cart website that uses MVC Architecture of ASP.NET.*

### **VB.NET**

- [1]. Program to illustrate Shared constructors and instance constructors.
- [2]. Program to illustrate Method overriding
- [3]. Program to illustrate Method overloading
- [4]. Program to illustrate Abstract Classes
- [5]. Program to illustrate Interfaces
- [6]. Program to illustrate Inheritance of Windows form controls.
- [7]. Program to illustrate Reusable .DLL file-Code
- [8]. Program to illustrate Reusable .DLL file-Customized DateTimePicker control to display date in British format.
- [9]. Program to illustrate Property Procedures
- [10]. Program to illustrate Parameter Array
- [11]. Program to illustrate a Menu Bar with Tool Bar and Context Menu
- [12]. Program to illustrate the use of Help files
- [13]. Program to illustrate Dynamic binding using reference types
- [14]. Display data from a database table in a Windows form with provision to navigate through the rows using buttons-First, Previous, Next and Last
- [15]. Program to illustrate Report Building
- [16]. Create a Relationship between two database tables and display data from the two tables on a Windows form using the relationship.
- [17]. Program to illustrate the deployment of a .Net application.

### **ASP.NET**

- [18]. Program to illustrate the use of validation controls.
- [19]. Program to illustrate the use of Datacontrols in ASP.Net (Repeater, Datalist etc).
- [20]. Program to illustrate the use of WebServices.
- [21]. Program to illustrate the use of XML web controls.
- [22]. Program to create an advertisement on a web page using XML files.
- [23]. Program to illustrate the navigation from one webpage to another.
- [24]. Program to illustrate caching.

**PS 605.3 [E1]: Cognitive Computing and Artificial Intelligence**

**Total No. of Lectures : 45**

**Total Marks: 100**

**[L – T – P – S]**

**No. of Lectures / Week: 4**

**Credits : 3**

**[3 – 1 – 0 – 2]**

**Course Objectives:**

1. To understand the fundamental concepts of cognitive science and how it interacts with humans naturally with cognitive computing
2. To understand the concept of computational neuroscience and its applications, Application of problem solving using cognitive psychology.
3. To understand the application of a given AI technique to a given concrete problem, usage of intelligent agent in AI problems, defining AI problem as a state space search.
4. To understand various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent, to learn the different search techniques for the design of AI problem.
5. To understand the concept of DFS & BFS and learn the application of statistical reasoning in AI, to provide the concept of Bayes rule in designing AI systems.

**Course Outcomes:**

1. Apply AI technique on current applications with cognitive psychology using connectionist approach
2. To design applications using computational cognitive neuroscience by applying techniques of cognitive computing and neural network theory
3. To Design intelligent agents for problem solving, reasoning and planning.
4. To implement AI systems with different approaches of knowledge representation, design AI systems with heuristic search techniques
5. To implement AI systems using statistical and symbolic reasoning, designing AI models using Bayes rule

**Unit - I**

**Cognitive Science:** Cognitive view, Fundamental concepts, Computers in Cognitive science, Applied Cognitive science, Interdisciplinary nature of Cognitive science

**Cognitive Psychology:** The Nature of Cognitive Psychology, The Notion of Cognitive Architecture, Propositional and Schematic representation, Cognitive processes, Working memory and Attention, Mental Images, Automatic and Controlled processes, The Acquisition of Skill Approach, The Connectionist approach to cognitive architecture

**(10hrs)**

**Unit -II**

**Cognitive Psychology-Further Explorations:** Concepts and Categories, Memory, Reasoning, Problem Solving

**Neuroscience: Brain and Cognition:** Introduction o the study of the nervous system, Organization of the central nervous system, Neural Representation, Neuropsychology, Computational Neuroscience **(9hrs)**

### **Unit - III**

**Artificial Intelligence:** The AI Problems, The Underlying assumption, AI Technique, The Level of the model, Criteria for success, some general references, Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems.

**Intelligent Agents:** Agents and Environments, The nature of environments, The structure of agents. **(9hrs)**

### **Unit - IV**

**Heuristic search techniques:** Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis.

**Knowledge representation issues:** Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem.

**Using predicate logic:** Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction.

**Logical Agents:** Knowledge -based agents, the Wumpus world, Logic-Propositional logic, Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic. **(10hrs)**

### **Unit - V**

**Symbolic Reasoning Under Uncertainty:** Introduction to nonmonotonic reasoning, Logic for nonmonotonic reasoning, Implementation Issues, Augmenting a problem-solver,

**Implementation:** Depth-first search, Implementation: Breadth-first search.

**Statistical Reasoning:** Probability and Bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy logic.

**Quantifying Uncertainty:** Acting under uncertainty, Basic probability notation, Inference using full joint distributions, Independence, Bayes' rule and its use, The Wumpus world revisited. **(10hrs)**

### **Text Books :**

1. Neil A Stillings, Steven E. Weisler, Chrisopher H Chase, Mark H Feistein, Jay L Garfield and Edwina L Rissland, "Cognitive Science", Second Edition, MIT Press
2. Elaine Rich, Kevin Knight, Shivashankar B Nair:, "Artificial Intelligence", 3rd edition. 2013, Mc Graw Hill
3. Stuart Russel, Peter Norvig, "Artificial Intelligence A Modern Approach", 3rd edition 2013 Pearson.

### **Reference Books :**

1. E. Charniak, *et.al.*, "Introduction to Artificial Intelligence", 2<sup>nd</sup> Ed, 2014, Pearson Education.
2. P. H. Winston, "Artificial Intelligence", 1<sup>st</sup> Edition, 2010, Pearson India
3. Rich and K. Knight, "Artificial Intelligence", 1<sup>st</sup> Edition, 2013, Pearson Education.
4. Hurwitz, Kaufman, and Bowles, "Cognitive Computing and Big Data Analytics", Wiley, Indianapolis, 2005.
5. Jerome R. Busemeyer, Peter D. Bruza, "Quantum Models of Cognition and Decision", Cambridge University Press, 2014
6. Carbonell, "Machine Learning paradigms and Methods", 5<sup>th</sup> Ed, 2009, MIT Press,

### **PS 605.3 [E2] : Computational Intelligence and Machine Learning**

**Total No. of Lectures : 48**

**Total Marks: 100**

**[L – T – P – S]**

**No. of Lectures / Week: 4**

**Credits : 3**

**[3 – 1 – 0 – 2]**

#### **Course Objectives:**

1. Understand fundamentals of key intelligent systems technologies including knowledge-based systems, neural networks, fuzzy systems, and evolutionary computation
2. Understand the concept of neural network and fuzzy systems
3. To understand the concepts of computational intelligence systems; working out the performance metrics for these systems
4. To learn the concept of machine learning and its types; understand the usage of dimensionality reduction, application of classification and clustering
5. To understand various classification algorithms like decision tree, LDA; learn HMM and its use

#### **Course Outcomes:**

1. Gain a working knowledge of knowledge-based systems using neural networks
2. Implement intelligent systems technologies with neural network and fuzzy logic
3. Implement typical computational intelligence systems with various performance metrics and conducting the analysis
4. To implement machine learning models using Bayesian algorithm; implement applications using k-means clustering.
5. To implement machine learning models using decision trees & LDA and analyze the results.

### **Unit - I**

**Computational Intelligence:** Adaption – Adaption versus Learning, Types & spaces of adaption, Self-Organizing and Evolution, Historical views

**Evolutionary Computation Concepts and Paradigms:** History, Overview, Genetic Algorithms, Evolutionary Programming, Evolution Strategies, Genetic Programming, Particle Swarm Optimization

**Neural Network Concepts and Paradigms:** History, Components and Terminology, Topologies, Adaptation, Comparing Neural Networks and Other Information Processing Methods, Preprocessing, Postprocessing

**(10hrs)**

## **Unit – II**

**Neural Network Implementations:** Implementation Issues, Back-propagation Implementation, The Kohonen Network Implementations, Evolutionary Back-propagation Network Implementation

**Fuzzy Systems Concepts and Paradigms:** History, Fuzzy Sets and Fuzzy Logic, Theory of Fuzzy Sets, Approximate Reasoning, Developing a Fuzzy Controller

**Fuzzy Systems Implementations:** Implementation Issues, Fuzzy Rule System Implementation, Evolving Fuzzy Rule Systems

**(9hrs)**

## **Unit - III**

**Computational Intelligence Implementations–** Implementation Issues, Fuzzy Evolutionary Fuzzy Rule System Implementation, Choosing the Best Tools, Applying Computational Intelligence to Data Mining

**Performance Metrics:** General Issues, Percent Correct, Average Sum-squared Error; Analysis and Explanation

**Analysis and Explanation:** Sensitivity Analysis, Hinton Diagrams, Computational Intelligence Tools for Explanation Facilities

**(9hrs)**

## **Unit - IV**

**Introduction:** Machine Learning Foundations, Overview, Applications, Types of Machine Learning, Basic Concepts in Machine Learning, Examples of Machine Learning, Applications.

**Supervised Learning:** Probably Approximately Correct (PAC) Learning, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm.

**Bayesian Decision Theory:** Introduction, Classification, Discriminant Functions, Bayesian Networks, Association Rules.

**Dimensionality Reduction:** Introduction, Subset Selection, Principal Components Analysis, Linear Discriminant Analysis.

**Clustering:** Introduction, Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm, Hierarchical Clustering, Choosing the Number of Clusters.

**(10hrs)**

## **Unit - V**

**Decision Trees:** Introduction, Univariate Trees, Pruning, Rule Extraction from Trees, Multivariate Trees.

**Linear Discrimination:** Introduction, Generalizing the Linear Model, Geometry of the Linear Discriminant, Pairwise Separation, Gradient Descent, Logistic Discrimination, Support Vector Machines.

**Hidden Markov Models:** Introduction, Discrete Markov Processes, Three Basic Problems of HMMs, Evaluation Problem, Learning Model Parameters, Model Selection in HMM.

**Accessing and Comparing Classification Algorithms:** Introduction, Cross-Validation and Resampling Methods, Measuring Error, Assessing a Classification Algorithm's Performance, Comparing Two Classification Algorithms, Comparing Multiple Classification Algorithms: Analysis of Variance. (10hrs)

**Text Books :**

1. Russel Eberhart, Yuhui Shi, "Computational Intelligence Concepts to Implementation", 2<sup>nd</sup> Edition, 2010, Elsevier Publications
2. Ethem Alpaydin, "Introduction to Machine Learning", 1<sup>st</sup> 2004, MIT press

**Reference Books :**

1. Christopher Bishop, "Pattern Recognition and Machine Learning", 1<sup>st</sup> 2006, Springer.
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", 1<sup>st</sup> 2012, MIT press
3. Tom Mitchell, "Machine Learning", 1997, McGraw-Hill.
4. .N Sivanandam, S.N Deepa, "Principles of Soft Computing", 3<sup>rd</sup> Edition, 2015, Wiley.
5. F. Hayes Roth et.al., "Building Expert Systems", 1<sup>st</sup> Edition, 2009, Pearson Education.
6. Anderson J.A., "An Introduction to Neural Networks", 3<sup>rd</sup> Ed, 2014, Pearson Asia

**PS 605.3 [E3] Deep Learning and Neural Networks**

**Total No. of Lectures : 48**

**Total Marks 100**

**[ L – T – P – S ]**

**No. of Lectures / Week 4**

**Credits : 3**

**[ 3 – 1 – 0 – 2 ]**

**Objectives:**

1. To understand the concept of machine learning and its types; learn the concepts of ANN
2. To appreciate the different concepts of memory network; learn the concept of fuzzy logic
3. To understand the concept of fuzzy relation, fuzzy arithmetic and fuzzy decision making
4. To gain an idea on deep learning and linear algebra related to it; understand the application of CNN and RNN
5. To learn the concepts of transfer learning and Autoencoders.

**Course outcomes:**

1. To implement a neural network for an application of your choice using an available tool
2. To implement different memory network using programming language; develop applications using fuzzy logic.
3. Apply fuzzy logic to many real world problems.
4. To design and implement deep learning models using CNN and RNN
5. To implement deep learning models using autoencoders and transfer learning
6. .

**Unit - I**

**Artificial Neural Network:** An Introduction: Fundamental Concept, Evolution of Neural Networks, Basic Modes of Artificial Neural Network, Important Terminologies of ANNs, McCulloch-Pitts Neuron, Linear Separability, Hebb Network

**Supervised Learning Network:** Introduction, Perceptron Networks, Adaptive Linear Neuron (Adaline), Multiple Adaptive Linear Neurons, Back-Propagation Network, Radial Basis Function Network

**Unsupervised Learning Networks:** Introduction, Fixed Weight Competitive Nets, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter propagation Networks, Adaptive Resonance Theory Network  
(10 hrs)

### Unit - II

**Associative memory networks:** Introduction, Training Algorithms for Pattern Association, Autoassociative Memory Network, Heteroassociative Memory Network, Bidirectional Associative Memory (BAM), Continuous BAM, Hopfield Networks, Iterative Autoassociative Memory Networks, Temporal Associative Memory Network

**Special Networks:** Introduction, Simulated Annealing Network, Boltzmann Machine, Probabilistic Neural Net, Cellular Neural Network

**Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets:** Introduction, Classical Sets (Crisp Sets), Fuzzy Sets  
(9 hrs)

### Unit - III

**Classical Relations and Fuzzy Relations:** Introduction, Cartesian Product of Relation, Classical Relation, Fuzzy Relations, Tolerance and Equivalence Relations, Noninteractive Fuzzy Sets

**Membership Functions:** Introduction, Features, Fuzzification, Methods of Membership Value Assignments

Defuzzification: Introduction, Defuzzification Methods

**Fuzzy Arithmetic and Fuzzy Measures:** Introduction, Fuzzy Arithmetic, Extension Principle, Fuzzy Measures, Measures of Fuzziness, Fuzzy Integrals

Fuzzy Decision Making: Introduction, Individual Decision Making, Multi-person Decision Making, Multi-objective Decision Making, Multi-attribute Decision Making, Fuzzy Bayesian Decision Making  
(10 hrs)

### Unit - IV

**Introduction:** Historical trends in Deep learning, Deep learning: Overview of Methods.

**Applied Math for Machine Learning:** Linear Algebra, Probability and Information Theory, Numerical Computation.

**Deep Networks:** Deep Feedforward Networks – Feed Forward networks, Gradient Based learning, Backpropagation; Regularization- Overview, Parameter Penalties, Data Augmentation, Multi Task learning, Bagging, Dropout; Optimization for Training Deep Models – Optimization vs training, Basic Algorithms, Adaptive learning Rates; Convolution Networks – The Convolution operation and CNNs, Convolution Networks, Pooling; Sequence Modeling: Recurrent and recursive Nets – Sequence Modeling, Unfolding Graphs, Recurrent Neural networks, Bidirectional RNNs, Deep Recurrent Networks.  
(10 hrs)

### Unit - V



**Deep Learning research:** Linear Factor Models- PCA and factor Analysis, ICA; Autoencoders – Stochastic Encoders and Decoders, Denoising Autoencoders, Applications; Representation Learning- Greedy Layer wise Unsupervised Pretraining, Transfer Learning and Domain Adaptation, Semi-supervised Distinguishing of causal factors, Distributed Representation; Structured Probabilistic Models for Deep Learning – Using Graphs to describe model structure, Sampling from Graphical models; Monte Carlo Methods – Markov Chain Monte Carlo Methods, Gibbs Sampling, Deep generative Models – Boltzmann Machines, Deep Belief Networks, Directive Generative nets. **(9 hrs)**

**Text books:**

1. S.N Sivanandam, S.N Deepa, “ Principles of Soft Computing”, 3<sup>rd</sup> Edition, 2015, Wiley.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, 1<sup>st</sup> 2016 MIT press

**Reference books :**

1. Haykin S., “Neural Networks-A Comprehensive Foundations”, 3<sup>rd</sup> Ed, 2012, Pearson
2. Kishan Mehrotra, Chilukuri K. Mohan, Sanjay Ranka: “Elements of Artificial Neural Networks”, 2<sup>nd</sup> Edition, 2014, Penram International Publishing
3. Simon O Haykin, “Neural Networks and Learning Machines”, 3<sup>rd</sup> 2008, Prentice Hall
4. Michael Nielson, “Neural Networks and Deep learning”, 2<sup>nd</sup> 2015, Determination Press

**PS 606.3 [E1]: BIG DATA ANALYTICS with MAP REDUCE AND HADOOP**

**Total No. of Lectures : 48      Total Marks : 100      [ L – T – P – S ]**

**No. of Lectures / Week : 4      Credits : 3      [ 3 – 1 – 0 – 2 ]**

**Course Objectives:** The course aims to cover the following objectives

1. Understanding the Big Data Fundamentals, including the characteristics of Big Data, the sources Big Data (such as social media, sensor data, geospatial data etc) and Big Data Analytics.
2. Introducing to No-SQL databases and different properties and characteristics associated with it.
3. Learning about Hadoop, the need for it, Distributed processing, and using it for analyzing huge amount of data.
4. Understanding Map Reduce programming and learning to write programs using mapper and reducer.
5. Exploring Hadoop Eco system, familiarizing with Hive and Pig.

**Course Outcomes :** Upon Completion of the course, the students will be able to

1. Identify and distinguish big data analytics applications from other applications and the use of Big Data.
2. Describe No SQL databases and understanding different concepts related to No SQL and its applications using MongoDB.
3. Understanding Hadoop and its advantage over the traditional database applications in solving practical problems
4. Writing programs using mapper and reducer.
5. Using Hive and Pig for analyzing and querying data and knowing the advantages over the traditional Data handling solutions.

## UNIT- I

**Introduction to big data:** Data, Characteristics of data and Types of digital data:, Sources of data, Working with unstructured data, Evolution and Definition of big data, Characteristics and Need of big data, Challenges of big data.

**Big data analytics:** Overview of business intelligence, Data science and Analytics, Meaning and Characteristics of big data analytics, Need of big data analytics, Classification of analytics, Challenges to big data analytics, Importance of big data analytics, Basic terminologies in big data environment. (10 hrs)

## UNIT II

**NoSQL Data Management :** Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models; relationships, graph databases, schemaless databases, materialized views, distribution models, sharding; master-slave replication; peer-peer replication; sharding and replication; consistency; relaxing consistency; version stamps; Case studies using MongoDB.

( 10 hrs)

## UNIT -III

**Introduction to Hadoop:** Introducing Hadoop, need of Hadoop, limitations of RDBMS, RDBMS versus Hadoop, Distributed Computing Challenges, History of Hadoop , Hadoop Overview, Use Case of Hadoop, Hadoop Distributors, HDFS (Hadoop Distributed File System) , Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator), Interacting with Hadoop Ecosystem . ( 10 hrs)

## UNIT -IV

**Introduction to MAPREDUCE Programming:** Introduction , Mapper, Reducer, Combiner, Partitioner , Searching, Sorting , Compression, Real time applications using MapReduce, Data serialization and Working with common serialization formats, Big data serialization formats.

**( 9 hrs)**

## **UNIT –V**

**Introduction to Hive:** Introduction to Hive, Hive Architecture , Hive Data Types, Hive File Format, Hive Query Language (HQL), User-Defined Function (UDF) in Hive.

**Introduction to Pig:** Introduction to Pig, The Anatomy of Pig , Pig on Hadoop , Pig Philosophy , Use Case for Pig: ETL Processing , Pig Latin Overview , Data Types in Pig , Running Pig , Execution Modes of Pig, HDFS Commands, Relational Operators, Piggy Bank , Word Count Example using Pig , Pig at Yahoo!, Pig versus Hive

**( 9 hrs)**

### **Text Book :**

1. Seema Acharya, Subhashini Chellappan “Big Data and Analytics”, 1<sup>st</sup> Edition, 2015, Wiley International
2. S. Mohanthy, Madhu Jagadish, Harsh Srivatsa, “Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics”, 1<sup>st</sup> Edition, 2015, Wiley Apress

### **Reference Books :**

1. Jey Liebowitz, “Big Data and Business Analytics”, 1<sup>st</sup> Edition, 2014, CRC Press
2. Tom White, “Hadoop – Definitive Guide”, 1<sup>st</sup> Edition, 2015, O’Reilly Publishers
3. Boris Lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, 1<sup>st</sup> Edition, 2015, Wiley India Publications.
4. E Caprilo, Dean Wampler, “Hive Programming”, 1<sup>st</sup> Edition, 2015, O’Reilly Publishers
5. [Sherif Sakr, “Large Scale and Big Data: Processing and Management”, 2014, CRC Press.

## PS 606.3 [E2]: BIG DATA ANALYTICS WITH SCALA AND SPARK

<b>Total No. of Lectures : 48</b>	<b>Total Marks : 100</b>	<b>[ L - T - P - S ]</b>
<b>No. of Lectures / Week : 4</b>	<b>Credits : 3</b>	<b>[ 3 - 1 - 0 - 2 ]</b>

**Course Objectives:** This course introduces students to the following objectives

1. Understanding the concepts of Functional programming and introducing to Scala and object oriented Scala.
2. Elaborating on the Spark's programming model in detail, being careful to understand how and when it differs from familiar programming models, like shared-memory parallel collections or sequential Scala collections.
3. Understanding Spark SQL and exploring the use of Spark SQL for Data Exploration, Data Munging and Data streaming.
4. Using Spark in Machine Learning for classification using Bayes and Naïve Bayes Algorithm.
5. Learn to perform Testing in Spark and introducing PySparrk and Sparkr.

**Course Outcomes:** Upon successful completion of this course, the student will be able to:

1. Understand what Functional programming is and will know why classical data analysis techniques are no longer adequate
2. Understand the benefits that Spark and Spark SQL offers for processing structured and unstructured data.
3. Understand conceptually how Spark SQL is used for Data Exploration, Data Munging and Data Streaming.
4. Understand how Spark can be used for Machine Learning.
5. Understand the use of PySparrk and Sparkr

### Unit- I

**Scala:** Purposes of Scala, Platforms and editors, Installing and setting up Scala, Scala: the scalable language, Scala for Java programmers, Scala for the beginners

**Object Oriented Scala:** Variables in Scala, Methods, classes, and objects in Scala, Packages and package objects, Java interoperability, Pattern matching, Implicit in Scala, Generic in Scala, SBT and other build systems.

**Functional Programming Concepts:** Introduction to functional programming, Functional Scala for the data scientists, FP and Scala for learning Spark; Pure functions and higher-order functions; Using higher-order functions; Error handling in functional Scala; Functional programming and data mutability

**Collection of APIs :** Scala collection APIs, Types and hierarchies, Performance characteristics, Java interoperability, Using Scala implicits **(10 hrs)**

## **Unit- II**

**Spark :** Introduction to data analytics, Introduction to big data, Distributed computing using Apache Hadoop, Apache Spark.

**Spark – REPL & RDDs:** Dig deeper into Apache Spark, Apache Spark installation, Introduction to RDDs, Using the Spark shell, Actions and Transformations, Caching, Loading and saving data.

**Special RDD Operations:** Types of RDDs, Aggregations, Partitioning and shuffling, Broadcast variables, Accumulators.

**Spark SQL:** Introducing Spark Session, Understanding Spark SQL concepts, Using Spark SQL in streaming applications; Spark SQL and DataFrames, DataFrame API and SQL API, Aggregations, Joins.

**Spark SQL for Processing Structured and Unstructured Data:** data sources in Spark applications, Spark with relational databases, Spark with MongoDB (NoSQL database), Spark with JSON data, Spark with Avro files, Spark with Parquet files, Defining and using custom data sources in Spark **(10 hrs)**

## **Unit- III**

**Spark SQL for Data Exploration:** Exploratory Data Analysis (EDA), Spark SQL for basic data analysis, Visualizing data with Apache Zeppelin, Sampling data with Spark SQL APIs, Spark SQL for creating pivot tables

**Spark SQL for Data Munging:** Data munging, Exploring data munging techniques, Munging textual data, Munging time series data, Dealing with variable length records, Preparing data for machine learning

**Spark Streaming:** Spark Streaming, Discretized streams, Stateful /stateless transformations Check pointing, Interoperability with streaming platforms (Apache Kafka), Structured streaming.

**Graphx:** A brief introduction to graph theory, GraphX, VertexRDD and EdgeRDD, Graph operators, Pregel API, PageRank; Exploring graphs using GraphFrames, Analyzing JSON input modeled as a graph

Processing graphs containing multiple types of relationships, Understanding GraphFrame internals

**(10 hrs)**

## **Unit- IV**

**Spark MLLIB & ML:** Introduction to machine learning, Spark machine learning APIs, Feature extraction and transformation, Creating a simple pipeline, Unsupervised machine learning, Binary and multiclass classification

**Bayes and Nave Bayes:** Multinomial classification, Bayesian inference, Naive Bayes, The decision trees

**Clustering Data with MLLIB:** Unsupervised learning, Clustering techniques, Centroid-based clustering (CC), Hierarchical clustering (HC), Distribution-based clustering (DC), Determining number of clusters, A comparative analysis between clustering algorithms, Submitting Spark job for cluster analysis.

**Text Analytics using Spark ML :** Understanding text analytics, Transformers and Estimators, Tokenization, StopWordsRemover, NGrams, TF-IDF, Word2Vec, CountVectorizer, Topic modeling using LDA, Implementing text classification.

**(9 hrs)**

## **Unit- V**

**Spark Tuning:** Monitoring Spark jobs, Spark configuration, Common mistakes in Spark app development, Optimization techniques;

**Deploying Spark on a Cluster** – Spark architecture in a cluster, Deploying the Spark application on a cluster

**Testing and Debugging in Spark:** Testing in a distributed environment, Testing Spark applications, Debugging Spark applications.

**PySpark & SparkR:** Introduction to PySpark, Installation and configuration, Introducing SparkR, the SparkR architecture, SparkR DataFrames, SparkR for EDA and data munging tasks, SparkR for computing summary statistics, SparkR for data visualization, SparkR for machine learning

**(9 hrs)**

### **Text Book :**

1. Md. Rezaul Karim, Sridhar Alla, "Scala and Spark for Big Data Analytics - Harness the power of Scala to program Spark and analyze tonnes of data in the blink of an eye", 1<sup>st</sup> Ed, 2017, PACKT
2. Romeo Kienzler, "Mastering Apache Spark 2.x", 2<sup>nd</sup> Edition, 2016, PACKT Publishers

### **Reference Books :**

1. Ilya Ganelin, Ema Orhian, Kai Sasaki, Brennon York, "Spark: Big Data Cluster Computing in Production", 1<sup>st</sup> Edition, 2016, Wiley
2. Rishi Yadav, "Apache Spark 2.x Cookbook", 2<sup>nd</sup> Edition, 2016, PACKT Publishers
3. Dean Wampler, Alex Payne, "Programming Scala, Scalability = Functional Programming + Objects", 2<sup>nd</sup> Edition, 2016, O'Reilly Publishers
4. Jason Swartz, "Learning Scala Practical Functional Programming for the JVM", 2016, O'Reilly
5. Guller, Mohammed, "Big Data Analytics with Spark A Practitioner's Guide to Using Spark for Large Scale Data Analysis", 2<sup>nd</sup> Edition, 2016, Apress
6. Luu, Hien, "Beginning Apache Spark 2 With Resilient Distributed Datasets, Spark SQL, Structured Streaming and Spark Machine Learning library", 2<sup>nd</sup> Ed, 2016, Apress Edition
7. Nabi, Zubair, "Pro Spark Streaming The Zen of Real-Time Analytics Using Apache Spark", 2<sup>nd</sup> Edition, 2017, Apress Edition.

8. Matei Zaharia, Holden Karau, Andy Konwinski, Patrick Wendell, "Learning Spark Lightning-Fast Big Data Analysis", 2<sup>nd</sup> Edition, 2017, O'Reilly Publishers
9. Matei Zaharia, Bill Chambers, "Spark: The Definitive Guide Big Data Processing Made Simple", 3<sup>rd</sup> Edition, 2106, O'Reilly Publications
10. Paul Chiusano, "Functional Programming in Scala", 2<sup>nd</sup> Edition, 2017, Wiley
11. Janek Bogucki, Alessandro Lacava, Aliaksandr Bedrytski, Matthew de Detrich, Benjamin Neil, "Professional Scala", 2<sup>nd</sup> Edition, 2016, Wiley Wrox

### **PS 606.3 [E3] : BIG DATA VISUALIZATION USING TABLEAU**

**Total No. of Lectures : 48                      Total Marks : 100                      [ L – T – P – S ]**

**No. of Lectures / Week : 4                      Credits : 3                      [ 3 – 1 - 0 - 2 ]**

**Course Objectives:** This course introduces students to the following objectives

1. Understanding Data visualization techniques and getting introduced to Tableau to both design and critique visualizations
2. Understand why visualization is an important part of data analysis and using Data from various Data sources.
3. Understand the components involved in visualization design such as Charts and Maps.
4. Introducing Tableau public, getting to know the various advanced features and different user defined functions.
5. Understand the type of data and its impact in the type of visualization.

**Course Outcomes:** Upon successful completion of this course, the student will be able to:

1. Knowing the impact of Data visualization techniques and how it helps to better understand the data Topics in information design, interaction design and user engagement.
2. Understand and apply the fundamental concepts and techniques in data visualization
3. Solve specific real-world problems related to the visualization and interpretation of data analysis results using charts and maps.
4. Getting to know Tableau public and using its various features.
5. Working with different real time examples and understanding the impact of visualization in real life situations.

### **UNIT– I**

**Dashboard:** Preparing the dashboard, Showing the power of data visualization, Connecting to data sources, Introducing the Tableau interface, Interacting with your first data visualization, Sharing visualization with the world.

**Summarizing Data for Dashboards:** Dashboards and dates, Grouping your data with calculations, Correlation with calculations, Using cross-tabs flexibly, Simplifying your business rules with customer calculations

**Interfacing with Data for Dashboards:** grouping data with clarity, Hierarchies for revealing the dashboard message, Classifying data for dashboards, Actions and interactions, Drilling into the details, Working with input controls

**Using Dashboards to get Results:** Enriching data with mashups, Page trails, Guided analytics with Tableau, Sharing results in a meeting, Notes and annotations, Using external data to enrich your dashboard.

**(10 hrs)**

## **UNIT – II**

**Putting the Dash into Dashboards:** Choosing the visualization, Using parameters in dashboards, Using custom geocoding in Tableau, Profiting from Big Data to rev your visualization, Filtering data for focus

Creating choices in dashboards using conditional logic

**Making Dashboards Relevant:** Adding an infographic to your Tableau dashboard, String manipulation in dashboards, Correcting data exports from Tableau to Excel, Blending data, Optimizing tips for efficient, fast visualization

**Visual Best Practices:** Coloring the numbers, Dueling with dual axes, three dimensional data, pie charts or not? Sizing to make a data story.

**Connecting to Data Sources:** Connecting to text files- to Excel files - to Access databases - to a SQL Server; Pasting from a clipboard; Connecting to other databases, Connecting to Windows Azure Marketplace, dimensions and measures, Changing data types, Applying filters, Merging multiple data sources.

**(10 hrs)**

## **UNIT – III**

**Creating Univariate Charts:** Creating tables, bar graphs, pie charts, sorting the graphs, creating histograms, line charts, Using the Show Me toolbar, stacked bar graphs, box plots, Showing aggregate measures.

**Creating Bivariate Charts:** Creating tables, Creating scatter plots, Swapping rows and columns, Adding trend lines, Selecting color palettes, Using dates.

**Creating Multivariate Charts:** Creating facets, area charts, bullet graphs, dual axes charts, Gantt charts, heat maps



**Creating Maps:** Setting geographic roles, Placing marks on a map, Overlaying demographic data, Creating choropleth maps, Using polygon shapes, Customizing maps. **(10 hrs)**

#### **UNIT – IV**

**Calculating User Defined Fields :** Using predefined functions, Calculating percentages, Applying the If-Then logic, Applying logical functions, Showing totals, percentage of totals, Discretizing data, Manipulating text, Aggregating data.

**Advanced Features:** Viewing data, Changing the mark size, Using the presentation mode, Adding annotations, Excluding data on the fly, Customizing mark shapes, Adding drop-down selectors, Adding search box selectors, Adding slider selectors, Creating dashboards, Creating animated visualizations, Creating parameters

**Tableau Public:** Tableau Public overview, Telling story with Tableau Public, Installing Tableau Public

Opening files and creating profile,. Discover, Explore; Tableau Public user interface, Using the Marks card, The Show Me tool; Connecting Data - Public data, Tables and databases, data sources that Tableau Public connects to, The databases, tables, dimensions, facts, field formats and conventions, Connecting to the data in Tableau Public. **(09 hrs)**

#### **UNIT – V**

**Calculations:** Creating calculated fields, Types of calculations -number functions, date functions, Type conversions, string functions, aggregate functions, logic functions, Blending data sources; Creating quick table calculations, Changing over time, Compute using Manually editing table calculations, Ranking The level of detail calculations

**Dashboard Design and Style:** Dashboard design process, Best practices for dashboard design, Creating a dashboard, dashboard tab interface, Setting the size of dashboard elements, Adding and using Filters, Filtering across Data sources with parameters, Actions, URL actions.

**(9 hrs)**

#### **Text Book :**

- [1] David Baldwin, “Mastering Tableau - Master the intricacies of Tableau to create effective data visualizations”, 1<sup>st</sup> Ed, 2017, PACKT
- [2] Acharya, Seema, Chellappan, Subhashini, “Pro Tableau A Step-by-Step Guide”, 2017, Apress
- [3] Joshua N. Milligan, “Learning Tableau 10”, 2<sup>nd</sup> Edition, 2016, PACKT Publishers

#### **Reference Books :**

- [1] Jen Stirrup et al., "Tableau: Creating Interactive Data Visualizations", 2<sup>nd</sup> Ed, 2016, PACKT
- [2] Joshua N. Milligan, Donabel Santos, "Tableau 10 Bootcamp", 1<sup>st</sup> Edition, 2015, PACKT
- [3] Ryan Sleeper, "Practical Tableau -100 Tips, Tutorials, and Strategies from a Tableau Zen Master", 2<sup>nd</sup> Edition, 2016, O'Reilly Publishers
- [4] Ben Jones, "Communicating Data with Tableau - Designing, Developing, and Delivering Data Visualizations", 1<sup>st</sup> Edition, 2015, O'Reilly Publishers
- [5] Jen Stirrup, Ruben Oliva Ramos, "Advanced Analytics with R and Tableau", 2<sup>nd</sup> Edition, 2017, PACKT Publishers
- [6] Joshua N. Milligan, "Learning Tableau", 1<sup>st</sup> Edition, 2016, PACKT
- [7] Ashutosh Nandeshwar, "Tableau Data Visualization Cookbook", 2<sup>nd</sup> Edition, 2016, PACKT
- [8] Chandraish Sinha, "Tableau 10 for Beginners : Step by Step Guide to Developing Visualizations in Tableau 10", 1<sup>st</sup> Edition, 2015, Create Space Publishers
- [9] Khan, Arshad, "Jumpstart Tableau A Step-By-Step Guide to Better Data Visualization", 1<sup>st</sup> Edition, 2016, Apress International

### **PS 607. 3 P Machine Learning & Big Data Lab**

<b>Total No. of Practicals : 90</b>	<b>Total Marks : 100</b>	<b>[ L - T - P - S ]</b>
<b>No. of Labs / Week : 3</b>	<b>Credits : 2</b>	<b>[ 0 - 1 - 3 - 0 ]</b>

**Course Objectives:** This subject enables students to

- master the basics in business intelligence (BI), data mining (DM), and knowledge discovery in databases;
- learn the role that software tools/applications play in BI and DM, with emphasis on industrial case studies and practical applications;
- Have an overall understanding of the major issues and applications in business intelligence and data mining, including a basic grasp of the algorithm classes and best practices for building successful BI projects

**Course Outcome:** Upon completion of the subject, students will be able to

- examine the concepts of data warehousing and OLAP;
- apply the concepts of BI and DM techniques for clustering, association, and classification;
- understand the operation procedures of BI projects in an organization;
- select appropriate DM tools and methods to manipulate and achieve data;

- apply DM concepts for formulating business strategies and programs to enhance business intelligence.

### **Computational Intelligence Lab Exercises:**

- [1]. Write a program to generate few activation functions that are being used in Neural Networks.
- [2]. Write a program to generate AND NOT function using McCulloch Pitts Neuron Model.
- [3]. Write a program for Hebb net to classify two dimensional input patterns in bipolar with their targets given below. "\*" indicates a +1 and "." Indicates -1.
- [4]. Write a program to generate perceptron network for an AND function with bipolar i/o.
- [5]. Write a program for pattern classification using perceptron network. Test with noisy pattern.
- [6]. Write a program to generate OR function with bipolar i/o using ADALINE network
- [7]. Write a program to perform adaptive prediction with ADALINE.
- [8]. Write a program for adaptive noise cancellation using ADALINE network
- [9]. Write a program to generate XOR function for bipolar i/o using MADALINE network.
- [10]. Write a program to find the weight matrix of an auto associative net. Test the response.
- [11]. Write a program to find the weight matrix in bipolar form for the BAM network.
- [12]. Write a program and a function to train Hopfield network.
- [13]. Write a program to generate XOR function with momentum factor using BPN algorithm.
- [14]. Write a program for data compression using a suitable network.
- [15]. Write a program for approximating a two dimensional functions using BPN in batch mode.
- [16]. Write a program to generate Radial Basis Function Network.
- [17]. Write a program for drawing feature maps (Kohonen Self Organizing feature maps) in 2-D view.
- [18]. Write a program to generate LVQ net to form five vectors assigned to two classes.
- [19]. Write a program to generate Full Counter Propagation Network.
- [20]. Write a program to generate ART network

### **Business Intelligence Laboratory exercises**

- [21] Experiment dealing with elementary concepts in Statistics . Calculate Probability and Conditional Probability for given data set ( with discrete attributes and continuous attributes) and vizualise them.
- [22] Gain insight for running pre- defined decision trees and explore results using MS OLAP Analytics.
- [23] To Perform various PL/SQL commands in Oracle 11g
- [24] To perform multi dimensional data model using SQL queries e.g: Star, Snowflake, Fact Constellation schemas.
- [25] Using IBM OLAP Miner – Understand the use of data mining for evaluating the content of multidimensional cubes.
- [26] To perform various OLAP operations such as Slice, dice, roll up, drill up, pivot etc.
- [27] To perform Text mining on the given data warehouse.
- [28] To perform Correlation ship analysis between for the given data set.

- [29] Publish cognos cubes to a business intelligence portal. Metadata & ETL Lab: The objective of the lab exercises is to implement metadata import agents to pull metadata from leading business intelligence tools and populate a metadata repository.
- [30] Import metadata from specific business intelligence tools and populate a meta data repository.
- [31] Publish metadata stored in the repository
- [32] Load data from heterogeneous sources including text files into a pre-defined warehouse schema.
- [33] Using Teradata Warehouse Miner – Create mining models that are executed in SQL
- [34] Design a data mart from scratch to store the credit history of customers of a bank. Use this credit profiling to process future loan applications.
- [35] Design and build a Data Warehouse using bottom up approach titled 'Citizen Information System'. This should be able to serve the analytical needs of the various government departments and also provide a global integrated view.
- [36] To perform attribute relevance analysis on the given data.
- [37] To perform the information gain for a particular attribute in the given data.
- [38] To perform the experiment to predict the class using the Bayesian Classification.
- [39] To find out a weight or bias updating using the Back Propagation Neural Network.
- [40] To perform various Data Mining algorithms on the given database using Clementine.
- [41] To perform data Mining using Weka tool.
- [42] Experiment with any Classification method.
- [43] To perform Data Mining using Ms-Excel Mining Tool.
- [44] Experiment with the Apriori Association Mining Algorithm
- [45] Perform Market basket analysis with a given data set.
- [46] Experiment with data set using any Clustering algorithm.

### **Big Data Programming**

- [1] MapReduce: Simplified Data Processing on Large Clusters
- [2] Hadoop Exercises
- [3] Nextgen Hadoop Exercises
- [4] Dryad: Distributed Data-Parallel Programs from Sequential Building
- [5] Pregel: a system for large-scale graph processing
- [6] FlumeJava: Exercises
- [7] Making time-stepped applications tick in the cloud
- [8] PrIter: a distributed framework for prioritized iterative computations

### ***Database Programming Languages – SQL, PL/SQL, NoSQL***

- [9]. Study of Open Source Databases : MySQL/ MongoDB/ CouchDB etc
- [10]. Design and Develop SQL/NoSQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym.
- [11]. Design at least 10 SQL/NoSQL queries for suitable database application using SQL/NoSQL DML statements: Insert, Select, Update, Delete with operators, functions, and set operator.
- [12]. Design at least 10 SQL/NoSQL queries for suitable database application using SQL DML statements: all types of Join, Sub-Query and View.

### ***Large Scale Databases***

- [13] Implement aggregation and indexing with suitable example using MongoDB.
- [14] Implement Map reduces operation with suitable example using MongoDB.
- [15] Design and Implement any 5 query using MongoDB
- [16] Implement any one Concurrency Control Protocol using MongoDB and .net/Java
- [17] Create simple objects and array objects using JSON
- [18] Encode and Decode JSON Objects using Java/Perl/PHP/Python/Ruby
- [19] Implement any machine learning algorithm for BIG data

### **Python Lab Exercises:**

- [1] Create a new program to input text and print
- [2] Write a program using print that, when run, prints out a tic-tac-toe board.
- [3] Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4... 1/10.
- [4] Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero. What should your program do if the user inputs a negative number? As a programmer, you should always consider "edge conditions" like these when you program! (Another way to put it- always assume the users of your program will be trying to find a way to break it! If you don't include a condition that catches negative numbers, what will your program do?)
- [5] Write a program using a for loop that calculates exponentials. Your program should ask the user for a base base and an exponent exp, and calculate baseexp.
- [6] Write a method fact that takes a number from the user and prints its factorial.
- [7] Write a method rand divis 3 that takes no parameters, generates and prints a random number, and finally returns True if the randomly generated number is divisible by 3, and False otherwise. For this method we'll use a new module, the random module. At the top of your code, underneath import math, add the line import random.
- [8] Write a method roll dice that takes in 2 parameters - the number of sides of the die, and the number of dice to roll - and generates random roll values for each die rolled. Print out each roll and then return the string
- [9] Write a function roots that computes the roots of a quadratic equation. Check for complex roots and print an error message saying that the roots are complex.
- [10] Drawing Rectangles: To display a rectangle, you need to specify two points: the upper left corner and the bottom right corner. Remember our y-axis is flipped. Run your program and make sure that the rectangle appears on the screen. Try changing the color and width of the outline of the rectangle. Look at the setOutline and setWidth methods.
- [11] Drawing a Digital Clock: In dig clock.py, create a class called DigitalClock that has attributes hour, minute, second and pos, and a draw method. The attributes store the time in military time, i.e. 3:30pm will be hour = 15, minute = 30, second = 23 and the position - the upper left corner of the rectangle face.

**Total Marks : 150 Final Viva : 100 [ L - T - P - S ]**  
**Internal Assessment : 50 Credits : 4 [ 0 - 2 - 4 - 4 ]**

**Learning Objectives :** The purpose of a thesis is to enable the student to develop deeper knowledge, understanding, capabilities and attitudes in the context of the programme of study. The thesis offers the opportunity to delve more deeply into and synthesise knowledge acquired in previous studies. A thesis for a Domain Knowledge should place emphasis on the technical/scientific/artistic aspects of the subject matter.

Graduates are prepared to serve as project leaders and team members who add value through innovation, customer focus, prudence, and professional responsibility, consistent with the objectives of the projects in which they are involved and the organizations they support.

**Learning Outcomes** for a thesis are based on the objectives for MCA has Specific learning outcomes: for the student to demonstrate:

- Considerably more in-depth knowledge of the major subject/field of study, including deeper insight into current research and development work.
- Concepts to address specific management needs at the individual, team, division and/or organizational level
- Practical applications of project management to formulate strategies allowing organizations to achieve strategic goals
- A perspective of leadership effectiveness in organizations
- Team-building skills required to support successful performance
- Critical-thinking and analytical decision-making capabilities to investigate complex business problems to propose project-based solutions
- Skills to manage creative teams and project processes effectively and efficiently

## **GUIDELINES FOR REPORT WRITING**

### **1. Title Page**

#### **First page of report**

Try to find a title that clearly describes the work you have done and be as precise as possible [Capital 'Cambria – 16 font size].

Mention your name, name of the department (i.e. Department of Computer Applications), name of the university (AIMIT, St Aloysius College, Mangalore),

place and month and year of submission of the report [all those above will be centre alignment, font size 14, and your name, previous degree (14 font size, italics) will be font size 16] [Check Annexure – I]

#### **Second Page**

There should be a Forwarding Certificate page of standard format signed by the supervisor (Internal, and external if any), Head of the department and Dean of the School with date and seal. [Check Annexure – II]

#### **Third Page**

There should be a Certificate of Approval page of standard format signed by the Committee members of the viva-voce. [Check Annexure – III]

#### **Fourth Page**

Declaration by the student

[Check Annexure – IV]

#### **General Introduction**

- The Report should be prepared in A-4 (21x29.7 cm, or 8.5x11 inch) size sheet.
- Please remember that only distinct black print on clean white paper will be reproduced clearly, and margin widths and spacing must be rigidly observed.
- As the report will also be kept in CD format, color illustrations or figures are acceptable.
- Gray scale material may be used if necessary.
- The Final Report will be hard bind format in maroon rexin materials.
- Students need to submit (One copy for Internal Supervisor, One copy for external Supervisor (if any), One copy for Departmental Library, One copy for main library, One copy for student)

- 4 or 5 copies of the report (hard binding) along with pdf version of complete thesis in CD.
- Manuscripts should be typed with 1.5 spacing except for headlines.
- The font type should be Times New Roman or Cambria (shown here), as close as possible.
- Laser Printed manuscripts on A4 (or 8.5x11 inch) Sheets with 12-point letters, you may prepare your manuscript directly.
- Standard character spacing and a line spacing of 13-point will result as you see in this sheet.
- The side margins of 30 mm each. The top margin should be 30 mm for the title page only and 22 mm on all subsequent pages. The bottom margin should be 29mm.

### **Description of Major Headings**

1. This sheet is type set in accordance with the style to be followed for the headings.
2. Major headings are in upper and lower case letters printed bold without underlining.
3. They should appear with left-hand justified in the sheet.
4. In order to save space, a blankline should be placed only before major headings and subheadings.

### **Subheadings**

- Sub-subheadings are to be in lower case with an initial capital without underlining.
- They should start on a separate line at the left hand margin beginning with Parenthesized letters in alphabetical of numerical order.
- Equations are to be numbered consecutively throughout the text.
- The equation number should be placed in parentheses and flush with the right-hand margin of the column.
- Leave a blank line before and after equations.
- The font sizes are demonstrated: Usages - 10 points; For subscript and footnotes - 12 points For body text, sub headings - 14 points Main headings.
- The graphs should be scaled.
- The quantities represented by the abscissa and coordinate should be written briefly in words with corresponding units clearly stated.



## **2. Abstract**

- On a separate page, (shown in this guidelines), summarize the main points of the report.
- Persons getting interested in the report after reading the title should be able to judge from the abstract whether the report is really interesting for them.
- So, briefly formulate the problem that has been investigated, (i) objectives and their rationale in brief, (ii) methodology adopted in brief, (iii) high points of the findings including recommendation.
- The abstract should not occupy more than one page (about 400 to 500 words). This page should precede the content page.

## **3. Table of Contents (TOC)**

- Should list only those items that follow it appearing in the following order - List of tables (1.1, 1.2, 1.3., 2.1, 2.2, .. etc.)  
- List of figures (1.1, 1.2, 1.3., 2.1, 2.2, .. etc.) - Nomenclature: necessary whenever the number of symbols exceeds 0.
- This is in order of English (i.e., Roman) letters (Uppercase followed by lowercase), Symbols in Greek letters, subscripts and superscripts used, Special Symbols, followed by acronyms (i.e., Abbreviations) if any; everything in alphabetical order.
- All entries in nomenclature should have appropriate units in SI system.  
- The chapters (1, 2, ... N, followed by the name of the chapter),  
- Sections within chapters (e.g. 1.1, 2.4, etc. + name)  
- Subsections within sections (e.g. 1.1.1 + name)  
- Appendices (I, II, III, IV, .. etc. + name), if any - References

### **The page numbers where they start**

- Do not include the abstract and the table of contents itself in the table of contents.
- Every page of the report other than the title page and abstract should be numbered
- Pages of Table of Contents, Nomenclature, List of Tables and List of Figures should be numbered with lower case Roman numerals (i, ii, iii, iv, ...etc.).
- From the first page of the first chapter onwards, all the pages should be numbered using Hindu-Arabic numerals (1, 2, 3, ... etc.).

#### **4. The Chapters**

- The number of chapters you need and their contents strongly depend on the topic selected and the subject matter to be presented.
- Roughly the following chapters may be included.
- However, it is your own report and you have to structure it according to the flow of overall logic and organization.
- Each chapter, section, subsection, etc. should have a title.
- An identical entry should exist in the TOC.
- Each chapter is numbered using Hindu-Arabic numerals:
  - 1, 2, 3, ... Sections within a chapter are numbered using a two level scheme, (chapter no).(section no); for example, sections in chapter 3 are numbered 3.1, 3.2, 3.3, ... Subsections within a section are numbered using a three - level scheme, (chapter no).(section no).(subsection no); for example, subsections in chapter 3, section 2 are numbered 3.2.1, 3.2.2, 3.2.3, ...
- General Structure of the Dissertation Initial Pages (As mentioned above)
  - Chapter 1: Introduction
  - Chapter 2: Review of literature
  - Chapter 3: Methodology (or Materials and Methods)
  - Chapter 4: Theoretical Consideration or Model development (Optional)
  - Chapter 4 or 5: Results and Discussion
  - Chapter 5: Conclusions    List of Reference (as per standard style: Ref Annexure V)
  - Appendices
  - List of Publications

#### **Introduction**

In this chapter you formulate the problem that you want to address, the initial goals you had, etc. without going into details. Here you also describe the structure of the rest of your report, indicating which chapter will address which issue.

#### **Review of literature**

The discussion on the literature may be organized under a separate chapter & titled suitably. Summarize the literature that you have read. Rather than literally copying the texts that you

have read, you should present your own interpretation of the theory. This will help you in developing your own thinking discipline and technical language.

### **Theory Oriented Chapters**

The basic theory necessary to formulate the subject matter may be presented under a separate chapter & titled suitably.

### **Practice Oriented Chapters (experiment design)**

Depending on the work that you have done, it might be important to write about the system specifications, practical details, system behavior and characteristics and cross links of the selected topic.

### **Conclusions**

This is one of the most important chapters and should be carefully written. Here you evaluate your study, states which of the initial goals were reached and which not, mention the strong and weak points of your work, etc. You may point out the issues recommended for future research.

## **5. Equations**

Each equation should be numbered using a two-level scheme, (chapter no).(eq no). While typing, the equation numbers should be flush right. (Use MS Word Equation editor or LaTeX) This number (e.g. 2.4, with 2 as chapter number and 4 as equation number) should be used (as Eqn. 2.4)

Whenever the equation is referred in the text. The equations should be clearly written.

Symbols used in the equations should be explained immediately after the equation when they are referred first as well as in the nomenclature. SI units must be used throughout the report. Example:  $a = b + c$  (3.14)

## **6. Acronyms**

Avoid acronyms (short forms) in the report except the following standard ones. Equation(s): Eq(s), Figure(s): Fig(s). The words 'Table' and 'Chapter' are not shortened. If any other acronyms have to be used, list them separately at the beginning (after nomenclature). Mention the acronym in the brackets following its full form, whenever it occurs first. The first word in a sentence is never a short form.

## **7. Tables and figures**

Tables and figures should be numbered and captioned. Each table or figure should be numbered using a two-level scheme, (chapter no). (Table no) or (chapter no). (figure no).

This number (e.g. Table 4.8, or Fig. 3.7) should be used whenever the equation is referred in the text. Each table as well as figure should have a title. An identical entry should exist in List of Tables or List of Figures respectively. Title of a table is given at the top of the table following its number. Title of a figure is given at the bottom of the figure following its number. Tables and figures should be on separate pages immediately following the page where they are referred first. Photocopied tables should not be included. Photocopied figures should be avoided as far as possible and if included they should be large enough and clear. If taken from any reference, the reference should be cited within the text as well as at the caption of the figure or table.

## **1. Bibliography style as per the University Standards**

## **2. The Appendices**

Appendices are useful for those things that you consider important, but that do not fit in the main presentation of your work.

There could be several reasons for using appendices: the material is too long and has too many details

(e.g. the specifications of instruments or equipment), you have formulated a theorem, the proof of which is too long for the main text, you want to include a user manual for the software that you have come across (strongly recommended!), you want to present the schematics of a hardware design, experimental set-up, survey proforma etc.

Appendices tend to occupy many pages. Think carefully on what you want to include.

Appendices follow chapters, and are numbered using Roman numerals (Appendix I, Appendix II, Appendix III, etc.) in this format.

### **PA 609.3 SEMINAR AND TECHNICAL COMMUNICATION - II**

<b>Total No. of Demo Hrs : 30</b>	<b>Total Marks : 50</b>	<b>[ L – T – P – S ]</b>
<b>No. of Hrs / Week : 2</b>	<b>Credits : 1</b>	<b>[ 0 – 2 – 0 – 4 ]</b>

#### **Introduction**

Graduates of final year IT program are supposed to design and implement projects through knowledge and skills acquired in previous semesters. Students should identify complex engineering problems and find effective, efficient and innovative ways of solving them through their projects.

In a technical seminar, students should aim to review literature in a focused way for identifying a complex problem to be attempted in their final year project. Seminar should make the student attain skills like

- a. gathering of literature in specific area in a focused manner
- b. effectively summarizing the literature to find state-of-the-art in proposed area
- c. identifying scope for future work
- d. presenting (arguing) the case for the intended work to be done as project
- e. reporting literature review and proposed work in scientific way using good English.

#### **Course Objectives :**

- To perform focused study of published or unpublished research literature relevant to a specific topic.
- To study, interpret and summarize literature scientifically.
- To build independent thinking on complex problems.
- To build collaborative work practices
- To communicate scientific information to a larger audience.
- To use presentation standards and guidelines effectively.
- To be ethical in presenting purpose, sources, conduct and use of the literature reviewed.
- To define future work or problem statement for projects.

#### **Course Outcomes :**

- Gather, organize, summarize and interpret literature with the purpose of formulating a proposal.
- Write a technical report summarizing state-of-the-art on an identified topic.

- Present the study using graphics and multimedia techniques.
- Define intended future work based on the technical review.

### **GUIDELINES FOR PROJECT BASED SEMINAR (PBS)**

3. A group of 3-4 students shall identify problem(s) in Computer Engineering / Information Technology referring to recent trends and developments in consultation with institute guide.
4. The group must review sufficient literature (books, journal articles, conference papers, magazines, web resources etc.) in relevant area in parts (allocated to each student) decided by the SIG guide.
5. Research articles could be referred from IEEE, ACM, Science direct, Springer, Elsevier, IETE, CSI or from freely available digital libraries like Digital Library of India (dli.ernet.in), National Science Digital Library, JRD Tata Memorial Library, citeseerx.ist.psu.edu, getcited.org, arizona.openrepository.com, Open J-Gate, Research Gate, worldwidescience.org etc.
6. The group shall present the study as individual seminars in 20 – 25 minutes concluding with the solution to problem identified as their project statement.
7. Each student shall submit two copies of the seminar report in a prescribed format duly signed by the guide and Head of the department.
8. Internal guide shall define a project statement based on the study by student group.
9. Broad contents of review report (20-25 pages) shall be
  - i. Introduction of specific topic
  - ii. Motivation, purpose and scope of review
  - iii. Related work with citations
  - iv. Discussion (your own reflections and analysis)
  - v. Conclusions
  - vi. Project definition. (Short version of RUP's vision document if possible).
  - vii. Bibliography

### **EVALUATION SCHEME (for add on certification)**

- a) A panel of staff members from the institute will assess the seminar internally during the presentation
- b) Attendance for all seminars for all students is compulsory.
- c) Criteria for evaluation
 

i. Relevance of topic	- 05 Marks
ii. Relevance + depth of literature reviewed	- 10 Marks
iii. Seminar report (Technical Content)	- 10 Marks
iv. Seminar report (Language)	- 05 Marks
v. Presentation Slides	- 05 Marks

- |      |                      |            |
|------|----------------------|------------|
| vi.  | Communication Skills | - 05 Marks |
| vii. | Question and Answers | - 10 Marks |

### Reference Books

1. Gersen and Gersen, "Technical Writing: Process and Product" 6<sup>th</sup> Ed, 2012, Pearson Education Asia.
2. Rutherford, "Basic Communication Skills for Technology", 3<sup>rd</sup> Ed, 2009, Pearson Education Asia.
3. Lesikar, "Lesikar's Basic Business Communication", 2011; McGraw Hill Publishers

## VI SEMESTER

### PH 601.6 : INDUSTRY INTERNSHIP / PROJECT WORK

<b>Total Marks</b>	<b>: 500</b>	<b>External</b>	<b>: 300</b>	<b>[ L - T - P - S ]</b>
<b>Internal Assessment</b>	<b>: 200</b>	<b>Credits</b>	<b>: 20</b>	<b>[ 0 - 2 - 0 - 10 ]</b>

### Learning Objectives:

To provide students with an opportunity to gain work experience that will enhance and complement their academic learning. The course requirements are designed to provide a structure that will enable students to make connections between what they learn in the classroom and on the job, to further develop analytical and interpersonal skills, and to practice business writing skills.

### Course Requirements

1. The Internship / Project work / Dissertation for credit requires students to spend the majority of their time in technical, analytical, or administrative work that will contribute to their learning as outlined in the course objectives.
2. Work of a clerical nature must be limited to a maximum of 15 percent of the time spent on the job.
3. Prior to beginning an internship for credit, students must receive an internship orientation at the Training and Placement Cell of AIMIT..
4. A meeting with the faculty advisor / Guide to cover the ground rules and requirements.
5. Submission of the Final Report within seven days of the completion of the internship

The body of the Final Report will cover the following:

- **Job description:** Describe in detail your internship position duties and responsibilities. Discuss what duties were performed on a daily basis, periodic (e.g., weekly) basis, and one-time special projects.

- **Knowledge gained:** Describe the knowledge gained or enhanced as a result of your internship experience. Relate this knowledge to what you learned in specific courses at AIMIT. Did your courses prepare you to handle the responsibilities of your position?
- **Skills learned:** Describe the skills that you learned or sharpened on the job. Discuss any skills that you learned as part of a course at AIMIT that were useful on the job. Consider a skill as the ability to do something like problem solving, analyze a problem, work in a groups, etc.
- **Attitudes/values:** Describe the attitudes or values that you found to be important for success in your job. Think of attitudes as a way of thinking or behavior, e.g., stubborn, patient, confrontational, etc. Consider values as the things you regard as important in life, e.g., dependability, integrity, hard work, etc.
- **Learning outcomes:** Identify the outcomes or results from the knowledge, skills and attitudes or values that you have described above. For example, what can you do for an organization today that you could not have done, or could not have done as well, before your internship

### **Guidelines to prepare the Project Document / Dissertation**

The following format guidelines are intended to help you prepare your master's thesis or dissertation and should be used in conjunction with the specific style adopted by your IT program. It is your responsibility to conform to the following format requirements and ensure that your manuscript's presentation is of the highest quality. Because requirements may change over time, students should not use existing library or departmental copies of manuscripts as examples of proper format.

#### **Format**

All pages of your manuscript must be in 'Letter Size', 8 ½ X 11 inch, format.

#### **Reproduction Quality**

The copies of your manuscript must be clean, unshaded, and free of spots and smudges. Faint, streaked, or uneven copies are unacceptable.

#### **Margins**

The left margin of each page must be 1 1/2 inches, and the top, right, and bottom margins 1 inch.

#### **Placement of Page Numbers**

There are only two ways to paginate your manuscript; upper right hand corner and bottom center. If your page numbers are at the bottom, leave two blank line spaces between the last line of text and the line on which the page number is placed. Whether they are at the top or the bottom,



page numbers should appear just outside the 1-inch margins (.5 to .8 inches from the top or bottom edge of the page. Whichever method of pagination is selected, it must be followed consistently. Use lower-case Roman numerals for the front matter (which is all pages before the body of research), create section break and continue (beginning again with page "1") with Arabic numerals for the remainder of the manuscript, including the text, illustrations, appendices and references.

### **Type and Font**

Your manuscript should be double-spaced (one and a half spaces can be used if approved by the chair of your committee) and single-sided. References may be single-spaced with a double space between each reference. Indented quotations may also be single-spaced. Use a professional quality font (e.g., Arial, Times Roman, Courier or Helvetica). Font size for your text should be 12 point; headings may be up to 14 point. Fonts for tables, figures, and appendices may range from 8 to 12 point.

### **Style**

The style of your thesis or dissertation may follow any one of many standard style guides, as preferred by your graduate unit, or the style considered standard in your particular discipline. You should consult your advisor for preferences or additional requirements your department may have. In any case, your manuscript must be internally consistent.

### **Format Guidelines**

Thesis or dissertation manuscripts are generally divided into three sections – the Front Matter, the Body of Research, and the Reference Matter.

For a visual reference to format the Front Matter, utilize the Example of Completed Front Matter link at the Approval Template page. A Thesis Example and a Dissertation Example will help you format the Front Matter for pagination and the placement of the proper order of the front matter pages which can be generated at the "MS Word Templates" page.

### **Approval (Signature) Page**

The Approval Page is the first page of the Front Matter and the manuscript. Count this as page "i". Type the names of the committee members on the lines provided at the center of the page.

### **Title Page**

The Title page contains the title of your manuscript, your name, your previous degrees (including your majors, institutions and years centered on the page). Count the title page as page "ii". The degree you will be receiving at SAC, and the month and year of your graduation should be listed toward the bottom of the page (check with Graduate Studies for the graduation date). When listing the degree to be awarded, please refer to the Master's Degree List included with these guidelines. Do not use abbreviations.

### **Dedication Page**

This is an optional page. If you use one, number it in appropriate sequence with a lower-case Roman numeral. The title must be in capital letters, centered just below the top margin of the page. The dedication itself may be single or double-spaced.

### **Acknowledgement Page**

This is also an optional page. If you use one, number it in appropriate sequence with a lower-case Roman numeral. The title must be in capital letters, centered just below the top margin of the page. The acknowledgment itself may be single or double-spaced.

### **Abstract Page**

On the Abstract page first list the title of your manuscript, your name, all degrees you have already earned (in chronological order), and the degree to be awarded. These lines should be centered on the page, beginning just below the top margin. Then double-space, and on the following line, center the word ABSTRACT. Double-space again before beginning the text of your abstract. Use paragraph indentation as appropriate. The text itself should be either one and a half spaces or double-spaced.

Number the Abstract Page in appropriate sequence with a lower-case Roman numeral.

### **Table of Contents**

The Table of Contents page is counted and numbered with a lower-case Roman numeral. If you have used a List of Figures (Optional) and/or a List of Tables (Optional), they must be included in your Table of Contents. Tab leaders should be used between the heading levels and the page numbers. (DO NOT simply type dots across the page--the spacing will not work out. Instead, set a dot leader tab. If you have multiple appendices, they must each be listed (see section on Appendices).

### **List of Figures**

Placed on separate page after the Table of Contents. This page is counted and numbered with a lower-case Roman numeral. It may be single or double-spaced. Tab leaders should be used between the title of the figures and page the numbers. This page should be listed at the beginning of the Table of Contents.

### **List of Tables**

Placed on separate after the Table of Contents. This page is counted and numbered with a lower-case Roman numeral. It may be single or double-spaced. Tab leaders should be used between the title of the tables and the page numbers. This page should be listed after the List of Figures at the beginning of the Table of Contents.

### **Preface Page**

This page is counted and numbered with a lower-case Roman numeral.

### **The Text**

Beginning with the first page of the text (begin again with page "1"), pages are numbered with sequential Arabic numerals through the end of your manuscript. Each chapter/major division of the text must start on a new page. Each of these lead pages should be counted and numbered.

### **Figures**

Figures may include diagrams, charts, drawings, schematics, photographs, etc. Each of the two required copies of your manuscript must contain its own original figures, with the exception of photographs, in which case both may be high-quality copies either in color or black and white. Figures should be inserted as near as reasonably possible to the text to which they relate. They should be numbered consecutively with Arabic numerals as part of the continuing text.

Figures and their captions must appear on the same page, within the required margins. If captions are more than one line long, they may be single-spaced. They should be placed on paper of the same size and weight as the rest of the manuscript. Colored materials are acceptable, but since color does not reproduce on microfilm, an alternate key should be provided if it will be needed for interpretation of the figure in black and white.

Oversized figures may be presented in one of two ways: A horizontal figure that is too wide to fit on a regular manuscript page may be mounted on another piece of paper at the left hand margin, and folded like a fan. The folds must be within the right hand margin.

A figure that is both too long and too wide may be folded and inserted into a 6 ½ x 9 " envelope that is mounted on another sheet of paper.

### **Tables**

Tables that are a half-page or shorter in size may be placed at the top or the bottom of the page, or in the center, with text above and below. Tables may also be placed alone on the page immediately following the page that refers to them. The placement of tables should be consistent throughout the manuscript. Tables continuing for more than one page should be labeled [e.g., Table 1 (cont.)], and oversized tables should be treated in the same way as oversized figures.

### **Reference matter**

It may include notes to the text, appendices, a glossary, a list of references, and an index. The appendices and the list of references are the two most commonly used categories, and are discussed in detail below.

### **Appendices**

The appendix (or a series of appendices) usually follows the main text, and contains material that is useful for a detailed review of the study, but is not essential to an understanding of the text. For example, an appendix is the appropriate section in which to place material such as raw data, the results of individual laboratory analyses, or sample forms. This may be useful supporting data even though it is not specifically utilized in the text. Note, however, that some reference should be made in the text to the fact that these materials appear in the appendix. The pages of the

appendices are numbered in sequence with those of the text. Although it is preferable, you do not have to meet margin requirements for the material in your appendix, except for the left-hand margin.

After the last page of text, include a list of Appendices on a separate page. Individual appendices should start on a separate page and should be clearly marked.

The List of Appendices should also be included in the Table of Contents. To list appendices in your Table of Contents, use "Appendices" as your major heading. On the next line, indent five spaces, and begin listing each appendix with its title (for example, "Appendix A. Survey Data") and page number.

### **List of References**

No manuscript is complete without a full listing of the necessary bibliographic information about the sources upon which the study is based. In most cases, only those sources actually cited in the study are listed. This section will be called "List of References", "References Cited", or simply "References", and all pages are counted and numbered. The list is most often arranged alphabetically, although it may follow some other logical plan. It will follow the appendices.

### ***Problems encountered :***

#### **Front Matter**

Formatting on front material is very detailed. Make sure that formatting matches examples. Make sure that pages are numbered correctly.

#### **Margins**

Margins for the entire manuscript must be:

left – 1.5 inches; top, right, bottom – 1 inch

Exceptions: Top, right and bottom margins may vary in the Appendix pages, but the left margin must be 1.5 inches throughout the ENTIRE manuscript. Page numbers in the Appendices must also appear consistently as in the rest of the manuscript.

#### **Landscape-oriented figures and tables**

Margin requirements must be met, and page numbers must be placed consistently as in the rest of the manuscript.

#### **Table of Contents/Headings & Subheadings within manuscripts**

Your Table of Contents will be checked against the body of your manuscript.

#### **Page numbers must be correct.**

All headings/sub-headings that appear at the same level should have the same appearance in the body of the manuscript and be distinguished from other heading-levels by appearance or numbering.

All headings and subheadings (as many levels as you include in the Table of Contents) should appear in the Table of Contents. If you have some third-level headings in the Table of Contents, then ALL third-level subheadings should appear in the Table of Contents. The major section headings (usually Chapter headings) should each begin on a new page. Other levels should not be started on a new page.

### **Forms**

Your manuscript must be accompanied by ALL the appropriate completed forms or it will not be accepted.

***Please Note: The problems listed above are among the most common, but manuscripts can be returned for other problems as well.***

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