Dr. AMBEDKAR GOVERNMENT ARTS COLLEGE
(AUTONOMOUS)
CHENNAI - 600 039

(Accredited by NAAC at level "B")

M. Sc (Computer Science)

FOR CANDIDATES ADMITTED FROM 2022-23 ONWARDS

Syllabus

Under Choice Based Credit System

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)

PG & RESEARCH DEPARTMENT OF COMPUTER SCIENCE

Based on UGC – Learning Outcomes-Based Curriculum Framework

(For the candidates admitted from the academic year 2022-2023 onwards)

Sem. No	Part	Course	Subject code	Course Title	Ins. Hrs/ Week	Credit	Exam Hrs	Marks		Total
								Int	Ext	
I	A	CC-I	22PACSC1	Advanced Java Programming	5	4	3	25	75	100
	A	CC-II	22PACSC2	Advanced Web Technology	5	4	3	25	75	100
	A	CC-III	22PACSC3	Design and Analysis of Algorithms	5	4	3	25	75	100
	A	CCP-IV	22PACSC4	**Advanced Java Programming Lab**	4	3	3	40	60	100
	A	CCP-V	22PACSC5	**Advanced Web Technology Lab**	4	3	3	40	60	100
	A	CEC-I	*	Any one from Elective-I Subjects	5	3	3	25	75	100
	B	SBE - I	22PASBE1	Employability Skills	2	2	3	25	75	100
				Total	**30**	**23**				
II	A	CC-VI	22PBCSC1	Machine Learning	5	4	3	25	75	100
	A	CC-VII	22PBCSC2	Principles of Compiler Design	5	4	3	25	75	100
	A	CC-VIII	22PBCSC3	Object Oriented System Development	4	3	3	25	75	100
	A	CCP-IX	22PBCSC4	**Machine Learning using Python Lab**	4	3	3	40	60	100
	A	CEC-II	**	Any one from Elective-II Subjects	4	3	3	25	75	100
	A	CEC-III	***	Any one from Elective-III Subjects	4	3	3	25	75	100
	A	EDS-I	22PBCSD1	Advanced Web Design	2	3	3	25	75	100
	B	SBE - II	22PBSBE2	Leadership and Communication Skills	2	2	3	25	75	100
				Total	**30**	**25**				
III	A	CC-X	22PCCSC1	Digital Image Processing	5	4	3	25	75	100
	A	CC-XI	22PCCSC2	Internet of Things	5	4	3	25	75	100
	A	CC-XII	22PCCSC3	Software Project Management	4	3	3	25	75	100
	A	CC-XIII	22PCCSC4	Statistics for Data Science	4	3	3	25	75	100
	A	CCP-XIV	22PCCSC5	**Digital Image Processing Lab**	4	3	3	40	60	100
	A	CEC-IV	****	Any one from Elective-	4	3	3	25	75	100

				IV Subjects						
	A	EDS-II	22PCCSD2	Cyber Security	2	3	3	25	75	100
	B	SBE - III	22PCSBE3	Managerial Skills	2	2	3	25	75	100
	C	Internship	22PCINT1	Internship	-	2	-	-	-	-
				Total	**30**	**27**				
IV	A	CEC-V	22PDCSP1	**Project Work**	-	15	3	75	225	300
	B	SBE - IV	22PDSBE4	Personality Development	2	2	3	25	75	100
				Total	**2**	**17**				
				Overall Total	**92**	**92**				

CORE ELECTIVE COURSES:

***Elective - I** (Any one subject of the following Core Elective chosen by the candidate)		****Elective - II** (Any one subject of the following Core Elective chosen by the candidate)	
Sub. Code	**Core Elective Courses**	**Sub. Code**	**Core Elective Courses**
22PACSE1A	Cloud Computing	22PBCSE2A	Optimization Techniques
22PACSE1B	Data Mining and Data Warehousing	22PBCSE2B	Scientific Computing Methods
22PACSE1C	Information Security	22PBCSE2C	Big Data Analytics

*****Elective - III** (Any one subject of the following Core Elective chosen by the candidate)		******Elective - IV** (Any one subject of the following Core Elective chosen by the candidate)	
Sub. Code	**Core Elective Courses**	**Sub. Code**	**Core Elective Courses**
22PBCSE3A	Wireless Networks	22PCCSE4A	Embedded Systems
22PBCSE3B	Block Chain Technology	22PCCSE4B	Web Services
22PBCSE3C	Advanced Database Management Systems	22PCCSE4C	Soft Computing

SEMESTER-I

M.Sc Degree Programme in Computer Science

First Semester				
Course Title		**ADVANCED JAVA PROGRAMMING**		
Course Code		**22PACSC1**		
Course No	**Course Category Core / Elective /**	**No of Credits**	**No of hrs /week**	**Total marks (Internal+External)**
CC I	**Core**	**4**	**5**	**25 + 75=100**

COURSE OBJECTIVES

- To provide the ability to design a console based, GUI based and web based advanced applications.
- Students will also be able to understand integrated development environment to create, debug and run multi-tier and enterprise-level applications
- To develop distributed applications
- Analyzing different problems in Web Applications and providing solutions
- Applying the knowledge to develop Web Applications for industries and individuals.

UNIT - I **15 Hours**

Servlet : Introduction – Servlet Architecture - Servlet Life Cycle-Generic Servlet, Http Servlet-Performing URL redirection-Session Tracking-Cookies-Using JDBC in Servlets

UNIT - II **15 Hours**

JDBC: Introduction – JDBC Architecture-Types of Drivers-Statement- Result set - Prepared Statement-Batch Update - Callable Statement-Creating a New Database and Table with JDBC.

UNIT - III **15 Hours**

Java Beans : Introduction –Advantage of java bean -The Component Model-JavaBeans Architecture-Writing simple beans.

EJB : EJB Component Model-Need for Enterprise JavaBeans-Enterprise Java Bean Architecture-Classification of Enterprise Java bean -Entity Beans-Session Bean-Message driven beans.

UNIT - IV **15 Hours**

RMI-Overview – Developing Applications with RMI: Declaring & Implementing Remote Interfaces-Stubs & Skeletons, Registering Remote Objects, Writing RMI Clients –Pushing Data from RMI Servlet.

UNIT - V **15 Hours**

JSP:Introduction JSP-JSP Life Cycle - Examining MVC and JSP - JSP Scripting Elements & Directives - Working with Variables Scopes - Error Pages - Using Java Beans in JSP.

TEXT BOOKS

1. J. McGovern, R. Adatia ,Y. Fain and et al, "J2EE 1.4 Bible", Wiley India Pvt. Ltd; 2003.
2. H. Schildt, "Java 2 : "The Complete Reference", 5th Edition, Tata McGraw -Hill, 2002.

REFERENCE BOOKS

1. Janson Hunter, "Java Servlet Programming", 2nd Edition, O' Reilly Media, 2007.
2. H. M. Deitel and P. J. Deitel, "JAVA: How to Program", 6th Edition, PHI, 2005.
   A. R. Callaway, " Inside Servlets", Pearson Education, 2007.
3. Joseph O'Neil, " JavaBeans from the Ground Up", Tata McGraw - Hill, 1998.
4. Tom Valesky, "Enterprise JavaBeans", Pearson Education, 2008.

WEB RESOURCES

1. https://www.edureka.co/blog/advanced-java-tutorial
2. https://www.javatpoint.com/jsp-tutorial
3. https://www.javatpoint.com/servlet-tutorial
4. https://www.javatpoint.com/RMI

METHODOLOGY OF TEACHING

Chalk and Talk method, Power point presentation, seminars, flipped learning, quiz, Assignment

COURSE OUTCOMES (COs):

Upon completion of this course, the students

CO	COURSE OUTCOME	K- LEVELS
CO1	Define Servlets and classify the different types of Servlets and apply them to understand and Develop programs using servlets and to Create cookies, construct databases and their connectivity using Servlets	**K1,K2,K3,K4**
CO2	Study the basics of JDBC, construct databases and their connectivity and apply them to develop programs using JDBC.	**K1,K2,K3,K6**
CO3	Understand ,Design and Develop programs using Java Beans and Enterprise Java Bean	**K1,K2,K3,K6**
CO4	Study the basic concepts of RMI .Analyze and Apply the concepts of RMI to develop an application	**K1,K2,K3,K4**
CO5	Explain the different types of JSP tags. Analyze and Apply them to Develop JSP programs.	**K1,K2,K3,K4,K6**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating.		

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	1	1	3
CO2	3	2	2	2	1	3
CO3	3	3	3	2	1	3
CO4	3	3	3	2	1	3
CO5	3	3	3	2	1	3
Total	15	14	13	9	5	15
Average	3	2.8	2.6	1.8	1	3

Level of Correlation between PSO's and CO's

1– Low ,

2 – Medium ,

3 – High ,

0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

First Semester				
Course Title		**ADVANCED WEB TECHNOLOGY**		
Course Code		**22PACSC2**		
Course number	**Core category**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal+External)**
CC – II	**Core**	**4**	**5**	**25+75**

COURSE OBJECTIVES

- To understand the fundamentals of .NET frame work and basics of C# Language.
- To explore C#.NET technologies for designing and developing dynamic, interactive and responsive web applications using HTML and Web server controls.
- To impart the knowledge of event handling, Exception handling and Page tracing.
- To learn how to maintain the session state and application state while developing web application.
- To apply the concept of C#.NET technology in the real-world scenario.

UNIT – I **15 Hours**

OVERVIEW OF ASP.NET: .NET Frame work-Common Language Runtime- .NET Class Library. **C#**: C# Language Basics- Variables and Data types-Variable Operations-Conditional Logic-Loops-Methods-Building Basic Class-Value types and Reference types-Understanding Namespaces and Assemblies.

UNIT – II **15 Hours**

Developing ASP.NET Applications: The Anatomy of a Web Form- Writing Code - The Anatomy of an ASP.NET Application- HTML Server controls - The HTML Control Classes - Page Class-Application Events. **Web Controls**: Basic Web Control Classes.

UNIT – III **15 Hours**

Web Controls: Web Control Classes-List Controls-Table Controls-Web Control Events and AutoPostBack. **Error Handling:** The Exception Class - The Exception Chain. Handling Exception: Catching Specific Exceptions - Nested Exception Handlers - Exception Handling in Action - Throwing Your Own Exceptions**. Page Tracing**: Enabling Tracing - Tracing Information - Writing Trace Information - Application-Level Tracing.

UNIT – IV **15 Hours**

State Management: View State-Transferring information between Pages-Cookies-Session States- Session States Configuration- Application State-**Validation**: Understanding Validation - The Validation Controls. **Rich Controls**: Calendar-AdRotator-Pages with multiple Views-User Controls.

UNIT – V **15 Hours**

ADO.NET: The Data Provider Model- Direct Data Access- Disconnected Data Access-Data Binding: Single Value Data Binding-Repeated Value Data Binding-Data Controls: Grid View- Formatting the Grid View-Selecting a Grid View Row-Editing with the Grid View-Sorting and Paging the Grid View. Files and Streams: File System Information-Reading and Writing with Streams- Allowing File Uploads.

TEXT BOOK

Matthew MacDonald, "Beginning ASP.NET 4 in C# 2010", APRESS, 2010.

REFERENCE BOOKS

1. Matthew MacDonald," Pro ASP.NET 4 in C# 2010", APRESS, 2010.
2. Bill Evjen, Scott Hanselman, "Professional ASP.NET 3.5 in C# and VB", Wrox Publication,2011
3. Imar Spaanjaars, " Beginning ASP.NET 4 in C# and VB", Wrox Publication,2010

WEB REFERENCES

1. https://freevideolectures.com/course/3565/asp-net
2. https://link.springer.com/content/pdf/bfm%3A978-1-4302-2609-3%2F1.pdf
3. https://www.youtube.com/watch?v=aLyBE6rJdD4&list=PL6n9fhu94yhXQS_p1i-HLIftB9Y7Vnxlo&index=2

METHODOLOGY OF TEACHING

- Lectures, Assignments, Group discussions, Seminar , Quiz, Home work

COURSE OUTCOME (COs)

At the end of the Course, the Student will be able to:

CO	COURSE OUTCOME	K- LEVELS
CO1	**Identify** the need for .NET framework and C#. **Explain** the C# program construct to build console application.	**K1, K2,K3**
CO2	**Compare** the HTML and Web Server control and select best one to **develop** web applications. **Analyze** the domain to find solution through program.	**K1, K2,K3,K4**
CO3	**Identify** runtime error and **classify** them. **Summarize** the advantages of tracing.	**K2, K3,K4**
CO4	**Make use of** managing states between different web pages and applications. **Evaluate** the user data using validation controls. **Discover** the suitable rich controls to create applications like advertisement.	**K3,K4,K5**
CO5	**Judge** the **value** of database connectivity and .NET technology to apply in real-world scenario.	**K5**
K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating		

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	1
CO2	2	2	2	3	1	1
CO3	3	3	3	2	2	1
CO4	3	3	3	2	3	2
CO5	2	3	3	3	2	1
Total	13	14	14	12	10	6
Average	2.6	2.8	2.8	2.4	2	1.2

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

First Semester				
Course Title		**DESIGN AND ANALYSIS OF ALGORITHMS**		
Course Code		22PACSC3		
Course No	**Course Category Core / Elective**	**No of Credits**	**No of hrs / week**	**Total Marks (Internal+ External)**
CC-III	**Core**	**4**	**5**	**25+75 = 100**

COURSE OBJECTIVES

To learn effective problem solving in computing applications using different algorithmic design techniques and analyze the algorithmic procedure to determine the computational complexity of algorithms.

UNIT - I **16 Hours**

Introduction: Definition - Characteristics – Algorithm Specification – Performance Analysis- Asymptotic Notations. Elementary Data Structures: Stacks and Queues – Trees – Graphs

UNIT- II **13 Hours**

Divide and Conquer: The General Method – Binary Search – Finding The Maximum and Minimum – Merge Sort – Quick Sort – Selection - Strassen's Matrix Multiplication.

UNIT- III **16 Hours**

The Greedy Method: General Method - Knapsack Problem - Tree Vertex Splitting – Job Sequencing With Deadlines - Minimum Cost Spanning Trees – Prim's method, Krushakal Algorithms - Single Source Shortest Paths.

UNIT- IV **15 Hours**

Dynamic Programming: The General Method – Multistage Graphs – All-Pairs Shortest Paths - String Editing - 0/1 Knapsack - The Traveling Salesperson Problem.

UNIT- V **15 Hours**

Backtracking: The General Method – The 8-Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycles – Knapsack Problem. **Branch and Bound**: General Method - 0/1 Knapsack Problem.

TEXT BOOK

1. Ellis Horowitz, Satraj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press, Second Edition, Reprint 2009.

REFERENCES BOOKS

1. V.Aho, Hopcropft, Ullman, "Data structures and Algorithms", LPE
2. S.E. Goodman, ST. Hedetniem , "Introduction to design and Analysis of Algorithms", TMH.

WEB RESOURCES

1. https://nptel.ac.in/courses/106105164

METHODOLOGY OF TEACHING

Class Lecturers, Assignments, Group Discussion, Quiz, Seminar

COURSE OUTCOMES (Cos)

Upon completion of this course, the students are able to

CO	COURSE OUTCOME	K- LEVELS
CO1	**Define, What** is an algorithm and **Illustrate** about various elementary data structures, **Analyse** the time complexities of various algorithm **Choose** the best data structure for the real life applications	**K1, K2, K4, K5**
CO2	**Define What** is divide and conquer method **apply** the methods to solve simple problems. **Identify** the problem and **choose** the appropriate methodology to solve it	**K1, K3, K5**
CO3	**Define** the greedy method and **list** and **explain** some applications**, compare** their performance.	**K1, K2, K4**
CO4	**Define** and **Apply** dynamic programming technique to solve some problems, study the **importance** of shortest path problems	**K1, K3, K5**
CO5	**Tell what** kind of problems does the back tracking method is suitable by **apply** the method to different problems, able to **choose** the best methods to solve the real time problems	**K1,K3, K6**
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO-PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	0	2	3	3
CO2	3	3	0	2	2	3
CO3	3	3	0	2	2	3
CO4	3	3	1	2	2	3
CO5	3	3	1	3	2	3
Total	15	15	2	11	11	15
Average	3	3	0.4	2.2	2.2	3

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

First Semester				
Course Title		**22PACSC4**		
Course Code		**ADVANCED JAVA PROGRAMMING LAB**		
Course No	**Course Category Core / Elective**	**No of Credits**	**No of hrs /week**	**Total marks (Internal+External)**
CCP-IV	**Core**	**3**	**4**	**40 + 60=100**

COURSE OBJECTIVES

- Student will be able to use advanced technology in Java such as Remote method Invocation, JSP.
- Student will be able to develop web application using Java Servlet.
- Students will also be able to understand integrated development environment to create, debug and run enterprise-level applications using Enterprise java bean.

LAB EXERCISES

1. HTML to Servlet Communication
2. Designing Online Applications with JSP
3. Creating JSP program using JavaBeans
4. Working with Enterprise JavaBeans
5. Performing Java Database Connectivity.
6. Implement a Client/Server application using RMI.
7. Update a given Table using Batch Update.
8. Designing Employee Details Applications with JSP.
9. Program for Payroll using JDBC.
10. Creating Mark Sheet using Tables with JSP.

COURSE OUTCOMES (COs)

Upon completion of this course, the students

CO	COURSE OUTCOME	K- LEVELS
CO1	Recall the concepts of Servlets and realize them using Generic and Http Servlets and Create cookies, construct databases and their connectivity using Servlets.	**K1,K2,K3,K6**
CO2	Recall the concepts of JDBC and realize them by developing JDBC applications, construct databases and their connectivity using JDBC.	**K1,K,K3,K4**
CO3	Understand the basics of EJB,RMI,JSP, Realize and Develop simple and EJB programs, RMI Programs, JSP Programs	**K1,K,K3,K6**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating.		

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	1
CO2	3	2	2	2	2	1
CO3	3	3	3	2	2	2
Average of CO-PSO Mapping	3	2.6	2.3	2	2	1.3
Total of CO-PSO Mapping	9	8	7	6	6	4

Level of Correlation between PSO's and CO's

1– Low ,

2 – Medium ,

3 – High ,
0 – No Correlation

M.Sc Degree Programme in Computer Science

First Semester				
Course Title		**ADVANCED WEB TECHNOLOGY LAB**		
Course Code		**22PACSC5**		
Course No	**Core category**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CCP-V	**Core**	**3**	**4**	**40+60**

COURSE OBJECTIVES

- To implement console applications using C#.
- To create simple web applications using C#.NET.
- To develop web applications using Error handling and Page tracing.
- To implement web applications to validate user input.
- To develop web applications using database.

C#

1. Create a simple class for Employee using appropriate data members and member functions.
2. Write a C# Sharp program to sort a list of elements using Quick sort.
3. Write a C# Sharp program to sort a list of elements using Merge sort.
4. Write a C# Sharp program to illustrate multilevel inheritance.
5. Write a C# Sharp program to search key element in the given list of elements using binary search.

C#.NET

6. Create an application form to apply for a new course in a college, fill the information and submit it (Use Basic Web Server controls).
7. Design Sign Up form and validate User Name (Minimum 8 character Maximum 15 and only characters and underscore), Password (Minimum 8 Characters) and Confirm Password (Both should be same), Phone No (Only digits), Email-id etc. (Use Validation controls).
8. Design a web page using C#.Net to illustrate Exception handling in Block level and Page level.
9. Write a C#.net program to demonstrate application state and view state management.
10. Create a web form for Online Library data entry (Use Application/Session Variables).
11. Develop an application to illustrate the usage of Request and Response Objects in ASP.NET.
12. Create an employee database and manipulate the records.
13. Create a student database and manipulate the records.
14. Create a web page to demonstrate DataGrid control**.**
15. Create a web page to demonstrate Grid View control**.**

COURSE OUTCOME (COs)

At the end of the Course, the Student will be able to:

CO code	Course Outcomes	K-levels
CO1	Recall the basics of C# language and apply to implement programs.	**K1,K2**
CO2	Apply the syntax of HTML and Web server controls with coding techniques and experiment their functionalities.	**K3**
CO3	Analyze the domain and develop C#.NET web applications using SQL Server database.	**K4**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating.		

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	1
CO2	3	2	2	3	1	1
CO3	3	3	3	2	2	1
Total	9	8	8	7	5	3
Average	3	2.67	2.67	2.33	2.3	1

Level of Correlation between PSO's and CO's

1– Low ,

2 – Medium ,

3 – High ,

0 – No Correlation

M.Sc Degree Programme in Computer Science

First Semester				
Course Title		**CLOUD COMPUTING**		
Course Code		**22PACSE1A**		
Course No	**Course Category Core / Elective /**	**No of Credits**	**No of hrs /week**	**Total marks (Internal+External)**
CEC-I	**Elective**	**3**	**5**	**25 + 75=100**

COURSE OBJECTIVES

- To understand the concept of cloud computing.
- To illustrate the evolution of cloud from the existing technologies.
- To understand the concept of Virtualization and design of cloud Services
- To elaborate the usage of cloud in various applications.

UNIT – I: Basics of Cloud Computing: 15 Hours

Introduction – Essentials of Cloud Computing – Needs of Cloud Computing- History of Cloud Computing- Benefits of Cloud Computing – Limitations of Cloud Computing- Vendors of Cloud Computing- Elastic Computing- Social Networking- Enterprise Cloud Computing. Factors that affect cloud computing: Cloud Data center requirements- Influence of Cloud Computing on Business Companies.

UNIT – II: Architecture of Cloud Computing 15 Hours

Introduction- Grid architecture- Cloud Computing Architecture –Similarities and differences between grid and cloud computing- Characteristics of Cloud Computing. Models of cloud computing: Cloud service models – cloud computing sub services models- cloud deployment models.

UNIT – III: Data Center and Virtualization Technology 15 Hours

Cloud Data Center: Introduction – Cloud data center elements – Storage network technologies. Virtualization Technology: Introduction – virtualization reference model – advantages of virtualization- server/compute virtualization – Need and advantage of Server/compute virtualization- Techniques of server/compute virtualization- types of virtualizations- exploring network virtualization - tools used in network virtualization – benefits of network virtualization - Understanding desktop virtualization – techniques used for desktop virtualization – Components used for desktop virtualization.

UNIT – IV: Cloud Security and Advanced Technologies 15 Hours

Security issues of Cloud Computing: Introduction – security concerns of cloud computing – cloud information security objectives- cloud security design principles – cloud security services – secure cloud software testing – cloud architectural consideration-VM security Recommendations-Challenges to cloud security. Advanced technologies in Cloud Computing: Security clouds – app-specific cloud- mobile cloud computing – Big table – cloud usage for big data analytics and IoT.

UNIT – V: Cloud Application Case Studies 15 Hours

Case Studies: Cloud for Manufacturing Industry – Cloud for Healthcare – Cloud for Education – cloud for energy systems – cloud for transportation systems- Live video streaming APP.

TEXT BOOKS

1. Shailendra Singh, "**Cloud Computing**", Oxford University Press,2018.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012

REFERENCE BOOKS

1. Barrie Sosinsky," **Cloud Computing Bible**", Wiley Publishing Inc, 2013.

2. John W.Rittinghouse and James F.Ransome, "**Cloud Computing: Implementation, Management, and Security**", CRC Press, 2010.
3. Michael Miller, "**Cloud Computing Web Based Applications that change the way you work and collaborate online**", Pearson Education,2019.

WEB REFERENCES

1. https://nptel.ac.in/courses/106/105/106105167/
2. https://www.tutorialspoint.com/cloud_computing/index.html
3. https://www.guru99.com/cloud-computing-for-beginners.html
4. https://www.youtube.com/watch?v=LICA-ILkO4w

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Quiz.

COURSE OUTCOMES (COs)

Upon completion of this course, the students

CO	COURSE OUTCOME	K- LEVELS
CO1	Define the core concepts of the cloud computing paradigm: Evolution, need, and summarize its advantages, limitations and explain the factors that affect cloud computing.	**K1, K2, K3**
CO2	Show the differences between grid and cloud architecture and experiment with different service models and deployment models.	**K2, K3**
CO3	Construct and examine the ability to understand virtualization technology used in cloud.	**K3, K4**
CO4	Infer and evaluate the knowledge of various security techniques used in cloud computing.	**K4, K5**
CO5	Justify the importance of cloud in various applications.	**K5**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating.		

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	1
CO2	3	2	2	3	1	1
CO3	3	3	3	2	2	-
CO4	2	3	3	2	3	2
CO5	3	2	1	3	2	1
Total	14	13	12	12	10	5
Average	2.8	2.6	2.4	2.4	2	1

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

First Semester				
Course Title		**DATA MINING**		
Course Code		**22PACSE1B**		
Course number	**Core category**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal+External)**
CEC-I	**Elective**	**3**	**5**	**25+75**

COURSE OBJECTIVES

- To introduce the basic concepts of Data Mining
- To study the various techniques of Data mining
- To learn various algorithms used for Information Retrieval from Datasets

UNIT – I **15 Hours**

Introduction: Data mining – Kind of Data – Kinds of Patterns – Major issues in Data mining – Data Warehouse - Introduction of Functionalities – Classification – Introduction to Data Warehousing – Modeling: Data cube and OLAP

UNIT - II **15 Hours**

Data Preprocessing: Preprocessing the Data – Data cleaning – Data Integration, Data reduction Data Transformation and Data discretization.

UNIT – III **15 Hours**

Mining Association Rules: Basic Concepts - Frequent item set mining - Mining Multilevel associations – Mining Multi dimensional associations – Mining Quantitative associative rules – mining rare patterns and negative patterns

UNIT – IV **15 Hours**

Classification and Prediction: Introduction – Decision Tree Induction – Bayesian Classification – Rule based Classification - Classification of Back Propagation. Prediction – Classifier Accuracy.

UNIT - V **15 Hours**

Cluster Analysis: Introduction – Types of Data in Cluster Analysis – Requirements of Cluster analysis - Partitioning Methods – Hierarchical Methods - Density Based Methods – Data mining applications.

TEXT BOOK

1. J.Han and M. Kamber, “Data Mining Concepts and Techniques”, Second Edition, Morgan Kaufmann Publishers

REFERENCE BOOKS

1. K.P. Soman , Shyam Diwakar, V.Ajay “Insight into Data Mining Theory and Practice “, Prentice Hall of India Pvt. Ltd, New Delhi
2. Margaret H Dunham, S. Sridhar, “Data mining – Introductory and advanced topics”, Pearson Education 2008

WEB REFERENCES

- https://www.javapoint.com/data mining-tutorial.
- Nptel course titled Data Mining.
- https://onlinecourses.swayam2.ac.in/cec20_cs12/

COURSE OUTCOMES (COs)

On completion of the course the students will be able to:

CO	COURSE OUTCOME	K- LEVELS
CO1	Define Data mining and identify different types of data and patterns, explain and illustrate the concept of Data warehouse and schemas	**K1, K2,K3**
CO2	Acquire the basic knowledge of Data preprocessing and understand its need and apply preprocessing techniques	**K1, K2,K3**
CO3	Acquaint knowledge about Association rules and explain frequent item sets, classify different association rules and construct them	**K1, K2,K3, K4**
CO4	Gain knowledge about classification and prediction, Compare and evaluate various classification algorithms and apply in real time dataset	**K1, K2,K3, K4**
CO5	Learn and explain the need for cluster analysis, categorize and evaluate clustering algorithms	**K1, K2, K4, K5**
K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating		

CO-PO MAPPING COURSE ARTICULATION MATRIX

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	2	1	1	1
CO2	3	2	2	2	1	1
CO3	3	2	2	1	1	1
CO4	3	3	2	1	1	1
CO5	2	2	2	1	1	1
Total	13	11	10	6	5	5
Average	2.6	2.2	2	1.2	1	1

Level of Correlation between PSO's and CO's

1– Low,
2 – Medium,
3 – High,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

First Semester				
Course Title		**INFORMATION SECURITY**		
Course Code		**22PACSE1C**		
Course No	**Course Category Core / Elective**	**No of Credits**	**No of hrs / week**	**Total Marks (Internal + External)**
CEC-I	**Elective**	**3**	**5**	**25+75 = 100**

COURSE OBJECTIVES

- To understand and apply the models of information security
- To study and analyze cryptographic and forensic methods
- Analyze and simulate the network and application security
- Explore the nature and logic behind security threats on the web as an ethical hacker

UNIT - I **15 Hours**

Information Security - Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Balancing Security and Access, Security SDLC.

UNIT - II **15 Hours**

Cryptography- Classical Cryptography, Symmetric Cryptography, Public Key (Asymmetric cryptography), Modern Cryptography. Forensics: DRM technology, Steganography, Biometrics.

UNIT – III **15 Hours**

Network Security- Network Protocols, Wireless Security (WiFi, WiMAX, Bluetooth, cell phone), IDS and IPS, Network Intrusion Management

UNIT - IV **15 Hours**

Application Security- Software Security, Mobile Security, and Database Security

UNIT - V **15 Hours**

Information Security Threats- Viruses, Worms and other malware, Email Threats, 12 CO6 46 Web Threats, Identity Theft, Data Security Breaches, Ethical Hacking -Hacking Tools and Techniques

TEXT BOOKS

1. W. Stallings, “Cryptography and Network Security: Principles and Practice”, 6th Edition, Prentice Hall, 2013.
2. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Vikas Publishing House, New Delhi, 2003

REFERENCE BOOKS

1. NeilDaswani, ChristophKern, AnitaKesavan, “Foundations of Security: What Every Programme”, APRESS, 2007.
2. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, 2003.

WEB REFERENCES

1. http://williamstallings.com/Cybersecurity/
2. freecomputerbooks.com › compscspecial Security Books

METHODOLOGY OF TEACHING

Class Lecturers, Assignments, Lab exercises, Discussions, seminars, quiz and assessments

COURSE OUTCOMES (COs)

Upon completion of this course, the students are able to

CO	COURSE OUTCOME	K- LEVELS
CO1	Analyze the broad perceptive and need of information security.	K1, K2, K4
CO2	Explain the various encryption techniques and illustrate the master fundamentals of secret and public cryptography.	K2, K3, K4
CO3	Compute the Risk control strategies and Risk Management and compare with Hash Algorithms, Signature and network security designs.	K1, K2, K3, K4
CO4	Describe the policies of Information Security and hence identify network security designs using available secure solutions	K1, K3
CO5	illustrate the Intrusion Detection and Prevention Systems and discover the layers of application security	K1,K2, K4
CO6	Identify different threats and suggest fixes in data and cyber security.	K1,K2,K3,K5
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating.		

CO-PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	3	2	3
CO2	2	3	1	3	1	3
CO3	3	3	3	2	2	2
CO4	3	3	2	1	3	2
CO5	3	3	2	2	2	2
Total	13	15	10	11	10	15
Average	2.6	3	2	2.2	2	3

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SEMESTER-II

M.Sc Degree Programme in Computer Science

Second Semester				
Course Title		**MACHINE LEARNING**		
Course Code		**22PBCSC1**		
Course No	**Course Category Core / Elective /**	**No of Credits**	**No of hrs /week**	**Total marks (Internal+External)**
CC-VI	**Core**	**4**	**5**	**25 + 75=100**

COURSE OBJECTIVES:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability based learning techniques
- To understand graphical models of machine learning algorithms

UNIT - I **15 Hours**

INTRODUCTION: Designing a learning system - Perspectives and Issues in machine learning - Concept learning task - Concept learning as search - Version spaces - Candidate Elimination learning algorithm - Inductive Bias.

UNIT - II **15 Hours**

DECISION TREE LEARNING: Decision Tree representation - Appropriate Problems for Decision Tree Learning - Basic Decision tree learning algorithm - Hypothesis space search and Inductive Bias in Decision tree learning - Issues in Decision Tree Learning. **ANN**: Perceptrons - Back propagation Algorithms.

UNIT - III **15 Hours**

BAYESIAN LEARNING: Bayes Theorem and Concept learning - Maximum Likelihood and Least Squared error hypothesis - Maximum Likelihood hypotheses for predicting probabilities - Minimum description Length principle - Bayes optimal classifier - Gibbs algorithm - Naïve Bayes classifier - Bayesian Belief networks -EM algorithm.

UNIT - IV **15 Hours**

ANALYTICAL AND COMBINING ANALYTICAL AND INDUCTIVE LEARNING: Analytical learning - Explanation based learning - Inductive Analytical approaches to learning - Using prior knowledge to initialize the hypothesis, to alter the search objective.

UNIT - V **15 Hours**

INSTANCE-BASED LEARNING AND REINFORCEMENT LEARNING: K - nearest neighbor learning -Locally weighted regression - Radial Basis functions - Case based reasoning - Reinforcement learning: Learning task-Q Learning:Q function - Algorithm for learning Q-convergence - Temporal difference learning.

TEXT BOOK

1. Tom M Mitchell, "Machine Learning", McGraw Hill, 1st Edition, 2003.

REFERENCE BOOKS

1. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, 2nd Edition, 2010.
2. Stephan Marsland, "Machine Learning - An Algorithmic Perspective", Chapman and Hall, 1st Edition, 2009.
3. Nils Nilsson, "Introduction to Machine Learning", MIT Press, 1997.
4. Jude Shavil, Thomas G Dietterich, "Readings in Machine Learning", Morgan Kaufmann Publishers, 1990.8. Peter Harrington, “Machine Learning in Action”, Dream Tech

WEB RESOURCES

1. https://nptel.ac.in/courses/106/105/106105152/
2. http://www.cs.cmu.edu/~tom/mlbook.html

METHODOLOGY OF TEACHING

Chalk and Talk method, Power point presentation, seminars, flipped learning, quiz, Assignment

COURSE OUTCOMES (COs):

Upon completion of this course, the students

CO	COURSE OUTCOME	K- LEVELS
CO1	Define and explain the fundamental issues and challenges of machine learning and different learning algorithms and representations. Understand the Knowledge representation issues and concept learning.	**K1,K2,K3,K4**
CO2	Define and explain the Decision Tree representation and artificial neural networks. Apply the knowledge gained to develop a system	**K1,K2,K3,K4,K6**
CO3	Able to define and explain the BAYES Theorem, Gibbs Algorithm, EM Algorithm. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and Apply the knowledge gained to develop a system. The result can be analyzed and evaluated.	**K1,K2,K3,K4,K5**
CO4	The learners shall understand the machine learning techniques like Analytical and Inductive learning to apply the techniques in computing.	**K1,K2,K3,K4**
CO5	The learners shall understand the machine learning techniques like Instance based learning and reinforcement to apply the techniques in computing.	**K1,K2,K3,K4**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating		

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	3
CO2	3	2	3	2	1	3
CO3	3	3	3	2	2	2
CO4	3	3	3	1	1	3
CO5	3	2	3	1	2	2
Average of CO-PSO Mapping	3	2.6	3	1.6	1.6	2.6
Total of CO-PSO Mapping	15	13	15	8	8	13

Level of Correlation between PSO's and CO's

1– Low ,

2 – Medium ,

3 – High ,

0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Second Semester				
Course Title		**PRINCIPLES OF COMPILER DESIGN**		
Course Code		**22PBCSC2**		
Prerequisite		**Data structures, Different Programming Languages**		
Course number	**Core category**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal+External)**
CC – VII	**Core**	**4**	**5**	**25+75**

COURSE OBJECTIVES

- To learn the various phases of compiler.
- To learn the various parsing techniques.
- To understand intermediate code generation.
- To learn to implement front-end of the compiler.
- To learn to implement code generator.

UNIT – I LEXICAL ANALYSIS 15 Hours

The Structure of a Compiler – The role of the lexical analyzer - Input buffering - Specification of tokens - Recognition of tokens. **Finite automata:** NFA – Transition tables – Acceptance of input strings by Automata – DFA – Conversion of an NFA to DFA – Minimizing DFA – Simulation of NFA – Construction of NFA from Regular expression.

UNIT – II SYNTAX ANALYSIS 15 Hours

Introduction: Definition – The role of the parser. **Context-free grammars:** Definition of CFG – Notational Conventions – Derivations – Parse Tree and Derivations – Ambiguity – CFGs Vs REs .**Writing a grammar**: Lexical versus Syntactic Analysis – Eliminating Ambiguity – Elimination of Left Recursion – Left Factoring. **Top down Parsing**: Definition – Recursive-Descent parsing – FIRST and FOLLOW – Nonrecursive predictive parsing – LL(1) grammars. **Bottom-up Parsing**: Definition – Reductions – Handle Pruning – Shift-Reduce Parsing – Conflicts during Shift-Reduce Parsing.

UNIT – III SYNTAX DIRECTED TRANSLATION 15 Hours

Syntax Analysis Continued: LR parsers – Construction of SLR Parsing table – Construction of CLR Parsing table – Construction of LALR Parsing table.

Syntax Directed Translation - Inherited and Synthesized attributes – Dependency graphs – Ordering the evaluation of attributes – S-attributed definitions – L-attributed definitions – Applications of Syntax Directed translation.

UNIT – IV INTERMEDIATE CODE GENERATION 15 Hours

Variants of Syntax trees: DAG for Expressions – The Value Number method for Constructing DAG's. **Three Address code**: Quadruples, Triples and Indirect Triples. **Types and Declarations**: Type Expressions – Type Equivalence – Declarations – Storage Layout for Local Names – Sequences of Declarations – Fields in records and classes. Translation of Expressions – Type checking - Control flow - Back patching - Switch Statements - Procedure calls.

UNIT – V CODE GENERATION AND CODE OPTIMIZATION 15 Hours

Issues in the design of a code generator - The target language – Address in the Target Code – Basic Block and Flow graphs – Optimization of Basic Blocks - A simple code generator – Peephole Optimization.

TEXT BOOK

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi and Jeffrey D. Ullman, "Compilers- Principles, Techniques and Tools", Second Edition, Pearson Education Asia, 2009.

REFERENCES BOOKS

1. A.V. Aho, Ravi Sethi, J.D. Ullman, Compilers - Principles, Techniques and Tools, Addison-Wesley, 2003.
2. Kennath C.Louden, Compiler Construction Principles and Practice, Vikas publishing House, 2004.
3. S.Godfrey Winster, S.Aruna Devi, R.Sujatha, "Compiler Design", yesdee Publishers, Third Reprint

2019.

WEB REFERENCES

1. https://nptel.ac.in/courses/106104123
2. **https://www.digimat.in/nptel/courses/video/106105190/L02.html**

METHODOLOGY OF TEACHING

- Lectures, Assignments, Group discussions, Seminar , Quiz, Home work

COURSE OUTCOME (COs)

At the end of the Course, the Student will be able to:

CO	COURSE OUTCOME	K- LEVELS
CO1	**Explain** the different phases of compiler. **Construct** NFA and DFA for given Regular expression.	**K1, K2,K3**
CO2	**Apply** different parsing algorithms to **develop** the parsers for a given grammar. **Summarize** behavior of different parser. **List** the different types of parser suffer from conflict.	**K2,K3,K4**
CO3	**Apply** translation techniques to type checking and intermediate-code generation. **Inspect** the attributes to find suitable for top-down and bottom-up parser.	**K2, K3,K4**
CO4	**Choose** the techniques to generate intermediate-code. **Analyze** the three address code suitable for program construct.	**K3,K4**
CO5	**Evaluate** the code optimization techniques and implement a simple code generator.	**K5**
K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating		

CO-PO MAPPING COURSE ARTICULATION MATRIX

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	1
CO2	2	2	2	3	1	1
CO3	3	3	3	2	2	1
CO4	3	3	3	2	3	1
CO5	2	3	3	3	2	1
Total	13	14	14	12	10	5
Average	2.6	2.8	2.8	2.4	2	1

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Second Semester				
Course Title		**OBJECT ORIENTED SYSTEMS DEVELOPMENT**		
Course Code		**22PBCSC3**		
Course No	**Course Category Core / Elective /**	**No of Credits**	**No of hrs /week**	**Total marks (Internal+External)**
CC-VIII	**Core**	**3**	**4**	**25+ 75=100**

COURSE OBJECTIVES

- Introduce the concept of Object-oriented design and understand the fundamentals of OOSD life cycle.
- Familiar with evolution of object-oriented model, classes and it notations
- Practice UML in order to express the design of software projects.
- Specify, analyze and design the use case driven requirements for a particular system.
- Enrich knowledge about DBMS, designing classes and object oriented testing

UNIT – I **12 Hours**

Fundamentals of OOSD - Overview of Object Oriented Systems Development: Two orthogonal view of the software – OOSD methodology - Why an Object Orientation. Object basics: Object Oriented Philosophy- Objects – Attributes – Object respond to messages – Encapsulation and information hiding – class hierarchy Polymorphism – Object relationship and associations. OOSD life cycle: Software development process – OOSD Use case Driven Approach –Reusability.

UNIT – II **12 Hours**

Methodology, Modeling and UML - Object Oriented Methodologies: Rumbaugh et al.'s object modeling technique – The Booch methodology – The Jacobson et al. methodology – Patterns – Frameworks - The Unified approach. Unified Modeling Language : Static and dynamic models – Why modeling - UML diagrams – UML class diagram – Use case diagram – UML dynamic modeling –packages and model organization.

UNIT – III **12 Hours**

Object Oriented Analysis - Object Oriented Analysis process: Business Object Analysis - Use case driven object oriented analysis –Business process modeling – Use-Case model – Developing effective documentation. Classification: Classifications theory – Approaches for identifying classes – Noun phrase approach – Common class patterns approach – Use-Case Driven approach – Classes, Responsibilities, and Collaborators - Naming classes. Identifying object relationships, attributes, and methods: Association – Super- Sub class relationship – Aggregation – Class responsibility – Object responsibility.

UNIT – IV **12 Hours**

Object Oriented Design - Object Oriented Design Process and Design Axioms - OOD process- OOD axioms – Corollaries – Design patterns. Designing classes: Designing classes – Class visibility – Refining attributes – Designing methods and protocols – Packages and managing classes. Access layer: Object Store and persistence – DBMS – Logical and physical Database Organization and access control – Distributed Databases and Client Server Computing — Multi database Systems – Designing Access layer classes. View Layer: Designing view layer classes – Macro level process – Micro level process – The purpose of view layer interface – Prototyping the user interface.

UNIT – V **12 Hours**

Software Quality - Software Quality Assurance: Quality assurance tests – Testing strategies – Impact of Object Orientation on Testing - Test Cases- Test Plan – Continuous testing. System Usability and Measuring User satisfaction: Usability Testing – User satisfaction test – A tool for analyzing user satisfaction. System Usability and Measuring User satisfaction: Introduction – Usability Testing

TEXT BOOK

1. Ali Bahrami, "Object Oriented Systems Development using UML", McGraw-ill, 2008

REFERENCE BOOKS

1. Booch Grady, Rumbaugh James, Jacobson Ivar, "The Unified modeling Language – User Guide, Pearson Education, 2006
2. Brahma Dathan, Sarnath Ramnath, "Object Oriented Analysis, Design and Implementation", Universities Press, 2010.
3. Mahesh P.Matha, "Object-Oriented Analysis and Design Using UML", PHI Learning Private Limited, 2012.
4. Rachita Misra, Chhabi Rani Panigrahi, Bijayalaxmi Panda,"Principles of Software Engineering and System Design", Yesdee Publishing 2019.

WEB REFERENCES

1. https://www.tutorialspoint.com/object_oriented_analysis_design/index.h tm
2. https://www.wisdomjobs.com/e-university/object-oriented-analysis-and- de sign-tutorial-2107.html
3. https://sites.google.com/site/atulkg/courses/object-oriented-design-analysis- fall-2010

METHODOLOGY OF TEACHING

Chalk and Talk method, Power point presentation, seminars, flipped learning, quiz, Assignment

Course Outcomes (COs):

Upon completion of this course, the students

CO	COURSE OUTCOME	K- LEVELS
CO1	**Define** the basics of object orientation, and **compare** oo with the traditional system development, learn the OOSDLC method for developing systems.	K1 K2 K3 K4
CO2	**Learn the** different types of methodologies in object orientation and **Apply** the best practices to work with Unified approach and UML Modeling and **Analyze** them to construct different UML diagrams and performance	K1 K2 K3 K4 K5 K5
CO3	**Understand** the basics of object oriented analysis process and **Identify** the use cases and actors, **Analyze** and **Classify** the objects using different approaches, **Identify** objects and **Relate** them to **Draw** static Class/Object diagram.	K1 K2 K3 K4 K5 K6
CO4	**Study** the basics of object oriented design process, axioms, corollaries and **Apply** them to **Refine** Class/Object diagram, **Develop** user interfaces and store objects using databases.	K1 K2 K3
CO5	**Learn** the basics of software quality assurance, testing strategies, **Apply** them to **Derive** test suite and test plan.	K1 K2 K3

K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	1	1	3
CO2	3	2	2	2	1	3
CO3	3	3	3	2	1	3
CO4	3	3	3	2	1	3
CO5	3	3	3	2	1	3
Average of CO-PSO Mapping	3	2.8	2.6	1.8	1	3
Total of CO-PSO Mapping	15	14	13	9	5	15

Level of Correlation between PSO's and CO's
1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Second Semester				
Course Title		**MACHINE LEARNING USING PYTHON - LAB**		
Course Code		**22PBCSC4**		
Course No	**Course Category Core / Elective /**	**No of Credits**	**No of hrs /week**	**Total marks (Internal+External)**
CCP IX	**Core**	**3**	**4**	**40 + 60=100**

COURSE OBJECTIVES

The students should be able to:

- Understand the implementation procedures for the machine learning algorithms.
- Design Python programs for various Learning algorithms.
- Apply appropriate data sets to the Machine Learning algorithms.
- Identify and apply Machine Learning algorithms to solve real world problems.

LAB EXERCISES

1. Simple Programs in Python.
2. Demonstrate Scipy library.
3. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file

4. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

5. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample

6. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

7. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

8. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.

9. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

10. Write a program to implement k-Nearest Neighbours algorithm to classify the iris data set. Print both correct and wrong predictions.

11. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

COURSE OUTCOMES (COs):

Upon completion of this course, the students

CO	COURSE OUTCOME	K- LEVELS
CO1	Acquire knowledge on fundamental concepts of machine learning. Apply and implement the Candidate-Elimination algorithm and Back propagation algorithm.	**K1,K2,K3,K4,K5,K6**
CO2	Read the naïve Bayesian classifier and apply to develop an application.	**K1,K2,K3,K4,K5,K6**
CO3	Define the working of the decision tree based ID3 algorithm. Apply and implement the algorithms. Define k-Nearest Neighbor algorithm to classify the iris data set. Apply and implement the algorithm Define the non-parametric Locally Weighted Regression algorithm. Apply and implement the algorithm	**K1,K2,K3,K4,K5,K6**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating		

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	1
CO2	3	2	2	2	2	1
CO3	3	3	3	2	1	1
Total	9	8	7	6	5	3
Average	3	2.6	2.3	2	1.6	1

Level of Correlation between PSO's and CO's

1– Low ,

2 – Medium ,

3 – High ,

0 – No Correlation

M.Sc Degree Programme in Computer Science

Second Semester				
Course Title		**ADVANCED WEB DESIGN**		
Course Code		**22PBCSD1**		
Course number	**Core category**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal+External)**
EDS-I	**Core**	**3**	**2**	**25+75**

COURSE OBJECTIVES

- To build web applications using HTML and client side script technologies
- To build web applications with cascading style sheets
- To build web applications with DHTML and XML Data object in order to provide secure web design.

UNIT – I HTML **6 Hours**

Structure of an HTML document - Elements of HTML - Working with Lists - Tables and Frames - Working with Hyperlinks - Images and Multimedia -Working with Forms and controls.

UNIT – II CASCADING STYLE SHEET **6 Hours**

CSS Properties - **CSS Styling**: Background – Text Format – Controlling Fonts – Working with block elements and objects - Working with Lists and Tables – CSS Id and Class . **Box Model**: Introduction – Border properties – Padding Properties – Margin properties .

UNIT – III ADVANCED CSS **6 Hours**

Grouping - Dimension – Display - Positioning - Floating – Align – Pseudo class – Navigation Bar – Image Sprites – Attribute sector – Creating page Layout and Site Designs.

UNIT – IV XHTML and DHTML **6 Hours**

Client Side Script – Browser Languages – **XHTML**: Forms – Frames – Tables etc. **DHTML**: Cascading Style Sheets – Object Model – Event Model – Filters and Transitions – Data Controls – Handling of Multimedia Data

UNIT – V XML **6 Hours**

XML – Introduction – Syntax – Document structure – Document type Definitions – namespaces – XML schemas – Displaying raw XML documents – Displaying XML documents with CSS – XSLT style sheets – XML Processors

TEXT BOOKS

1. P I. Bayross, “Web Enable Commercial Application Development Using HTML, DHTML, Java Script, CGI”, BPB Publications, 2000.
2. T. A. Powell, “Complete Reference HTML”, Third Edition, TMH, 2002.
3. Patrick Carey, “HTML, XHTML and XML, Course Technology”, CENGAGE Learning, 2010.

REFERENCES BOOKS

1. Paul Wilton, “Beginning Java Script”, Wiley, India, 2004.

WEB REFERENCES

1. http://www.webstyleguide.com/wsg3/index.html
2. http://designingfortheweb.co.uk

METHODOLOGY OF TEACHING

- Lectures, Assignments, Group discussions, Seminar , Quiz, Home work

COURSE OUTCOME (COs)

At the end of the Course, the Student will be able to:

CO	COURSE OUTCOME	K- LEVELS
CO1	**Apply** the knowledge of the HTML concepts in **understanding** the web application development**.**	**K1, K2,K3**
CO2	**Demonstrate** the knowledge of HTML, CSS code and HTML editor to **build** personal and/or business websites following current professional and/or industry standards	**K2,K3**
CO3	**Understand**, **analyze** and **apply** the role of markup languages like HTML, DHTML, and XML in the working of the web and web applications.	**K2, K3,K4**
CO4	**Build** secure dynamic web application using XML.	**K3,K4**
CO5	**Analyze** and **assess** the more secure web design.	**K4, K5**
K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating		

CO-PO MAPPING COURSE ARTICULATION MATRIX

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	1
CO2	2	2	2	3	1	1
CO3	3	3	3	2	2	1
CO4	3	3	3	2	3	1
CO5	2	3	3	3	2	1
Total	13	14	14	12	10	5
Average	2.6	2.8	2.8	2.4	2	1

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Second Semester				
Course Title		**OPTIMIZATION TECHNIQUES**		
Course Code		22PBCSE2A		
Course No	**Course Category Core / Elective**	**No of Credits**	**No of hrs / week**	**Total Marks (Internal+ External)**
CEC-II	**Elective**	**3**	**4**	**25+75 = 100**

COURSE OBJECTIVES

- To understand the concept of optimization techniques and develop mathematical model of real life cases.
- To study various optimization algorithms. Understand optimization techniques using algorithms, and Investigate, study, develop, organize and promote innovative solutions for various applications.

UNIT – I **13 Hours**

Linear Programming Problem (LPP): Formulations and graphical solution of (2 variables) canonical and standard terms of linear programming problem. Simplex method, Two phase simplex method

UNIT – II **12 Hours**

Duality in LPP- dual problem to primal- primal to dual problem-duality simplex method-Revised simplex method- revised simplex method versus simplex method

UNIT – III **11 Hours**

Transportation Model: North West corner Method, Least cost method, and Vogel's approximation method. Assignment Model : Hungarian assignment model – Travelling sales man problem.

UNIT – IV **12 Hours**

Replacement Problem: Introduction – Various replacement situations – Replacement Policy – Variables Maintenance costs and fixed money value – Variable Maintenance Costs and Variable Money Value – Individual Replacement Policy – Group Replacement Policy.

UNIT – V **12 Hours**

Project Scheduling PERT/CPM Networks – Fulkerson's Rule – Measure of Activity – PERT Computation – CPM Computation – Resource Scheduling.

TEXT BOOKS

1. Kanti Swarup, P.K. Gupta & Man Mohan, "Operation Research", 1996.
2. S. Kalavathy, "Operations Research", Second Edition, Vikas Publishing House Pvt.Ltd.,

REFERENCE BOOKS

1. John W. Chinneck, "Feasibility and Infeasibility in Optimization-Algorithms and Computational Methods", Springer, 2015.
2. Taha, H.A., "Operations Research: An Introduction", Prentice Hall of India (2007) 8th ed

WEB RESOURCES

1. https://www.srividyaengg.ac.in/coursematerial/CSE/104745.pdf
2. https://nptel.ac.in/courses/111105039

METHODOLOGY OF TEACHING

Class Lecturers, Assignments, Group Discussion, Quiz, Seminar

COURSE OUTCOMES (Cos)

Upon completion of this course, the students are able to

CO	COURSE OUTCOME	K- LEVELS
CO1	**Define** the terms of OR, **Solve** the optimization problem using graphical method, **Interference** the results	**K1, K3, K4**
CO2	**What** is duality? **Solve** the optimization problem using dual simplex method, **Compare and contrast** the revised simplex method with simplex method.	**K1, K3, K5**
CO3	**Illustrate** the transportation problem, **Solve** the transportation problem using various methods. Solve the assignment problem	**K2, K3**
CO4	**Define** the replacement problem, **Explain** the various replacement situations, Study about maintenance cost, **Compare** the Individual Replacement Policy with Group Replacement Policy	**K1, K2, K5**
CO5	**Relate** the real time project scheduling problem with mathematical problems, **Summarize** the steps of PERT and CPM computation, **Choose** the best method among PERT and CPM	**K1,K2, K5**
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO-PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	0	2	2	3
CO2	3	3	0	2	2	3
CO3	3	3	1	2	2	3
CO4	3	3	1	2	2	3
CO5	3	3	1	2	3	3
Total	14	15	3	10	11	15
Average	2.8	3	0.6	2	2.2	3

Level of Correlation between PSO's and CO's

1– Low ,

2 – Medium ,

3 – High ,

0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Second Semester				
Course Title		**Scientific Computing**		
Course Code		**22PBCSE2B**		
Course number	**Core category**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC-II	**Core**	**3**	**4**	**25+75**

COURSE OBJECTIVES

- To understand the concept of Scientific computing
- To acquaint with basic concepts of numerical methods
- To study the numerical differentiation and integration methods.

UNIT – I **12 Hours**

Root finding for nonlinear equations: Bisection methods – Fixed point Iteration method – Newton Raphson method – Graffe's squaring method – Secant method

UNIT - II **12 Hours**

Solution of Simultaneous linear equations: Gauss Elimination – Gauss Seidel method – Gauss Jacobi iterative methods- Matrix Inversion method: Gauss Jordan methods

UNIT- III **12 Hours**

Interpolation methods: Newton's divided difference interpolating polynomials – Lagrange's polynomial– Newton forward and backward difference formula – Numerical differentiation: Strling's and Bessel's Central difference formula – Numerical differentiation using Newton's forward and backward interpolation formula

UNIT – IV **12 Hours**

Numerical integration: Numerical integration by Trapezoidal rule, Simpon's 1/3 and 3/8 rules – Double integral using Trapezoidal and Simpson rules.

UNIT – V **12 Hours**

Initial value problems for ordinary differential equation: Taylor series method for simultaneous first order and second order differential equations– Modified Euler's method – Runge-Kutta method for simultaneous differential equations – RK second order and fourth order methods.

TEXT BOOKS

1. Steven C. Chapra and Raymond P. Camale, "Numerical Methods for Engineering", 5th Edition, Tata McGraw Hill, 2008.
2. S.S.Sastry, "Introdcutory Methods of Numerical Analysis", 4th Edition, Prentice-Hall of India, 2008

REFERENCE BOOKS

1. M.K.Jain, S.R.K. Iyengar and R.K.Jain, "Numerical Methods for Scientific and Engineering Computation", 5th Edition, New Age International (P) Ltd., 2007.
2. S. Arumugam, A. Thangapandi Issac and A. Somasundaram, "Numerical Methods", 2nd Edition, Scitech Publications Pvt. Ltd., 2008
3. V.Rajaram, "Computer Oriented Numerical Methods", 3rd Edition, PHI, 2005.

WEB REFERENCES

1. NPTEL & MOOC courses titled Numerical methods
2. https://onlinecourses.nptel.ac.in/noc21_ma45/
3. https://math.iitm.ac.in/public_html/sryedida/caimna/content1.html

COURSE OUTCOMES (Cos)

On completion of the course the students will be able to:

CO	COURSE OUTCOME	K- LEVELS
CO1	Learn numerical techniques to compute the roots of non linear equations	**K1, K2, K3**
CO2	Learn numerical techniques to solve system of simultaneous linear equations	**K1, K2, K3**
CO3	Gain knowledge about Difference operators and to learn how to interpolate given set of values	**K1, K2, K3**
CO4	Calculate the definite value of integral using different methods	**K1, K2, K3, K4**
CO5	Solve ordinary and partial differential equations	**K1, K2, K3**
K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating		

CO-PO MAPPING COURSE ARTICULATION MATRIX

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	1	1	1
CO2	3	3	2	1	1	1
CO3	3	3	2	1	1	1
CO4	3	3	2	1	1	1
CO5	3	2	2	1	1	1
Total	15	14	10	5	5	5
Average	3	2.8	2	1	1	1

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Second Semester				
Course Title		**BIG DATA ANALYTICS**		
Course Code		**22PBCSE2C**		
Course No	**Course Category Core / Elective /**	**No of Credits**	**No of hrs /week**	**Total marks (Internal+External)**
CEC-II	**Elective**	**3**	**4**	**25 + 75=100**

COURSE OBJECTIVES:

- To explore the fundamental concepts of big data analytics
- To learn to analyze the big data using intelligent techniques.
- To learn to use various techniques for mining data stream.
- To understand the applications using Map Reduce Concepts

UNIT – I: Basics of Big Data Analytics **12 Hours**

Classification of Digital Data – Introduction to Big Data: Characteristics, Evolution, Definition, Challenges – What is Big Data? – 5 V's of Big Data – Big Data Analytics: Definition, importance of Big Data Analytics, Classification, challenges – Data Science and Data Scientists – Terminologies in Big Data Environments: In-Memory Analytics, In-Database Processing, SMP, MPP, Shared Nothing Architecture, CAP Theorem.

UNIT – II: Hadoop Architecture **12 Hours**

Hadoop: Features, Advantages, Versions – Overview of Hadoop Ecosystem – Hadoop distributions – Why to use Hadoop? – RDBMS vs. Hadoop – Hadoop overview - HDFS (Hadoop Distributed File System) – Hadoop Map Reduce data processing – Managing applications and resources with YARN (Yet Another Resource Negotiator) – Map Reduce programs for Word Count, Market Analysis and Weather data Analysis – Streaming using Map Reduce.

UNIT – III: Hive **12 Hours**

Hive: Introduction to Hive – Hive architecture – Data Types – File formats – Hive Query Language (HQL): DDL, DML Statements, Database commands, Managed and External Tables, Data loading into tables, Querying tables, Partitions: Static and Dynamic partition, Bucketing – Views, Sub queries and Joins - Aggregation – RCFILE implementation – SERDE (Serializer / Deserializer) – UDF (User Defined Functions).

UNIT – IV: Pig **12 Hours**

Pig: Introduction to Pig – Pig Architecture – Pig Latin overview: Operators – Data Types – Pig Execution Modes – Relational Operators – Eval Functions – Tuple and Map data types – User Defined Functions – Parameter substitution – Word Count example using Pig – Comparison of Pig and Hive. Introduction to Jasper Reports.

UNIT – V: NoSQL **12 Hours**

NoSQL: Uses of NoSQL – Types of NoSQL Databases – Advantages – New SQL - SQL vs. NoSQL vs. New SQL. MongoDB: Introduction – Necessity of MongoDB- RDBMS vs. MongoDB terminologies – Data Types. MongoDB Query Language: Insert, save, Update and Remove – Count, Limit, Sort and Skip – Arrays – Aggregate Functions – Map Reduce Function.

TEXT BOOK

1. Seema Acharya, "Big Data and Analytics", Second Edition, , Wiley India Private Limited.

REFERENCE BOOKS

1. Lars George, "HBase: The Definitive Guide", O'Reilley,2011.
2. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley,2012.
3. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

4. AlanGates,"ProgrammigPig",O'Reilley,2011. Hadoop in Practice by Alex Holmes, MANNING Publ

WEB REFERENCES:

1. Hadoop: http://hadoop.apache.org/.
2. Hive: https://cwiki.apache.org/confluence/display/Hive//LanguageManual.
3. Pig: https://pig.apache.org/docs/r0.17.0/

METHODOLOGY OF TEACHING

Class lectures, Group Discussion, Assignments, Quiz.

Course Outcomes (COs):

Upon completion of this course, the students

CO	COURSE OUTCOME	K- LEVELS
CO1	Finds the reason about the evolution of data science and its development. Explain the basic of big data analytics and to develop the code. Importance of various kinds of data comparing the other language.	**K1, K2, K3**
CO2	Outline and model HDFS environment using NoSQL implementing the queries. Aggregate the data using NoSQL.	**K2, K3**
CO3	Identify the concept of basic Hadoop, data format and analyzing the data in the HDFS environment. Test for the concept Hadoop mapper and reducer implementations and java/python interfaces. Significance of various methods of streaming, serialization.	**K3, K4**
CO4	Analyze Map Reduce applications, unit test, MR Unit, create file using Map Reduce sorting and shuffling process. Determine the creation of input and output format of Map Reduce.	**K4, K5**
CO5	Judge the usage of related tools and Definition of MongoDB, Pig, Hive QL. Life Build data manipulation by Hive QL queries.	**K5**

K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	1
CO2	2	2	2	3	1	1
CO3	3	3	3	2	2	-
CO4	3	3	3	2	3	2
CO5	1	2	3	3	2	1
Total	12	13	14	12	10	5
Average	2.4	2.6	2.8	2.4	2	1

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Second Semester				
Course Code		22PBCSE3A		
Name of the Course		**WIRELESS NETWORKS**		
Course No	**Course Category Core / Elective**	**No of Credits**	**No of hrs / week**	**Total Marks (Internal + External)**
CEC- III	**Elective**	**3**	**4**	**25+75 = 100**

COURSE OBJECTIVES :

- To Study about Wireless Networks, Protocol Stack and Standards.
- To Study about Fundamentals of 3G Services, Its Protocols and Applications.
- To Study about Evolution of 4G Networks, its Architecture and Applications.

UNIT – I **12 Hours**

WIRELESS LAN - Introduction-WLAN Technologies: Advantages and Disadvantages - Infrared, Spread Spectrum -IEEE802.11: System Architecture – Hiper LAN: HiperLAN2 – Bluetooth: Architecture, Radio Layer, IEEE802.16-WIMAX: Physical Layer, MAC, Spectrum Allocation For WIMAX

UNIT – II **11 Hours**

MOBILE NETWORK LAYER - Introduction – Mobile IP: IP Packet Delivery, Agent Discovery, Tunneling and Encapsulation, IPV6-Network Layer in the Internet- Mobile Ad-Hoc Network: Routing, Destination Sequence Distance Vector, Dynamic Source Routing.

UNIT – III **13 Hours**

MOBILE TRANSPORT LAYER - TCP Enhancements For Wireless Protocols – Traditional TCP: Congestion Control, Fast Retransmit/Fast Recovery, Implications of Mobility – Classical TCP Improvements: Indirect TCP, Snooping TCP, Mobile TCP – TCP Over 3G Wireless Networks.

UNIT IV **12 Hours**

WIRELESS WIDE AREA NETWORK - Overview Of UTMS Terrestrial Radio Access Network-UMTS Core Network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High Speed Downlink Packet Access (HSDPA)-LTE Network architecture and Protocol.

UNIT V **12 Hours**

4G NETWORKS - Introduction – 4G Vision – 4G Features and challenges – Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart Antenna Techniques, OFDM-MIMO Systems, Adaptive Modulation and Coding with time Slot Scheduler, Cognitive Radio.

TEXT BOOKS

1. Jochen Schiller, ”Mobile Communications”, Second Edition, Pearson Education 2012.(Unit I,II,III)
2. Vijay Garg, “Wireless Communications And Networking”, First Edition, Elsevier 2014.(Unit IV,V)

REFERENCE BOOKS

1. Erik Dahlman, Stefan Parkvall, Johan Skold And Per Beming, “3G Evolution HSPA And LTE For Mobile Broadband”, Second Edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy Kuri, “Wireless Networking”, First Edition, Elsevier 2011.
3. Simon Haykin, Michael Moher, David Koilpillai, “Modern Wireless Communications”, First Edition, Pearson Education 2013.

WEB RESOURCES

1. https://nptel.ac.in/courses/117102062
2. https://nptel.ac.in/courses/106105160

METHODOLOGY OF TEACHING

Class Lecturers, Assignments, Group Discussion, Quiz, Seminar

Course Outcomes (Co)

Upon completion of this course, the students are able to

CO	COURSE OUTCOME	K- LEVELS
CO1	**Explain** about wireless LAN, Bluetooth and Hyper LAN, **Examine** the IEEE 802.xx family architecture, Study the importance of WiMAX	**K2, K4, K5**
CO2	**Define** the various terms of Mobile IP, **interpret** the packet delivery on Mobile IP, **List** and **Choose** the best routing algorithm for Mobile environment,	**K1, K2, K3, K4**
CO3	**Summarize** the TCP Enhancements for Wireless Protocols, **Analyze** the Classical TCP Improvements, **compare** TCP with other 3G networks	**K2, K4, K5**
CO4	**What** is UTMS? **Outline** the latest LTE architecture, Study the **improvements** on UMTS Core Network Architecture	**K1, K2, K6**
CO5	**Define** the 4G technology, and **explain** the various 4G Technologies, **Design** and **develop** Wireless Network Environment for any application using latest Wireless Protocols and Standards	**K1,K2, K6**
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO-PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	3
CO2	3	3	2	2	2	3
CO3	3	3	2	2	3	3
CO4	3	3	3	2	3	3
CO5	3	3	3	2	3	3
Total	15	15	12	10	13	15
Average	3	3	2.4	2	2.6	3

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Second Semester				
Course Title		**BLOCK CHAIN TECHNOLOGY**		
Course Code		22PBCSE3B		
Course No	**Course Category Core / Elective**	**No of Credits**	**No of hrs / week**	**Total Marks (Internal+ External)**
CEC-III	**Elective**	**3**	**4**	**25+75 = 100**

COURSE OBJECTIVES

- To understand the concepts of block chain technology
- To understand how Blockchain and Bitcoin works and its applications in Government.

UNIT - I **12 Hours**

Introduction to Blockchain : Back story of Blockchain - What is Blockchain? - Centralized vs. Decentralized Systems - Layers of Blockchain - Why is Blockchain Important? Limitations of Centralized Systems - Blockchain Uses and Use Cases

UNIT - II **14 Hours**

How Blockchain Works: Blockchain Foundation - Cryptography - Symmetric Key Cryptography - Cryptographic Hash Functions - MAC and HMAC - Asymmetric Key Cryptography - Diffie-Hellman Key Exchange - Symmetric vs. Asymmetric Key Cryptography - Game Theory - Why to Study Game Theory - The Blockchain - Merkle Trees - Properties of Blockchain Solutions Blockchain Transactions - Distributed Consensus Mechanisms - Blockchain Applications - Scaling Blockchain - Off-Chain Computation - Sharding Blockchain State

UNIT - III **12 Hours**

How Bitcoin Works - The History of Money - Dawn of Bitcoin - What Is Bitcoin? - Working with Bitcoins - The Bitcoin Blockchain - Block Structure - The Genesis Block

UNIT - IV **11 Hours**

The Bitcoin Network - Network Discovery for a New Node - Bitcoin Transactions - Consensus and Block Mining - Block Propagation - Bitcoin Scripts - Bitcoin Transactions Revisited - Scripts - Full Nodes vs. SPVs - Bitcoin Wallets

UNIT - V **11 Hours**

Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems.

TEXT BOOK

1. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, "Beginning Blockchain : A Beginner's Guide to Building Blockchain Solutions" - Apress - 2018.

REFERENCE BOOKS

1. Andreas Antonopoulos, "*Mastering Bitcoin: Unlocking Digital Crypto currencies*", O'Reilly Media, Inc. 2014.
2. Melanie Swa, "*Block chain* ",O'Reilly Media 2014.
3. ArshdeepBahga, Vijay Madisetti, "*Block chain Applications: A Hands-On Approach*", White Falcon Publishing Solutions, 2019

WEB RESOURCES

1. https://nptel.ac.in/courses/106105184/
2. **https://consensys.net/blockchain-use-cases/government-and-the-public-sector/**
3. **https://www.ibm.com/blockchain/industries/government**

METHODOLOGY OF TEACHING

Class Lecturers, Assignments, Group Discussion, Quiz, Seminar

Course Outcomes (Cos)

Upon completion of this course, the students are able to

CO	COURSE OUTCOME	K- LEVELS
CO1	**Define** the basis of Blockchain, C**ompare** and **contrast** the centralized and decentralized system	**K1, K4**
CO2	Knows **how** Blockchain works, **examine** and **analyze** the various cryptography techniques,	**K1, K4,**
CO3	**Define** the Bitcoin terms, **design** the structure of the genesis block	**K1, K6**
CO4	**Discover** a new node in a network, **explain** the Bitcoin transactions, **Compare** Full Nodes vs. SPVs	**K1,K4, K5,**
CO5	**Illustrate** how Blockchain helps for Government,	**K2**
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating		

CO-PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	2	3
CO2	3	3	3	3	2	3
CO3	3	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	2	3	3
Total	15	15	15	14	13	15
Average	3	3	3	2.8	2.6	3

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Second Semester				
Course Title		**ADVANCED DATABASE MANAGEMENT SYSTEM**		
Course code		**22PBCSE3C**		
Course No	**Course Category Core / Elective /**	**No of Credits**	**No of hrs /week**	**Total marks (Internal+External)**
CEC-III	**Elective**	**3**	**4**	**25 + 75=100**

COURSE OBJECTIVES:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability based learning techniques
- To understand graphical models of machine learning algorithms

UNIT I **12 Hours**

Relational and parallel Database Design: Basics, Entity Types, Relationship Types, ER Model, ER-to-Relational Mapping algorithm. Normalization: Functional Dependency, 1NF, 2NF, 3NF, BCNF and 4NF.

UNIT II **12 Hours**

Parellel Database : I/O Parallelism, Inter query Parallelism, Intra query Parallelism, Intra operation Parallelism, Interoperation Parallelism, Query Optimization.

Distributed Database: Architecture, Distributed data storage, Distributed transactions, Commit protocols, Concurrency control, Distributed Query Processing.

UNIT III **12 Hours**

Spatial Database: Spatial Database Types, Spatial Data Model, Spatial Database Queries, Spatial data indexing.

Logic based databases: Complex Data Types, Structured Types and Inheritance, Table Inheritance, array and Multiset, Object Identity and Reference Types, Object Oriented versus Object Relational.

UNIT IV **12 Hours**

XML Databases: XML Hierarchical data model, XML Documents, DTD, XML Schema, XML Querying, XHTML, Illustrative Experiments.

UNIT V **12 Hours**

Temporal Databases: Introduction, Intervals, Packing and Unpacking Relations, Generalizing the relational Operators, Database Design, Integrity Constraints, Multimedia Databases: Multimedia Sources, Multimedia Database Queries, Multimedia Database Applications

TEXT BOOKS

1. Abraham Silberschatz, Henry F Korth , S Sudarshan, “Database System Comcepts”, 6th edition , McGraw-Hill International Edition , 2011
2. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, 8th Edition, Pearson Education Reprint 2016.

REFERENCE BOOKS

1. Ramez Elmasri, Shamkant B Navathe, “Fundamental of Database Systems”, Pearson, 7th edition 2016.
2. Thomas Connolly, Carolyn Begg., “Database Systems a practical approach to Design , Inmplementation and Management “, Pearson Education, 2014.

WEB RESOURCES

1. https://nptel.ac.in/courses/106/106/106106093/
2. https://www.javatpoint.com/dbms-tutorial
3. https://www.tutorialspoint.com/dbms/index.html

METHODOLOGY OF TEACHING

Chalk and Talk method, Power point presentation, seminars, quiz, Assignment

COURSE OUTCOMES (COs):

Upon completion of this course, the students

CO	COURSE OUTCOME	K- LEVELS
CO1	Gain Knowledge on the basics of Entity type, relation types, ER model . Learn and compare and learn different Normal Forms,.	**K1,K2,K3,K4**
CO2	Acquaint knowledge on Architecture, parallelism, inter query, intra query parallelism and Distributed data storage, Distributed transactions, protocols, Query processing, object oriented Vs object relational.	**K1,K2,K3,K4,K6**
CO3	Acquire knowledge on Characteristics, Techniques, query in spatial database and logical based database	**K1,K2,K3,K4,K5**
CO4	Learn about XML Database, XML Documents, XML Schema for illustrate Experiments.	**K1,K2,K3,K4**
CO5	Understand and learn the role of Temporal Database And Multimedia Database.	**K1,K2,K3,K4,K6**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating		

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	3
CO2	3	2	3	2	1	2
CO3	3	3	2	2	2	3
CO4	3	3	3	1	1	3
CO5	3	2	2	1	2	2
Total	15	13	12	8	8	13
Average	3	2.6	2.4	1.6	1.6	2.6

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Second Semester				
Course Title		**INTERNSHIP**		
Course Code		**22PCINT1**		
Course No	**Course Category Core / Elective /**	**No of Credits**	**No of hrs /week**	**Total marks (Internal+External)**
-	**Internship**	**2**	**-**	**-**

COURSE OBJECTIVES:

Internship is on-the-job training offered by a company/firm to the students to work at a firm for a limited period of time (**during summer vacation of I year**) as part of degree course.

To receive a satisfactory grade (S) for an internship course, a student must submit a report that satisfies the following criteria:

The report must be of professional quality, typed, and at least eight full, single-spaced pages in length. Title pages, employer letters, and bibliography pages will not be counted toward the page requirements. The report must contain, suggestions for content include general discussion of projects technical specifications of projects, what the intern learned, mistakes the intern made, activities the company provided for interns, and interactions with other employees and supervisors.

The report should accurately reflect the student's activity with the firm and contains no proprietary information or breach of confidentiality concerning the firm's products, procedures, etc. The report will not be accepted unless it is accompanied by the employer's letter. The letter should be bound into the report in a report folder, and the folder should be submitted.

SEMESTER-III

M.Sc Degree Programme in Computer Science

Third Semester				
Course Title		**DIGITAL IMAGE PROCESSING**		
Course code		**22PCCSC1**		
Prerequisite		**Calculus, Basic Programming Skill**		
Course number	**Core category**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal+External)**
CC – X	**Core**	**4**	**5**	**25+75**

COURSE OBJECTIVES

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods.

UNIT – I **15 Hours**

Digital image fundamentals: Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models

UNIT – II **15 Hours**

Spatial Domain: The basics of intensity transformations and spatial – Basic intensity transformation functions – Histogram processing – Fundamentals of Spatial Filtering– Smoothing and Sharpening Spatial Filtering. **Frequency Domain**: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering.

UNIT – III **15 Hours**

Image Restoration: degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.

UNIT – IV **15 Hours**

Color Image Processing: Color Fundamentals, Color Models, Pseudo color image processing.
Edge Detection: Edge detection, Edge linking via Hough transform – Thresholding - Region based Segmentation – Region growing – Region splitting and merging.

UNIT – V **15 Hours**

Image Compression: Fundamentals, Image Compression Models, Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding. **Image Compression standards**: JPEG standard, MPEG. **Recognition**: Patterns and pattern classes.

TEXT BOOK

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing‘, Pearson, Fourth Edition, 2018.

REFERENCE BOOKS

1. Anil K. Jain, _Fundamentals of Digital Image Processing‘, Pearson, 2002.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB‘, Pearson Education, Inc., 2011.
3. Kenneth R. Castleman, _Digital Image Processing‘, Pearson, 2006.

WEB REFERENCES

- https://www.digimat.in/nptel/courses/video/117105135/L01.html

METHODOLOGY OF TEACHING

- Lectures, Assignments, Group discussions, Seminar , Quiz, Home work

COURSE OUTCOME (COs)

At the end of the Course, the Student will be able to:

CO	COURSE OUTCOME	K- LEVELS
CO1	**Understand** and **apply** the basics and fundamentals of digital image processing, such as digitization, sampling and quantization.	**K1, K2,K3**
CO2	**Apply** the techniques of smoothing, sharpening and enhancement on images. **Show** the difference between Spatial and Frequency filtering.	**K2,K3,K4**
CO3	**Understand** the restoration concepts and filtering techniques**. Classify** the noise model and **identify** the type of noise occurred in an image.	**K2, K3,K4**
CO4	**Analyze** and **apply** color image processing techniques. **Make use of** the basics of segmentation	**K3,K4**
CO5	**Justify** the compression techniques to reduce the size of memory needed by an image.	**K5**
K1-Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating		

CO-PO MAPPING COURSE ARTICULATION MATRIX

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	1
CO2	2	2	2	3	1	1
CO3	3	3	3	2	2	1
CO4	3	3	3	2	3	1
CO5	2	3	3	3	2	1
Total	13	14	14	12	10	5
Average	2.6	2.8	2.8	2.4	2	1

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Third Semester				
Course Title		**22PCCSC2**		
Course Code		**INTERNET OF THINGS**		
Course No	**Course Category Core / Elective /**	**No of Credits**	**No of hrs /week**	**Total marks (Internal+External)**
CC-XI	**Core**	**4**	**5**	**25 + 75=100**

COURSE OBJECTIVES

- To understand the fundamentals of Internet of Things
- To learn about the basics of IOT protocols.
- To build low-cost embedded system using Arduino/RaspberryPi.
- To apply the concept of Internet of Things in the real-world scenario.

UNIT – I: Introduction to IoT **15 Hours**

Introduction to IoT – Characteristics of IoT - Physical Design of IoT: Things in IoT, IoT Protools. - Logical Design of IoT: Functional Blocks, Communication Models, Communication APIs. - IoT Enabling Technologies: WSN, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems. - IoT Levels & Deployment Templates.

UNIT – II: IoT and Machine to Machine **15 Hours**

IoT and M2M: M2M, Difference between IoT and M2M. - SDN and NFV for IoT - IoT system management: Need for IoT system management, SNMP, Network operator requirements, NETCONF, YANG, IoT System Management with NETCONF and YANG.

UNIT – III: IoT Physical Devices **15 Hours**

IoT Platforms Design Methodology: Ten steps in IoT design methodology- IoT Physical Devices & Endpoints: Basic building blocks of IoT devices – Arduino Uno: Arduino pins – IDE - Sketch Functions (digital Read(), digital Write(),
Pin Mode(), analog Read(), analog Write(), delay(), delay Microseconds() – Sketch Constants and Variables – Important Sketch Structures (loop(), setup()) – Raspberry Pi 4: Pins and Components – Interfaces – Python Library for Raspberry Pi interfacing.

UNIT – IV: Analog Sensors and Digital Sensors interfacing **15 Hours**

Interfacing Analog and Digital Sensors with Arduino/Raspberry Pi: Interfacing LED and Potentiometer – Controlling high-voltage appliances with Relay module – Interfacing Servo Motor – Interfacing PIR Motion Sensor HC-SR501 – Interfacing Ultrasonic Sensor HC-SR04 – Interfacing DHT22 Temperature and Humidity Sensor – Interfacing Soil Moisture Sensor – Interfacing Flame Sensor – Interfacing MQ2 Gas Sensor – Interfacing LDR –HC-06 Bluetooth module – ESP8266 Wi-Fi module - Liquid Crystal Display. (Note: Interfacing with either Arduino or Raspberry Pi).

UNIT – V: Case Studies **15 Hours**

Case Studies and Real-World Applications: Real-World design constraints–Applications: Smart Home – Smart Cities – Smart Environment - Smart Grids – Logistics Applications - Agriculture.

TEXT BOOK

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-on Approach”, Universities Press, 2015.

REFERENCE BOOKS

1. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
2. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
3. Olivier Hersent, David Boswarthick, Omar Elloumi ,”The Internet of Things – Key applications and Protocols”, Wiley, 2012
4. AmmarRayes, SamereSalam,“Internet of Things – From Hype to Reality”, First Edition, Springer Publishers, 2017.
5. Raj Kamal, “Internet of Things Architecture and Design Principles”, First Edition, Mc-Graw Hill Education, 2017.
6. Jan Holler, Vlasios Tsiatsis , 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.
7. AgusKurniawan, “Smart Internet of Things Projects”, First Edition, Packt Publishing Ltd., 2016.

WEB REFERENCES

1. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/
2. https://www.arduino.cc/reference/en/
3. https://www.raspberrypi.com/documentation/

METHODOLOGY OF TEACHING

Class lectures, Demonstrations, Group Discussion, Assignments, Quiz.

COURSE OUTCOMES (COs)

Upon completion of this course, the students

CO	COURSE OUTCOME	K- LEVELS
CO1	Show the vision of IoT from a global context.	**K1**
CO2	Explain the fundamentals of IoT and M2M.	**K2**
CO3	Classify the role of big data, cloud computing and data analytics in a typical IoT system and experiment with the same.	**K2, K3**
CO4	Identify the market perspective of IoT.	**K3**
CO5	Analyze the application of IoT in Industry, Home, Grids and Buildings.	**K4**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating		

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	1
CO2	2	2	2	3	3	1
CO3	3	3	3	2	2	-
CO4	3	3	3	2	3	2
CO5	2	1	3	3	2	1
Total	13	12	14	12	12	5
Average	2.6	2.4	2.8	2.4	2.4	1

Level of Correlation between PSO's and CO's
1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Third Semester				
Course Title		**SOFTWARE PROJECT MANAGEMENT**		
Course Code		**22PCCSC3**		
Course No	Course Category Core / Elective /	No of Credits	No of hrs /week	Total marks (Internal+External)
CC - XII	**Core**	**3**	**4**	**25+ 75=100**

COURSE OBJECTIVES

- Understand the framework of project management
- Learn to monitor and control the project
- Know the sound knowledge in Agile method
- Know the team, cost, quality and resource management
- Identify and control the risk in the projects

UNIT – I **12 Hours**

Project Management Framework: Introduction: Project – Project management - Relationship among Project, Program and Portfolio management – Project and operations management- Role of project manager – Project management body of knowledge – Enterprise Environmental factors. Project life cycle and Organization: Overview of project life cycle – Projects vs Operational Work – Stakeholders – Organizational influences on project management. **The Standard for Project Management of a Project**: Project management processes for a project: Common project management process interactions - Projects management process groups - Initiating process group planning process group – Executing process group – Monitoring and controlling process group – Closing process group.

UNIT – II **12 Hours**

Choosing Methodologies and Technologies – Software Processes and Process Models – Choice of Process Models – The Waterfall Model– Prototyping – other ways of categorizing prototype - **Agile Methods** – Extreme Programming Selecting the Most Appropriate Process Model- Need of Agile – Iterative vs Incremental-Agile Manifesto and Mindset – Lean, Scrum and Kanban methods-uncertainty, Risk, and lifecycle selection-Scrum Elements overview-5 levels of planning- Scrum Process overview-Agile Team-roles and responsibilities- Epic- feature- User Stories-PBI-The Sprint.

UNIT – III **12 Hours**

The Project Management Knowledge Areas: Project integration management: Develop project charter – Develop project management plan – Direct and manage project execution – Monitor and control project work – Perform integrated change control – Close project or phase. Project scope management: Collect requirements – Define Scope – Create WBS – Verify Scope – Control Scope. Project team management: Define activities – Sequence activities – Estimate activity resources – Estimate Activity Durations – Develop Schedule – Control Schedule.

UNIT – IV **12 Hours**

Project cost management: Estimate costs – Determine budget – Control costs. Project Quality Management: Plan quality - perform quality assurance – Perform quality control. Project Human Resource Management: Develop human resource plan – Acquire project team – Develop project team – Manage project team. Project Communications Management: Identify stakeholders – Plan communications - Distribute information – Manage stakeholder expectations – report performance.

UNIT – V **12 Hours**

Project Risk Management: Plan risk management - Identify risks – Perform qualitative risk analysis – Perform quantitative risk analysis – plan risk responses – Monitor and control risks. Project Procurement Management: Plan – Conduct – Administer – Close procurements.

TEXT BOOKS

1. "A guide to the Project management Body of Knowledge (PMBOK Guide)" Fouth Edition, Project Management Institute, Pennsylva- nia,2008
2. BOB Huges, Mike Cotterell, Rajib Mall "Software Project Manage- ment", McGraw Hill, FifthEdition,2011.
3. Emerson, "Agile Handbook,"Philosophie

REFERENCE BOOKS

1. Futrell, "Quality Software Project Management", Pearson Education India.
2. Royce, "Software Project Management", Pearson Education India.
3. C.Ravindranath Pandian, "Applied Software Risk Management-A Guide for Software Project Managers", Auerbach Publications, 2015.
4. Benjamin A. Lieberman, "The Art of Software Modeling", Auer- bach Publications,2010.

WEB REFERENCES

1. https://www.tutorialspoint.com/software_engineering/software_projectmanagement.htm
2. https://onlinecourses.nptel.ac.in/noc19_cs70/preview
3. https://www.javatpoint.com/software-project-management

COURSE OUTCOMES (COs)

Upon completion of this course, the students

CO	COURSE OUTCOME	K- LEVELS
CO1	**Gain Knowledge** on the basics of project management framework. **Learn** project management of a project. Apply **the basic knowledge of project basics.**	**K1, K2, K3**
CO2	**Acquaint knowledge** on methodologies and technologies to know sound knowledge in agile methods.	**K1, K2, K3, K4**
CO3	**Acquire knowledge** on to monitor and control the project work. To **understand** and know the project team management.	**K1, K2, K3, K4, K5, K6,**
CO4	To **understand** and know the team cost, quality and resource management. **Apply and analyze** Project cost management.	**K1, K2, K3, K4, K5**
CO5	**Analyze and understand** identify and control the risk in the projects.	**K1, K2, K3, K4, K5, K6**

K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**–Creating

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	1	1	3
CO2	3	2	2	2	1	3
CO3	3	3	3	2	1	3
CO4	3	3	3	2	1	3
CO5	3	3	3	2	1	3
Total	15	14	13	9	5	15
Average	3	2.8	2.6	1.8	1	3

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Third Semester				
Course Title		**STATISTICS FOR DATASCIENCE**		
Course Code		**22PCCSC4**		
Course No	**Course Category Core / Elective**	**No of Credits**	**No of hrs / week**	**Total Marks (Internal + External)**
CC-XIII	**Core**	**3**	**4**	**25+75 = 100**

COURSE OBJECTIVES

- To provide an understanding of the statistical methods and probabilistic concepts by which real- life problems are analyzed (Focus on problems- No derivations)
- To develop the students ability to deal with numerical and quantitative issues
- To enable the use of statistical, graphical and algebraic techniques wherever relevant.

UNIT - I **12 Hours**

Sample spaces - Events - Axiomatic approach to Probability - Conditional Probability - Independent Events -Bayes' Formula - Random Variables - Continuous and Discrete Random Variables - Distribution Function of a Random Variables - Expectation, Variance - Coefficient of Variation -Chebyshev's Inequality.

UNIT - II **12 Hours**

Bivariate Distribution – Conditional and Marginal Distributions – **Discrete Distributions:** Discrete, Uniform, Binomial, Poisson and Geometric Distributions – **Continuous Distributions**: Uniform, Normal, Exponential and Gamma Distributions (only simple problems).

UNIT – III **12 Hours**

Correlation: Bivariate Data - Correlation between Two Variables - Covariance between Two Variables - Karl Pearson's Coefficient of Correlation - Rank Correlation. **Regression Analysis**: Simple Linear Regression - Regression Equations.

UNIT - IV **12 Hours**

Concepts of Sampling Distributions and Standard Error -Point Estimation (Concepts Only) - Interval Estimation of Mean and Proportion. Tests of Hypotheses - Critical Region - Two Types of Errors - Level of Significance - Power of the Test - Large Sample Tests for Mean and Proportion - Exact Tests Based on Normal, t, f and Chi-Square Distributions. The method of least squares

UNIT - V **12 Hours**

Basic Principles of Experimentation – Analysis of Variance – One Way and Two Way Classifications – Computing Randomized Design – Randomized Block Design.

TEXT BOOK

1. Gupta S.C and Kapoor V.K, "Fundamentals of Mathematical Statistics", 11th Edition, Sultan Chand & Sons, India, 2007.

REFERENCE BOOKS

1. P.R.Vital, —Mathematical Statistics‖, Marghan Publication, 2004.
2. T.K.V. Iyengar "Probability & Statistics for MCA". S. Chand & company, New Delhi, 2009 edition.
3. Trivedi, K.S, "Probability and Statistics with Reliability, Queuing and Computer Science Applications", Prentice Hall India,1994.
4. James T. McClave and Terry Sincich, "Statistics", 12th Edition, Pearson Education, India, 2013.

5. Erwin Miller and John E.Freund, "Probability and Statistics for Engineers", 7th Edition, Pearson Education, India, 2017.

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2. https://nptel.ac.in/courses/111/105/111105043/
3. https://nptel.ac.in/courses/110/106/110106064/

METHODOLOGY OF TEACHING

Class Lecturers, Assignments, exercises, Discussions, seminars, quiz and assessments

COURSE OUTCOMES (COs)

Upon completion of this course, the students are able to

CO	COURSE OUTCOME	K-LEVELS
CO1	Recall the concepts of sample spaces, events, axiomatic approach, conditional probability, Bayes' theorem. Summarize the random variables, expectation and variance. Demonstrate the chebyshev's inequality	**K1, K2, K4**
CO2	Distinguish Discrete and continuous distributions. Solve the real time problems involving various distributions like Binomial, Poisson and normal distributions.	**K2, K3, K4**
CO3	Explain the concept of Bivariate analysis and point out the importance of correlation analysis, Regression analysis and various curves using method of least squares.	**K1, K2, K3, K4**
CO4	Explain the concept of Bivariate analysis and point out the importance of correlation analysis, Regression analysis and various curves using method of least squares.	**K1, K3**
CO5	Differentiate large and small samples. Compare the various parametric tests like Z-test, t-test, F test by giving practical examples. Explain the non-parametric chi square test with illustrated examples	**K1,K2, K4**
CO6	Restate the analysis of variance and classify the one way and two classifications. Categorize the computing randomized design and randomized block design. Define time series and list the components of time series. Illustrate the measurement of trend and seasonal variations.	**K1,K2,K3, K5**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,		**K6**–Creating

CO-PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	3	2	2
CO2	2	3	1	3	1	1
CO3	3	3	3	2	2	1
CO4	3	3	2	1	3	1
CO5	3	3	2	2	2	1
CO6	3	2	2	2	2	1
Total	16	20	14	13	12	6
Average	2.6	3.3	2.3	2.1	2	1

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Third Semester				
Course Title		**DIGITAL IMAGE PROCESSING LAB**		
Course Code		**22PCCSC5**		
Course number	**Core category**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC – XIV	**Core**	**3**	**4**	**40+60**

COURSE OBJECTIVES

- Apply basics of Digital Image Processing to implement Relationships between Pixels.
- Apply the contrast stretching methods on low contrast image, Histogram, and Histogram Equalization.
- Implementation of smoothing and sharpening filters.
- To implement image restoring techniques.

LIST OF EXPERIMENTS [MATLAB]

1. Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2. Implementation of Relationships between Pixels
3. Implementation of Transformations of an Image
4. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
5. Display of bit planes of an Image
6. Display of FFT(1-D & 2-D) of an image
7. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
8. Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)
9. Implementation of image sharpening filters and Edge Detection using Gradient Filters
10. Image Compression by DCT,DPCM, HUFFMAN coding
11. Implementation of image restoring techniques
12. Implementation of Image Intensity slicing technique for image enhancement
13. Canny edge detection Algorithm

COURSE OUTCOME (COs)

At the end of the Course, the Student will be able to:

CO	COURSE OUTCOME	K- LEVELS
CO1	**Recall** the basics of Digital Image Processing to **summarize** their functional operation.	**K1,K2**
CO2	**Experiment with** images using the techniques of smoothing, sharpening and enhancement.	**K3**
CO3	**Discover** the applications of image compression and recognition.	**K4**
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating		

CO- PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	2	1
CO2	3	2	2	3	1	1
CO3	3	3	3	2	2	1
Total	9	8	8	7	5	3
Average	3	2.67	2.67	1.4	2.3	1

Level of Correlation between PSO's and CO's

1– Low
2 – Medium
3 – High
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Third Semester				
Course Title		**CYBER SECURITY**		
Course Code		22PCCSD2		
Course No	**Course Category Core / Elective**	**No of Credits**	**No of hrs / week**	**Total Marks (Internal + External)**
EDS - II		**3**	**2**	**25+75 = 100**

COURSE OBJECTIVES

- To Understand the basic concepts of security and various attacks, prevention of virus , privacy in computing, legal and ethical issues in computer security.
- To gain knowledge by introducing and researching state-of-the-art in computer security, different types of malicious codes.
- To expose the students implement privacy policies in computer systems and to protect programs from malicious attacks

UNIT – I **6 Hours**

Security Problem in Computing: Secure- Attacks - The meaning of Computer Security- Confidentiality – Integrity- Availability – Computer Criminals.

UNIT – II **6 Hours**

Program Security: Secure Programs – Fixing Faults- Unexpected Behavior – Types of Flows- Viruses and other Malicious code: Kinds of Malicious code- Document viruses- Home for viruses – Prevention of virus Infection.

UNIT – III **6 Hours**

Administering Security: Organizational security Policies – Physical Security: Natural Disasters – Power Loss – Surge Suppressor- Human vandals- contingency planning

UNIT – IV **6 Hours**

Privacy in Computing: Privacy concepts – Privacy principles and concepts – Fair information Policies – controls on commercial websites – Government and Privacy.

UNIT – V **6 Hours**

Legal and Ethical Issues in Computer Security: Protecting programs and Data- Copyrights – Patents- Rights of employees and employers – Ownership of Products.

TEXT BOOK

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing ", Fourth Edition, Pearson ,2009.

REFERENCE BOOKS

1. William Stallings, "Cryptography and Network Security", PHI, 2006
2. Bruce Schneier, "Applied Cryptography", 2nd Edition, Wiley, 2006.3.
3. Bruce Schneier and Niels Ferguson, "Practical Cryptography", Wiley,2003

WEB REFERENCES

1. https://www.edureka.co/blog/what-is-cybersecurity/
2. https://www.javatpoint.com/cyber-security-tutorial
3. https://www.geeksforgeeks.org/cyber-system-security/
4. https://www.tutorialspoint.com/fundamentals_of_science_and_technology/cyber_crime_and_cyber_security.htm

METHODOLOGY OF TEACHING

Class Lecturers, Assignments, exercises, Discussions, seminars, quiz and assessments

COURSE OUTCOME (COs)

Upon completion of this course, the students are able to

CO	COURSE OUTCOME	K- LEVELS
CO1	**Find** out the basic concepts of computer security, **classify** the types of computer attack and i**dentify** the computer criminals.	K1, K2, K3
CO2	**Find** out how to secure programs, **apply** the process of fixing faults, **classify** the different types of viruses and **analyze** the ways to prevent virus infections and **discuss** on it.	K1, K2, K3, K4, K5
CO3	**Classify** the different types of organizational security policies, **find** out the method of **apply**ing the physical security and **analyze** it**.**	K1, K2, K3, K4, K5, K6
CO4	**Determine** the security problems faced due to natural disasters	K1, K2, K3, K4, K5, K6
CO5	**Define** the legal and Ethical issues in computer security and **explain** the various security aspects like copyrights, patents, **identify** the rights of employees and employers and ownership of products and **analyze**	K1, K2
K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating		

CO-PSO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	3	2	2
CO2	2	3	1	3	1	1
CO3	3	3	3	2	2	1
CO4	3	3	2	1	3	1
CO5	3	3	2	2	2	1
CO6	3	2	2	2	2	1
Total	16	20	14	13	12	6
Average	2.6	3.3	2.3	2.1	2	1

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Third Semester				
Course Title		**EMBEDDED SYSTEMS**		
Course Code		22PCCSE4A		
Course No	**Course Category Core / Elective**	**No of Credits**	**No of hrs / week**	**Total Marks (Internal + External)**
CEC-IV	**Elective**	**3**	**4**	**25+75 = 100**

COURSE OBJECTIVES

- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
- Describe the hardware software co-design and firmware design approaches.
- Know the RTOS internals, multitasking, task scheduling, communication and synchronization
- Learn the development life cycle of Embedded System

UNIT – I **12 Hours**

Introduction to Embedded system - Embedded system vs General computing systems - History - Classification - Major Application Areas- Purpose of Embedded systems - Smart running shoes: The innovative bonding of lifestyle with embedded technology Characteristics and Quality Attributes of Embedded systems

UNIT – II **12 Hours**

Elements of an Embedded system - core of the embedded system: General purpose and domain specific processors, ASICs, PLDs, COTS - Memory - Sensors and Actuators - Communication Interface: Onboard and External Communication Interfaces – Embedded Firmware - Reset circuit, Brown- out protection circuit, Oscillator unit, Real-time clock, and Watchdog timer - PCB and Passive Components

UNIT – III **12 Hours**

Embedded Systems - Washing machine: Application-specific -Automotive: Domain specific. Hardware Software Co-Design - Computational Models – Embedded Firmware Design Approaches - Embedded Firmware Development Languages - Integration and testing of Embedded Hardware and firmware.

UNIT – IV **12 Hours**

RTOS based Embedded System Design: Operating System Basics -Types of operating Systems - Tasks, process and Threads -Multiprocessing and Multitasking - Task scheduling – Task Communication - Task Synchronization - Device Drivers - choosing an RTOS.

UNIT – V **12 Hours**

Components in embedded system development environment, Files generated during compilation, simulators, emulators and debugging -Objectives of Embedded product Development Life Cycle – Different Phases of EDLC - EDLC Approaches - Trends in Embedded Industry -Case Study: Digital Clock.

TEXT BOOK

1. K. V. Shibu, "Introduction to embedded systems", TMH Education Pvt. Ltd. 2009.

REFERENCE BOOKS

1. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, TMH. Second Edition 2009
2. Frank Vahid, Tony Givargis, “Embedded System Design”,JohnWiley,

Third Edition 2006.
3. Cliff Young, Faraboschi Paolo, and Joseph A. Fisher,"Embedded Computing: A VLIW Approach to Architecture, Compilers and Tools", Morgan Kaufmann Publishers, An imprint of Elsevier,2005.
4. David E. Simon, "An Embedded Software Primer" Pearson Education, 1999

WEB REFERENCES

1. https://www.tutorialspoint.com/embedded_systems/es_overview.ht m
2. https://www.javatpoint.com/embedded-system-tutorial
3. https://nptel.ac.in/courses/108/102/108102045/
4. https://www.codrey.com/embedded-systems/embedded-systems- introduction/

METHODOLOGY OF TEACHING

Class Lecturers, Assignments, Group Discussion, Quiz, Seminar

Course Outcomes (Cos)

Upon completion of this course, the students are able to

CO	COURSE OUTCOME	K- LEVELS
CO1	**Find** out the basics of embedded system and **explain** the purpose, characteristics and **identify** its application areas and **analyze** it.	**K1,K2,K3,K4**
CO2	**Explain** the general purpose and specific processors of embedded system, and **find** out the sensors, actuators and communication interfaces	**K1, K2**
CO3	**Apply** the fundamental knowledge on the applications of embedded systems in various devices, **demonstrate how** to **develop** the hardware and software for embedded systems in specific programming languages, **analyze** and **justify** it.	**K1,K2,K3,K4, K5,K6**
CO4	**Explain** RTOS based embedded design, **analyze** the various types of operating systems, **find** out the different RTOS, **choose** an RTOS for embedded systems and **evaluate** it.	**K1,K2,K3,K4, K5**
CO5	**Define** the various components of embedded systems, and **explain** the objectives of Embedded product development Life cycle (EDLC), **identify** its phases, through case study and recent trends in embedded industry.	**K1 K2 K3**
K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6– Creating		

CO-PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	1	1	3
CO2	3	3	2	1	1	3
CO3	3	3	2	1	1	3
CO4	3	3	2	1	1	3
CO5	3	3	2	1	1	3
Total	15	15	10	5	5	15
Average	3	3	2	1	1	3

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Third Semester				
Course Title		**WEB SERVICES**		
Course Code		22PCCSE4B		
Course No	**Course Category Core / Elective**	**No of Credits**	**No of hrs / week**	**Total Marks (Internal + External)**
CEC-IV	**Elective**	**3**	**4**	**25+75 = 100**

COURSE OBJECTIVES:

To enable the student to be familiar with distributed services, XML and web services.
To study the use of web services in B2C and B2B applications

Unit – I **12 Hours**

Overview of Distributed Computing. Introduction to web services – Industry standards, Technologies and concepts underlying web services – their support to web services. Applications that consume web services.

Unit – II **12 Hours**

XML – its choice for web services – network protocols to back end databases- technologies – SOAP, WSDL – exchange of information between applications in distributed environment – locating remote web services – its access and usage. UDDI specification – an introduction.

Unit – III **12 Hours**

A brief outline of web services – conversation – static and interactive aspects of system interface and its implementation, work flow – orchestration and refinement, transactions, security issues – the common attacks – security attacks facilitated within web services quality of services – Architecting of systems to meet users requirement with respect to latency, performance, reliability, QOS metrics, Mobile and wireless services – energy consumption, network bandwidth utilization, portals and services management.

Unit – IV **12 Hours**

Building real world enterprise applications using web services – sample source codes to develop web services – steps necessary to build and deploy web services and client applications to meet customer s requirement – Easier development, customization, maintenance, transactional requirements, seamless porting to multiple devices and platforms.

Unit – V **12 Hours**

Deployment of Web services and applications onto Tomcat application server and axis SOAP server (both are free wares) – Web services platform as a set of enabling technologies for XML based distributed computing

TEXT BOOKS

1. Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services: An Architects Guide , Prentice Hall, Nov 2003.
2. Heather Williamson, "XML: The Complete Reference ", Tata McGraw-Hill Education

India.

REFERENCE BOOKS

1. Martin Kalin, "Java Web Services: Up and Running", O'Reilly Publishers.

WEB REFERENCES

1. XML Soap (w3schools.com)
2. Apache Tomcat® - Welcome!
3. https://www.guru99.com/soap-simple-object-access- protocol.html

METHODOLOGY OF TEACHING

Class Lecturers, Assignments, Group Discussion, Quiz, Seminar

Course Outcomes (Cos)

Upon completion of this course, the students are able to

CO	COURSE OUTCOME	K- LEVELS
CO1	**Introduce** the Web Services. **Identify** the applications that consume web services. support web services.	**K1,K2, K3, K4**
CO2	**Recognize** XML web services. **Acquire** knowledge on SOAP, WSDL environment.	**K1,K2, K3, K4**
CO3	**Understand** different aspects of web services. **Apply** and **Analyze** various architecting of systems to meet user requirements. **Evaluate** the method for analyzing the user requirements.	**K1,K2, K3, K4, K5**
CO4	**Recognize** the real world applications using web services, necessary steps for deploying web services. **Analyze** and **Evaluate** client	**K1, K2, K3, K4, K5**
CO5	**Understand** and **Apply** concepts of Web Services and Applications. **Recognize** free web services. **Analyze** XML based distributed computing.	**K1, K2, K3, K4**

K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6–Creating

CO-PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	1	1	3
CO2	3	3	2	1	1	3
CO3	3	3	2	1	1	3
CO4	3	3	2	1	1	3
CO5	3	3	2	1	1	3
Total	15	15	10	5	5	15
Average	3	3	2	1	1	3

Level of Correlation between PSO's and CO's
1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.Sc Degree Programme in Computer Science

Third Semester				
Course Title		**SOFT COMPUTING**		
Course Code		22PCCSE4C		
Course No	**Course Category Core / Elective**	**No of Credits**	**No of hrs / week**	**Total Marks (Internal + External)**
CEC-IV	**Elective**	**3**	**4**	**25+75 = 100**

Course Objectives:

- Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
- Introduce students to artificial neural networks and fuzzy theory from an engineering perspective.

Unit – I **12 Hours**

Introduction: Soft Computing Constituents – Soft Computing Vs Hard Computing – Characteristics - Applications - Artificial Neural Network (ANN): Fundamental Concept – Application Scope – Basic Terminologies – Neural Network Architecture – Learning Process – Basic Models of ANN: McCulloch-Pitts Model – Hebb Network –Linear Separability.

Unit – II **12 Hours**

Supervised Learning Networks: Perceptron Networks – Adaline and Madaline Networks – Back Propagation Network – Radial Basis Function Network. Associative Memory Networks – BAM – Hopfield Network - Boltzmann Machine. Unsupervised Learning Networks: Kohonen Self Organizing Network – Counter Propagation Network – ART Network.

Unit – III **12 Hours**

Fuzzy Sets: Basic Concept – Crisp Set Vs Fuzzy Set - Operations on Fuzzy Set – Properties of Fuzzy Sets – Fuzzy Relations: Concept – Fuzzy Composition – Fuzzy Equivalence and Tolerance Relation - Membership Functions: Features – Fuzzification – Methods of Membership value assignments – Defuzzification – Methods.

Unit – IV **12 Hours**

Fuzzy Arithmetic – Extension Principle – Fuzzy Measures – Fuzzy Rules and Fuzzy Reasoning: Fuzzy Propositions – Formation of Rules – Decomposition of Rules – Aggregation of Rules – Approximate Reasoning – Fuzzy Inference and Expert Systems – Fuzzy Decision Making – Fuzzy Logic Control Systems.

Unit – V **12 Hours**

Genetic Algorithm: Fundamental Concept – Basic Terminologies – Traditional Vs Genetic Algorithm - Elements of GA - Encoding - Fitness Function – Genetic Operators: Selection – Cross Over - Inversion and Deletion - Mutation – Simple and General GA – The Schema Theorem - Classification of Genetic Algorithm – Genetic Programming – Applications of GA.

TEXT BOOK

1. S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Wiley India, 2007.

REFERENCE BOOK

1. S. Rajasekaran, G.A.V. Pai, "Neural Networks, Fuzzy Logic, Genetic Algorithms", Prentice Hall India, 2004.

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1. https://www.javatpoint.com/what-is-soft-computing
2. https://www.tutorialspoint.com/fuzzy_logic/index.htm
3. https://www.javatpoint.com/artificial-neural-network-genetic- algorithm

METHODOLOGY OF TEACHING

Class Lecturers, Assignments, Group Discussion, Quiz, Seminar

Course Outcomes (Cos)

Upon completion of this course, the students are able to

CO	COURSE OUTCOME	K- LEVEL
CO1	**Acquire** knowledge on Artificial Neural Network and its Architecture and able to **explain** the basic models of ANN. This helps to **identify** different neural network architectures, algorithms and its applications.	**K1, K2, K3**
CO2	**Understand** neural network concept, **identify** and describe soft computing techniques and their roles in building intelligent machines, **analyse** various supervised and unsupervised learning networks, performance **evaluation** of different learning algorithms	**K1, K2, K3, K4, K5, K6**
CO3	**Acquaint** with the fundamentals fuzzy logic concepts, fuzzy principles and relations. It helps to **experiment** with how fuzzy logic is widely used for commercial and practical purposes.	**K1, K2, K3**
CO4	**Initiate** to learn about the fuzzy arithmetic and fuzzy logic control systems, **apply** fuzzy rules and reasoning, **examine** how fuzzy logic is applied with great success in various control applications.	**K1, K2, K3, K4**
CO5	**Recall** artificial neural network, **Understand** the fundamental concept of genetic algorithms, **apply** various genetic operators to **Analyse** the genetic algorithms and **compare** with their applications.	**K1, K2, K3, K4, K5**

K1 – Remembering , K2– Understanding , K3 –Applying ,K4 –Analysing , K5–Evaluating , K6– Creating

CO-PO Mapping (Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	1	1	3
CO2	3	3	2	1	1	3
CO3	3	3	2	1	1	3
CO4	3	3	2	1	1	3
CO5	3	3	2	1	1	3
Total	15	15	10	5	5	15
Average	3	3	2	1	1	3

Level of Correlation between PSO's and CO's

1– Low ,
2 – Medium ,
3 – High ,
0 – No Correlation

BLOOM TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 x 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4, K5	B (INTERNAL CHOICE) EITHER (a) OR (b)	5 x 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5, K6	C (Answer any three question from five questions)	3 x 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SEMESTER-IV

M.Sc Degree Programme in Computer Science

Fourth Semester				
Course Title		**PROJECT WORK**		
Course Code		**22PDCSP1**		
Course No	Course Category Core / Elective /	No of Credits	No of hrs /week	Total marks (Internal+External)
CEC-V	**Core**	**15**	*****	**75 + 225=300**

COURSE OBJECTIVES

Each student will develop and implement individually a Project work which is an application (software or hardware or both) based on any emerging latest technologies. The Project work is to be carried out either in an R & D section of any Industry or Research Institute or University or in the Institute itself (i.e., in which the candidate is studying) within the duration of IV Semester. The Project work report shell be submitted through the Guides / Supervisors to the Head of the Department and then to this College not later than 20th April.

COURSE OUTCOMES (COs)

Upon completion of this course, the students

CO	COURSE OUTCOME	K- LEVELS
CO1	Identify the problem by applying acquired knowledge. Learn to apply the knowledge gained through various courses in solving a real life problem.	**K1,K2,K3,K4,K5,K6**
CO2	Analyze and categorize executable project modules after considering risks. Practice different phases of software/system development life cycle.	**K1,K2,K3,K4,K5,K6**
CO3	Choose efficient tools for designing project modules. To introduce the student to a professional environment and/or style typical of a global IT industry.	**K1,K2,K3,K4,K5,K6**
CO4	Combine all the modules through effective team work after efficient testing.	**K1,K2,K3,K4,K5,K6**
CO5	Able to prepare effective, real-life, technical documentation. To provide an opportunity to practice time, resource and person management.	**K1,K2,K3,K4,K5,K6**

K1 – Remembering , **K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating , **K6**– Creating.

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CO-PSO MAPPING(Course Articulation Matrix)

CO / PO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	2	2
CO2	3	2	2	3	3	2
CO3	3	3	3	2	2	1
CO4	3	3	3	2	3	3
CO5	3	2	3	3	2	2
Total	15	13	14	13	12	10
Average	3	2.6	2.8	2.6	2.4	2

Level of Correlation between PSO's and CO's

1– Low ,

2 – Medium ,

3 – High ,

0 – No Correlation