

5.1 SOFTWARE ENGINEERING

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4 - 2

RATIONALE

The system analysis and design is the backbone of Application software development. After studying the subject the students will be able to develop and design the system according to given requirements. It involves various steps in analysis and design of the system. It includes the knowledge of preparing project systematically. It is important to know about various aspects of the system analysis and design so that the students will be able to understand the responsibilities while designing and implementing the project.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- understanding the problem and corresponding requirement for development of software.
- describe the various phases of the system development life cycle.
- identify the expected benefits and scope of the projects.
- prepare and develop data flow diagrams and decision tables.
- perform a feasibility study of the system.
- write detailed design specifications for programmes and database.
- select methods for evaluating the effectiveness and efficiency of a system.
- apply different testing techniques on simple programme.

DETAILED CONTENTS

1. Introduction to Software Engineering

(10 periods)

System Concepts: Types of systems : (open, closed, static and dynamic systems).

Introduction, Programmes v/s Software Products

Emergence of Software Engineering- Early Computer Programming, High-level Language Programming, Control flow based Design, Data Structure Oriented Design, Object Oriented Design

2. Software Life Cycle Models

(12 periods)

Requirement of Life Cycle Model, Classic Waterfall Model, Prototyping Model, Evolutionary Model, Spiral Model, introduction to agile methodology.

Comparison of different Life Cycle Models

3. Software Planning

(10 periods)

Responsibilities of Software Project Manager

- Metrics for Project Size Estimation- LOC(Lines of Code), Function Point Metric
- Project estimation Techniques- Using COCOMO Model.

4. Requirement Analysis and Specification

(06 periods)

Requirement gathering and Analysis, Software Requirement Specifications(SRS), Characteristics of good SRS

5. Software Design and Implementation

(10 periods)

Characteristics and features of good Software Design Cohesion and Coupling, Software design Approaches- Function Oriented Design (Data flow diagrams, Data dictionary, Decision Trees and tables), Object Oriented Design, Structured Coding Techniques, Coding Styles, and documentation

6. Software Testing

(08 periods)

Concept of Testing, Testing type cycle (V-Model), Verification v/s Validations, Unit Testing, Black Box Testing, White Box Testing, Integration testing, System testing, Configuration management, Overview of test cases.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Software installation, operation, development and viva-voce

LIST OF PRACTICALS

1. Develop a SRS on a given topic/project/problem.
2. Develop DFD Model (level 0 and level 1 DFD) of the problem.
3. Develop sequence diagram
4. Develop class diagrams
5. Use testing tools such as J-meter, Canoo Web Test
6. Use a project management tool such as Microsoft project or Gantt project etc (Team week, Target process, Gantt project)
7. Write test cases for any known application
8. Take any system and study its system specification and report the various bugs.

RECOMMENDED BOOKS

1. Software Engineering by Rajib Mall, PHI Publishers, New Delhi
2. An Integrated Approach to Software Engineering by Pankaj Jalote, Narosa Publishing House Pvt Ltd, Darya Ganj, New Delhi 110002
3. Software Engineering, Sangeeta Sabharwal, New Age International, Delhi
4. Software Engineering by KK Aggarwal and Yogesh Singh
5. Software Engineering – A Practitioner's Approach by RS Pressman, Tata McGraw Hill Publishers, New Delhi

6. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	18
2	12	24
3	10	18
4	06	10
5	10	18
6	08	12
Total	56	100

5.2 WEB DEVELOPMENT USING PHP

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4 - 6

RATIONALE

This course will enable the students to understand and develop competency amongst the students to design professional database backed dynamic and feature based web sites. The course covers the use of programming with PHP and the concepts of database with MySQL. Students will be introduced to popular web application frameworks for building scalable web applications. The main objective for this course is to motivate student's interest in learning Web-app development by giving them an insight into its possibilities through practical applications. In addition, the course also provides a sufficiently broad but practical introduction to Server-side web technologies.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- perform various logical operations in PHP
- create simple programmes to validate forms in PHP
- perform database connectivity using PHP
- apply the basic concepts, principles and practices of Web-site development using server-side technologies (PHP & MySQL)
- install Word Press
- create and manage Blogs, Websites using WordPress

DETAILED CONTENTS

20. PHP Introduction (20 Periods)

Introduction to PHP: How PHP Works , The php.ini File, Basic PHP Syntax, PHP variables, statements, operators, decision making, loops, arrays, strings, PHP OOPs concept, PHP forms (form handling , validation) , get and post methods, functions.

Introduction to cookies, storage of cookies at client side, Using information of cookies. Creating single or multiple server side sessions. Timeout in sessions.

21. PHP and MySQL (10 Periods)

Introduction to MySQL, connecting to MySQL, database, creation, insertion, deletion and retrieval of MySQL data using PHP.

22. Ajax

(08 Periods)

AJAX Introduction, XMLHttpRequest, Request object, server response, AJAX events, Validation, Interaction with API

23. WordPress (CMS)

(18 Periods)

WordPress Basics:

Introduction to content management systems based on PHP, Introduction to WordPress, How WordPress Works ,Installation of WordPress

Posts&Pages:

Introduction to Blogging, Creating Blogs, Using Images, Wrapping Text Around Images, Comments, Post Formats, Linking to Posts, Pages, and Categories, Using Smilies, Links Manager, WordPress Feeds, Using Password Protection,

Customizing Site Appearance and Themes:

Developing a Color Scheme, Designing Headers, CSS Horizontal Menus, Dynamic Menu Highlighting, Navigation Links, Next and Previous Links, Styling for Print, Designing Your Post Meta Data Section, Separating Categories in your Post Meta Data Section, Customizing the Read More, Formatting Date and Time, Finding CSS Styles, Creating Individual Pages, Uploading Files using WordPress Themes, Templates, Template Tags, Template Hierarchy, Validating a Website, Know Your Sources, WordPress Site Maintenance

LIST OF PRACTICALS

1. Design PHP based web pages using correct PHP, CSS, and XHTML syntax, structure.

2. Create Web forms and pages that properly use HTTP GET and POST protocol as appropriate.
- 3 Design SQL language within MySQL and PHP to access and manipulate databases.
4. Install and configure both PHP and MySQL.
- 5 Create PHP code that utilizes the commonly used API library functions built in to PHP.
6. Design and create a complete web site that demonstrates good PHP/MySQL client/server design using ajax
7. To store a cookie using PHP on client side.
8. To save the user session on server side.
9. Design website using WordPress
10. Creation of basic Blogging website

INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the capabilities of websites/WebPages to students while doing practical exercises. Since the entire course content is web based, students can practice it online. The teachers should have practice on this framework. Entire course is hands-on based so practicals should be conducted in the laboratory.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Actual laboratory and practical work, exercises and viva-voce
- Software installation, operation, development and viva-voce

RECOMMENDED BOOKS

1. Head First PHP &MySQL , O'Reilly Media, Inc , Michael Morrison, Lynn Beighley
2. Sams Teach Yourself PHP, MySQL, and Apache All in One" by Julie C. Meloni, Publisher: SAMS ,ISBN 0-672-32976-X
3. Web enabled development application by Ivan Byross: Commercial; TMH
4. PHP: The Complete Reference , by Steven HolznerMcgraw Higher Ed
5. PHP and MySQL Web Development , by Luke Welling , Pearson Education india
6. WordPress 3.5 Complete ,Packt Publishing , by karolkrol , Aaron hodge Silver
7. WordPress Web Application Development ,Packt Publishing
8. Professional WordPress: Design and Development, by Brad Williams, David Damstra, and Hal Stern, Wrox Publication
9. Building Web Apps with WordPress: WordPress as an Application Framework , by Brian Messenlehner and Jason Coleman , O'Reilly Media
10. e-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR.

Websites for Reference:<http://swayam.gov.in> , <http://spoken-tutorial.org>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	20	36
2	10	18
3	08	14
4	18	32
Total	56	100

5.3 COMPUTER PROGRAMMING USING PYTHON

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RATIONALE

This course introduces to the students the Python language. Upon completion of this course, the student will be able to write non trivial Python programs dealing with a wide variety of subject matter domains. Topics include language components, the IDLE/IDE environment, control flow constructs, strings, I/O, collections, classes, modules, and regular expressions.

LEARNING OUTCOMES

After undergoing the course, the students will be able to:

- execute Python code in a variety of environments
- use correct Python syntax in Python programs
- use the correct Python control flow construct
- write Python programs using various collection data types
- write home grown Python functions
- use standard Python modules such as os, sys, math, and time
- trap various errors via the Python Exception Handling model
- use the IO model in Python to read and write disk files
- create their own classes and use existing Python classes.
- understand and use the Object Oriented paradigm in Python programs
- use the Python Regular Expression capabilities for data verification

DETAILED CONTENTS

1. Introduction (04 Periods)

- Brief History of Python
- Python Versions
- Installing Python
- Environment Variables
- Executing Python from the Command Line
- IDLE
- Editing Python Files
- Python Documentation
- Getting Help
- Dynamic Types
- Python Reserved Words
- Naming Conventions

2. Basic Python Syntax (04 Periods)

- Basic Syntax
- Comments
- String Values
- String Methods
- The format Method
- String Operators
- Numeric Data Types
- Conversion Functions
- Simple Output
- Simple Input
- The % Method
- The print Function

3. Language Components (06 Periods)

- Indenting Requirements
- The if Statement
- Relational and Logical Operators
- Bit Wise Operators
- The while Loop
- break and continue
- The for Loop

4. Collections (10 Periods)

- Introduction
- Lists
- Tuples
- Sets
- Dictionaries
- Sorting Dictionaries
- Copying Collections
- Summary

5. Functions (08 Periods)

- Introduction
- Defining Your Own Functions
- Parameters
- Function Documentation
- Keyword and Optional Parameters
- Passing Collections to a Function
- Variable Number of Arguments
- Scope
- Functions - "First Class Citizens"
- Passing Functions to a Function
- map
- filter
- Mapping Functions in a Dictionary
- Lambda
- Inner Functions
- Closures

6. Modules (04 Periods)

- Modules
- Standard Modules - sys
- Standard Modules - math
- Standard Modules - time
- The dir Function

7. Exceptions (04 Periods)

- Errors
- Runtime Errors
- The Exception Model
- Exception Hierarchy
- Handling Multiple Exceptions
- Raise
- assert

8. Input and Output (04 Periods)

- Introduction
- Data Streams
- Creating Your Own Data Streams
- Access Modes
- Writing Data to a File
- Reading Data From a File
- Additional File Methods
- Using Pipes as Data Streams
- Handling IO Exceptions

9. Classes in Python (06 Periods)

- Classes in Python

- Principles of Object Orientation
- Creating Classes
- Instance Methods
- File Organization
- Special Methods
- Class Variables
- Inheritance
- Polymorphism

10. Regular Expressions

(06 Periods)

- Introduction
- Simple Character Matches
- Special Characters
- Character Classes
- Quantifiers
- The Dot Character
- Greedy Matches
- Grouping
- Matching at Beginning or End
- Match Objects
- Substituting
- Splitting a String
- Compiling Regular Expressions
- Flags

LIST OF PRACTICALS

1. Getting started with Python and IDLE in interactive and batch modes
2. What do the following string methods do?
 - lower
 - count
 - replace
3. Write instructions to perform each of the steps below

- (a) Create a string containing at least five words and store it in a variable.
 - (b) Print out the string.
 - (c) Convert the string to a list of words using the string split method.
 - (d) Sort the list into reverse alphabetical order using some of the list methods (you might need to use `dir(list)` or `help(list)` to find appropriate methods).
 - (e) Print out the sorted, reversed list of words.
4. Write a program that determines whether the number is prime.
- What is your favorite number? 24
- 24 is not prime
- What is your favorite number? 31
- 31 is prime
5. Find all numbers which are multiple of 17, but not the multiple of 5, between 2000 and 2500?
6. Swap two integer numbers using a temporary variable. Repeat the exercise using the code format: `a, b = b, a`. Verify your results in both the cases.
7. Find the largest of n numbers, using a user defined function `largest()`.
8. Write a function `myReverse()` which receives a string as an input and returns the reverse of the string.
10. Check if a given string is palindrome or not.
11. WAP to convert Celsius to Fahrenheit
12. Find the ASCII value of charades
13. WAP for simple calculator

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on practicals and experts from industries may be invited to deliver lectures and share experiences with the students.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Software installation, operation, development
- Actual laboratory and practical work exercises
- Viva-voce

RECOMMENDED BOOKS

1. Learning Python by Mark Lutz; Pratham Books, Bangalore
2. Foundations of Python Network Programming by John Goerzen and Brandeure Rhodes; Apress-eBook distributed by Springer Science and Business Media, New York
3. Dive Into Python by Mark Pilgrim; Pratham Books, Bangalore
4. Think Python by Allen B. Downey; O'Reilly Media
5. Python Programming For Beginners: A Must Read Introduction to Python Programming by Robert Richards; Pratham Books, Bangalore
6. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference: <http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	04	06
2.	04	06
3.	06	10
4.	10	20
5.	08	14
6.	04	06
7.	04	06
8.	04	08
9.	06	12
10.	06	12
Total	56	100

5.4 COMPUTER ARCHITECTURE AND HARDWARE MAINTENANCE

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4 - 4

RATIONALE

The subject provides the students with the knowledge of detailed organization of currently available personal computers in order to understand their functioning. The students will also get familiar with Architecture of multi processor systems.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- use CPU, register and stack.
- compare micro programmed and hardwired control.
- compare RISC and CISC architecture.
- understand memory hierarchy and memory types.
- explain the function of BIOS.
- illustrate multi processor systems.
- set-up, diagnose problems troubleshoot & Maintained the computer components.

DETAILED CONTENTS

1. Hardware Organisation of computer system (10 periods)
 - 1.1 CPU organisation: general register organisation, stack organisation, instruction formats(three address, two address, one address, zero address and RISC instruction). Addressing modes: Immediate, register, direct, indirect, relative, indexed.
 - 1.2 CPU Design:Microprogrammedvs hard wired control.
 - 1.3 Reduced instruction set computers: CISC characteristics, RISC characteristics, and their comparison.
2. Memory organisation (10 periods)

- 2.1 Memory Hierarchy
- 2.2 RAM and ROM chips, Memory address map, Memory connections to CPU.
- 2.3 Auxillary memory: Magnetic disks and magnetic tapes.
- 2.4 Associative memory
- 2.5 Cache memory
- 2.6 Virtual memory
- 2.7 Memory management hardware
- 2.8 Read and Write operation

3. Arithmetic Operations (08 periods)
 - 3.1 Introduction, Addition, Subtraction, Multiplication and Division algorithm.

4. I/O Organization (10 periods)
 - 4.1 Basis Input output system(BIOS)
 - Function of BIOS
 - Testing and initialization
 - Configuring the system
 - 4.2 Modes of Data Transfer
 - Programmed I/O : Synchronous, asynchronous and interrupt initiated.
 - DMA data transfer

5. 8085 Microprocessor: Introduction, Architecture, Pin diagram, Comparison with 8086. (6 periods)

6. Architecture of multi processor systems (12 periods)
 - 6.1 Forms of parallel processing
 - 6.2 Parallel processing and pipelines, basic characteristics of multiprocessor
 - 6.3 General purpose multiprocessors
 - 6.4 Interconnection networks: time shared common bus, multi port memory, cross bar switch, multi stage switching networks and hyper cube structures.

LIST OF PRACTICALS

1. Demonstration of following:
 - (i) motherboard
 - (ii) Key board & Keyboard decoder
 - (iii) Video Adapter & display controllers
 - (iv) Floppy Drive, CD Drive and Hard Disk.
 - (v) Multifunction Input/Output controllers
 - (vi) Assembly of PC

2 Troubleshooting & repair of following equipment:

- (i) Dot Matrix Printer, Laser, Inkjet Printer.
- (ii) Digital Plotter
- (iii) C. P. U.
- (iv) Disk Drive

3. Trouble Shooting of

- (i) Network
- (ii) Power Supplies.

INSTRUCTIONAL STRATEGY

Since the subject is theoretical one, the practical aspects should be taught along with the theory instruction. The students should be given quiz tests and asked to give seminars on small topics. There is sufficient time in the subject and the students can be taken to laboratory for demonstration.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Viva-voce

LIST OF RECOMENEDED BOOKS

1. Computer Architecture and Organisation by Moris Mano
2. Computer Architecture by J.P.Hayes
3. Structured Computer Organisation by Tanenbaum Andrew S, PHI
4. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (in periods)	Marks Allotted (%)
1.	10	20
2.	10	20
3.	08	10
4.	10	20
5.	06	10
6	12	20
Total	56	100

5.5 INTERNET OF THINGS

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RATIONALE

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain like agriculture, space, healthcare, manufacturing, construction, water, and mining. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology. This introductory syllabus will enable learners to leverage their business and/or technical knowledge across IoT-related functions in the workplace.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- understand the concepts of Internet of Things.
- understand what constitutes an IoT design solution
- identify the sensors and other devices needed for different IoT solutions
- understand the component parts of an IoT network and its connections
- build small IoT applications.

DETAILED CONTENTS

1. Introduction to Internet Of Things (IoT)

(10 Periods)

Introduction to IoT, Defining IoT, Things in IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, IoT Protocols, IoT communication Models, IoT communication API's, IoT enabling Technologies.

2. IoT Devices

(12 Periods)

How electronic devices fit with the Internet of Things, and why they are important

: Breadboard and its internal connections, LED and its connections, Tri-color LED, Resistor

Introduction to the many 'end devices', sensors and actuators, differentiate between different sensor types

3. IoT Networks

(12 Periods)

Introduction to the components of basic IoT networks, the types of network connections and how data travels through them, and the role of Internet Protocols. understanding of microcontrollers/Arduino and communication protocols

4.

(12 Periods)

, feature of arduino device, Arduino device introduction Components of Arduino board C) Arduino Programming Language, Understanding of basic of Arduino IDE, function, control statement, loops, datatype, variables : (Language

5. IoT and M2M

(10 Periods)

Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT- Software defined networking, network function virtualization, IoT and WoT.

LIST OF PRACTICALS

- :

13. Installation of Arduino IDE
14. Interfacing Light Emitting Diode (LED)- Blinking LED
15. Interfacing Button and LED – LED blinking when button is pressed.
16. Interfacing Light Dependent Resistor (LDR) and LED, displaying automatic night lamp
17. Interfacing Temperature Sensor (LM35) and/or humidity sensor (e.g. DHT11)
18. Interfacing Liquid Crystal Display (LCD) – display data generated by sensor on LCD
19. Interfacing Air Quality Sensor-pollution (e.g. MQ135) - display data on LCD, switch on LED when data sensed is higher than specified value.
20. Interfacing Bluetooth module (e.g. HC05)- receiving data from mobile phone on Arduino and display on LCD
21. Interfacing Relay module to demonstrate Bluetooth based home automation application. (using Bluetooth and relay).

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment, seminar or case study method. The teacher will discuss case studies with students , since this subject is practical oriented, the teacher should demonstrate functioning of various sensors and demonstrate building of IoT applications. Solution to various regression and classification problems should also be built

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- viva-voce
- Actual laboratory and practical work exercises
- Software installation, operation, development

RECOMMENDED BOOKS

1. The Internet of Things: Connecting Objects to the Web, Wiley Publisher Hakima Chaouchi
2. Internet of Things: A Hands On Approach, University Press, Vijay Madiseti, Arshdeep Bahga.
3. 21 Internet Of Things (IOT) Experiments, BPB Publications Yashavant Kanetkar
4. Arduino Projects For Engineers ,BPB Publications ,Neerparaj Rai
5. Internet of Things – A Hands on Approach, By Arshdeep Bahga and Vijay Madiseti Universities Press, ISBN: 9788173719547
6. The Internet of Things , Pearson, By Michael Miller ISBN: 9789332552456
7. e-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR, Chandigarh.

Websites for Reference: <http://www.spoken-tutorial.org> , <http://swayam.gov.in>

LIST OF COMPONENTS

1. One kit for 3-4 students : Arduino Uno, sensors (Bluetooth module (HC05), MQ135, DHT11, breadboard , LCD, 2-relay module etc)
2. Consumables : LED, button, connecting wires, LDR, LM35, battery, etc

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	10	16
2.	12	22
3.	12	22
4.	12	22
5.	10	18
Total	56	100

5.6 MINOR PROJECT WORK

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LEARNING OUTCOMES

After undergoing this subject, the student will be able to:

- Use effectively oral, written and visual communication
- Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
- Identify, analyze and solve problems creatively through sustained critical investigation.
- Develop leadership abilities.
- Apply fundamental and disciplinary concepts and methods in ways appropriate to their areas of study.

Minor project work aims at exposing the students to various industries dealing with computers. It is expected from them to get acquainted with computer environment. For this purpose, student during middle of the course are required to be sent for a period of two to four weeks at a stretch in different establishments. Depending upon the interest of students they are sent for exposure to:

1. Industrial practices in installation and maintenance of computers and computer networks
2. Fabrication of computers
3. Fault diagnosis and testing of computers
4. Industrial practices in respect of documentation and fabrication
5. A variety of computers and peripherals in assembly organizations
6. Software package development organizations
7. Maintenance of database
8. Write procedure or functions which can be attached as the library objects to the main projects
9. Write a procedure function to convert number of words.
10. Write a procedure function to convert all data function (create your own) Database connectivity, (SQL server, Oracle, Access), Library classes in C++ (same application),
11. design web applications using PHP

Note: The teachers may guide /help students to identify their minor project work and check out their plan of action well in advance.

As a minor project activity each student is supposed to study the operations at site and prepare a detail project report of the observations/processes/activities by him/her. The students should be guided by the respective subject teachers. Each teacher may guide a group of 4 to 5 students.

The teachers along with field supervisors/engineers will conduct performance assessment of students. Criteria for assessment will be as follows:

	Criteria	Weightage
(a)	Attendance and Punctuality	15%
(b)	Initiative in performing tasks/creating	30%

	new things	
(c)	Relation with people	15%
(d)	Report Writing	40%

6.1 DEVELOPMENT OF ANDROID APPLICATIONS

RATIONALE

Knowing the details of Mobile and their working principle are need of the every common man. Mobile Application development is the very hot business domain. Majority of the corporate have a separate division for the development of mobile applications. It is essential that diploma students must know the way to apply advanced data communicating methods and networking protocols for wireless and mobile devices. Hence this subject.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- . • illustrate the usage of different components of Android OS in detail
- develop a mobile application using different components of Android
 - choose appropriate controls to design the GUI to meet desired needs
 - consume JSON data and call web services from Android mobile app.
 - write a program in Android to store data in databases
 - develop Mobile applications using Android

DETAILED CONTENTS

1. Introduction to ANDROID

(10 periods)

What is Android? Dalvik Virtual Machine & .apk file extension, Fundamentals: Basic Building blocks - Activities, Services, Broadcast Receivers & Content providers, UI Components - Views & notifications, Components for communication -Intents & Intent Filters, Android API levels (versions & version names)

2. Environment Setup and Basic Project Structure

(08 periods)

Setting up development environment Android, Manifest.xml, Gradle, Uses-permission & uses-sdk, Resources & R.java, Assets, Layouts & Drawable Resources, First sample Application, Launching emulator, Editing emulator settings, Emulator shortcuts, Logcat usage, Introduction to DDMS, Hello World App, Creating your first project The manifest file Layout resource, Running your app on Emulator, Debugging the Android App.

3. Android Fundamentals and User Interface Design (12 periods)

Activities and Activity lifecycle, Permission System

Basic UI Components:

Text View, Button, Radio Button, Edit Text, Image View for image, Check Box, Progress Bar, Event Handling in Android

Layouts:

Linear Layout, Relative Layout, Frame Layout, Coordinate Layout, [dip, dp, sip, sp] versus px

Intents:

Intents introduction and importance, Types of Intents (Explicit Intents, Implicit intents)

4. Menus and Preferences (10 periods)

Introduction to Menus, Types of Menus (Option menu, Context menu), Uses of Shared Preferences

5. Advanced UI Components (12 periods)

Time and Date, List View, Grid View, Card View, recycler view Adaptors (Base Adaptor, Array Adaptor) & View Holder, Dialogs, Toast, Popup, Fragments, Material Design(Introduction, Navigation, Floating Button, Tool bar).

6. Threads in Android (12 periods)

Threads running on UI thread (run on UI Thread), Worker thread, Handlers & Runnable, AsyncTask, calling web services and consuming JSON data from Web Services.

7. Notifications & Services (10 periods)

Broadcast Receivers (Introduction, different ways to register a broadcast receiver), Introduction to Notification, Overview & Types of services, implementing a Service, Service lifecycle

8. Storage and Content Provider (10 periods)

Supported Storage in Android (Internal memory, External memory, Shared Preferences and network), SQLite introduction, CRUD Operations in SQLite database (cursor, content values etc), Basics of Content Provider

LIST OF PRACTICALS

1. Install the Android Studio and Setup the Development Environment

2. Write a program to demonstrate activity (Application Life Cycle)
3. Write a program to demonstrate different types of layouts
4. Write a program to implement simple calculator using text view, edit view, option button and button
5. Write a program to develop app having multiple activities and user should be able switch between the activities by using intents.
6. Write a program to demonstrate list view
7. Write a program to demonstrate photo gallery
8. Write a program to demonstrate Date picker and time picker
9. Develop an simple application with context menu and option menu.
10. Write a program to demonstrate the functionality of Shared Preferences.
11. Develop a sample Android application having navigation items similar to Gmail Application.
12. Write a program to demonstrate a service
13. Write a program to demonstrate the application of intent class
14. Write a program to create a text file in a external memory
15. Write a program to store and fetch data from SQL life database.

INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the capabilities of Android app to students while doing practical exercises. The students should be made familiar with developing mobile app and understand the basic concept of Android Platform.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Software installation, operation, development
- Actual laboratory and practical work, exercises and viva-voce

RECOMMENDED BOOKS

1. Beginning Android 4 Application Development by Wei-Meng Lee ; Wiley India
2. Android Apps for Absolute Beginners by Jackson; Apress
3. Head First Android Development: A Brain-Friendly Guide , by David Griffiths and DawnGriffiths ,O`Relilly
4. Android Programming for Beginners , by John Horton, Packt Publishing

5. Professional Android, 4th Edition , by Reto Meier, Ian Lake , Wrox Press

6. **Beginning Android Programming with Android Studio (Wrox Beginning Guides),**
by **Jerome DiMarzio, Wrox Press**

7. E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR,
Chandigarh.

Websites for Reference:<http://swayam.gov.in> , <http://spoken-tutorial.org> ,
<https://developer.android.com>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	10	14
2.	08	08
3.	12	14
4.	10	12
5.	12	14
6.	12	14
7.	10	12
8.	10	12
Total	84	100

6.2 CLOUD COMPUTING

L T P

4 - 4

RATIONALE

This course offers a good understanding of cloud computing concepts and challenges faced in implementation of cloud computing.

LEARNING OUTCOMES

After undergoing the subject, the students would be able to:

- explain core concepts of cloud computing paradigm.
- explain various Service Models
- explain various Deployment Models.
- describe SLA management in Cloud Computing
- explain and apply the concept of virtualization.
- describe the scheduling of tasks in cloud.
- illustrate the fundamental concepts of cloud storage.
- describe various security issues in the cloud.
- make use of cloud.

DETAILED CONTENTS

1. Introduction (08 Periods)
Evolution of Cloud Computing, Cloud Computing Overview, Characteristics, Applications, Benefits, Challenges.
2. Service and Deployment Models (08 Periods)
 - 2.1 Cloud Computing Service Models: Infrastructure as a Service, Platform as a Service, Software as a Service;
 - 2.2 Cloud Computing Deployment Models: Private Cloud; Public Cloud, Community Cloud, Hybrid Cloud, Major Cloud Service providers.

3. Service Level Agreement (SLA) Management (06 Periods)
Overview of SLA, Types of SLA, SLA Life Cycle, SLA Management Process.
4. Virtualization Concepts (08 Periods)

Overview of Virtualization, Types of Virtualization, Benefits of Virtualization, Hypervisors.
5. Cloud Security (06 Periods)

Infrastructure Security, Data Security & Privacy Issues, Legal Issues in Cloud Computing.
6. Cloud Storage (08 Periods)
Overview; Storage as a Service, Benefits and Challenges, Storage Area Networks (SANs).
7. Scheduling in Cloud (12 Periods)
Overview of Scheduling problem, Different types of scheduling, Scheduling for independent and dependent tasks, Static vs. Dynamic scheduling.

LIST OF PRACTICALS

1. Introduction to Cloud Vendors: Amazon, Microsoft, IBM.
2. Setting up Virtualization using Virtualbox/VMWare Hypervisor
3. Introduction to OwnCloud
4. Installation and configuration of OwnCloud software for SaaS
5. Accessing Microsoft AZURE cloud-services
6. Cloud Simulation Software Introduction: CloudSim

INSTRUCTIONAL STRATEGY

In addition to classroom teaching, the teacher should demonstrate the practical usage of cloud using real cloud services.

MEANS OF ASSESSMENT

- Assignments and Quiz/class tests, mid-term and end-term written tests
- Actual laboratory and practical work and Viva-Voce

RECOMMENDED BOOKS

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski (Editors): Cloud Computing: Principles and Paradigms, Wiley, 2011

2. Kumar Saurabh, Cloud Computing, Wiley, 2012.
3. Barrie Sosinsky: Cloud Computing Bible, Wiley, 2011.
4. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper: Cloud Computing for Dummies, Wiley, 2010
5. E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference: <http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	08	14
2.	08	14
3.	06	11
4.	08	14
5.	06	11
6.	08	14
7.	12	22
Total	56	100

6.3 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

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RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mindset with managerial skills helps the student in the job market. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

LEARNING OUTCOMES

After undergoing this course, the students will be able to :

- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- Explain the principles of management including its functions in an organisation.
- Have insight into different types of organizations and their structures.
- Inculcate leadership qualities to motivate self and others.
- Manage human resources at the shop-floor
- Maintain and be a part of healthy work culture in an organisation.
- Use marketing skills for the benefit of the organization.
- Maintain books of accounts and take financial decisions.
- Undertake store management.
- Use modern concepts like TQM, JIT and CRM.

DETAILED CONTENTS

SECTION – A

ENTREPRENEURSHIP

1. Introduction

(04 Periods)

- 1.1 Concept /Meaning and its need
- 1.2 Qualities and functions of entrepreneur and barriers in entrepreneurship
- 1.3 Sole proprietorship and partnership forms and other forms of business organisations

- 1.4 Schemes of assistance by entrepreneurial support agencies at National, State, District –level, organisation: NSIC, NRDC, DC, MSME, SIDBI, NABARD, NIESBUD, HARDICON Ltd., Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

2. Market Survey and Opportunity Identification/Ideation (04 Periods)

- 2.1 Scanning of the business environment
- 2.2 Salient features of National and Haryana State industrial policies and resultant business opportunities
- 2.3 Types and conduct of market survey
- 2.4 Assessment of demand and supply in potential areas of growth
- 2.5 Identifying business opportunity
- 2.6 Considerations in product selection
- 2.7 Converting an idea into a business opportunity

3. Project report Preparation (06 Periods)

- 3.1 Preliminary project report
- 3.2 Detailed project report including technical, economic and market feasibility
- 3.3 Common errors in project report preparations
- 3.4 Exercises on preparation of project report
- 3.5 Sample project report

SECTION –B

MANAGEMENT

4. Introduction to Management (06 Periods)

- 4.1 Definitions and importance of management
- 4.2 Functions of management: Importance and process of planning, organising, staffing, directing and controlling
- 4.3 Principles of management (Henri Fayol, F.W. Taylor)
- 4.4 Concept and structure of an organisation
- 4.5 Types of industrial organisations and their advantages
- 4.6 Line organisation, staff organisation
- 4.7 Line and staff organisation
- 4.8 Functional Organisation

5. Leadership and Motivation (08 Periods)

- 5.1 Leadership: Definition and Need, Qualities and functions of a leader, Manager Vs leader, Types of leadership, Case studies of great leaders
- 5.2 Motivation: Definition and characteristics, Importance of self motivation, Factors affecting motivation, Theories of motivation (Maslow, Herzberg, Douglas, McGregor)
- 6. Management Scope in Different Areas (14 Periods)
 - 6.1 Human Resource Management: Introduction and objective, Introduction to Man power planning, recruitment and selection, Introduction to performance appraisal methods
 - 6.2 Material and Store Management: Introduction functions, and objectives, ABC Analysis and EOQ
 - 6.3 Marketing and sales: Introduction, importance, and its functions, Physical distribution, Introduction to promotion mix, Sales promotion
 - 6.4 Financial Management: Introductions, importance and its functions, knowledge of income tax, sales tax, excise duty, custom duty, VAT, GST
- 7. Work Culture (08 Periods)
 - 7.1 Introduction and importance of Healthy Work Culture in organization
 - 7.2 Components of Culture
 - 7.3 Importance of attitude, values and behavior
 - 7.4 Behavioural Science – Individual and group behavior.
 - 7.5 Professional ethics – Concept and need of Professional Ethics and human values.
- 8. Basic of Accounting and Finance (10 Periods)
 - 8.1 Basic of Accounting: Meaning and definition of accounting, Double entry system of book keeping, Trading account, PLA account and balance sheet of a company
 - 8.2 Objectives of Financial Management: Profit Maximization v/s Wealth Maximization
- 9. Miscellaneous Topics (10 Periods)
 - 9.1 Total Quality Management (TQM): Statistical process control, Total employees Involvement, Just in time (JIT)

- 9.2 Intellectual Property Right (IPR) : Introduction, definition and its importance, Infringement related to patents, copy right, trade mark

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment, seminar or case study method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organisations on visit. Approach extracted reading and handouts may be provided.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/Prototype making.

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development and Management by J.S.Narang; Dhanpat Rai & Sons, Delhi.
3. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
4. Handbook of Small Scale Industry by PM Bhandari
5. Entrepreneurship Development and Management by MK Garg
6. E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	06
2	04	06
3	06	08
4	06	08
5	08	12
6	14	20
7	08	12
8	10	14
9	10	14
Total	70	100

6.4.1 ADVANCED JAVA

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6 - 6

RATIONALE

The diploma holders in Computer Science and Engineering need to understand how server side programming can be done using Java/J2EE Technology They should be able to connect the middle layer to backend and frontend by server side programming Hence this subject is introduced in the curriculum.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Understand Server Side Architecture of Web Applications
- Connect to Database and do the CRUD Database operations using JDBC
- Develop Web Application by using Servlets and JSP
- Manage Session in the web application
- Understand Ajax Concept and uses

DETAILED CONTENTS

24. Introduction Server Side Platform (10 Periods)

Introduction to Web Applications, Dynamic websites, Three Layer Architecture of Web Application , Client Server Architecture , IP Address, Port, URL. Web Server, Introduction to Tomcat Web Server (Installation and its Services), Introduction to J2EE

25. Database Programming using JDBC (14 Periods)

Introduction to JDBC, JDBC Drivers & Architecture, JDBC API

CURD operation Using JDBC API:

Database Connection, JDBC Statement, Prepared Statements (Advantages and Disadvantages), Using Result Sets

26. Java Servlets (17 Periods)

Servlet introduction, working of servlet, advantage of servlet, servlet terminology, Servlet Container, Life cycle of a servlet, introduction to servlet API, Servlet interface, Generics Servlet class, Http servlet class, RequestDispatcher (include() and forward).

27. Handling Sessions in Servlets

(14 Periods)

Introduction to Session, Session Tracking mechanism: URL rewriting, Hidden form fields, Cookies and Http Session (Working, Advantages and Disadvantages of all session tracking mechanism)

28. JSP

(17 Periods)

Introduction to JSP - Architecture, JSP- Life cycle, JSP-syntax, JSP-Directive, JSP-Actions, JSP- Implicit objects, JSP - Client request, JSP - Server response, JSP integration with database, JSP Session

29. AJAX

(12 Periods)

AJAX Introduction, XMLHttpRequest, Request object, server response, AJAX events, Validation, Interaction with API

LIST OF PRACTICALS

1. Exercises related to make JDBC connections and CRUD operations on database by using JDBC APIs
2. Installation and configuration of Web Server Tomcat
3. Exercises related to Java Servlets
4. Exercises related to JSP
5. Exercises related to AJAX.
6. Exercises related to Session and Cookies.

INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the capabilities of server-side programming to students while doing practical exercises. The students should be made familiar with web server and dynamic web site development tools and techniques along with three tier architecture concept.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Actual laboratory and practical work, exercises and viva-voce
- Software installation, operation, development and viva-voce

RECOMMENDED BOOKS

8. Head First Servlets And JSP , Bert Bates , O' Reilly
9. Java Server Programming Java EE 7 (J2EE 1.7), Black Book , Kogent Learning Solutions Inc.
10. Jdbc, Servlets, And Jsp Black Book, Santosh Kumar KDT Editorial Services , Wiley
11. J2EE: The Complete Reference, Jim Keogh , McGraw Hill Education
12. e-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

<http://spoken-tutorial.orgs>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	10
2	14	16
3	16	22
4	14	16
5	16	22
6	14	14
Total	84	100

6.4.2 .NET TECHNOLOGIES

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6 - 6

RATIONALE

This is an upcoming technology. It is based on object oriented approach and is user friendly. It supports various languages such as C#, Asp.net etc. The demonstration should be given using Net software for describing the various features of Dot Net Technologies.

LEARNING OUTCOMES

After undergoing this subject, students will be able to:

- Know about basics of Net Framework and its working
- Know about C# basics and its programming concepts
- Learn about advanced and latest features of C#
- Know about ADO.net basics and its applications
- Know about programming aspects of ASP.net and its applications
- Design and develop a website using latest features of Asp.net and C# language

DETAIL CONTENTS

1. Net Framework (15 Periods)

Introduction, common language routine, common types system, common language specification, the base class library, the .net class library, Intermediate language. Justin-time compilation and assemblies, Introduction to web services, unified classes.

2. C# Basics (15 Periods)

Getting started with .net framework, exploring visual studio.net, Inside a C# program, data types, statements, arrays, using strings, objects, classes, struts, events, namespaces and important partial classes.

3. Advance Feature of C# (09 Periods)

Collection and data structure, exception handling, Threading using stream and files, assemblies.

4. ADO.net (15 Periods)

Introduction to ADO.net, ADO.net benefits, ADO.net compared to classic ADO-datasets, managed providers- data binding; Introducing data source controls- reading and write data using the Sql data source control.

5. ASP.net

(15 Periods)

Introduction to ASP.net, Working with web and HTML controls, using Rich server controls, login controls, overview of ASP.net validation control using simple validations, using the complex validators, accessing data using ADO.net.

6. ASP.net 6.0

(15 Periods)

Features of ASP.net 6.0, stages in web form processing, Introduction to server controls, data binding controls, session state, ADO.net, database

Note: Use of latest version of Visual Studio (Visual Studio 2017 or above) is strongly recommended

LIST OF PRACTICALS

1. Write a program to check whether empty query string is entered in Asp.net
2. Write a program to change colour or Label text control programmatically in Asp. Net
3. Write a program to Enable-Disable Textbox and change width of TextBox programmatically in Asp.net
4. Write a program to increase and decrease font size programmatically
5. Write C# code to display the asterisk pattern as shown below:

6. Write C# code to prompt a user to input his/her name and country name and then the output will be shown as an example below:
Hello Ram from country India!
7. Write C# code to do the following
 - Convert binary to decimal
 - Convert decimal to hexadecimal
 - Convert decimal to binary
 - Convert decimal to octal
8. Write a C# code to perform Celsius to Fahrenheit Conversion and Fahrenheit to Celsius conversion.
9. Write ASP. Net program to store objects in Session State and Storing Session State in SQL Server.
10. Problems regarding State Management.

RECOMMENDED BOOKS

1. Christan Nagel, Professional C#.net, Publication.
2. Mathew Macdonald and Robert Standefer, ASP.net complete reference, TMH
3. Vijay Mukhi, C# the Basis, BPB Publications
4. E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	15	18
2.	15	18
3.	09	10
4.	15	18
5.	15	18
6.	15	18
Total	84	100

6.4.3 DATA SCIENCE AND MACHINE LEARNING

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6 - 6

RATIONALE

The diploma holders in Computer Science and Engineering needs to understand about Data Science and Machine Learning and how to implement Machine Learning Algorithms. They should be able to solve real time problems using data science and Machine learning techniques. Hence this subject is introduced in the curriculum.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Understand the basics of Data Science
- Understand and develop Machine Learning Algorithms.
- Implement Dimensionality Reduction Techniques

DETAILED CONTENTS

Data Science

1. Introduction of data Science and Machine Learning (12 Periods)

Fundamentals of Artificial Intelligence, need and applications of Data Science, Data Mining, data preparation, Machine Learning, Types and Applications of Machine learning

2. Data Preprocessing, Analysis and Visualization (10 Periods)

Data Pre-processing: Pre-processing Techniques- Mean Removal, Scaling, Normalization, Binarization, One Hot Encoding, Label encoding, Data Analyses: Loading

and summarizing the dataset, Data Visualization: Univariate Plots, Multivariate Plots, Training Data, Test Data, Performance Measures

3. Statistical Inference (12 Periods)

Populations and samples, Types of Statistical modelling, Types of probability distributions. Parametric and Non-Parametric Methods, Distance Metrics

4. Exploratory Data Analysis and the Data Science Process (10 Periods)

Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process

5. Machine Learning Algorithms (12 Periods)

Introduction to Supervised Learning Algorithms – Decision Tree, Linear Regression, k-Nearest Neighbours (k-NN), SVM and Introduction to Unsupervised Learning Algorithms - K-means Clustering, MeanShift Algorithm, Dimensionality Reduction Techniques, Introduction to Neural Networks,

6. Mining Social-Network Graphs (10 Periods)

Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighbourhood properties in graphs

7. Data Science and Ethical Issues (16 Periods)

Discussions on privacy, security, ethics, A look back at Data Science, Next-generation data scientists

LIST OF PRACTICALS

1. WAP to implement the Decision Tree Algorithm
2. WAP to implement the Linear Regression
3. WAP to implement the k-Nearest Neighbors (k-NN)
4. WAP to implement the SVM Algorithm
5. WAP to implement the K-means Clustering
6. WAP to implement various Distance Metrics
7. WAP to implement Dimensionality Reduction Techniques

INSTRUCTIONAL STRATEGY

The subject is conceptual and practical based. Students should be given clear idea about the basic concepts of Data Science and Machine Learning. In practical session student should be asked to explain the algorithm and then write program for algorithm and run on computer. It is required that students should maintain records (files with printouts).

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Actual laboratory and practical work, exercises and viva-voce
- Software installation, operation, development and viva-voce

RECOMMENDED BOOKS

6. e-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR.

Websites for Reference:

<http://www.spoken-tutorial.org>

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	14	17
2.	10	12
3.	12	14
4.	10	12
5.	12	14
6.	10	12
7.	16	18
Total	84	100

6.5 MAJOR PROJECT WORK

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- - 8

RATIONALE

Major Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. It is also essential that the faculty of the respective department may have a brainstorming to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The students should identify themselves or accept the given project assignment at least two to three months in advance. The project work identified in collaboration with industry should be preferred. Each teacher is expected to guide the project work of 5–6 students.

The project assignments may consist of:

- Programming customer based applications
- Web page designing (Only dynamic)
- Database applications
- Software Development

LEARNING OUTCOMES

After undergoing this subject, the student will be able to:

- Use effectively oral, written and visual communication
- Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
- Identify, analyze and solve problems creatively through sustainment critical investigation.
- Develop, leadership abilities..
- Apply fundamental and disciplinary concepts and methods in ways appropriate to their areas of study.

A suggestive criterion for assessing student performance by the external (personnel from industry) and internal (teacher) examiner is given in table below: