SDM College OF Engineering & Technology

Dharwad-580002

Department of Information Science & Engineering

New Courses Introduced – (Last 5 years)

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HOD, ISE

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1.2.1 Percentage of new courses introduced of the total number of courses across all programmes offered during the last five years (20)

Sl.No	Name of the Course	Course Code	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development	Year of introduction (during the last five years)	Link to the relevant document
	UG				
1	Programming in Java	15UISC504	Employability/ Skill development	**2017-18**	
2	Java Lab	15UISL506	Employability/ Skill development		
3	Mini Project-I	15UISL507	Employability/ Entrepreneurship/ Skill development		
4	Unix Systems Programming	15UISE620	Skill development		
5	Computer Graphics	15UISE623			
6	Advanced DBMS	15UISE624	Employability/ Skill development		
7	Agile Technology	11UISE763	Skill development		
1	Machine Learning	15UISC800	Employability/ Skill development	**2018-19**	
2	Machine Learning Lab	15UISL803	Employability/ Skill development		
3	Artificial Intelligence	15UISE851	Skill development		
4	Project management	15UISE852			
5	Digital Image Processing	15UISE861			
6	Service Oriented Architecture	15UISE862			
1	Unix &Shell Programming	18UISC303	Employability/ Skill development	**2019-20**	
2	Operating System	18UISC404	Employability/ Skill development		
3	Introductory Project	18UISL407	Employability/ Skill development		
1	Software Engineering	18UISC500	Employability/ Skill development	**2020-21**	
2	Java and Web Technology	18UISC501	Employability/ Skill development		
3	Computer Networks	18UISC503	Employability/ Skill development		
4	System software	18UISE511			
5	Advanced Data Structures	18UISE512	Employability/ Skill development		
6	Soft skills/Aptitude	18UHUL507			
7	Artificial Intelligence and Machine Learning	18UISC600	Employability/ Skill development		
8	Internet of Things	18UISC601	Employability/ Skill development		
9	Computer Networks Lab	18UISL602	Employability/ Skill development		
10	Soft skills/Aptitude	18UHUL605			
11	User Interface Design	18UISE612			
12	Object Oriented Modeling and Design	18UISE621	Skill development		
13	Agile Methodologies	18UISO633	Entrepreneurship/ Skill development		

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1	Storage management	18UISC701		**2021-22**	
2	Internship	18UISL704	Entrepreneurship/ Skill development		
3	Deep Learning	18UISE713	Skill development		
4	Supply Chain management	18UISO722			
5	Virtual reality and augmented reality	18UISO723			
6	Cryptography and Cyber Security	18UISC800	Employability/ Skill development		
7	Block Chain management	18UISE812	Employability/ Skill development		
8	Data Compression	18UISE813			
9	Dev Ops	18UISO821			
10	Data Science	18UISO822	Skill development		
11	Computer Vision	18UISO823			
	PG				
1	Big Data Analytics	18PITEC100	Employability/ Skill development	**2018-19**	
2	Applied Mathematics	18PITEC101			
3	Agile Technology	18PITEE125	Employability/ Skill development		
4	Fuzzy System	18PITEE128			
5	Artificial Intelligence	18PITEE129	Employability/ Skill development		
6	Data Analytics Lab	18PITEL102	Employability/ Skill development		
1	Research Methodology and IPR	20PRMIC100		**2020-21**	
2	Distributed Computing Systems	20PITC101			
3	Cloud Computing	20PITE126	Employability/ Skill development		
4	Storage Technologies	20PITE127	Employability/ Skill development		
5	Internet of Things	20PITC201	Employability/ Skill development		
6	Data Science	20PITE225	Employability/ Skill development		
7	Virtual reality	20PITE228			
8	Pervasive computing	20PITE233			

	2021-22	2020-21	2019-20	2018-19	2017-18
New Courses	11(UG)	8(PG)+13(UG)	3(UG)	6(UG)+6(PG)	7(UG)
Total Courses	48(UG)+21(PG)	50(UG)+21(PG)	47(UG)+19(PG)	46(UG)+19(PG)	45(UG)
Percentage	23%(UG)	38%(PG),26%(UG)	6%(UG)	13%(UG),32%(PG)	16%(UG)

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UG-2017-18

Scheme for III Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
15UMAC300	PC	Engineering Mathematics-III	4-0-0	4	50	100	3		
15UISC300	PC	Data Structures	3-2-0	4	50	100	3		
15UISC301	PC	Digital Circuits	3-0-0	3	50	100	3		
15UISC302	PC	Discrete Mathematical & Graphical Structures	4-0-0	4	50	100	3		
15UISC303	PC	Computer Organization	4-0-0	4	50	100	3		
15UISC304	PC	Digital Circuits Lab	0-0-3	1.5	50			50	3
15UISC305	PC	Data Structures Lab	0-0-3	1.5	50			50	3
15UISC306	PC	Unix/Linux Lab	1-0-2	2	50			50	3
Total			**19-2-8**	**24**	**400**	**500**		**150**	

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Scheme for IV Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration In hours
15UMAC400	PC	Engineering Mathematics - IV	4-0-0	4	50	100	3		
15UISC400	PC	Object Oriented Programming	4-0-0	4	50	100	3		
15UISC401	PC	Analysis and Design of Algorithms	3-0-2	4	50	100	3		
15UISC402	PC	Data Communication	4-0-0	4	50	100	3		
15UISC403	PC	Microcontroller 8051	4-0-0	4	50	100	3		
15UISC404	PC	Finite Automata and Formal Language	3-2-0	4	50	100	3		
15UISL405	PC	Microcontroller Laboratory	0-0-3	1.5	50			50	3
15UISL406	PC	Object Oriented Programming Laboratory	0-0-3	1.5	50			50	3
Total			**22-2-8**	**27**	**400**	**600**		**100**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination*

L: Lecture **T**: Tutorials **P**: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination* **L**: Lecture **T**: Tutorials **P**: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

BS- Basic Science, PC- Program Core

Scheme for V Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
15UISC500	PC	Management, Entrepreneurship and Intellectual Property Rights	4-0-0	4	50	100	3		
15UISC501	PC	Operating Systems	4-0-0	4	50	100	3		

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15UISC502	PC	Database Management System	4-0-0	4	50	100	3		
15UISC503	PC	System software	4-0-0	4	50	100	3		
15UISC504	PC	Programming in Java	4-0-0	4	50	100	3		
15UISL505	PC	Database Management System Lab	0-0-2	1	50			50	3
15UISL506	PC	Java Lab	0-0-2	1	50			50	3
15UISL507	PC	Mini project – I	0-0-6	4	50	100	3		
Total			**20-0-10**	**26**	**400**	**600**		**100**	

Scheme for VI Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration In hours
15UISC600	PC	Web Technology	4-0-0	4	50	100	3		
15UISC601	PC	File structures	3-0-2	4	50	100	3		
15UISC602	PC	Software Engineering	4-0-0	4	50	100	3		
15UISC603	PC	Computer Networks	3-0-0	3	50	100	3		
15UISL604	PC	Web Technology Lab	0-0-2	1	50			50	3
15UISL605	PC	Mini Project-II	0-0-6	4	50			50	3
15UISE6XX	PE	Elective – I	4-0-0	4	50	100	3		
15UISE6XX	PE	Elective – II	4-0-0	4	50	100	3		
Total			**22-0-10**	**28**	**400**	**600**		**100**	

Code	Elective – I	Code	Elective –II
15UISE620	Unix Systems Programming	15UISE623	Computer Graphics
15UISE621	Advanced Computer Architecture	15UISE624	Advanced Data Base Management System
15UISE622	Advanced Data Structures	15UISE625	System simulation and Modeling

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Scheme for VII Semester

Course Code	Course Title	Teaching		Examination				
				CIE	Theory (SEE)		Practical (SEE)	
		L-T-P-S (Hrs/Week)	Credits	Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration In hours
11UISC701	Network Security and Cryptography	4-0-0-0	4	50	100	3		
11UISC702	Data Mining	3-0-0-0	3	50	100	3		
11UISC706	Cloud Computing	3-0-0-0	3	50	100	3		
11UISL703	Project Phase I	0-0-6-0	4	50			50	3
11UISL704	Computer Networks Lab	0-0-2-0	1	50			50	3
11UISL705	Data Mining and Machine Learning Tools Lab	1-0-2-0	2	50			50	3
11UISE7XX	Elective-V	4-0-0-0	4	50	100	3		
11UISE7XX	Elective-VI	4-0-0-0	4	50	100	3		
Total		**20-0-10-0**	**25**	**400**	**500**		**150**	

Code	Elective – V	Code	Elective –VI
11UISE750	Digital Image Processing	11UISE760	Mobile computing
11UISE751	Information Storage Management	11UISE761	Network Management
11UISE752	Software Testing	11UISE762	Compiler design
		11UISE763	Agile Technology

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L: Lecture **T**: Tutorials **P**: Practical

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Scheme for VIII Semester

Course Code	Course Title	Teaching		Examination				
				CIE	Theory (SEE)		Practical (SEE)	
		L-T-P-S (Hrs/Week)	Credits	Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration In hours
11UISC800	Big Data Analytics	3-0-0-0	03	50	100	3		
11UISL801	Project Phase II	0-0-10-0	10	50			50	3
11UISL802	Seminar	0-0-3-0	02	50				
11UISE8XX	Elective-VII	4-0-0-0	04	50	100	3		
11UISE8XX	Elective-VIII	4-0-0-0	04	50	100	3		
Total		**11-0-13-0**	**23**	**250**	**300**		**50**	

Code	Elective courses-VII	Code	Elective courses-VIII
11UISE850	Business intelligence **	11UISE860	Software architecture
11UISE851	Mobile and Ad Hoc Networks	11UISE861	Data Science
11UISE852	Internet of Things	11UISE862	Wireless Sensor Networks

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination

L: Lecture **T**: Tutorials **P**: Practical **S**: Self-study

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

** Open elective

Total Credits offered for the Fourth year: 48

Note: Interdisciplinary Elective open for all Engineering Branches

11UMAE875 Applied Numerical Methods (VIII Sem)

11UPHE876 Nanotechnology (VIII Sem)

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15UISC504 Programming in Java (4-0-0-0) 4 : 52Hrs.

Course Learning Objectives: Student should understand the Object Oriented Principles, able to program Java classes and methods and conditionals and experiencing the importance of Object Oriented 4G languages like Java & in developing GUI applications.

Course Outcomes:

ID	Description of the Course Outcome	Mapping to Program Outcome		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Illustrate java language constructs and multi threading programming	3	1,2	3
CO-2	Use JDBC and MySql database for applications	1	2,3,	
CO-3	Implement the concepts of OOP using java language.	1	2,3	2
CO-4	Design GUI applications.	1	2,3	

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	2.8	2.5	2.25										2.5	1.0

Pre-requisites:

1. Object -Oriented Programming
2. Basic programming skills

Contents:

1) **Introduction to Java :** Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Simple Java programs. Data types and other tokens: Boolean variables, int, long, char, operators, arrays, whitespaces, literals, assigning values; Creating and destroying objects; Access specifiers. Operators and Expressions: Arithmetic Operators, Bitwise operators, Relational operators, The Assignment Operator, The ? Operator; Operator Precedence; Logical expression; Typecasting; Strings. Control Statements: Selection statements, iteration statements, Jump Statements

10 Hrs.

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2) **Classes, Inheritance :** Classes: Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes. overloading Inheritance: Simple, multiple, and multilevel inheritance; Overriding interfaces Packages - Access Protection - Importing Packages - **8 Hrs.**

3) **Exception handling in Java:** Exception Handling-Exception Types, Uncaught Exceptions, Try and catch, Multiple catch Clauses, Nested try Statements, Exception sub Classes, **8 Hrs.**

4) **Multi Threaded Programming:** Multi Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Thread priority; Thread exception; Synchronization; **8 Hrs.**

5) **GUI Programming :** Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features Using Swing Components, Java Utilities **10 Hrs.**

6) **MySQL and JDBC** : The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Metadata, **8 Hrs.**

Reference books:

1) Herbert Schildt: Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 19).

2) Jim Keogh: J2EE The Complete Reference, Tata McGraw Hill, 2007.(Chapters 5, 6, 11).

15UISL506	Java Lab	(0-0-2-0) 1:	36 Hrs.

Course Learning Objectives: Student should understand the Object Oriented Principles, able to program Java classes and methods and conditionals and experiencing the importance of Object Oriented 4G languages like Java & in developing GUI applications

Course Outcomes:

ID	Description of the Course Outcome	Mapping to Program Outcome		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Illustrate java language constructs and multi threading	3	1,2	3
CO-2	Use JDBC and MySql database for applications.	1	2,3	
CO-3	Implement the concepts of OOP using java language.	1	2,3	2
CO-4	Design GUI applications.	1	2,3	

PO →	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	2.8	2.5	2.25										1.5	1.0

Pre-requisites:

1. Object -Oriented Programming
2. Basic programming skills.

Contents:

1) Programs on Classes,
2) Programs on Exceptions
3) Programs on Inheritance
4) Programs on Multi Threaded Programming
5) Programs on Swings
6) Programs on MySQL and JDBC

Reference Books:

1) Herbert Schildt: "Java The Complete Reference", 7/e, Tata McGraw Hill 2012.
2) Jim Keogh: "J2EE The Complete Reference", 7/e Edition Tata McGraw Hill, 2012.

15UISL507 Mini project – I (Theme based) (0-0-4-0) 4 : 52 Hrs.

Course Learning Objectives: Understand programming language concepts, particularly Java and object-oriented concepts. Plan, analyze, design and implement a software project. Demonstrate independent learning. Demonstrate the ability to locate and use technical information from multiple sources. Demonstrate an understanding of professional ethics. Participate in a class or project team. Demonstrate the ability to communicate effectively in speech. Demonstrate the ability to communicate effectively in writing. Learn to work as a team and to focus on getting a working project done on time with each student being held accountable for their part of the project. Learn about and go through the software development cycle with emphasis on different processes - requirements, design, and implementation phases. Gain confidence at having conceptualized, designed, and implemented a working, medium sized project with their team.

Course Outcomes:

Description of the Course Outcome		Mapping to Program Outcome		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Apply** problem solving and programming skills for identified problem statement.	2, 13	1	14
CO-2	**Design** the system for an identified requirement	3	4	1
CO-3	**Analyze and Incorporate** the changes			
CO-4	**Demonstrate** an ability to work in a team	9		11
CO-5	**Demonstrate** an ability to present the work carried out both in written and oral form.	10		11

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	1.33	3	3	2.5	3				3	1			2.5	1

Prerequisites:

1. C, C++, Data Structures.

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15UISE620	Unix System Programming	(4-0-0-0) 4 : 50 Hrs.

Course Learning Objectives: In this course, students will learn to develop complex system-level software in the C programming language while gaining an intimate understanding of the UNIX operating system and its programming environment, topics covered will include the user/kernel interface, fundamental concepts of UNIX, user authentication, basic and advanced I/O, file systems, signals, process relationships, and inter-process communication. Fundamental concepts of software development and maintenance on UNIX systems.

Course Outcomes:

Description of the Course Outcome		Mapping to Program Outcome		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** various POSIX and UNIX standards, UNIX File system, Process and control, signals and daemon processes.	1		
CO-2	**Illustrate** the characteristics of various API's and system calls.		1, 13	3
CO-3	**Write** C/C++ programs in UNIX/POSIX platform to use and implement various system calls.	13	2	1, 3
CO-4	**Demonstrate** race conditions, exec system calls, job control, signals and processes through different system calls.	13	2	1, 3

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	1.75	2	1										2	

Pre-requisites:

1) This course requires programming in C/C++.
2) Operating system fundamentals and UNIX shell commands.

Contents:

1) **Introduction**: UNIX and ANSI Standards: The ANSI C Standard, The ANSI/ISO C++ Standards, Difference between ANSI C and C++, The POSIX Standards, The POSIX.1 FIPS Standard, The X/Open Standards. UNIX and POSIX APIs: The POSIX APIs, the UNIX and POSIX Development Environment, API Common Characteristics. **6 Hrs.**
2) **UNIX Files**: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links.UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs. **12 Hrs.**

3) **UNIX Processes** : The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes. **6 Hrs.**

4) **Process Control**: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times. Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp and tcsetpgrp Functions, Job Control, Orphaned Process Groups.

10 Hrs.

5) **Signals and Daemon Processes**: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging. **8 Hrs.**

6) **Network programming:** IP Addresses, structs, and Data Munging -IP Addresses, versions 4 and 6, Byte Order, structs, IP Addresses, Part Deux, Header files, Socket API functions - socket, bind, listen, accept, connect, gethostbyname and gethostbyaddr, Protocol and address families, Raw sockets, Options for sockets, Blocking and non-blocking mode, Terminating sockets, Client-server example using TCP, Client-server example using UDP. **10 Hrs.**

Beyond the Syllabus Coverage:

1. Linux command implementation / Demonstrator of open source software from students

Reference books:

1) W. Richard Stevens, Stephen A. Rago," Advanced Programming in the UNIX Environment", 2/e, Addison-Wesley, 2005.
2) Terrence Chan," Unix System Programming Using C++", Prentice Hall India, 1999.
3) Maurice. J. Bach," The Design of the UNIX Operating System", Prentice Hall of India, 1988.
4) Uresh Vahalia," Unix Internals", Pearson Education, 2001.
5) Beej's Guide to Network Programming, Using Internet Sockets

15UISE623	Computer Graphics	(4-0-0-0) 4 : 52 Hrs.

Course Learning Objectives: Student should understand the basics of, Interactive computer graphics architecture, Modeling and Geometric transformations of 2D/3D objects, Graphics API programming.

Course Outcomes:

ID	Description of the Course Outcome	Mapping to Program Outcome		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Describe** the significant Features, basic elements of computer graphics and different lighting and shading effects on given objects.	1		10
CO-2	**Demonstrate** 2D/3D graphics primitives, polygon filling, transformations and views for a given geometric object.	2	1,3,13	10
CO-3	**Illustrate** the characteristics of various OpenGL API.	13	1	
CO-4	**Use** OpenGL programming to Implement problems related to computer graphics.	2,5,13		1,10

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	2	3	3		3					1			2.66	

Pre-requisites:

1. Fundamental knowledge in linear algebra and Coordinate geometry.
2. Data structures and any programming language.

Contents:

1) **Introduction:** Introduction to Computer Graphics and Basics of OpenGL: Applications of computer graphics, A graphics system, Images: Physical and synthetic, Imaging systems, the synthetic camera model, the programmer's interface, Graphics architectures, Graphics Programming: The Sierpinski gasket.

4 Hrs.

2) **OpenGL Basics :**The OpenGL API, Primitives and Attributes, Color, Viewing, Control

Functions, The two dimensional gasket program, Polygons and recursion, the three dimensional gasket. **8 Hrs.**

3) **Input and Interaction:** Interaction, Input devices, Programming Event-Driven input: Menus, Picking, Building interactive models, Animating interactive programs, Design of interactive programs. **7 Hrs.**
4) **Basic Raster Algorithms:** Overview, Rasterization, Bresenham's algorithm: line and circles, Filling rectangles, Filling polygons, Antialiasing, Clipping a line, Clipping polygon, Polygon mesh and Parametric curves. **9 Hrs.**
5) **Geometric Objects and Transformations:** Scalars, Points, and Vectors, Three-dimensional Primitives, Coordinate Systems and Frames, Frames in OpenGL, Modeling a Colored Cube, Affine Transformations, Rotation, Translation and Scaling, Transformations in Homogeneous Coordinates, Concatenation of Transformations, OpenGL Transformation Matrices. **12 Hrs.**
6) **Viewing:** Simple Projections, Viewing with a computer, Positioning of camera, Projections in OpenGL, Hidden Surface removal. **6 Hrs.**
7) **Lighting and Shading :** Light and matter, Light sources, The Phong lighting model, Light sources in OpenGL , Polygon Shading , Approximation of sphere by recursive subdivision , Specification of matrices in OpenGL, Shading of the sphere model. **6 Hrs.**

Reference books:

1) Edward Angel, "Interactive Computer Graphics: A Top-down Approach Using OpenGL", 5/e, Addison-Wesley, 2012.
2) Donald D. Hearn, M. Pauline Baker, Warren Carithers, "Computer Graphics with OpenGL", 4/e, Addison-Wesley, 2010.
3) John Hughes, A. V. Dam, M. McGuire, David F., James D. Foley, Steven K.F., Kurt A." Computer Graphics: Principles and Practice ", 3/e, Pearson, 2013.
4) Edward Angel, "OpenGL: A Primer ", 3/e, Addison-Wesley, 2007.

15UISE624	Advanced Database Management Systems	(4-0-0-0) 4 : 52 Hrs.

Course Learning Objectives:

1. Define parallel and distributed databases and its applications.
2. Show applications of Object Oriented database.
3. Explain basic concepts, principles of intelligent databases.
4. Utilize the advanced topics of data warehousing and mining.

Infer emerging and advanced data models.

Course Outcomes : Upon the completion of the course, the student should be able to,

ID	Description of the Course Outcome	Mapping to Program Outcome		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Select the appropriate high performance database like parallel and distributed database.			1
CO-2	Infer and represent the real world data using object oriented database.		3	2
CO-3	Outline the different data mining and data warehouse applications.	1		
CO-4	Extend to learn enhanced data models for some advanced applications.			3
CO-5	Apply PL/SQL for different databases.	3		

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
Mapping Level	1	1	2.5	2							

Pre-requisites:

Database Management Systems,SQL.

Contents:

1. **Review of Relational Data Model and Relational Database Constraints:** Relational model concepts; Relational model constraints and relational database schemas; Update operations, anomalies, dealing with constraint violations, Types and violations. Overview of Object-Oriented Concepts – Objects, Basic properties. Advantages, examples, Abstract data types, Encapsulation, class hierarchies, polymorphism, examples. **8 Hrs**
2. **Object and Object-Relational Databases:** Overview of OOP; Complex objects; Identity, structure etc. Object model of ODMG, Object definition Language ODL;

Object Query Language OQL; Conceptual design of Object database. Overview of object relational features of SQL; Object-relational features of Oracle; Implementation and related issues for extended type systems syntax and demo examples, The nested relational model. Overview of C++ language binding;**8 Hrs**

3. **Parallel and Distributed Databases :** Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

8 Hrs

4. **Data Warehousing, Decision Support and Data Mining :** Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support, View materialization, Maintaining materialized views. Introduction to Data Mining; Counting co-occurrences; Mining for rules; Tree-structured rules; ROC and CMC Curves; Clustering; Similarity search over sequences; Incremental mining and data streams; Additional data mining tasks. **8 Hrs**
5. **Enhanced Data Models for Some Advanced Applications :** Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management.

8 Hrs

6. **PL/SQL:** Basics, Cursors, Exceptions, Subprograms, Packages. **12 Hrs**

Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2013.
2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2013.

Reference:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010.

11UISE763	Agile Technology	(4-0-0-0) 4 : 52 Hrs.

Course Learning Objectives: To promote new software development technique that encourages the adaptive planning, evolutionary development and fast delivery of a software product which is a time-boxed iterative approach, and encourages rapid and flexible response to change.

Course Outcomes:

ID	Description of the Course Outcome	Mapping to Program Outcome		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	To analyze how an iterative, incremental development process leads to faster delivery of more useful software	5		
CO-2	To implement principles and practices of extreme programming		7	
CO-3	To describe the roles of prototyping in the software process			9
CO-4	To understand the concept of Mastering Agility			5

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level					2		2		1					

Contents:

1. Learning Agile, Understanding agile values, Agile Principle, A Team Lead, Architect, and Project Manager Walk into a Bar, No Silver Bullet, Agile to the Rescue! (Right?), A Fractured Perspective, The Agile Manifesto Helps the Purpose Behind Each Practice, Understanding the Elephant, Where to Start with a New Methodology.**10hrs**
2. The agile principle, The 12 Principles of Agile Software, The Customer Is Always Right...Right? Delivering the Project, Communicating and Working together,Project Execution—Moving the Project Along ,Constantly Improving the Project and the Team, The Agile Project: Bringing All the Principles Together. **10hrs**
3. The Rules of Scrum, Act I: I Can Haz Scrum? Everyone on a Scrum Team Owns the Project ,Act II: Status Updates Are for Social Networks! , The Whole Team Uses the Daily Scrum Act III: Sprinting into a Wall 119, Sprints, Planning, and Retrospectives ,Act IV: Dog Catches Car Scrum and Self-Organizing Teams, The Rules of Scrum, Act I: I Can Haz Scrum? , Everyone on a Scrum Team Owns the Project, Act II: Status Updates Are for Social Networks! , The Whole Team Uses the Daily Scrum, Act III: Sprinting into a Wall, Sprints, Planning, and Retrospectives, Act IV: Dog Catches Car. **12hrs**
4. Scrum Planning and Collective Commitment, Act V: Not Quite Expecting the Unexpected ,User Stories, Velocity, and Generally Accepted Scrum Practices, Act VI: Victory Lap Scrum Values Revisited, XP and Embracing Change, Act I: Going into Overtime ,The Primary Practices of XP ,Act II: The Game Plan Changed, but We're Still Losing ,The XP Values Help the Team Change Their Mindset ,An Effective Mindset

Starts with the XP Values ,Act III: The Momentum Shifts 200,Understanding the XP Principles Helps You Embrace Change. **10hrs**

5. XP, Simplicity, and Incremental Design, Act IV: Going into Overtime, Part 2: Second Overtime ,Code and Design, Make Code and Design Decisions at the Last Responsible Moment ,Incremental Design and the Holistic XP Practices ,Act V: Final Score, Lean, Eliminating Waste, and Seeing the Whole, Lean Thinking, Act I: Just One More Thing, Creating Heroes and Magical Thinking ,Eliminate Waste ,Gain a Deeper Understanding of the Product, Deliver As Fast As Possible

10hrs

Text book:

1. "Learning Agile UNDERSTANDING SCRUM, XP, LEAN, AND K ANBAN", Andrew Stellman & Jennifer Greene, O'Reilly Media,1st Edition, 2014

Reference books:

2. "Agile Software Development, Principles, Patterns, and Practices", Robert C. Martin, Prentice Hall; 1st edition, 2002
3. "Agile and Iterative Development A Manger's Guide", Craig Larman Pearson Education, First Edition, India, 2004

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Scheme for III Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
15UMAC300	PC	Engineering Mathematics-III	4-0-0	4	50	100	3		
15UISC300	PC	Data Structures	3-2-0	4	50	100	3		
15UISC301	PC	Digital Circuits	3-0-0	3	50	100	3		
15UISC302	PC	Discrete Mathematical & Graphical Structures	4-0-0	4	50	100	3		
15UISC303	PC	Computer Organization	4-0-0	4	50	100	3		
15UISC304	PC	Digital Circuits Lab	0-0-3	1.5	50			50	3
15UISC305	PC	Data Structures Lab	0-0-3	1.5	50			50	3
15UISC306	PC	Unix/Linux Lab	1-0-2	2	50			50	3
Total			**19-2-8**	**24**	**400**	**500**		**150**	

Scheme for IV Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration In hours
15UMAC400	PC	Engineering Mathematics - IV	4-0-0	4	50	100	3		
15UISC400	PC	Object Oriented Programming	4-0-0	4	50	100	3		
15UISC401	PC	Analysis and Design of Algorithms	3-0-2	4	50	100	3		
15UISC402	PC	Data	4-0-0	4	50	100	3		

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		Communication							
15UISC403	PC	Microcontroller 8051	4-0-0	4	50	100	3		
15UISC404	PC	Finite Automata and Formal Language	3-2-0	4	50	100	3		
15UISL405	PC	Microcontroller Laboratory	0-0-3	1.5	50			50	3
15UISL406	PC	Object Oriented Programming Laboratory	0-0-3	1.5	50			50	3
Total			**22-2-8**	**27**	**400**	**600**		**100**	

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Scheme for V Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
15UISC500	PC	Management, Entrepreneurship and Intellectual Property Rights	4-0-0	4	50	100	3		
15UISC501	PC	Operating Systems	4-0-0	4	50	100	3		
15UISC502	PC	Database Management System	4-0-0	4	50	100	3		
15UISC503	PC	System software	4-0-0	4	50	100	3		
15UISC504	PC	Programming in Java	4-0-0	4	50	100	3		
15UISL505	PC	Database Management System Lab	0-0-2	1	50			50	3
15UISL506	PC	Java Lab	0-0-2	1	50			50	3
15UISL507	PC	Mini project – I	0-0-6	4	50	100	3		
Total			**20-0-10**	**26**	**400**	**600**		**100**	

Scheme for VI Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration In hours
15UISC600	PC	Web Technology	4-0-0	4	50	100	3		
15UISC601	PC	File structures	3-0-2	4	50	100	3		
15UISC602	PC	Software Engineering	4-0-0	4	50	100	3		
15UISC603	PC	Computer Networks	3-0-0	3	50	100	3		
15UISL604	PC	Web Technology Lab	0-0-2	1	50			50	3
15UISL605	PC	Mini Project-II	0-0-6	4	50			50	3
15UISE6XX	PE	Elective – I	4-0-0	4	50	100	3		
15UISE6XX	PE	Elective – II	4-0-0	4	50	100	3		
Total			**22-0-10**	**28**	**400**	**600**		**100**	

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Code	Elective – I	Code	Elective –II
15UISE620	Unix Systems Programming	15UISE623	Computer Graphics
15UISE621	Advanced Computer Architecture	15UISE624	Advanced Data Base Management System
15UISE622	Advanced Data Structures	15UISE625	System simulation and Modeling

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Scheme for VII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
15UISC700	PC	User Interface Design	4-0-0	4	50	100	3		
15UISC701	PC	Big Data Analytics	4-0-0	4	50	100	3		
15UISC702	PC	Data Mining	3-0-0	3	50	100	3		
15UISL703	PC	Project- Phase I	0-0-4	4	50			50	3
15UISL704	PC	Computer Networks Lab	0-0-2	1	50			50	3
15UISL705	PC	Data Analytics Lab	0-0-2	1	50			50	3
15UISE7XX	PE	Elective-V	4-0-0	4	50	100	3		
15UISE7XX	PE	Elective-VI	4-0-0	4	50	100	3		
Total			**19-0-8**	**25**	**400**	**500**		**150**	

Code	Elective – I	Code	Elective –II
15UISE750	Cloud Computing	15UISE760	Mobile computing
15UISE751	Object Oriented modeling & Design	15UISE761	Information Storage Management
15UISE752	Software Testing	15UISE762	Internet of Things

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Scheme for VIII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration In hours
15UISC800	PC	Machine Learning	3-0-0	3	50	100	3		
15UISL801	PC	Project-Phase II	0-0-6	10	50			50	3
15UISL802	PC	Seminar	0-0-2	2	50				
15UISL803	PC	Machine Learning Lab	0-0-2	1	50			50	3
15UISE8XX	PE	Elective – VII	4-0-0	4	50	100	3		
15UISE8XX	PE	Elective – VIII	4-0-0	4	50	100	3		
Total			**11-0-10**	**24**	**300**	**300**		**100**	

Code	Elective – I	Code	Elective –II
15UISE850	Network Security & Cryptography	15UISE860	Wireless Sensor Networks
15UISE851	Artificial Intelligence	15UISE861	Digital Image Processing
15UISE852	Project management	15UISE862	Service Oriented Architecture

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination*

L: Lecture **T**: Tutorials **P**: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

Dr. Jagadeesh D. Pujari
HOD, ISE

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15UISC800	Machine Learning	3-0-0

Contact Hours: 42

Course Learning Objectives (CLOs): Machine Learning is the discipline of designing algorithms that allow machines to learn patterns and concepts from data without being explicitly programmed. This fundamental course will enable students to understand the concept of machine learning and problems relevant to it. Students will be able to differentiate between supervised and unsupervised learning and apply neural networks, Bayes classifier and k nearest neighbour, for problems related to machine learning.

Course Outcomes(COs):

Description of the course outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** the issues and challenges of machine learning and **Use** a suitable learning technique	1	2	
CO-2	**Analyze** concept learning, ANN, instance based, Decision tree, Bayes classifier and Reinforcement learning	1,2		4
CO-3	**Design and Demonstrate** various Machine learning algorithms in a range of real-world applications	3,13	5	6
CO-4	**Analyze** the underlying mathematical relationship across Machine Learning algorithms	1	2	6
CO-5	Understand the necessity of Dimensionality reduction, prediction systems and **Apply** to the given data set.	1	1	12

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping	2.75	2.5	3.0	1.0	2.0	1.0						1.0	3.0	

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Level														

Prerequisites:

Linear algebra, statistics and probability

Contents:

1) **Introduction:** Basic Definitions, Types of learning**,** Designing a Learning system, Perspective and Issues in Machine Learning, Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias. **08 Hrs.**
2) **Decision Tree Learning:** Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space searching decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning. **08 Hrs.**
3) **Artificial Neural Networks:** Introduction- Neural Network representation and appropriate problems, Back propagation algorithm. **06 Hrs.**
4) **Bayesian Learning:** Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and Least –Squared Error Hypotheses, ML for predicting probabilities, MDL principle, Naive Bayes Classifier,Bayesian belief networks, EM algorithm **08 Hrs.**
5) **Instance Based and Reinforcement Learning:** Introduction, k-nearest neighbour learning, locally weighted regression, radial basis function, Introduction to reinforcement learning **06 Hrs.**
6) **Dimensionality Reduction and Recommendation system**: PCA, Matrix factorization, SVD – Applications to machine learning, Collaborative Filtering.

06 Hrs.

Reference books:

[1] Tom M. Mitchell, "Machine Learning"**,**India Edition, McGraw Hill Education, 2013

[2] EthemAlpaydin, "Introduction to Machine Learning", 2nd Edition, PHI Learning Pvt. Ltd., 2013.

[3] Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", 2nd Edition, Springer series in statistics.

15UISL803	Machine Learning Lab	0-0-2

Contact Hours: 36

Course Learning Objectives (CLOs): This course will enable the students to choose appropriate datasets and make use of it in implementing any machine learning algorithms. The students can use any suitable language of their choice for algorithm implementation and problems of real world application.

Course Outcomes(COs):

Description of the course outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** appropriate dataset for the given algorithm and design and implement the given algorithm.	1	2,3,5,13	12
CO-2	**Design** and **implement** a suitable machine learning algorithm for the given problem definition.	1,2	3,5,13	12,14

PO →	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO1 3	PSO1 4
Mapping Level	3.0	2.5	2.0		2.0							2.0	2.0	1.0

List of programs:

1) Implement and demonstrate the FIND-S algorithm for a given data set
2) For a given set of training data examples, implement and demonstrate the Candidate-Elimination algorithm.
3) 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.
4) Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5) Write a program to implement the naïve Bayesian classifier for a sample training data set
6) For a given data set implement PCA algorithm

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7) Implement the non-parametric locally weighted regression algorithm in order to fit data points. Select appropriate data points and draw graphs.
8) For the given problem definitions, apply a suitable Machine learning algorithm. Choose appropriate data set

Reference books:

[1] Tinniam V Ganesh, "Practical Machine Learning with R and Python", 2/e
[2] AurélienGéron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems",1/e.

15UISE851	Artificial Intelligence	(4-0-0) 4

Contact Hours: 52 Course Learning Objectives (CLOs): The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning.

Course Outcomes(COs):

Description of the course outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/PSOs(13-14)		
		Substantial Level (3)	Moderate Level (2)	Sli ght (1) Level
CO-1	Describe concepts of AI and Intelligent agents.	1	2	
CO-2	Apply searching techniques for AI systems	2	2	
CO-3	Design the logic for knowledge representation and reasoning in AI based systems.	3	3	
CO-4	Formalize a given problem in the language/framework of different AI methods.	3	3	
CO-5	Analyze different learning algorithms in AI systems & Implement applications using different artificial intelligence concepts.	3	3	

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Lev	3	2.3	2.5											

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Pre-requisites:

Exposure to algorithms and programming

Contents

1. Introduction: What is AI? What is AI? Foundation of AI, History of AI, state of art, Intelligent Agents, Agents and environment, AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized productions system- Problem solving methods – Problem graphs, matching. **10 Hrs**

2. Solving problems by searching: State space search: Depth first and Breath first, Indexing and Heuristic functions Heuristic Search- Best First Search, Hill Climbing, Beam Search, Randomized Search: Simulated Annealing, Genetic Algorithms, Ant Colony optimization, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms. **10 Hrs**

3. Representation of Knowledge: Game playing: Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic- Structured representation of knowledge, Mini max Algorithm, Alpha Beta Algorithm. **10 Hrs**

4. Production based system, Frame based system. Inference; Backward chaining, Forward chaining, Propositional Logic, First Order Logic, Soundness and Completeness Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network-Dempster – Shafer theory. **08 Hrs**

5. Planning and Constraint Satisfaction: Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Graph plan, Constraint Propagation, Basic plan generation systems – Strips -Advanced plan generation systems– K strips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning. **08 Hrs**

6. Natural Language Processing: Language Models, Text Classification, Information Retrieval Information Extraction Natural Language for Communication, Machine Translation, Speech Recognition , Perception , Image Formation, Early Image- Processing Operations, Object Recognition by Appearance Reconstructing the 3D World, Object Recognition from Structural Information. **06 Hrs**

Reference Books:

1) Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.

2) Elaine Rich, Kevin Knight, Shiva Shankar B Nair, Artificial Intelligence, Tata McGraw Hill 3rd Edition, 2013.
3) Stefan Edelkamp and Stefan Schroedl. Heuristic Search: Theory and Applications,Morgan Kaufmann, 2011.
4) Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009.
1) Pamela McCorduck, Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence, A K Peters/CRC Press; 2nd Edition, 2004.

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15UISE852	Project Management	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives(CLOs): Student are able to Understand the basic principles and components of project management, Appreciate the integrated approach to managing projects ,Apply the appropriate project management tools and techniques, Prepare project schedules with reports.

Course Outcomes Os):

Description of the course outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Illustrate the concepts, tools and techniques for managing large projects.		1	
CO-2	Analyze various sub processes in the project management frameworks.		2	
CO-3	Evaluate risks in projects and economics analysis of project feasibility.	11		
CO-4	Develop project plans for various types of organizations.		11	

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	2.0	2.0									2.5			

Pre-requisites:

Students should have knowledge of software engineering

Contents:

1) Introduction: Project, Project management, relationships among portfolio management, program management, project management, and organizational project management, relationship between project

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management, operations management and organizational strategy, business value, role of the project manager, project management body of knowledge 10**Hrs.**

2) Generation and Screening of Project Ideas: Generation of ideas, monitoring the environment, corporate appraisal, scouting for project ideas, preliminary screening, project rating index, sources of positive net present value. Project costing. **Project Scope Management:** Project scope management, collect requirements define scope, create WBS, validate scope, control scope. **Organizational influences & Project life cycle:** Organizational influences on project management, project state holders & governance, project team, project life cycle. **10 Hrs.**

3) Project Integration Management: Develop project charter, develop project management plan,direct& manage project work, monitor & control project work, perform integrated change control, close project or phase. **Project Quality management:** Plan quality management, perform quality assurance, control quality **12 Hrs.**

4) Project Risk Management: Plan risk management, identify risks, perform qualitative risk analysis, perform quantitative risk analysis, plan risk resources, control risk. **Project Scheduling:** Project implementation scheduling, Effective time management, Different scheduling techniques, Resources allocation method, PLM concepts. Project life cycle costing **12 Hrs.**

5) Tools & Techniques of Project Management: Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Techniques (PERT) Planning, Computerized project management**.08 Hrs.**

Beyond the Syllabus Coverage(Suggestive):

1. Seminar
2. Case Study

Reference Books:

[1] Project Management Institute, "A Guide to the Project Management Body of Knowledge (PMBOK Guide)", 5th Edition, 2013, ISBN: 978-1-935589-67-9

[2] Prasanna Chandra, Project Planning Analysis Selection Financing Implementation & Review, Tata McGraw Hill Publication, 7th Edition, 2010, ISBN 0-07-007793-2.

[3] Harold Kerzner, Project Management A System approach to Planning Scheduling & Controlling, John Wiley & Sons Inc., 11th Edition, 2013, ISBN 978-1-118-02227-6.

[4] Rory Burke, "Project Management – Planning and Controlling Techniques", John Wiley & Sons, 4th Edition, 2004, ISBN: 9812-53-121-1

15UISE861	**Digital Image Processing**	**(4-0-0) 4**

Contact Hours: 52

Course Learning Objectives (CLOs): The objective of this course is to cover the basic theory and algorithms that are widely used in digital image processing, Expose the students to

current technologies and issues that are specific to image processing systems. Students should be able to develop hands-on experience in using computers to process images and familiarize with MATLAB Image Processing Toolbox, critical thinking about shortcomings of the state of the art in image processing

Course Outcomes(COs):

Description of the course outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Interpret the basic transformation on image representation, image enhancement techniques, Image restoration process, and compression techniques	1		
CO-2	Demonstrate filtering techniques to enhance the appearance of an image, basic morphological algorithms, segmentation algorithms and Color models.	1		
CO-3	Apply Image processing techniques in both spatial and frequency domains.	2	13	

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	3.0	3.0											2.0	

Prerequisites:
Engineering Mathematics

Contents:

1) **Digital Image Fundamentals And Transforms**: Elements of visual perception –Image sampling and quantization Basic relationship between pixels – Basic geometric transformations-Introduction to Fourier Transform and DFT – Properties of 2D Fourier

Transform – FFT – Separable Image Transforms –Walsh – Hadamard – Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve transforms **9 Hrs.**

2) **Image Enhancement Techniques**: Spatial Domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters: Smoothing – Sharpening filters – Homomorphic filtering **9 Hrs.**
3) **Image Restoration:** Model of Image Degradation/restoration process – Noise models – Inverse filtering -Least mean square filtering – Constrained least mean square filtering – Blind image restoration – Pseudo inverse – Singular value decomposition **9 Hrs.**
4) **Image Compression:** Lossless compression: Variable length coding – LZW coding – Bit plane coding- predictive coding-DPCM. Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization **9 Hrs.**
5) **Image Segmentation and Representation**: Edge detection – Thresholding - Region Based segmentation – Boundary representation: chair codes- Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors- Fourier descriptors - Regional descriptors –Simple descriptors- Texture **9 Hrs.**
6) **Case study**: Implementation of various image processing techniques using image processing simulators **7Hrs.**

Reference books:

[1] Rafael C Gonzalez, Richard E Woods, "Digital Image Processing", 3/e, Pearson Education, 2010.

[2] William K Pratt, "Digital Image Processing", 2/e, John Willey, 2007.

[3] MillmanSonka, Vaclav hlavac, Roger Boyle, Broos/colic, Thompson Learniy "Image Processing Analysis and Machine Vision", 2/e, John Willey, 2008.

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15UISE862	Service Oriented Architecture	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course will enable students to compare various architectures for application development. The course illustrates the importance of SOA in Application Integration Learn web service and SOA related tools and governance.

Course Outcomes(COs):

Description of the course outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/PSOs(13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Compare** the different IT architecture	1,3		2, 13
CO-2	**Analyze** and design of SOA based applications	2,3		4
CO-3	**Demonstrate** the implementation of web service and realization ofSOA		5	
CO-4	**Demonstrate** the implementation of REST ful services	5		13

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	2.0	1.0		1.0	2.0								1.0	

Prerequisites:

Understanding of Software engineering and software testing fundamentals and concepts.

Contents:

1) SOA BASICS: Software Architecture; Need for Software Architecture, Objectives of Software Architecture, Types of IT Architecture, Architecture Patterns and Styles, Service oriented Architecture; Service Orientation in Daily Life, Evolution of SOA, Drives for SOA, Dimension of SOA, Key components, perspective of SOA, Enterprise-wide SOA;

Considerations for Enterprise -Wide SOA, Strawman Architecture For Enterprise-Wide-SOA- Enterprise, SOALayers, Application Development Process, SOA Methodology **11 Hrs.**

2) SOA BASICS: Software Architecture; Need for Software Architecture, Objectives of Software Architecture, Types of IT Architecture, Architecture Patterns and Styles, Service oriented Architecture; Service Orientation in Daily Life, Evolution of SOA, Drives for SOA, Dimension of SOA, Key components, perspective of SOA, Enterprise-wide SOA; Considerations for Enterprise -Wide SOA, Strawman Architecture For Enterprise-Wide-SOA- Enterprise, SOALayers, Application Development Process, SOA Methodology **10 Hrs.**

3) SOA BASICS: Software Architecture; Need for Software Architecture, Objectives of Software Architecture, Types of IT Architecture, Architecture Patterns and Styles, Service oriented Architecture; Service Orientation in Daily Life, Evolution of SOA, Drives for SOA, Dimension of SOA, Key components, perspective of SOA, Enterprise-wide SOA; Considerations for Enterprise -Wide SOA, Strawman Architecture For Enterprise-Wide-SOA- Enterprise, SOALayers, Application Development Process, SOA Methodology **10 Hrs.**

4) SOA BASICS: Software Architecture; Need for Software Architecture, Objectives of Software Architecture, Types of IT Architecture, Architecture Patterns and Styles, Service oriented Architecture; Service Orientation in Daily Life, Evolution of SOA, Drives for SOA, Dimension of SOA, Key components, perspective of SOA, Enterprise-wide SOA; Considerations for Enterprise -Wide SOA, Strawman Architecture For Enterprise-Wide-SOA- Enterprise, SOALayers, Application Development Process. **10 Hrs.**

5) SOA Technologies-PoC; Loan Management System (LMS), PoC- Requirements Architectures of LMS SOA based integration; integrating existing application, SOA best practices, Basic SOA using REST. Role of WSDL,SOAP and JAVA/XML Mapping in SOA. **10 Hrs.**

Reference books:

[1] Shankar Kambhampaly, "Service–Oriented Architecture for Enterprise Applications", a. Wiley Second Edition, 2014.

[2] Mark D. Hansen, "SOA using Java Web Services", Practice Hall, 2007.

[3] WaseemRoshen, "SOA-Based Enterprise Integration", Tata McGraw-HILL, 2009

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Scheme for III Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
18UMAC300	BS	Engineering Mathematics-III	3 - 0 - 0	3	50	100	3	-	-
18UISC300	PC	Data Structures	3 - 2 - 0	4	50	100	3	-	-
18UISC301	PC	Logic Design	3 - 0 - 0	3	50	100	3	-	-
18UISC302	PC	Discrete Mathematics & Graph Theory	4 - 0 - 0	4	50	100	3	-	-
18UISC303	PC	Unix and Shell Programming	3 - 0 - 2	4	50	100	3	-	-
18UISC304	PC	Computer Organization and Architecture	3 - 0 - 0	3	50	100	3	-	-
18UISL305	PC	Data Structures Laboratory	0 - 0 - 3	1.5	50	-	-	50	3
18UISL306	PC	Logic Design Laboratory	0 - 0 -3	1.5	50	-	-	50	3
Total			**19 - 2 - 8**	**24**	**400**	**600**		**100**	

Scheme for IV Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration In hours
18UMAC400	BS	Engineering Mathematics - IV	3 - 0 - 0	3	50	100	3	-	-
18UISC400	PC	Object Oriented Programming	4 - 0 - 0	4	50	100	3	-	-
18UISC401	PC	Microcontroller	4 - 0 - 0	4	50	100	3	-	-
18UISC402	PC	Finite Automata and Formal Language	3 - 2 - 0	4	50	100	3	-	-
18UISC403	PC	Design and Analysis of Algorithms	3 - 0 - 0	3	50	100	3	-	-
18UISC404	PC	Operating System	3 - 0 - 0	3	50	100	3	-	-
18UISL405	PC	Object Oriented Programming Laboratory	0 - 0 - 3	1.5	50	-	-	50	3
18UISL406	PC	Microcontroller	0 - 0 -3	1.5	50	-	-	50	3

		Laboratory							
18UISL407	PC	Introductory Project	0 - 0-2	1	50	-	-	-	-
Total			**20 - 2 -8**	**25**	**450**	**600**		**100**	

Scheme for V Semester

Course Code	**Course Category**	**Course Title**	**Teaching**		**Examination**				
			L-T-P (Hrs/Week)	**Credits**	**CIE**	**Theory (SEE)**		**Practical (SEE)**	
					Max. Marks	***Max. Marks**	**Duration in hours**	**Max. Marks**	**Duration in hours**
15UISC500	PC	Management, Entrepreneurship and Intellectual Property Rights	4-0-0	4	50	100	3		
15UISC501	PC	Operating Systems	4-0-0	4	50	100	3		
15UISC502	PC	Database Management System	4-0-0	4	50	100	3		
15UISC503	PC	System software	4-0-0	4	50	100	3		
15UISC504	PC	Programming in Java	4-0-0	4	50	100	3		
15UISL505	PC	Database Management System Lab	0-0-2	1	50			50	3
15UISL506	PC	Java Lab	0-0-2	1	50			50	3
15UISL507	PC	Mini project – I	0-0-6	4	50	100	3		
Total			**20-0-10**	**26**	**400**	**600**		**100**	

Scheme for VI Semester

Course Code	**Course Category**	**Course Title**	**Teaching**		**Examination**				
			L-T-P (Hrs/Week)	**Credits**	**CIE**	**Theory (SEE)**		**Practical (SEE)**	
					Max. Marks	***Max. Marks**	**Duration in hours**	**Max. Marks**	**Duration In hours**
15UISC600	PC	Web Technology	4-0-0	4	50	100	3		
15UISC601	PC	File structures	3-0-2	4	50	100	3		
15UISC602	PC	Software Engineering	4-0-0	4	50	100	3		
15UISC603	PC	Computer Networks	3-0-0	3	50	100	3		
15UISL604	PC	Web Technology Lab	0-0-2	1	50			50	3
15UISL605	PC	Mini Project-II	0-0-6	4	50			50	3
15UISE6XX	PE	Elective – I	4-0-0	4	50	100	3		
15UISE6XX	PE	Elective – II	4-0-0	4	50	100	3		
Total			**22-0-10**	**28**	**400**	**600**		**100**	

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Code	Elective – I	Code	Elective –II
15UISE620	Unix Systems Programming	15UISE623	Computer Graphics
15UISE621	Advanced Computer Architecture	15UISE624	Advanced Data Base Management System
15UISE622	Advanced Data Structures	15UISE625	System simulation and Modeling

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Scheme for VII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
15UISC700	PC	User Interface Design	4-0-0	4	50	100	3		
15UISC701	PC	Big Data Analytics	4-0-0	4	50	100	3		
15UISC702	PC	Data Mining	3-0-0	3	50	100	3		
15UISL703	PC	Project- Phase I	0-0-6	4	50			50	3
15UISL704	PC	Computer Networks Lab	0-0-2	1	50			50	3
15UISL705	PC	Data Analytics Lab	0-0-2	1	50			50	3
15UISE7XX	PE	Elective-V	4-0-0	4	50	100	3		
15UISE7XX	PE	Elective-VI	4-0-0	4	50	100	3		
Total			**19-0-10**	**25**	**400**	**500**		**150**	

Code	Elective – I	Code	Elective –II
15UISE750	Cloud Computing	15UISE760	Mobile computing
15UISE751	Object Oriented modeling & Design	15UISE761	Information Storage Management
15UISE752	Software Testing	15UISE762	Internet of Things

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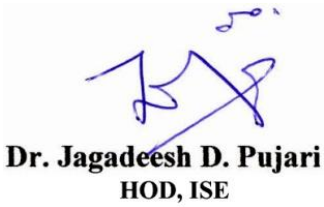
Scheme for VIII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration In hours
15UISC800	PC	Machine Learning	3-0-0	3	50	100	3		
15UISL801	PC	Project- Phase II	0-0-6	10	50			50	3
15UISL802	PC	Seminar	0-0-2	2	50				
15UISL803	PC	Machine Learning Lab	0-0-2	1	50			50	3
15UISE8XX	PE	Elective – VII	4-0-0	4	50	100	3		
15UISE8XX	PE	Elective – VIII	4-0-0	4	50	100	3		
Total			**11-0-10**	**24**	**300**	**300**		**100**	

Code	Elective – I	Code	Elective –II
15UISE850	Network Security & Cryptography	15UISE860	Wireless Sensor Networks
15UISE851	Artificial Intelligence	15UISE861	Digital Image Processing
15UISE852	Project management	15UISE862	Service Oriented Architecture



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18UISC303	Unix and Shell Programming	(3-0-2) 4

Contact Hours: 52

Course Learning Objectives (CLOs): The objective of the course is to provide a sound technical exposure to the concepts, commands, and procedures in a multiuser, multitasking operating system. To expertise the students with sound knowledge and superior competence in Shell programming in an extremely effective way. They would have a clear appreciation of the role of an O.S. in a computing environment.

Course Outcomes(COs):

Description of the course outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/PSOs(13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Describe** the architecture and features of UNIX Operating System and distinguish it from other Operating System			1
CO-2	**Illustrate** working with vi editor, creating & editing text file with vi editor using standard vi editor commands.		2	
CO-3	**Demonstrate the** execution of various commands by considering the concepts of directories, pipelines, I/O directions, wildcard patterns. basic regular expressions. processes, filters, grep and sed.	2		
CO-4	**Demonstrate** the capabilities to write and execute shell script.	2		1

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	1.0	2.75	2 0											

Contents:

1) **Introduction**, Brief history. UNIX Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. The login prompt. General features of UNIX commands/ command structure. Command arguments and options. Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The man command knowing more about UNIX commands and using UNIX online manual pages. The man with keyword option and whatis. The more command and using it with other commands. Knowing the user terminal, displaying its characteristics and setting characteristics. Managing the non-uniform behaviour of terminals and

keyboards. The root login. Becoming the super user: su command. The /etc/passwd and /etc/shadow files. Commands to add modify and delete users. **7L+3P=10 Hrs.**

2) **Unix files**. Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (...) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. File attributes and permissions and knowing them. The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions. **8L+2P=10 Hrs.**

3) **The VI editor. Basics.** The .exrc file. Different ways of invoking and quitting vi. Different modes of VI. Input mode commands. Command mode commands. The ex mode commands. Illustrative examples Navigation commands. Repeat

command. Pattern searching. The search and replace command. The set, map and abbr commands. Simple examples using these commands. The shells interpretive cycle. Wild cards and file name generation. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee. Command substitution. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions. **8L+2P=10 Hrs.**

4) **Shell programming.** Ordinary and environment variables. The .profile. Read and read only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options. The umask and default file permissions. Two special files /dev/null and /dev/tty.

8L+2P=10 Hrs.

5) **The Process**: Meaning of a process. Mechanism of process creation. Parent and child process. The ps command with its options. Executing a command at a specified point of time: at command. Executing a command periodically: cron command and the crontab file. Signals. The nice and nohup commands. Background processes. The bg and fg command. The kill command. The find command with illustrative example.

Structure of a PERL script. Running a PERL script. Variables and operators. String handling functions. Default variables - $_ and $. – representing the current line and current line number. The range operator. Chop () and chomp () functions. Lists and arrays. The @- variable. The splice operator, push (), pop (), split () and join (). File handles and handling file – using open(), close() and die () functions. Associative arrays – keys and value functions. Overview of decision making loop control structures – the foreach. Regular expressions – simple and multiple search patterns. The match and substitute operators. Defining and using subroutines. **8L+4P=12 Hrs.**

Reference books:

[1] Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill

[2] Behrouz A. Forouzan, Richard F. Gilberg: UNIX and Shell Programming- Cengage Learning – India Edition. 2009.

[3] M.G. Venkateshmurthy: “UNIX & Shell Programming”, Pearson Education, 2005.

[4] Richard Blum, Christine Bresnahan : Linux Command Line and Shell Scripting Bible, 2ndEdition , Wiley, 2014.

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18UISC404	Operating Systems	3-0-0

Contact Hours: 39

Course Learning Objectives (CLOs): Student should identify the concepts, principles and services of operating system, all fundamentals of operating system abstractions and demonstrate them, to explain protection and security requirements of operating systems analyze basic resource management techniques in job and process scheduling compare different memory management techniques and apply concurrency and synchronization techniques to write concurrent programs.

Course Outcomes(COs):

Description of the course outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Describe Operating systems and their functions.	1		
CO-2	Analyze Process, IPC, Scheduling, synchronization, storage management	2		
CO-3	Illustrate various operating system algorithms and Apply various techniques to solve real time problems.		2	12

PO →	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	3.0	2.5										1.0		

Prerequisites:

1. Computer organization,
2. The different parts of computer system
3. High level languages such as C.

Contents:

1. **Introduction to operating systems & their classification:** What is an operating system, Mainframe systems, Desktop systems, Multiprocessor system, Distributed system, Clustered system, Real time system, Handheld system, Feature migration, Computing environments, Operating system structures: System components, OS Services, System calls, System programs, System structure, Virtual machines. **6 Hrs.**
2. **Process, Inter process Communication, Threads & CPU Scheduling :** Process concept, Process scheduling, Operation on processes, Cooperating processes, Inter process communication. Threads - Overview, Multithreading models, Threading issues, Pthreads, Java threads. CPU scheduling - Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple

processor scheduling, Real time scheduling. **8 Hrs.**

3. **Process Synchronization and handling Deadlocks:** The Critical section problem, Synchronization hardware, Semaphores, Classical problems of synchronization, Critical regions, monitors. Deadlock - System model, Deadlock characterization, Methods for handling deadlocks - Deadlock prevention, deadlock avoidance, Deadlock detection and recovery from deadlock. **10 Hrs.**
4. **Storage Management: Main** memory management - Background, Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with paging. Virtual memory - Background, Demand paging, Process creation, Page replacement algorithms, Allocation of frames, Thrashing. File System interface - File concept, Access methods, Directory structure, Disk scheduling methods, Disk management, Swap space management. **10 Hrs.**
5. **Protection and Security :** Goals of protection , Domain of protection, Access matrix , implementation of access matrix, Revocation of access rights, The security problem, Authentication, Program threats, System threats, Securing systems and facilities, Intrusion detection. **5 Hrs.**

Reference books:

[1] Abraham silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", 9/e, Jhon wiley& Sons, 2012.

[2] Milan Milankovic, "Operating system concepts and design"; 2/e, Mcgrawhill 2008.

18UISL407	Introductory Project	(0-0-2) 1

Contact Hours: 36

Course Learning Objectives (CLOs):

Introductory project is introduced with an objective of understanding and identifying the community expectation in terms of possible Engineering solutions by applying the fundamental knowledge of basic sciences and basic engineering courses

Course Outcomes(COs):

Description of the course outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/PSOs(13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Perform literature review for a given topic	1,2		
CO-2	Identify problem from literature review	1,2		
CO-3	Establish objectives and methodology for the problem defined	1,2		
CO-4	Analyze the existing solution for the identified problem	2,3	5,13,14	6,7
CO-5	Prepare a report and present their findings using PPT	10		11

PO →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	3.0	3.0	3.0		2.0	1.0	1.0			3.0	1.0		2.0	2.0

Prerequisites:

1. Fundamental knowledge of basic sciences and basic engineering courses.

Contents:

The project shall be engineering oriented in terms of problem definition, related literature survey and existing solutions. The team consisting of 10-12 students shall be asked to identify the problems related to community and try to propose a solution. The faculty members handling the courses for that semester shall guide the students. A committee consisting of minimum 3 faculty members shall evaluate at the end for CIE.

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Scheme for III Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
18UMAC300	BS	Engineering Mathematics-III	3 - 0 - 0	3	50	100	3	-	-
18UISC300	PC	Data Structures	3 - 2 - 0	4	50	100	3	-	-
18UISC301	PC	Logic Design	3 - 0 - 0	3	50	100	3	-	-
18UISC302	PC	Discrete Mathematics & Graph Theory	4 - 0 - 0	4	50	100	3	-	-
18UISC303	PC	Unix and Shell Programming	3 - 0 - 2	4	50	100	3	-	-
18UISC304	PC	Computer Organization and Architecture	3 - 0 - 0	3	50	100	3	-	-
18UISL305	PC	Data Structures Laboratory	0 - 0 - 3	1.5	50	-	-	50	3
18UISL306	PC	Logic Design Laboratory	0 - 0 -3	1.5	50	-	-	50	3
Total			**19 - 2 - 8**	**24**	**400**	**600**		**100**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination*

L: Lecture **T**: Tutorials **P**: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks

BS- Basic Science, PC- Program Core

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Scheme for IV Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration In hours
18UMAC400	BS	Engineering Mathematics - IV	3 - 0 - 0	3	50	100	3	-	-
18UISC400	PC	Object Oriented Programming	4 - 0 - 0	4	50	100	3	-	-
18UISC401	PC	Microcontroller	4 - 0 - 0	4	50	100	3	-	-
18UISC402	PC	Finite Automata and Formal Language	3 - 2 - 0	4	50	100	3	-	-
18UISC403	PC	Design and Analysis of Algorithms	3 - 0 - 0	3	50	100	3	-	-
18UISC404	PC	Operating System	3 - 0 - 0	3	50	100	3	-	-
18UISL405	PC	Object Oriented Programming Laboratory	0 - 0 - 3	1.5	50	-	-	50	3
18UISL406	PC	Microcontroller Laboratory	0 - 0 -3	1.5	50	-	-	50	3
18UISL407	PC	Introductory Project	0 - 0- 2	1	50	-	-	-	-
Total			**20 - 2 -8**	**25**	**450**	**600**		**100**	

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Scheme for V Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs./Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration in Hrs.
18UHUC500	HU	Management, Entrepreneurship and IPR	4 - 0 - 0	4	50	100	3	-	-
18UISC500	PC	Software Engineering	4 - 0 - 0	4	50	100	3	-	-
18UISC501	PC	Java and Web Technology	4 - 0 - 0	4	50	100	3	-	-
18UISC502	PC	Database Management System	3 - 0 - 0	3	50	100	3	-	-
18UISC503	PC	Computer Networks	3 - 0 - 0	3	50	100	3	--	--
18UISE5XX	PE	Program Elective-1	3 - 0 - 0	3	50	100	3	--	--
18UISL504	PC	Database Management System Lab	0 - 0 - 3	1.5	50	--	--	50	3
18UISL505	PC	Java Lab	0 - 0 - 3	1.5	50	--	--	50	3
18UISL506	PC	Minor Project-1	0 - 0 - 2	1	50	--	--	--	--
18UHUL507	HU	Soft skills/Aptitude	0 - 0 - 2	1	50	--	--	--	--
Total			**21 - 0 - 10**	**26**	**500**	**600**		**100**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination* **L**: Lecture
T: Tutorials **P**: Practical
*SEE for theory courses is conducted for 100 marks and reduced to 50 marks
PC- Program Core HU- Humanities, PC- Program Core

Minor project – 1 is undertaken to focus on the domain related problem definitions, building prototypes which can lead to take up the project in the higher semester(s). The work based on the core courses studied shall be used to formulate the problem. The team consisting of 10-12 students shall be asked to identify the problems related to community and try to propose the

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solution. The faculty members handling the courses for that semester shall guide the students. A committee consisting of minimum 3 faculty members shall evaluate at the end for CIE. There is no SEE for Minor project-1.

Soft skills/Aptitude: This is included with an objective of improving the communication skills, proficiency in English language and aptitude ability of the student. This is a credit course and aimed to enhance the employability. Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

Management, Entrepreneurship and IPR course shall be taught in the V semester only. However, the departments can take flexibility of deciding the contents of the course as per the department specific requirements. The credit for this course is 4 and common to all departments

Elective

Code	Elective – 1
18UISE511	System software
18UISE512	Advanced Data Structures
18UISE513	Real Time Operating Systems and Embedded Systems

Scheme for VI Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs./Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration in Hrs.
18UISC600	PC	Artificial Intelligence and Machine Learning	3-0-2	4	50	100	3	-	-
18UISC601	PC	Internet of Things	4-0-0	4	50	100	3	-	-

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18UISE6XX	PE	Program Elective-2	3-0-0	3	50	100	3	-	-
18UISE6XX	PE	Program Elective-3	3-0-0	3	50	100	3	-	-
18UISO6XX	OE	Open Elective	3-0-0	3	50	100	3	--	--
18UISL602	PC	Computer Networks Lab	0-0-3	1.5	50	--	--	50	3
18UISL603	PC	Web Technology Lab	0-0-3	1.5	50	--	--	50	3
18UISL604	PC	Minor Project-2	0-0-4	2	50	--	--	50	3
18UHUL605	HU	Soft skills/Aptitude	0-0-2	1	50	--	--	--	--
Total			**16 - 0 -14**	**23**	**450**	**500**		**150**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination* **L**: Lecture
T: Tutorials **P**: Practical
*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.
PC- Program Core, PE-Program Elective, OE- Open Elective and HU- Humanities.

Minor project-2 is to be taken up having had an exposure to the project work in the previous semesters. The students are expected to locate the state-of-the-art technology in his/her domain of interest by an extensive literature survey and select a topic from an emerging area relevant to their branch/interdisciplinary and define the problem for the project work. The problem could be defined to develop prototypes for industrial needs. A team consisting of not more than 4 students shall be guided by a faculty member. This project work is to supplement and prepare the students to take up major project work at higher semesters. A committee consisting of minimum 3 faculty members shall evaluate at the end for CIE with suitable rubrics. The weightage of marks shall be 50% for the committee and 50% for the guide. There is a SEE (viva voce) examination which shall be examined by two internal examiners appointed by COE based on the suggestions by the respective HoD.

Soft skills/Aptitude: This is included with an objective of improving the communication skills, proficiency in English language and aptitude ability of the student. This is a credit course and aimed to enhance the employability. Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing

components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

Elective

Code	Elective – 2	Code	Elective – 3	Code	Open Elective
18UISE611	ADBMS	18UISE621	Object Oriented Modeling and Design	18UISO631	Management Information Systems
18UISE612	User Interface Design	18UISE622	Data mining	18UISO632	Cyber Law and Ethics
18UISE613	Computer graphics using Open GL	18UISE623	Unix Systems Programming	18UISO633	Agile Methodologies

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Scheme for VII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
15UISC700	PC	User Interface Design	4-0-0	4	50	100	3	-	-
15UISC701	PC	Big Data Analytics	4-0-0	4	50	100	3	-	-
15UISC702	PC	Data Mining	3-0-0	3	50	100	3	-	-
15UISL703	PC	Project-Phase I	0-0-6	4	50	-	-	50	3
15UISL704	PC	Computer Network Lab	0-0-2	1	50	-	-	50	3
15UISL705	PC	Data Analytics Lab	0-0-2	1	50	-	-	50	3
15UISE7XX	PE	Elective-V	4-0-0	4	50	100	3	-	-
15UISE7XX	PE	Elective-VI	4-0-0	4	50	100	3	-	-
Total			**19-0-10**	**25**	**400**	**500**		**150**	

Code	Elective – V	Code	Elective –VI
15UISE750	Cloud Computing	15UISE760	Mobile computing
15UISE751	Object Oriented modeling & Design	15UISE761	Information Storage Management
15UISE752	Software Testing	15UISE762	Internet of Things

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination*

L: Lecture **T**: Tutorials **P**: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

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Scheme for VIII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration In hours
15UISC800	PC	Machine Learning	3-0-0	3	50	100	3	-	-
15UISL801	PC	Project-Phase II	0-0-6	10	50	-	-	50	3
15UISL802	PC	Seminar	0-0-2	2	50	-	-	-	-
15UISL803	PC	Machine Learning Lab	0-0-2	1	50	-	-	50	3
15UISE8XX	PE	Elective – VII	4-0-0	4	50	100	3	-	-
15UISE8XX	PE	Elective – VIII	4-0-0	4	50	100	3	-	-
Total			**11-0-10**	**24**	**300**	**300**		**100**	

Code	Elective – VII	Code	Elective –VIII
15UISE850	Network Security & Cryptography	15UISE860	Wireless Sensor Networks
15UISE851	Artificial Intelligence	15UISE861	Digital Image Processing
15UISE852	Project management	15UISE862	Service Oriented Architecture

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination*

L: Lecture **T**: Tutorials **P**: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

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HOD, ISE

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18UISC500	Software Engineering	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

Student should understand the need for a process of software development complexity of system development, types of systems and quality requirements, analysis of any problem domain and formulation of requirements and assessment of quality, contemporary modeling, designing, development and validation techniques, fundamental aspects of software testing techniques.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Illustrate** the need for Software Engineering and software process.	1	-	12
CO-2	**Analyze** the system to be automated for identifying the software requirements.	-	2	-
CO-3	**Design** High-level and Low-level design of an application from the identified software requirements.	10	3	-
CO-4	**Apply** the methods of test generation from requirements and structural testing.	-	4	-
CO-5	**Adapt** software testing techniques.	-	13	10

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.0	2.0	2.0	-	-	-	-	-	2.0	-	1.0	2.0	-

Pre-requisites: 1.Basics of Computer Programming

Contents:

Unit-I

Overview FAQ's about software engineering, Professional and ethical responsibility. Socio-Technical systems: Emergent system properties; Systems engineering; Organizations, people and computer systems; Legacy systems. Critical Systems: A simple safety critical system; System dependability; Availability and reliability. **Software Processes:** Models, Process iteration, Process activities; The Rational Unified Process; Computer Aided Software Engineering. **10 Hrs.**

Unit-II

Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; The software requirements document. **Requirements Engineering Processes**: Feasibility studies; Requirements elicitation and analysis; Requirements validation; Requirements management. **System Models**: System models: Context models, Behavioural models, Data models, Object models, structured methods. **10 Hrs.**

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Unit-III

Software Design: Architectural Design: Architectural design decisions; System organization; Modular decomposition styles; Control styles. **Object Oriented design**: Objects and Object Classes; An Object-Oriented design process; Design evolution. UI Design Issues. Development: Rapid Software Development: Agile methods; Extreme programming; Rapid application development. Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution. **10 Hrs.**

Unit-IV

Basics of Software Testing: Human Errors and Testing; Software Quality; Requirements, Behavior and Correctness. **Software testing**: System testing; Component testing; Test case design; Test automation. **Testing Techniques:** Test Generation from Predicates, Statement testing, Branch Testing, Condition Testing, Path Testing, Procedural Call Testing, Data Flow Testing. **11 Hrs.**

Unit-V

Structural (White Box) Testing: Definition-Use pairs, Definition-Use associations; Data flow testing criteria; Data flow coverage with complex structures; The infeasibility problem. **Fault Based Testing**: Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis.**Black Box Testing:** Introduction, Functional testing, Integration testing, System testing, Acceptance testing, Adhoc testing, Regression testing, Smoke testing; The Test-Selection Problem; Equivalence Partitioning; Boundary Value Analysis; Category-Partition Method, Cause-Effect Graphing. **11 Hrs.**

Reference Books:

1) Ian Somerville, "Software Engineering",8/e, Pearson Education, 2012.
2) Rogers S Pressman, "Software Engineering: A Practitioners Approach",7/e, MCGrawHill, 2007.
3) Shari Lawrence Pfleeger, Joanne m Atlec , "Software Engineering theory and Practice" , 3/e, Pearson Education, 2006.
4) Waman S Jawadekar, "Software Engineering Principles and Practice", Tata McGraw Hill, 2004.
5) Foundations of Software Testing - Aditya P Mathur, Pearson Education, 2008
6) Software Testing and Analysis Process Principles and Techniques – Mauro Pezze, Michal Young, Wiley India, 2008

18UISC501	Java and Web Technology	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

Students should be able to write object-oriented code for a given problem applying the Java language features. Students should understand the World Wide Web, HTML5 tags, Java Scripts, Servlets, PHP and should be able to develop web applications.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Implement** the concepts of object-oriented programming using Java language and **Illustrate** the concept of Interface and Packages.	1	2	3,12,13,14
CO-2	**Apply** multi-threaded programming and exception handling in Java programs.	13	1, 2, 3	12,14
CO-3	**Use** JDBC to build the java application and **Illustrate** the structure of the World Wide Web.	1	2, 3,13	5,12,14
CO-4	**Develop** web database applications using PHP and MySQL database .	2,13	1,3	5,12,14
CO-5	**Develop** simple web applications using Applets, HTML5 and Servlets.	1	2, 3, 5	12,13,14

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.6	2.2	1.8	-	1.33	-	-	-	-	-	-	1.0	2.6	1.0

Pre-requisites: 1. Basic programming skills

Contents:

Unit-I

Introduction to Java: Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Simple Java programs. Data types, literals, assigning values; Operators and Expressions, Typecasting; Arrays, Strings; Control Statements: Selection statements, iteration statements, Jump Statements.

Classes: Class Fundamentals, Declaring objects, Object Reference Variables, Constructors, this keyword, Garbage collection, finalize( ) method.

Inheritance: Inheritance basics, super keyword, Multi-level hierarchy, Method overriding, Dynamic Method Dispatch.

Packages and Interfaces: Packages, Access Protection, Importing packages, Interfaces. **11 Hrs.**

Unit-II

Exception handling in Java: Exception-handling fundamentals, Exception types, Uncaught Exceptions, Using try and catch, Multiple catch clauses, Nested try statements; throw, throws and finally clauses, Java's built-in exceptions, Creating Own Exception Subclasses.

Multi-threaded Programming: The Java Thread Lifecycle, Creating a Thread, Extending Thread, Implementing Runnable, Thread Priorities, Synchronization.

10 Hrs.

Unit-III

JDBC: Introduction, JDBC driver types, JDBC Process, Statement Objects, ResultSet, Reading the ResultSet

Web and HTML: Introduction to World Wide Web, HTML5, Cascading StyleSheet, Validation using JavaScript **10 Hrs.**

Unit-IV

PHP: Introduction, Applications of PHP, Embedding PHP into HTML, php tag, Language syntax, Variables, Data types, Operators, Loops, Arrays, Built-in functions, Form handling with PHP

Database access with PHP and MySQL: Connecting to MySQL, Selecting a database with built-in functions in PHP, Executing an SQL query, Displaying the result with mysql_fetch_row and mysql_fetch_array functions **09 Hrs.**

Unit-V

Applets: Types of applets, Applet basics, The Applet class, Applet architecture, An applet skeleton, Simple Applet Display Methods, Outputting to the console, Repainting, A simple banner applet, Status Window, HTML Applet tag, Passing parameters to applets, getDocumentBase() and getCodeBase(), AudioClip Interface

Servlets: Background, The Life Cycle of a Servlet, Using tomcat for servlet development, A simple servlet – creating and compiling the servlet source code, Reading servlet parameters, The Cookie class, Handling HTTP Requests and Responses, Using Cookies, Session Tracking **12 Hrs.**

Reference Books:

1) Herbert Schildt, "Java The Complete Reference", 8/e, Tata McGraw-Hill Education
2) E. Balagurusamy, "Programming with Java - A Primer", 5/e, McGraw Hill Education, 2014
3) Jim Keogh, "J2EE The Complete Reference", McGraw Hill Education, 2007
4) Robert W. Sebesta, "Programming the World Wide Web", 8/e, Pearson Education

18UISC503	Computer Networks	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course is designed to expose the students to build an understanding of the fundamental concepts of computer networking. The course focuses on to Familiarize the student with the basic taxonomy and terminology of the computer networking area. It also introduces the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the Uses Of Computer Networks, layered architecture and their significance	2,1	1	12
CO-2	**Illustrate** the various applications of The Data Link Layer, Medium Access Control Sub layer	2	1, 13	-
CO-3	**Comprehend** the concepts of network layer, Transport layer for both connection-less and connection-oriented circuits.	1	2, 13	-
CO-4	**Implement** the different application layer protocols.	2, 13	4	5
CO-5	**Design** different applications for internet usage in application layer.	2, 13	6	1

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.2	2.8	-	2.0	1.0	2.0	-	-	-	-	-	-	2.5	-

Pre-requisites: 1. Basics of Digital Circuits principles
2. Communication principles

Contents:

Unit-I

Introduction: Uses Of Computer Networks, Network Hardware, Network Software reference Models, Example Networks

The Data Link Layer: Data Link Layer Design Issues, Error Detection and Correction Elementary Data Link Protocols, Sliding Window Protocols, Example Data Link Protocols. **8 Hrs.**

Unit-II

The Medium Access Control Sub layer: The Channel Allocation Problem, Multiple Access Protocols, Ethernet, Wireless Lans, Data Link Layer Switching. **7 Hrs.**

Unit-III

The Network Layer: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, Quality of Service, Internetworking, The Network Layer in The Internet. **8 Hrs.**

Unit-IV

The Transport Layer: The Transport Service, Elements Of Transport Protocols, Congestion Control Algorithms, The Internet Transport Protocols: UDP, The Internet Transport Protocols: TCP, Performance Issues. **8 Hrs.**

Unit-V

Application Layer: DNS--The Domain Name System, Electronic Mail, The World Wide Web, Real time Audio and Video, Content Delivery and Peer-To-Peer. **8 Hrs.**

Reference books:

1) Andrew S. Tanenbaum, David J. Wetherall, University of Washington, "Computer Networks", Pearson, 5/e, 2011.
2) Behrouz Forouzan, "Data Communications and Networking", 4/e, McGraw Hill,2006
3) Alberto Leon-Garcia, Indra Widjaja "Communication Networks**",**2/e, Tata McGraw-Hill Education India, 2004
4) Behrouz Forouzan, "TCP/IP Protocol Suite", 3/e,McGraw Hill, 2005

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18UHUL507	Soft skills/Aptitude	(0-0-2)1

Contact Hours: 24

Course Learning Objectives (CLOs):

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1 to 12)/PSO(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the significance of communication in the profession.		10	
CO-2	**Use**the English language with proficiency		10	12
CO-3	**Solve** Aptitude related problems		9	12
CO-4	**Demonstrate** the competency in the placement activities.		9	

PO's	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
Mapping Level	-	-	-	-	-	-	-	-	2.0	2.0	-	1.0	-	-	-

Contents:

Training on communication skills, proficiency in English language and aptitude ability involving the internal and external resource.

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

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18UISE511	System Software	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

To view some of the major tasks of the system software of a computer system, focusing on internal working of the hardware and software interface of a typical system

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1,12)/ PSO (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** the architecture of hypothetical machines and data structures used for assembler design	1	-	-
CO-2	**Design**, **analyze** and **implement** one pass, two pass or multi pass assembler.	3	2, 4	13
CO-3	**Design** and **analyze** loaders, linkers and various options in designing.	3	2, 4	-
CO-4	**Design** and **analyze** macro processors	3	2, 4	-
CO-5	**Illustrate** the various phases of compilers	1	-	13

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.0	3.0	2.0	-	-	-	-	-	-	-	-	1.0	-

Prerequisites: 1. Computer Organization
2. Knowledge of Programming

Contents:

Unit-I

Machine Architecture and Assemblers : Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples. Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures **8 Hrs**.

Unit-II

Assemblers M/c Dependent and Independent Features : Program Relocation. Machine Independent Features - Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking. **Assembler Design options** Assembler Design Operations - One-Pass Assembler, Multi-Pass Assembler. **8 Hrs.**

Unit-III

Loaders and Loader Design options : Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader Machine-Dependent Loader Features - Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader. Machine-Independent Loader Features- Automatic Library Search, Loader Options. Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders. **8 Hrs.**

Unit-IV

Macro Processor: Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine-Independent Macro Processor Features - Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor Design Options – Recursive Macro Expansion, General-Purpose Macro Processors, Macro Processing Within Language Translators. **8 Hrs.**

Unit-V

Compilers: Intermediate Code generation : Basic compiler functions- grammars, lexical analysis, Syntactic analysis,: Revisited. Intermediate Code generation - Three address code, Types and Declarations, Translation of expressions. **7 Hrs.**

Reference Books:

1) Leland L. Beck and D. Manjula, "System Software", 3rd Ed., Pearson Education, 2012.
2) Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers-Principles, Techniques and Tools", 2nd Edition, Addison-Wesley, 2008
3) D. M. Dhamdhere, "System Programming and Operating Systems", 2nd Ed., Tata McGraw Hill, 2008
4) John J. Donovan, "System Programming", 2nd Ed., Tata McGraw Hill, 2004.

18UISE512	Advanced Data Structures & Algorithms	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

It introduces students to a number of highly efficient algorithms and data structures for fundamental computational problems across a variety of areas. Students are also introduced to techniques such as amortized complexity analysis.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1,12)/ PSO (1,2,3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyse** and **Apply** amortized analysis on data structures, including binary search trees, and disjoint sets.	2	3	-
CO-2	**Design** and **Implement** operations like searching, insertion, and deletion, traversing mechanism etc. Red black trees, augmenting data structure	3	13	-
CO-3	**Perform** the operation like Union, find min, extract min and delete operation on mergeable heaps	4	13	-
CO-4	**Implementation** and complexity analysis of fundamental algorithms such as graph algorithm ,max flow, and sorting network	3	-	13
CO-5	**Applications** of algorithms in a string matching algorithm	-	13	12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	-	3.0	2.66	3.0	-	-	-	-	-	-	-	1.0	1.75	-

Prerequisites:

1.Data structures Programming

Contents:

Unit-I

Amortised analysis: Aggregate analysis, the accounting method, the potential method, dynamic tables, **Binary Search Tree** Definition and various operations performed on BST, **Disjoint sets / union-find** Disjoint Set Operations, Linked list representation of disjoint sets, Disjoint-set forests, Analysis of union by rank with path compression. **9 Hrs.**

Unit-II

Red Black Trees: Properties, Rotations, Insertion, Deletion , Augmented Data structure, Dynamic order statistics, Retrieving an element with a given rank, How to augment a data structure, Interval trees. **8 Hrs.**

Unit-III

Binomial Heaps: Binomial trees and binomial heaps, operations on binomial heaps **Fibonacci Heaps:** Structure of Fibonacci heaps, Mergeable – heap operations, Decreasing a key and deleting a node, Bounding the maximum degree. **8 Hrs.**

Unit-IV

Graph Algorithms: Maximum Flow: Flow Networks, The Ford-Fulkerson method. **Sorting Networks:** Comparison Networks, The zero-one principle, Abitonic sorting network, A merging network, A sorting network **7 Hrs.**

Unit-V

String Matching: The naïve string matching algorithm, The Rabin –Karpalgorithm, String matching with finite automata, The Knuth-Morris-Pratt algorithm. **7 Hrs.**

Reference Books:

1) Cormen T.H et al, "Introduction to Algorithms", 2/e, PHI, 2001.
2) S.Dasgupta, C.H.Papadimitriou,and U.V. Vazirani, "Algorithms",3/e,Mcgraw-Hill, 2006
3) J. Kleinberg and E. Tardos," Algorithm Design", 2/e, Addison-Wesley, 2006

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18UISC600	Artificial Intelligence and Machine Learning	(3-0-2) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

Students will be exposed to the concepts of Artificial Intelligence & Machine Learning principles and techniques, Introduction to Artificial Intelligence & Machine Learning as cutting edge Technology for emerging Engineers. They also learn to implement Machine Learning algorithms on standard data set.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** the concepts of Artificial Intelligence & Machine Learning.	1	-	-
CO-2	**Apply searching** and knowledge based techniques for Artificial Intelligence systems.	1	2, 5	-
CO-3	**Demonstrate** Machine Learning algorithms for given data set.	1, 2	3, 5,13	12,14
CO-4	**Illustrate** the techniques of Artificial Neural Network and Predictive Analytics.	1	2, 3, 5,13	12
CO-5	**Compare** Machine Learning & Deep learning techniques for real world applications.	1, 2	5,13	14

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	3.0	2.0	-	2.0	-	-	-	-	-	-	1.0	2.0	1.0

Pre-requisites:

1. Background of data structures, database and basic statistics
2. Programming languages

Contents:

Unit-I

Introduction to AI & ML: What is Machine Learning?, What is Artificial Intelligence?, Machine Learning vs AI, Machine Learning vs Deep Learning, Types of Machine Learning, Process of Machine Learning, Production system characteristics -Specialized productions system- Problem solving methods. **8T Hrs.**

Unit-II

Searching Techniques: Introduction, Problems, Problem Spaces and search, Heuristic search technique (Breadth First Search, Depth First Search), Knowledge Representation Issues, Introduction to predicate calculus, Knowledge representation using Predicate logic, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge. **(8T+2P)Hrs.**

Unit-III

Learning Techniques in Machine Learning: Supervised Learning (Classification & Regression), Unsupervised Learning (Clustering & Dimensionality Reduction) Reinforcement Learning. **(9T+4P)Hrs.**

Unit-IV

Artificial Neural Network: Introduction, Neural Network representation, Perceptrons, Back propagation algorithm. Predictive Analytics-Forecasting and Ensemble Techniques**. (8T+2P) Hrs.**

Unit-V

Deep learning: Introduction and its applications, Machine Learning Applications across Industries (Healthcare, Retail, Financial Services, Manufacturing & Hospitality). **(6T+5P) Hrs.**

Reference Books:

1) Tom M Mitchell, "Machine Lerning",1/e, McGraw Hill Education, 2017.
2) Stuart Rusell, Peter Norving ," Artificial Intelligence: A Modern Approach", 2/e ,Pearson Education, 2009
3) Ethem Alpaydın, "Introduction to Machine Learning", 2/e, MIT press, 2015.
4) Elaine Rich, Kevin K and S B Nair, "Artificial Intelligence", 3/e, McGraw Hill Education, 2017.
5) AurÈlienGÈron," Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools and Techniques to Build Intelligent Systems", 1/e, Shroff/O'Reilly Media, 2017.
6) Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", 2/e, springer series in statistics, 2017.

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18UISC601	Internet of Things	(4-0-0) 4

Contact Hours: **52**

Course Learning Objectives (CLOs):

In recent years we have witnessed a wave of new Internet of Things (IoT) devices in consumer markets. These include wearable such as wrist watch computers and ear phones for personal entertainment, work assistance and bio-metric monitoring. Enabled with energy-efficient computing cores and sensors, these devices can be programmed to perform a variety of personalized or context-specific tasks at extremely low power consumption. Many believe that IoT will play a key role in the next frontier of computing. At the end of this course, the student should understand the Internet of Things (IoT) technology and should be in a position to develop his/her own product using cloud, python, android, arduino and wireless sensor networks. We will focus on new opportunities and challenges on tiny devices and use of machine learning technology to enhance their usage.

Course Outcomes(COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the significance of IoT and its applications and **use** Arduino/ Raspberry Pi platforms.	1,2	-	4,12
CO-2	**Illustrate** the Communications and Networking aspects of IoT.	2,3	1	12
CO-3	**Write** program using python and survey on Wireless protocols	3,5	13,14	12
CO-4	**Develop** an IoT application using Arduino/ Raspberry Pi.	2,3	5,6,13,14	7,12
CO-5	**Analyze** IoT applications data.	-	4	8

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.0	3.0	3.0	2.0	2.5	-	-	-	-	-	-	1.0	2.0	2.0

Prerequisites:

Computer networks

Contents:

Unit – I

Introduction: Introduction to Internet of Things (IoT): IoT overview, Physical and Logical design of IoT, IoT Enabling Technologies, IoT levels, Domain Specific IoTs: Home Automation, Smart Cities, Smart Environment, Smart Energy, Smart Retail, Smart Logistics, Smart Agriculture, Smart Industry, Smart Health. **10 Hrs.**

Unit – II

IoT and M2M: Introduction, M2M, Difference between IoT and M2M, Introduction to Software Defined Networking (SDN) and Network Function Virtualization (NFV) for IoT, MQTT.
Tools for IoT: Introduction, NETCONF, YANG, YIN and BEEP. **10 Hrs.**

Unit-III

IoT Systems - Logical Design using Python: Introduction, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Classes, Python Packages of Interest for IoT **5 Hrs.**
Wireless Protocols for IoT: Bluetooth and Bluetooth Smart, IEEE 802.15.4 WPAN, ZigBee **5 Hrs.**

Unit-IV

IoT Platform Design Methodology: Introduction, IoT Design Methodology, Case Study on IoT System, IoT Physical Devices and End-Points - Basic Building Blocks of IoT, Arduino/Raspberry Pi & its interfaces, Programming Arduino/Raspberry Pi & other I/O Devices, 6LoWPAN. **12 Hrs.**

Unit-V

Data Analytics for IoT: Introduction, Apache Hadoop, Using Hadoop Map Reduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis **10 Hrs.**

Beyond the Syllabus Coverage (Suggestive):

1. Students' Survey papers related to IoT
2. Laboratory Experiments
3. Seminar

Reference books:

1) Arshdeep Bahga, Vijay Madisetti, ”Internet of Things: A Hands on Approach” Universities Press., 2015
2) Srinivasa K G, Siddesh G.M, Hanumantha Raju R ―Internet of Things, CENGAGE Leaning India, 2017.
3) Daniel Minoli, ”Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications”, Wiley, 2013
4) Claire Rowland, Elizabeth Goodman et.al.,” Designing Connected Products”, First Edition, O’Reilly, 2015
5) Samuel Greengard, The Internet of Things, MIT Press, 2015
6) Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.
7) Internet of Things courses from www.edx.org, www.coursera.org, www.nptel.ac.in

18UISL604	Minor Project - II	(0-0-4) 2

Contact Hours: 52

Course Learning Objectives (CLOs): Though the Specific objectives of this course depends on the Project chosen, below the generic objectives of this course:

Course Outcomes(COs):

Description of the course outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Apply** problem solving and programming skills for identified problem statement.	2, 13	1	14
CO-2	**Design** the system for an identified requirement	3	4	1
CO-3	**Analyze and Incorporate** the changes in the development cycle.	4, 2	13	1, 14
CO-4	**Use** modern tools for realizing the solution.	5		14
CO-5	**Demonstrate** an ability to work in a team	9		11
CO-6	**Demonstrate** an ability to present the work carried out both in written and oral form.	10		11

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	1.33	3.0	3.0	2.5	3.0	-	-	-	3.0	1.0	-	-	2.5	1.0

Prerequisites: Knowledge of
a) Software Engineering concepts
b) Any Programming Language

Guidelines for Conduction

Spirit of The Course: To ensure that undergraduates can successfully apply the knowledge they have gained through a project, demonstrates the practical application of principles learnt in different courses and enables students to integrate material learnt at different stages of the curriculum up to the 5thsemester; also appreciating the need for domain knowledge for certain applications, and that this may necessitate study within that domain.

1. Students Form a Team. Size of the team can vary from 3 to 4. With genuine explanation bigger or smaller is team is allowed.
2. Guide for this course is a must and will be chosen by team itself by interacting with faculty.

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3. In consultation with Guide, Team will prepare the project plan and its specific outcomes, which Team promises/declares to accomplish.
4. Project Report: A Course closure document outlining the problems, specifications, including the survey of literature, various results obtained, solutions and the problems faced deviation from the promised milestones, testing report, user manual, appendix reference etc is expected to be produced by each team of project.
5. Demonstration, seminar, quiz, tests, Viva-Voce, publications, Reports can be used for the evaluation.
6. There can be designated Committee to monitor this process of Mini Project.

Assessment:

CIE - Minimum 2 reviews of the project + any other relevant components

SEE – SEE exam and Project Demonstration + any other component as decided by Project Coordinator and HoD

Note:

- There can be designated Committee to monitor this process of Mini Project.
- An Internal Guide is allotted per group who guides and monitors the project progress.
- Course Outcomes (2 or more) are to be written per project and should map to following Program Outcomes and Program Specific Outcomes. Internal Guide can include other POs apart from the ones mentioned below if those POs are deemed suitable by them.
- Industry, society, etc., Interactions are required as part of Project.
- At the end of the course, students are required to submit a mini-project report.

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18UHUL605	Soft skills/Aptitude	(0-0-2)1

Contact Hours:24

Course Learning Objectives (CLOs):

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1 to 12)/PSO(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the significance of communication in the profession.		10	
CO-2	**Use** the English language with proficiency		10	12
CO-3	**Solve** Aptitude related problems		9	12
CO-4	**Demonstrate** the competency in the placement activities.		9	

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	1.0		1.0		3	2.0				2.0	1.0				

Contents:

Training on communication skills, proficiency in English language and aptitude ability involving the internal and external resource.

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

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18UISE612	User Interface Design	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

User Interface design is a course offered as a core subject at the undergraduate level for VI semester students. The objective of this course is for the students to learn the basic principles of user interface design. The goal of user interface designer is to make the user's interaction as simple and efficient as possible, in terms of accomplishing users goals. On learning this they should be able to deploy the knowledge of UID principles, design concepts and related methodologies, be familiar with the design technologies for individuals, apply theories and concepts associated with effective work design to real-world application.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** the Characteristics of Graphics Interface and its Principles	1	-	12
CO-2	**Design** the standards and structures for Human computer interaction	2,5	3	12
CO-3	**Illustrate** the components of web systems and text boxes	1	2,5	12
CO-4	**Demonstrate** the use of multimedia systems and its accessibility.	1	2	12
CO-5	**Summarize** the concepts of windows layout and visualization	1,3	5	12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.33	2.5	-	2	-	-	-	-	-	-	1.0	-	-

Pre-requisites: Knowledge of Software Engineering

Contents:

Unit-I

Introduction: Human–Computer Interface, Characteristics of Graphics Interface, Direct Manipulation Graphical System, Web User Interface, Popularity, Characteristic & Principles. **7 Hrs.**

Unit-II

Human Computer Interaction: User Interface Design Process, Obstacles, Usability, Human Characteristics In Design, Human Interaction Speed ,Business Functions, Requirement Analysis, Direct and Indirect Methods.

Basic Business Functions, Design Standards, System Timings, Human Consideration In Screen Design, Structures Of Menus, Functions Of Menus, Contents Of Menu,Formatting, Phrasing The Menu, Selecting Menu Choice, Navigating Menus,Graphical Menus. **9 Hrs.**

Unit-III

Windows: Introduction, Characteristics, Components, Presentation Styles, Types, Managements, Organizations, Operations, Web Systems,Device,Based Controls Characteristics,Screen, Based Controls, Operate Control,Text Boxes,Selection Control,Combination Control,Custom Control,Presentation Control. **8 Hrs.**

Unit-IV

Multimedia: Text For Web Pages –Effective Feedback–Guidance & Assistance, Internationalization– Accessibility–Icons–Image–Multimedia–Coloring. **8 Hrs.**

Unit-V

Windows Layout– **Test**: Prototypes, Kinds of Tests, Retest, Information Search, Visualization, Hypermedia, WWW– Software Tools. **7 Hrs.**

Reference Books:

1) Ben Shneiderman, Plaisant, Cohen, Jacobs,"Designing the UserInterface‖",5/e, Pearson Education, 2010.
2) JeniferTidwell,"Designing Interfaces Patternsfor effective design", 2/e,O'ReillyMedia, 2010.
3) Jesse James Garrett, "The Elements of User Experience: User– CenteredDesign for the Web and Beyond", 2/e, Pearson Education,2011.
4) Wilbert O. Galitz, "The EssentialGuidetoUserInterfaceDesign -AnIntroduction to GUI Design Principles and Techniques", 2/e, Wiley Dream Tech, 2011.

18UISE621	Object Oriented Modeling and Design	(3-0-0)3

Contact Hours: 39

Course Learning Objectives (CLOs):

This course makes students to know the process of object oriented system modeling, design, and tools used in the industry to enable them to construct software system using various standards and techniques.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Apply** the fundamental object orientation concept in solving problem by indentifying classes, objects, their properties association	1,2	-	12
CO-2	**Analyze** the problem scenario and **model** the system using UML diagrams	1,2	3,5	12
CO-3	**Illustrate** the concept of process overview, system conception, domain analysis.	1	2,3	12
CO-4	**Describe** the concepts of application analysis, system design.	1,2	3	12
CO-5	**Explain** the concept of class design implementation modeling.	1,2	-	12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.8	2.0		2.0							1.0		

Pre-requisites:

1. Exposure to basics of object oriented Programming Terminologies
2. Software Engineering

Contents:

Unit-I

Introduction, Modeling Concepts, class Modeling: What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling history.Modeling as Design Technique*:* Modeling; abstraction; The three models. Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips. **7 Hrs.**

Unit-II

Advanced Class Modeling, State Modeling, Advanced State Modeling: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips. State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips , : Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips. **9 Hrs.**

Unit-III

Interaction Modeling:. Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models

Process Overview, System Conception, Domain Analysis: ProcessOverview: Development stages; Development life cycle. System Conception**:** Devising a system concept; Elaborating a concept; Preparing a problem statement Domain Analysis**:** Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis. **9 Hrs.**

Unit-IV

Application Analysis, System Design: Application Analysis: Application interaction model; Application class model; Application state model; Adding operations. Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example **7 Hrs.**

Unit- V

Class Design, Implementation Modeling,: Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recurring downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example. Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing. Legacy Systems: Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance. **7 Hrs.**

Reference books:

1) Michael Blaha, James Rumbaugh,"Object-Oriented Modeling and Design with UML", 2 /e, Pearson Education, 2005.
2) Ali Bahrami, "Object oriented systems development", McGrawHill, 1999.
3) Booch, G., Rumbaugh and Jacobson, "The Unified Modeling Language User Guide", 2/e, Pearson, 2005

18UISO633	Agile methodologies	(3-0-0) 3

Contact Hours: 39

Course Objectives: To understand how an iterative, incremental development process leads to faster delivery of more useful software. To understand the essence of agile development methods .To understand the principles and practices of extreme programming and to understand the roles of prototyping in the software process, understand the concept of Mastering Agility.

Course Outcome (CO's):

Description of the course outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Substantial Level (3)**	**Substantial Level (3)**
CO-1	**Analyse** The XP Lifecycle, XP Concepts, Adopting XP.	1	-	12
CO-2	Implement Work on Pair Programming, Root-Cause Analysis.	1	4	13
CO-3	**Design** Retrospectives, Planning, Incremental Requirements, Customer Tests.	1	4	12
CO-4	**Implement** Concepts to Eliminate Waste.	2	-	1
CO-5	Determine value to productive systems through Agile methods	4	-	13

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.5	3.0	-	2.0	-	-	-	-	-	-	-	1.0	1.0	-

Pre-requisites: 1. Knowledge of Software Engineering

Contents:

Unit - I

Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor.

Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility. **07 Hrs.**

Unit - II

Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives.

Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting. **Releasing:**" Done Done", No Bugs,

Version Control, TenMinute Build, Continuous Integration, Collective Code Ownership, Documentation. **08 Hrs.**

Unit - III

XP-Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating, Developing: Incremental Requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing. **08 Hrs.**

Unit - IV

Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading.

Improve the Process: Understand Your Project, Tune and Adapt, Break the Rules.

Rely on People: Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People.

Eliminate Waste: Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput. **08 Hrs.**

Unit - V

Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently.

Seek Technical Excellence: Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery. **08 Hrs.**

Reference Books:

1) James shore, Chromatic, "The Art of Agile Development (Pragmatic guide to agile software development)", O'Reilly Media, Shroff Publishers & Distributors, 2013.
2) Robert C. Martin, "Agile Software Development, Principles, Patterns, and Practices", Prentice Hall; 1/e, 2002
3) Craig Larman,"Agile and Iterative Development A Manger's Guide", Pearson Education, 1/e, India, 2004.

UG-2021-22

Scheme for III Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
18UMAC300	BS	Engineering Mathematics-III	3 - 0 - 0	3	50	100	3	-	-
18UISC300	PC	Data Structures	3 - 2 - 0	4	50	100	3	-	-
18UISC301	PC	Logic Design	3 - 0 - 0	3	50	100	3	-	-
18UISC302	PC	Discrete Mathematics & Graph Theory	4 - 0 - 0	4	50	100	3	-	-
18UISC303	PC	Unix and Shell Programming	3 - 0 - 2	4	50	100	3	-	-
18UISC304	PC	Computer Organization and Architecture	3 - 0 - 0	3	50	100	3	-	-
18UISL305	PC	Data Structures Laboratory	0 - 0 - 3	1.5	50	-	-	50	3
18UISL306	PC	Logic Design Laboratory	0 - 0 -3	1.5	50	-	-	50	3
Total			**19 - 2 - 8**	**24**	**400**	**600**		**100**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination*

L: Lecture **T**: Tutorials **P**: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks

BS- Basic Science, PC- Program Core

Scheme for IV Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration In hours
18UMAC400	BS	Engineering Mathematics - IV	3 - 0 - 0	3	50	100	3	-	-
18UISC400	PC	Object Oriented Programming	4 - 0 - 0	4	50	100	3	-	-
18UISC401	PC	Microcontroller	4 - 0 - 0	4	50	100	3	-	-
18UISC402	PC	Finite Automata and Formal Language	3 - 2 - 0	4	50	100	3	-	-

18UISC403	PC	Design and Analysis of Algorithms	3 - 0 - 0	3	50	100	3	-	-
18UISC404	PC	Operating System	3 - 0 - 0	3	50	100	3	-	-
18UISL405	PC	Object Oriented Programming Laboratory	0 - 0 - 3	1.5	50	-	-	50	3
18UISL406	PC	Microcontroller Laboratory	0- 0- 3	1.5	50	-	-	50	3
18UISL407	PC	Introductory Project	0 - 0- 2	1	50	-	-	-	-
Total			**20 - 2 -8**	**25**	**450**	**600**		**100**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination* **L**: Lecture **T**: Tutorials **P**: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

BS- Basic Science, PC- Program Core

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Scheme for V Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs./Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration in Hrs.
18UHUC500	HU	Management, Entrepreneurship and IPR	4 - 0 - 0	4	50	100	3	-	-
18UISC500	PC	Software Engineering	4 - 0 - 0	4	50	100	3	-	-
18UISC501	PC	Java and Web Technology	4 - 0 - 0	4	50	100	3	-	-
18UISC502	PC	Database Management System	3 - 0 - 0	3	50	100	3	-	-
18UISC503	PC	Computer Networks	3 - 0 - 0	3	50	100	3	--	--
18UISE5XX	PE	Program Elective-1	3 - 0 - 0	3	50	100	3	--	--
18UISL504	PC	Database Management System Lab	0 - 0 - 3	1.5	50	--	--	50	3
18UISL505	PC	Java Lab	0 - 0 - 3	1.5	50	--	--	50	3
18UISL506	PC	Minor Project-1	0 - 0 - 2	1	50	--	--	--	--
18UHUL507	HU	Soft skills/Aptitude	0 - 0 - 2	1	50	--	--	--	--
Total			**21 - 0 - 10**	**26**	**500**	**600**		**100**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination* **L**: Lecture**T**: Tutorials **P**: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks PC- Program Core HU- Humanities, PC- Program Core

Minor project – 1 is undertaken to focus on the domain related problem definitions, building prototypes which can lead to take up the project in the higher semester(s). The work based on the core courses studied shall be used to formulate the problem. The team consisting of 10-12 students shall be asked to identify the problems related to community and try to propose the solution. The faculty members handling the courses for that semester shall guide the students. A committee consisting of minimum 3 faculty members shall evaluate at the end for CIE. There is no SEE for Minor project-1.

Soft skills/Aptitude: This is included with an objective of improving the communication skills, proficiency in English language and aptitude ability of the student. This is a credit course and aimed to enhance the employability. Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The

arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

Management, Entrepreneurship and IPR course shall be taught in the V semester only. However, the departments can take flexibility of deciding the contents of the course as per the department specific requirements. The credit for this course is 4 and common to all departments

Elective

Code	Elective – 1
18UISE511	System software
18UISE512	Advanced Data Structures
18UISE513	Real Time Operating Systems and Embedded Systems

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Scheme for VI Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs./Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration in Hrs.
18UISC600	PC	Artificial Intelligence and Machine Learning	3-0-2	4	50	100	3	-	-
18UISC601	PC	Internet of Things	4-0-0	4	50	100	3	-	-
18UISE6XX	PE	Program Elective-2	3-0-0	3	50	100	3	-	-
18UISE6XX	PE	Program Elective-3	3-0-0	3	50	100	3	-	-
18UISO6XX	OE	Open Elective	3-0-0	3	50	100	3	--	--
18UISL602	PC	Computer Networks Lab	0-0-3	1.5	50	--	--	50	3
18UISL603	PC	Web Technology Lab	0-0-3	1.5	50	--	--	50	3
18UISL604	PC	Minor Project-2	0-0-4	2	50	--	--	50	3
18UHUL605	HU	Soft skills/Aptitude	0-0-2	1	50	--	--	--	--
Total			**16 - 0 -14**	**23**	**450**	**500**		**150**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination* **L**: Lecture **T**: Tutorials **P**: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

PC- Program Core, PE-Program Elective, OE- Open Elective and HU- Humanities.

Scheme for VII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs./Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration in Hrs.
18UISC700	PC	Big Data Analytics	3-2-0	4	50	100	3	-	-
18UISC701	PC	Storage Management	4-0-0	4	50	100	3	-	-
18UISO7XX	PE	Program Elective-4	3-0-0	3	50	100	3	-	-
18UISE7XX	OE	Open Elective	3-0-0	3	50	100	3	--	--
18UISL702	PC	Big Data Analytics Lab	0-0-2	1	50	--	--	50	3
18UISL703	PC	Major Project Phase-1	0- 0 -4	2	50	--	--	50	3
18UISL704	PC	Internship	4weeks	2	50	--	--	50	3
Total			**13-2-6**	**19**	**350**	**400**		**150**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination* **L**: Lecture **T**: Tutorials **P**: Practical

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks

PC- Program Core

Elective

Code	Elective – 4	Code	Open Elective
18UISE711	Digital Image Processing	18UISO721	Cloud Computing
18UISE712	Mobile Communication and	18UISO722	Supply Chain Management
18UISE713	Deep Learning	18UISO723	Virtual Reality and Augmented
18UISE714	Software Testing		

Scheme for VIII Semester

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs./Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration in Hrs.
18UISC800	PC	Cryptography and Cyber Security	4-0-0	4	50	100	3	-	-
18UIS8XX	PE	Program Elective-5	3-0-0	3	50	100	3	-	-
18UISO8XX	OE	Open Elective	3-0-0	3	50	100	3	--	--
18UISL801	PC	Technical Seminar	0-0-2	1	50	--	--	--	--
18UISL802	PC	Major Project Phase-2	0-0 -12	7	50	--	--	50	3
Total			**10-0-14**	**18**	**250**	**300**	**--**	**50**	**--**

PC- Program Core ,PE-Program Elective, OE- Open Elective

Code	Program Elective-5	Code	Program / Open Elective Open Elective
18UISE811	Wireless Sensor Networks	18UISO821	Dev-Ops
18UISE812	Block Chain Management	18UISO822	Data Sciences
18UISE813	Data Compression	18UISO823	Computer Vision

Dr. Jagadeesh D. Pujari
HOD, ISE

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18UISC701	Storage Management	(4-0-0) 4

Contact Hours: **52**

Course Learning Objectives (CLOs): The main objective of this course is to provide an understanding of storage architectures its logical and physical components including storage subsystems, RAID and Intelligent storage systems,storage networking technologies such as FC-SAN, NAS,and data archival solution – CAS. Identifying different storage virtualization backup technologies, storage security domains its management and their benefits.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain storage architecture Its logical and physical components of a storage infrastructure including storage subsystems, Different RAID techniques	-	4	1
CO-2	Describe the intelligent storage systems including different networking technologies such as FC-SAN and Virtualization in SAN	2	-	12
CO-3	Describe the different network attached storage systems its components and its implementations	1	-	-
CO-4	Explain the different back up technologies.	-	4	5
CO-5	Describe the storage security aspects and explain the different parameters of managing and monitoring storage infrastructure.	3	-	12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.0	3.0	3.0	2.0	1.0	-	-	-	-	-	-	1.0	-	-

Prerequisites:

1) Computer Networks

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Contents:

Unit-I **Introduction to Information Storage:** Information Storage, Evolution of Storage Architecture, Data center Infrastructure, Virtualization and cloud computing. Data Center Environment: Application, Database Management System(DBMS), Host(compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based On Application, Disk Native Command Queuing, Introduction to Flash Drives, Concept in Practice: VMware ESXi. Data Protection: RAID:RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID levels, RAID Impact on Disk Performance, RAID Comparison.	**12 Hrs**
Unit-II **Intelligent Storage Systems:** Components of an Intelligent Storage System, Storage Provisionin, Types of intelligent Storage Systems, Concepts in Practice: EMC Symmetrix and VNX. Fibre Channel Storage Area Networks: Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, fabric Services, Switched fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN.	**10 Hrs**
Unit-III **Network-Attached Storage**: General-purpose Servers versus NAS Devices, benefits of NAS, File Systems and network File Sharing. Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, factors Affecting NAS Performance, File-Level Virtualization, Concepts in Practice: EMC Isilon and EMC VNX gateway. Object-Based and unified Storage: Object-Based Storage Devices, Content- Addressed Storage.	**10 Hrs**
Unit-IV **Backup and Archive :** Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operation, Backup Topologies, Backup in NAS Environments, Backup Targets, Data Deduplication for Backup, Backup in Virtualized Environments, Data Archive, Archiving Solution Architecture.	**10 Hrs**
Unit-V **Securing the Storage Infrastructure:** Information Security Framework, Risk Triad, Storage Security Domains, Security implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments, Concepts in practice: RSA and VMware Security Products. Managing the Storage Infrastructure: Monitoring the Storage Infrastructure, Storage Infrastructure Management Activities.	**10 Hrs**

Reference Books:

1) EMC^2 : Information Storage and Management, Willey India 2013.
2) Marc Farley, "Building Storage Networks", Tata McGrawHill, Osborne, 2001
3) EMC Corporation, Information Storage and Management, Wiley, India. ISBN-13: 978-8126537501, August 2012.
4) Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.

18UISL704	Internship	4 weeks - 3

Contact Hours: 4 weeks

Course Learning Objectives (CLOs): The internship module aims to provide the student with a practice-oriented and hands-on working experience in the real world or industry, and to enhance the student's learning experience i.e. to integrate theory and practice. It gives an opportunity to develop a right work attitude, self-confidence, interpersonal skills and ability to work as a team in a real organizational setting. Also, to further develop and enhance operational, customer service, competency in specific areas related to student's area of career interest, skills in research, analysis and other life-long knowledge and skills in a real-world work environment. Through Internship, students can get pre-employment training and the company or organization can assess the performance of the student and offer the student an employment opportunity after his/her graduation, if it deems fit.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Solve** real life challenges in the workplace by analyzing work environment and conditions, and selecting appropriate skill sets acquired from the course.	1, 2	4	12
CO-2	**Communicate and collaborate** effectively and appropriately with different professionals in the work environment.	5,10	8	6,7,11,12
CO-3	**Demonstrate** critical thinking, problem-solving skills and creativity and innovation by analyzing underlying issue/s to challenges.	1,2,3,4,5,13,14	6,7,8	12
CO-4	**Demonstrate** the application of knowledge and skill sets acquired from the course and workplace in the assigned job function/s.	1,2,3,4,5,13,14	6,7,8	12
CO-5	**Demonstrate** an ability to work as a professional in a heterogeneous team environment.	9,10,11	8	12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	3.0	3.0	2.66	3.0	1.66	1.66	2.0	3.0	3.0	2.0	1.0	3.0	3.0

The students are to undergo internship in Private industries/R&D organizations/Centers of Excellence/Laboratories of Reputed Institutions/Govt. & Semi Govt. organizations, PSUs, construction companies, entrepreneurial organizations, inter departments within the college etc. to get exposure to the external world for a period of 4 weeks in the summer vacation after VI sem and before start of VII semester.

The students are to prepare a report on the internship work carried out. The internal faculty shall monitor the student and award CIE marks. There is a SEE in which the student shall present his work before a panel of examiners consisting of HoD, Guide and one faculty member during VII semester. The performance shall be communicated to the COE office and the same shall reflect in the VII semester grade card.

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18UISC800	Cryptography and Cyber Security	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): To help the students design and develop secure solution to provide confidentiality and integrity, user authentication, secure network and transport layer communication, secure wireless communication, defeat vulnerabilities and electronic payment. This fundamental course covers the theory of encryption and standard protocols for data communications and network security. Topics that may be covered include PKI, digital signatures, message authentication codes, hash functions, etc. An examination of network security defenses and countermeasures are also covered.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Identify and inspect vulnerabilities and defense strategies of attacks on a network.	1		12
CO-2	Apply and analyze different cryptographic algorithms for secure data transmission using recent tools.	5	2	-
CO-3	Implement DES, AES, MAC and other applications.	-	2,5	12
CO-4	Analyze the basics of GSM, UMITS.	-	5	2
CO-5	Implement Cryptographic algorithms for Authentication and Kerberos. Implement the Firewall Policy in the domain of security.	-	3	5

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	1.6	2.0	-	2.5	-	-	-	-	-	-	1.0	-	-

Prerequisites:
Computer Networks

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Contents:

Unit-I **Introduction:** Cyber attacks, motives, common attacks, vulnerabilities, Defence strategies and Techniques, Access control-authentication and authorization, data protection, prevention and detection, response, recovery, and forensics, guiding principles. ARP and network layer protocols, IP Version 4, IP Version 6.	**10 Hrs**
Unit-II **Basics of Cryptography:** Preliminaries, Secret versus "Public" key cryptography, type of attacks, Mono alphabetic ciphers, Poly alphabetic Ciphers, Elementary Transposition ciphers, other cipher properties, confusion and diffusion, block ciphers and stream ciphers.	**10 Hrs**
Unit-III **Secret Key Cryptography**: Product ciphers, DES Construction, Fiestel Structure, Round Function, Modes of Operation, MAC and Other Applications, attacks.	**10 Hrs**
Unit-IV **Cellphone Security**: Entities Involved, Security Goals, GSM(2G) Security, Entity Authentication and key agreement, Encryption, Problems and Drawbacks, Security in UMITS(3G), Security Enhancements, Integrity Protection and Encryption.	**10 Hrs**
Unit-V **Authentication:** One-way authentication, password-based authentication, certificate-based authentication, mutual authentication. Authentication-II centralized authentication, the needham Schroeder protocol, preliminary version1, 2 and 3, Kerberos. Firewalls: Basics of Firewall Functionality, policies and access control lists, firewall types, practical issues, placement of firewalls, firewall configuration, personal firewalls: A case study, Chains and tables, commands. Case Study-Cyber Law and forensics.	**12 Hrs**

Reference Books:

1) Bernard Menezes, Network Security and Cryptography, Cengage Learning, Cengage Learning India Pvt. Ltd, Second Impression 2018.
2) Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw Hill, E/2, 2019.
3) William Starling, Cryptography and Network Security, 5th Edition, Pearson.
4) Bruce Schneier, Applied Cryptography, Second Edition: Protocols, Algorthms, and Source Code in C (cloth),John Wiley & Sons, Inc., ISBN: 0471128457

18UISE812	Block Chain Management	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): To help the students design and develop secure solution to provide confidentiality and integrity, user authentication, secure network and transport layer communication, secure wireless communication, defeat vulnerabilities and electronic payment. Block chain is a distributed, decentralized public ledger. Block chain simply means chain of blocks. It means digital information ("the block") stored in a public database ("the chain"). Blocks on a Blockchain have three parts:

First Blocks show information like date, time and amount. Second Blocks store information about who carried out the transaction by using digital signature instead of identifiable names. Third Blocks store information that makes them different from other blocks by the use of a unique code called HASH.

This fundamental course covers the theory of Block chain and standard protocols for data communications and network security. Topics that may be covered include Supply Chain and Logistics, digital signatures, message authentication codes, hash functions, etc. An examination of network security defenses and countermeasures are also covered.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1,12)/ PSO (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** and inspect vulnerabilities In Block chain Concepts.	1	-	12
CO-2	**Apply** and **analyze** different cryptographic algorithms for secure data transmission using recent Tools. Block chain Application Components.	5	2	-
CO-3	**Analyze** the basics of Ethereum Development Tools	-	2	14
CO-4	**Discuss** electronic payment with help of Authentication and Authorization. Externally Owned Account(EOAs), Key pairs	-	-	2
CO-5	**Implementing** the Cryptographic algorithms Compiling and Deploying a Contract. Working with EOA Accounts	-	-	5

PO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.0	-	-	3.0	-	-	-	-	-	-	-	-	-

Prerequisites:

Network Security and Cryptography

Contents:

Unit-I **Introduction:** Block chain Concepts, Block chain Evolution, Block chain structure, Block chain characteristics, Block chain Application example Escrow, Block chain stack, Block chain Decentralized Computation Platform-Ethereum, Decentralized Storage platform-Swarm, Decentralized Massaging platform-Whisper, Smart Contracts, Decentralized Applications, Tools and Interfaces, from Web 2.0 to the next generation decentralized web, Domain specific Block chain Applications, FinTech, Internet of Things, Industrial and Manufacturing, Registry of Assets and Inventory, energy, Supply Chain and Logistics, Records and Identities, Healthcare, Block chain Benefits and Challenges	**08 Hrs**
Unit-II **Blockchain Application Templates**: Block chain Application Components, Blockchain Application Components, Design Methodology for Block chain Applications, Blockchain Application Templates: Many-to-One, Many-to-One for IoT Applications, Many-to-Many or Peer-to-Peer, One-to-One for Financial Applications.	**08 Hrs**
Unit-III **Block chain Components and Applications**: Setting up Ethereum Development Tools, Ethereum Clients, Go-Ethereum Clien, Python Ehtereum Client(Python App), Ethereum Languages, Solidity, TestIRPC, Mist Ethereum Wallet, MetaMask, Web3 JavaScript API, Truffle.	**08 Hrs**
Unit-IV **Ethereum Accounts**: Ethereum Accounts, Externally Owned Account (EOAs), Keypairs, Working with EOA Accounts, Creating Account, Listing Accounts, Updating Accounts, Checking Balance, Account Transactions, Working with Contract Accounts, Computing and Deploying Contract, Interacting with Contracts, Installing or Watching a Contract.	**08 Hrs**
Unit-V **Smart Contracts**: Structure of a Contract, Setting up and Interacting with a contract using Get Client, Compiling and Deploying a Contract, Interacting with a contract, Gas, Logs, Events, Setting up and Interacting with a Contract Using Mist Wallet, Compiling and Deploying Contract, Interacting with a Contract, Smart Contract Examples, Event Registration Contract, Voting Contract, Name Registry Contract, IoT Smart Switch Contracts, Smart Contract Patterns, Withdrawal, Access Restriction, Rejecter, Circuit Breaker, Allow Once per Account, Case Study.	**07 Hrs**

Reference Books:

1) ArshdeepBahga, Vijay Madisetti, "Block chain Applications: A Hands-On Approach" Universities Press, 2019.

2) Blockchain Technology Concepts and Applications by Kumar Saurabh and Ashutosh Saxena.

3) The Block chain Developer A Practical Guide for Designing, Implementing, Publishing, Testing and Securing Distributed Blockchain Based Projects by EladElrom.

18UISE813	Data Compression	(3-0-0) 3

Contact Hours: **39**

Course Learning Objectives (CLOs): The course provides an overview of classical and modern techniques and algorithms of various types of data compression. It covers statistical and dictionary methods, lossless and lossy compression algorithms in graphics, video and audio compression

Course Outcomes (COs):

Description of the course outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** Hoffman coding: Loss less image compression, Text compression, Audio Compression	1	-	-
CO-2	**Design** and Analysis of various coding techniques	3	-	1
CO-3	**Analyze** various Image compression and dictionary based techniques like static Dictionary, Diagram Coding, Adaptive Dictionary	3	-	-
CO-4	**Conceptualize** basis for commonly used lossless compression techniques, and understand how to use and evaluate several readily available implementations of those techniques	3	-	-
CO-5	**Demonstrate** various transformations	4	-	1

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.0	-	3.0	3.0	-	-	-	-	-	-	-	-	-	-

Prerequisites:

1. Engineering Mathematics

Contents:

Unit-I	
Introduction: Compression Techniques, Lossless Compression, Lossy Compression, Measure Of Performance, Model And Coding .Mathematical Performance Of Lossless Compression: Overview,A Brief Introduction To Information Theory, Derivation Of Average Information, Models, Coding, Algorithmic Information Theory, Minimum Description Length Principle	**08 Hrs**

Unit-II **Huffman coding:** The Huffman Coding Algorithm, Nonbinary Huffman Codes, Adaptive Huffman Coding, Golomb Codes, Rice Codes, Tunstall Codes, Applications Of Huffman Coding Arithmetic Coding.: Introduction Dictionary,Coding A Sequence,Generating A Binary Code, Adaptive Arithmetic Coding, Binary Arithmetic Coding, Comparison Of Huffman And Arithmetic Coding.	**08 Hrs**
Unit-III **Dictionary Technique**: Introduction, Static Dictionary, Adaptive Dictionary, Grammar-Based Compression, Context-Based Compression: Prediction With Partial Match (Ppm),The Burrows–Wheeler Transform, Associative Coder Of Buyanovsky (Acb), Dynamic Markov Compression	**07 Hrs**
Unit-IV **Lossless Image Compression**: Introduction, CALIC, JPEG-LS,Prediction Using Conditional Averages, Multiresolution Approaches, Lossless Image Compression Formats, Facsimile Encoding, JBIG2-T.88, MRC-T.44, Mathematical Preliminaries for Lossy Coding: Introduction, Distortion Criteria, Information Theory Revisited, Rate Distortion Theory, Models.	**08 Hrs**
Unit-V **Mathematical Preliminaries for Transforms**: Sub bands, and Wavelets: Over view, Introduction, Vector Space, Fourier series, Fourier transform, Liner system, sampling, Discrete Fourier transform, Z transform coding: Over view, Introduction, Transform, Transform of Interest, Quantization and coding of Transform co-effients, Application Image compression-JPEG, Application of Audio Compression	**09 Hrs**

Reference Books:

1) Khalid sayood, " Introduction to Data Compression",5th Edition, 2018
2) Mark Nelson , "The Data Compression Book "
3) David Salomon., "Data Compression: The Complete Reference "

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18UISO821	DevOps	(3-0-0) 3

Contact Hours: **39**

Course learning objectives (CLO): Student will be able to introduce dev ops concepts and architecture of Dev ops, analyze Building the code and deployment

Course Outcomes (COs):

Description of the course outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Understand** the need and significance of Dev ops	2	5	3
CO-2	**Understand** analysis of layers in Dev ops and its effect on software architecture	2	3	1
CO-3	**Design** and development of solutions using Dev ops code	3	2	1
CO-4	**Deployment** of code to practical problems using Dev ops tools	4	5	2
CO-5	**Analysis** of workflow issues and their tracking	5	2	4

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	1.0	2.2	2.0	2.0	2.3	-	-	-	-	-	-	-	-	-

Prerequisites:

1. Linear algebra
2. Statistics and probability

Contents:

Unit-I	
Introduction: Introduction to DevOps and Continuous Delivery, Introducing DevOps, Howfast is fast? The Agile wheel of wheels Beware the cargo cult Agile fallacy, DevOps and ITIL. The DevOps process and Continuous Delivery – an over view. The developers, The revision control system, The build server, Theartifact repository, Package managers, Test environments, Staging/ production, Release management, Scrum, Kanban, and the delivery pipeline, Wrapping up –a complete example, Identifying bottlenecks.	**07 Hrs**

Unit-II **DevOps Architecture**: How DevOps Affects Architecture, Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns. The principle of cohesion, Coupling, Back to the monolithic scenario, Apractical example, Three-tier systems, The presentation tier, The logic tier, Thedata tier, Handling database migrations, Rolling upgrades, Hello world inLiquibase, The changelog file, The pom.xml file, Manual installation, Micro services, Interlude – Conway's Law, How to keep service interfaces forward compatible, Micro services and the data tier, DevOps, architecture, and resilience.	**08 Hrs**
Unit-III **Building the code** : Why do we build code?, The many faces of build systems, The Jenkins buildserver, Managing build dependencies, The final artifact, Cheating with FPM,Continuous Integration, Continuous Delivery, Jenkins plugins, The host server,Build slaves, Software on the host, Triggers, Job chaining and build pipelines, A look at the Jenkins filesystem layout, Build servers and infrastructure ascode, Building by dependency order, Build phases, Alternative build servers, Collating quality measures, About build status visualization, Taking build errorsseriously, Robustness.	**08 Hrs**
Unit-IV **Deploying the Code**: Why are there so many deployment systems? Configuring the base OS, Describing clusters, Delivering packages to a system, Virtualization stacks, Executing code on the client ,A note about the exercises, The Puppet master and Puppet agents, Ansible, PalletOps, Deploying with Chef, Deploying with SaltStack, Salt versus Ansible versus Puppet versus PalletOps execution models, Vagrant, Deploying with Docker, Comparison tables, Cloud solutions, AWS,Azure	**08 Hrs**
Unit-V **Issue Tracking**: What are issue trackers used for? Some examples of workflows and issues, What do we need from an issue tracker?, Problems with issue tracker proliferation, All the trackers, Bugzilla, Trac, Redmine, The GitLab issue tracker, Jira. Introducing the IoT and DevOps, The future of the IoT according to the market, Machine-to-machine communication, IoT deployment affects software architecture, IoT deployment security, Okay, but what about DevOps and theIoT again? A hands-on lab with an IoT device for DevOps.	**08 Hrs**

Reference books:

1) The DevOps Hand Book, Gene Kim, Jez Humble, Patric Debois & John Wills.
2) The Practical Guide to Enterprise DevOps and Continuous Delivery, Julian Fish.

18UISO822	Data Science	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course will enable students to define data science and its fundamentals demonstrate the process in data science, Explain machine learning algorithms necessary for data sciences, Illustrate the process of feature selection and analysis of data analysis algorithms and Visualize the data and follow of ethics

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Define** data science and its fundamentals	-	-	4
CO-2	**Demonstrate** the process in data science	-	3	-
CO-3	**Explain** machine learning algorithms necessary for data sciences	-	-	-
CO-4	**Illustrate** the process of feature selection and analysis of data analysis algorithms	-	2	-
CO-5	**Visualize** the data and follow of ethics	1	-	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.0	2.0	1.0	-	-	-	-	-	-	-	-	-	-

Prerequisites:

Database Management Systems

Contents:

Unit-I	
Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets. Needed Statistical Inference: Populations and samples, Statistical modeling, probability distributions, fitting a model, - Introduction to R	**08 Hrs**

Unit-II **Exploratory Data Analysis and the Data Science Process**: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: RealDirect (online real estate firm). Three Basic Machine Learning Algorithms: Linear Regression, kNearest Neighbors (k-NN), k-means	**08 Hrs**
Unit-III **One More Machine Learning Algorithm and Usage in Applications:** Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web.	**10 Hrs**
Unit-IV **Feature Generation and Feature Selection (Extracting Meaning From Data)**: Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system.	**08 Hrs**
Unit-V **Mining Social-Network Graphs:** Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs, Data Visualization: Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues, Discussions on privacy, security, ethics, Next-generation data scientists	**07 Hrs**

Reference Books:

1) Doing Data Science Cathy O'Neil and Rachel Schutt Straight Talk From The Front line. O'Reilly 2014.

2) Mining of Massive Datasets. v2.1 Jure Leskovek, Anand Rajaraman and Jeffrey Ullman Cambridge University Press 2014.

3) Machine Learning: A Probabilistic Perspective Kevin P. Murphy 2013.

4) Data Mining: Concepts and Techniques Jiawei Han, Micheline Kamber and Jian Pei Third Edition 2012.

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18UISO823	Computer Vision	(3-0-0)3

Contact Hours: 39

Course Learning Objectives (CLOs): The course will have a comprehensive coverage of theory and computation related to imaging geometry, and scene understanding. It will also provide exposure to clustering, classification and deep learning techniques applied in this area

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/PSOs(13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** the formation of image and transformation of image in different dimensions	1	2	-
CO-2	**Analyze** the geometry of camera models and calibration of camera	1	2	-
CO-3	**Design** and apply the algorithms for feature extraction	3	-	13,14
CO-4	**Design** and **apply** algorithm for segmentation, and classification of images	4	-	13,14
CO-5	**Apply** deep neural network algorithms in image analysis	4	-	11

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.0	3.0	3.0	-	-	-	-	-	-	1.0	-	1.0	1.0

Prerequisites:

Linear Algebra, Vector Calculus, Data Structures and Programming

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Contents:

Unit-I **Introduction:** Definition and brief history of computer vision. **Image formation:** Geometric primitives and transformations: Geometric primitives, 2D Transformation, 3D Transformation, 3D Rotations, 3D to 2D Projections Photometric **image formation**: Lighting, Reflectance and shading, Optics. **The digital camera**: sampling and aliasing, Color, Compressing,	**07 Hrs**
Unit-II **Camera geometry:** Geometric Camera Models, Pinhole Perspective Weak Perspective Cameras with Lenses the Human Eye Intrinsicand Extrinsic Parameters Rigid Transformations and Homogeneous Coordinates Intrinsic Parameters, Extrinsic Parameters Perspective Projection Matrices, Weak-Perspective Projection Matrices Geometric Camera Calibration A Linear Approach to Camera Calibration A Nonlinear Approach to Camera Calibration	**08 Hrs**
Unit-III **Feature detection and description:** **Points and patches:** Feature detectors Feature descriptors, Feature matching, Feature tracking Application: Performance-driven animation, **Edges**: Edge detection Edge linking Application: Edge editing and enhancement **Lines**: Successive approximation Hough transforms, Vanishing points	**08Hrs**
Unit-IV **Segmentation:** Active contours : Snakes, Dynamic snakes and CONDENSATION , Scissors ,Level Sets, Application: Contour tracking and proto scoping, **Split and merge**: Watershed Region splitting (divisive clustering) Region merging (agglomerative clustering) ,Graph-based segmentation, Probabilistic aggregation, **Mean shift and mode finding** K-means and mixtures of Gaussians ,Mean shift , **Normalized cuts** Graph cuts and energy-based methods, Application: Medical image segmentation.	**08 Hrs**
Unit-V **Deep Neural Architecture and application**: Image Classification, Image Classification with Localization, Object Detection, Object Segmentation, Image Style Transfer, Image Colorization, Image Reconstruction, Image Super-Resolution, Image Synthesis.	**08 Hrs**

Reference Books:

1) Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.

2) Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003

3) Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.

4) K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990

5) R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.

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SDM College of Engg.&Tech., Dharwad Scheme for M.Tech.(IT)

Scheme of Teaching and Examination

I Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max.	*Max.	Duration	Max.	Duration
18PITEC100	Big Data Analytics	4-0-0	4	50	100	3		
18PITEC101	Applied Mathematics	4-0-0	4	50	100	3		
18PITEEXXX	Elective 1	4-0-0	4	50	100	3		
18PITEEXXX	Elective 2	4-0-0	4	50	100	3		
18PITEEXXX	Elective 3	3-0-2	4	50	100	3		
18PITEL102	Data Analytics Lab	0-0-3	2	50			50	3
18PITEL103	** Seminar	0-0-3	1	100				
Total		**19-0-8**	**23**	**400**	**500**		**50**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examinations

L: Lecture **T**: Tutorials **P**: Practical

* SEE for theory courses is conducted for 100 marks and reduced to 50 marks

** Seminar is to be conducted every week and 2-3 students/week will present a topic from emerging areas in power systems preferably the contents not studied in their regular courses. The seminar shall be evaluated by 3 faculty members having specialization in power system and allied areas.

Elective List:

Course Code	Elective Courses	Course Code	Elective Courses
18PITEE125	Agile Technology	18PITEE128	Fuzzy System
18PITEE126	Web Services	18PITEE129	Artificial Intelligence
18PITEE127	Internet of things		

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II Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
18PITEC200	Machine Learning	4-0-0	4	50	100	3		
18PITEC201	Natural Language Processing	3-0-2	4	50	100	3		
18PITEEXXX	Elective 4	4-0-0	4	50	100	3		
18PITEEXXX	Elective 5	4-0-0	4	50	100	3		
18PITEEXXX	Elective 6	4-0-0	4	50	100	3		
18PITEL202	Machine learning Lab	0-0-3	2	50			50	3
18PITEL203	** Seminar	0-0-3	1	100				
Total		19-0-8	23	400	500		50	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examinations
L: Lecture **T**: Tutorials **P**: Practical
* SEE for theory courses is conducted for 100 marks and reduced to 50 marks
* * Seminar is to be conducted every week and 2-3 students/week will present a topic from emerging areas in power systems preferably the contents not studied in their regular courses. The seminar shall be evaluated by 3 faculty members having specialization in power system and allied areas.

Elective List:

Course Code	Elective Courses	Course Code	Elective Courses
18PITEE225	Web Services	18PITEE228	Predictive Modeling
18PITEE226	Cloud Computing	18PITEE229	Optimization Technique
18PITEE227	Simulation and Modeling		

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SDM College of Engg.&Tech., Dharwad Scheme for M.Tech.(IT)
Scheme of Teaching and Examination
IIISemester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P-S (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
18PITEC300	Computer Vision	4-0-0	4	50	100	3		
18PITEEXX	Elective 7	4-0-0	4	50	100	3		
18PITELXXX	Internship in Industry/R&D organization/ Elective 8	** Min 4 weeks during vacation after 2nd sem/ 3-0-0	3	50/50	100	3	50	3
18PITEL302	*** Project Phase 1	0-0-15	9	50			50	3
Total		**8/11-0-15**	**20**	**200**	**200/300**		**100**	

* SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

** The students are expected to undergo training in industry for a period of ***four weeks*** during the vacation immediately after completion of II Semester examination. A faculty is to be allotted to guide the student. A committee consisting of three faculty members shall evaluate the work carried out and the knowledge the students have acquired. **OR The students can take one elective course if they do not undergo internship.**

Project phase-I: The students are expected to formulate the problem and carry out the intensive literature survey along with preliminary investigations supporting the project phase-II in IV semester

Course code(Elective 7)	Elective Courses	Course code (Elective 8)	Elective Courses
18PITEE325	Modern Cryptography	18PITEE335	Pattern Recognition
18PITEE326	Deep Learning	18PITEE336	Distributed Computing
18PITEE327	Knowledge Discovery	18PITEE337	Bio Informatics

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IV Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
				CIE	Theory (SEE)		Practical (SEE)	
		L-T-P-S (Hrs/Week)	Credits	Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
18PITEL400	Project phase-II	0-0-20	22	100	-	-	100	3
Total		**0-0-20**	**22**	**100**	**-**		**100**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
L: Lecture **T**: Tutorials **P**: Practical

* SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

** Project phase-II: The students are expected to work on a project for the full semester in an industry or an institution

Dr. Jagadeesh D. Pujari
HOD, ISE

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18PITEC100	Big Data Analytics	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLO's):

Students will learn to optimize business decisions and create competitive advantage with Big Data analytics and learn to explore the fundamental concepts of big data analytics and analyze the big data using intelligent techniques and understand the various search methods and visualization techniques. They also learn to use various techniques for mining data stream and understand the applications using Map Reduce Concepts.

Course Outcome (CO's):

Description of the Course Outcome(CO's): At the end of the course the student will be able to:		Mapping to POs(1-3)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Demonstrate the big data platform and explore the big data analytics techniques business applications.	1		
CO-2	Design efficient algorithms for mining the data from large volumes.		1	
CO-3	Analyze the HADOOP and Map Reduce technologies associated with big data analytics.			2
CO-4	Illustrate on Big Data applications using Pig and Hive.		2	
CO-5	Demonstrate the fundamentals of various big data analytics techniques.	3		

POs	PO-1	PO-2	PO-3
Mapping Level	2.5	1.5	3

Pre-requisites:

1. Knowledge of data structure, data bases and basic statistics.
2. Some programming experiences

Contents:

1	**Introduction to big data :** Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting	**10Hrs.**
2	**Mining data streams :** Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window –	**10 Hrs.**

	Decaying Window - Real time Analytics Platform(RTAP) Applications – Case Studies - Real Time Sentiment Analysis- Stock Market Predictions.	
3	**Hadoop:** History of Hadoop- the Hadoop Distributed File System – Components of HadoopAnalysing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features-Hadoop environment.	**10 Hrs**
4	**Frameworks:** Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper - IBM InfoSphereBigInsights and Streams.	**10 Hrs**
5	**Predictive Analytics-** Simple linear regression- Multiple linear regression- Interpretation of regression coefficients. Visualizations - Visual data analysis techniques- interaction techniques - Systems and applications.	**12Hrs**

Reference Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.
4. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.
6. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.
7. Pete Warden, "Big Data Glossary", O'Reilly, 2011.

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18PITEC101	AppliedMathematics	(4-0-0) 4

Contact Hours: 52 Hrs

Course Learning Objectives (CLO's):

This course will enable students to Acquaint with principles of linear algebra, Probability and its distribution, random process and apply the knowledge in the applications of Data mining and Machine Learning engineering sciences.

Course Outcome (CO's):

Description of the Course Outcome(CO's): At the end of the course the student will be able to:		**Mapping to POs(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Solve problems involving basic probability.	1		
CO-2	Apply the knowledge of different probability distribution in machine learning and Data mining Concepts.	2	1	
CO-3	Calculate correlation, regression coefficients.	1	2	
CO-4	Use Least squares method to compute time series	3	1	

POs	**PO-1**	**PO-2**	**PO-3**
Mapping Level	2.5	2.5	3

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Contents

1	**Probability**: Definitions of probability, Addition theorem, Conditional probability, Multiplication theorem, Bayes theorem of probability	**10Hrs**
2	**Random variables and their properties**: Discrete Random variable, Continuous Random variable, Probability Distribution joint probability distributions their properties, Transformation variables, Mathematical expectations, probability generating functions.	**10Hrs**
3	**Probability Distributions / Discrete distributions**: Binomial, Poisson Negative binominal distributions and their properties. (Definition, mean, variance, moment generating function, Additive properties, fitting of the distribution.) Continuous distributions: Uniform, Normal, exponential distributions and their properties.	**10Hrs**
4	**Curve fitting using Principle of Least Squares.Multivariate Analysis**: Correlation, correlation coefficient, Rank correlation, Regression Analysis, Multiple Regression, Attributes, coefficient of Association, $\chi 2$ – test for goodness of fit, test for independence	**12Hrs**
5	**Linear Algebra:** Computation of Eigen values and Eigen vectors of real symmetric matrices-Given's method. Orthogonal vectors and orthogonal bases. Gram-Schmidt orthogonalization process. QR decomposition, singular value decomposition, least square approximations	**10Hrs**

Reference Book:

1. T. VeerarajanProbability, Statistics and Random Processes by , Tata McGraw Hill
2. Kishor S. TrivediProbability & Statistics with Reliability, Queuing and Computer Applications, Prentice Hall of India ,1999
3. V.K. Rohatgi& A.K. Md.E.SalehAn Introduction to Probability and Statistics.

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18PITEL102	Data Analytics Lab	(0-0-3) 2

Contact Hours:26

Course Learning Objectives (CLO's):

Students will learn to Optimize business decisions and create competitive advantage with Big Data analytics and Imparting the architectural concepts of Hadoop and introducing map reduce paradigm and Introducing Java concepts required for developing map reduce programs and Derive business benefit from unstructured data and Introduce programming tools PIG & HIVE in Hadoop echo system.

Course Outcome (CO's):

Description of the Course Outcome(CO's): At the end of the course the student will be able to:		Mapping to POs(1 to 3)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Preparing for data summarization, query, and analysis.	1		
CO-2	Applying data modeling techniques to large data sets.		1	
CO-3	Creating applications for Big Data analytics.			2
CO-4	Building a complete business data analytic solution.		2	

POs	PO-1	PO-2	PO-3
Mapping Level	2.5	1.5	

Lab Exercises:

1	rform setting up and Installing Hadoop in its two operating modes:	**2Hrs**
2	n a basic Word Count Map Reduce program to understand Map ReduceParadigm.	**2Hrs**
3	Stop word elimination problem	**2Hrs**
4	rite a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented. Data available at: Instead of breaking the sales down by store, give us a sales breakdown by product category across all of our stores	**4Hrs**
5	tall and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.	**2Hrs**
6	rite a Pig Latin scripts for finding TF-IDF value for book dataset (A corpus of eBooks available	**4Hrs**

	at: Project Gutenberg)	
7	Install and Run Hive then use Hive to create, alter, and drop databases, tables, views,functions, and indexes.	**4Hrs**
8	Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scala.	**2Hrs**
9	Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together	**4Hrs**

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18PITEE125	Agile Technology	(4-0-0) 4

Contact Hours: 52

Course Objectives:

To understand how an iterative, incremental development process leads to faster delivery of more useful software To understand the essence of agile development methods To understand the principles and practices of extreme programming To understand the roles of prototyping in the software process

To understand the concept of Mastering Agility

Course Outcome(CO's):

Description of the Course Outcome(CO's): At the end of the course the student will be able to:		**Mapping to POs(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyse** The XP Lifecycle, XP Concepts, Adopting XP	1		
CO-2	Work on Pair Programming, Root-Cause **Analysis**, Retrospectives, **Planning**, Incremental Requirements, Customer Tests	1		
CO-3	**Implement** Concepts to Eliminate Waste		2	

POs	**PO-1**	**PO-2**	**PO-3**
Mapping Level	1	2	

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Pre-requisites: Software Engineering.

Contents:

1	**Why Agile?**: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor.	**10Hrs.**
2	**Understanding XP:** The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility.	**10 Hrs**
3	**Practicing XP:** Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:**"Done Done", No Bugs, Version Control, TenMinute Build, Continuous Integration, Collective Code Ownership, Documentation, Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating, Developing: Incremental Requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing.	**12Hrs.**
4	**Mastering Agility:** Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process**: Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People**: Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste**: Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput	**10Hrs**
5	**Deliver Value:** Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence**: Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery.	**10Hrs**

Reference Books:

4) James shore, Chromatic, "The Art of Agile Development (Pragmatic guide to agile software development)", O'Reilly Media, Shroff Publishers & Distributors, 2013.
5) Robert C. Martin, "Agile Software Development, Principles, Patterns, and Practices", Prentice Hall; 1st edition, 2002
6) Craig Larman,"Agile and Iterative Development A Manger's Guide", Pearson Education, First Edition, India, 2004.

18PITEE126	Web services	(4-0-0) 4

Contact Hours:52

Course Objectives: This course will enable students to Define and explain WebServices, Summarize WSDL WebServices, Analyze Web serviceArchitecture, Explain Building Blocks of Webservices and Web Analytics approach

Description of the Course Outcome(CO's): At the end of the course the student will be able to:		**Mapping to POs(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyse** Web service Architecture	1		
CO-2	Illustrate the Building Blocks of Web services and Web Analytics approach	1		
CO-3	Apply Web services as a Problem and a Solution		2	

POs	**PO-1**	**PO-2**	**PO-3**
Mapping Level	1	2	

Contents

1	**Introduction:** Middleware: Understanding the middle ware, RPC and Related Middle ware, TP Monitors, Object Brokers, Message-Oriented Middleware.	**10Hrs**
2	**Web Services:** Web Services Technologies, Web Services Architecture.	**10Hrs**
2	**Basic Web Services Technology:** WSDL Web Services Description Language, UDDI Universal Description Discovery and Integration, Web Services at work interactions between the Specifications, Related Standards	**10Hrs**
3	**Service Coordination Protocols**: Infrastructure for Coordination Protocols, WS- Coordination, WS-Transaction, Rosetta Net and Other Standards Related to Coordination Protocols	**10Hrs**
4	**Service Composition:** Basic of Service Composition, A New Chance of Success for Composition, Services Composition Models, Dependencies between Coordination and Composition, BPEL: Business Process Execution Language for Web Services, Outlook, Applicability of the Web Services, Web services as a Problem and a Solution.	**6Hrs**
5	**Introduction to Web Analytics:** Web Analytics approaches**,** a model of analysis, pose the questions, gather data, transform data, analyze the data. Case study.	**6Hrs**

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Reference Books:

1 Web Services(Concepts, Architectures and Applications), Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju, **Springer International Edition** 2009.

2. Practical Web Analytics for User Experience: How Analytics can help you Understand your Users, Michael Beasley, Morgan Kaufmann, 2013

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18PITEE128	Fuzzy System	(4-0-0) 4

Contact Hours: 52

Course Objectives:

Provide an understanding of the basic mathematical elements of the theory of fuzzy sets. Provide an emphasis on the differences and similarities between fuzzy sets and classical sets theories. Cover fuzzy logic inference with emphasis on their use in the design of intelligent or humanistic systems. Provide a brief introduction to fuzzy arithmetic concepts. Provide an insight into fuzzy inference applications in the area of control and robotics.

Course Outcome(CO's): Upon the completion of the course, the student should be able to

CO	Description of the Course Outcome(CO's)	Mapping to POs(1 to 3)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Understand** the characterization and quantification of certainty and uncertainty in fuzzy logic	3	1	2
CO-2	**Understand** the concepts of mathematical relations and logic for fuzzy systems.		3	2
CO-3	**Recognize** fuzzy logic membership function and fuzzy inference.		1,3	2
CO-4	**Know** the Fuzzy Decision Making and various Classification techniques.		1,3	2

PO →	PO1	PO2	PO3
Mapping Level	2	1	2.25

Contents:

1	**Introduction, Classical Sets and Fuzzy Sets:** Background, Uncertainty and Imprecision, Statistics and Random Processes, Uncertainty in Information, Fuzzy Sets and Membership, Chance versus Ambiguity. Classical Sets - Operations on Classical Sets, Properties of Classical (Crisp) Sets, Mapping of Classical Sets to Functions Fuzzy Sets - Fuzzy Set operations, Properties of Fuzzy Sets. Sets as Points in Hyper cubes	**7 Hrs**
2	**Classical Relations and Fuzzy Relations**:Cartesian Product, Crisp Relations- Cardinality of Crisp Relations, Operations on Crisp Relations, Properties of Crisp Relations, Composition. Fuzzy Relations - Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition, Non-interactive Fuzzy Sets. Tolerance and Equivalence Relations - Crisp Equivalence Relation, Crisp Tolerance Relation, Fuzzy Tolerance and Equivalence Relations. Value Assignments - Cosine Amplitude, Max-min Method, Other Similarity methods	**6 Hrs**
3	**Membership Functions :**Features of the Membership Function, Standard Forms and Boundaries,	**6**

	Fuzzification, Membership Value Assignments – Intuition, Inference, Rank Ordering, Angular Fuzzy Sets, Neural Networks, Genetic Algorithms, Inductive Reasoning.	**Hrs**
4	**Fuzzy-to-Crisp Conversions, Fuzzy Arithmetic :**Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations, Defuzzification Methods Extension Principle - Crisp Functions, Mapping and Relations, Functions of fuzzy Sets – Extension Principle, Fuzzy Transform (Mapping), Practical Considerations, Fuzzy Numbers Interval Analysis in Arithmetic, Approximate Methods of Extension - Vertex method, DSW Algorithm, Restricted DSW Algorithm, Comparisons, Fuzzy Vectors	**7 Hrs**
5	**Classical Logic and Fuzzy Logic :**Classical Predicate Logic – Tautologies, Contradictions, Equivalence, Exclusive OR and Exclusive NOR, Logical Proofs, Deductive Inferences. Fuzzy Logic, Approximate Reasoning, Fuzzy Tautologies, Contradictions, Equivalence and Logical Proofs, Other forms of the Implication Operation, Other forms of the Composition Operation	**6 Hrs**
6	**Fuzzy Rule- Based Systems :** Natural Language, Linguistic Hedges, Rule-Based Systems - Canonical Rule Forms, Decomposition of Compound Rules, Likelihood and Truth Qualification, Aggregation of Fuzzy Rules, Graphical Techniques of Inference	**6 Hrs**
7	**Fuzzy Decision Making :** Fuzzy Synthetic Evaluation, Fuzzy Ordering, Preference and consensus, Multi-objective Decision Making, Fuzzy Bayesian Decision Method, Decision Making under Fuzzy States and Fuzzy Actions.	**7 Hrs**
8	**Fuzzy Classification** :Classification by Equivalence Relations - Crisp Relations, Fuzzy Relations. Cluster Analysis, Cluster Validity, c-Means Clustering - Hard c-Means (HCM), Fuzzy c-Means (FCM). Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering	**7 Hrs**

Reference Books:

1. Timothy J. Ross: Fuzzy Logic with Engineering Applications, 2nd Edition, Wiley India, 2006
2. Michal Baczynski and BalasubramaniamJayaram, *Fuzzy Implications*, Springer Verlag, Heidelberg, 2008
3. Kevin M Passino and Stephen Yurkovich, *Fuzzy Control*, Addison Wesley Longman, 1998.

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18PITEE129	Artificial Intelligence	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives: The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning

Course Outcome(CO's):

Description of the Course Outcome(CO's): At the end of the course the student will be able to:		**Mapping to POs(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Describe concepts of AI and Intelligent agents.	1	2	
CO-2	Apply searching techniques for AI systems	2	2	
CO-3	Design the logic for knowledge representation and reasoning in AI based systems.	3	3	
CO-4	Formalize a given problem in the language/framework of different AI methods.	3	3	
CO-5	Analyze different learning algorithms in AI systems &Implement applications using different artificial intelligence concepts.	3	3	

POs	**PO-1**	**PO-2**	**PO-3**
MappingLevel	3	2.3	2.5

Pre-requisites: Statistics and Probability

Contents:

1	Introduction: What is AI? AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized productions system- Problem solving methods – Problem graphs, matching	**10Hrs.**
2	State space search:Depth first and Breath first, Indexing and Heuristic functions Heuristic Search- Best First Search, Hill Climbing, Beam Search, Randomized Search: Simulated Annealing, Genetic Algorithms, Ant Colony optimization, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms	**10Hrs**
3	Representation of Knowledge - Game playing – Knowledge representation, Knowledge	**10Hrs**

	representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge, Mini max Algorithm, AlphaBeta Algorithm	
4	Production based system, Frame based system. Inference – Backward chaining, Forward chaining, Propositional Logic, First Order Logic, Soundness and Completeness Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network-Dempster – Shafer theory	**10Hrs**
5	Planning and Constraint Satisfaction: Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Graph plan, Constraint Propagation, Basic plan generation systems – Strips -Advanced plan generation systems– K strips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning	**12Hrs**

Reference Books:

1. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.
2. Elaine Rich, Kevin Knight, Shiva Shankar B Nair, Artificial Intelligence, Tata McGraw Hill 3rd Edition, 2013.
3. Stefan Edelkamp and Stefan Schroedl. Heuristic Search: Theory and Applications,MorganKaufmann, 2011.
4. Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, 3rd Edition,Prentice Hall, 2009.
5. Pamela McCorduck, Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence, A K Peters/CRC Press; 2nd Edition, 2004

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PG-2019-20

SDM College of Engg.&Tech., Dharwad Scheme for M.Tech.(IT)

Scheme of Teaching and Examination

I Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
18PITEC100	Big Data Analytics	4-0-0	4	50	100	3		
18PITEC101	Applied Mathematics	4-0-0	4	50	100	3		
18PITEEXXX	Elective 1	4-0-0	4	50	100	3		
18PITEEXXX	Elective 2	4-0-0	4	50	100	3		
18PITEEXXX	Elective 3	3-0-2	4	50	100	3		
18PITEL102	Data Analytics Lab	0-0-3	2	50			50	3
18PITEL103	** Seminar	0-0-3	1	100				
Total		**19-0-8**	**23**	**400**	**500**		**50**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examinations

L: Lecture **T**: Tutorials **P**: Practical

* SEE for theory courses is conducted for 100 marks and reduced to 50 marks

** Seminar is to be conducted every week and 2-3 students/week will present a topic from emerging areas in power systems preferably the contents not studied in their regular courses. The seminar shall be evaluated by 3 faculty members having specialization in power system and allied areas.

Elective List:

Course Code	Elective Courses	Course Code	Elective Courses
18PITEE125	Agile Technology	18PITEE128	Fuzzy System
18PITEE126	Web Services	18PITEE129	Artificial Intelligence
18PITEE127	Internet of things		

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II Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
18PITEC200	Machine Learning	4-0-0	4	50	100	3		
18PITEC201	Natural Language Processing	3-0-2	4	50	100	3		
18PITEEXXX	Elective 4	4-0-0	4	50	100	3		
18PITEEXXX	Elective 5	4-0-0	4	50	100	3		
18PITEEXXX	Elective 6	4-0-0	4	50	100	3		
18PITEL202	Machine learning Lab	0-0-3	2	50			50	3
18PITEL203	** Seminar	0-0-3	1	100				
Total		19-0-8	23	400	500		50	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examinations
L: Lecture **T**: Tutorials **P**: Practical
* SEE for theory courses is conducted for 100 marks and reduced to 50 marks
* * Seminar is to be conducted every week and 2-3 students/week will present a topic from emerging areas in power systems preferably the contents not studied in their regular courses. The seminar shall be evaluated by 3 faculty members having specialization in power system and allied areas.

Elective List:

Course Code	Elective Courses	Course Code	Elective Courses
18PITEE225	Web Services	18PITEE228	Predictive Modeling
18PITEE226	Cloud Computing	18PITEE229	Optimization Technique
18PITEE227	Simulation and Modeling		

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SDM College of Engg.&Tech., Dharwad Scheme for M.Tech.(IT)
Scheme of Teaching and Examination
IIISemester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P-S (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
18PITEC300	Computer Vision	4-0-0	4	50	100	3		
18PITEEXX	Elective 7	4-0-0	4	50	100	3		
18PITELXXX	Internship in Industry/R&D organization/ Elective 8	** Min 4 weeks during vacation after 2nd sem/ 3-0-0	3	50/50	100	3	50	3
18PITEL302	*** Project Phase 1	0-0-15	9	50			50	3
Total		**8/11-0-15**	**20**	**200**	**200/300**		**100**	

* SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

** The students are expected to undergo training in industry for a period of ***four weeks*** during the vacation immediately after completion of II Semester examination. A faculty is to be allotted to guide the student. A committee consisting of three faculty members shall evaluate the work carried out and the knowledge the students have acquired. **OR The students can take one elective course if they do not undergo internship.**

Project phase-I: The students are expected to formulate the problem and carry out the intensive literature survey along with preliminary investigations supporting the project phase-II in IV semester

Elective 7

Course code	Elective Courses
18PITEE325	Modern Cryptography
18PITEE326	Deep Learning
18PITEE327	Knowledge Discovery

Elective 8

Course code	Elective Courses
18PITEE335	Pattern Recognition
18PITEE336	Distributed Computing
18PITEE337	Bio Informatics

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IV Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
				CIE	Theory (SEE)		Practical (SEE)	
		L-T-P-S (Hrs/Week)	Credits	Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
18PITEL400	Project phase-II	0-0-20	22	100	-	-	100	3
Total		**0-0-20**	**22**	**100**	**-**		**100**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
L: Lecture **T**: Tutorials **P**: Practical

* SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

** Project phase-II: The students are expected to work on a project for the full semester in an industry or an institution
*

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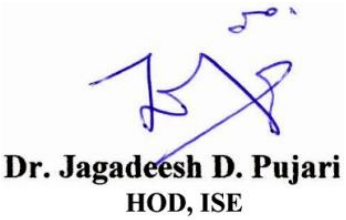

Dr. Jagadeesh D. Pujari
HOD, ISE

PG-2020-21

Scheme of Teaching and Examination

I Semester

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
20PRMIC100	Research Methodology and IPR	2-0-0	2	50	50	2		
20PITC100	Data Analytics	4-0-0	4	50	100	3		
20PITC101	Distributed Computing Systems	4-0-0	4	50	100	3		
20PITC102	Artificial Intelligence	4-0-0	4	50	100	3		
20PITEXXX	Elective 1	4-0-0	4	50	100	3		
20PITL103	Data Analytics Lab	0-0-3	2	50			50	3
20PITL104	Seminar	0-0-2	1	50				
Total		**18-0-5**	**21**	**350**	**450**		**50**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination

L: Lecture **T**: Tutorials **P**: Practical

***** SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

Seminar is to be conducted every week and 2-3 students/week will present a topic from emerging areas in respective PG program preferably the contents not studied in their regular courses. The seminar shall be evaluated by 3 faculty members having specialization in respective program and allied areas.

Electives for I Semester:

Course Code	Elective 1 Courses
20PITE125	Agile Technology
20PITE126	Cloud Computing
20PITE127	Storage Technologies

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Scheme of Teaching and Examination
II Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
20PITC200	Machine and Deep Learning	4-0-0	4	50	100	3		
20PITC201	Internet of Things	3-2-0	4	50	100	3		
20PITEXXX	Elective 2	3-0-2	4	50	100	3		
20PITEXXX	Elective 3	4-0-0	4	50	100	3		
20PITEXXX	Elective 4	3-0-2	4	50	100	3		
20PITL202	Machine Learning Lab	0-0-3	2	50			50	3
20PITL203	Seminar	0-0-2	1	50				
Total		**17-2-9**	**23**	**350**	**500**		**50**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination

L: Lecture **T**: Tutorials **P**: Practical

***SEE** for theory courses is conducted for **100 marks** and reduced to **50 marks**.

Seminar is to be conducted every week and 2-3 students/week will present a topic from emerging areas in respective PG program preferably the contents not studied in their regular courses. The seminar shall be evaluated by 3 faculty members having specialization in respective program and allied areas.

Electives for II Semester:

Course Code	Elective 2 Courses	Course Code	Elective 3 Courses	Course Code	Elective 4 Courses
20PITE225	Data Science	20PITE228	Virtual reality	20PITE231	Advanced Computer Graphics
20PITE226	Client-server Programming	20PITE229	Parallel Computing	20PITE232	User Interface Design
20PITE227	Network Engineering	20PITE230	Mobile Adhoc & sensor network	20PITE233	Pervasive computing

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Scheme of Teaching and Examination
III Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
20PITC300	Web Services	4-0-0	4	50	100	3		
20PITEXXX	Elective 5	3-0-0	3	50	100	3		
20PITEXXX	Elective 6	3-0-0	3	50	100	3		
20PITEXXX	Elective 7	3-0-0	3	50	100	3	--	--
		OR						
20PITL301	Internship in Industry or R&D organization	** Min 4 weeks during vacation after 2nd sem	3	50	--	--	100	3
20PITL302	*** Project phase 1	0-0-15	9	50			50	3
Total		**13-0-15/10-4weeks-15)**	**22**	**250**	**400/300**		**50/150**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
L: Lecture **T**: Tutorials **P**: Practical

***SEE** for theory courses is conducted for 100 marks and reduced to 50 marks.

**** The students are expected to undergo training in industry for a period of ***four weeks*** during the vacation immediately after completion of II Semester examination. A faculty is to be allotted to guide the student. A committee consisting of three faculty members shall evaluate the work carried out and the knowledge the students have acquired.**OR The students can take one elective course if they do not undergo internship.**

*****Project phase-I: The students are expected to formulate the problem and carry out the intensive literature survey along with preliminary investigations supporting the project phase-II in IV semester.

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Electives for III Semester:

Course Code	Elective 5 Courses	Course Code	Elective 6 Courses	Course Code	Elective 7 Courses
20PITE325	Computer Vision	20PITE328	Natural Language Processing	20PITE331	Modern Cryptography
20PITE326	Semantic Web and Social Network	20PITE329	Enterprise Application Programming	20PITE322	Bio Informatics

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Scheme of Teaching and Examination
IV Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
20PITL400	Project phase-II	0-0-20	22	100	--	--	100	3
Total		**0-0-20**	**22**	**100**	**--**	**--**	**100**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
L: Lecture **T**: Tutorials **P**: Practical
***SEE** for theory courses is conducted for 100 marks and reduced to 50 marks.
****** Project phase-II: The students are expected to work on a project for the full semester in an industry or an institution

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20PRMIC100	Research Methodology and IPR	(2-0-0) 2

Contact Hours: 26

Course Learning Objectives (CLOs): The students are expected to learn about the need and types of research, problem formulation, literature review, measurement, scaling, data collection, testing of hypothesis, result interpretation and report writing. Further, the students shall know about the intellectual property rights, copy rights, trademarks, patents, patents filing procedure, infringement &remedies and information technology act etc.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Formulate** the research problem, carryout literature survey and decide the methodology.	-	1	-
CO-2	**Use** measurement and scaling and **carryout** data collection.	-	1	-
CO-3	**Test** the hypothesis, **interpret** & **analyze** the results and **write** the report.	2	3	-
CO-4	**Explain** the need of IPR, copy right, patents, trademarks,& the filing procedure and know about infringement, remedies and regulatory framework.	-	2	-

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	2	2.5	2	-

Prerequisites: 1) Branch specific course on problem analysis (Preferred)

Contents:

1) **Research Methodology:** Introduction, meaning of research, objectives of research, motivation in research, types of research, research approaches, significance of research, research methods versus methodology, research and scientific method, importance of knowing how research is done, research process, criteria of good research and problems encountered by researchers in India.

2Hrs.

Defining the Research Problem: Research problem, selecting the problem, necessity of defining the problem, technique involved in defining a problem, an illustration. **1 Hrs.**

Reviewing the literature: Importance of the literature review in research, How to review the

literature, searching the existing literature, reviewing the selected literature and writing about the literature reviewed. **2 Hrs.**

Research Design: Meaning of research design, need for research design, features of a good design, important concepts relating to research design, different research designs, basic principles of experimental designs, important experimental designs. **3 Hrs.**

2) **Measurement and Scaling:** Measurement in research, measurement scales, sources of error in measurement, scaling, meaning of scaling and important scaling techniques **2 Hrs.**

Data Collection: Collection of primary data, observation method, interview method, collection of data through questionnaires, collection of data through schedules, difference between questionnaires and schedules, collection of secondary data. **2 Hrs.**

Testing of Hypotheses: What is a Hypothesis? Basic concepts concerning testing of hypotheses, procedure for hypothesis testing, flow diagram for hypothesis testing, measuring the power of a hypothesis test, tests of hypotheses. **2 Hrs.**

3) **Interpretation and Report Writing:** Meaning of interpretation, technique of interpretation, precaution in interpretation, significance of report writing, different steps in writing report, layout of the research report, types of reports, oral presentation and mechanics of writing a research report, precautions for writing research reports, plagiarism and its significance. **3 Hrs.**

Introduction to Intellectual Property Rights: Meaning and conception of IPR, competing, rationale for protection, international conventions, world court. **1 Hrs.**

Copy right: Historical evolution of the law on copy right, meaning, content, substance, ownership, primary, special rights, obligations, period, assignment and relinquishment of copy rights. License and application for registration of copy right.

4) **Patents:** Meaning of Patent, purpose and policy object of patent law, gains to inventor, application of patents, joint application, discovery and invention, patentable and non-patentable inventions, publications and public use, priority date and its purpose, procedure for obtaining patent. Stages of procedure, refusal to grant patent - consequence, protection period, drafting if claims, grant of patent and significance of date of patent and date of ceiling. Services available with patent office, jurisdiction, appellate authorities, powers and obligations of central government, patent agent and controller – not a civil court. **4 Hrs.**

5) **Industrial design:** Concepts &Significance **1 Hr.**

Trademarks: Definitions and conceptions of Trademark, advantages of registration, marks which are not registrable, known and well-known trademarks, application for registration and procedure for registration, procedure and certification of Trademarks. **1 Hr.**

Infringement and Remedies: Meaning of infringement, acts of infringements, suit against infringement and defense against infringement, reliefs and certificate of validity. **1 Hr.**

The information Technology Act: Definitions, certifying authority, meaning of compromise of digital signature, offences and penalties, applicability of IPRs, cybercrimes, adjudicating officer, violation, damages and penalties, Cyber regulation appellate tribunal, World Wide Web and domain names and cyber flying. Self Study. **1 Hr.**

Reference Books:

1) C.R. Kothari, GauravGarg, Research Methodology: Methods and Techniques, New Age International, 4th Edition, 2018.
2) Ranjit Kumar,Research Methodology a step-by-step guide for beginners, SAGE Publications, 3rdEdition, 2011.

3) Fink A, Conducting Research Literature Reviews: From the Internet to Paper, SagePublications, 2009.
4) N. K. Acharya, Text book on Intellectual Property Rights,4th Edition, Asia Law House, Hyderabad

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20PITC101	Distributed Computing Systems	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): The students are expected to learn about the design and properties distributed system, the principles underlying the functioning of distributed systems, describe the problems and challenges associated with these principles, and evaluate the effectiveness and shortcomings of their solutions, recognize how the principles are applied in contemporary distributed systems, explain how they affect the software design, and be able to identify features and design decisions that may cause problems, design a distributed system that fulfills requirements with regards to key distributed systems properties (such as scalability, transparency, etc.), be able to recognize when this is not possible, and explain why, build distributed system software using basic OS mechanisms as well as higher-level middleware and languages.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** distributed system and its properties **design** a system as a distributed system,	1	-	-
CO-2	**Describe** the problems and challenges associated with these principles, and **evaluate** the effectiveness and shortcomings of their solutions;	2	3	-
CO-3	**Recognize** the applied principles in contemporary distributed systems, and be able to identify features and design decisions that may cause problems;	1	3	-
CO-4	**Design** a distributed system that fulfills requirements with regards to key distributed systems properties (such as scalability, transparency, etc.)	1	2	4
CO-5	**Implement** distributed system software using basic OS mechanisms as well as higher-level middleware and languages.	1	-	4

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	3.0	2.5	2.0	1.0

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Prerequisites: 1) Operating system

Contents:

1)	**Characterization of Distributed Systems**-Introduction, Examples of Distributed systems, Resource sharing and web, challenges, System models- Introduction, Architectural and Fundamental models, Networking and Internet-working, Inter process Communication. Distributed objects and Remote Invocation-Introduction, Communication between distributed objects, RPC, Events and notifications, Case study-Java RMI	**10 Hrs**
2)	**Operating System Support**-Introduction, OS layer, Protection, Processes and Threads, Communication, and Invocation, Operating system architecture, Distributed File Systems-Introduction, File Service architecture, case study- SUN network file systems. Name Services-Introduction, Name Services and the Domain Name System, Case study of the Global Name Service, Case study of the X.500 Directory Service.	**10 Hrs**
3)	**Peer to Peer Systems**-Introduction, Napster and its legacy, Peer to Peer middleware, Routing overlays, Overlay case studies-Pastry, Tapestry, Application case studies-Squirrel, OceanStore. Time and Global States-Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging. Coordination and Agreement – Introduction, Distributed mutual exclusion, Elections, Multicast communication, consensus and related problems.	**10 Hrs**
4)	**Transactions and Concurrency control –**Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency controls. Distributed Transactions – Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery, Replication-Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data.	**12 Hrs**
5)	**Security and Authentication:** basic concepts, Kerberos. Resource sharing and load balancing. **Special topics:** distributed objects, distributed databases, directory services, web services.	**10 Hrs**

Reference Books:

1) Distributed Systems Concepts and Design, G Coulouris, J Dollimore and T Kindberg, Fourth Edition, Pearson Education.
2) Distributed Systems, S. Ghosh, Chapman & Hall/CRC, Taylor, & Francis Group, 2010.
3) Distributed Computing, S. Mahajan and S. Shah, Oxford University Press.
4) Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI.
5) Advanced Concepts in Operating Systems, M Singhal, N G Shivarathri, Tata McGraw-Hill Edition.
6) Reliable Distributed Systems, K. P. Birman, Springer.

20PITE126	Cloud Computing	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLO's): Cloud computing helps organizations realize cost savings and efficiencies without spending capital resources up front, while modernizing and expanding their IT capabilities.

Course Outcomes (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Compare and Contrast the various cloud service models, cloud delivery models, key cloud characteristics, roles and boundaries and important terminology	1	-	-
CO-2	Explain how virtualization technology has enabled cloud computing.	-	2	-
CO-3	Demonstrate how various cloud providers such as AWS, Google Compute and Microsoft Azure implement and offer IaaS, PaaS and SaaS services.	-	3	-
CO-4	Develop, deploy, manage and scale applications running in platforms such as Java /Python Platform (PaaS).	-	3	-
CO-5	Describe how cloud can be used to perform Big Data Analytics using distributed computing technologies like Hadoop.	-	3	-

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	3.0	2.0	2.0	-

Pre-requisites: Computer Networks

Contents:

1) **Introduction**: Cloud Infrastructure Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, Exercises Self learning component:-. User experience and software licensing **10Hrs**
2) **Cloud Computing**: Application Paradigms. Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Grep, The Web application, Cloud for science and engineering, High-performance computing on a cloud, SLC: Cloud computing for Biology research, Social computing **9Hrs**

3) **Cloud Resource Virtualization**: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and par a virtualization, Hardware support for virtualization, Case Study: Xen a VMM based para virtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, Exercises and problems **8Hrs**
4) **Cloud Resource Management and Scheduling**: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines **8Hrs**
5) **Python for Cloud**: Python for Amazon Web Services, Python for Google Cloud Platform, Python for Windows Azure, Python for MapReduce, Python Packages of Interest, Python Web Application Framework - Django, Designing a RESTful Web API **Cloud Application Development in Python**: Design Approaches, Image Processing App, Document Storage App, MapReduce App, Social Media Analytics App **8Hrs**
6) **Comparing Cloud Platforms**: AWS (Amazon Web Services), GCP (Google Cloud Platform), IBM Cloud, Salesforce.
Cloud Native and Emergent Cloud Trends: Hybrid Multicloud, Serverless, Microservices, Cloud Native, DevOps, Application Modernization **9Hrs**

Reference Books:

1) Arshdeep Bahga and Vijay Madisetti - "Cloud Computing: A Hands-On Approach", Universities Press India, 2014.
2) Dan C. Marinescu "Cloud Computing and Practice", 1/e, Elsevier (MK), 2013.
3) Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, "Mastering Cloud".
4) Morgan Kaufmann - "Computing Foundations and Applications Programming", 2/e, 2013.
5) Anthony. Velte, "Cloud Computing A Practical Approach", 1/e, McGraw Hill, 2010.
6) Tom White, "Hadoop: The Definitive", 3/e, O'Reilly, 2013.

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20PITE127	Storage Technologies	(4-0-0) 4

Contact Hours:52

Course Learning Objectives (CLO's): To help the students: To outline basic terminology and components in information storage and retrieval systems, to compare and contrast information retrieval models and internal mechanisms such as Boolean, Probability, and Vector Space Model, to describe current trends in information retrieval such as information visualization. To understand a backup process and securing and managing storage infrastructure

Course Outcome (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Illustrate** the role and use of technology in business systems and operations	1	-	-
CO-2	**Identify** and describe organizational structure and business processes within these.	1	-	-
CO-3	**Develop** an understanding of network engineering principles for network, system and service management.	-	2	-
CO-4	**Implement** information systems in industry	-	2	-
CO-5	**Discuss the** method and replication methods.	2	-	4

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	3.0	1.3		1

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Pre-requisites: Computer Network

Contents:

1) **Introduction to Information Storage:** Information Storage, Evolution of Storage Architecture, Data center Infrastructure, Virtualization and cloud computing. **Data Center Environment:** Application, Database Management System(DBMS), Host(compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based On Application, Disk Native Command Queuing, Introduction to Flash Drives, Concept in Practice: VMware ESXi. **Data Protection: RAID:** RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares, **Case Study**. **10 Hrs.**
2) **Intelligent Storage Systems:** Components of an Intelligent Storage System, Storage Provisioning, Types of intelligent Storage Systems, Concepts in Practice: EMC Symmetrix and VNX. **Fibre Channel Storage AreaNetworks:** Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity,Switched Fabric Ports, Fibre Channel Architecture, fabric Services, Switched fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN, Concepts in Practice: EMC Connectrix and EMC VPLEX.**IP SAN and FcoE:** iSCSI, FCIP, FcoE. **10 Hrs.**
3) **Network-Attached Storage:** General-purpose Servers versus NAS Devices, benefits of NAS, File Systems andnetwork File Sharing. Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, factors Affecting NAS Performance, File-Level Virtualization, Concepts in Practice: EMC Isilon and EMC VNX gateway. **10 Hrs.**
4) **Backup and Archive: B**ackup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operation, Backup Topologies, Backup in NAS Environments, Backup Targets, Data Dedupulication for Backup, Backup in Virtualized Environments, Data Archive, Archiving Solution Architecture, Concepts in Practice: EMC Networker, EMC Avamar, and EMC Data domain. **Local Relication:** Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas, Local Replication in Virtualized Environment, Concepts in Practice: EMC TimeFinder. **10 Hrs**
5) **Securing the Storage Infrastructure:** Information Security Framework, Risk Triad, Storage SecurityDomains, Security implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments, Concepts in practice: RSA and VMware Security Products. Case Study. **12 Hrs**

Reference Books:

1) EMC^2: Information Storage and Management, Willey India 2013.
2) EMC Corporation, Information Storage and Management, Wiley, India. ISBN-13: 978-8126537501, August 2012.
3) Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.
4) Marc Farley, "Building Storage Networks", Tata M cGraw Hill, Osborne, 2001.
5) Additional resource material on www.emc.com/resource-library/resource-library.esp.

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20PITC201	Internet of Things	(3-2-0) 4

Contact Hours: 39

Course Learning Objectives: This course considers at the Internet of Things (IoT) as the general theme of real-world things becoming increasingly visible and actionable via Internet and Web technologies. The goal of the course is to take a top-down as well as a bottom-up approach, thereby providing students with a comprehensive Analysis of the IoT: from a technical viewpoint as well as considering the societal and economic impact of the IoT.

Course Outcomes:

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Illustrate** portable IoT applications using Arduino/ Raspberry Pi.	2	-	-
CO-2	**Develop** web services to access and control IoT devices.	3	-	-
CO-3	**Deploy** an IoT application and connect to the cloud.	-	3	-
CO-4	**Analyze** IoT applications data.	2	-	-

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	-	3.0	2.5	-

Pre-requisites: Computer Networks

Contents:

1. **Introduction:** Introduction to Internet of Things (IoT): IoT overview, Physical and Logical design of IoT, IoT Enabling Technologies, IoT levels, Domain Specific IoTs: Home Automation, Smart Cities, Smart Environment, Smart Energy, Smart Retail, Smart Logistics, Smart Agriculture, Smart Industry, Smart Health. **7 Hrs.**
2. **Data-Link Layer and Networking Layer Protocols for Internet of Things:** Recent Protocols for IoT, L2 Protocols for IoT, Power Line Communication (PLC), Broadband Over Power Lines (BPL), OFDM, Home Plug, Connected Home, Convergent Digital Home Network, IEEE 1905.1, Netricity, Field bus, Industrial Ethernet, IEEE 1451, Smart Cards, IoT Ecosystem, IEEE 802.15.4,EUI64 Addresses, 6LowPAN, IP+UDP Header Compression: Stateless, Context Based Compression, Routing Protocol for Low-Power and Lossy Networks (RPL), IPv6 Technologies for the IoT, MQTT, 6LoWPAN. **10 Hrs.**
3. **IoT and M2M:** Introduction, M2M, Difference between IoT and M2M, Introduction to Software Defined Networking (SDN), SDN for IoT and Network Function Virtualization (NFV) for IoT, Cloud Computing, Sensor-Cloud, Fog Computing, **7 Hrs.**
4. **IoT Systems - Logical Design using Python:** Introduction, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Classes, Python Packages of Interest for IoT **5 Hrs.**

5. **Tools for IoT and case studies:** Introduction, NETCONF, YANG, YIN and BEEP, Case Studies illustrating IoT Design-Introduction, Home and Agriculture Automation **4 Hrs.**
6. **Data Analytics for IoT:** Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Data Handling and Analytics **7 Hrs.**
7. **Semester Project using Arduino and Raspberry Pi:** **20Hrs**
    a) Project Design Meeting.
    b) Project Plan (timeline, assignment of tasks, etc.)
    c) Introduction & Overview of Projects
    d) Project Implementation Strategy Meeting
    e) User Interfaces and Application Examples
    f) Project Progress Demo -1, 2, 3, 4, 5
    g) Final Project Demo

Beyond the Syllabus Coverage (Suggestive):

1. Students' Survey papers related to IoT
2. Laboratory Experiments
3. Seminar

Reference Books:

1. Arshdeep Bahga, Vijay Madisetti, ”Internet of Things: A Hands on Approach” Universities Press., 2015
2. Daniel Minoli, ”Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications”, Wiley, 2013
3. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases", 2017 CRC Press)
4. Michael Miller,” The Internet of Things”, First Edition, Pearson, 2015.
5. Claire Rowland, Elizabeth Goodman et.al.,” Designing Connected Products”, First Edition, O’Reilly, 2015
6. Samuel Greengard, The Internet of Things, MIT Press, 2015
7. H. Zhou, "The Internet of Things in the Cloud: A Middleware Perspective," CRC Press, 2012, ISBN:1439892997
8. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.
9. Manoel Carlos Ramon, “Intel Galileo and Intel Galileo Gen 2: API Features and Arduino Projects for Linux Programmers”, Apress, 2014.
10. Internet of Things courses from www.edx.orgwww.coursera.orgwww.nptel.ac.in

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20PITE225	Data Science	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course will enable students to Define data science and its fundamentals , Demonstrate the process in data science, Explain machine learning algorithms necessary for data sciences , Illustrate the process of feature selection and analysis of data analysis algorithms and Visualize the data and follow of ethics

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Define data science and its fundamentals	-	-	4
CO-2	Demonstrate the process in data science	-	3	-
CO-3	Explain machine learning algorithms necessary for data sciences	-	-	-
CO-4	Illustrate the process of feature selection and analysis of data analysis algorithms	-	2	-
CO-5	Visualize the data and follow of ethics	1	-	-

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	3	2	2	1

Prerequisites: 1) Database Management Systems

Contents:

1) Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets. NeededStatistical Inference: Populations and samples, Statistical modeling, probability distributions, fitting a model, - Introduction to R **12Hrs**
2) Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA,The Data Science Process, Case Study: RealDirect (online real estate firm). Three Basic Machine Learning Algorithms: Linear Regression, kNearest Neighbors (k-NN), k-means **10Hrs**
3) One More Machine Learning Algorithm and Usage in Applications: Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web **10Hrs**
4) Feature Generation and Feature Selection (Extracting Meaning From Data): Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system **10Hrs**

5) Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs, Data Visualization: Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues, Discussions on privacy, security, ethics, Next-generation data scientists **10Hrs**

Reference Books:

1. Doing Data Science Cathy O'Neil and Rachel Schutt Straight Talk From The Frontline.O'Reilly 2014.
2. Mining of Massive Datasets. v2.1 Jure Leskovek, Anand Rajaraman and Jeffrey Ullman Cambridge University Press 2014 .
3. Machine Learning: A Probabilistic Perspective Kevin P. Murphy 2013.
4. Data Mining: Concepts and Techniques Jiawei Han, Micheline Kamber and Jian Pei Third Edition 2012.

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20PITE228	Virtual Reality	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLO's): The objective of the course is to provide an understanding to the students the fundamentals of virtual reality systems. Aim is to summarize the 3D interaction techniques and its importance to provide design guidelines to develop and analyze the real world applications of virtual reality.

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Course Outcome (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** fundamentals of virtual reality systems	1	2	-
CO-2	**Summarize** the hardware and software of the virtual reality.	1	2	-
CO-3	**Explain** the 3D Interaction Techniques design guidelines for a virtual reality system.	-	3	-
CO-4	**Summarize** the design guidelines for a virtual reality system	-	-	3
CO-5	**Analyze** the applications of virtual reality.	4	-	-

POs	PO-1	PO-2	PO-3	PO-4
Mapping Level	3.0	2.0	2.0	3.0

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Contents

1) **VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS**: The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for virtual reality, benefits of virtual reality. **10 Hrs**
2) **HARDWARE TECHNOLOGIES FOR 3D USER INTERFACES-** Visual Displays, Auditory displays, choosing Output devices for 3D User Interfaces.
   3D USER INTERFACE INPUT HARDWARE: Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Choosing Input Devices for 3D Interfaces.
   SOFTWARE TECHNOLOGIES: Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occludes, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits.. **12 Hrs**
3) **3D INTERACTION TECHNIQUES**: 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Deign Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Way finding, User Centered Way finding Support, Environment Centered Way finding Support, Evaluating Way finding Aids, Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestural Commands,Tools, Multi modal System Control Techniques, Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques, Design Guidelines, Beyond Text and Number entry. **10 Hrs**
4) **DESIGNING AND DEVELOPING 3D USER INTERFACES**: Strategies for Designing and Developing Guidelines and Evaluation. **ADVANCES IN 3D USER INTERFACES:** 3D User Interfaces for the Real World, AR Interfaces as 3D Data Browsers, 3D Augmented Reality Interfaces, Augmented Surfaces and Tangible Interfaces, Agents in AR, Transitional AR-VR Interfaces - The future of 3D User Interfaces, Questions of 3D UI Technology, 3D Interaction Techniques, 3D UI Design and Development,3D UI evaluation and other issues. **12 Hrs**
5) **VIRTUAL REALITY APPLICATIONS**: Engineering, Architecture, Education, Medicine, Entertainment, Science, Training. **8 Hrs**

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Reference Books:

1) Kelly S. Hale Kay, M. StanneyHandbook of Virtual Environment : Design , CRC Press, 2nd Edition, 2015.
2) Steven M. LaValle., Virtual reality – http://vr.cs.uiuc.edu/book.html,Cambridge, 2016
3) Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009.
4) Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
5) Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.
6) William R Sherman and Alan B Craig, "Understanding Virtual Reality: Interface, Application and Design (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002.
7) John Vince, "Virtual Reality Systems", Addison Wesley, 1995.

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20PITE233	Pervasive Computing	(3-0-2) 4

Contact Hours: 52

Course Learning Objectives (CLO's): The course aims at providing a sound conceptual foundation in the area of Pervasive Computing aspects and developing a design thinking approach towards problem-solving in this domain. The course attempts to provide a balanced treatment of the mechanisms and environments of pervasive computing and initiates senior CSE and EE students to the state-of-the-art in the area. At the end of this course, students should be able to conceptualize, analyze and design select classes of pervasive computing systems.

Course Outcome (CO's):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-4)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Illustrate** the fundamental theoretical concepts in pervasive computing	1	-	-
CO-2	**Explain** the aspects of context awareness	1	2	-
CO-3	**Describe** the methods for efficient resource allocation and task migration	1	2	3
CO-4	**Analyze** the HCI Service Selection and HCI migration framework	1	3	4
CO-5	Design and implement pervasive application systems	4	-	-

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**
Mapping Level	3.0	2.0	1.5	2.0

Pre-requisites: Computer Network

Contents:

1) **Pervasive Computing Concepts**: Perspectives of Pervasive Computing, Challenges, Technology; The Structure and Elements of Pervasive Computing Systems: Infrastructure and Devices, Middleware for Pervasive Computing Systems, Pervasive Computing Environments **12Hrs**
2) Context Collection, User Tracking, and Context Reasoning; Resource Management in Pervasive Computing: Efficient Resource Allocation in Pervasive Environments, Transparent Task Migration, Implementation and Illustrations.**10T+2P=12Hrs**
3) HCI interface in Pervasive Environments: HCI Service and Interaction Migration, Context- Driven HCI Service Selection, Scenario Study: Video Calls at a Smart Office, A Web Service– Based HCI Migration Framework . **12T+2P=14Hrs**
4) Pervasive Mobile Transactions: Mobile Transaction Framework, Context-Aware Pervasive Transaction Model, Dynamic Transaction Management, Formal Transaction Verification, Evaluations
5) Case Studies: iCampus Prototype, IPSpace: An IPv6-Enabled Intelligent Space **12T+2P=14Hrs**

Reference Books:

1) Minyi Guo, Jingyu Zhou, Feilong Tang, Yao Shen,"Pervasive Computing: Concepts, Technologies and Applications",CRC Press, 2016.
2) Obaidat, Mohammad S., Mieso Denko, and Isaac Woungang, eds. Pervasive computing and networking. John Wiley & Sons, 2011.
3) Laurence T. Yang, Handbook On Mobile And Ubiquitous Computing Status And Perspective, 2012, CRC Press

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PG-2021-22

Scheme of Teaching and Examination

I Semester

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
20PRMIC100	Research Methodology and IPR	2-0-0	2	50	50	2		
20PITC100	Data Analytics	4-0-0	4	50	100	3		
20PITC101	Distributed Computing Systems	4-0-0	4	50	100	3		
20PITC102	Artificial Intelligence	4-0-0	4	50	100	3		
20PITEXXX	Elective 1	4-0-0	4	50	100	3		
20PITL103	Data Analytics Lab	0-0-3	2	50			50	3
20PITL104	Seminar	0-0-2	1	50				
Total		**18-0-5**	**21**	**350**	**450**		**50**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination

L: Lecture **T**: Tutorials **P**: Practical

***** SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

Seminar is to be conducted every week and 2-3 students/week will present a topic from emerging areas in respective PG program preferably the contents not studied in their regular courses. The seminar shall be evaluated by 3 faculty members having specialization in respective program and allied areas.

Electives for I Semester:

Course Code	Elective 1 Courses
20PITE125	Agile Technology
20PITE126	Cloud Computing
20PITE127	Storage Technologies

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Scheme of Teaching and Examination

II Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
20PITC200	Machine and Deep Learning	4-0-0	4	50	100	3		
20PITC201	Internet of Things	3-2-0	4	50	100	3		
20PITEXXX	Elective 2	3-0-2	4	50	100	3		
20PITEXXX	Elective 3	4-0-0	4	50	100	3		
20PITEXXX	Elective 4	3-0-2	4	50	100	3		
20PITL202	Machine Learning Lab	0-0-3	2	50			50	3
20PITL203	Seminar	0-0-2	1	50				
Total		**17-2-9**	**23**	**350**	**500**		**50**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination

L: Lecture **T**: Tutorials **P**: Practical

***SEE** for theory courses is conducted for **100 marks** and reduced to **50 marks**.

Seminar is to be conducted every week and 2-3 students/week will present a topic from emerging areas in respective PG program preferably the contents not studied in their regular courses. The seminar shall be evaluated by 3 faculty members having specialization in respective program and allied areas.

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Electives for II Semester:

Course Code	Elective 2 Courses	Course Code	Elective 3 Courses	Course Code	Elective 4 Courses
20PITE225	Data Science	20PITE228	Virtual reality	20PITE231	Advanced Computer Graphics
20PITE226	Client-server Programming	20PITE229	Parallel Computing	20PITE232	User Interface Design
20PITE227	Network Engineering	20PITE230	Mobile Adhoc & sensor network	20PITE233	Pervasive computing

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Scheme of Teaching and Examination
III Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
20PITC300	Web Services	4-0-0	4	50	100	3		
20PITEXXX	Elective 5	3-0-0	3	50	100	3		
20PITEXXX	Elective 6	3-0-0	3	50	100	3		
20PITEXXX	Elective 7	3-0-0	3	50	100	3	--	--
		OR						
20PITL301	Internship in Industry or R&D organization	** Min 4 weeks during vacation after 2nd sem	3	50	--	--	100	3
20PITL302	*** Project phase 1	0-0-15	9	50			50	3
Total		**13-0-15/10-4weeks-15)**	**22**	**250**	**400/300**		**50/150**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
L: Lecture **T**: Tutorials **P**: Practical
***SEE** for theory courses is conducted for 100 marks and reduced to 50 marks.
****** The students are expected to undergo training in industry for a period of ***four weeks*** during the vacation immediately after completion of II Semester examination. A faculty is to be allotted to guide the student. A committee consisting of three faculty members shall evaluate the work carried out and the knowledge the students have acquired.**OR The students can take one elective course if they do not undergo internship.**
*****Project phase-I: The students are expected to formulate the problem and carry out the intensive literature survey along with preliminary investigations supporting the project phase-II in IV semester.

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Electives for III Semester:

Course Code	Elective 5 Courses	Course Code	Elective 6 Courses	Course Code	Elective 7 Courses
20PITE325	Computer Vision	20PITE328	Natural Language Processing	20PITE331	Modern Cryptography
20PITE326	Semantic Web and Social Network	20PITE329	Enterprise Application Programming	20PITE322	Bio Informatics
20PITE327	Cyber Crime and Cyber Forensics	20PITE330	Block Chain Management	20PITE333	Data Compression

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Scheme of Teaching and Examination
IV Semester M. Tech.

Course Code	Course Title	Teaching		Examination				
		L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
				Max. Marks	*Max. Marks	Duration in hours	Max. Marks	Duration in hours
20PITL400	Project phase-II	0-0-20	22	100	--	--	100	3
Total		**0-0-20**	**22**	**100**	**--**	**--**	**100**	

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
L: Lecture **T**: Tutorials **P**: Practical
***SEE** for theory courses is conducted for 100 marks and reduced to 50 marks.
****** Project phase-II: The students are expected to work on a project for the full semester in an industry or an institution

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