M.Sc.

INFORMATION TECHNOLOGY

SYLLABUS

THOSE WHO JOINED FROM THE ACADEMIC YEAR

2024 - 2025

MANONMANIAM SUNDARANAR UNIVERSITY
THIRUNELVELI – 627 012

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

PG PROGRAMME – AFFILIATED COLLEGES

M.Sc. INFORMATION TECHNOLOGY

(Choice Based Credit System)

(with effect from the academic year 2024-2025)

PREAMBLE

The Learning Outcome-based Curriculum Framework (LOCF) approach has been adopted in M.Sc Information Technology Programme to create and disseminate knowledge to the students on the latest technologies by imparting the technical skills to meet industrial needs and inculcate the skills for employability at the point of graduation.

Vision

Empowering students with computing knowledge to stay in forefront of state-of-art technologies for rendering the need based services to the society.

Mission

- To impart quality based education by inculcating technical, entrepreneurship and leadership skills to meet global challenges.
- To enable the students acquire the skill of employability and entrepreneurship.

Programme Educational Objectives (PEOs):

PEO 1: To equip students with the advanced concepts of Information Technology.

PEO 2: To help students in getting employment by mastering their skills.

PEO 3: To nurture creative thinking and make the students capable of undertaking innovative practices.

PEO 4: To develop environmental awareness, empowerment of humanity and civic consciousness.

PEO 5: To build the ability to cope with the changing environment

PEO 6: To mould them as responsible citizens by imparting value based education.

Program Outcomes (POs):

On successful completion of the M.Sc. Information Technology program, the

graduates will be:

PO 1: Knowledge: Gain in-depth knowledge of software and hardware techniques

PO 2: Problem solving: Ability to critically analyze and provide software solutions for problems

PO 3: Environment and sustainability: Understand the impact of software solutions in environmental and societal context and strive for sustainable development.

PO 4: Team Work: Work in teams to accomplish the objective.

PO 5: Communication Skills: Able to communicate effectively.

Programme Specific Outcomes (PSOs):

PSO 1: Understand and analyze the advanced knowledge in the Information Technology domain.

PSO 2: Enhance the logical and analytical thinking to understand the computational systems.

PSO 3: Ability to comprehend the development methodologies of software systems and to design the software solutions.

PSO 4: Explore the developing areas in the Information Technology sector and to enrich themselves to be skillful to meet the diverse expectations of the industry.

PSO 5: Equipped to be competent in providing optimal and ethical solutions to the technological challenges laid by the professional societies.

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**
PSO 1	S	S	L	S	S
PSO 2	S	S	S	S	S
PSO 3	M	S	M	S	M
PSO 4	S	S	S	S	S
PSO 5	L	S	S	S	S

S – Strong, M- Medium, L- Low

REGULATIONS/ PROGRAMME SPECIFIC REQUIREMENTS

Duration of the Course:

M.Sc. Information Technology is a 2 years full time programme spread over four semesters.

Eligibility for Admission to the Programme

Candidates who have studied Bachelor's degree in relevant disciplines like B.Sc. in IT/CS, BCA, BE/BTech in IT or CS from recognized university are eligible for this programme (as specified in the admission guidelines given by the Directorate of Collegiate Education 2024-'2025 www.tndce.tn.gov.in)

SEMESTER WISE COURSE LIST
FIRST YEAR
Semester-I

Specification	Courses	Credits	No. of Hours
Core – I	Mathematical Foundation for Information Technology	4	5
Core – II	Python Programming	4	5
Core – III	Java with Networking	4	4
Core – IV [LAB]	Python Programming – Practical	3	4
Core – V [LAB]	Java with Networking– Practical	3	4
Elective – I	Distributed Operating System / Green Computing / Human Computer Interaction	3	4
Elective – II	Data Communication & Networking / Block Chain Technology / Internet of Things and its Applications	3	4
		24	**30**

Semester-II

Specification	Courses	Credits	No. of Hours
Core – VI	Relational Database Management System	4	5
Core – VII	Data Structures and Algorithms	4	5
Core – VIII [LAB]	RDBMS - Practical	3	4
Core – IX [LAB]	Data Structures and Algorithms - Practical	3	4
Elective – III	Compiler Design / Intelligent Systems / Robotics and its Applications	3	4
Elective – IV	Software Project Management / Software Testing / Object Oriented Analysis and Design	3	4
Skill Enhancement Course – I	Open Source Technologies	2	4
		22	**30**

SECOND YEAR
Semester – III

Specification	Courses	Credits	No. of Hours
Core – X	R Programming	4	5
Core – XI	Research Methodology	4	4
Core – X1I	Wireless Networks and Mobile Computing	4	4
Core – XIII [LAB]	Data Analytics using R - Practical	3	4
Core – XIV [PRJ]	Mini Project	6	6
Elective – V	Cryptography & Network Security / Big Data Analytics / Distributed and Cloud Computing	3	4
Skill Enhancement Course – II	Soft Computing	2	3
	Internship	2	-
		28	**30**

Semester-IV

Specification	Courses	Credits	No. of Hours
Core – XV	Project with Viva Voce	16	30
	Extension Activity	1	-
		17	**30**

Total Credits : 91

Scheme of Evaluation (THEORY): Core/ Elective/ Skill Enhancement Courses

Total Marks:100 (Internal:25 Marks, External:75Marks

There is no Passing Minimum for the CIA component. But overall(CIA + External),the student should get 50% or more to get a pass	
CIA-Internal Marks	**External Marks**
i. Average of best two tests from three: 15 Marks ii. Assignment: 05 Marks iii. Seminar: 05 Marks	End Semester Examination
Total: 25 Marks	Total: 75 Marks
Minimum Passing 50% i.e. 38marks	

Scheme of Evaluation (PRACTICAL): Core / Skill Enhancement Course

Total Marks:100 (Internal:50 Marks, External:50 Marks

There is no Passing Minimum for the CIA component. But overall(CIA + External),the student should get 50% or more to get a pass	
CIA-Internal Marks	**External Marks**
i. Completion of Practical in time : 20 Marks ii. Model Practical Test : 20 Marks iii. Completion of Record work: 10 Marks	End Semester Practical Examination
Total: 50 Marks	Total: 50 Marks
Minimum Passing 50% i.e. 38 marks	

Scheme of Evaluation (PROJECT)

Total Marks:100 (Internal:50 Marks, External:50 Marks

There is no Passing Minimum for the CIA component. But overall(CIA + External),the student should get 50% or more to get a pass	
CIA-Internal Marks	**External Marks**
i. Completion of Project in time : 10 Marks ii. Review marks(3 reviews) : 30 Marks iii. Completion of Report work: 10 Marks	End of IV Semester Project Submission and Viva-voce Examination
Total: 50 Marks	Total: 50 Marks
Minimum Passing 50% i.e. 38marks	

Project : Individual Project report should be submitted at the end of IV semester for external evaluation. Internal – 50 Marks, External – 50 Marks (Total 100 Marks). The internal marks should be given based on the presentation of three reviews(0^{th} review -10 Marks, 1^{st} review – 10 Marks, 2^{nd} review – 10 Marks) and the performance assessment of the guide (Project completion in time 10 Marks and Report 10 Marks).

External (End Semester) Examination Question Pattern

Time: 3 hours Max. Marks: 75

Part– A (15 x 1 = 15)

Answer all the questions

Ten Questions, three objective type questions from each unit.

Part–B (5 x 4 = 20)

Answer all the questions

Five Questions, two short answer type questions from each unit with internal choice (Either ... Or ...type)

Part–C (5 x 8 = 40)

Answer all the questions

Five Questions, two descriptive/Analytical type questions from each unit with internal choice (Either... Or …type)

Internship/Industrial visit/Field visit/Research Knowledge Updation Activity:

- A report should be submitted at the end of III semester and evaluated by external examiners.
- Internal – 50 Marks, External – 50 Marks (Total : 100 Marks)
- Internship students should submit certificate of attendance from the industry along with report.

Extension Activity :

- Outreach Activities / Conducting Virtual Presentations
  - Outreach Activities
    - Creating awareness of the usage of Computers in remote places
    - Performing any computer exhibition in a village
    - Conducting any type of awareness programmes using computers/ software
  - Conducting Virtual Presentations
    - Encourage the school students through some presentations
    - Conducting higher education awareness among school students using computers
- External examination will be conducted at the end of IV semester.
- Internal – 50 Marks, External – 50 Marks (Total : 100 Marks)

Title of the Course	MATHEMATICAL FOUNDATION FOR INFORMATION TECHNOLOGY									
Category	CORE		**Paper Number**	CORE I						
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	4	0	0	I	I	4	5	25	75	100

Objectives of the Course

1. Propositional function, quantifiers, rules of inference.
2. Binary relations, posets, Hasse diagram, lattice, Functions, and pigeonhole principle.
3. Algebraic structures like groups and elementary combinatorics.
4. How to generate various types of functions recursively and solve them.
5. Various concepts in graphs like its representation, planar graphs, graph coloring andtrees

Course Outline

UNIT I : MATRIX ALGEBRA Matrices - Rank of a matrix - Solving system of equations Eigenvalues and Eigenvectors - Cayley - Hamilton theorem - Inverse of a matrix.

UNIT II : BASIC SET THEORY Basic definitions - Venn diagrams and set operations - Laws of set theory -. Relations - Properties of relations - Matrices of relations - Closure operations on relations - Functions - Injective, subjective and objective functions-Hermitian and Unitary operators/matrices.

UNIT – III : COMBINATORICS Review of Permutation and Combination - Mathematical Induction - Pigeon hole principle - Principle of Inclusion and Exclusion

UNIT IV : MATHEMATICAL LOGIC Propositions and logical operators - Truth table - Propositions generated by a set - Equivalence and implication - Basic laws - Some more connectives - Functionally complete set of connectives - Normal forms - Proofs in propositional calculus - Predicate calculus

	UNIT V : GRAPH THEORY: Graphs: An Introduction, Special Graphs, Subgraph, Degree of a Vertex – The Concept, Given a Degree Sequence – How to Draw the Graph? Adjacency Matrices, Incidence Matrices, Isomorphism of Graphs, Paths and Circuits, Euler Paths, Hamiltonian Circuit, the Travelling Salesman Problem, Shortest Path Problem
Extended Professional Component	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) (is a part of internal component only, Not to be included in the External Examination question paper)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	1. J.P Trembley, R. Manohar, "Discrete Mathematical structures with applications to Computer Science", Tata McGrawHill publications, 2017 2. Seymour Lipschutz, Marc Lipson, "Discrete Mathematics", Revised Third Edition, Schaum's Outline Series, Tata McGraw Hill Publications, 2002. 3. John Vince, "Foundation Mathematics for Computer Science, A Visual Approach", Springer, 2015. 4. Jayant Ganguly, "Mathematical Foundations for Computer Science Engineers", PHI, 2011
Reference Books	1. K. Trivedi, "Probability and Statistics with Reliability, Queuing, and Computer ScienceApplications", Wiley, 2016. 2. M. Mitzenmacher and E. Upfal, "Probability and Computing: Randomized Algorithms andProbabilistic Analysis", Cambridge University Press, 2005. 3. Alan Tucker, "Applied Combinatorics", 6th Edition, Wiley 2012.
Website and e-Learning Source	https://nptel.ac.in/courses/106/106/106106183/ https://nptel.ac.in/courses/111/105/111105035/ https://nptel.ac.in/courses/111/102/111102133/ https://nptel.ac.in/courses/106/103/106103015/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1. Apply mathematical concept for Information Technology problem solving.

CLO2. Design mathematical models for real time projects and applications.

CLO3. Analyze each learning model from a different algorithmic approach

CLO4. Acquire knowledge of relations, functions and mathematical logic

CLO5. Understand the basic concepts of Graph Theory

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	2
CO2	3	2	2	3	3	2
CO3	3	2	3	3	3	3
CO4	3	2	3	3	3	3
CO5	3	2	2	3	3	3
Weightage of course contributed to each PSO	15	10	12	15	15	13

Title of the Course			PYTHON PROGRAMMING							
Category		CORE		Paper Number			CORE II			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	5	0	0	I	I	4	5	25	75	100
Pre-requisite	Basic understanding on object oriented programming concepts									
Objectives of the Course	To acquire programming skills in core Python and to develop database applications in Python									
Course Outline	**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									

	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 – EncapsulationInheritance – 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"reillyMedia, 5 th Edition. 2. Timothy A. Budd, (2011), "Exploring Python", Tata MCGraw Hill Education PrivateLimited, First Edition. 3. Allen Downey, Jeffrey Elkner, Chris Meyers, (2012), "How to think like a computerscientist: 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 each PSO	**15**	**13**	**15**	**15**	**13**	**15**

Title of the Course		**JAVA WITH NETWORKING**						
Category		CORE		**Paper Number**			CORE III	
Course							**Inst.**	**Marks**

Code	L	T	P	Year	Semester	Credits	Hours	CIA	External	Total
	4	0	0	I	I	4	4	25	75	100

Pre-requisite	Basic understanding on Java concepts
Objectives of the Course	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.
Course Outline	**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
	UNIT-II : String Handling Functions – Collections Framework: Collection Classes, StringTokenzier, Date, Calendar - Abstract Classes - Packages and Interfaces: Packages – Access Protection Importing Packages – Interfaces
	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
	UNIT-IV : The Applet Class-Event Handling – Introducing the AWT: Working with windows, graphics andText, Using AWT Controls, Layout Managers and Controls - Developing JavaServer Pages
	UNIT-V: **Developing Servlets** -Structuring Web application with the MVC pattern – Sessions andCookies - 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 each PSO	15	13	13	12	14	13

Title of the Course			PYTHON PROGRAMMING - PRACTICAL						
Category		CORE	Paper Number			CORE IV			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	0	0	4	I	I	3	4	50	50	100
Pre-requisite	Basic understanding of C, C++ and Java programming languages									
Objectives of the Course	This course gives practical experience in Python basics, Object Oriented programming like Classes, Inheritance, and Polymorphism, GUI Applications and Database connection.									
Course Outline	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"reillyMedia, 5 th Edition. 2. Timothy A. Budd, (2011), "Exploring Python", Tata MCGraw Hill Education PrivateLimited, First Edition. 3. Allen Downey, Jeffrey Elkner, Chris Meyers, (2012), "How to think like a computerscientist: 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	PSO 1	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**

Title of the Course					**JAVA WITH NETWORKING – PRACTICAL**					
Category		CORE		**Paper Number**			CORE V			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	0	0	4	I	I	3	4	50	50	100

Pre-requisite	Students should able to know the concept of Java Fundamentals, Applet, Swings, JDBC, JavaBeans.
Objectives of the Course	• Using Graphics, Animations and Multithreading for designing Simulation and Game based applications. • Design and develop GUI applications using Abstract Windowing Toolkit (AWT), Swing and Event Handling. • Design and develop Web applications • Designing Enterprise based applications by encapsulating an application's business logic. • Designing applications using pre-built frameworks.
Course Outline	**1.** Write a program to create a JTable. **2.** Convert an image in RGB to a grayscale image. **3.** Count number of access times of the servlet page. **4.** Write a program to display a string in frame window with pink color as background. **5.** Create chat application using either TCP or UDP protocol. **6.** Implement TCP Server for transferring files using Socket and Server Socket. **7.** Implement Student information system using JDBC and RMI. **8.** Create Servlet file and study web descriptor file. **9.** Write a program to design simple calculator with the use of Grid Layout. **10.** Create login form and perform state management using Cookies, HTTP Session and URL Rewriting. **11.** Write an Applet which will lay two sound notes in a sequence continuously use the play () methods available in the applet class and the methods in the audio clip interface. **12.** Write a program to demonstrate the use of InetAddress class and its factor methods. **13.** Create Servlet file which contains following functions: 1. Connect 2. Create Database 3. Create Table 4. Insert Records into respective tables 5. Update records of particular table in database

	6. Delete Records from table. 7.Delete table and also database **14.** Develop Simple Servlet Question Answer Application using Database **15.** Develop simple shopping cart application using EJB [Stateful Session Bean].
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	Java the Complete Reference, ninth edition by Herbert Schild, Publisher: McGraw Hills
Reference Books	**1.** Head First EJB 3.0 by Kathy Sierra, Bert Bates, Publisher: O'Reilly Media **2.** Head First Servlets and JSP by Bryan Basham, Kathy Sierra & Bert Bates, Publisher: O'Reilly Media **3.** Just Hibernate, A Lightweight Introduction to the Hibernate Framework by Madhusudhan Konda, Publisher: O'Reilly Media **4.** Programming Jakarta Struts, 2nd Edition by Chuck Cavaness, Publisher: O'Reilly Media
Website and e-Learning Source	https://nptel.ac.in/courses/106/105/106105191/ https://onlinecourses.nptel.ac.in/noc19_cs84/preview

CO's	**Course Outcomes**
CLO1	Learn the Internet Programming, using Java Applets
CLO2	Create a full set of UI widgets and other components, including windows, menus, buttons, checkboxes, text fields, scrollbars and scrolling lists, using Abstract Windowing Toolkit (AWT) & Swings
CLO3	Apply event handling on AWT and Swing components.
CLO4	learn to access database through Java programs, using Java Data Base Connectivity (JDBC)
CLO5	Create dynamic web pages, using Servlets and JSP.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3
CO2	3	3	2	3	3	3
CO3	3	3	2	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	2	3	3	3
Weightage of course contributed to each PO/PSO	15	15	10	15	15	15

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="9">DISTRIBUTED OPERATING SYSTEM</td></tr>
<tr><td colspan="2">Category</td><td colspan="3">Elective</td><td colspan="3">Paper Number</td><td colspan="3">ELECTIVE I A</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">L</td><td rowspan="2">T</td><td rowspan="2">P</td><td rowspan="2">Year</td><td rowspan="2">Semester</td><td rowspan="2">Credits</td><td rowspan="2">Inst. Hours</td><td colspan="3">Marks</td></tr>
<tr><td>CIA</td><td>External</td><td>Total</td></tr>
<tr><td></td><td>4</td><td>0</td><td>0</td><td>I</td><td>I</td><td>3</td><td>4</td><td>25</td><td>75</td><td>100</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="9">Basic understanding of Operating Systems</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="9">This course gives clear idea about the Distributed operating system</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="9">UNIT – I
Fundamentals: What is Distributed Operating System? – Evolution of Distributed Computing System – Distributed Computing System Models – Why are Distributed Computing Systems gaining popularity? – What is a Distributed Computing System? – Issues in Designing Distributed Computing System – Introduction to Distributed Computing Environment (DCE). Computer Networks: Introduction– Network Types – LAN Technologies–WAN Technologies– Communication Protocols – Internetworking – ATM Technology.</td></tr>
<tr><td colspan="2"></td><td colspan="9">UNIT - II
Message Passing: Introduction –Desirable features of Good Message Passing System – Issues in IPC Message Passing – Synchronization – Buffering – Multi datagram Messages – Encoding and Decoding of Message Data– Process Addressing – Failure Handling – Group Communication</td></tr>
<tr><td colspan="2"></td><td colspan="9">UNIT - III
Remote Procedure Calls : Introduction– The RPC Model – Transparency of RPC– Implementing RPC mechanism–Stub Generation–RPC Messages–Marshaling Arguments and Results– Server Management– Parameter Passing Semantic–Call Semantics– Communication Protocol for RPC's – Complicated RPC's –Client Server Binding–Exception Handling–Security–Some Special Types of RPC's –RPC in Heterogeneous Environments – Light weight RPC. Distributed Shared Memory: Introduction – General Architecture of DSM Systems – Design and Implementation Issues of DSM – Granularity – Structure of Shared Memory – Consistency Models – Replacement Strategy – Thrashing–Other Approaches to DSM– Heterogeneous DSM –Advantages of DSM.</td></tr>
</table>

	UNIT – IV **Synchronization**: Introduction – Clock Synchronization – Event Ordering – Mutual Exclusion – Deadlock – Election Algorithms. Process Management: Introduction-Process Migration– Threads.
	UNIT – V **Distributed File System:** Introduction – Desirable features of a Good Distributed File System– File Models – File Accessing Models – File Sharing Semantics – File Caching Schemes – File Replication – Fault Tolerance – Atomic Transactions – Design Principles.
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
Skills acquired from this course	Full details about the operating system and its usage in the computers
Recommended Text	1. Pradeep K Sinha,"Distributed Operating Systems", PHI Learning, 2012. 2. Andrew S Tanenbaum, "Distributed Operating Systems", First Edition, PHI 2002
Reference Books	3. George Coulouris, Gordon Blair, Jean Dollimore, Tim Kindberg, "Distributed Systems - Concepts and Design", Fifth Edition Pearson 2017. 4. Manish Varshney, Shanoo Agarwal, "Concepts Of Distributed System", CBS Publisher and Distributors, 2016.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Know the basic concepts of operating system
CLO2	Understand the details regarding the message passing
CLO3	Understand the Remote Procedure calls
CLO4	To know the synchronization
CLO5	To know about the distributed file system

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 each PSO	15	13	15	15	13	15

Title of the Course				GREEN COMPUTING					
Category		Elective		Paper Number			ELECTIVE I B		
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks	
								CIA	External	Total
	4	0	0	I	I	3	4	25	75	100
Pre-requisite	Understanding the Computer Science fundamentals									
Objectives of the Course	To understand the fundamentals of green computing To understand the details about Green Servers and Data Centers To understand about Reducing Greenhouse Gas Emissions To study about the Green Computing by Industry Segment									
Course Outline										
	UNIT I: Green Computing and Saving Money: Key Concepts –Getting Focused on Money- Saving Efforts – Implementing Energy Efficiency – Changing How Current Devices Are Used – Moving to Cloud Services – Digitizing Non-IT Functions – Greening Your Energy-Saving Moves – Some Big Thinking About Money- Saving Efforts. Green Computing and the Environment: Key Concepts – Environmental Drivers for Green Computing –Green Agenda– Key Roots of Environmentalism – Environmentalism and IT – The New Imperative of Climate Change – A Brief History of the Climate and Climate Change – The 2°C Warming "Limit" – Climate Change and IT –Next with Climate Change – What It Means to "Go Green"									

	UNIT II: A New Vision of Computing: Key Concepts – Cloud Computing Emerges – The End of the PC Era – Some New- Model IT – Challenges – A Few Examples from a Multinational – How a Company Adopted the iPhone – A Mental Model for IT Simplicity – Why Green Computing Fits the New Model – Disadvantages of Cloud Computing – Managing Disadvantages of Cloud Computing – What to Do Besides Cloud Computing – Efficiency and Cloud Computing – Greenability and Cloud Computing – Responsibility, Usability, and Cloud Computing – The Philosophical Implications of Green Computing – The Zen of Green Computing. Building a Green Device Portfolio : Key Concepts – Introduction
	UNIT III: Green Servers and Data Centers: Key Concepts – Choosing and Creating Green Data Centers – Green Data Centers as a Model – The Last Shall Be First –Data Center Green – Building and Power Supply Considerations – Servers, Storage, and Networking – Data Center Suppliers 59 Saving Energy: Key Concepts – Saving Energy Serves Many Masters – Cost Savings through Energy Savings – Risk Reduction through Energy Savings – Carbon Footprint Reduction through Energy Savings – Improving Your Reputation and Brand – Why Energy Prices Will Stay High –Embodied Energy – Analyzing Your Energy Usage – A Recipe for Energy Savings – Understanding the Unique Energy Needs of IT – Focusing on Solar Power – Saving Energy and the Supply Chain – Energy-Saving Pilot Projects – Selling Energy Savings
	UNIT IV: Reducing Greenhouse Gas Emissions: Key Concepts – Why Greenhouse Gas Emissions Are Important – Sources and Sinks of Greenhouse Gases and Warming –Reducing Emissions I: Embodied Energy – Reducing Emissions II: Daily Energy Use – Reducing Emissions III: Taking Steps to Use Different Sources – Reducing Emissions IV: Supply Chain Success. Reducing Resource Use: Key Concepts – Resource Use Is Important – A Resource Use Checklist – Planned Obsolescence and Resource Use – The Story of Apple and EPEAT – Case Study: Computer Hardware and RSI

	UNIT V: Green Computing by Industry Segment: Key Concepts – Evaluating Greenness – The Newsweek – Green 500 Approach – Looking at Industry Segments – Analyzing Your Own Initiatives, Company, and Sector. The Future: Deep Green Computing: Key Concepts – Green Computing and the Future – Megatrends for Green Computing – An Increasing Need for Sustainability – The Continually Decreasing Cost of Core Computing Capabilities – The Ability of Computing to Do More and More Telepresence Instead of Travel – Telecommuting Instead of Commuting – Toward Deep Green Computing – Platforms for Deep Green Computing – Selling Deep Green Computing.
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	Green computing, Reducing Greenhouse Gas Emissions, Green Computing by Industry Segment, Green Servers and Data Centers
Recommended Text	Bud E. Smith, Green Computing Tools and Techniques for Saving Energy, Money and Resources, CRC Press, 2014.
Reference Books	1. TobyVelte, Anthony Velte, Robert Elsenpeter, Green IT, McGraw Hill, 2008. 2. AlvinGalea, Michael Schaefer, Mike Ebbers, Green Data Center: Steps for the Journey, Shroff Publishers and Distributers, 2011
Website and e-Learning Source	1. https://blogs.nvidia.com/blog/2022/10/12/what-is-green-computing 2. https://www.techtarget.com/searchdatacenter/definition/green-computing 3. https://www.techopedia.com/definition/14753/green-computing

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Green Computing and Saving Money
CLO2	A New Vision of Computing
CLO3	Green Servers and Data Centers
CLO4	Reducing Greenhouse Gas Emissions
CLO5	Green Computing by Industry Segment

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 each PSO	15	11	8	13	13	13

Title of the Course			HUMAN COMPUTER INTERACTION						
Category		Elective		Paper Number		ELECTIVE IC			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	I	3	4	25	75	100
Pre-requisite	Understanding the impact of human factors and Computer Science fundamentals									
Objectives of the Course	To think constructively and analytically in designing and evaluating interactive technologies									
Course Outline										
	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								
	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								

	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/paperse n/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 each PSO	**15**	**11**	**8**	**13**	**13**	**13**

Title of the Course			**DATA COMMUNICATION AND NETWORKING**						
Category		Elective		**Paper Number**		ELECTIVE II A			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**	
								CIA	**External**	**Total**
	4	0	0	I	I	3	4	25	75	100

Pre-requisite	Basic knowledge about computer networks
Objectives of the Course	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
Course Outline	
	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)

Course 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**

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="9">BLOCK CHAIN TECHNOLOGY</td></tr>
<tr><td colspan="2">Category</td><td colspan="3">Elective</td><td colspan="2">Paper Number</td><td colspan="4">ELECTIVE VC</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">L</td><td rowspan="2">T</td><td rowspan="2">P</td><td rowspan="2">Year</td><td rowspan="2">Semester</td><td rowspan="2">Credits</td><td rowspan="2">Inst. Hours</td><td colspan="3">Marks</td></tr>
<tr><td>CIA</td><td>External</td><td>Total</td></tr>
<tr><td></td><td>4</td><td>0</td><td>0</td><td>I</td><td>I</td><td>3</td><td>4</td><td>25</td><td>75</td><td>100</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="9">Able to know the fundamentals of computer networks</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="9">The main objectives of this course are to:
To understand the concepts of block chain technology
To understand the consensus and hyper ledger fabric in block chain technology.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="9">UNIT - I
History: Digital Money to Distributed Ledgers -Design Primitives: Protocols, Security, Consensus, Permissions, Privacy- : Block chain Architecture and Design-Basic crypto primitives: Hash, Signature- Hash chain to Block chain-Basic consensus mechanisms.</td></tr>
<tr><td colspan="2"></td><td colspan="9">UNIT - II
Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Block chain consensus protocols: Permissioned Block chains-Design goals-Consensus protocols for Permissioned Block chains.</td></tr>
<tr><td colspan="2"></td><td colspan="9">UNIT - III
Decomposing the consensus process-Hyper ledger fabric components-Chain code Design and Implementation: Hyper ledger Fabric II:-Beyond Chain code: fabric SDK and Front End-Hyper ledger composer tool.</td></tr>
<tr><td colspan="2"></td><td colspan="9">UNIT - IV
Block chain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital markets-Insurance- Block chain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting</td></tr>
<tr><td colspan="2"></td><td colspan="9">UNIT - V
Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems: Block chain Cryptography: Privacy and Security on Block chain</td></tr>
</table>

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	Get the ideas to test the different software
Recommended Text	1. Mark Gates, "*Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and the future of money*", Wise Fox Publishing and Mark Gates 2017. 2. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "*Hands-On Block chain with Hyper ledger: Building decentralized applications with Hyperledger Fabric and Composer*", 2018. 3. Bahga, Vijay Madisetti, "*Block chain Applications: A Hands-On Approach*", Arshdeep Bahga, Vijay Madisetti publishers 2017.
Reference Texts	1. Andreas Antonopoulos, "*Mastering Bitcoin: Unlocking Digital Crypto currencies*", O'Reilly Media, Inc. 2014. 2. Melanie Swa, "*Block chain* ",O'Reilly Media 2014.
Web References	1. NPTEL & MOOC courses titled blockchain technology 2. blockgeeks.comguide/what-is-block-chain-technology https://nptel.ac.in/courses/106105184/

CLO1: State the basic concepts of block chain

CLO2: Paraphrase the list of consensus and Demonstrate and Interpret working of Hyper ledger Fabric

CLO3: Implement SDK composer tool and explain the Digital identity for government

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
Weightage of course contributed To each PSO	9	7	8	6	8	7

<table>
<tr><td colspan="3">Title of the Course</td><td colspan="8">INTERNET OF THINGS AND ITS APPLICATIONS</td></tr>
<tr><td colspan="3">Category</td><td colspan="3">Elective</td><td colspan="3">Paper Number</td><td colspan="2">ELECTIVE II C</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">L</td><td rowspan="2">T</td><td rowspan="2">P</td><td rowspan="2">Year</td><td rowspan="2">Semester</td><td rowspan="2">Credits</td><td rowspan="2">Inst. Hours</td><td colspan="3">Marks</td></tr>
<tr><td>CIA</td><td>External</td><td>Total</td></tr>
<tr><td></td><td>4</td><td>0</td><td>0</td><td>I</td><td>I</td><td>3</td><td>4</td><td>25</td><td>75</td><td>100</td></tr>
<tr><td colspan="3">Pre-requisite</td><td colspan="8">Basic understanding of computer hardware components and networking concepts</td></tr>
<tr><td colspan="3">Objectives of the Course</td><td colspan="8">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.</td></tr>
<tr><td colspan="3">Course Outline</td><td colspan="8"></td></tr>
<tr><td colspan="3"></td><td colspan="8">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</td></tr>
<tr><td colspan="3" rowspan="3"></td><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
</table>

	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 1. 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 each PSO	15	13	12	12	13	14

Title of the Course		RELATIONAL DATABASE MANAGEMENT SYSTEM								
Category		CORE		Paper Number			CORE VI			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	5	0	0	I	II	4	5	25	75	100
Pre-requisite	Fundamental computer knowledge that includes the hardware and memory storage.									
Objectives of the Course	To understand the basic DBMS models, architecture, query and to normalize the database. To Learn Transaction Processing, Recovery and Distributed Database.									

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**: LogRecords-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, SixthEdition, Tata Mcgraw Hill. 2. Ivan Bayross, SQL, PL/SQL The Programming Language of ORACLE, Fourth edition, BPBPublications. 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, TataMcGrawHill Publication. 4. RamezElmasri, Shamkant B. Navathe (2014), "Database Systems", Sixth edition, PearsonEducation, 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/(FunctionalDependencies)

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, andrecovery 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/SQLdatabase 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 each PSO	**15**	**13**	**15**	**15**	**15**	**12**

Title of the Course				**DATA STRUCTURES AND ALGORITHMS**						
Category		CORE		**Paper Number**			CORE VII			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	5	0	0	I	II	4	5	25	75	100

Pre-requisite	The Prerequisites for Data Structures And Algorithms is one must be aware of at least one programming language.
Objectives of the Course	By the end of the course the students will be able to ➢ Enumerate the Sorting Quick and Heap Sort, Radix Sort, AVL trees and Graph Traversals ➢ Summaries the Search Trees, building Optimal search trees, Height balanced and Weight balanced trees ➢ Interpret the problems using B –trees, Red Black Trees and Splay trees ➢ To Differentiate Interval Trees , Segment Trees, Trees for Weighted Intervals and Higher dimensional Segment Trees ➢ To Conceive various algorithmic paradigms for solving various kinds of problems
Course Outline	**UNIT-I :** **Primary Data Structures**, Time and Space Complexity Analysis Sorting – Quick and Heap Sort, Radix Sort, AVL trees, Graph Traversals Asymptotic notations, conditional asymptotic notations, Amortized analysis, NP complete and NP hard Time and Space complexity analysis by solving recurrence equations
	UNIT-II : **Optimization Data structures** Search Trees, building Optimal search trees, Height balanced and Weight balanced trees B –trees, Red Black Trees and Splay trees

	UNIT-III : **Data Structures for sets of Intervals** Interval Trees - Segment Trees, Trees for Weighted Intervals, Higher dimensional Segment Trees. Range Counting and Semi group model. K-d trees, Orthogonal Range trees, Leftist heap, Skew heap, Binomial heap and Fibonacci heaps.
	UNIT-IV : **Data structures for Strings & Transformations** Dynamic Structures, Persistent Structures, Tries, Compressed Tries, Suffix Trees and Suffix Arrays
	UNIT-V: **Advanced Algorithm Design** Dynamic Programming - Rod Cutting, Matrix chain multiplication, Longest Common Subsequence .Greedy Algorithms – Activity selection problem, Matroids and Greedy methods
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. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms: Third Edition", The MIT Press, 2014.
Reference Books	1. Thomas H.Cormen, "Algorithms Unlocked", The MIT Press, 2013 2. Peter Brass, "Advanced Data Structures", Cambridge University Press, 2014
Website and e-Learning Source	https://goalkicker.com/AlgorithmsBook/ https://nptel.ac.in/courses/106/102/106102064/ https://nptel.ac.in/courses/106/102/106102064/.

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: Explain how the choice of data structures and algorithm design methods impacts the performance of programs.
CLO 2: Describe the concept of Range Counting and Semi group model. K-d trees, Orthogonal Range trees, Leftist heap.
CLO 3: Design and implement an appropriate hashing function for an application.
CLO 4: Compare alternative implementations of data structures with respect to performance.
CLO 5: Contrast the benefits of dynamic and static data structures implementations.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	3	3
CO2	3	3	2	3	3	3
CO3	3	2	3	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	2	3	3	3
Weightage of course contributed to each PSO	15	13	11	15	15	15

Title of the Course			RDBMS PRACTICAL							
Category		CORE		Paper Number			CORE VIII			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	0	0	4	I	II	3	4	50	50	100
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			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, BPBPublications
Reference Books	RamezElmasri, Shamkant B. Navathe (2014), "Database Systems", Sixth edition, PearsonEducation, 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**

Title of the Course		**DATA STRUCTURES AND ALGORITHMS - PRACTICAL**								
Category		CORE		**Paper Number**		CORE IX				
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	0	0	4	I	II	3	4	50	50	100

Pre-requisite	The Prerequisites For Data Structures And Algorithms is, one must be aware of at least one programming language.
Objectives of the Course	The main objectives of this course are to: ➢ Describe the concept of Activity selection of Huffman coding Implementations ➢ Design and implement of Spanning tree Implementations ➢ Explain the Implementation of Binary Search Tree ➢ Identify the Red Black tree Implementation
Course Outline	1. Implementation of Merge sort and quick sort Algorithms 2. Implementation of Binary Search Tree 3. Red Black Tree Implementation 4. Implementation of Heap Implementation 5. Implementation of Fibonacci Heap Implementation 6. Implementation of Graph Traversals 7. Implementation of Spanning Tree Implementation 8. Shortest path Algorithms(Dijkstra's, Bellman Ford Algorithms) 9. Implementation of Matrix Chain Multiplication 10. Activity selection and Huffman coding Implementation
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	Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms: Third Edition", The MIT Press, 2014.
Reference Books	Peter Brass, "Advanced Data Structures", Cambridge University Press, 2014
Website and e-Learning Source	1. https://goalkicker.com/AlgorithmsBook/ 2. http://algs4.cs.princeton.edu/home/ 3. techread.dev/en/books/about/algori...

By the end of the course the students will be able to

CLO 1: Define how the design of data structures and algorithm design methods impacts the performance of programs.

CLO 2: Implement the applications using Fibonacci Heap and shortest path Algorithms

CLO 3: Identify various algorithmic for Implementation of Matrix Chain Multiplication algorithms

CLO 4 : Demonstrate the creation of Graph Traversals methods and the concepts of Binary Search tree

CLO 5: Construct Data structure programs using Merge sort and Quick sort.

Develop programs for implementing trees and their traversal operations.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3
CO2	2	3	3	3	3	2
CO3	2	3	3	3	3	2
CO4	3	3	3	3	3	2
CO5	3	3	2	3	3	3
Weightage of course contributed to each PSO	13	15	13	15	15	12

Title of the Course	COMPILER DESIGN								
Category	Elective			Paper Number			ELECTIVE III A		
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	I	II	3	4	25	75	100
Pre-requisite	Basic knowledge in one of the programming language and data structures									
Objectives of the Course	To acquire the knowledge about the compiler design and to understand the different phases of Compiler									
Course Outline										

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

	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
	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 each PSO	**15**	**12**	**13**	**13**	**13**	**14**

Title of the Course				**INTELLIGENT SYSTEMS**					
Category		Elective		**Paper Number**			ELECTIVE III B		
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**	
								CIA	**External**	**Total**
	4	0	0	I	II	3	4	25	75	100
Pre-requisite	Basic knowledge of data mining concepts									
Objectives of the Course	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.									
Course Outline										
	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									
	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 each PSO	**15**	**12**	**12**	**15**	**13**	**11**

Title of the Course			**ROBOTICS AND ITS APPLICATIONS**						
Category		Elective		**Paper Number**			ELECTIVE IIIC		
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	4	0	0	I	II	3	4	25	75	100

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 each PSO	**15**	**10**	**10**	**14**	**14**	**12**

Title of the Course	**SOFTWARE PROJECT MANAGEMENT**									
Category	Elective			**Paper Number**			ELECTIVE IVA			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	4	0	0	I	II	3	4	25	75	100
Pre-requisite	Basic knowledge about the fundamentals of software project development									
Objectives of the Course	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									
Course Outline										
	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.									

	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	PSO 1	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 each PSO	**15**	**12**	**12**	**13**	**15**	**13**

Title of the Course	**SOFTWARE TESTING**									
Category	Elective			**Paper Number**			ELECTIVE VC			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	4	0	0	I	II	3	4	25	75	100

Pre-requisite	Able to know the fundamentals of software engineering
Objectives of the Course	The main objectives of this course are to: • To enable a clear understanding about software tester • To apply software testing knowledge and engineering concepts to detect errors in the software • To practice software oriented testing projects • To prepare software testing techniques and tools for industry standards.
Course Outline	**UNIT – I SOFTWARE QUALITY ASSURANCE** Introduction to Software Quality Engineering : What is software quality – Benefits of software quality – Software development life cycle model – Types of defects – Definitions used in software quality engineering - Software Quality Assurance and Quality Control - Software Configuration Management (SCM).Software Quality Assurance : Benefits of SQA – Role of SQA – SQA people – SQA plan – What is process – Process frame works. Reviews, Inspections and walkthroughs : Management and Technical reviews - Inspections and walkthroughs – Inspection forms and check lists – Rate of Inspection – Inspection metrics- Estimating total number of defects in the software.
	UNIT – II TESTING TECHNIQUES Introduction to Testing : Guiding Principles of testing – Composition of testing team – Essential skills of a tester – Types of Testing – Evaluating the quality of test cases – Techniques for reducing number of test cases – Requirements for effective testing – Test Oracle – Economics of Software testing – Handling defects – Risk in software testing – Requirements traceability matrix. White box (Structural) Testing : Introduction to control flow graph – Control flow testing – Basis path testing – Linear Code Sequence And Jump (LCSAJ) coverage or JJ –path coverage – Loop testing – Data flow testing – Slice-based testing – Pitfalls of white box testing – Tools for white box testing. Integration Testing : Types of Integration testing – Functional Decomposition based Integration – Call graph-based Integration – Path-based Integration – Smoke testing.
	UNIT – III FUNCTIONAL & NON-FUNCTIONAL TESTING Functional Testing : Logic-based Testing – State Transition Testing – Use Case-based Testing – Syntax Testing – Domain Testing – Petry Net-based testing – Tools used in Functional testing. Non-functional, Acceptance and Regression Testing : Non-functional Testing – Acceptance Testing - Regression Testing.

	UNIT – IV INCORPORATING SPECIALIZED TESTING TECHNIQUES Testing of OO Software and Agile Testing : Basics of OO system – Overview of UML diagram – OO Testing – Quality Metrics for OO Software – Agile Testing. Test Management: Activities in Test Management – Evaluation of Test Effectiveness – Release Management – Tools used in Test management. Cloud Testing: Introduction to Cloud computing – Cloud testing – Testing as a Service(TaaS).
	UNIT – V TEST AUTOMATION & QUALITY METRICS Test Automation : Advantages and disadvantages of test automation – Activities in test Automation - Test Automation Frame work – Tools for Test Automation – Script languages in Test Automation. Metrics for Software Quality : Categories of Software metrics – Metrics program – Types of Metrics – Some Commonly used Software Metrics. Tools for Quality Improvement: Basic Quality Control Tool – Check sheet – Cause and effect Diagram – Pareto Diagram – Histogram – Scatter Plot – Run chart – Control Chart – Orthogonal defect Classification.
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	Get the ideas to test the different software
Recommended Text	1. Anirban Basu, "Software Quality Assurance, Testing and Metrics", PHI, 2015. 2. Sandeep Desai, Abhishek Srivastava, "Software Testing A Practical Approach", PHI , 2016.
Reference Texts	1. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing Principles and practices", Pearson, 2012. 2. Aditya P Mathur, "Foundations of Software Testing", Pearson, 2011

CLO1: Get an insight into the process of various software testing techniques **CLO2:** Able to measure the performance of the using various metrics **CLO3:** Able to evaluate the system with various testing techniques and strategies

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
Weightage of course contributed To each PSO	9	7	8	6	8	7

Title of the Course				OBJECT ORIENTED ANALYSIS AND DESIGN						
Category		Elective		**Paper Number**			ELECTIVE IVC			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	4	0	0	I	II	3	4	25	75	100
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

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 each PSO	**15**	**11**	**11**	**15**	**11**	**14**

Title of the Course					**OPEN SOURCE TECHNOLOGIES**					
Category		SKILL		**Paper Number**			SKILL I			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	4	0	0	I	II	2	4	25	75	100
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 adatabase using PHP.								

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", WileyDreamTech 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 andconsistency 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 each PSO	15	13	15	11	11	13

Title of the Course			R PROGRAMMING						
Category		CORE	Paper Number			CORE XI			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	5	0	0	II	IIII	4	5	25	75	100
Pre-requisite	Basic idea about any programming language									
Objectives of the Course	To impart knowledge about Big-data To study the control structures and vectors. To study about the lists To study the factors and tables To study about the object oriented programming									
Course Outline										
	UNIT I: INTRODUCTION Evolution of Big Data - Best Practices for Big Data Analytics - Big Data Characteristics - Validating - The Promotion of the Value of Big Data - Big Data Use Cases - Characteristics of Big Data Applications - Perception and Quantification of Value - Understanding Big Data Storage - A General Overview of High-Performance Architecture - HDFS - MapReduce and YARN - MapReduce Programming Model									

	UNIT II: CONTROL STRUCTURES AND VECTORS Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, DataFrames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations
	UNIT III: LISTS Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DataFrames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations
	UNIT IV: FACTORS AND TABLES Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables, Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions R PROGRAMMING
	UNIT V: OBJECT-ORIENTED PROGRAMMING S Classes, Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation
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. Roger D. Peng, "R Programming for Data Science", 2012. 2. Norman Matloff, "The Art of R Programming - A Tour of Statistical Software Design", 2011.

Reference Books	1. Garrett Grolemund, Hadley Wickham, "Hands-On Programming with R: Write Your Own Functions and Simulations", 1st Edition, 2014 2. Venables, W.N., and Ripley, "S Programming", Springer, 2000.
Website and e-Learning Source	1. https://www.simplilearn.com 2. https://www.tutorialspoint.com/data-analytics-using-r-programming/index.asp 3. https://www.javatpoint.com/r-tutorial

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CO's	Course Outcomes
CLO1	Understanding the fundamentals of Big Data
CLO2	Study about control structures and vectors
CLO3	Get the knowledge about Lists
CLO4	Get the information about the factors and tables
CLO5	Object oriented Programming

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 each PSO	**15**	**11**	**11**	**13**	**14**	**13**

Title of the Course		**RESEARCH METHODOLOGY**								
Category		CORE		**Paper Number**		CORE XI				
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	4	0	0	II	IIII	4	4	25	75	100

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 defininga 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	3. R. Ganesan, "Research Methodology for Engineers", MIP Publishers, Chennai, 2011. 4. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
Reference Books	3. Peter S. Menell ,Mark A. Lemley, Robert P. Merges, "Intellectual Property in the New Technological "Vol. I Perspectives, 2021. 4. Laura R. Ford,"The Intellectual Property of Nations: Sociological and Historical Perspectives on a 5. RatanKhananabis and SuvasisSaha, "Research Methodology", Universities Press, Hyderabad, 2015. 6. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007. 7. 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 each PSO	**15**	**11**	**11**	**13**	**14**	**13**

Title of the Course		**Wireless Networks and Mobile Computing**								
Category		CORE		**Paper Number**		CORE I				
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	4	0	0	II	III	4	4	25	75	100

Pre-requisite	This course requires the understanding of Wireless Mobile computing and applications environment.
Objectives of the Course	Students will try to learn: ➢ Define the fundamentals of wireless networks. Summarize about Learning and analyzing the different wireless technologies. ➢ Interpret the process of building and mobile networks applications. ➢ Understand and evaluate emerging wireless technologies and computing environments ➢ Critically asses the design considerations for wireless networks and J2ME ➢ Conceive the security threats and related security standards on Wireless computing
Course Outline	**UNIT-I :** **Mobile Computing Architecture:** Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Wireless Networks : Global Systems for Mobile Communication (GSM and Short Service Messages (SMS): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Introduction to SMS, SMS Architecture, SM MT, SM MO, SMS as Information bearer, applications, GPRS and Packet Data Network, GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS, Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Introduction to WiMAX
	UNIT-II : Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices. Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6
	UNIT-III : **Mobile OS and Computing Environment :**Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators

	UNIT-IV : **Building, Mobile Internet Applications :** Thin client: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, HTML, cHTML, XHTML, VoiceXML
	UNIT-V: **J2ME:**Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP
Extended Professional Component (is a part ofinternal 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. Ashok Talukder, RoopaYavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
Reference Books	1. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003 2. Raj kamal: Mobile Computing, Oxford University Press, 2007. 3. ItiSahaMisra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.
Website and e-Learning Source	https://nptel.ac.in/courses/108/106/106106167/ https://nptel.ac.in/courses/117/104/117104099/ https://nptel.ac.in/courses/106/106/106106147/

Students will able to:

CLO1: Explain the basic concepts of wireless network and wireless generations

CLO 2: Demonstrate the different wireless technologies such as CDMA, GSM, GPRS etc

CLO 3: Appraise the importance of mobile computing networks and mobile client IP- Protocols

CLO 4: Explain the design considerations for deploying the wireless network infrastructure

CLO 5: Differentiate and support the security measures, standards. Services and layer wise security considerations

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	2	3	3
CO2	2	3	2	2	3	3
CO3	2	3	2	2	3	3
CO4	3	3	2	2	3	3
CO5	3	3	2	2	3	3
Weightage of course contributed to each PSO	12	15	10	10	15	15

Title of the Course				DATA ANALYTICS USING R - PRACTICAL						
Category		CORE		Paper Number		CORE IV				
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	0	0	4	II	III	3	4	50	50	100
Pre-requisite		Basic understanding of C, C++ and Java programming languages								
Objectives of the Course		This course gives practical experience in R Programming basics and different applications in data analytics								

Course Outline	1. To get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) using in R. 2. To perform data import/export (.CSV, .XLS, .TXT) operations using data frames in R. 3. To get the input matrix from user and perform Matrix addition, subtraction, multiplication, inverse transpose and division operations using vector concept in R. 4. To perform statistical operations (Mean, Median, Mode and Standard deviation) using R. 5. To perform data pre-processing operations i) Handling Missing data ii) MinMax normalization 6. To perform dimensionality reduction operation using PCA for Houses DataSet 7. To perform Simple Linear Regression with R. 8. To perform K-Means clustering operation and visualize for iris data set 9. Write R script to diagnose any disease using KNN classification and plot the results. 10. To perform market basket analysis using Association Rules (Apriori)
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	Programming knowledge in R Programming
Recommended Text	1. Roger D. Peng, "R Programming for Data Science", 2012. 2. Norman Matloff, "The Art of R Programming - A Tour of Statistical Software Design", 2011.

Reference Books	1. Garrett Grolemund, Hadley Wickham, "Hands-On Programming with R: Write Your Own Functions and Simulations", 1st Edition, 2014 2. Venables, W.N., and Ripley, "S Programming", Springer, 2000.
Website and e-Learning Source	1. https://www.simplilearn.com 2. https://www.tutorialspoint.com/data-analytics-using-r-programming/index.asp 3. https://www.javatpoint.com/r-tutorial

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 each PSO	**15**	**13**	**15**	**15**	**13**	**15**

Title of the Course	MINI PROJECT									
Category	CORE			**Paper Number**			CORE XIV			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	0	0	6	II	III	6	6	50	50	100
Pre-requisite	UG Level Programming knowledge									

Title of the Course	Cryptography and Network Security									
Category	Elective			**Paper Number**			ELECTIVE V A			
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	4	0	0	II	III	3	4	25	75	100
Pre-requisite	The Prerequisites of Cryptography and information security is to understand the principles and practices of cryptographic techniques									
Objectives of the Course	the students will be able to ➢ Understand a variety of generic security threats and vulnerabilities, and identify.(K1) ➢ Appreciate the application of security techniques and technologies in solving real life security problems in practical systems.(K2) ➢ Apply appropriate security techniques to solve security problem(K3,K4) ➢ Design security protocols and methods to solve the specific security problems. K5,K6)									
Course Outline	**UNIT-I :**Fundamentals and Mathematics of Cryptography Overview - Classical Crypto Systems – Substitution Ciphers – Transposition Ciphers- Stream and Block Ciphers – Introduction to Number Theory – Congruences – Chinese Remainder theorem – Modular Arithmetic - Modular Exponentiation – Fermats and Eulers Theorem - FiniteFields – GF(2n) Fields.									
	UNIT-II : Encryption Techniques Symmetric Encryption Techniques – DES – AES - Public-Key Cryptography and RSA – Key Management - Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Symmetric Key Distribution – Kerberos - X.509 Authentication Service - differential cryptanalysis - linear cryptanalysis - side channel attack - lattice reduction attack - MerkleHellman knapsack attack - Hellman's time-memory tradeoff (TMTO) attack.									
	UNIT-III : Hash Functions and Signatures Message Authentication and Hash Functions – Description of MD Hash Family – Secure Hash Algorithms – SHA 512 - Digital Signatures and Authentication Protocols – Digital Signature Standard – Process, Services, Attacks on Digital Signature- Digital Signature Schemes.									

	UNIT-IV : Security Practices Vulnerability Analysis - Flaw Hypothesis Methodology, NRL taxonomy and Aslam's model - Auditing - Anatomy of an Auditing System - Design of Auditing Systems - Posteriori Design - Auditing mechanisms - Risk Analysis and Management - Disaster Recovery Planning/Incident Response Planning - Intrusion Detection System
	UNIT-V: Secure Development Secure Coding - OWASP/SANS Top Vulnerabilities - Buffer Overflows - Incomplete mediation - XSS - Anti Cross Site Scripting Libraries - Canonical Data Format - Command Injection - Redirection - Inference – Application Controls - Secure Software Development Life Cycle - Testing, Maintenance and Operation - Evaluation of Security Systems.
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. William Stallings, "Cryptography And Network Security – Principles And Practices", PearsonEducation, Fourth Edition, 2006.
Reference Books	1. Wade Trappe And Lawrence C. Washington, "Introduction To Cryptography With Coding Theory" Second Edition, Pearson Education, 2007. 2. Mark Stamp, "Information Security: Principles And Practice", Wiley Inter Science, 2011.
Website and e-Learning Source	1. http://nptel.ac.in/courses/106105031/lecture by Dr. Debdeep Mukhopadhyay IIT Kharagpur **2.** https://ocw.mit.edu/courses/electrical-engineering-andcomputer-science/6-033-computer-system-engineering-spring2009/video-lectures/ lecture by Prof. Robert Morris and Prof. Samuel Madden MIT.

CLO1: To provide students with contemporary knowledge in Cryptography and Security.
CLO 2: To understand how cryptography can be used as an effective tool in providing assurance concerning privacy and integrity of information
CLO 3: To provide skills to design security protocols for security problems.
CLO 4: Analyze particular security problems for given application
CLO 5: Familiar with current research issues and directions of security

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO 6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
CO4	3	3	3	3	3	3
CO5	3	2	3	3	3	3
Weightage of course contributed To each PSO	15	12	14	12	14	13

Title of the Course		BIG DATA ANALYTICS							
Category		Elective		Paper Number			ELECTIVE V B		
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks	
								CIA	External	Total
	4	0	0	II	III	3	4	25	75	100

Pre-requisite	This course provides an in-depth understanding of terminologies and the core concepts behind big data problems, applications, systems and the techniques, that underlie today's big data computing technologies.
Objectives of the Course	By the end of the course the students will be able to ➢ Identify and distinguish big data analytics applications. ➢ Describe big data analytics tools. ➢ Present cases involving big data analytics in solving practical problems.
Course Outline	**UNIT-I :** **Overview of Big Data and Data Analytics** Overview of Big Data: Characteristics of Big Data-Big Data Sources-Challenges in Big Data processing-Scalability issues; Business Intelligence v/s Data Analytics-Need of Data Analytics- Data Analytics in Industries- Role of the Data Scientist. The Design of HDFS- HDFS Concepts- Blocks – Name nodes and Data nodes; The Command- Line Interface: Basic File system Operations; Hadoop File systems: Interfaces-The Java Interface-Data Flow; Hadoop **I/O:** Data Integrity-Compression-Serialization-File-based data structures**.**
	UNIT-II : **MapReduce and its application** Analyzing the Data with Unix Tools- Analyzing the Data with Hadoop- Map and Reduce- Java Map Reduce; Data Flow- Combiner Functions- Running a Distributed Map Reduce Job; Hadoop Streaming; Hadoop Pipes.

	UNIT-III : **Application development using MapReduce framework** The Configuration API- Configuring the Development Environment- Writing a Unit Test- Running Locally on Test Data- Running on a Cluster- Tuning a Job- MapReduce Workflows.
	UNIT – IV : **Working of MapReduce** Mining Data Streams: The Stream Data Model- Sampling data in a stream- Filtering Streams- The Bloom filter; Counting distinct elements in a stream- The Flajolet-Martin Algorithm. How stream works-Streams Processing Language; Apache Spark - Introduction- Features of Apache Spark- Components of Spark- Resilient Distributed Datasets- Data Sharing using Spark RDD-Spark Streaming.
	UNIT-V: **Analytics for Big Data in motion** Mining Data Streams: The Stream Data Model- Sampling data in a stream- Filtering Streams- Mining Social Network Graphs: Clustering of Social Network Graphs- Direct Discovery of Communities- Partitioning of Graphs- Finding overlapping communities- Simrank; Sentimentanalysis- Document sentiment classification- Rules of Sentiment Composition- Sentiment analysis using Twitter data.
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. Jure Leskovec, Anand Rajaraman, Jeff Ullman, "Mining of Massive Datasets", 2nd Edition, Cambridge University Press, UK, 2011.
Reference Books	1. Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw-Hill, 2012. 2. Liu, Bing. "Sentiment analysis and opinion mining." Synthesis lectures on human language technologies, Cambridge University Press, 2015. 3. Holden Karau, Andy Konwinski, Patrick Wendell, MateiZaharia, " Learning Spark: Lightning- Fast Big Data Analysis", O'Reilly Media, 2015. 4. David Loshin, Morgan, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL and Graph”, Kaufman Publishers, 2013.

Website and e-Learning Source	https://nptel.ac.in/courses/106/105/106105166/ https://onlinecourses.nptel.ac.in/noc21_ee85/preview

CLO1: To understand the basic knowledge of big data analytics.
CLO 2: To learn the techniques and tools for big data analytics.
CLO 3: To conduct application case studies to show the usage of big data analytics.
CLO 4: Design and develop program to big data analytics techniques.
CLO 5: Conduct big data analytics using system tools.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
CO4	3	3	3	3	3	3
CO5	3	2	3	3	3	3
Weightage of course contributed To each PSO	15	12	14	12	14	13

Title of the Course	Distributed and Cloud Computing									
Category	Elective			Paper Number			ELECTIVE V C			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	II	III	3	4	25	75	100
Pre-requisite	The Prerequisites of Cloud computing is it builds upon prior knowledge that students have on computing and software systems and programming knowledge.									

Objectives of the Course	The main objectives of this course are to: ➢ Classify and describe the architecture and taxonomy of Parallel and Distributed Systems Context.(K1) ➢ Cloud Virtualization, Abstractions and Enabling Technologies Characterize the distinctions between Infrastructure, Platform and Software as a Service (IaaS, PaaS, SaaS).(K2) ➢ Examine the design of task and data parallel distributed algorithms on Programming Patterns for "Big Data" Applications on Cloud.(K3,K4) ➢ Application Execution Models on Clouds.(K5) ➢ Illustrate the use of load balancing techniques for stateful and stateless applications.(K6)
Course Outline	**UNIT-I :** **Distributed Communication** Introduction to Distributed Systems – Characterization of Distributed Systems – Distributed Architectural Models –Remote Invocation – Request-Reply Protocols – Remote Procedure Call –Remote Method Invocation – Group Communication – Coordination in Group Communication– Ordered Multicast – Time Ordering – Physical Clock Synchronization – Logical Time and Logical Clocks.
	UNIT-II : **Distributed Resource Management** Global States– Distributed Mutual Exclusion – Election Algorithms – Distributed Deadlock – Distributed File System Architecture – HDFS – Map Reduce.
	UNIT-III : **Introduction to Cloud** Cloud Computing Overview – Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service , Broad network access , Location independent resource pooling , Rapid elasticity , Measured service. Architectural influences – High- performance Computing, Utility and Enterprise Grid Computing, Autonomic Computing, Service Consolidation, Horizontal scaling, Web services, High scalability Architecture. Cloud Benefits – Cloud Deployment Model: Public Clouds – Private Clouds – Community Clouds - Hybrid Clouds - Advantages of Cloud Computing.

	UNIT-IV : **Virtualization Techniques** Introduction to Virtual Machines, Emulation :Interpretation and Binary Translation, Process Virtual machines and System Virtual machines Virtualization : Virtualization and cloud computing - Need of virtualization – limitations – Types of Hardware Virtualization: Full Virtualization – Para Virtualization – Case Studies : Xen,VMware – Desktop Virtualization – Network Virtualization.
	UNIT-V: **Cloud Resources Management And Issues** Cloud architecture: Cloud delivery model, Cloud Storage Architectures, Software as a Service (SaaS): SaaS service providers – Google App Engine, Salesforce.com and googleplatfrom – Benefits – Operational benefits - Economic benefits – Evaluating SaaS – Platform as a Service (PaaS): PaaS service providers – Right Scale – Salesforce.com – Rackspace – Force.com – Services and Benefits – Infrastructure-as-a -Service (IaaS): IaaS Service Providers – Amazon EC2 – GoGrid.
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	George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems Concepts and Design, Fifth Edition, Pearson Education Asia, 2012.
Reference Texts	1. Distributed Systems - Principles and Paradigms, Andrew S. Tanenbaum,Maarten Van Steen, Second Edition, Pearson Prentice Hall, 2006. 2. MukeshSinghal, Advanced Concepts In Operating Systems, McGraw Hill Series in Computer Science, 1994. 3. Cloud Computing A Practical Approach - Anthony T.Velte, Toby J. Velte, Robert Elsenpeter Tata-McGraw- Hill , New Delhi – 2010.
Website and e-Learning Source	https://nptel.ac.in/courses/106/104/106104182/ https://onlinecourses.nptel.ac.in/noc21_cs15/preview

CLO1: Introduction to distributed systems and cloud computing.
CLO 2: Design, architectures and technology. Cloud applications, service quality and security.
CLO 3: Algorithms for synchronization, coordination, data sharing, resource allocation, consistency, fault tolerance.
CLO 4: Replication, consistency and concurrency control in transactional systems.
.**CLO 5:**Illustrate the use of load balancing techniques for stateful and stateless applications.
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CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO 6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
CO4	3	3	3	3	3	3
CO5	3	2	3	3	3	3
Weightage of course contributed To each PSO	15	12	14	12	14	13

Title of the Course	SOFT COMPUTING									
Category	Elective			Paper Number			ELECTIVE V C			
Course Code	L	T	P	Year	Semester	Credits	Inst. Hours	Marks		
								CIA	External	Total
	4	0	0	II	IV	3	4	25	75	100
Pre-requisite	Able to know the fundamentals of networks.									
Objectives of the Course	The main objectives of this course are to: • To explore the benefits computing methodologies like neural netwoks, fuzzy logic and genetic algorithms • To enable the students to develop hybrid systems for the industrial problems									

Course Outline	**UNIT - I NEURAL NETWORKS FUNDAMENTALS** Artificial Neural Network : Basic Concepts of Neural networks - Evolution of Neural networks - Basic Models of Artificial neural network - Terminologies of ANN- McCulloch - Pitts Neuron - Linear separability - Hebb Network - Applications of Neural networks. Supervised learning Network : Introduction – Perceptron Networks – Adaptive Linear Neuron – Multiple Adaptive Linear Neurons – Back propagation Network.
	UNIT – II CATEGORIES OF NEURAL NETWORKS Associative Memory Networks : Introduction – Training algorithms for pattern association – Auto associative Memory Network – Bidirectional Associative Memory – Hopfield Networks. Unsupervised Learning networks: Introduction – Fixed Weight Competitive Nets - Kohonen Self-Organizing Maps – Learning Vector Quantization – Adaptive Resonance Theory Network.
	UNIT – III BASIC CONCEPTS OF FUZZY SET Introduction to Classical Sets and Fuzzy Sets : Introduction - Classical sets - Fuzzy Sets. Classical Relation and Fuzzy Relations :- Introduction - Cartesian product of a relation - Classical Relation - Fuzzy Relations. Membership Functions : Introduction - Features of Membership Functions – Fuzzification - Methods of Membership Value Assignments. Defuzzification : Introduction - Lambda-Cuts for Fuzzy Sets - Lambda-Cuts for Fuzzy Relations - Defuzzification Methods.
	UNIT - IV FUZZY ARITHMETIC AND DECISION MAKING Fuzzy Arithmetic and Fuzzy Measures : Introduction - Fuzzy Arithmetic - Extension principles – Fuzzy measures. Fuzzy Rule Base and Approximate Reasoning : Introduction- Truth values and Tables in fuzzy logic - Fuzzy properties - Formation of rules- Decomposition of rules - Aggregation of Fuzzy rules - Fuzzy reasoning - Fuzzy Inference Systems. Fuzzy Decision Making : Individual Decision Making - Multiperson Decision Making - Multiobjective Decision Making - Multiattribute Decision Making. Fuzzy Logic Control Systems : Introduction - Control System Design - Architecture and Operation of FLC System.

	UNIT - V GENETIC ALGORITHMS Genetic Algorithms : Introduction - Basic Operators and Terminologies in GAs - Traditional Algorithm vs. Genetic Algorithm - Simple GA - General Genetic algorithm - The Schema Theorem - Classification of Genetic Algorithm - Applications of Genetic Algorithm. Applications of Soft Computing : Introduction - A Fusion approach of Multispectral Images with SAR Image for Flood area Analysis - Optimization of TSP using Genetic Algorithm Approach
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.
Recommended Text	1. S.N Sivanandam and S.N Deepa, "Principles of Soft Computing", Wiley – India, 2007. 2. S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2004.
Reference Texts	1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI,Pearson Education 2004. 2. S.N.Sivanandam, S.N.Deepa, "Introduction to Genetic Algorithms", Springer, 2007. 3. Timothy J.Ross, "Fuzzy Logic with Engineering Application", McGraw Hill, 2000. 4. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 2003.

CLO1: Implement machine learning through neural networks
CLO 2: Able to write genetic algorithms to solve optimization problem
CLO 3: Understand fuzzy concepts and develop a fuzzy expert system to derive decisions

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	3	3
CO2	3	2	3	2	3	3
CO3	3	2	3	2	2	1
Weightage of course						

contributed to each PSO	**9**	**7**	**8**	**6**	**8**	**7**

Title of the Course	**PROJECT WITH VIVA VOCE**									
Category	CORE			**Paper Number**		CORE XV				
Course Code	**L**	**T**	**P**	**Year**	**Semester**	**Credits**	**Inst. Hours**	**Marks**		
								CIA	**External**	**Total**
	0	5	25	II	IV	16	30	50	50	100
Pre-requisite	UG Level Programming knowledge									