THIRUVALLUVAR UNIVERSITY

SERKKADU, VELLORE–632115

M.Sc. INFORMATION TECHNOLOGY

SYLLABUS

FROM THE ACADEMIC YEAR
2023 – 2024

P19

(ii) TANSCHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION	
Programme	**M.Sc. INFORMATION TECHNOLOGY**
Programme Code	
Duration	**2 years for PG**
Programme Outcomes (Pos)	**PO1: Problem Solving Skill** Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context. **PO2: Decision Making Skill** Foster analytical and critical thinking abilities for data-based decision-making. **PO3: Ethical Value** Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities. **PO4: Communication Skill** Ability to develop communication, managerial and interpersonal skills. **PO5: Individual and Team Leadership Skill** Capability to lead themselves and the team to achieve organizational goals. **PO6: Employability Skill** Inculcate contemporary business practices to enhance employability skills in the competitive environment. **PO7: Entrepreneurial Skill** Equip with skills and competencies to become an entrepreneur. **PO8: Contribution to Society** Succeed in career endeavors and contribute significantly to society. **PO 9 Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and a global perspective. **PO 10: Moral and ethical awareness/reasoning** Ability to embrace moral/ethical values in conducting one's life.
Programme Specific Outcomes (PSOs)	**PSO1 – Placement** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.

	PSO 2 - Entrepreneur To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. **PSO3 – Research and Development** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4 – Contribution to Business World** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5 – Contribution to the Society** To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

Template for P.G., Programmes

Semester–I	Credit	Hours	Semester-II	Credit	Hours	Semester-III	Credit	Hours	Semester–IV	Credit	Hours
1.1. Core-I	5	7	2.1. Core-IV	5	6	3.1. Core-VII	5	6	4.1. Core-XI	5	6
1.2 Core-II	5	7	2.2 Core-V	5	6	3.2 Core-VII	5	6	4.2 Core-XII	5	6
1.3 Core – III	4	6	2.3 Core – VI	4	6	3.3 Core – IX	5	6	4.3 Project with viva voce	7	10
1.4 Discipline Centric Elective -I	3	5	2.4 Discipline Centric Elective – III	3	4	3.4 Core – X	4	6	4.4Elective - VI (Industry / Entrepreneurship) 20% Theory 80% Practical	3	4
1.5 Generic Elective-II:	3	5	2.5 Generic Elective -IV:	3	4	3.5 Discipline Centric Elective - V	3	3	4.5 Skill Enhancement course / Professional Competency Skill	2	4
			2.6 Skill Enhancement I	2	4	3.6 NME II	2	3	4.6 Extension Activity	1	
			Human Rights	2	2	3.7 Internship/ Industrial Activity	2	-			
			MOOC Course	2	-						
	20	**30**		**26**	**30**		**26**	**30**		**23**	**30**
Total Credit Points -95											

Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credits and Hours Distribution System for all Post – Graduate Courses including Lab Hours

First Year – Semester – I

Part	List of Courses	Credits	No. of Hours
	Core – I	5	7
	Core – II	5	7
	Core – III	4	6
	Elective – I	3	5
	Elective – II	3	5
		20	**30**

Semester-II

Part	List of Courses	Credits	No. of Hours
	Core – IV	5	6
	Core – V	5	6
	Core – VI	4	6
	Elective – III	3	4
	Elective – IV	3	4
	Skill Enhancement Course [SEC] - I	2	4
	Human Rights	2	2
	MOOC Course	2	-
		26	**30**

Second Year – Semester – III

Part	List of Courses	Credits	No. of Hours
	Core – VII	5	6
	Core – VIII	5	6
	Core – IX	5	6
	Core (Industry Module) – X	4	6
	Elective – V	3	3
	Skill Enhancement Course - II	2	3
	Internship / Industrial Activity [Credits]	2	-
		26	**30**

Semester-IV

Part	List of Courses	Credits	No. of Hours
	Core – XI	5	6
	Core – XII	5	6
	Project with VIVA VOCE	7	10
	Elective – VI (Industry Entrepreneurship)	3	4
	Skill Enhancement Course – III / Professional Competency Skill	2	4

	Extension Activity	1	-
		23	**30**

Total 95 Credits for PG Courses

- All the elective subjects are selected from the list which is not already chosen as elective
- Minimum of TWO Lab experiments or exercises should be done per Unit/Serial Number at PG level

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)can be carried out accordingly, assigning the appropriate level in the grids:

	POs							PSOs		
	1	2	3	4	5	6	…	1	2	…
CLO1										
CLO2										
CLO3										
CLO4										
CLO5										

2 b. Structure of Course

Course Code	**Course Name**		**Credits**
Lecture Hours: (L) per week	**Tutorial Hours : (T) per week**	**Lab Practice Hours: (P)per week**	**Total: (L+T+P) per week**
Course Category :	**Year & Semester:**	**Admission Year:**	
Pre-requisite			
Links to other Courses			
Learning Objectives: (for teachers: what they have to do in the class/lab/field)			
Course Outcomes: (for students: To know what they are going to learn) **CO1:** **CO2:** **CO3:** **CO4:** **CO5:**			
Recap: (not for examination) Motivation/previous lecture/ relevant portions required for the course) [This is done during 2 Tutorial hours)			
Units	**Contents**		**Required Hours**
I			**18**
II			**18**
III			**18**
IV			**18**
V			**18**
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill		
Learning Resources: ● **Recommended Texts** ● **Reference Books** ● **Web resources**			
Board of Studies Date:			

3. Learning and Teaching Activities

3.1 Topic wise Delivery method

Hour Count	Topic	Unit	Mode of Delivery

3.2 Workload

The information below is provided as a guide to assist students in engaging appropriately with the course requirements.

Activity	Quantity	Workload periods
Lectures	60	60
Tutorials	15	15
Assignments	5	5
Cycle Test or similar	2	4
Model Test or similar	1	3
University Exam Preparation	1	3
	Total	90 periods

1. **Tutorial Activities**

Tutorial Count	Topic

2. **Laboratory Activities**
3. **Field Study Activities**
4. **Assessment Activities**

Assessment Principles:

Assessment for this course is based on the following principles:

1. Assessment must encourage and reinforce learning.
2. Assessment must measure achievement of the stated learning objectives.
3. Assessment must enable robust and fair judgments about student performance.
4. Assessment practice must be fair and equitable to students and give them the opportunity to demonstrate what they learned.
5. Assessment must maintain academic standards.

Assessment Details:

Assessment Item	Distributed Due Date	Weightage	Cumulative Weightage
Assignment 1	3rd week	2%	2%
Assignment 2	6th Week	2%	4%
Cycle Test – I	7th Week	6%	10%
Assignment 3	8th Week	2%	12%
Assignment 4	11th Week	2%	14%
Cycle Test – II	12th Week	6%	20%
Assignment 5	14th Week	2%	22%
Model Exam	15th Week	13%	35%
Attendance	All weeks as per the Academic Calendar	5%	40%
University Exam	17th Week	60%	100%

TEACHING METHODOLOGIES

Traditional Teaching methods like Chalk and Board, Virtual Class room, LCD projector, Smart Class, Video Conference, Guest Lectures.

Asking students to formulate a problem from a topic covered in a week's time

Assignment, Class Test, Slip test

Asking students to use state-of-the-art technologies/software to solve problems

Applications, Use of Mathematical software

Introducing students to applications before teaching the theory

Training students to engage in self-study without relying on faculty (for example – library and internet search, manual and handbook usage, etc.)

Library, Net Surfing, Manuals, NPTEL Course Materials published in the website

Other university websites.

Faculty Course File Structure

CONTENTS

a. Academic Schedule
b. Students Name List
c. Time Table
d. Syllabus
e. Lesson Plan
f. Staff Workload
g. Course Design(content, Course Outcomes(COs), Delivery method, mapping of COs with Programme Outcomes(POs), Assessment Pattern in terms of Revised Bloom's Taxonomy)
h. Sample CO Assessment Tools.
i. Faculty Course Assessment Report(FCAR)
j. Course Evaluation Sheet
k. Teaching Materials(PPT, OHP etc)
l. Lecture Notes
m. Home Assignment Questions
n. Tutorial Sheets
o. Remedial Class Record, if any.
p. Projects related to the Course
q. Laboratory Experiments related to the Courses
r. Internal Question Paper
s. External Question Paper
t. Sample Home Assignment Answer Sheets
u. Three best, three middle level and three average Answer sheets
v. Result Analysis (CO wise and whole class)
w. Question Bank for Higher studies Preparation (GATE/Placement)
x. List of mentees and their academic achievements

Credit Distribution for PG Programme in Information Technology

M.Sc., Information Technology

Illustration – I

	First Year Semester-I	**Credit**	**Hours per week(L/T/P)**
Part A	CC1 - Python Programming	5	7
	CC2 - Python Programming - Practical	5	7
	CC3 - Web Development using Word Press– Practical	4	6
	Elective I(Generic / Discipline Specific)(One from Group A)	3	5(4 L+ 1T)
	Elective II(Generic / Discipline Specific)(One from Group B)	3	5(4L + 1T)
	Total	**20**	**30**

	Semester-II	**Credit**	**Hours per week(L/T/P)**
Part A	CC4 – Database Systems	5	7
	CC5 – RDBMS - Practical	5	6
	CC6 –Mobile Development - Practical	4	6
	Elective III (Generic / Discipline Specific)(One from Group C)	3	4
	Elective-IV(Computer / IT related) (One from Group D)	3	4
Part B	Skill Enhancement Course -SEC Mobile Development	2	3
	Human Rights	2	2
	MOOC Course	2	-
	Total	**26**	**30**

	Second Year - Semester-III	**Credit**	**Hours per week(L/T/P)**
Part A	CC7 - Advanced Java	5	6
	CC8 - Advanced Java – Practical	5	6
	CC9 – Open Source Technologies	5	6
	CC10- Open Source Technologies - Practical	4	6
	Elective V(Generic / Discipline Specific)(One from Group E)	3	3
Part B	Skill Enhancement Course -SEC Industry Module – Mini project done with in the campus	2	3
	Internship / Industrial Activity (Carried out in Summer Vacation at the end of I year – 30 hours)	2	-
	Total	**26**	**30**

	Semester-IV	**Credit**	**Hours per week (L/T/P)**
Part A	CC11–.NET with C# Programming	5	6
	CC12 - .NET with C# Programming –Practical	5	6
	Core Project with viva voce - Industry related project and carried out in the industry	7	10
	Elective VI (Generic / Discipline Specific)(One from Group F)	3	4
Part B	Professional Competency Skill Enhancement Course Term paper & Seminar presentation – Staff supervisor should Select and assign different Advanced Technology topics to the students. The students must give presentation of the allotted topic in the respective class hours. The document of the presentation of respective topic allotted to them must be prepared and submitted with soft binding (around 50 to 100 Pages). – Evaluation is done by the External examiners similar to Project Viva voce.	2	4
Part C	Extension Activity	1	-
	Total	**23**	**30**

TOTAL CREDITS: 95

- **All the elective subjects are selected from the list which is not already chosen as elective**

- **Minimum of TWO Lab experiments or exercises should be done per Unit/Serial Number at PG level**

Elective Courses

Courses are grouped (Group A to Group F) so as to include topics focussed on IT Oriented (ITC) courses for flexibility of choice by the stakeholders / institutions.

Semester I : Elective I and Elective II

Elective I to be chosen from **Group A** and **Elective II** to be chosen from **Group B**

Group A:

1. Data Structures
2. Compiler Design
3. Natural Language Processing

Group B:

1. Operating Systems
2. Digital Computer Architecture
3. Human Computer Interaction

Semester II : Elective III & Elective IV

Elective III to be chosen from **Group C** and **Elective IV** to be chosen from **Group D**

Group C:

1. Networks and Security
2. Cloud Computing
3. Biometric Techniques

Group D :

1. Software Engineering
2. Object oriented analysis and design
3. Software Project Management

Semester III : Elective V

Elective V to be chosen from Group E

Group E:

1. Research Methodology
2. Internet of Things
3. Trends in Computing

Semester IV : Elective VI

Elective VI to be chosen from Group F

Group F:

1. IntelligentSystems
2. Introduction to Robotics
3. Virtual and Augmented Reality

Instructions for Course Transaction

Courses	Lecture hrs	Tutorial hrs	Lab Practice	Total Hrs
Core	75	15	--	90
Electives	75	15	--	90
ED	75	15	--	90
Lab Practice Courses	45	15	30	90
Project	20	--	70	90

Testing Pattern (25+75)

Internal Assessment

Theory Course: For theory courses there shall be three tests conducted by the faculty concerned and the average of the best two can be taken as the Continuous Internal Assessment (CIA) for a maximum of 25 marks. The duration of each test shall be one / one and a half hour.

Computer Laboratory Courses: For Computer Laboratory oriented Courses, there shall be two tests in Theory part and two tests in Laboratory part. Choose one best from Theory part and other best from the two Laboratory part. The average of the best two can be treated as the CIA for a maximum of 25 marks. The duration of each test shall be one / one and a half hour.

There is no improvement for CIA of both theory and laboratory, and, also for University End Semester Examination.

Written Examination : Theory Paper (Bloom's Taxonomy based)

Question paper Model

Intended Learning Skills	**Maximum 75 Marks** **Passing Minimum: 50%** **Duration : Three Hours**
	Part –A(10x 2 = 20 Marks) Answer ALL Questions **Each Question carries 2 marks**
Memory Recall / Example/ Counter Example / Knowledge about the Concepts/ Understanding	Two questions from each UNIT
	Question 1 to Question 10
	Part – B (5 x 5 = 25 Marks) **Answer ALL Questions** **Each questions carries 5 Marks**
Descriptions/ Application (problems)	**Either-or Type** Both parts of each question from the same UNIT
	Question 11(a) or 11(b) To **Question 15(a) or 15(b)**
	Part-C (3x 10 = 30 Marks) **Answer any THREE questions** **Each question carries 10 Marks**
Analysis /Synthesis / Evaluation	There shall be FIVE questions covering all the five units
	Question 16 to Question 20

Each question should carry the course outcome and cognitive level

For instance,

1. [CO1 : K2] Question xxxx
2. [CO3 : K1] Question xxxx

Different Types of Courses

(i) Core Courses (Illustrative)

(ii) Elective Courses (ED within the Department Experts) (Illustrative)

(iii)Elective Courses (ED from other Department Experts)

(iv) Skill Development Courses

(v) Institution-Industry-Interaction (Industry aligned Courses)

Programmes /course work/ field study/ Modelling the Industry Problem/ Statistical Analysis / Commerce-Industry related problems / MoU with Industry and the like activities.

Syllabus for M.Sc. Information Technology

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">PYTHON PROGRAMMING</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE I</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>Course Code</td><td></td></tr>
<tr><td></td><td></td><td>Semester</td><td>I</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td>-</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic understanding on object oriented programming concepts</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To acquire programming skills in core Python and to develop database applications in Python</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT-I : Core Python: Introduction - Python Basics: Comments - Statements and syntax - variable Assignment - Identifiers - Python objects : Built-in-types - Internal types - Standard Type operators - Standard type Built-in-functions. Numbers : Introduction to Numbers - Integers - Floating point numbers - Complex numbers - Operators - Built-in and factory functions – Conditionals and Loops -Sequences : Strings, Lists and Tuples</td></tr>
</table>

	UNIT-II : Mapping and set types.- **Functions and functional programming**: Introduction - Calling functions - Creating functions - passing functions - Formal arguments - Variable - Length Arguments - Functional Programming - Variable Scope – Recursion
	UNIT-III : Modules: Modules and Files – namespaces - Importing Modules - Features - Built-in functions. **Object Oriented Programming**: Introduction - Object Oriented Programming – Encapsulation Inheritance – Polymorphism - **Errors and Exceptions**: Introduction – Exceptions in Python.
	UNIT-IV : GUI Programming: Introduction – **Using Widgets**: Core widgets- Generic widget properties – Labels – Buttons – Radio Buttons – Check Buttons – Text – Entry – List Boxes – Menus – Frame – Scroll Bars – Scale
	UNIT-V: Database Programming: Connecting to a database using MongoDB - Creating Tables - INSERT-UPDATE - DELETE - READ operations.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Wesley J. Chun, (2007), "Core Python Programming", Pearson Education, Second Edition – (Unit I,II,III). 2. Charles Dierbach, (2015), "Introduction to Computer Science Using Python A Computational Problem-Solving Focus", Wiley India Edition- (Unit III- Object Oriented Programming) 3. Martin C Brown, (2018), "The Complete Reference Python", McGraw Hill Education (India) Private Limited – (Unit IV)

Reference Books	1. Mark Lutz, (2013), "Learning Python Powerful Object Oriented Programming", O"reilly Media, 5 th Edition. 2. Timothy A. Budd, (2011), "Exploring Python", Tata MCGraw Hill Education Private Limited, First Edition. 3. Allen Downey, Jeffrey Elkner, Chris Meyers, (2012), "How to think like a computer scientist: learning with Python"
Website and e-Learning Source	1. http://interactivepython.org/courselib/static/pythonds 2. http://www.ibiblio.org/g2swap/byteofpython/read/ 3. http://www.diveintopython3.net/ 4. http://docs.python.org/3/tutorial/index.html

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Explain the basic concepts in python language.
CLO2	Apply the various data types and identify the usage of control statements, loops, functions and modules in python for processing the data
CLO3	Analyze and solve problems using basic constructs and techniques of python.
CLO4	Assess the approaches used in the development of interactive application.
CLO5	To build real time programs using python

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**3**	**3**	**3**	**2**	**2**
CLO2	**3**	**3**	**3**	**3**	**3**	**2**
CLO3	**3**	**2**	**3**	**3**	**3**	**3**
CLO4	**3**	**3**	**3**	**3**	**3**	**3**
CLO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**13**	**15**	**15**	**13**	**15**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">PYTHON PROGRAMMING - PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">CORE II</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>Course Code</td><td></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">-</td><td colspan="2">2</td><td>4</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">Basic understanding of C, C++ and Java programming languages</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">This course gives practical experience in Python basics, Object Oriented programming like Classes, Inheritance, and Polymorphism, GUI Applications and Database connection.</td></tr>
</table>

Course Outline **For each serial number at least 2 Lab exercises should be done at PG level**	1. Python Basic programs 2. Control Structures 3. Lists 4. Functions and Recursions 5. Modules 6. String Processing 7. Dictionaries and Sets 8. Classes and Objects 9. Polymorphism 10. Inheritance 11. GUI Application 12. Working with Database
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Wesley J. Chun, (2007), "Core Python Programming", Pearson Education, Second Edition –
Reference Books	1. Mark Lutz, (2013), "Learning Python Powerful Object Oriented Programming", O"reilly Media, 5 th Edition. 2. Timothy A. Budd, (2011), "Exploring Python", Tata MCGraw Hill Education Private Limited, First Edition. 3. Allen Downey, Jeffrey Elkner, Chris Meyers, (2012), "How to think like a computer scientist: learning with Python"
Website and e-Learning Source	1. http://interactivepython.org/courselib/static/pythonds 2. http://www.ibiblio.org/g2swap/byteofpython/read/ 3. http://www.diveintopython3.net/ http://docs.python.org/3/tutorial/index.html

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understand the significance of control statements, loops and functions in creating simple programs.

CLO2	Apply the core data structures available in python to store, process and sort the data
CLO3	Analyze the real time problem using suitable python concepts
CLO4	Assess the complex problems using appropriate concepts in python
CLO5	Develop the real time applications using python programming language.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	3	2	2
CLO2	3	3	3	3	3	2
CLO3	3	2	3	3	3	3
CLO4	3	3	3	3	3	3
CLO5	3	3	3	3	3	3
Weightage of course contribute to eachPSO	15	13	15	15	13	15

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">WEB DEVELOPMENT USING WORD PRESS - PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td colspan="2">2</td><td>4</td><td colspan="2">6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic understanding on HTML and CSS</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The primary course objective of this paper is to learn the fundamentals of basic web concepts, HTML, DHTML, JavaScript and Word Press</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6">UNIT-I :
Introduction to HTML - Lists - Adding Graphics to HTML Documents - Tables -Linking Documents - Frames- Developing HTML Forms</td></tr>
</table>

For each UNIT at least 2 Lab exercises should be carried out using the specified components in the syllabus	**UNIT-II :** **Dynamic HTML** - Cascading Style Sheets - Use of SPAN Tag - External Style Sheets -Use of DIV Tag - Developing Websites
	UNIT-III : **Introduction to JavaScript** - JavaScript in Web Pages - Advantages - Writing JavaScript into HTML - Basic Programming Techniques - Operators and Expressions- JavaScript Programming Construct: Conditional Checking, Controlled Loops, Functions: Built-in Functions, User-Defined Functions - Placing Text in a Browser - Dialog Boxes.
	UNIT-IV : **JavaScript Document Object Model:** Introduction - Understanding Objects in HTML - Handling Events using JavaScript. Forms used by a Website: Form Object - Built-in Objects.
	UNIT-V: **Word Press:** Installation - Stetting and administration- Word press: Theming basics - Our First Word Press Website - Theme Foundation - Menu and navigation - Home page - Dynamic Sidebars and Widgets - Page - archive Page results - Testing and Launching
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text	1. Ivan N. Bayross, (2005), Web Enabled Commercial Applications Development Using HTML, DHTML, JavaScript, perlCGI, 3rd Edition, BPB Publications. (Unit I, II, III and IV) 2. Jesse Friedman,(2012), Web Designer's Guide to WordPress: Plan, Theme, Build, Launch (Voices That Matter), 1st Edition , New Riders. (Unit V)
Reference Books	1. N.P. Gopalan, J. Akilandeswari, (2009), Web Technology: A Developer‟s Perspective, Eastern Economy Edition, PHI Learning Private Limited. 2. Deitel&Deitel, (2000), Internet and World Wide Web How to program, Prentice Hall. 3. Jon Duckett, (2004), Beginning Web Programming with HTML, XHTML, and CSS, Wiley Publishing, Inc.
Website and **e-Learning Source**	1. http://www.sergey.com/web_course/content.html 2. http://www.pageresource.com/jscript/index.html 3. http://www.peachpit.com/guides/content.aspx 4. https://www.tutorialspoint.com/wordpress/index.htm

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Identify the tools which will be suitable for the requirement of the webpage.
CLO2	Implement Java script and Style Sheets effectively in the Web Pages
CLO3	Analyze the different tools and built-in functions available to be applied in the webpage
CLO4	Rate the design and effectiveness of the Web Pages created.
CLO5	Design and publish a website using Word press

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	3	3	2	2	3
CLO2	3	3	3	2	2	3
CLO3	3	3	3	2	2	3
CLO4	3	3	3	2	2	3
CLO5	3	3	3	3	3	3
Weightage of course contribute to eachPSO	15	15	15	11	11	15

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">DATABASE SYSTEMS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">1</td><td>-</td><td colspan="2">5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Fundamental computer knowledge that includes the hardware and memory storage.</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To understand the basic DBMS models, architecture, query and to normalize the database. To Learn Transaction Processing, Recovery and Distributed Database.</td></tr>
</table>

Course Outline	**UNIT-I : Introduction**: Database System Applications-Purpose of Database Systems-View of Data- Database Users and Administrators. **Relational Database**: Structure of Relational Databases- Databases Schema- Keys-Schema Diagrams-**Formal Relational Query Languages**: Relational Algebra-Tuple Relational Calculus
	UNIT-II :Database Design: Overview of Design Process-The Entity Relationship Model-Constraints- Removing Redundant Attributes in Entity Sets-Entity-Relationship Diagrams-Reduction to Relational Schemas-Extended E-R features -Alternative Notations for Modeling Data**. Relational Database Design:** Features of Good Relational Design-Functional Dependency-**Normalization**: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF- Functional Dependency Theory
	UNIT-III : Transaction Management: Transaction Concept-Simple Transaction Model-Storage Structure- Transaction Atomicity and Durability-Transaction Isolation-Serializability. **Concurrency Control:** Lock Based Protocols-Locks-Granting of Locks-Two Phase Locking Protocol-Time Stamp Based Protocol - **Recovery System:** Failure Classification-**Recovery and Atomicity**: Log Records-Database Modification-Concurrency Control and Recovery-Recovery Algorithm
	UNIT-IV : Distributed Database: Homogeneous and Heterogeneous Databases-Distributed Data storage- Distributed Transactions-Commit Protocols-Concurrency Control in Distributed Databases- Distributed Query Processing. Case study: MongoDB
	UNIT-V:SQL - Table Fundamentals - Viewing Data - Inserting - Deleting - Updating - Modifying - Constraints - Functions - Grouping - Subqueries - Joins - Views.**PL/SQL**: Introduction - PL/SQL Block - Data Types And Variables - Control Structure - Cursors - PL/SQL Security - Locks. PL/SQL Database Objects: Exception Handling- Packages - Procedures and Functions - Database Triggers

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Abraham Silberchatz, Henry F.Korth, S.Sudarshan, Database Systems Concepts, Sixth Edition, Tata Mcgraw Hill. 2. Ivan Bayross, SQL, PL/SQL The Programming Language of ORACLE, Fourth edition, BPB Publications. Unit IV & V
Reference Books	1. AtulKahate, Introduction to Database Management systems, Pearson education. 2. Carlo Zaniolo, Stefano Ceri, Christos Faloustsos, R.T.Snodgrass, V.S.Subrahmanian, (1997), Advanced Database Systems, Morgan Kaufman. 3. George Koch, Kelvin Loney, (2002), Oracle 9i : The Complete Reference, Oracle Press, Tata McGrawHill Publication. 4. RamezElmasri, Shamkant B. Navathe (2014), "Database Systems", Sixth edition, Pearson Education, New Delhi
Website and e-Learning Source	1. http://awtrey.com/tutorials/dbeweb/database.php 2. http://www.slideshare.net/SalamaAlbusaidi/emerging-database-technology-multimedia- database. 3. http://www.tutorialspoint.com/dbms/index.htm 4. http://www.tutorialspoint.com/plsql/index.htm 5. https://opentextbc.ca/dbdesign/chapter/chapter-11-functional-dependencies/(Functional Dependencies)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Explain the relational databases and uses of PL/SQL
CLO2	Apply Schema, ER- Model, normalization, transaction, concurrency, and

	recovery on tables using SQL and PL/SQL.
CLO3	Analyze and manage relational & distributed, database, transaction, concurrency control and query languages
CLO4	Assess databases based on models and Normal Forms.
CLO5	Design and construct tables and manipulate it effectively using PL/SQL database objects

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CLO1	**3**	**3**	**3**	**3**	**3**	**3**
CLO2	**3**	**3**	**3**	**3**	**3**	**2**
CLO3	**3**	**2**	**3**	**3**	**3**	**2**
CLO4	**3**	**3**	**3**	**3**	**3**	**2**
CLO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**13**	**15**	**15**	**15**	**12**

Title of the Course		**RDBMS PRACTICAL**					
Paper Number		**CORE V**					
Category	Core	**Year**	I	**Credits**	4	**Course Code**	
		Semester	II				
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		-	2		4	6	
Pre-requisite		Basic understanding of SQL queries					

Objectives of the Course	The primary Course Objective of this paper is to learn and implement SQL & PL/SQL.
Course Outline **For each serial number at least 2 Lab exercises should be done at PG level**	1. DDL Commands 2. DML Commands 3. DCL Commands 4. Usage of Sub Queries in DML and Create-SQL 5. Solving queries using built-in functions 6. Simple programs in PL/SQL block 7. Exception Handling in PL/SQL 8. Programs using Implicit Cursors 9. Programs using Explicit Cursors 10. Procedures & User-defined functions 11. Creation of Triggers
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Ivan Bayross, SQL, PL/SQL The Programming Language of ORACLE, Fourth edition, BPB Publications
Reference Books	RamezElmasri, Shamkant B. Navathe (2014), "Database Systems", Sixth edition, Pearson Education, New Delhi
Website and e-Learning Source	1. http://awtrey.com/tutorials/dbeweb/database.php 2. http://www.slideshare.net/SalamaAlbusaidi/emerging-database-technology-multimedia- database. 3. http://www.tutorialspoint.com/dbms/index.htm 4. http://www.tutorialspoint.com/plsql/index.htm

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Choose appropriate SQL queries and PL/SQL blocks for the database.
CLO2	Implement SQL and PL/SQL blocks for the given problem effectively.
CLO3	Analyse the problem and Exceptions using queries and PL/SQL blocks.
CLO4	Validate the database for normalization using SQL and Pl/SQL blocks.
CLO5	Design Database tables, create Procedures, user-defined functions and Triggers.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**3**	**2**	**3**	**3**	**3**
CLO2	**3**	**3**	**3**	**3**	**3**	**3**
CLO3	**3**	**3**	**2**	**3**	**3**	**3**
CLO4	**3**	**3**	**2**	**3**	**3**	**2**
CLO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contribute to each PSO	**15**	**15**	**12**	**15**	**15**	**14**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">MOBILE DEVELOPMENT - PRACTICAL</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE VI</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>II</td><td>Credits</td><td>4</td><td>Course Code</td><td colspan="2"></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>II</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">-</td><td colspan="2">2</td><td>4</td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">Basic understanding on Java Programming</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">To provide the students with the basics of Android Software Development tools, development of software on mobile platforms and deploying software to mobile devices.</td></tr>
<tr><td colspan="2" rowspan="4">Course Outline

For each UNIT at least 2 Lab exercises should be carried out using the specified components in</td><td colspan="8">UNIT-I :

Getting Started with Android Programming – Using Eclipse for Android Development – Using Android Emulator - Getting to know the Android User Interface: Understanding the Components of a Screen</td></tr>
<tr><td colspan="8">UNIT-II :
Designing your User Interface with views: Basic Views – Picker Views – List Views - Displaying Pictures</td></tr>
<tr><td colspan="8">UNIT-III :
Activities, Fragments and Intents : Understanding Activities – Applying Styles and Themes to an Activity – Displaying a Dialog Window – Displaying a Progress Dialog – Linking Activities Using Intents – Fragments.</td></tr>
<tr><td colspan="8">UNIT-IV :
Menus with Views: Option Menu – Context Menu. Utilizing the Action Bar: Adding Action Items to the Action Bar – Customizing the Action Items and Application Icon -Working with Audio and Video.</td></tr>
</table>

the syllabus	**UNIT-V:** **Messaging:** SMS Messaging – Sending E- Mail- Data Persistence: Creating and Using Databases – Developing Android Services – Publishing Android Applications
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition
Reference Books	1. OnurCinar, (2012), Android Apps with Eclipse, Apress, Springer(India) Private Limited. 2. RetoMeier, (2010), Professional Android 2 Application Development, Wiley India Edition
Website and e-Learning Source	1. http://devcloper.android.com/training/basics/firstapp/index.html 2. www.vogella.com/articles/Android/article.html 3. www.coreservlets.com/android-tutorial/ 4. www.edumobile.org/android/category/android-beginner-tutorial 5. http://www.androidhive.info/2011/11/android-sqlite-database-tutorial/ (Unit V: Ex. No.3 (SQLite Database)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Demonstrate the setup and configuration of Android Development Environment.
CLO2	Apply the necessary UI components with different styles, themes, views, and layouts
CLO3	Examine and implement the required services such as messaging, mailing, multimedia concepts for the given problem
CLO4	Test and debug the Android applications with different inputs.

CLO5	Create mobile applications that make use of various android features, functions and database tasks

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**3**	**2**	**3**	**3**	**3**
CLO2	**3**	**3**	**3**	**2**	**3**	**3**
CLO3	**3**	**3**	**2**	**2**	**3**	**3**
CLO4	**3**	**3**	**3**	**3**	**3**	**3**
CLO5	**3**	**3**	**2**	**2**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**15**	**12**	**12**	**15**	**15**

Title of the Course		**MOBILE DEVELOPMENT**					
Paper Number		**SKILL ENHANCMENT COURSE - SEC**					
Category	Core	**Year**	II	**Credits**	2	**Course Code**	
		Semester	II				
Instructional Hours per week		**Lecture**	**Tutorial**			**Total**	
		3				3	
Pre-requisite		Basic understanding on Java Programming					
Objectives of the Course		To provide the students with the basics of Android Software Development tools, development of software on mobile platforms and deploying software to mobile devices.					
Course Outline		**UNIT-I :** Getting Started with Android Programming – Using Eclipse for Android Development – Using Android Emulator - **Getting to know the Android User Interface:** Understanding the Components of a Screen					

	UNIT-II : **Designing your User Interface with views:** Basic Views – Picker Views – List Views - Displaying Pictures
	UNIT-III : **Activities, Fragments and Intents :** Understanding Activities – Applying Styles and Themes to an Activity – Displaying a Dialog Window – Displaying a Progress Dialog – Linking Activities Using Intents – Fragments.
	UNIT-IV : **Menus with Views:** Option Menu – Context Menu. **Utilizing the Action Bar:** Adding Action Items to the Action Bar – Customizing the Action Items and Application Icon -Working with Audio and Video.
	UNIT-V: **Messaging:** SMS Messaging – Sending E- Mail- Data Persistence: Creating and Using Databases – Developing Android Services – Publishing Android Applications
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition
Reference Books	3. OnurCinar, (2012), Android Apps with Eclipse, Apress, Springer(India) Private Limited. 4. RetoMeier, (2010), Professional Android 2 Application Development, Wiley India Edition
Website and e-Learning Source	6. http://devcloper.android.com/training/basics/firstapp/index.html 7. www.vogella.com/articles/Android/article.html 8. www.coreservlets.com/android-tutorial/ 9. www.edumobile.org/android/category/android-beginner-tutorial 10. http://www.androidhive.info/2011/11/android-sqlite-database-tutorial/ (Unit V: Ex. No.3 (SQLite Database)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Demonstrate the setup and configuration of Android Development Environment.
CLO2	Apply the necessary UI components with different styles, themes, views, and layouts
CLO3	Examine and implement the required services such as messaging, mailing, multimedia concepts for the given problem
CLO4	Test and debug the Android applications with different inputs.
CLO5	Create mobile applications that make use of various android features, functions and database tasks

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**3**	**2**	**3**	**3**	**3**
CLO2	**3**	**3**	**3**	**2**	**3**	**3**
CLO3	**3**	**3**	**2**	**2**	**3**	**3**
CLO4	**3**	**3**	**3**	**3**	**3**	**3**
CLO5	**3**	**3**	**2**	**2**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**15**	**12**	**12**	**15**	**15**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">ADVANCED JAVA</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE VII</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>II</td><td>Credits</td><td>4</td><td>Course Code</td><td></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>III</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">1</td><td>-</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic understanding on Java concepts</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To understand the basic concepts of core principles of the Java language and gain knowledge to develop dynamic Web applications using applet, servlet, jsp and JavaBean.</td></tr>
<tr><td colspan="2" rowspan="3">Course Outline</td><td colspan="6">UNIT-I :
The Genesis of Java: Java‟s Magic, The Java Buzzwords-An Overview of Java - Data types, Variables, Arrays-Operators-Control Statements- Introducing Classes – A Close Look at Methods and Classes-Inheritance</td></tr>
<tr><td colspan="6">UNIT-II :
String Handling Functions – Collections Framework: Collection Classes, StringTokenzier, Date, Calendar - Abstract Classes - Packages and Interfaces: Packages – Access Protection Importing Packages – Interfaces</td></tr>
<tr><td colspan="6">UNIT-III :
Exception Handling: Exception types – Creating your own exceptions - Multithreaded Programming: Creating a Thread, Creating Multiple Threads, Using isAlive() and join(), Thread Priorities, Synchronization, Inter-thread Communication, Suspending, Resuming and Stopping Threads - JDBC</td></tr>
</table>

	UNIT-IV : The Applet Class-Event Handling – Introducing the AWT: Working with windows, graphics and Text, Using AWT Controls, Layout Managers and Controls - Developing JavaServer Pages
	UNIT-V: **Developing Servlets** -Structuring Web application with the MVC pattern – Sessions and Cookies - Using JSP tags with JavaBeans
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Herbert Schildt, (2004), "Java 2: The Complete Reference", Fifth Edition,Tata McGraw Hill, New Delhi. 2. Joel Murach, (2008), "Andrea Steelman,,Murach‟s Java Servlets and JSP", Second Edition, Shroff Publishers
Reference Books	1. Matthew Mac Donald, (2002), "ASP.NET : The Complete Reference", MC Graw Hill. 2. VladaMatena, (2003), "Applying Enterprise JavaBeans", Second Edition, Addison Wesley. 3. Cay S Horstmann& Gary Cornell, Core Java Vol II Advanced Features, Eighth Edition, Addison Wesley. 4. Bruce W Perry (2004), Java Servlets & JSP Cook Book, Second edition, O‟reilly Media.

Website and e-Learning Source	1. http://netbeans.org/kb/docs/javaee/javaee-intro.html 2. http://www.jsptube.com/ 3. http://articles.sitepoint.com/article/java-servlets-1 4. http://www.java-tips.org/java-tutorials/tutorials/introduction-to-java-servlets-with- netbeans.html 5. http://download.oracle.com/javase/tutorial/javabeans/index.html 6. http://www.javapoint.com/steps-to-connect-to-the-datadase-in-java/ (Unit III: JDBC)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understand and explain programming language constructs, Java mechanisms, OOP and Internet programming concepts
CLO2	Apply logical constructs as well as include Object oriented features, Packages, Interfaces, Exceptions and Threads , JDBC, Internet programming technologies
CLO3	Compare and contrast classical and advanced Java in terms of features, architecture, platform and technologies
CLO4	Choose an approach to solve real world problem from the acquired knowledge of Java
CLO5	Create programs that make strong use of classes and objects and develop JDBC,GUI, Web and Enterprise based applications

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**3**	**2**	**2**	**2**	**2**
CLO2	**3**	**3**	**2**	**3**	**3**	**2**
CLO3	**3**	**2**	**3**	**2**	**3**	**3**
CLO4	**3**	**2**	**3**	**2**	**3**	**3**
CLO5	**3**	**3**	**3**	**3**	**3**	**3**

Weightage of course contribute to eachPSO	**15**	**13**	**13**	**12**	**14**	**13**

Title of the Course	**ADVANCED JAVA - PRACTICAL**						
Paper Number	**CORE VIII**						
Category	Core	**Year**	II	**Credits**	4	**Course Code**	
		Semester	III				
Instructional Hours per week	**Lecture**	**Tutorial**		**Lab Practice**		**Total**	
	-	2		4		6	
Pre-requisite	Basic understanding of core Java, JSP and HTML						
Objectives of the Course	This course gives practical training in basics and advanced Java programming like applet, Servlets, JSP and Java Beans						

Course Outline **For each Serial number at least 2 Lab exercises should be carried out at PG level**	1. Classes and objects 2. Implementing classes 3. Strings 4. Collection 5. Date and Calendar 6. Packages 7. Exception handling 8. Threads 9. JDBC 10. Applets 11. Event handling **Servlet** 1. Simple Web Applications 2. Using Sessions and Cookies 3. Forwarding requests and Redirecting responses 4. Web Applications using Database **Bean** 1. Developing Simple Beans 2. Use Beans with JSP tags
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Herbert Schildt, (2004), "Java 2: The Complete Reference", Fifth Edition,Tata McGraw Hill, New Delhi. 2. Joel Murach, (2008), "Andrea Steelman,,Murach‟s Java Servlets and JSP", Second Edition, Shroff Publishers
Reference Books	Bruce W Perry (2004), Java Servlets & JSP Cook Book, Second edition, O‟reilly Media.

Website and e-Learning Source	1. http://netbeans.org/kb/docs/javaee/javaee-intro.html 2. http://www.jsptube.com/ 3. http://articles.sitepoint.com/article/java-servlets-1 4. http://www.java-tips.org/java-tutorials/tutorials/introduction-to-java-servlets-with- netbeans.html 5. http://download.oracle.com/javase/tutorial/javabeans/index.html

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Demonstrate understanding and use of different Java mechanisms for efficient application development
CLO2	Use an appropriate development environment to write, compile and run Java Programs
CLO3	Analyze the problem and apply the appropriate problem solving method with the required building blocks and mechanisms of Core and Advanced Java
CLO4	Test the correctness and consistency of the Java program with different inputs
CLO5	Create simple applications that make use of core java concepts and develop JDBC, GUI, Web and Enterprise based applications

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**3**	**3**	**3**	**3**	**3**
CLO2	**3**	**3**	**3**	**3**	**2**	**2**
CLO3	**3**	**3**	**3**	**3**	**2**	**3**
CLO4	**3**	**3**	**3**	**2**	**3**	**3**
CLO5	**3**	**3**	**2**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**15**	**14**	**14**	**13**	**14**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">OPEN SOURCE TECHNOLOGIES</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE IX</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>Course Code</td><td></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>II</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">6</td><td colspan="2"></td><td></td><td>6</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic understanding of computer programming, Internet and HTML/XHTML</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To learn the efficiency of Open Source Technology and to train to have a good practical knowledge of how to write successful PHP and Ruby code and utilizing a database using PHP.</td></tr>
</table>

Course Outline	**UNIT-I :** **PHP:** Introduction – Creating a PHP page – Running PHP page –HTML and PHP – Printing Text – Comment Statements – Working with variables – Storing data in variables - Interpolating strings – Constants - Understanding Internal Datatypes – Operators – Flow Control – Strings: String Functions - Converting to and from strings - Formatting text strings - Working with numbers.
	UNIT-II : Date and Time - Create an Array - Use an Associative Array - Functions to Work with Arrays - Work with Arrays of Arrays - Create and Use Functions
	UNIT-III : Reading Data in web pages: Handling various controls - PHP Browser-Handling power: Data Validation - File Handling : Opening a file – Reading Text from a file – Closing a file- Working with Databases: Creating , Inserting , Accessing , Updating , Deleting and Sorting Database - Work with Cookies and Sessions
	UNIT-IV : **Ruby:** Getting Started with Ruby – Working with Numbers and Strings – Variables – Constants – Operators – Conditionals and Loops
	UNIT-V: Arrays - Hashes - Methods - Blocks : Classes and Objects : Creating a Class and an Object- Exception Handling – File Handling
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text	1. Steven Holzner, (2016), "PHP: The Complete Reference", McGraw Hill Education Private Limited, Indian Edition. (Unit I, II) 2. RachnaKapur, Mario Briggs, Tapas Saha, Ulisses Costa, Pedro Carvalho, Raul F. Chong, Peter Kohlmann (2010), "Getting Started with Open Source Development", DB2 on Campus Book Series. (Unit III) 3. http://indexof.es/Ruby/Beginning%20Ruby%20On%20Rails.pdf (Unit IV) 4. http://www.cs.uni.edu/~wallingf/teaching/agile-may2010/ruby/programming-ruby.pdf(Unit V)
Reference Books	1. W. Jason Gilmore (2010), "Beginning PHP &MySql", Apress. 2. Joel Murach, Ray Harris (2010), "PHP and MySQL",Shroff Publishers & Distributors 3. Larry Ullman (2008), "PHP 6 and MySQL 5", Pearson Education. 4. John Coggeshall (2006), "PHP 5", Pearson Education. 5. Michale C. Glass (2004), "Beginning PHP, Apache, MySQL Web Development", Wiley DreamTech Press.
Website and e-Learning Source	1. http://www.w3schools.com/php/ 2. http://howtostartprogramming.com/PHP/ 3. http://www.massey.ac.nz/~nhreyes/MASSEY/159339/Lectures/Lecture%2011%20-%20PHP%20-%20Part%205%20-%20CookiesSessions.pdf 4. http://www.tutorialspoint.com/mysql/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Demonstrate the setup and configuration of development environment to write PHP and Ruby Scripts
CLO2	Select the appropriate language fundamentals and techniques to write and compile PHP and Ruby programs
CLO3	Examine the bugs and analyze how to prevent and remove the bugs

CLO4	Test and debug the application with sample inputs to check the correctness and consistency of the scripts
CLO5	Create simple programs that make use of various PHP and Ruby features and functions and solve web application and database tasks using PHP

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**3**	**3**	**1**	**2**	**3**
CLO2	**3**	**3**	**3**	**2**	**2**	**2**
CLO3	**3**	**2**	**3**	**3**	**2**	**2**
CLO4	**3**	**2**	**3**	**2**	**3**	**3**
CLO5	**3**	**3**	**3**	**3**	**2**	**3**
Weightage of course contribute to eachPSO	**15**	**13**	**15**	**11**	**11**	**13**

Title of the Course		**OPEN SOURCE TECHNOLOGIES - PRACTICAL**					
Paper Number		**CORE X**					
Category	Core	**Year**	I	**Credits**	4	**Course Code**	
		Semester	II				
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
			2		4	6	
Pre-requisite		Basic understanding of computer programming, Internet and HTML/XHTML					
Objectives of the Course		To learn the efficiency of Open Source Technology and to train to have a good practical knowledge of how to write successful PHP and Ruby code and utilizing a database using PHP.					

<table>
<tr><td>Course Outline

For each UNIT at least 2 Lab exercises should be carried out using the specified components in the syllabus</td><td>UNIT-I :

PHP: Introduction – Creating a PHP page – Running PHP page –HTML and PHP – Printing Text – Comment Statements – Working with variables – Storing data in variables - Interpolating strings – Constants - Understanding Internal Datatypes – Operators – Flow Control – Strings: String Functions - Converting to and from strings - Formatting text strings - Working with numbers.</td></tr>
<tr><td></td><td>UNIT-II :
Date and Time - Create an Array - Use an Associative Array - Functions to Work with Arrays - Work with Arrays of Arrays - Create and Use Functions</td></tr>
<tr><td></td><td>UNIT-III :
Reading Data in web pages: Handling various controls - PHP Browser-Handling power: Data Validation - File Handling : Opening a file – Reading Text from a file – Closing a file- Working with Databases: Creating , Inserting , Accessing , Updating , Deleting and Sorting Database - Work with Cookies and Sessions</td></tr>
<tr><td></td><td>UNIT-IV :

Ruby: Getting Started with Ruby – Working with Numbers and Strings – Variables – Constants
– Operators – Conditionals and Loops</td></tr>
<tr><td></td><td>UNIT-V:

Arrays - Hashes - Methods - Blocks : Classes and Objects : Creating a Class and an Object- Exception Handling – File Handling</td></tr>
<tr><td>Recommended Text</td><td>5. Steven Holzner, (2016), “PHP: The Complete Reference”, McGraw Hill Education Private Limited, Indian Edition. (Unit I, II)
6. RachnaKapur, Mario Briggs, Tapas Saha, Ulisses Costa, Pedro Carvalho, Raul F. Chong, Peter Kohlmann (2010), “Getting Started with Open Source Development”, DB2 on Campus Book Series. (Unit III)
7. http://indexof.es/Ruby/Beginning%20Ruby%20On%20Rails.pdf (Unit IV)
8. http://www.cs.uni.edu/~wallingf/teaching/agile-may2010/ruby/programming-ruby.pdf(Unit V)</td></tr>
</table>

Reference Books	6. W. Jason Gilmore (2010), "Beginning PHP &MySql", Apress. 7. Joel Murach, Ray Harris (2010), "PHP and MySQL",Shroff Publishers & Distributors 8. Larry Ullman (2008), "PHP 6 and MySQL 5", Pearson Education. 9. John Coggeshall (2006), "PHP 5", Pearson Education. 10. Michale C. Glass (2004), "Beginning PHP, Apache, MySQL Web Development", Wiley DreamTech Press.
Website and e-Learning Source	5. http://www.w3schools.com/php/ 6. http://howtostartprogramming.com/PHP/ 7. http://www.massey.ac.nz/~nhreyes/MASSEY/159339/Lectures/Lecture%2011%20-%20PHP%20-%20Part%205%20-%20CookiesSessions.pdf 8. http://www.tutorialspoint.com/mysql/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Demonstrate the setup and configuration of development environment to write PHP and Ruby Scripts
CLO2	Select the appropriate language fundamentals and techniques to write and compile PHP and Ruby programs
CLO3	Examine the bugs and analyze how to prevent and remove the bugs
CLO4	Test and debug the application with sample inputs to check the correctness and consistency of the scripts
CLO5	Create simple programs that make use of various PHP and Ruby features and functions and solve web application and database tasks using PHP

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**3**	**3**	**1**	**2**	**3**
CLO2	**3**	**3**	**3**	**2**	**2**	**2**
CLO3	**3**	**2**	**3**	**3**	**2**	**2**

CLO4	**3**	**2**	**3**	**2**	**3**	**3**
CLO5	**3**	**3**	**3**	**3**	**2**	**3**
Weightage of course contribute to eachPSO	**15**	**13**	**15**	**11**	**11**	**13**

Title of the Course		**.NET WITH C# PROGRAMMING**					
Paper Number		**CORE XI**					
Category	Core	**Year**	II	**Credits**	4	**Course Code**	
		Semester	IV				
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	1		-	5	
Pre-requisite		Basic understanding on object oriented programming with IDEs					

Objectives of the Course	To understand the basics structure of C# programming and the components of Active Server Pages which provide sufficient knowledge to work with SQL Server using Microsoft ADO.NET
Course Outline	**UNIT-I :** **The C# Language :** Basics- Variables and Data Types - Variable Operations - Object Based Manipulation - Conditional logic - Loops - Methods - Types, Objects and Namespaces- Delegates.
	UNIT-II : **ASP.Net 4.5 Essentials:** Introduction to .NET : Benefits of .NET Framework - **Overview of .NET Framework 4.5 :** Common Language Runtime - Common Type System - Metadata and Assemblies- Introduction to visual studio 2012 IDE: Exploring Visual Studio 2012 IDE - **ASP.NET 4.5 Overview:** ASP.NET Life cycle: Life cycle of an ASP.Net web page- **Developing a Web Application:** File Types in ASP.NET 4.5- Exploring ASP.NET web pages - Understanding ASP.NET 4.5 Directives- **Application structure and State:** The Global.asax Application File- Using states: Application State- Session State-View State-Cookies- Postback and Cross-page posting.
	UNIT-III : **Web Forms:** Standard controls: Label control-Button Control-TextBox Control-Literal Control- PlaceHolder Control-HiddenField Control -Navigation controls: TreeView, Menu and SiteMapPath - Validation controls -**Rich controls**: Calendar Controls- AdRotator control.
	UNIT-IV : **LINQ Queries :** Standard Query operators: Filtering operators-Projection operators-Sorting operators-Grouping operators-set operators-Aggregate operators -Lambda Expressions - **Working with Login controls:** Login control- Password Recovery control - Create User Wizard control-Change Password control

	UNIT-V: **ADO.NET Fundamentals:** Configuring your Database - ADO.NET Basics- Direct Data Access - Disconnected Data Access -**Data Binding :** Data Binding with ADO.NET- Data Source Controls - **The Data Controls :** The GridView - Formatting the GridView - Selecting a GridView Row- Editing, Sorting and Paging the GridView- Crystal Report
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Kogent (2013), ASP.NET 4.5 Black Book – DreamtechPress,New Delhi (Unit 2,3,4) 2. Matthew MacDonald (2010), Beginning ASP.NET 4 in C#, Apress.(Unit 1,5)
Reference Books	1.Greg Buczek(2002), ASP.NET Developer‟s guide, Tata McGraw Hill Publications. 2.Jesse Liberty, (2002), Programming C#, 3.0, O‟Reilly Press. 3.J.Sharp, (2009), Microsoft Visual C# 2008 Step by Step, PHI Learning Private Ltd. 4.Christian Nagel et al., (2007), Professional C# 2005 with .NET 3.0, Wiley India. 5.Herbert Schildt,(2010), C# 4.0 The Complete Reference, Tata McGraw Hill Publications
Website and e-Learning Source	1. www.homeandlearn.co.uk/csharp/csharp.html 2. http://msdn.microsoft.com/en-us/library//aa645596.aspx 3. http://www.csharpkey.com/csharp/ 4. http://www.w3schools.com/aspnet/default.asp 5. http://www.maconstateit.net/tutorials/ASPNET20/default.htm 6. http://csharp-station.com/Tutorial/AdoDotNet/Lesson01 (Unit V : ADO.NET Fundamentals) **7.** http://www.c-sharpcorner.com/UploadFile/009464/use-crystal-report-in-Asp-Net-using-C-Sharp/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the features of C# and ASP.NET concepts to understand the real time applications
CLO2	Identify the salient properties of C# programming concepts and ASP .NET Application
CLO3	List the various stages involved in creating a web form
CLO4	Select the appropriate web controls to develop the web forms
CLO5	Construct a database driven web applications with the facilitated web services.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**3**	**3**	**3**	**3**	**3**
CLO2	**3**	**3**	**3**	**3**	**3**	**2**
CLO3	**3**	**3**	**2**	**3**	**3**	**2**
CLO4	**3**	**3**	**2**	**3**	**3**	**3**
CLO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**15**	**13**	**15**	**15**	**13**

Title of the Course		**NET WITH C# PROGRAMMING - PRACTICAL**					
Paper Number		**CORE XII**					
Category	Core	**Year**	**II**	**Credits**	**4**	**Course Code**	

		Semester	**IV**				
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		-	**2**		**4**	**6**	
Pre-requisite		Basic understanding on the concept like C, C++, C#, ASP					
Objectives of the Course		To provide sufficient knowledge in developing web applications and to manipulate data from SQL Server using Microsoft ADO.NET					
Course Outline **For each serial number at least 2 Lab exercises should be done at PG level**		1. C# Basics 2. Delegates 3. Lambda Expressions 4. LINQ 5. Usage of Web Sever Controls 6. Usage of AdRotator, Calendar Controls 7. Working with Validation controls 8. Menu Control 9. Cookies, View state, Session 10. Developing Database Applications using Data Grid 11. Creating Crystal Report					
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)		Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)					
Skills acquired from this course		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill					
Recommended Text		Kogent (2013), ASP.NET 4.5 Black Book –DreamtechPress,New Delhi					
Reference Books		Herbert Schildt,(2010), C# 4.0 The Complete Reference, Tata McGraw Hill Publications.					
Website and e-Learning Source		http://www.csharpkey.com/csharp/ http://www.w3schools.com/aspnet/default.asp					

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Demonstrate simple programs using C# programming concepts such as

	classes, objects, method overloading
CLO2	Solve complex programs using delegates, Lambda expression and LINQ
CLO3	Analyze the usage of web server controls, calendar controls, validation controls and menu controls in asp.net application
CLO4	Evaluate the role of Cookies, View state and Session state in creating an web Application
CLO5	Design a data driven web application by connecting to the data sources

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CLO1	**3**	**3**	**3**	**2**	**3**	**3**
CLO2	**3**	**3**	**3**	**3**	**2**	**3**
CLO3	**3**	**3**	**3**	**3**	**3**	**2**
CLO4	**3**	**3**	**3**	**3**	**3**	**2**
CLO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**15**	**15**	**14**	**14**	**13**

Title of the Course		**DATA SCIENCE**					
Paper Number		**CORE XIII**					
Category	Core	**Year**	II	**Credits**	4	**Course Code**	
		Semester					
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	1		-	5	
Pre-requisite		Basic understanding on Machine learning concepts					
Objectives of the Course		To Understand the basics of data science and perform data analysis, Data mining tasks & techniques					

Course Outline	**UNIT-I :** **Introduction:** Data Mining – Kinds of Data and Patterns to be Mined – Technologies used – Kinds of Applications are Targeted - Major Issues –Data objects and Attribute types – Basic statistical Descriptions of Data – Data Visualization - **Data Preprocessing:** Data Cleaning – Data Integration - Data Reduction - Data Transformation
	UNIT-II : **Classification:** Basic concepts - Decision Tree Induction: Working of Decision Tree - Building Decision Tree - Methods for Expressing Attribute Test Conditions - Measures for Selecting the Best Split - Algorithm for Decision Tree Induction – Classification: Alternative Techniques: Rule - Based Classifier– Nearest Neighbour Classifier - Bayesian Classifiers.
	UNIT-III : **Association Analysis**: Basic Concepts - Frequent Itemset Generation - Rule Generation - Compact Representation of Frequent Item sets –FP Growth Algorithm
	UNIT-IV : Cluster Analysis: Introduction-Desired Features of Cluster Analysis -Types of Data- Computing Distance - Types of Cluster Analysis Methods - Partitioning Methods - Hierarchical Methods – Density - Based Methods - Cluster Analysis Software
	UNIT-V: Web Data Mining: Introduction - Web terminology and characteristics - Locality and Hierarchy in the web- Web Content Mining - Web Usage Mining - Web Structure Mining – Web Mining- software
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text	1. Vipin Kumar - Michael Steinbach - Pang - Ning Tan - (2006) - Introduction to Data Mining - Pearson Education. (Unit II: Chapters 4 & 5; Unit III: Chapter 6) 2. Jiawei Han and Micheline Kamber - (2012) - Data Mining Concepts and Techniques - Third Edition - Morgan Kaufmann. (Unit I : Chapters 1, 2 &3;) 3. G.K. Gupta, "Introduction to Data mining with case studies", 2nd Edition, PHI Private limited, New Delhi, 2011. (Unit IV: Chapter 4, Unit V: Chapters 5)
Reference Books	1. Bhavani M. Thuraisingham - Data Mining: Technologies - techniques - tools and trends - CRC Press 2. Yanchang Zhao (2012 - 2013) - R and Data Mining: Examples and Case Studies - Elsevier. 3. Robert I. Kabacoff (2011) - R in Action Data analysis and graphics with R - Manning Publications. 4. Samir Madhavan, "Mastering Python for Data Science", Packet Publishing, 2015.
Website and e-Learning Source	1. http://www.thearling.com/text/dmwhite/dmwhite.htm 2. http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=AD0770256 3. https://www.datamentor.io/r - programming#tutorial 4. http://www.csis.pace.edu/~ctappert/cs816-15fall/books/2015DataScience&BigDataAnalytics.pdf 5. http://www.rdatamining.com/ 6. https://www.analyticsvidhya.com/blog/2016/02/complete - tutorial - learn - data - science - scratch/ 7. https://www.tutorialspoint.com/data_mining/dm_classification_prediction.htm (Classification)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the basics in data science
CLO2	Identify suitable technique for the given problem
CLO3	Analyse and formulating data for the problem under consideration

CLO4	Interpret and demonstrate the knowledge of data analysis techniques in decision making
CLO5	Develop the model using data mining and computing techniques

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CLO1	**3**	**3**	**2**	**2**	**3**	**3**
CLO2	**3**	**2**	**3**	**2**	**3**	**3**
CLO3	**3**	**2**	**3**	**2**	**2**	**1**
CLO4	**3**	**3**	**3**	**3**	**3**	**3**
CLO5	**3**	**2**	**3**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**12**	**14**	**12**	**14**	**13**

Title of the Course		**PROJECT WITH VIVA VOCE**					
Paper Number		**CORE XIV**					
Category	Core	**Year**	II	**Credits**	7	**Course Code**	
		Semester	IV				
Instructional Hours per week		**Lecture**	**Tutorial**		**Industry Practice hours**	**Total**	
					10		
Pre-requisite		Current tools and Programming knowledge					

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">DATA STRUCTURES</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE I (EC1)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">1</td><td>-</td><td colspan="2">5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic understanding of programming and foundational concepts in computer science</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To become familiar with the various data structures and their applications and to increase the understanding of basic concepts of the design and use of algorithms</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6"></td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-I :

Introduction and Overview: Definitions – Concept of Data Structures – Overview of Data Structures – Implementation of Data Structures – Arrays: Definition – One Dimensional Array – Multidimensional Arrays: Two Dimensional Array – Sparse Matrices – Three dimensional and n-dimensional Arrays – Stacks : Introduction – Definition – Representation of Stack – Operations on Stack – Applications of Stacks: Evaluation of Arithmetic Expressions – Implementation of Recursion - Tower of Hanoi Problem</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-II :

Queues: Introduction – Definition – Representation of Queues – Various Queue Structures : Circular Queue – Deque – Priority Queue – Applications of Queues : Simulation – CPU Scheduling in a Multiprogramming Environment – Round Robin Algorithm – Linked Lists: Single Linked List – Circular Linked List – Double Linked List – Circular Double Linked List – Applications of Linked List: Polynomial Representation</td></tr>
</table>

	UNIT-III : **Trees:** Basic Terminologies – Representation of Binary Tree: Linear Representation – Linked Representation – **Operations:** Traversals – **Types of Binary Trees**: Expression Tree – Binary Search Tree – Splay tree
	UNIT-IV : **Sorting:** Bubble Sort, Insertion Sort, Selection Sort, Shell Sort – Quick Sort - Merge Sort - Radix Sort - Heap Sort – **Searching:** Linear Search - Binary Search
	UNIT-V: **Graphs:** Introduction – Graph representation and its operations – Path Matrix – Graph Traversal - Application of DFS – Shortest Path Algorithm - **Minimum Spanning Tree :** Prim‟s Algorithm – Kruskal‟s Algorthim - Greedy – Knapsack – Back Tracking – 8 Queens
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Debasis Samantha (2013), Classic Data Structures, Second Edition, PHI Learning Private Limited. 2. P. Sudharsan, J. John Manoj Kumar, C & Data Structures, Third Edition, RBA Publications. Unit 4: Chapter 14, Unit 5: Chapter 13 3. Ellis Horowitz, SartajSahni, Sanguthevar Rajeshakaran, (2007), Fundamentals of Computer Algorithms, Second Edition, Universities Press (P) Limited
Reference Books	1. Sara Baase, (1991), Computer Algorithms – Introduction to Design and Analysis, Addison- Wesley Publishing Company 2. Robert Kruse, C.L.Tondo, Bruce Leung, Data Structures and Program Design in C ,2nd Edition, PHI Publications.

Website and e-Learning Source	1. http://www.cs.sunysb.edu/~skiena/214/lectures/ 2. http://datastructures.itgo.com/graphs/dfsbfs.htm 3. http://oopweb.com/Algorithms/Documents/PLDS210/VolumeFrames.html 4. http://discuss.codechef.com/questions/48877/data-structures-and-algorithms 5. http://code.tutsplus.com/tutorials/algorithms-and-data-structures--cms-20437

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the basic data structures
CLO2	Identify the different operations and memory representations
CLO3	Interpret different techniques with their complexities
CLO4	Compare the applications of various data structures
CLO5	Choose an algorithm to solve simple problems suited for appropriate situations

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**1**	**2**	**2**	**1**	**2**
CLO2	**3**	**2**	**2**	**2**	**2**	**3**
CLO3	**3**	**2**	**3**	**3**	**3**	**2**
CLO4	**3**	**3**	**2**	**3**	**3**	**3**
CLO5	**3**	**3**	**3**	**3**	**3**	**2**
Weightage of course contribute to eachPSO	**15**	**11**	**12**	**13**	**12**	**14**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">COMPILER DESIGN</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE I (EC1)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">1</td><td>-</td><td colspan="2">5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic knowledge in one of the programming language and data structures</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To acquire the knowledge about the compiler design and to understand the different phases of Compiler</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6"></td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-I :
Compilers & Translators, Need of Translators, Structure of a Compiler, Phases, Lexical Analysis, Syntax Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Book Keeping, A Symbol Table in brief, Semantic Analysis, L-value, r-values, Error Handling</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-II :
Rules of Lexical Analyser, Need for Lexical Analysis, Input Buffering, Preliminary Scanning, A simple Approach to the Design of Lexical Analysers, Transition Diagrams, Regular Expression, String & Languages, Finite Automata, Non-deterministic Automata, Deterministic Automata, From regular Expression to Finite Automata, Context free Grammars, Derivations & Parse Trees, Parsers, Shift Reduce Parsing, Operator-Precedence Parsing</td></tr>
</table>

	UNIT-III : Symbol Table Management, Contents of a Symbol Table, Names & Symbol table records, reusing of symbol table spaces, array names, Indirection in Symbol Table entries, Data Structures for Symbol Tables, List, Self Organizing Lists, Search Trees, Hash Tables, Errors, Reporting Errors, Sources of Errors Syntactic Errors, Semantic Errors, Dynamic Errors, Lexical Phase Errors, Minimum Distance Matching, Syntactic Phase Error, Time of Detection, Ponic mode, Case study on Lex and Yacc
	UNIT-IV : Principal Sources of Optimization, Inner Loops, Language Implementation Details Inaccessible to the User. Further Optimization, Algorithm Optimization, Loop Optimization , Code Motion, Induction Variables, Reduction in Strength, Basic Blocks, Flow Graphs, DAG Representation of Basic Blocks, Value Numbers & Algebraic Laws, Global Data Flow Analysis, Memory Management Strategies , Fetch Strategy, Placement Strategies, Replacement Strategies, Address Binding, Compile Time, Load Time, Execution Time, Static Loading, Dynamic Loading, Dynamic Linking
	UNIT-V: Problems in Code Generation, a Simple Code Generator, Next-Use Information, Register Descriptors, Address Descriptors, Code Generation Algorithm, Register Allocation & Assignment, Global Register Allocation, Usage Counts, Register Assignment for Outer Loops, Register Allocation by Graph Coloring, Code Generation from DAG's, Peep-Hole Optimization, Redundant Loads & Stores, Un-Reachable Code, Multiple Jumps, Algebraic Simplifications, Use of Machine Idioms
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Compilers: Principles, Techniques & Tools, Second Edition by A. V. Aho, Monicas. Lam, Ravi Sethi, J. D. Ullman
Reference Books	1. Dhamdhere D.M., "Compiler Construction: Theory and Practice", McMillan India Ltd., 1983 2. Holub Allen, "Compiler Design in C", Prentice Hall of India, 1990
Website and e-Learning Source	1. https://www.geeksforgeeks.org/compiler-design-tutorials/ 2. https://www.tutorialspoint.com/compiler_design/ 3. https://www.javatpoint.com/compiler-tutorial 4. https://onlinecourses.nptel.ac.in/noc19_cs01/preview 5. http://ecomputernotes.com/compiler-design

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Identify the major phases of compilation and the functionality of LEX and YACC
CLO2	Describe the functionality of compilation process and symbol table management
CLO3	Apply the various parsing, optimization techniques and error recovery routines to have a better code for code generation
CLO4	Analyze the techniques and tools needed to design and implement compilers.
CLO5	Test a compiler and experiment the knowledge of different phases in compilation

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**2**	**2**	**2**	**3**	**2**
CLO2	**3**	**2**	**2**	**2**	**3**	**3**
CLO3	**3**	**2**	**3**	**3**	**2**	**3**
CLO4	**3**	**3**	**3**	**3**	**2**	**3**
CLO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**12**	**13**	**13**	**13**	**14**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="7">NATURAL LANGUAGE PROCESSING</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="7">ELECTIVE I (EC1)</td></tr>
<tr><td>Category</td><td>Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">1</td><td>-</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="7">Basic understanding of natural language and linguistics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="7">To learn the fundamentals of natural language processing and to understand the role of CFG, semantics of sentences and pragmatics</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="7"></td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-I :
Introduction: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance</td></tr>
<tr><td colspan="2"></td><td colspan="7">UNIT-II :
Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rulebased, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models</td></tr>
</table>

	UNIT-III : Syntactic Analysis: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures
	UNIT-IV : Semantics and Pragmatics: Requirements for representation, FirstOrder Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selection restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods
	UNIT-V: Discourse Analysis and Lexical Resources: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC)
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text	1. Daniel Jurafsky, James H. Martin;Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech; Pearson Publication; 2014. 2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python , First Edition, OReilly Media, 2009.
Reference Books	1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015. 2. Richard M Reese, ―Natural Language Processing with Java , O_Reilly Media, 2015. 3. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010. 4. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
Website and e-Learning Source	1. http://www.cse.iitb.ac.in/~pb/papers/nlp-iitb.pdf 2. https://www.nitk.ac.in/faculty/dr-sarika-jain 3. https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-natural-language-processing-nlp 4. https://www.sas.com/en_us/insights/analytics/what-is-natural-language-processing-nlp.html 5. https://towardsdatascience.com/your-guide-to-natural-language-processing-nlp-48ea2511f6e1

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language
CLO2	Identify various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parsing and semantic analysis
CLO3	Classify the text into an organized group using a set of handicraft linguistic rules with appropriate NLP processes and algorithms
CLO4	Analyze the system with various language analysis methods and interpret the results
CLO5	Assess NLP systems, identify and suggest solutions for the shortcomings

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**2**	**2**	**2**	**2**	**2**
CLO2	**3**	**2**	**2**	**2**	**2**	**2**
CLO3	**3**	**2**	**2**	**3**	**2**	**3**
CLO4	**3**	**2**	**2**	**3**	**2**	**3**
CLO5	**3**	**2**	**2**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**10**	**10**	**13**	**11**	**13**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">OPERATING SYSTEMS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE II (EC2)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">1</td><td>-</td><td colspan="2">5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic understanding of working principles of computer and about hardware and software components</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To develop fundamental knowledge of Operating systems, to become familiar with CPU Scheduling, memory and file management concepts, to learn concepts and programming techniques of Linux</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6"></td></tr>
</table>

	UNIT-I : **Introduction :** Evolution of Operating System - Structure - Processes - The Process Concepts - Inter Process Communication - IPC Problems - Scheduling Levels - Preemptive Vs Non- Preemptive Scheduling - **Scheduling Algorithms:** First Come First Served - Shortest Job First - Shortest Remaining Time Next - Three Level Scheduling - Round Robin Scheduling - Priority Scheduling -Multiple Queues - Shortest Process Next - Guaranteed Scheduling - Lottery Scheduling - Fair-Share Scheduling - Thread Scheduling
	UNIT-II : Swapping - Virtual Memory - Page Replacement Algorithm - Segmentation
	UNIT-III : **Deadlock** - Examples of Deadlock - Detection - Recovery - Avoidance - Prevention – Semaphore -Shared Memory
	UNIT-IV : **File System** - Files - Directories - I/O Management - Disks - Disk Arm Scheduling Algorithm
	UNIT-V: **Introduction to Linux:** Introducing Shell Programming - Linux File Systems - Linux File system calls - Implementation of Linux File systems - Linux Commands - Directory Oriented Commands - File Oriented Commands - Communication Oriented Commands- General Purpose Commands
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text	1. Andrew S. Tanenbaum, (2001), Modern Operating Systems, 2nd Edition, Prentice Hall of India. 2. B.Mohamed Ibrahim, (2005) Linux Practical Approach, Firewall Media.
Reference Books	1. Silberchatz, Galvin, Gagne, (2003), Operating Systems Concepts, 6th Edition Wiley India Edition. 2. JhonGoerzen, (2002), Linux Programming Bible, 4th Edition, Wiley- dreamtech India (P) Ltd.
Website and e-Learning Source	1. https://www.webopedia.com/TERM/O/operating_system.html 2. https://www.tutorialspoint.com/operating_system/operating_system_tutorial.pdf 3. http://iips.icci.edu.iq/images/exam/Abraham-Silberschatz-Operating-System-Concepts---9th2012.12.pdf 4. https://www.informatics.indiana.edu/rocha/academics/i101/pdfs/os_intro.pdf 5. https://www.youtube.com/watch?v=oJMYYMIGVMU

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the fundamental concepts of an OS and their respective functionality
CLO2	Demonstrate the importance of open-source operating system commands
CLO3	Identify and stimulate management activities of operating system
CLO4	Analyze the various services provided by the operating system
CLO5	Interpret different problems related to process, scheduling, deadlock, memory and files

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**1**	**1**	**2**	**2**	**2**
CLO2	**3**	**2**	**2**	**3**	**3**	**2**
CLO3	**3**	**3**	**2**	**2**	**2**	**2**
CLO4	**3**	**3**	**3**	**3**	**2**	**3**
CLO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**12**	**11**	**13**	**12**	**12**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">DIGITAL COMPUTER ARCHITECTURE</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE II (EC2)</td></tr>
<tr><td>Category</td><td>Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td>1</td><td>-</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic knowledge in Digital Design and Computer Architecture</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To provide a comprehensive introduction of the basic design of a computer and the interdependence and interoperation between the various components inside a computer</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6"></td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-I :
Data Representation - Data Types - Number Systems - Decimal and Alphanumeric Representation - Complements - (r-1)‟s complement - (r‟s) complement - Fixed-point Representation - Floating-point Representation - Binary Codes - Gray Codes - Decimal Codes - Alphanumeric Codes – Error Detection Codes</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-II :
Digital Computers - Logic Gates - Boolean Algebra - K-Map Simplification - Combinational Circuits - Half Adder - Full Adder - SR, D, JK and T Flip Flops - Sequential Circuits - State Table - State Diagram - Digital Components: Integrated Circuits - Decoders - NAND Gate Decoder - Encoders - Multiplexers - Registers - Shift Registers - Binary Counters - Memory Unit</td></tr>
</table>

	UNIT-III : Register Transfer and Micro-operations: Register Transfer Language - Register Transfer - Bus and Memory Transfers - Arithmetic Micro-operations - Logic Micro-operations - Shift Micro- operations - Arithmetic Logic Shift Unit. Computer Organization and Programming: Instruction Codes - Computer Registers - Computer Instructions - Timing and Control - Instruction Cycle - Memory Reference Instructions - Input-Output and Interrupt
	UNIT-IV : Central Processing Unit: General Register Organization - Instruction Formats - Addressing Modes - Data Transfer and Manipulation - Program Control. I/O Organization: Peripheral Devices - I/O Interface - Asynchronous Data Transfer - Modes of Transfer - Priority Interrupt - DMA
	UNIT-V: Memory Organization and CPU: Memory Hierarchy - Main Memory - Auxiliary Memory - Associative Memory - Cache Memory - Virtual Memory - Memory Management Hardware
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	M. Morris Mano, "Computer System Architecture", Prentice Hall of India, 2001
Reference Books	1. John P. Hayes, "Computer Architecture and Organization", Tata McGraw Hill, 1996. 2. V C Hamatcher et al, "Computer Organization", Tata McGraw Hill, 1996.

Website and e-Learning Source	1. http://www.labri.fr/perso/strandh/Teaching/AMP/Common/Strandh-Tutorial/Dir.html 2. http://www.computer-pdf.com/architecture/ 3. http://www.uotechnology.edu.iq/depcse/lectures/3/ 4. http://www.csie.nuk.edu.tw/~kcf/course/ComputerArchitecture/ 5. http://www.ecs.csun.edu/~cputnam/Comp546/Putnam/Cache%20Memory.pdf(UnitV: Cache Memory)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Demonstrate the fundamental concept of binary representation and codes, combinational circuits, Instruction formats, register operations and memory organization
CLO2	Explain the various types of flip flops, different types of micro operations, as well as the addressing modes in the instruction set
CLO3	Apply the various number conversion systems and simplification of equations using K-map
CLO4	Analyze the various design of combinational circuits and flip flops to design a computer
CLO5	Distinguish the major components of a computer including CPU, memory, I/O and storage

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**2**	**1**	**2**	**2**	**2**
CLO2	**3**	**2**	**2**	**2**	**2**	**2**
CLO3	**2**	**2**	**2**	**2**	**2**	**2**
CLO4	**3**	**2**	**2**	**2**	**3**	**2**
CLO5	**3**	**2**	**3**	**2**	**3**	**3**
Weightage of course contribute to eachPSO	**14**	**10**	**10**	**10**	**12**	**11**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">HUMAN COMPUTER INTERACTION</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE II (EC2)</td></tr>
<tr><td>Category</td><td>Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
1</td><td>Lab Practice
-</td><td>Total
5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Understanding the impact of human factors and Computer Science fundamentals</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To think constructively and analytically in designing and evaluating interactive technologies</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6"></td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-I :
Foundations: The Human: Introduction-Input-Output Channels- Memory. The Computer: Introduction- Text Entry Devices- Display Devices- Memory. The Interaction: Introduction – Models of Interaction-Frameworks and HCI Ergonomics-Interaction Styles-Elements of the WIMP Interface-Interactivity - The Context of the Interactions</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-II :
Design Process: Design Basics- Introduction - Process- User Focus-Scenarios- Navigation Design- Screen Design and Layout-Interaction and Prototyping. Design Rules-Introduction- Principles to Support Usability-Guidelines-Golden Rules and Heuristics-HCI Patterns</td></tr>
</table>

	UNIT-III : Implementation Support: Introduction - Elements of Windowing Systems - Programming the Application- Using Toolkits-User Interface Management Systems. Evaluation Techniques: What is an Evaluation- Goal of Evaluation-Evaluation Through Expert Analysis-Choosing an Evaluation Method
	UNIT-IV : Universal Design: Introduction - Universal Design Principles-Designing for Diversity. User Support: Introduction-Requirements of User Support-Approaches to User Support-Adaptive Help Systems-Designing User Support Systems
	UNIT-V: Models: Cognitive Models: Introduction-Goals and Task-Linguistic Models- Challenge of Display Based System-Physical and Device Models - Cognitive Architectures
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Alan dix, Janet finlay, Gregory D. Abowd and Russell Beale,(2004),Human Computer Interaction, 3rd edition, Pearson Education
Reference Books	1. John C. Caroll, (2002), Human Computer Interaction in the new millennium, Pearson Education 2. Jenny Preece, Yvonne Rogers, Helen Sharp (2019), Interaction Design: Beyond Human–Computer Interaction,fifth edition, John Wiley & Sons Inc.

Website and e-Learning Source	1. http://courses.iicm.tugraz.at/hci/ 2. http://www.hcibook.com/hcibook/downloads/pdf/exercises.pdf 3. http://www.idemployee.id.tue.nl/g.w.m.rauterberg/lectures.html 4. http://user.medunigraz.at/andreas.holzinger/holzinger/papersen/HCI/Workshop/forISSEP%2 02005.pdf 5. http://universaldesign.ie/What-is-Universal-Design/The-7-Principles/ (Unit IV**:** Universal Design Principles)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Describe typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms
CLO2	Identify the usability and the beneficiary factors of User support systems
CLO3	Analyze the core theories, models and methodologies in the field of HCI
CLO4	Evaluate interactive systems based on the human factor theories
CLO5	Elaborate an interactive system based on the design principles, standards and guidelines

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**2**	**1**	**2**	**2**	**2**
CLO2	**3**	**2**	**1**	**2**	**2**	**2**
CLO3	**3**	**2**	**2**	**3**	**3**	**3**
CLO4	**3**	**3**	**2**	**3**	**3**	**3**
CLO5	**3**	**2**	**2**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**11**	**8**	**13**	**13**	**13**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">NETWORKS AND SECURITY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE III (EC3)</td></tr>
<tr><td>Category</td><td>Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>II</td><td colspan="4"></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td>-</td><td colspan="3">5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic knowledge about computer networks</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To understand the importance of networking and the basic model followed in network design and to understand necessary approaches and techniques to build protection mechanisms in order to secure computer networks</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6"></td></tr>
</table>

	UNIT-I : Uses of Computer Networks – Network Hardware – Line Configuration – Topology – Transmission Modes – **Reference Models:** OSI Reference Model – TCP/IP Reference Model – **Physical Layer:** Guided Transmission Media – Wireless Transmission – Communication Satellites – **Public Switched Telephone Network**: Local Loop – Multiplexing – Switching
	UNIT-II : **Data Link Layer:** Design Issues - Error Detection and Correction - **Network Layer :** Design Issues – **Routing Algorithms** : Shortest Path Routing – Distance Vector Routing – Link State Routing – Broadcast Routing – Multicast Routing – Congestion Control
	UNIT-III : **Network Layer in the Internet:** IP Addresses –**Transport Layer:** Elements of Transport Protocols: Addressing – Connection Establishment – Connection Release – **Application Layer:** Domain Name System – **Email:** Architecture and Services
	UNIT-IV : **Network Security:** Introduction to Cryptography - Symmetric - Key Cryptography - Asymmetric- key Cryptography – Security Services: Message Confidentiality - Message Integrity - Message Authentication - Digital Signature - Entity Authentication – **Security in the Internet:** IPSecurity - SSL/TLS: SSL services - SSL Protocols - Firewalls
	UNIT-V: **Security for Wireless Networks:** Introduction – Protecting the wireless networks – Physical Security – Authentication and access control- **Smartphone Security:** Security Threats - Steps to smartphone security –**Websites and Web application Security:** Definition – Available Technologies - Threats - Strategies. **Case Study: To study recent Wi -Fi and Smartphone technologies**

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Andrew S.Tanenbaum, David J. Wetherall (2010), Computer Networks, Prentice Hall of India, V Edition. (Unit I - Unit - III) Unit I – Chapter 1,2 Unit II – Chapter 3,5 Unit III – Chapter 5,6,7 2. Behrouz A. Forouzan, (2016), Data Communications and Networking, Tata McGraw-Hill Publishing Company Limited, IV Edition. (Unit IV) Unit IV - Chapter 30, 31, 32
Reference Books	1. Charles P. Pfleeger, Shari Lawrence Pfleeger(2002), Security in Computing, 3rd Edition, Pearson Education. 2. James F. Kurose, Keith W. Ross (2005),Computer Networking, 3rd Edition, Addison Wesley,. 3. William Stallings(2006), Cryptography and Network Security: Principles and Practice, 3rd Edition, PHI.
Website and e-Learning Source	1. http://wndw.net/pdf/wndw3-en/ch09-security-for-wireless-networks.pdf (Unit V- Wireless Networks Security) 2. https://www.fcc.gov/sites/default/files/smartphone_master_document.pdf (Unit V- Steps to smartphone security) 3. https://www.csoonline.com/article/3241727/mobile-security/6-mobile-security-threats-you- should-take-seriously-in-2019.html (Unit V – SmartPhone Security Threats) 4. https://kgk.uni-obuda.hu/sites/default/files/12_Kadena.pdf (Unit V – SmartPhone Security Threats) 5. https://www.goodfirms.co/glossary/web-security/ (Unit V – Web Security)

C

ourse Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the concepts and fundamentals of data communication and computer networks
CLO2	Identify the usage and importance of layered model, network security and web security
CLO3	Classify the techniques based on required application
CLO4	Analyze the significant applications of protocols and layers used in data communication and networking
CLO5	Explain the functionality of various techniques and algorithms that works at different layers

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**2**	**3**	**3**	**2**	**3**
CLO2	**3**	**2**	**2**	**2**	**2**	**2**
CLO3	**3**	**2**	**3**	**2**	**2**	**3**
CLO4	**3**	**2**	**2**	**2**	**3**	**2**
CLO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**11**	**13**	**12**	**12**	**13**

Coursecode		**CLOUDCOMPUTING**	**L**	**T**	**P**	**C**
Elective		**Elective III (EC3)**	**4**	**0**	**0**	**4**
Pre-requisite		Basicknowledgeonsoftwaresystemspecificallyon operating system				
CourseObjectives:						
Themainobjectivesofthiscourseareto: 1. Understandthedifferentconceptsofcloudcomputinganditsservices 2. Storeand retrievethe datafromcloudand canprovidethe securitytothedataincloud						
Unit:1	**Introduction**		**12hours**			

Introduction:CloudComputingBasics:CloudComputingOverview-Applicationsofcloudcomputing-Intranetsandthecloud– Firstmovers inthecloud -Benefits-limitations ofcloudcomputing– SecurityConcerns– Cloud ComputingServices–Salesforce.com		
Unit:2	**CloudComputingTechnology**	**12hours**
HardwareandInfrastructure–Clients– Security– Network– Services-CloudStorage– Standards– CloudComputingatwork:SoftwareasaService–SoftwarePlusServices– DevelopingApplications		
Unit:3	**VirtualMachinesandVirtualization**	**12hours**
Introduction - Understanding Virtualization - History of Virtualization – Leveraging Blade Servers – Server Virtualization – Desktop Virtualization – Virtual Networks – Data Storage Virtualization. DataStorageinCloud:EvolutionofNetworkStorage–CloudbaseddataStorage–Advantagesanddisadvantagesof Cloudbaseddatastorage-CloudbasedBackupsystems-FileSystems–Cloudbased BlockStorage		
Unit:4	**MigratingintoaCloud**	**12hours**
Introduction– Broadapproaches ofMigratingintocloud –TheSevenStep ModelsofMigratingintoaCloud.MobileCloudComputing:EvolutionofMobileComputing–MobileCloudEcoSystem–MobilePlayers		
Unit:5	**Datasecurityincloud**	**10hours**
Introduction – Current state of data security – Homo sapiens and Digital Information – Cloud Computing and Datasecurity Risk – Cloud Computing and Identity – The Cloud, Digital Identity and Data Security- Content LevelSecurity- ProsandCons		
Unit:6	**Introductionto Industry 5.0**	**02hours**
Discussiononcasestudy-Expertlectures-Onlineseminars–Webinars– Workshops		
	TotalLecturehours	**60hours**

TextBooks	
1	AnthonyT. Velte,TobyJ. Velte, RobertElsenpeter, "CloudComputing:APractical Approach",McGrawHill
2	KrisJamsa,"CloudComputing"JonesandBarlettStudentEdition2014
ReferenceBooks	
1	RajkumarByya,JamesBroberg,AndrzejGoscinski,"CloudComputingPrnciplesandParadigms",Wiley&sons
2	E-Resources
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]	
1	https://swayam.gov.in/nd1_noc20_cs55/
2	https://nptel.ac.in/courses/106/105/106105223/

CourseDesignedBy:Dr.E.Chandra

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Articulatethemainconcepts, keytechnologiesofcloudcomputingintermsof strengths,limitationsandapplications.
CLO2	CategorizethearchitectureandinfrastructureofcloudcomputingsuchasIaaSandSaaS
CLO3	Explaintheconceptofvirtualmachinesandvirtualization
CLO4	Applysuitablestoragealgorithms incloudcomputing
CLO5	Beexposeinbroadapproachesofmigratingintoacloudandmobilecloudcomputing, Describeaboutthedatasecurityconcepts incloudcomputing

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**3**	**3**	**3**	**2**	**2**
CLO2	**3**	**3**	**3**	**3**	**3**	**2**
CLO3	**3**	**2**	**3**	**3**	**3**	**3**
CLO4	**3**	**3**	**3**	**3**	**3**	**3**
CLO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**13**	**15**	**15**	**13**	**15**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">BIOMETRIC TECHNIQUES</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE III(EC3)</td></tr>
<tr><td>Category</td><td>Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>II</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">1</td><td>-</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic knowledge of computer vision and cyber security concepts</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To understand various physiological and behavioural biometrics and its applications</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6"></td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-I :
Introduction: Biometric Fundamentals - Biometrics Vs Traditional Techniques - Benefits of Biometrics in Identification Systems - Key Biometric Terms and Processes: Verification, Identification and Biometric Matching - Accuracy in Biometric Systems: False Match Rate, False Non-Match Rate, Failure to Enroll Rate, Derived Metrics</td></tr>
<tr><td colspan="2" rowspan="2"></td><td colspan="6">UNIT-II :
Physiological Biometrics: Finger Scan: Components-How it works-Competing Technologies- Deployments-Strengths and Weaknesses. Facial Scan: Components- How it Works-Competing Technologies-Deployments-Strengths and Weaknesses</td></tr>
<tr><td colspan="6">UNIT-III :
Other Physiological Biometrics: Iris Scan: Components-How it Works-Competing Technologies-Deployments-Strengths and Weaknesses. Voice Scan: How it Works-Competing Technologies-Deployments-Strengths and Weaknesses. Other Physiological Biometrics: Hand Scan and Retina Scan</td></tr>
</table>

	UNIT-IV : Behavioural Biometrics: Signature Scan and Keystroke Scan: How it Works-Competing Technologies-Deployments-Strengths and Weaknesses. Esoteric Biometrics: Vein Pattern- Facial Thermography-DNA-Sweat Pores- Hand Grip- Finger Nail Bed- Body Odor- Ear-Gait- Skin Luminescence- Brain Wave Pattern- Foot Print and Foot Dynamics
	UNIT-V: Biometric Applications: Categorizing Biometric Applications - Application Areas: Criminal and Citizen Identification, Surveillance, PC/Network Access, E-Commerce/Telephony and Retail/ATM - Costs to Deploy -Issues in Deployment-Biometric Standards
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Samir Nanavati, Michael Thieme, Raj Nanavati,(2003),Biometrics - Identity Verification in a Networked World, Wiley-dreamtech India Pvt Ltd, New Delhi 2. John D. Woodward, Nicholas M. Orlans, Peter T. Higgins, Biometrics: the ultimate reference, Dreamtech Press
Reference Books	Anil K Jain, Patrick Flynn, Arun A Ross, (2008), Handbook of Biometrics, Springer

Website and e-Learning Source	1. http://www.sans.org/reading-room/whitepapers/authentication/biometric-scanning/ 2. http://www.biometrics.gov/documents/biointro.pdf 3. http://www.cse.unr.edu/~bebis/CS790Q/Lect/IntroBiometrics.pdf 4. http://www.planetbiometrics.com/creo_files/upload/article-files/btamvol1 update.pdf 5. http://www.biometrics.gov/documents/biointro.pdf (Unit V: Biometric Applications)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the existing theories, methods and interpretations in the field of biometrics
CLO2	Identify the deployment areas, competing technologies, strength and weakness of various Physiological and Behavioral Biometrics
CLO3	Analyze various Application areas, Biometric security issues and Biometric standards
CLO4	Assess the methods relevant for design, development and operation of biometric access control systems
CLO5	Determine identification /verification systems to validate the user identity and technological uplifts in biometrics compared to traditional securing mechanisms

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**2**	**1**	**1**	**1**	**1**	**1**
CLO2	**2**	**2**	**1**	**1**	**2**	**2**
CLO3	**3**	**2**	**1**	**2**	**2**	**3**
CLO4	**3**	**2**	**2**	**3**	**3**	**2**
CLO5	**3**	**3**	**2**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**13**	**10**	**7**	**10**	**11**	**11**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">BLOCKCHAIN TECHNOLOGY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE III(EC3)</td></tr>
<tr><td>Category</td><td>Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>II</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">1</td><td>-</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic knowledge of networking and cyber security concepts</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To study the basics of Blockchain technology, private and public Blockchain, and smart contract. This paper familiarizes the students to explore various aspects of Blockchain technology like application in various domains</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6"></td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-I :

Introduction of Cryptography and Blockchain : Definition of Blockchain - Blockchain Technology Mechanisms & Networks - Blockchain Origins - Objective of Blockchain - Blockchain Challenges - Transactions and Blocks - P2P Systems - Keys as Identity - Digital Signatures, Hashing, and public key cryptosystems - private vs. public Blockchain</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-II :

Bitcoin and Cryptocurrency : Bitcoin Terminology- The Bitcoin Network - The Bitcoin Mining Process - Mining Developments - Bitcoin Wallets - Decentralization and Hard Forks - Ethereum Virtual Machine (EVM) - Merkle Tree- Double- Spend Problem - Blockchain and Digital Currency- Transactional Blocks - Impact of Blockchain Technology on Cryptocurrency</td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-III :

Introduction to Ethereum : Introduction to Ethereum - Consensus Mechanisms- Metamask Setup - Ethereum Accounts -Transactions -Receiving Ethers- Smart Contracts</td></tr>
</table>

	UNIT-IV : **Introduction to Hyperledger and Solidity Programming** : Definition of Hyperledger - Distributed Ledger Technology & its Challenges - Hyperledger & Distributed Ledger Technology - Hyperledger Fabric -Hyperledger Composer - Solidity - Language of Smart Contracts - Installing Solidity & Ethereum Wallet - Basics of Solidity - Layout of a Solidity Source File & Structure of Smart Contracts - General Value Types
	UNIT-V: **Blockchain Applications** : Internet of Things -Medical Record Management System - Domain Name Service and Future of Blockchain -Alt Coins
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained", Second Edition, Packt Publishing, 2018 2. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" Princeton University Press, 2016 3. Antonopoulos and G. Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", O'Reilly Publishing, 2018
Reference Books	1. Antonopoulos, Mastering Bitcoin, O'Reilly Publishing, 2014 2. D. Drescher, Blockchain Basics. Apress, 2017

Website and e-Learning Source	1. https://nptel.ac.in/courses/106/104/106104220/# 2. https://www.udemy.com/course/build-your-blockchain-az/ 3. https://eduxlabs.com/courses/blockchain-technology-training/?tab=tab-curriculum 4. https://www.geeksforgeeks.org/consensus-algorithms-in-blockchain/ 5. https://ec.europa.eu/programmes/erasmus-plus/project-result-content/eb79d492-327b-43d8-b479-dd0fd9fd4490/BLISS%2003T3%20Unit%201%20slides%20v3.0%20final%20controled.pptx

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understand and explore the working of Blockchain technology
CLO2	Identify the security and privacy implications of blockchain technology
CLO3	Apply the learning of solidity to build de-centralized apps on Ethereum
CLO4	Analyze the working of Smart Contracts and the working of Hyperledger
CLO5	Assess the methods relevant for design, development and operation of blockchain based applications

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	2	2	3	3	2	3
CLO2	2	2	2	2	2	2
CLO3	3	2	3	2	2	2
CLO4	3	2	2	2	3	2
CLO5	3	3	3	3	3	3
Weightage of course contribute to eachPSO	13	11	13	12	12	12

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">SOFTWARE ENGINEERING</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE IV(EC4)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td></td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>3</td><td colspan="2">-</td><td>2</td><td colspan="2">5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic knowledge of software programs</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">This paper familiarizes the students with the knowledge of basic Software engineering methods and practices and gives hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6"></td></tr>
</table>

	UNIT-I : Introduction: A Generic View of Process - Process Models: The Waterfall Model-Incremental Model-Evolutionary Model-Specialized Model-The Unified Process-Agile Process - Agile process Models Exercise: Choose any one project and do the following exercises for the chosen project a. Student Result Management System b. Library management system c. Online course reservation system d. Railway reservation system e. Recruitment system f. Stock Maintenance System Write the Problem Statement for a suggested system of relevance
	UNIT-II : System Engineering: System Engineering Hierarchy - System Modeling - Requirements Engineering: Tasks-Initiating The Process-Eliciting Requirements-Developing Use Cases- Negotiating Requirements-Validating Requirements - Building the Analysis Models: Data modeling concepts - Scenario based - Flow oriented - Class based Modeling Exercise: Preparation of Software Requirement Specification Document

	UNIT-III : Design Engineering: Design Concepts - Design Models - Pattern Based Design - Architectural Design - Component Level Design: Component - Class Based and Conventional Components Design - User Interface Design: Analysis and Design Exercise: Draw DFD and Use Case diagram for the chosen project using any CASE tools
	UNIT-IV : Testing Strategies: Software Testing - Strategies: Conventional - Object Oriented - Validation Testing - System Testing: Recovery - Security - Stress - Performance - Testing Tactics: Testing Fundamentals- Black Box - White Box - Basis Path-Control Structure Exercise: Develop test cases and perform various testing using any one of the testing tools
	UNIT-V: Estimation : Software project Estimation - Empirical Estimation models - Risk management : Software Risks - Risk Identification - Risk Projection - Risk Mitigation, Monitoring and Management - Quality Management: Quality Concepts - Quality Assurance -Software Reliability- Quality Standards.Case Study :Devops Tools Exercise: Perform Estimation of effort using FP Estimation for chosen system and prepare Gantt Chart/PERT Chart for the same.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Roger Pressman.S., "Software Engineering: A Practitioner's Approach", 6th Edition, Mcgraw Hill, 2005
Reference Books	1. Richard Failey, “Software Engineering Concepts”, Tata McGraw-Hill, 2004. 2. P. Fleeger, "Software Engineering", Prentice Hall, 1999. 3. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli, "Fundamentals ofSoftware Engineering", Prentice Hall Of India 1991. 4. Sommerville, "Software Engineering” 5th Edition: Addison Wesley, 1996.
Website and e-Learning Source	1. http://productdevelop.blogspot.in/2011/03/what-are-formal-technical-reviews-ftr.html 2. http://basicqafundamentals.blogspot.in/2011/03/difference-between-alpha-testing-beta.html 3. https://www.wiziq.com/tutorials/software-engineering 4. http://www.jkinfoline.com/software-engineering.html 5. http://www.freetutes.com/systemanalysis/ 6. http://www.softwaretestingstuff.com/2007/09/white-box-testing.html (Unit IV : White Box Testing)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Recognize the software process models including the specification, design, implementation, and testing for a software project
CLO2	Use recent and advanced tools necessary for software project development, testing, management and reuse
CLO3	Compare and contrast various design, testing and quality issues
CLO4	Prioritize the requirements and risk accordingly that meet user expected performance, maintenance and quality
CLO5	Design software projects with well-defined architecture, modules, components and interfaces

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**2**	**2**	**3**	**3**	**2**
CLO2	**3**	**2**	**2**	**3**	**3**	**2**
CLO3	**3**	**2**	**3**	**2**	**3**	**3**
CLO4	**3**	**3**	**2**	**3**	**3**	**3**
CLO5	**3**	**3**	**3**	**2**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**12**	**12**	**13**	**15**	**13**

Title of the Course		**OBJECT ORIENTED ANALYSIS AND DESIGN**					
Paper Number		**ELECTIVE IV(EC4)**					
Category	Elective	**Year**		**Credits**	3	**Course Code**	
		Semester					
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	1		-	5	
Pre-requisite		Basic understanding of atleast one of the object-oriented programs					

Objectives of the Course	The primary objective is to understand the principles & requirements and apply the UML (Unified Modeling Language) and tools for OOA and Design.
Course Outline	
	UNIT-I : Object Basics : Object- oriented Philosophy – Object – Object State, Behaviours and Methods. Encapsulation and Information Hiding – Class Hierarchy – Polymorphism, Aggregation, Object Containment, Meta Classes.
	UNIT-II : Object Oriented Methodologies: Rumbaugh Object Model, Booch Methodology- Jacobson Methodology, Patterns, Frameworks and Unified Approach.
	UNIT-III : Object Oriented Analysis: Business Object Analysis– Use Case Driven Approach – Use Case Model. Object Analysis – Noun Phrase Approach – CRC – Identifying Object Relationships and Methods.
	UNIT-IV : Object Oriented Design: The Design Process – Design Axioms – Corollaries – Design Patterns – Designing Classes. Software Quality: Tests- Testing Strategies – Test Cases – Test Plan – Continuous Testing – Mier‟s Debugging Principles.
	UNIT-V: UML and Programming: Introduction – State and Dynamic Models – UML Diagrams – Class Diagrams – Use Case Diagrams- UML Dynamic Modeling.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)

Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Ali Brahami, Object Oriented Systems Development, Tata-McGraw Hill, New Delhi.
Reference Books	1. Martin Fowler, Kendall Scott, UML Distilled- Applying the Standard Object Modeling Language, Addition Wesley. 2. Grady Booch, (1994), Object-oriented Analysis and Design with applications, 2nd Edition, Addition Wesley.
Website and e-Learning Source	1. http://www.slideshare.net/helghareeb/object-oriented-analysis-and-design-12164752 2. http://www.uml-diagrams.org/uml-object-oriented-concepts.html 3. http://www.tutorialspoint.com/object_oriented_analysis_design/index.htm 4. https://www.mppmu.mpg.de/english/kluth_oo_intro.pdf 5. http://www.agilemodeling.com/artifacts/useCaseDiagram.htm (Unit V: Use Case Diagrams)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Recognize the concepts and principles of object-oriented analysis, design and Testing
CLO2	Demonstrate the importance of system development process using various approaches and choose the relevant technique for a system in each phases of SDLC
CLO3	Differentiate various object-oriented analysis, design and testing methods and models.
CLO4	Assess various analysis, design and testing strategies appropriate to build high- performance object-oriented system
CLO5	Design Object oriented systems using object modeling techniques and analyze them for correctness and quality

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	2	3	2	2
CLO2	3	2	2	3	2	3
CLO3	3	3	2	3	2	3
CLO4	3	2	2	3	2	3
CLO5	3	2	3	3	3	3
Weightage of course contribute to eachPSO	15	11	11	15	11	14

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">SOFTWARE PROJECT MANAGEMENT</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE IV(EC4)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td></td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td></td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">1</td><td>-</td><td colspan="2">5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic knowledge about the fundamentals of software project development</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The primary objective is to define and highlight importance of software project management and to become familiarize in formulating software management metrics & strategy in managing projects</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6"></td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-I :
Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization.</td></tr>
</table>

	UNIT-II : Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software.
	UNIT-III : Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed.
	UNIT-IV : Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling
	UNIT-V: Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, "Quality Software Project Management", Pearson Education Asia 2002
Reference Books	1. Pankaj Jalote, "Software Project Management in Practice", Addison Wesley 2002. 2. Hughes, "Software Project Management", Tata McGraw Hill 2004, 3rd Edition.
Website and e-Learning Source	1. https://highered.mheducation.com/sites/0077109899/information-center-view/ 2. https://www.tutorialspoint.com/software_engineering/software_project_management.htm 3. https://www.smartsheet.com/content/software-project-management 4. https://www.philadelphia.edu.jo/academics/lalqoran/uploads/SPM_Chapter_1-%202016%204.ppt 5. https://cs.gmu.edu/~kdobolyi/cs421/projectmanagement.ppt

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understanding of project management fundamentals such as project planning, risk management and quality assurance
CLO2	Choose the appropriate scheduling and testing techniques to build a quality product
CLO3	Apply different cost estimation techniques and quality measures for software development
CLO4	Differentiate various software development models and methodologies, planning activities and scheduling methods
CLO5	Asses the importance of software project documentation and identify the methods to create project documentation, including requirements documents, design documents, and project plans

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	3	2	2	3	3	2
CLO2	3	2	2	3	3	2
CLO3	3	2	3	2	3	3
CLO4	3	3	2	3	3	3
CLO5	3	3	3	2	3	3
Weightage of course contribute to eachPSO	15	12	12	13	15	13

Title of the Course		**RESEARCH METHODOLOGY**					
Paper Number		**ELECTIVE V(EC5)**					
Category	Elective	**Year**	I	**Credits**	3	**Course Code**	
		Semester	I				
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	1		-	5	
Pre-requisite		Basic critical and writing skills					
Objectives of the Course		To impart knowledge and skills required for research problem formulation, analysis, solutions, technical paper writing and drafting and filing patents.					
Course Outline							

	UNIT-I : **Research Methodology:** Objectives and motivation of research - Types of research - Research approaches - Significance of research - Research methods verses methodology - Research and scientific method - Importance of research methodology - Research process - Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations- Criteria of good research. Defining the research problem: Definition of research problem - Problem formulation - Necessity of defining the problem - Technique involved in defining a problem.
	UNIT-II : **Literature Survey and Data Collection:** Importance of literature survey - Sources of information - Assessment of quality of journals and articles - Information through internet. Effective literature studies approaches, analysis, plagiarism, and research ethics. Data - Preparing, Exploring, examining and displaying.
	UNIT-III : **Research Analysis and Design:** Meaning of research design - Need of research design - Different research designs - Basic principles of experimental design - Developing a research plan - Design of experimental set-up - Use of standards and codes. Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.
	UNIT-IV : **Intellectual Property Rights:** Nature of Intellectual Property: Patents, Designs, Trade and Copyright- Process of Patenting and Development: technological research, innovation, patenting, development- Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

	UNIT-V: **Patent Rights:** Scope of Patent Rights- Licensing and transfer of technology- Patent information and databases- Geographical Indications -New Developments in IPR: Administration of Patent System, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs -Licenses, Licensing of related patents, patent agents, Registration of patent agents.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. R. Ganesan, "Research Methodology for Engineers", MIP Publishers, Chennai, 2011. 2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
Reference Books	1. Peter S. Menell ,Mark A. Lemley, Robert P. Merges, "Intellectual Property in the New Technological "Vol. I Perspectives, 2021. 2. Laura R. Ford,"The Intellectual Property of Nations: Sociological and Historical Perspectives on a 3. RatanKhananabis and SuvasisSaha, "Research Methodology", Universities Press, Hyderabad, 2015. 4. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007. 5. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners" 2010

Website and e-Learning Source	1. https://www.coursera.org/courses?query=research%20methodology 2. https://www.researchgate.net/topic/Research-Methodology 3. https://www.wto.org/english/tratop_e/trips_e/intel1_e.htm 4. https://www.isical.ac.in/~palash/research-methodology/RM-lec9.pdf 5. https://mrcet.com/downloads/digital_notes/CSE/Mtech/I%20Year/RESEARCH%20METHODLOGY.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understanding of research, IPR and patent fundamentals
CLO2	Identify the issues involved in research, IPR and patent filing
CLO3	Apply suitable instrumentation and sampling techniques for the research studies and recognize the framework for protecting IPR and process for obtaining patents
CLO4	Analyze data, and interpret research findings using appropriate methods and importance of IPR and patent protection in promoting research and development
CLO5	Design and develop research reports, research proposals, academic papers and patents

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**1**	**2**	**3**	**2**	**2**
CLO2	**3**	**2**	**2**	**3**	**3**	**2**
CLO3	**3**	**2**	**2**	**2**	**3**	**3**
CLO4	**3**	**3**	**2**	**3**	**3**	**3**
CLO5	**3**	**3**	**3**	**2**	**3**	**3**
Weightage of course contribute to	**15**	**11**	**11**	**13**	**14**	**13**

eachPSO						

Title of the Course	**INTERNET OF THINGS**						
Paper Number	**ELECTIVE V (EC5)**						
Category	Elective	**Year**	I	**Credits**	3	**Course Code**	
		Semester	I				
Instructional Hours per week	**Lecture**	**Tutorial**		**Lab Practice**		**Total**	
	4	1		-		5	
Pre-requisite	Basic understanding of computer hardware components and networking concepts						
Objectives of the Course	The primary objective of this course is to impart the knowledge on IoT Architecture, Protocol, various technologies and the application areas relating to IoT implementations.						
Course Outline							
	UNIT-I : Introduction to IoT - Introduction to Internet of Things: Introduction- Physical Design of IoT- Logical Design of IoT- IoT Enabling Technologies - IoT Levels & Deployment Templates						
	UNIT-II : Domain Specific IoT: Introduction-Home Automation-Cities-Environment-Energy-Retail- Logistics-Agriculture-Industry-Health & Lifestyle. IoT and M2M: Introduction - M2M-Difference between IoT and M2M - SDN and NFV for IoT.						

	UNIT-III : M2M to IoT- An Architectural Overview: Building an Architecture-Main design principles and needed capabilities-An IoT Architecture Outline- Standard Considerations. M2M and IoT Technology Fundamentals: Devices and Gateways-Local and wide area Networking-Data Management.
	UNIT-IV : IoT Architecture - Architecture Reference Model: Introduction-Reference Model and Architecture- IoT Reference Model: IoT Domain Model-Information Model-Functional Model-Communication Model-Safety, Privacy, Trust, Security Model IoT**.**
	UNIT-V: Implementation Examples: The Smart Grid-Introduction-Smart Metering-Smart House-Smart energy city. Case Study: Commercial Building automation today and in the future.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. ArshdeepBahga, Vijay Madisetti, ―Internet of Things – A hands-on approach, Universities Press, 2015 (Unit I and II) 2. Jan Holler, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier, 2014(Unit III, IV and V).

Reference Books	1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017 2. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012 3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things, Springer, 2011.
Website and e-Learning Source	1. https://www.tutorialspoint.com/internet_of_things/ 2. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/ 3. https://www.slideshare.net/khusuma/domain-specific-iot(Unit-II) 4. https://www.slideshare.net/PascalBodin/an-introduction-to-m2m-iot-technologies(Unit -III) 5. https://www.smartgrid.gov/the_smart_grid/smart_grid.html

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the fundamental concepts and Terminologies of IoT
CLO2	Determine the IoT enabling technologies, M2M and IoT, fundamentals and technological challenges faced by IoT in terms of Safety, privacy and trust
CLO3	Identify the different levels, models and standards of IoT and application areas in domain specific IoT
CLO4	Analyze the physical design, logical design, architecture Overview of M2M and IoT and reference models of IoT Architecture
CLO5	Assess the application areas and illustrate the implementation of IoT

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**2**	**2**	**2**	**2**	**3**
CLO2	**3**	**2**	**2**	**2**	**3**	**3**

CLO3	**3**	**3**	**2**	**2**	**3**	**3**
CLO4	**3**	**3**	**2**	**3**	**2**	**2**
CLO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**13**	**12**	**12**	**13**	**14**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">TRENDS IN COMPUTING</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE V (EC5)</td></tr>
<tr><td>Category</td><td>Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td></td></tr>
<tr><td colspan="2"></td><td>Semester</td><td>I</td><td colspan="4"></td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2"></td><td colspan="2">4</td><td colspan="2">1</td><td>-</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic understanding of computer networks and environmental issues</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">The primary objective of this course is to give students:
a) To understand the concepts and infrastructure of cloud computing and its business applications.
b) To understand the scope, design and model of grid computing
c) Knowledge about the reduction of energy use, waste, and other environmental impacts of Information Technology systems.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6"></td></tr>
</table>

	UNIT-I : **Cloud Computing**: Basics: Overview – Applications – Intranets and the Cloud – First Movers in the Cloud – Organization and Cloud Computing: Benefits – Limitations – Security Concerns- The Business Case for Going to the Cloud: Cloud Computing Services -Deleting Datacenter.
	UNIT-II : Hardware and Infrastructure: Clients – Security – Network – Services- Accessing the Cloud: Platforms - Cloud Storage: Overview – Cloud Storage Providers.
	UNIT-III : Developing Applications: Google – Microsoft - Local Cloud and Thin Clients: Virtualization – Server Solutions – Thin Clients – Migrating to the Cloud.
	UNIT-IV : **Grid Computing:** Introduction - Benefits – Grid Terms and Concepts: Types of Resources – Jobs and Applications – Scheduling, Reservation and Scavenging – Grid Software Components – Grid user role: User Perspective – Administrator Perspective - Design: Building grid architecture - Models – Topologies – Phases and Activities.
	UNIT-V: **Green Computing:** Introduction - History of Green Computing - Regulations and Industry Initiative - The Demons behind Green Computing - Approaches to Green Computing - Role of IT vendors - Green Computing Tips - Future is Green.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text	1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing - A practical Approach" , McGraw Hill, 2010. 2. Bart Jacob, Michael Brown, Kentaro Fukui, and NiharTrivedi, "Introduction to Grid Computing" ,IBM Redbook, 2005.
Reference Books	1. George Reese, "Cloud Application Architectures: Building Applications and Infrastructures in the cloud", O"Reilly Media Inc., 2009. 2. Halper Fern, Kaufman Marcia, Bloor Robin, Hurwit Judith, "Cloud Computing for Dummies ", Wiley India Pvt Ltd ,2009. 3. J. Velete, Anthony T. Velete, Robert Elsenpeter, "Green IT – Reduce Your Information System"s Environmental Impact While Adding to the Bottom Line", McGraw-Hill ,2008. 4. Bud E. Smith ," Green Computing: Tools and Techniques for Saving Energy, Money, and Resources", Auerbach Publications , 2013.
Website and e-Learning Source	1. http://www.siteground.com/tutorials/cloud/cloud_computing_infrastructure.htm 2. http://thecloudtutorial.com/ 3. http://studymafia.org/wp-content/uploads/2015/11/CSE-Green-Computing-Report.pdf 4. http://www.znu.ac.ir/data/members/dastjerdi_mohammad/Book11.pdf (Unit IV) 5. http://www.cs.kent.edu/~farrell/grid06/lectures/grid01.pdf (Unit V)

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the history, applications, benefits and limitations of Cloud, Grid and Green computing
CLO2	Describe the cloud infrastructure services, virtualization and determine how applications can be developed using cloud services
CLO3	Identify cloud storage providers, software components of grid, technologies applied in building a green system and various key sustainability in Green IT Trends
CLO4	Analyse the migrations and security concerns of cloud, different grid

	models, resources and also identify how the distributed computing environments can be built from lower level services
CLO5	Assess the business cases of cloud, and also various laws, approaches and protocols for regulating green IT

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	2	1	1	1	1	1
CLO2	2	2	1	1	1	2
CLO3	3	3	2	2	2	3
CLO4	3	2	2	2	3	2
CLO5	3	3	2	2	3	3
Weightage of course contribute to eachPSO	13	11	8	8	10	11

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">INTELLIGENT SYSTEMS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">ELECTIVE VI (EC6)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Elective</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td>-</td><td colspan="3">5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">Basic knowledge of data mining concepts</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">To acquire knowledge on various intelligent system techniques and methodologies and to have enriched knowledge on Knowledge representation, problem solving, and learning methods in solving particular engineering problems.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="6"></td></tr>
<tr><td colspan="2"></td><td colspan="6">UNIT-I :
Artificial Intelligence: AI problems-AI technique-Problem Search:-Production Systems – Problem Characteristics – Production system characteristics- Heuristic Search techniques: Generate and Test – Hill Climbing – Constraint Satisfaction, Means-end analysis</td></tr>
</table>

	UNIT-II : **Knowledge representation issues**: Representations and mappings – Approaches to Knowledge representations –- Frame problem –. **Using Predicate Logic**: Representing simple facts in logic - Representing Instance and ISA relationships – Computable functions and predicates – Resolution
	UNIT-III : **Representing knowledge using rules**: Procedural Vs Declarative knowledge – Logic programming – Forward Vs Backward reasoning – Matching – Control knowledge. **Knowledge representation summary**: Syntactic and Semantic spectrum of representation-Logic and slot – and-filler structures-Other representational techniques
	UNIT-IV : **Rule-based expert systems**: Introduction- Rules as a knowledge representation technique- players- Structure- Forward chaining and backward chaining inference techniques- **Fuzzy expert systems**: Introduction- Fuzzy sets- Linguistic variables and hedges- Operations - Fuzzy rules- - Building a fuzzy expert system
	UNIT-V: **Artificial neural networks**: Neuron- perceptron- Multilayer neural networks- - The Hopfield network- **Robotics**: Introduction-Robot hardware-Perception-Moving-Robotic software architecture.
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Text	1. Elaine rich and Kelvin Knight, "Artificial Intelligence ", Tata McGraw hill Publication, 3ndEdition, 2009. [Unit - I,II,III] Unit I : Chapters 1, 2, 3 Unit II : Chapters 4, 5 Unit III : Chapters 6, 11 2. Artificial Intelligence: A Guide to Intelligent Systems, 3rd edition, Michael Negnevitsky, Addison Wesley, 2011.[Unit IV-Chapter 1,2,4,V-Chapter 6] 3. Artificial Intelligence a modern Approach "– Stuart Russell & Peter Norvig, 3rd Edition Pearson Education[Unit V-Chapter 25-Robotics]
Reference Books	1. "Artificial Intelligence a modern Approach "– Stuart Russell & Peter Norvig, 3rd Edition, Pearson Education. 2. "Artificial Intelligence ", George F Luger , 4thEdition , Pearsons Education Publ, 2002. 3. "Foundations of Artificial Intelligent And Expert Systems", V S Janaki Raman, K Sarukesi, P Gopalakrishnan, Macmillan India Limited
Website and e-Learning Source	1. https://www.techopedia.com/definition/190/artificial-intelligence-ai 2. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligent_systems.htm 3. https://data-flair.training/blogs/heuristic-search-ai/ 4. http://teaching.csse.uwa.edu.au/units/CITS7212/Lectures/Students/Fuzzy.pdf 5. http://engineering.nyu.edu/mechatronics/smart/pdf/Intro2Robotics.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the applicability, strength and weakness of artificial intelligence in solving computational problems
CLO2	Demonstrate the role of knowledge representation, problem solving and learning in Intelligent-system engineering

CLO3	Identify the characteristics of AI, Knowledge representation, Experts systems and its variants with ANN and robotics.
CLO4	Analyze a comprehensive background in both software and hardware to work with the future of robotics and adaptive systems
CLO5	Assess the scientific background through various real time examples

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CLO1	**3**	**3**	**3**	**3**	**2**	**2**
CLO2	**3**	**3**	**3**	**3**	**2**	**2**
CLO3	**3**	**2**	**3**	**3**	**3**	**3**
CLO4	**3**	**2**	**2**	**3**	**3**	**2**
CLO5	**3**	**2**	**3**	**3**	**3**	**2**
Weightage of course contribute to eachPSO	**15**	**12**	**12**	**15**	**13**	**11**

Title of the Course		**INTRODUCTION TO ROBOTICS**					
Paper Number		**ELECTIVE VI (EC6)**					
Category	Elective	**Year**	I	**Credits**	3	**Course Code**	
		Semester	I				
Instructional Hours per week		**Lecture**	**Tutorial**		**Lab Practice**	**Total**	
		4	1		-	5	
Pre-requisite		Understanding of basic physics					
Objectives of the Course		To introduce students to fundamental components, functionality of Robotic systems and to provide knowledge in the design and development challenges in the field of robotics.					
Course Outline							

	UNIT-I : **Introduction**-Definition of Automation-Mechanization Vs Automation-Advantages-Goals-Social Issues-Types-Current Emphasis in Automation-Issues in automation in Factory Operations-Strategies of Automation
	UNIT-II : **Introduction** -History of Robots- Definition- Laws of Robotics-Characteristics-Components-Comparison of the Human and the Robot Manipulator-Robot Wrist and End of Arm Tools-Robot Terminology-Robotic Joints-Classification-Selection-Workcell-Robotics and Machine Vision-Applications
	UNIT-III : **Robot Components**: **Sensors**: Exteroceptors Sensors -Tactile Sensors -Proximity Sensors-Range Sensors-Machine Vision Sensors-Velocity Sensors-Proprioceptors-Robots with sensors- - **End Effectors**: Grippers-selection of grippers-Gripping mechanism- tools-Types of Grippers- **Drives**: Pneumatic, Hydraulic, Electric Actuators
	UNIT-IV : **Transformations**: Introduction to Manipulator Kinematics - Homogeneous Transformations-Robot Kinematics-Manipulator Path Control-Robot Dynamics- **Robot Programming Techniques**: Online programming- Lead-through Programming-Offline Programming-Task Level Programming-Motion Programming-Robot Programming Languages-Robot languages and its types
	UNIT-V: **Applications of Robots**: Robot Capabilities-Application of Robots-Manufacturing Applications-Material handling applications **Robotics and Artificial Intelligence:** Vision-Voice communication-Planning-Modelling-Adaptive control-Error monitoring and recovery-Autonomy and intelligence in robots-Expert systems in robotics

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Gupta.A.K, Arora. S. K., Industrial Automation and Robotics, Mercury Learning and Information, 2017(Unit I,II ,III,IV,V) 2. Mikell P Groover, "Industrial Robotics", Mc GrawHill, 2012.(Unit III: Drives :Fundamentals of Robot technology - Robot Drive systems, Unit IV: Transformations) 3. D.J.Todd, "Fundamentals of Robot Technology", An Introduction to Industrial Robots, Teleoperators and Robot Vehicles, Wiley,1986.(Unit V:Robotics and Artificial Intelligence)
Reference Books	1. Thomas. K. Rufuss, "Robotics and Automation Handbook", CRC Press, 2018 2. Ghoyal.K., Deepak Bhandari, "Automation and Robotics", S.K.Kataria& Sons Publishers, 2012. 3. John.J. Craig, "Introduction to Robotics: Mechanics and Control", Pearson, 2018. 4. Gonzalez, Fu Lee, Robotics: Control, Sensing, Vision and Intelligence, Wiley, 1998
Website and e-Learning Source	1. https://builtin.com/robotics 2. https://www.elprocus.com/robot-sensor/ 3. https://sp-automation.co.uk/the-top-seven-types-of-robots/ 4. https://robots.ieee.org/learn/types-of-robots/ 5. https://www.intel.in/content/www/in/en/robotics/types-and-applications

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes

CLO1	Outline the anatomy, specifications and applicability of Robotic system
CLO2	Demonstrate the role of kinematics and dynamic behavior of robots with programming techniques
CLO3	Identify the characteristics and functionality of robots in various sectors.
CLO4	Analyze the various functionality of robotic systems with respect to software and hardware components
CLO5	Assess the scientific background of robotic systems through various real time examples

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**1**	**1**	**2**	**2**	**2**
CLO2	**3**	**3**	**3**	**3**	**3**	**2**
CLO3	**3**	**2**	**3**	**3**	**3**	**3**
CLO4	**3**	**2**	**2**	**3**	**3**	**2**
CLO5	**3**	**2**	**3**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**10**	**10**	**14**	**14**	**12**

Title of the Course		**VIRTUAL AND AUGMENTED REALITY**					
Paper Number		**ELECTIVE VI (EC6)**					
Category	Elective	**Year**	I	**Credits**	3	**Course Code**	
		Semester	I				
Instructional Hours		**Lecture**		**Tutorial**		**Lab Practice**	**Total**

per week	4	1	-	5
Pre-requisite	Basic knowledge of computer graphics			
Objectives of the Course	To provide knowledge on basic principles of virtual & augmented reality and have the ability to use its technology as a platform for real-world applications.			
Course Outline				
	UNIT-I : **Virtual Reality**: The Three I's of VR – History – Early commercial VR Technology – Components of a VR System –**Input Devices:** Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces			
	UNIT-II : **Output Devices:** Graphics Displays – Sound Displays – Haptic Feedback - **Computer Architecture for VR:** The Rendering Pipeline- PC Graphics Architecture - **VR Programming:** Toolkits and Scene Graphs – Traditional and Emerging Applications of VR			
	UNIT-III : **Augmented Reality**: Introduction – **Augmented Reality Concepts:** Working Principle of AR –Concepts related to AR- Ingredients of an Augmented Reality Experience			
	UNIT-IV : Augmented Reality Hardware– Augmented Reality Software– Software to create content for AR Application – Tools and Technologies			
	UNIT-V: **Augmented Reality Content:** Introduction- Creating Content for Visual, Audio, and other senses – Interaction in AR - **Mobile Augmented Reality:** Introduction – Augmented Reality Applications Areas- Collaborative Augmented Reality			

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. Grigore C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Wiley Student Edition , Second Edition (Unit I: Chapter 1,2 & Unit II: Chapter 3,4,6,8 & 9) 2. Alan B. Craig(2013), "Understanding Augmented Reality: Concepts and Applications"(Unit III: Chapter 1, 2, Unit IV : Chapter 3, 4 & Unit V: Chapter 5,6,8) 3. Jon Peddie (2017), "Augmented Reality: Where We Will All Live", Springer, Ist Edition (Unit IV: Chapter 7 (Tools & Technologies)
Reference Books	1. Alan Craig & William R. Sherman & Jeffrey D. Will, Morgan Kaufmann(2009), "Developing Virtual Reality Applications: Foundations of Effective Design", Elsevier(Morgan Kaufmann Publishers) 2. Paul Mealy (2018), "Virtual and Augmented Reality",Wiley 3. Bruno Arnaldi & Pascal Guitton & Guillaume Moreau(2018), "Virtual Reality and Augmented Reality: Myths and Realities", Wiley
Website and e-Learning Source	1. Manivannan, M., (2018), "Virtual Reality Engineering," IIT Madras, https://nptel.ac.in/courses/121106013 2. Dube, A., (2020), "Augmented Reality - Fundamentals and Development," NPTEL Special Lecture Series, https://www.youtube.com/watch?v=MGuSTAqlZ9Q 3. http://msl.cs.uiuc.edu/vr/ 4. http://www.britannica.com/technology/virtual reality/Living-in -virtual-worlds 5. https://mobidev.biz/blog/augmented-reality-development-guide

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Outline the basic terminologies, techniques and applications of VR and AR
CLO2	Describe different architectures and principles of VR and AR systems
CLO3	Use suitable hardware and software technologies for different varieties of virtual and augmented reality applications
CLO4	Analyze and explain the behavior of VR and AR technology relates to human perception and cognition
CLO5	Assess the importance of VR/AR content and interactions to implement for the real-world problem

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CLO1	**3**	**1**	**1**	**2**	**2**	**2**
CLO2	**3**	**2**	**2**	**2**	**2**	**2**
CLO3	**3**	**2**	**2**	**3**	**3**	**3**
CLO4	**3**	**2**	**2**	**3**	**3**	**2**
CLO5	**3**	**2**	**3**	**3**	**3**	**3**
Weightage of course contribute to eachPSO	**15**	**9**	**10**	**13**	**13**	**12**